

Karina Grömer

The Art of Prehistoric Textile Making



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THE DEVELOPMENT OF CRAFT TRADITIONS
AND CLOTHING IN CENTRAL EUROPE

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The development of craft traditions
and clothing in Central Europe

Karina Grömer

with contributions of

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and

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The Prehistoric Art of Textile Making

The development of craft traditions and clothing in Central Europe

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Preface

The book „The Prehistoric Art of Textile Making – The development of craft traditions and clothing in Central Europe“ is aimed at historians, archaeologists and anyone interested in the history of costumes and crafts. It was written from the perspective of a prehistoric archaeologist to illuminate Central European history before written records. To facilitate access for the broad, scientifically interested public, basic concepts and methods of prehistoric archaeology are briefly explained if they are relevant to understanding the content of this book. A subject-specific glossary of archaeological and textile technological terms is included as well.

Textile crafts, especially spinning and weaving, were interpreted metaphorically in Classical Antiquity. The Fates (parcae in Ancient Rome, moirai in Ancient Greece), three wise women, span and cut off the thread of life. Symbolically, they controlled the life of every mortal from birth to death. This appreciation of textile crafts expressed in linguistic and mythological symbolism is no longer apparent in the modern world of mass production and global economy. Interestingly, however, textile crafts and above all weaving have contributed significantly to the general development of technology. Looms, invented in the Neolithic period, were the first machines in human history as they mechanized production processes. Automation by punch cards and binary code – crucial for the development of modern computing – were first applied in weaving. Joseph-Marie Jacquard* (1752 to 1834) built punch cards into an Austrian model loom which contained information about the pattern to be woven. These were scanned by needles, whereby a hole meant the thread was to be lifted and no hole meant the thread was to be lowered. Through the punch cards – data storage in modern terms – the Jacquard loom was the first machine that could be programmed as needed to achieve patterns of any complexity.

The roots of our history – and thus the history of textile crafts – lie in the darkness of prehistory far before the Romans. Essential textile techniques that still accompany us as textile customers today were already developed in the Stone and Bronze Ages.

Through the combination of different, sometimes inconspicuous sources and the application of modern scientific methods, prehistoric archaeology succeeds in painting a vivid picture of the development of textile crafts over time.

At the beginning the book describes the individual steps of textile production and their tangible archaeological traces, addressing complex issues of craft sociology – the craftspeople behind the textiles as well as the places of production. It further evaluates whether crafts were conducted in the framework of domestic production or if organized forms of production such as specialization and mass production already occurred in Central Europe in pre-Roman times. The book concludes with a chapter about the history of clothing before the Romans. Clothing is a characteristic feature of any culture. By combining insights from image sources, burial finds and textile remains, an attempt is made to investigate the phenomenon of clothing from the Stone to the Iron Age. This time span is very long indeed – it is therefore impossible to draw a complete picture of all developments of clothing in prehistory. Individual garment shapes, however, can already be reconstructed for this early period. Many aspects of prehistoric clothing can be accessed by archaeological remains and further interpretations about the social function of clothing are possible.

The German version of this book (*Prähistorische Textilkunst in Mitteleuropa – Geschichte des Handwerks vor den Römern*, 2010) was written in the context of a research project based at the Natural History Museum in Vienna; its focus is therefore Austria and its neighbouring countries. The research project was part of the international textile research framework “DressID – Clothing and Identities. New Perspectives on Textiles in the Roman Empire”, funded by the EU Culture Programme and conducted under the direction of the Curt-Engelhorn-Foundation of the Reiss-Engelhorn-Museums Mannheim between 2007 and 2012. Research on the prehistoric dyeing techniques was carried out within the FWF-Project Dyeing techniques of the prehistoric textiles from the salt mine of Hallstatt – analysis, experiments and inspiration for contemporary application. (FWF-Project L 431-G02; 2008-2012).

Within the last five years, however, textile research in Europe made important steps forward. New analytical methods were tested and applied to archaeological textiles, e.g. isotopic tracing. The book was therefore extended to include the latest research results and new exciting finds such as the Hamerum textiles. In this new edition, translated to English, more figures of recent investigations and new finds could be added.

I would like to thank my co-authors, Regina Hofmann-de Keizer and Helga Rösel-Mautendorfer, who have provided the latest research results in their respective specialised fields to be included in this book. The book was translated by Katharina Rebay-Salisbury and edited by Roderick B. Salisbury. The publication was funded by the Austrian Research Fund FWF (PUB 127-G19).

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Karina Grömer, November 2015

* J. Essinger 2004: *Jacquard's Web: How a Hand-Loom Led to the Birth of the Information Age*. Oxford: Oxford University Press.

A Introduction

The history of textile crafts and clothing can only be understood correctly in the framework of prehistoric research. A brief overview of the technical and cultural as well as social and economic development throughout the Stone, Bronze and Iron Ages will therefore introduce the topic.



1 Central Europe before the Romans

Prehistoric archaeology¹ is dedicated to the study of an era with no written records, from the beginning of human development to the dissemination of writing. Prehistory thus ends in Egypt in the 4th Millennium BC, whilst in Central Europe north of the Alps written history does not start before the expansion of the Roman Empire into the area.

The role of an archaeologist dealing with prehistory is to explore the life-world of our ancestors from the meagre resources of archaeological finds and to reconstruct everyday life, farming practices, craft techniques and social and religious ideas, as far as they are reflected, for example, in burial practices. Invaluable sources of knowledge are prehistoric settlements with structures such as houses, hearths, storage pits or ditches, which may be discovered during archaeological excavations. Archaeology is a popular theme on screen as well as fiction writing. However, that which is central to the prehistorian's interest is not hunting down spectacular gold treasures – as suggested by the well-known film character of Indiana Jones – but the entire legacy of human culture: vessels, stone tools, animal bones, metal artefacts, tools, jewellery, even the most inconspicuous piece of pottery. Of uttermost importance is the detailed consideration of all contextual information. When a sword is discovered, for example, only the context it is found in may reveal its meaning: found in a grave, it was probably a gift in honour of the deceased warrior or a possession of the deceased. As a stray find in a ruined settlement it could indicate a combat action, in which it was lost. A buried sword in a sacred place (such as a river source) is more likely to be interpreted as a dedication to a deity. For this reason, finds unearthed without contextual information, for instance during illegal metal detecting, are largely worthless for research, even if they are the most beautiful piece of jewellery or a magnificent sword.

In whichever way archaeological remains are interpreted, one must always be aware that the vast majority of the materials with

¹ For general introductions to archaeology see Cunliffe 1998. – Eggers 1959. – Eggert 2001. – Renfrew and Bahn 2005.

which prehistoric people were surrounded and with which they worked is lost to us today. In temperate Europe, organic materials start to decay as soon as they are deposited in the ground. This includes everything made of wood, leather, grass or wool, and therefore all kinds of food or clothing. Studying textile crafts and clothing history is therefore particularly challenging. In Europe, there are only few sites with exceptional conditions under which such materials were preserved (see section A2).

Since Christian Thomsen's 1836 research in Denmark, prehistory has been divided into three epochs, the Stone Age, Bronze Age and Iron Age, each named after the innovative use of working materials at the time. During the time before written history (particularly before the Celts around 400 BC), names of tribes, peoples and rulers were not recorded, but 'archaeological cultures' with similarities in material culture can be recognized, separated from one another and arranged chronologically. These cultures are defined based on typical tools, pottery or by uniform practices of burial and house construction. These 'archaeological cultures' and periods are named after defining features of the cultures, such as vessel forms (*e.g.* Bell Beaker Culture), vessel decoration (*e.g.* Linear Pottery Culture), or grave types (*e.g.* Tumulus Culture, Urnfield Culture). Finally, there are also special sites, including Hallstatt in Austria, which may give a culture or an era its name. It has to remain open whether these archaeological cultures coincide with former tribes, peoples or language groups.

In this book, the main focus is on sedentary cultures from the Neolithic period through Iron Age, since weaving and woven clothing are common at that time, and it is these achievements which will be dealt with in greater detail below. For orientation and as guidance, this book starts with a brief overview of prehistory in Central Europe². In Northern Europe, the individual prehistoric periods start a little later than in Central Europe.

² For a general overview see Cunliffe 1998. – Jones 2008. – Kristiansen 1991; 2000. – Milisauskas 2002. – Urban 2000. – Vandkilde 2007. – von Freeden and von Schnurbein 2002.

1.1 Stone Age

The **Palaeolithic period** is the one that has influenced the history of mankind the longest. Since humans learned to walk upright at about 4 million years ago, people lived as nomadic hunter-gatherers till the end of the last Ice Age around 10,000 BC. With the emergence of anatomically modern humans in Central Europe in the Upper Palaeolithic at around 40,000 BC, the first artistic expressions appear, of which the Venus of Willendorf or the expressive cave paintings of Lascaux and Altamira are the most famous examples.

The **Neolithic period** starts after the end of the last Ice Age in the Middle East and is tied to environmental changes at the beginning of the Holocene, which brought substantial changes to the plant and animal life. The Pleistocene fauna of large mammals such as the mammoth, woolly rhinoceros and cave bear disappeared, and instead of the ice-age steppe landscape, a mixed oak forest spread across much of Central Europe.

The Neolithic period is characterized by farming culture with agriculture and animal husbandry. These traits reach Central Europe from the southeast. People became sedentary in the 9th millennium BC in the Fertile Crescent, the area between the Euphrates and Tigris, Israel to the Sinai Peninsula. Early forms of grain and domestic animals lived in this area, and abetted the process. Einkorn and emmer wheat were cultivated, sheep, goat, cattle and pigs became domesticated. Agriculture led to the formation of permanent settlements: first houses, village and settlement communities arose, which were, among other reasons, necessary to protect raw materials and the harvest. Agriculture also, however, led to dependence on the soil and climate, resulting in a change of worldviews and religion. As early as the Neolithic, people altered their environment, for instance in order to gain land through deforestation. For the first time it was possible to live in one place from harvest to harvest, together with domestic animals as living meat stock. This new way of living led to an increase in population. The farmers sought new land, and so – after one of many theories – cereal cultivation and animal husbandry spread. From Asia Minor, where one of the oldest cities developed in Çatal Hüyük, the new way of life

spread and reached Greece in the 7th millennium BC, to spread further over the Carpathian Basin in the 6th millennium BC and then into temperate Europe. By 5,500 BC, a large farming culture inhabited Central Europe, which is called the 'Linear Pottery Culture' after its characteristic pottery decorations. In addition to the production of ceramic vessels, other new craft techniques emerged. Stone tools were ground, sawed and drilled from tough rocks such as serpentine and used for land clearance, processing of wood and construction works. Another new feature was the manufacture of woven textiles. Basketry of various types, as well as net making, twining techniques and the like were already known from the end of the Palaeolithic and the Mesolithic, but weaving on a loom truly was a novelty.

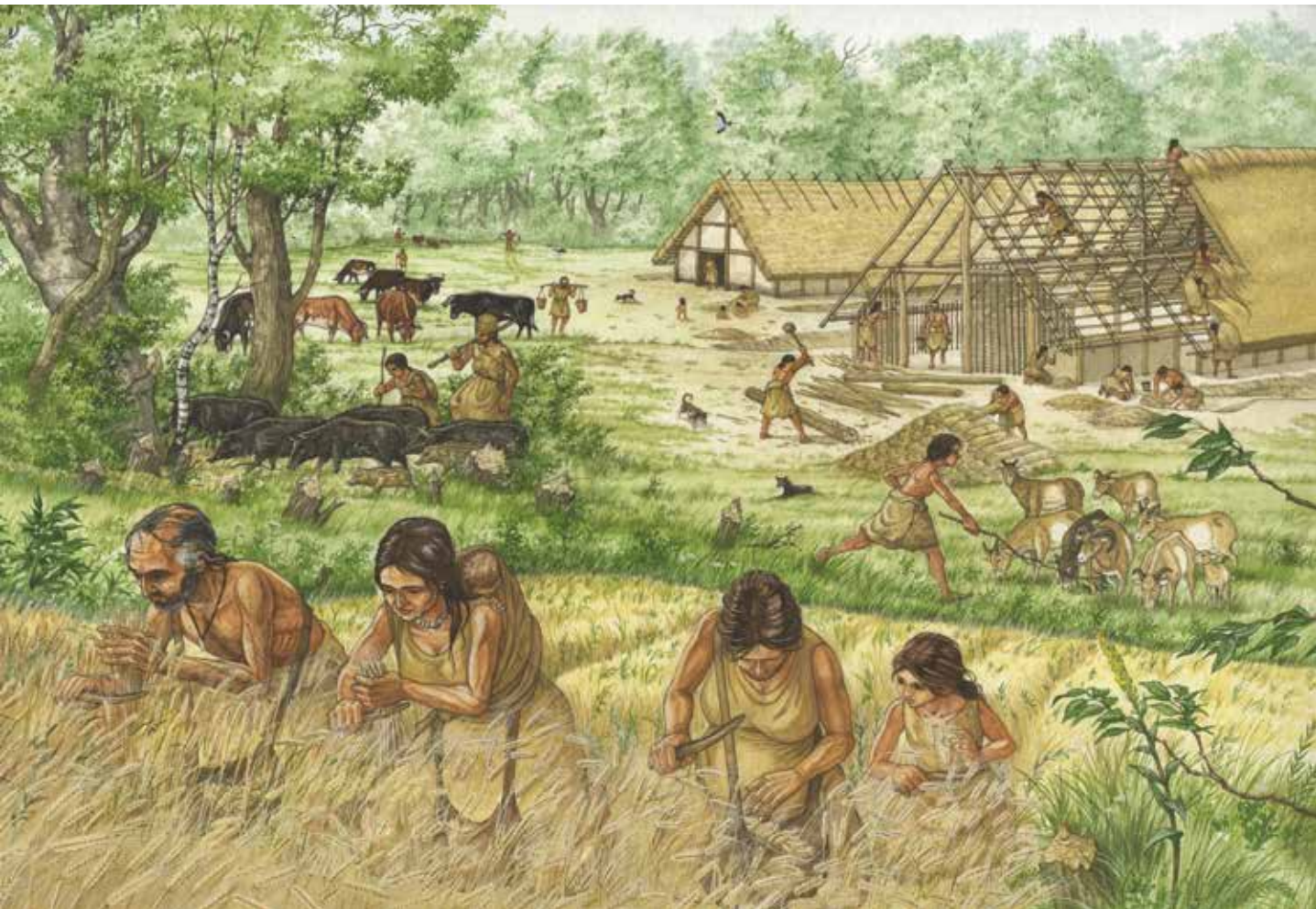
The Neolithic in Central Europe covers the period from c. 5,600 to 2,300 BC. The Early Neolithic is characterized by a coherent European culture, the Linear Pottery Culture, which is one of the best-researched cultures of prehistoric Europe. The first farmers preferred fertile loess soil near water for their settlements – particularly the Danube and its tributaries provided such conditions. Villages with a few houses were founded, fields were established close by (Fig. 2). For the first time, cemeteries were established, some with hundreds of burials, which provide information about the religious beliefs of these people. Components of dress fittings and jewellery made of bone and shell indicate the look of the clothing; small figurines are also a good source for reconstructing garments. Sickles with flint blades were used as harvesting tools, various axes made of greenstone were used for woodworking. For the first time in European history, ceramic vessels could be used for cooking and storing food.

Nevertheless, living together was far from peaceful paradise, as cruelly exemplified by the “massacre” site of Asparn-Schletz in Austria. In a fortification built around 5,000 BC, archaeologists found hundreds of skeletons. The entire population had been slaughtered; apart from young women who are missing in the anthropological statistics. They were probably abducted. The reasons for the conflict remain unknown. Traces of malnourishment on the human bones might indicate that crop failures and famine were responsible for this first documented act of war on European soil.

From c. 4,900 BC, in the Middle Neolithic, an expansion of the settlement area meant that former forest landscapes of the Alpine foothills or in mountainous zones were cleared and used for agriculture. At the same time the culture groups in Central Europe kept dividing. In the middle Danube region the Lengyel Culture was widespread, also named Painted Pottery Culture after the preferred ceramic ornament. In Germany, the Rössen Culture produced completely different ceramic types and decorations, as well as different domestic structures and forms of burial.

The settlement patterns were more diverse. Large, fortified villages acted as centres for several small villages in the vicinity. In the Danube region a characteristic of this period are circular ditch systems (*Kreisgrabenanlagen*) with diameters of up to 160m. These were composed of up to three parallel circular ditches with banks between the ditches, and often have a palisade along the innermost ditch. The monuments are likely to have had a specific legal, political and ritual significance –

Fig. 2. Artist's impression of life in an early farming community in Central Europe.



perhaps as meeting place, safe place or sanctuary. In terms of ritual and cult, small female figurines have been found, and will be referred to later when discussing the sources used for reconstructing prehistoric clothing.

Warm and humid climate had generally been predominant since the beginning of the Neolithic, but from c. 3,800 BC, the late Neolithic (Copper Age) onwards, the climate began to change to a slightly cooler, wetter transitional period.

While cultures in the millennia before the Copper Age were purely rurally oriented, new social and economic changes now occurred. Different social groups are archaeologically identifiable in the cemeteries. Different tools and weapons suggest that warriors and craftsmen emerged as new social groups. This period saw the beginnings of copper metallurgy, for the time being mainly used for jewellery, later tools were also made of this metal, and gold was also employed. In this era named Copper Age, the new sought-after raw material meant an economic and cultural boom in regions with copper and gold deposits, especially the Carpathian region. Alpine areas too were settled now.

The four-wheeled cart made its first appearance in Central Europe, evidenced by finds of wooden wheels from Switzerland and Slovenia and zoological evidence for domestic horses. Human mobility increased through the use of wagons and horses. For millennia it had only been possible to travel on foot or by water. Wheel and cart were also important for the development of agriculture, enlarging the areas that could be worked. The principle of the rotating axis was already familiar from the use of spindles in the Neolithic.

In contrast to the major European Early Neolithic Linear Pottery Culture, the Late Neolithic saw a breakdown into many different regional cultural groups that maintained contacts to neighbouring areas. For textile research the cultures of the lakes around the Alps are of particular interest, since organic materials and therefore textiles have been preserved in the wetlands. The Pfyn and Horgen Cultures inhabited today's Switzerland during the Late Neolithic, and the Cham Group and Jevišovice Culture were situated in Austria. It would be beyond the scope

of this framework to characterize the individual cultural phenomena in more detail. Here, they offer us names for the temporal succession of different regional cultures. Of particular interest is the Iceman, a mummy found in 1991 near an old mountain pass in the Ötztal Alps with clothing and equipment, which has survived c. 5,300 years in the ice of the glacier.

According to linguistic research, the Indo-European family of languages emerged during the Copper Age; it is, however, not possible to verify such an entity archaeologically.

The Neolithic period ends as it began – with pan-European cultures, the Corded Ware and Bell Beaker Culture, named after the outstandingly well-made bell-shaped cups with stamp impressions (Fig. 3). The end of the third Millennium BC is also characterized by large migratory movements in Western and Central Europe. At the same time, the Great Pyramids of the 4th Dynasty (2639–2504 BC) arise in Egypt under the pharaohs Khufu, Khafre and Menkaure.



Fig. 3. Bell beaker from Laa an der Thaya, Austria.

1.2 Bronze Age

The middle section of the classic three-age-system, the Bronze Age, begins at *c.* 2,300/2,200 BC in Central Europe and ends at the time of the first Olympic Games in Greece around 800 BC. It is the time of the Middle and (start of the) New Kingdom in Egypt, the time of the Hittite Empire and the Mycenaean Culture in the Aegean world.

The Bronze Age is characterized by a new material, bronze, an alloy of nine parts of copper and one part tin. The use of this metal had already been established by *c.* 5,000 BC in the Middle East. The discovery and the spread of knowledge related to metal processing resulted in a technological revolution in Central Europe that eventually transformed the economy and society as a whole. Bronze, and later iron, enabled the production of better tools and weapons, because both materials are very stable and malleable. This in turn led to an increased division of labour and other political and social differentiation. New occupations emerged: miners and metallurgists, lumberjacks, carpenters, charcoal makers, carriers, smelters, casters, blacksmiths, tin-smiths and armourers, domestic and long-distance traders *etc.*

Trade was very important and a defining feature of the period. The tin processed in Central Europe came mostly from the



Fig. 4. Bronze hoard of Sipbachzell in Austria.

British Isles and Spain, copper deposits exist also at the heart of the continent, in the Alps. Contacts established by metal trade, but also trade of luxury goods such as amber from the North Sea or necessities of life such as salt from the Alpine salt deposits can be traced across the whole continent. The peoples of Central Europe learned of the wealth of the Mediterranean countries through trade. During the following centuries, raids, military expansions and migrations to the climatically favourable south were carried out again and again (e.g. 'Dorian invasion' at c. 1,200/1,100 BC).

Through metal, surplus could be earned and wealth could be accumulated. This required better protection of settlements; and this protection was granted by the ruling upper class and their warriors. Richly furnished tombs and simple graves demonstrate differences in social structure and the division of labour. The Bronze Age elite had control of the trade routes and the major ore deposits and were responsible for the construction of fortifications.

Two distinct horizons of building fortresses can be differentiated; one in the early and the other in the late Bronze Age. During these times, fortified places provided protection and served the self-representation of the upper class. In the Middle Bronze Age the hilltop settlements were less important because monumental tombs served the purpose of representation. The prosperity of broad sections of the population is reflected in the cemeteries of this period.

In the **Early Bronze Age** (c. 2,300–1,600 BC), mighty fortifications were built with banks and ditches, always situated on an already naturally favourable mountain spur. Rectangular post structures with wattle and daub walls were used as houses. Large cemeteries were started, with people buried in the couched position. Through the graves we have a good picture of the appearance of the population at that time. At the cemetery of Gemeinlebarn, Austria, the anthropological analysis revealed that those persons who were buried with rich grave goods were unusually tall, with an average of 1.70 m (men). The poorer population measured on average only 1.66 m (men). Women were, on average, 10 cm shorter in both groups. This difference in

stature between rich and poor can be explained by better diet of the rich social sector, together with better living conditions, such as the lack of hard work during childhood. These graves are very important for our topic, since the metal jewellery and clothing items offer insights into the way garments were worn. Furthermore, textile residues may be preserved through metal corrosion in such graves.

The Early Bronze Age was a time of upheaval, in which many regional traditions were formed, as we can see from the archaeological finds, especially the ceramics. The bronze jewellery (pins, arm and leg rings), weapons and tools such as axes, however, were traded supra-regionally and reached even remote areas through network contacts. One of the larger cultural entities of the Early Bronze Age is the Únětice Culture, named after an archaeological site near Prague. The metallic wealth of this region is reflected in many bronze hoards and numerous jewellery in grave-goods.

As regards to the textile finds, the circum-alpine lake settlements remain crucial. The most significant body of textiles is known from northern Italy.

In the **Middle Bronze Age** (c. 1,600–1,250 BC) not as many regional groups can be determined. The reason for the unity of larger cultural entities is unclear. People were buried in large burial mounds or tumuli, which lend the name Tumulus Culture to this period. Considerable work was performed to build the burial mounds of the elite, which were often up to 15 m in diameter, and which may contain more than one burial. As in the Early Bronze Age, it is frequently observed that people with rich grave goods are taller, an indication that upper class families had a significantly better standard of living than the physically hard-working lower class. The warrior class had their own status symbols, particularly richly ornamented battle-axes. Weapon technology advanced during the Middle Bronze Age. The daggers used earlier in the Bronze Age were replaced by the first swords – items used exclusively for the personal combat, man against man. They continued to accompany men until well into the Middle Ages and beyond. Elite women adorned themselves with rich and heavy bronze

jewellery, often with exaggerated proportions: very long dress pins, massive tiaras, wide metal belts, large sets of ornaments worn on the chest – a wave of pomp dominated the Middle Bronze Age.

From the Middle Bronze Age onwards, salt was mined at Hallstatt in Austria – a lucky strike for textile research, as the ‘industrial waste’ collected in the mines contained large amounts of organic materials that were perfectly preserved by the salt. These provide excellent insights into the textiles used at the time.

In the **Late Bronze Age** (c. 1,250–800 BC), burial customs changed. The dead were cremated and buried in urns. In addition to the urns, small bowls as well as some jewellery and weapons were deposited in the graves. The religious backgrounds for the change to cremating the body have not yet been conclusively unravelled. In the so-called Urnfield period, large fortifications were again built on hilltops, such as in Stillfried an der March in Austria. These settlements are up to 50 acres in size and are surrounded by ditches, ramparts and mighty palisades. Inside the ramparts there were dwelling houses, granaries and workshops; the fortifications were centres of power with residential space and production centres. In the lowlands, there were also village-like settlements with peasant character. Until the end of the Bronze Age, agriculture intensified, culminating in a three-part division of forest, meadow and field, which was essentially maintained until the Middle Ages. Open meadows, as are common today, also emerged during the Bronze Age. There is growing evidence that during the Bronze Age, specialists became responsible for carrying out certain types of work (apart from metallurgy probably for pottery and trade, but also ritual and warfare).

During this time, the first migratory movements were historically documented. Especially in south-eastern Europe, there were extensive population shifts. The first wave of migration, the so-called ‘storm of the Sea Peoples’ brought unrest in the eastern Mediterranean. In the course of the events the Hittite Empire was destroyed in Asia Minor around 1,200 BC. The Dorian invasion in Greece essentially ended the Mycenaean Culture around 1,100 BC. In central Italy, the Proto Villanova

Culture was established, the roots of the culture of the Etruscans in the 9th century BC.

Migratory movements are hard to prove by archaeological means alone. Weapons, ceramics and jewellery of 'foreign' origin might point both to trade connections and the physical presence of different groups of people or tribes. It is clear from the archaeological evidence that the late Bronze Age was a time of many wars. The effort put into the construction of fortifications suggests that, and the development and refinement of weaponry is another argument. In addition to improving swords, protective armour and helmets were developed. Typical of this period are also hoards, the secure deposition and hiding of bronze objects. This might express the need to keep one's belongings safe.

1.3 Iron Age

At the end of the 8th century BC, the political and cultural situation in Central Europe had stabilized after the turmoil of the Urnfield period. While the Etruscan Culture became dominant on the Apennine Peninsula, Greece extended its sphere of influence through the formation of colonies on the north-western Mediterranean coast. The Thracians, Macedonians, Illyrians and Scythians established themselves in the Balkans.

Again, it was an innovative raw material, this time iron, which gave rise to the name of an era. The knowledge of the art of forging came from the eastern Mediterranean and spread during the 9th and 8th century to Central Europe. Iron was first used as jewellery, later for weapons and tools. Iron deposits are widespread; they are also found in Central Europe. Tin no longer had to be traded in from far-flung areas as it had been for the production of bronze. Iron production finally became cheaper than bronze production and lost iron objects were easier to replace than those made of bronze.

Iron was then primarily used for the production of weapons and tools (Fig. 5). This raw material was further important for the development of craft and farming devices, which remained in



use virtually unchanged from the Iron Age until pre-industrial times: ploughshares, pliers, chains, wheels, horse bits *etc.*

In the **Early Iron Age** (c. 800–400 BC), the influence of ancient urban cultures expanded into the zone north of the Alps. There is good evidence for trade with Greek colonies in southern France dating to the 6th century BC. Wine, spices, bronze vessels and luxury goods were the objects of desire, which were cherished by the Iron Age elites.

Iron Age elites at the top of the social pyramid tried to imitate the Mediterranean way of life by importing Greek household and luxury goods. Power and control over natural resources lay in the hands of a few large families. Feudal residences and lavish burials in large grave mounds were used for representation.

Fig. 5. Late Iron Age iron hoard from Gründberg, Austria with wagon fittings, tools and equipment. Excavations by the City Museum Nordico Linz and the University of Vienna.

The site of Heuneburg on the upper Danube in Germany is a particularly striking example. Within the fortification there was a central location with a large open area (market) and a palatial building for the 'lord'. The Heuneburg also had its own artisan quarter with workshops for different crafts. The walls were 3–4 m high; in one phase, walls and bastions were built of mud brick after Mediterranean fashion – a technique that turned out to be extremely unfavourable for the Central European climate and was soon replaced.

Life on such an Early Iron Age fortified settlement was, particularly in the West, comparable to Mycenaean court life as known from historical sources. It was also captured vividly in the scenic images of situla art from the East Alpine region between the 6th and 4th century BC: music was played, sport competitions took place, people danced, wine was served in drinking bowls, music with harp and pan flute was enjoyed. Wagon rides and processions complete the picture. Defended hilltop settlements were the central places, forming protected and representational seats for the nobility.

The Early Iron Age is also called the Hallstatt period after the finds from Hallstatt in Austria. The efficient exploitation of salt deposits and the associated extensive trade brought wealth to the local population, which was reflected in the exquisite grave goods of the large cemetery. In Hallstatt, salt mining began long before the Early Iron Age. The mining of salt dates back to the beginning of the Middle Bronze Age. Both in the Bronze Age and Iron Age parts of the Hallstatt salt mines textile remains have been discovered.

The Hallstatt Culture was spread from France over the Alps to Western Hungary; further east, the nomadic Scythians settled. The Hallstatt Culture was divided into a Western and Eastern area, which are different in terms of the extent to which Mediterranean elements became absorbed. The Western area was infiltrated by Greek imports via the trading post Massalia (Marseille) and was located between France and Germany, extending into Upper Austria. Large burial mounds with stone chambers were erected within view of the princely settlements. In some cases, the dead were laid out on a four-wheeled wagon. Famous



examples of such princely burials are the tombs of Hochdorf or Hohmichele in Germany, also containing textiles. Golden torcs such as the one from Uttendorf in Upper Austria (Fig. 6) served as a symbol of high social rank, and perhaps also as an attribute of gods.

Fig. 6. Gold torc from an Early Iron Age grave from Uttendorf, Upper Austria.

The Eastern Hallstatt area, located within eastern Austria, Slovakia and Hungary, was too remote to be reached by Greek traders. The area may best be understood as a periphery, in which the wealthier western area was imitated. For example, bronze vessels types were shaped in clay in the east. On the other hand, idiosyncratic styles flourished, particularly for local ceramics, as exemplified in the Kalenderberg Culture on the north-eastern edge of the Alps. In the east, neither gold grave goods nor wagons are typically found. Cremation graves are dominant. The elites are buried in burial mounds like in the west; ordinary people were frequently buried in inauspicious, shallow graves.

The **Late Iron Age** (c. 400–15 BC) is named after the archaeological site of La Tène on Lake Neuchâtel in Switzerland. The La Tène period in Austria ends in 15 BC, when Tiberius (Emperor

Augustus' stepson) extended the Roman Empire up to the Danube and set up a winter camp for his legions in Carnuntum. Thus, the area south of the Danube became part of the Roman Empire, whilst north of the Danube, Germanic tribes such as the Marcomanni and Quadi began to settle and replace the Celtic population. The La Tène Culture marks the transition to written history, as we are at least in part kept informed about events through the recorded, historical tradition. Inscriptions on devotional objects written in North Etruscan and attributed to the Raeti and Veneti are amongst the oldest written sources in the Alpine region (dating from the 3rd century BC onwards).

In the 5th century BC the Greek historian Herodotus first mentioned the name of a people from the area north of the Alps: *Keltoi* – the Celts, which he located 'at the source of the Danube'. Later, the Romans referred to the Celts in Western Europe as Gauls (*gallii*). Livy (c. 250 BC) indicates that there had been a Celtic King in the 6th century BC. The historical records thus confirm the notion of an aristocracy at the time.

The Celts, who had expanded their territory from c. 500 BC to the Alps, never erected a unified kingdom in Central Europe; they remained divided into tribes and tribal alliances. The Celts undertook far-reaching raids and expeditions; in 387 BC, they reached Rome, in 279 BC Delphi and finally, as hired mercenaries, Asia Minor, where they were even mentioned in the Bible: they are the Galatians in Paul's Epistles.

The La Tène period is characterized by large central hilltop settlements. The fortification ramparts, constructed of a nailed grid of wooden compartments filled with stones and soil, provided good protection against fire arrows. Julius Caesar mentions this particular form of construction as '*murus gallicus*' in his writings. Following the Roman conquest, most Celtic hilltop settlements were abandoned and new Roman cities were founded in the valleys.

Celtic cities (*oppida*) emerged in Central and Western Europe from about 120/100 BC. In his '*Commentarii de bello Gallico*' (58–49 BC) Caesar differentiates between the Gallic *oppidum* (*urbs*) from the open village (*vicus*) and the single farmstead

(*aedificium*). *Oppida* were fortified, town-like settlement centres, which served as the focal point of a tribe, as a refuge for the population at time of attack, and as a military assembly area. Since they were also fortified aristocratic residences, they included an administrative centre, workshops and tribal sanctuaries. In addition, coins were minted in these centres. Coins as a means of payment became introduced through Celtic mercenaries in Greek and Egyptian service from the middle of the 3rd century BC; Celtic rulers initially copied Greek coins and imitated their design.

At the courts of the aristocracy a new art style, the La Tène style, emerged (Fig. 7). Plant and animal motifs from Mediterranean art provided some influences, such as palmettes and lotus flowers; the Scythian and Persian animal style came from the East. These elements became absorbed and reworked into fanciful formations with symbolic content, which sometimes even included representations of people.

Fig. 7. Bracelet from Getzersdorf in Austria, Late Iron Age.



The Dürrnberg site in Austria (another salt mine), a production and trading centre, is as important to the understanding of textiles in the Late Iron Age as Hallstatt is for the Early Iron Age. The Dürrnberg salt mines contain hundreds of textile fragments dating between the 6th and 2nd century BC as well as the extended cemeteries offer insights in burial customs.

Burial customs changed in the La Tène Culture. The magnificent mounds were replaced by flat cemeteries, where square and round ditches surrounded individual grave areas. An emphasis on warrior grave goods suggests that a class of warriors gradually replaced the Hallstatt period elites. Jewellery and dress elements provide numerous clues to the appearance of clothing in the Hallstatt and La Tène period. Additionally, mineralized textiles are known from bronze and iron objects in the graves, allowing a glimpse of the 'textile culture' in this period. From the 2nd century BC, cremation became dominant and the remains were deposited in small, inauspicious graves. Towards the end of the La Tène period, there is no archaeologically visible funerary rite, thus our knowledge of clothing decreased.

In terms of technology, there were a number of changes in the centuries before the Christian era; the potter's wheel, for instance, was introduced. An important commercial product in the early Iron Age was high-quality iron produced in the Alpine region (*ferrum Noricum*), which was important for Rome as an expanding military power. Of similar importance was salt, which was now primarily extracted at the site Dürrnberg near Hallein and traded from there.

2 Textile preservation

Imagine a Celtic house in 300 BC: a loom, on which a woman is working, leans against the wooden wall of the house. Next to the loom there are a basket of wool and some spindles. A wood fire crackles under an iron cauldron, in which food is beginning to cook. Ingredients for the meal are being cut with iron knives and placed in ceramic pots. Vegetables, fruits and grains are stored in baskets within easy reach of the cooking place. A



Fig. 8. Celtic reenactment at the Open Air Museum Mitterkirchen, Austria, August 2014.

person is sitting on the nearby bedstead, which is comfortably padded with straw and animal skins...

What is left of this scene after thousands of years when the wind, rain and soil bacteria have done their work? Archaeologists often find only fragmentary remnants. The wooden walls and pillars of the house have long since gone, only the post holes, in which the supporting structures were embedded in the ground, remain. The fireplace with stone lining is still visible,

and charcoal and the red traces of fire on the surrounding clay floor have survived. The metal and bone cooking utensils, the cauldron, the pottery and metal knives are still present, to be uncovered during the excavation, but the food and wooden utensils are gone. Only meagre relics remain from the loom and the spindle basket: the loom weights, the stake holes of the frame of the loom at best, as well as some ceramic whorls of the spindles, but the wool, like the fruits and vegetables, has decayed.

As demonstrated by this example, the preservation conditions for organic materials under the climatic conditions of Central Europe are, especially for textiles, anything but suitable. Thus the majority of the materials which were handled by prehistoric people and with which they were surrounded are usually not preserved at archaeological sites. Only in serendipitous cases, such as the Neolithic and Bronze Age wetland settlements around the Alps, the findings from the salt mines in Hallstatt and Dürrenberg-Hallein or even the Iceman, a Neolithic mummy better known as 'Ötzi' show us the variety of raw materials in use.

Moreover, different preservation conditions³ also lead to a selective survival of organic finds, especially textile finds, which are discussed here. On some archaeological sites no plant materials are present; on other sites animal materials such as wool or leather are absent. This may be due to different environmental conditions. Favourable conditions for the preservation of fibrous materials, which are based on protein (such as wool) or cellulose (such as plant fibres) include a pH value that does not damage the fibres and does not allow harmful bacteria and fungi to survive. Animal fibres are best preserved in neutral pH of 7 and dissolve in alkaline environments. Vegetable fibres will degrade in an acidic environment; animal and vegetable materials are therefore only preserved together on the same site in exceptional cases. The rate of degradation is dependent on several factors. Heat, water, oxygen and nutrient deficiency determine the living conditions of soil organisms. The presence of tannins, as are present in bogs or tree coffins for example, can greatly delay

³ Textile preservation under dry conditions is excluded here, because it does not occur in Central and Northern Europe. For examples from the deserts of the Nile Valley, see Wild 1988, 7.

decomposition⁴. Different preservation conditions (oak coffins, wetland settlements, organics corroded onto metals, salt mines and glaciers) also represent various circumstances of deposition. Not only is the number of preserved textiles from Central European prehistory small, but it also represents a highly selective range of different contexts. Several of these special contexts of preservation are discussed below.

2.1 Preservation by metal corrosion products

During the Bronze and Iron Ages, numerous metal objects placed in graves as equipment for the afterlife provide an opportunity for textiles to be preserved. If textiles were deposited together with bronze and iron objects (for example as components of clothing in graves), metal corrosion at the contact points of the copper or ferrous metals and the adjacent textiles may lead to the emergence of a durable combination of materials (Fig. 9).

Under wet conditions the soluble metal salts penetrate the textile material and replace organic matter. During the duration of deposition in the soil a chemical combination of materials takes place, wherein the textile component becomes degraded. This process, referred to as mineralization, can lead to a complete



Fig. 9. Textiles attached on a bronze arm ring from the Roman cemetery of Mautern-Burggartengasse, Austria.

⁴ Cf. Farke 1986. – Gillis and Nosch 2007. – Wild 1988, 7–12.

replacement of the organic material⁵. When textiles are in contact with iron artefacts when they rust, the sulphides leaching out of the metal gradually invade the adjacent patches of textile, replacing the fibres or causing a negative imprint to be formed around them.

The transition from the conservation of organic materials by metal salts to complete mineralization of the fabrics until only imprints remain is a fluid process. From the finds of Hochdorf, Johanna Banck-Burgess⁶ was able to reconstruct the decomposition processes that lead to a change in the appearance of textiles. Thus, the fibre substance can degrade, the yarn thickness thins out and the surfaces may turn 'soapy', so that the textile structure is barely noticeable. In some cases when the fabrics have been completely replaced by the metal oxides, the weave structure and even the fibres are still recoverable as an imprint. The metal oxides can cause an increase of volume of the threads; through the growth of the fibre structure the textile may also appear densely compressed and unnaturally compact.

Textiles preserved in graves by metal corrosion are usually more than unsightly, because typically the original colouring is lost in this process. Furthermore, the remains are very fragmented, often limited to only of a few square millimetres and can therefore all too easily be overlooked during the excavation and restoration of the finds. Despite these limitations, textile residues obtained by metal corrosion are an important source for research, because of their clearly defined position in regard to the body of a buried person⁷.

2.2 Preservation by salt

In the prehistoric sites of the Austrian salt mines⁸ of Hallstatt and Dürrnberg near Hallein, preservation conditions unique in the whole of prehistoric Europe prevail. Salts may contribute to the preservation of fibres because they are toxic to microorganisms

⁵ Cf. Chen *et al.* 1998. – Mitschke 2001, 29. – Wild 1988, 8–11.

⁶ Banck-Burgess 1999, 93, pl. 1 and 2.

⁷ *E.g.* Bender Jørgensen 1992. – Rast-Eicher 2008.

⁸ Hallstatt: Grömer *et al.* 2013. – Dürrnberg: Stöllner 2005.



Fig. 10. '*Heidengebirge*' (layers containing objects from ancient mining activities) with textiles from the salt mine in Hallstatt, Austria, Early Iron Age.

such as bacteria. In a salty environment, single-celled bacteria dry out and die⁹. This prevents the decomposition process of organic materials due to bacterial activity.

The high pressure of the mountain closes the man-made cavities in the amorphous, soft geological material after the shortest possible time, so that the prehistoric remains, the so-called 'heathen's rock' (*Heidengebirge*) becomes hermetically sealed (Fig. 10). Through this air-tight embedding in the salt rock, no oxidative degradation processes can take place and microbiological degradation is strongly reduced. The high humidity in the mountain prevents the drying out of fibres¹⁰. The natural degradation processes are slowed by the constant and low temperatures in the salt mines. The textiles are therefore preserved so well in their organic matter that they are still elastic and supple when recovered. Salt preserves any organic material, both of plant and animal origin, without limitation. In contrast to lake-side settlements, bogs or oak coffins, sites with salt preservation thus do not show biases in regard to raw material origin.

⁹ Gengler 2005. – Van der Sanden 1996, 12.

¹⁰ See Gengler 2005, 28: chapter 3.1.3.5, 37: chapter 3.3.1.

2.3 Preservation within waterlogged contexts

Neolithic and Bronze Age textile materials are also known from wetland settlements within the circum-alpine area: from Switzerland, Germany, northern Italy and Austria. Prehistoric people built their houses as lakeside settlements, partly on the shore and partly as pile dwellings in the water. When organic materials were deposited in the water and remained there, chances became good that they would be able to survive the millennia.

Due to the relatively low oxygen levels in the water, the oxidation process of textiles were slowed down and bacteria were prevented from performing their decomposition work. Textiles sank to the ground and became embedded into geological deposits such as chalky sediments at the bottom of the lakes. Because of this alkaline environment, however, animal fibres were destroyed over time¹¹. For this reason preservation in waterlogged contexts mainly includes plant materials such as woven textiles of flax or sieves, nets, mats and baskets from materials like grass, tree bast and wood.

Fig. 11. Neolithic settlement Arbon Bleiche 3, Switzerland. Context and position of wood and textiles in the wetland conditions.



¹¹ Cf. Farke 1986, 56. – Rast-Eicher 2012, 381.

2.4 Preservation by ice

Since the spectacular discovery of the Iceman, a Neolithic mummy that melted from the glacier with all his belongings in 1991 (Fig. 12)¹², the mountainous regions of Central Europe increasingly moved into the focus of archaeological interest. Since then, other important discoveries were made in the Alps, for instance at Schnidejoch in Switzerland¹³. From this site we know of a quiver, a bow and arrows, remains of Neolithic shoes and a fragment of a legging.

The preservative effect of ice is based on the low temperatures. The combination of cold and dryness, freeze-drying, is also used in modern research for continued preservation of organic material.

Fig. 12. The Iceman, a Neolithic mummy from the Ötztal glacier, Italy, c. 3300 BC.



¹² Fleckinger 2011. – Spindler *et al.* 1995. – Spindler 1995.

¹³ Suter, Hafner and Glauser 2006.

2.5 Bogs

In bogs, the lack of oxygen as a result of constant moisture, the exclusion of air and permeation by humic acids prevent degradation and damage by microorganisms. In terms of the preservation conditions, however, it is important to distinguish raised bogs and fens¹⁴. In raised bogs, the polysaccharide of *Sphagnum* is essential for preservation. This carbohydrate resides in the peat moss and is released upon decomposition of plant cell walls. It is later converted into brown humic acid, which binds nitrogen and calcium. Due to the acidic pH level only animal fibres remain. Humic acids and tannin present under these conditions preserve protein-containing organic materials (wool, fur, leather, skin, hair, nails, horn), whereas plant matter and bones decay. In the calcareous fens, on the other hand, wool textiles decompose and only fabrics made of plant materials may be preserved. Most archaeological finds of textiles come from raised bogs and, therefore, only encompass woollen textiles.

The bogs of northern Europe are particularly significant for research into textiles and clothing¹⁵. From famous sites like Thorsberg or Huldremose we know complete vestments, which came to light as peat was recovered. Central Europe also has bogs, but since peat for fuel production played no major role due to the abundance of wood and forests, bogs were not exploited there. Most likely, many prehistoric (textile) treasures still lie dormant in Central European bogs.

2.6 Oak coffins

The famous intact oak coffins (Fig. 13) from burial mounds are primarily located in the territory of the North German Schleswig into middle Jutland in Denmark¹⁶. The deceased person was laid out in a hollowed-out tree trunk in complete clothing and the coffin covered with a stone packing, soil, clay, sand, grass or mossy turf. Humic acids penetrated into the interior of the

¹⁴ Cf. Farke 1986, 55–57. – Van der Sanden 1996, 18, 20 and 120. – Wild 1988, 7–8.

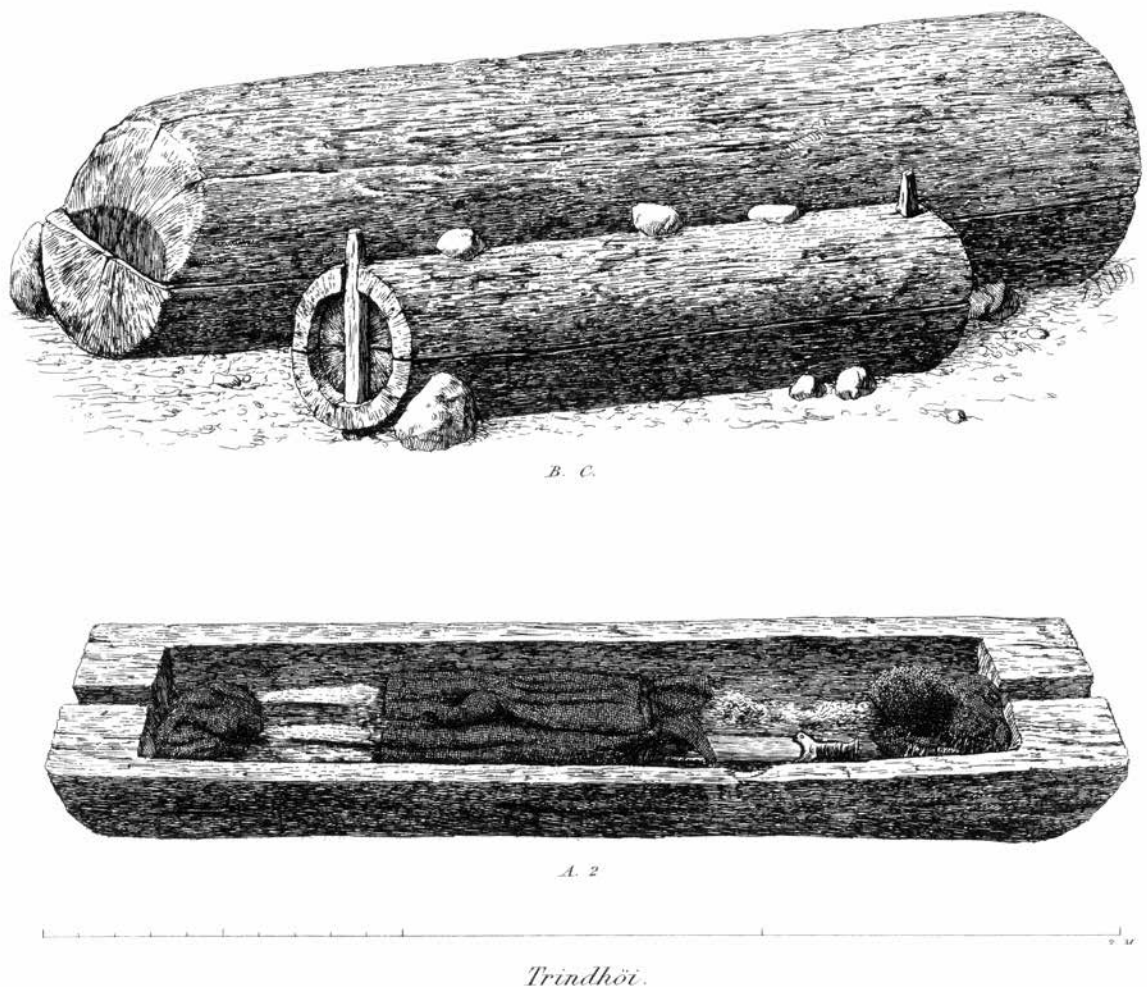
¹⁵ Mannering *et al.* 2012. – Möller-Wiering and Subbert 2012. – Schlabow 1976. – Van der Sanden 1996.

¹⁶ Broholm and Hald 1940. – Hald 1980. – Mannering *et al.* 2012. – Schlabow 1976, 12.

mounds with the rain and formed a gelatinous mass at a depth of 1–1.5 m from the upper mantle of the mound. In combination with the lime and iron particles present in the fill, this then developed into a rock-hard humus-iron layer and sealed the interior of the hill airtight. Through this process, the tree coffin rested under absence of air in a liquid enriched by humic acids. In addition, the tannins from the trunks of recently felled oaks had a preservative effect. Particularly wool textiles, leather, fur or horn preserve well in this milieu. The bones of the deceased, however, are usually in a very bad condition due to decalcification.

The phenomenon of well-preserved tree coffins is primarily known from the 'Nordic Bronze Age', more precisely the time

Fig. 13. Oak coffin from Trindhøj in Denmark, dendrochronologically dated to 1355 BC.



between the 15th and 13th centuries BC. From this period, complete garments have been recovered.

Only one case of similar preservation conditions for the conservation of textiles in south-eastern Central Europe is known so far. The early Bronze Age burial mound from Pustopolje in Bosnia-Herzegovina¹⁷ has revealed a perfectly preserved wooden grave construction, a grave chamber made of elm boards. The deceased lay in crouched position, wrapped in a large woollen cloth on boards that were coated with a thin animal hide.

2.7 Carbonisation

It may seem strange, but charred textiles also have some chance to survive the passing of time. With incomplete combustion, chemical processes interact with physical alterations. After carbonization¹⁸, the charred and usually shrunken textiles preserve in carbonized form. Although there are partial transformations, the microstructure of the textile usually remains substantially intact. Plant fibres are often more stable in a carbonised state, animal fibres, on the other hand, often perish in fire. If the textiles are exposed to excessive heat in the absence of oxygen, the process is called coalification. The amount of volatile constituents of the textile fibres thereby decrease more and more in favour of the carbon content. Again, the microstructure of plant and animal fibres is largely maintained. Examples include the Neolithic finds of Spitzes Hoch near Latdorf and Kreienkopp near Dietfurt¹⁹.

2.8 Imprints on ceramics

Information about textiles can also be obtained from impression on pottery or pieces of clay²⁰.

¹⁷ Cf. Benac 1986, 109. – Car 2012.

¹⁸ See Farke 1986, 57. – Rast-Eicher 2003. – Wild 1988, 11.

¹⁹ Bender Jørgensen 1992, 115, fig.1. – Schlabow 1959.

²⁰ Wild 1988, 11, fig. 5.

Although the organic material is not preserved, technical details such as thread count and weave can be documented, and in exceptional conditions, information about fibre material can also be recovered. Shrinkage in drying or firing of the clay therefore has to be taken into account. These impressions arise largely by chance, for instance when a clay pot that has not yet dried after moulding, turning or coil-building was set on a mat or weave²¹. On the other hand, imprints of textile elements were also deliberately used as an ornament in different prehistoric cultures. The best known of these cultures is the so-called Corded Ware Culture (Fig. 14) from the end of the Neolithic period²². The



Fig. 14. Corded Ware pottery from Franzhausen, Austria, Late Neolithic.

²¹ Examples see Richter 2010, fig. 34.2–34.3.

²² Cf. Grömer and Kern 2010.

decoration of pottery with impressions of about 2–3 mm thick cords corresponded to the aesthetics of the time.

3 Defining textiles

What actually is a textile? Conventionally, the term textile is applied to woven fabrics in particular. The British standard handbook for the textile industry: *Textiles Terms and Definitions*, The Textile Institute Manchester (7th edition 1975) says: '*Originally a woven fabric; the term is now applied to any manufacture from fibres, filaments or yarns, natural or man-made, obtained by interlacing*'.²³

In prehistoric and ethnographic research the term also encompasses a variety of things. Textile techniques are more closely defined as '*primarily all methods, which include the production of fabrics from smaller units, e.g. of thread, yarn, string, bast, leaves or parts thereof, rods, wood chips etc. Further, they include, on the one hand, the manufacture or production of raw materials, e.g. the production of string, yarn or thread, and, on the other hand, the processing of finished fabrics (cutting, sewing) as well as their decoration, e.g. embroidery and appliqué*'.²⁴

The term textile²⁵ encompasses not only woven fabrics, but all products which consist of interconnected basic components. These include mats made in plying and basketry techniques, objects of fabrics made in coiling techniques, nets, wickerwork and twined objects. The extensive range of fabric making techniques are amply shown by ethnological classification systems such as the work of Annemarie Seiler Baldinger²⁶ and Irene Emery²⁷ or, for prehistory, exemplified in the publications of the textile assemblages from the Swiss lake-dwellings of the Neolithic period²⁸.

²³ Kind comment by John Peter Wild, Manchester, Great Britain, Feb. 2015.

²⁴ Bühler-Oppenheim 1948, 84.

²⁵ See discussion about the term by Desrosiers 2010, 27–28.

²⁶ Seiler-Baldinger 1994. First published in 1973 as 'Systematik der Textilten Techniken', worked out at the Museum der Kulturen in Basel, Switzerland.

²⁷ Emery 1966 uses 'fabric' as the generic term for all fibrous constructions, 'textile' to refer specifically to woven fabrics.

²⁸ Médard 2010, 2012. – Rast-Eicher and Altorfer 2015. – Vogt 1937.

As apparent from the table of contents, this book focuses mainly on woven textiles and all the steps involved in their production. In addition, the most important end products, especially the clothes, are investigated more closely. In time and space the study area concentrates on prehistoric Central Europe.

B Craft techniques: from fibre to fabric

The techniques that were applied in the manufacture of prehistoric textiles can be understood through various means. The textile remnants themselves permit conclusions about different production processes and the use of specific equipment.



B Craft techniques: from fibre to fabric

Tools and equipment for textile crafts are abundant amongst archaeological finds, especially if they were made of durable materials such as stone, clay, bone or metal. Textile tools are found both in graves and on settlements, where the context in which they were found may be particularly revealing. Sometimes, for instance, a tool is found in its original position in a house that was destroyed by fire. Such serendipitous findings provide information about where the textile equipment was placed within the house, and sometimes about how it was assembled and handled²¹.

Some findings may appear very strange from the perspective of a 21st century onlooker – taking a look at our Grandparent's and Great-grandparent's generation generally helps to understand prehistoric textile crafts. Not too long ago, around the time of the World Wars in the 20th century, flax and wool was processed in rural areas in Europe, spun in the houses, woven and turned into tablecloths, other home-textiles or garments. This was often done by hand and with simple tools such as the spinning wheel, the hand loom and the foot-powered sewing machine. European folklore and, in some cases at least, non-European ethnographic records are rich sources of information for our topic.

In the definition of textiles and textile techniques in chapter A3 (pages 32–33) it was already mentioned that there are many different types of fabrics – weaves, basketry, plaits, wickerwork, nets, etc. In the following, the focus will be on archaeological remains of woven textiles from the Neolithic to the Iron Age, and discussion about their production.

The workflow (Fig. 15) starts (after the breeding of animals and the cultivation of fibre plants) with the extraction and preparation of plant or animal raw materials, from which the threads are made. In this book, thread manufacture will only be looked

²¹ Cf. Bender Jørgensen 2007, 8–9. – Ræder Knudsen 2007.

at in detail for spinning²², because spun yarns provide the primary base material for woven textiles in Central Europe. Several prehistoric weaving techniques are highlighted. Dyeing and decorative techniques are used to enhance the value of textiles and were already applied in manifold ways before Roman times. The work that occurs after removing the weave from the weaving equipment is referred to as finishing (*e.g.* raising the nap, fulling, pleating, bleaching, some decorative techniques like embroidery and appliqué, and dyeing the cloth). Finally, sewing and tailoring are the steps that eventually form a garment or utilitarian object.

The individual steps of production will now be considered in terms of the archaeological evidence from prehistoric finds and features. Each activity requires its own equipment – sometimes a highly specialized tool, sometimes universal tools such as knives, which are used for many different crafts or household activities, or even something a tool as simple as a stick. Resources such as space, work surfaces or specialized know-how shall also be considered for the prehistoric textile crafts.

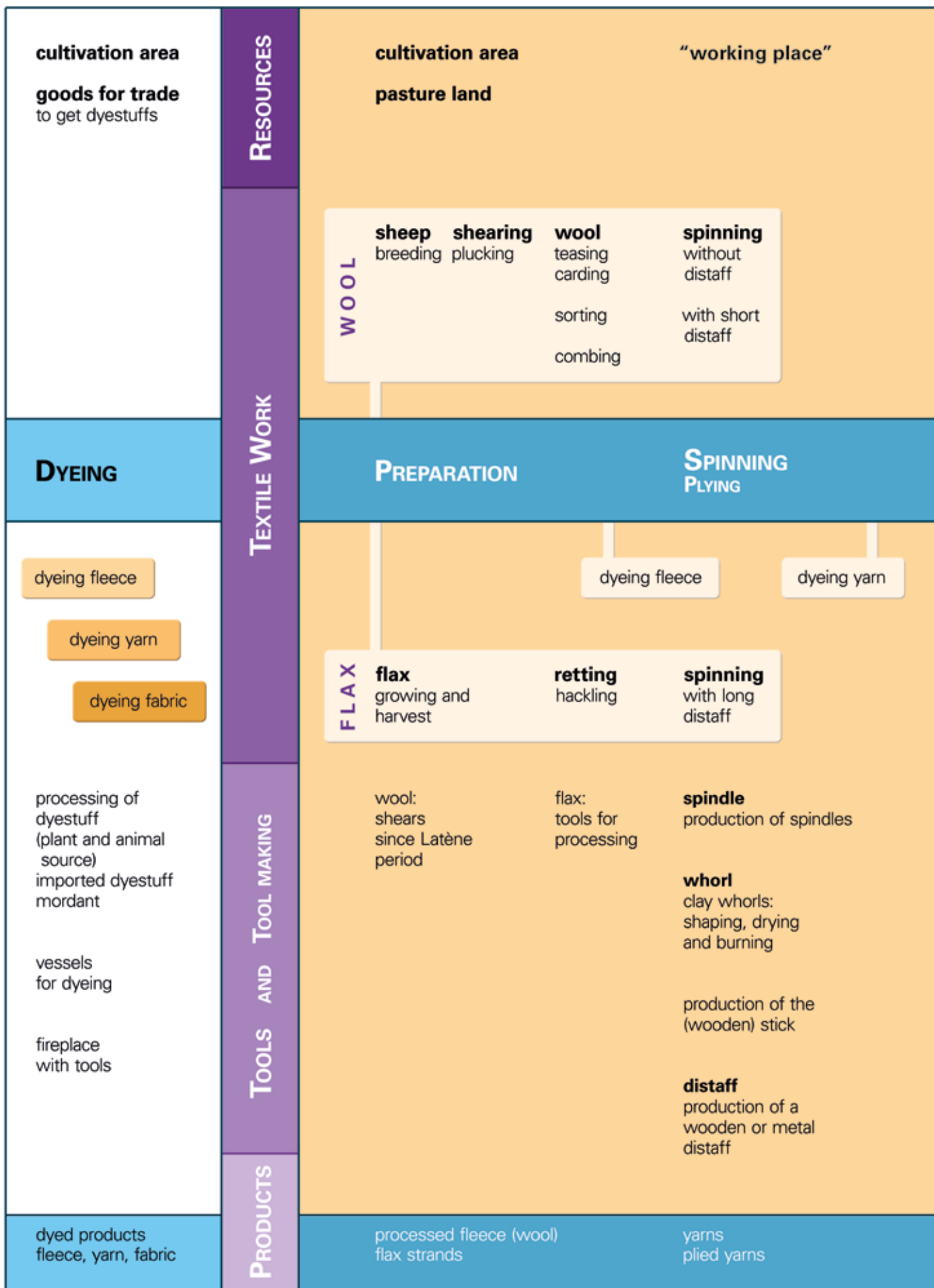
1 Raw Materials

The raw materials from which prehistoric textiles were made are very diverse. For closer examination, researchers look at them through the microscope (Fig. 16). If prehistoric textiles are well preserved as organic remnants, the fibre structure can be easily identified under the optical microscope with high magnification. Plant fibres and animal hairs are clearly different from each other. The bamboo-like fibrous thickening of the bast fibres such as flax or hemp and the scaly structure of the wool and animal hair are clearly visible on undamaged fibres. When the textiles are appropriately preserved, specialists may even be able to distinguish individual species from each other.

For a long time, mineralised textiles fibres, *i.e.* fibres preserved by metal corrosion, could not be identified due to raw material.

Following page:
Fig. 15. Textile
production sequence.

²² There is also evidence that plant fibres were spliced into yarns: Leuzinger and Rast-Eicher 2011.



place for the looms
warp-weighted looms
inside the house or outside
"weaving huts"

place for band looms

loom with one
heddle rod
tabby, basket weave

loom with more
heddle rods
twill variants

**specialised
know-how**

weaving with different
colours: stripes, checks
spin pattern
"flying thread"
inserted elements
beads, metal spirals

"working space"

finishing, fulling,
stretching ...

cutting and sewing
the textile

WEAVING

PATTERNING TECHNIQUES ON WEAVING

POST-PREPARATION

SEWING

band looms
tablet weaving

different patterning techniques:
tablet weaving and band looms

warping the loom
preparing the starting border
preparing the pattern

warping tools

production of the **loom**
(wooden) frame, heddles, shed rod

production of clay **weights**

production of **weaving tablets**

(wooden) **implements for weaving**
pin beater, weaving sword,
weaving comb

dyeing the fabric

patterning the fabric
embroidery, ...

tools for sewing:
needles
(bone, bronze, iron)

tools for cutting
knives
(flint, bronze, iron)
flat surface to cut on

scissors
(from Latène period)

tools for roughing the fabrics
frames for stretching
smoothing stones

fabrics
band weaves
weaving to shape

finished
ware

sewn products
clothing
functional textiles

Under an optical microscope, or light microscope, only a dark mass is visible, and details remain hidden. For the last few decades, however, the development of the scanning electron microscope (SEM)²³ has provided new insights. In the scanning electron microscope, the surface of the investigated fibres is scanned line by line and made visible at high magnification and an extraordinary depth of view. In this way, valuable information can now be obtained from fibre materials even if they are poorly preserved. Written records from ancient authors provide further information about the use of fibre materials in the Late Iron Age, such as a quotation from Herodotus about hemp (Hdt. 4.74).

Fig. 16. Analysis under transmitted light microscope (left) and scanning electron microscope (right) at the Curt-Engelhorn Centre for Archaeometry at the Reiss-Engelhorn Museums in Mannheim.

Raw materials of animal and plant origin were available to prehistoric people in order to produce textiles²⁴; in nature, however, mineral fibres also occur that could be woven into fabrics. Well-known and banned in the EU today because of its health hazards is asbestos, fibres deriving from the mineral amphibole (Fig. 17).

In ancient Greece²⁵ asbestos was spun and woven into textiles, and this raw material was admired mainly because of its resistance to fire. We thus learn from Pliny the Elder (Plin., *Nat. Hist.* 19.1.4):



²³ For analyses of mineralised remains with the SEM, see Fischer 2010, 57–58.

²⁴ Cf. Barber 1991. – Harris 2010, 2012. – Contributions in Gleba and Mannering 2012.

²⁵ Pekridou-Gorecki 1989, 31–32.

'There has been invented also a kind of linen which is incombustible by flame. It is generally known as "live" linen, and I have seen, before now, napkins that were made of it thrown into a blazing fire, in the room where the guests were at table, and after the stains were burnt out, come forth from the flames whiter and cleaner than they could possibly have been rendered by the aid of water. [...] By those who find it, it is sold at prices equal to those given for the finest pearls; by the Greeks it is called "asbestinon" [unquenchable], a name which indicates its peculiar properties.'

Unaware of the health hazards, asbestos was used to produce towels, tablecloths, scarves and shrouds – how fitting, cynics might say.

The use of mineral fibres has not been proven for the prehistoric periods in Central Europe, but the British Museum has an example of presumably Etruscan asbestos²⁶. From Austria, there is evidence for an asbestos thread, used as a lamp wick from Enns²⁷, dating to the 4th century CE.



Fig. 17. Mineral fibres, amphibol asbestos from Uri in Switzerland, Inv. Natural History Museum Vienna W A.I.160.

²⁶ After Gleba 2008, 64.

²⁷ Grömer 2014, 166–167; 270 (Rö-152).

In addition to these non-organic materials, metal threads²⁸ were used as strips or wires to be incorporated as a decorative element in textiles (for details see pages 193–197).

Man-made fibres such as rayon, nylon or polyester that characterize today's textile industry were only developed at the beginning of the 20th century and produced in even greater quantities since the 1960s and 1970s²⁹.

1.1 Plant Fibres

Plant fibres were already known to Palaeo- and Mesolithic people as raw materials for the manufacture of textile sheets such as mats and nets. Many of these products were based on twisted threads that were further processed by braiding, netting and twining techniques³⁰. Knowledge about the properties of grasses, tree bast and fibre plants, their preparation and their processing thus has a long tradition; a tradition that was extended by the early farmers of the Neolithic period to the new technique of weaving. Of all the plant fibres, flax was especially important in Central European prehistory. In addition, however, other plants such as hemp or stinging nettle were used for textile production. There is no evidence for the use of cotton in Europe in prehistoric times, it arrived during the Roman period³¹.

Archaeobotanical investigations are referred to again and again in the discussion of fibre plants. Archaeobotany is the science that deals with plant remains from archaeological excavations. They can give indication as to which crops were cultivated and used as well as how they were distributed.

²⁸ Systematics about worked metals emerged from ethnographical material: see Emery 1966, 5.

²⁹ Cf. Eberle *et al.* 1991, 30, 33.

³⁰ Bender Jørgensen 2013b. – Rast-Eicher 1997; 2005. – Soffer *et al.* 2000.

³¹ Barber 1991, 32. The use of cotton dates back to c. 3.000 BC in the Indus Valley.

Flax

Flax (*Linum usitatissimum*) is a versatile crop, which is already reflected by its exuberant botanical name – ‘*usitatissimum*’ means ‘the most useful’. It provides both fibres from the stem and oil, which is extracted from the seeds. Through selection and breeding to enhance those two traits, a large number of different types of flax are known today. A breakdown of their different types is beyond the scope of this book, but information can be found in a book on specialist crops by Udelgard Körber-Grohne³².

The cultivated flax plants with high yield are usually annual plants requiring very high maintenance and intensive cultivation. There are, however, also perennial varieties that could well have been used in the Neolithic period³³. Depending on variety and region, the individual plants are about 60 to 90 cm high, but may also be taller. The fibres of flax are embedded in the bark of the stem³⁴, whereby they are grouped into bundles. Individual fibres of prehistoric flax have a length of 4 to 10 cm and an average thickness of 14.9 μm .

The wild form of our cultivated flax, the narrow-leaved pale flax (*Linum bienne*), occurs in the Mediterranean region, North Africa and Western Asia. The fibres of the pale flax could be spun. As a crop, cultivated flax arrived – similar to many other achievements of the Neolithic period – in Central Europe from the south. The oldest evidence of this crop³⁵ for fibre production comes from the Near East, from the Pre-Pottery Neolithic at c. 9.000 BC. These are plant remains of cultivated flax from Jericho and linen fabrics from the Nahal Hemar Cave near the Dead Sea. One of the most remarkable recent finds is a linen cloth made of flax from a burial at Çatalhöyük in Turkey³⁶. Wrapped around an infant, the flax cloth was well preserved due to its partial carbonisation.

³² Körber-Grohne 1994, 366–379, for a history of linen and for archaeological finds of flax.

³³ Herbig and Maier 2011. – Karg 2011.

³⁴ Körber-Grohne 1994, 370–371. – Leuzinger and Rast-Eicher 2011, 3643–3646.

³⁵ A good summary of the origins of flax and its introduction to Europe is provided by Gleba 2008, 65–66.

³⁶ Özdöl Kutlu 2014.

To illustrate the flax plant, an entry in a herbarium over 200 years old is shown here (Fig. 18); it is one of a million plant records stored in the Department of Botany of the Natural History Museum in Vienna. Information about plants, their appearance and use has been recorded since the beginning of the modern era in engravings on copper plates and in watercolour paintings. Herbaria have been created for over 500 years. Plants are carefully dried, pressed and then stored on thin cardboard or loose in a paper sachet. Labels of the origin, collector and date of detection allow scientists to look into the past and sometimes they can even reveal information about climate change.

Flax as plant residues is found in the archaeological material from prehistoric settlements in Central Europe since the Neolithic period³⁷; it has been grown since the oldest phase of the Linear Pottery Culture in Central Europe, c. 5,500 BC.

Due to its resilience in the less-cultivated forms, flax also thrives in the more unfavourable climates and soils of the central mountain areas – flax could prevail alongside emmer and

einkorn. It was appreciated both for the fibres and because of the seeds that can be pressed for oil. Flax was eaten in prehistoric times, as evidenced by charred crusts of flaxseed on Late Neolithic potsherds from Switzerland³⁸. Particularly well-studied is the history of use of this crop for the Neolithic and the Bronze Age at Lake Zürich in Switzerland. The cultivation of flax reached a climax in the Late Neolithic period there, especially in the Horgen Culture between 3,300–3,200 BC³⁹. Numerous finds of teeth from heckling combs used for the preparation of flax and finds of linen fabrics go hand in hand with this evidence.

If archaeobotanical evidence for flax is found in a prehistoric settlement, it cannot be immediately determined whether its primary use was for fibre or oil, although a synergetic utilization is most probable. The textile specialist Antoinette Rast-Eicher remarks that the entire Neolithic textile production is based on the processing of plant materials, which has its roots in the Old and Middle Stone Age⁴⁰. Flax is also evidenced by

³⁷ After Lüning *et al.* 1997, 58–59 (Neolithic period). – Austrian finds in Kohler-Schneider 2007. – See also Gleba 2012, 219–221.

³⁸ Jacomet *et al.* 1990, 81–90.

³⁹ Herbig and Maier 2011. – Rast-Eicher 1997.

⁴⁰ Rast-Eicher 2005, 117–120. – See also Bender Jørgensen 2013b.



Fig. 18. Herbarium sheet of flax (*Linum usitatissimum*), Portenschlag, c. 1800. The flowers of the flax plant, originally blue, are now yellow.

archaeobotanical finds from the Bronze and Iron Age⁴¹, for example from the La Tène period settlement and sanctuary Roseldorf in Lower Austria.

Early Bronze Age examples of linen weaves⁴² stem from the wetland settlements of northern Italy, for instance the beautifully designed linen bands from Lago di Ledro. Middle Bronze Age linen fabrics are known from the Hallstatt salt mine in Austria. Whereas woollen fabrics outweigh those of flax in the Early Iron Age in Central Europe, people of the Late Iron Age (La Tène period) still used textiles made of flax. The famous embroidered linen textiles from Nové Zamky in Slovakia and the linen weaves from Dürrnberg near Hallein in Austria are noteworthy.

Blended weaves ('union fabrics') were also produced. In an Early Bronze Age textile from Unterteutschenthal, Germany, the thread system in one direction (possibly the warp) consisted of linen, the other (possibly the weft) of thick yarns of sheep's wool⁴³. Here, the strength of the flax plant was obviously appreciated and taken advantage of, whilst the combination with the warming properties of animal hair was exploited by combining the flax threads with bulky wool yarn.

Flax threads as sewing material for woollen textiles were also used, for example, for the trousers of a bog body discovered in 1900 in Damendorf, dating to the Roman Iron Age⁴⁴. The use of flax as a sewing thread can be explained by its stability and resistance to tearing.

Flax fibres are easy to smooth and can be spun into shiny threads, which in turn form a solid, sturdy fabric when woven. Flax has a cooling effect due to the high thermal conductivity of the fibres. The pale grey to light brown fibres can be bleached almost to white, although dyeing the material can prove difficult.

⁴¹ Cf. Roseldorf: Caneppele, Heiss and Kohler-Schneider 2010. – Generally for the Bronze and Iron Ages: Lüning, Jockenhövel, Bender and Capelle 1997, 163.

⁴² Examples: Lago di Ledro: Bazzanella *et al.* 2003, 161–171; Bazzanella 2012. – Hallstatt: Grömer 2012, 2013. – Nové Zamky: Belanová 2005, fig. 3–4, 2012. – Dürrnberg: Stöllner 2005, fig. 9. – Textiles from Switzerland: Rast-Eicher 2008.

⁴³ Schlabow 1959, 118–120.

⁴⁴ Van der Sanden 1996, 127, fig. 176.

Hemp

Hemp (*Cannabis sativa*) (Fig. 19) is less frequently identified as raw material of archaeological textiles. Hemp is difficult to distinguish from flax even under the scanning electron microscope, especially in the mineralized state. The usual material identification tests on modern materials, such as the combustion test, staining reaction, *etc.*, can usually not be performed on archaeological textile remains. Therefore, the neutral term 'bast fibre' is now preferred if it is not clear whether a plant fibre is flax, hemp, nettle or the like. It is quite possible that behind many 'flax textiles' published long ago there is actually a fabric made from hemp. When some organic matter of the textile is preserved, certain tests with the transmitted light microscope might provide more clarity⁴⁵.

Hemp is an annual plant⁴⁶ that produces only one thick stem, which usually reaches 1.2 to 3 m height, sometimes up to 5 m, depending on the variety and region. Today, hemp is mainly known as a hallucinogenic plant harvested for the drug marijuana – with the Indian hemp (*Cannabis indica*) having the most hallucinogenic effect. Modern varieties of industrial hemp with only slight traces of the psychoactive drug *tetrahydrocannabinol* have been re-introduced as fibre plant crops in Central Europe in recent years, whereas cultivation of the hallucinogenic varieties are largely prohibited because of the danger of drug abuse.

The fibres of hemp vary according to their position in the plant. The lower part of the stem forms a larger number of bast fibre rings, the upper part less. The fibres of the outer ring (nearest the epidermis) are coarser, with about 50 to 70 μm in diameter, than those of the inner ring (nearest the pith) with 12 to 30 μm . These are on average even finer than flax fibres and very fine textiles can be prepared with them. Ropes and coarser fabrics are made

⁴⁵ The 'Herzog test' can be applied to differentiate bast fibres such as flax and hemp. The distinction is possible, because the cellulose fibrils of these fibres are arranged differently in the cellulosic layer of the secondary wall 1. Under polarized light a different sequence of interference of the colours red and blue is therefore visible upon rotation of the fibres in orthogonal position between crossed polarizers and switched on wave plates. After Wülfert 1999, polarizing microscopy 283–293, Herzog test 290–293.

⁴⁶ See Körber-Grohne 1994, 379–391, for hemp and its history.

Fig. 19. Female and male hemp plants (*Cannabis sativa*): Water coloured chalcography, Miller 1782.



from the thicker, very tough and abrasion-resistant fibres of the outer ring. In historical times, these coarse fibres were used to manufacture canvas, tents, fire hoses and mailbags because of their particular durability.

Secure evidence for hemp comes from the early Celtic princely grave of Hochdorf, dating to c. 500 BC⁴⁷. The deceased was placed on a bronze couch (*klinē*) in his grave chamber. Several textiles made from hemp bast were discovered, which served as upholstery and cushioning on the couch. According to the investigations of Udelgard Körber-Grohne, the hemp bast from Hochdorf was not made of processed fibres. Instead, the bark of the stem was stripped off in narrow strips, spun and woven. This procedure resulted in thread sizes between 0.2 and 0.7 mm. The bottom layer comprised a weft-faced repp weave as well as a striped weave of hemp bast. A mattress was placed on top, with a cover made of a hemp bast weave and a filling of badger hair and parts of plants. Tablet woven ribbons were also discovered at Hochdorf, for which strips of hemp bast and fine woolen threads were used.

The research on the unusual textiles from Hochdorf⁴⁸ revealed additional hemp fabrics from the late Hallstatt and early La Tène period, from Saint-Colombe or Chavéria in France and Prague-Záběhllice or Stehelčevy in the Czech Republic. Udelgard Körber-Grohne⁴⁹ further reports a rope made of hemp bast, which was found in the Dürrnberg salt mine near Hallein.

Ancient written records about the use of this crop by Indo-European tribes in the Balkans date to the 5th century BC. The historian Herodotus (490/480–424 BC) notes in his *Histories* that the Thracian knew how to weave hemp clothes of similar quality to linen (Herodotus, *Histories* 4.74).

⁴⁷ Banck-Burgess 1999, 82–84, 100–101, for the weaves of hemp bast and their funerary function.

⁴⁸ Banck-Burgess 1999, 83 for comparable finds.

⁴⁹ Körber-Grohne 1994, 385.

Stinging Nettle

The stinging nettle (*Urtica dioica*)⁵⁰ was also processed into fibres and spun for making fabric. What sounds rather strange to modern ears was quite common not so long ago. During the Second World War, for example, the stinging nettle was grown on a large scale in Germany and Austria. The nettle fabrics were sown to produce clothes, especially for robust uniforms for the army. Nettle was an especially common material for making sails and fishing nets during the Middle Ages. However, since the stinging nettle is not very high-yield, this material was ousted in the wake of industrialization – except in times of economic hardship. Wild nettle plants have a fibre content of only 5% in their stems, cultivated varieties reach up to 15%. In comparison, hemp has a fibre content of 10% in wild plants and up to 40% in cultivated hemp.

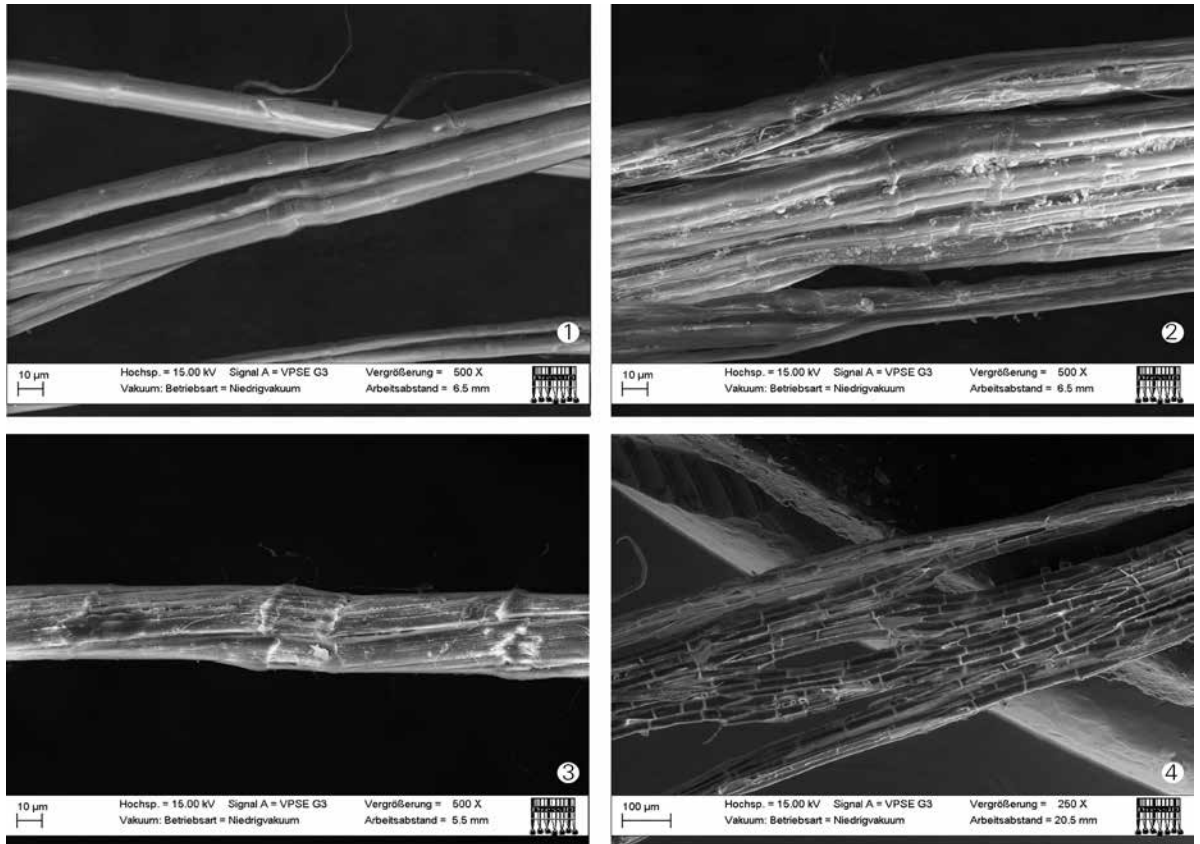
The stinging nettle grows on nutrient-rich soils, for example in lowland forests. It has accompanied humans since the earliest farmers, as it is a follower of human activities and emerges wherever settlements with open spaces are created. Archaeobotanists have found nettle plants in settlements of the Early Neolithic Linear Pottery Culture, for instance in Mold in Lower Austria⁵¹. A large amount of plants (over 200 pieces) were found during excavations at the Middle Neolithic circular ditch system Kamegg in Lower Austria. Because nettle is typically found in areas cleared and cultivated by humans, the mere existence of this plant cannot be taken as evidence of its use as a source of fibre. Since the method of extracting fibres from stems of flax and hemp was known from the Neolithic period, however, this technique of treatment was probably also applied to the nettle.

An actual textile made of nettle fibres is known from the Lusehøj burial mound near Voldtofte⁵² in Denmark, it was wrapped around cremated bone remains and placed inside a bronze urn. The typological features of the bronze urn indicate that it was

⁵⁰ General information on stinging nettles after Bredemann 1959. – See Barber 1991, 19–20.

⁵¹ Cf. Kohler-Schneider 2007 for various Austrian sites, including Kamegg. – Kohler-Schneider, Caneppele and Geihofer 2008, 113–115 (Mold).

⁵² Bergfjord *et al.* 2012. – Hald 1980, fig. 117. – Mannering *et al.* 2012, 97, fig. 3.3.



originally imported from the Eastern Alpine Area. The textile is a dense, fine tabby woven fabric and dates to period V of the Nordic Bronze Age (c. 900–750 BC), which is roughly equivalent to the beginning of the Iron Age in Central Europe. A recent strontium-isotope analysis of the nettle revealed that it most likely derived from areas with Precambrian rocks. Denmark, in contrast, consists of a geological base primarily composed of Tertiary and Cretaceous sediments. The strontium isotopic signature of the Lusehøj nettle textile can correspond to several locations with Precambrian rocks, *e.g.* in Sweden, Norway or Central Europe, in particular the Carinthian-Styrian region in Austria. The latter has a crystalline basement with a strontium isotopic signature matching the measurements of the nettle textile. Also the typological origin of the bronze urn, on which the textile was attached, can be placed there. So the nettle textile was presumably imported from that region to Denmark.

Fig. 20. Samples of plant fibres under the scanning electron microscope: flax (1), hemp (2), stinging nettle (3), linden bast (4). Curt-Engelhorn Centre for Archaeometry at the Reiss-Engelhorn Museums in Mannheim.

Furthermore, a close examination of the Huldremose woman (Huldremose I, 192–61 calBC), famous for the variety of garments such as the skirt, the scarf (both twill) and two capes made of fur has shown that she also wore a garment of nettle fibre covering the upper part of the body⁵³. A nettle thread was discovered, and distinct imprints of textiles were found on the chest and shoulders of the body. These are of the twill-woven scarf and some imprints of a tabby textile, which is thought to be of nettle cloth. On the back side of the body, stuck to the lower back, a tabby textile was found. It is made from z-twisted threads with a thread count of 9–10 threads per cm.

Tree bast

Tree bast from lime (*Tilia*; also called linden or basswood) (Fig. 20.4 and 21) or oak (*Quercus*) were mainly used in the Neolithic period for a variety of textile techniques, especially the production of ropes, nets or twined objects. These fibres were usually processed directly with the hands, turned and twisted. A special find was discovered at Arbon Bleiche 3⁵⁴ in a layer of House 3 of the wetland settlement. A completely preserved spindle was recovered (Fig. 38), dendrochronologically dated to 3,384–3,370 BC (the transitional period between the Pfyn and Horgen Cultures). The spindle shaft was made of hazel, the clay whorl was found still on the shaft, and spun material was wound around the shaft. The analysis showed that the spun material was bast of lime. In the Neolithic period lime bast was prepared so finely that fine threads of 0.5–0.7 mm diameter could be achieved.

Prehistoric woven textiles of tree bast have so far only rarely been discovered in Central Europe. A woven fabric made of lime bast is reported from Zürich-Mythenquai, dated to the time of the Corded Ware culture at the end of the Neolithic period⁵⁵. Another example comes from the Late Neolithic settlements on

⁵³ Gleba and Mannering 2010. – Mannering *et al.* 2012, 103–104.

⁵⁴ Leuzinger 2002, 119, fig. 147/3.

⁵⁵ Rast-Eicher 1997, 315.



Lake Zürich in Switzerland⁵⁶. The waterlogged environment preserved some textile fragments made of tree bast, most likely all from the same textile, woven in tabby with a yarn of 0.5–1 mm diameter. Twenty three fragments of a tabby weave from the Early to Middle Bronze Age are known from Valle delle Paiole in Northern Italy, which are said to be made of yarns of wool and tree bast⁵⁷. Beside these woven items, some very fine fabrics were made in twining techniques, which are by no means inferior to woven textiles in their fineness. Spinning and weaving bast into clothing is also known from folklore tradition in Latvia. Men's work clothing, aprons and women's skirts were made this way⁵⁸.

Fig. 21. Lime bast: after four to six weeks decay in water, the inner layers of the bast can be detached, the outer layers need more time.

⁵⁶ Rast-Eicher 1997, 317–320.

⁵⁷ After Bazzanella *et al.* 2003, 198. – Bazzanella 2012, fig. 8.11.

⁵⁸ Cf. Bielenstein 1935, 19–27.

Sometimes, research goes astray. At the beginning of the 1960s the textile remains from the Hallstatt period chieftain's grave from Hohmichele, Biberach district (Germany), were studied. Fine remnants of yarns were discovered, which formed complex 'embroidery' patterns in the form of angles, hooks, meanders and triangles on a fragment of woollen repp. The pattern threads were fine and showed a bright, papery saponified surface. The author of the textile reports, Hans-Jürgen Hundt, considered them to be silk, although even at that time scientific analyses by a botanist classified them as more likely of plant origin*. Hundt also interpreted the patterned fabrics from the princely grave of Hochdorf with threads of similar bright, papery saponified appearance as silk. Sweeping theories, for instance as to trade along the Silk Road to Central Europe, were built on these interpretations. In the 1990s, Karlheinz Mann from the Max Planck Institute for Biochemistry, Martinsried near Munich analysed the fibre remnants again by modern means**. Amino acid from animal protein should have been present if indeed the textile was a product of the mulberry silk moth. Based on these tests, however, silk could be ruled out; rather, the fabric is very finely processed plant fibre. According to the current state of research, there is no evidence for cultivated silk in the late Hallstatt and early La Tène period in Central Europe north of the Alps***. Sometimes textile archaeology can be as exciting as popular forensic TV shows.

* Hundt 1962, 206–208, with experts reports by A. Küntzel, M. Hopf and V. Thron. Interpretation of silk finds 213–215.

** Banck-Burgess 1999, 234–237, also for a research history of these finds.

*** See Bender Jørgensen 2013a, with a discussion of the recent analysis by Irene Good.

1.2 Animal fibres

Prehistoric people were most creative in the use of different animal hair for textile work. Hair of many animals with a certain staple length is suitable for spinning and/or weaving – especially the wool of the sheep.

Sheep's wool

Domestic animals like the sheep came to Central Europe with the first farmers in the Neolithic period, after their domestication had

taken place in the Near Eastern mountains in the area of the Fertile Crescent. Bones of sheep and goats are regular finds in settlements, from the

earliest farmers of the Linear Pottery Culture to the Iron Age. The proportion of their animal bones in comparison to other domesticated species varies through time. Based on the bones, the different phases of domestication and introduction of new breeds can be reconstructed⁵⁹. The sheep was a very common

⁵⁹ For a general history of the sheep as domesticated animal Benecke 1994, 228–238. – Lüning *et al.* 1997, 69, 84–87, 165–168. – Barber 1991, 20–30.

domestic and farm animal during later prehistory. Meat and milk served as food; the wool was spun and woven, leather and fur were used for clothing, belts and many other purposes. Even bones and tendons were processed into various devices.

But was the sheep in demand as a wool supplier from the beginning? Archaeozoologists can determine the purpose for which animals were kept from the bone material found on settlements. If they were slaughtered at a very young age, then the primary purpose must have been as a source of meat. Wool and dairy use, on the other hand, are most likely when a large number of older females appear among the finds.

The earliest breeds of sheep still had very short hair, similar to deer. The woolly sheep probably did not reach Central Europe before the Late Neolithic. A small figurine of a ram from the eponymous site of the Jordansmühl Culture in Poland, dating to c. 4,300–3,900 BC, shows a male sheep with longer hair⁶⁰. Osteological research observed that apparently a large breed of sheep (woolly sheep?) was introduced from the Near East or the Eastern European steppes to Central Europe between the 4th and



Fig. 22. Soay sheep, a primitive breed of domestic sheep (*Ovis aries*).

⁶⁰ Müller-Karpe 1974, pl. 458/B3.

3rd millennium BC⁶¹. On some sites, however, breeds of small, hairy sheep were kept for a longer period of time, such as in the Late Neolithic Mondsee Culture in Upper Austria⁶².

The use of wool fibres is one aspect of the ‘Secondary Products Revolution’⁶³. As the new materials for cloth were mainly obtained from domestic species of plant and animal, their availability depended on skilful economy and use of land. Animal skins are only obtained after the animal has been killed (primary product), whereas sheep wool (secondary product) can be harvested year after year.⁶⁴

The fleece of the sheep was subject to a long process of breeding. Hairy sheep breeds (like today’s bighorn sheep in Sardinia, which are a feral form of the early domesticated sheep) have about 6 cm long, coarse top outer hair (kemp). As in wild animals, kemp covers any shorter, finer underwool of the coat. However, the fine wool was the object of desire, since it can easily be spun, unlike the more rigid kemp. One of the breeding efforts, therefore, was to select animals according to the length of their fine wool. Moreover, breeding must have aimed at reducing the number of coarse hairs in the coat. The resulting mixture of coarse and fine hair in the fleece makes it possible to distinguish types of wool and sheep breeds from each other. For these complex issues, we refer to the works of Michael Ryder, especially as reinterpreted by Antoinette Rast-Eicher⁶⁵, who is tracing primitive breeds of sheep by measuring wool fineness and fibre quality. By measuring a sample of 100 wool fibres from one yarn and plotting the fibre diameter distribution as a histogram, conclusions can be drawn about the character of the fleece from which the wool came and about the preparation process. In Roman times, literary evidence⁶⁶ gives an additional picture, e.g. from the descriptions of Pliny the Elder. He mentions that

⁶¹ Lüning *et al.* 1997, 69, 85.

⁶² Pucher and Engl 1997, 22–27, 76–79.

⁶³ Sherratt 1981, 159, 180–181.

⁶⁴ See Harris 2012, 82.

⁶⁵ Rast-Eicher 2008; 2012, 386, 392–395. – Rast-Eicher and Bender Jørgensen 2013. – Ryder 1982; 1997.

⁶⁶ See also Gleba 2008, 74.

specific breeds of sheep, differing in the colour, length and thickness of their fleece, were established in different areas by the 1st century AD (Plin., *Nat. Hist.* 8. 189–193). At this point it should be remembered that different wool qualities also appear within a single flock of sheep (e.g. lamb or ewe), and different parts of the sheep's body produce different qualities of wool (e.g. the back or the belly).

What do the textile remnants themselves tell us about the use of wool? The surviving textiles of the Neolithic period have almost exclusively been produced from plant material. It has to be noted, however, that this may be a result of preservation conditions: the majority of the textiles in question comes from wetland settlements where animal material cannot survive. One of the earliest surviving woollen textiles⁶⁷ is a charred wool weave from Clairvaux-les-Lacs in Switzerland dating to c. 2,900 BC. Another find comes from Wiepenkathen in northern Germany and dates to c. 2,400 calBC. It is a flint dagger with a complete leather sheath and a wooden handle, where a scrap of textile has been tucked under the wood of the handle. It is described as woollen tabby with a yarn diameter of 1.6–2 mm.

Even in the Early Bronze Age, the proportion of linen fabric finds is still very high, but from the 16th century BC onwards, woollen textiles become more and more common⁶⁸. The majority of the Middle Bronze Age textiles from the salt mines of Hallstatt, for instance, or from the copper mines of Mitterberg, both in Austria, was made of wool. The famous complete garments from the oak coffins in Northern Europe dating to the period between the 14th and 12th centuries BC were also manufactured from wool. In the Hallstatt period, textiles from sheep's wool were preferred. Numerous examples come from the salt mines of Hallstatt or from Switzerland. Sheep bones are found regularly in settlements, for instance in the Hallstatt period settlement of

⁶⁷ Wiepenkathen: von Stokar 1938, 103. – Bender Jørgensen and Rast-Eicher 2015, 67–68, fig. 5.1. – Clairvaux-les-Lacs: Hundt 1986.

⁶⁸ Oak coffin finds: Hald 1980. – Mannering *et al.* 2012, 97. – Mitterberg and Hallstatt: Grömer 2006b. – Rast-Eicher 2013. – Switzerland: Rast-Eicher 2008, 2012.

Göttlesbrunn in Lower Austria⁶⁹. In the course of the La Tène period, linen fabrics become more frequent again.

Strontium isotope and DNA-analysis⁷⁰ have recently been applied to identify the geographic areas of origin for the raw material of archaeological textiles. The Huldremose textile, Denmark (Huldremose II, 'peplos', 180–50 BC), for example, was shown to have been made of wool both of local and non-local origin⁷¹.

Hair from other domestic animals

The **goat** belongs to the oldest domestic animals, along with the sheep. The coat of the goat as fibres or fur can also be converted into clothing and everyday objects. Roman written sources inform us about goat farming. From Columella (Col., *De Re Rustica* 7.6), for instance, we learn that goats were also shorn and emphasis was placed on their long, thick coat. Goat hair was primarily processed into ropes. For prehistoric times there is good evidence for extensive goat farming in Europe, especially in the mountainous regions of south-western and south-eastern Europe and in the Alps⁷². Goat hair (Fig. 23.2), however, has only rarely been identified in European archaeological textiles. Similar to the issue of differentiating flax and hemp, the finest wool of goats and sheep is hard to differentiate. Perhaps some textiles of fine goat hair are hidden behind what is described as sheep wool.

Spectacular textiles made of goat hair were found on the Vedrette di Ries Glacier⁷³, where leggings dating to the Iron Age between the 8th and 6th centuries BC were found. The goat wool of natural colour in shades of beige brown, beige grey to dark brown had been spun into medium-fine threads, which were woven in tabby and twill and further processed into leg wear. Furthermore, a tabby woven textile made of goat hair was identified

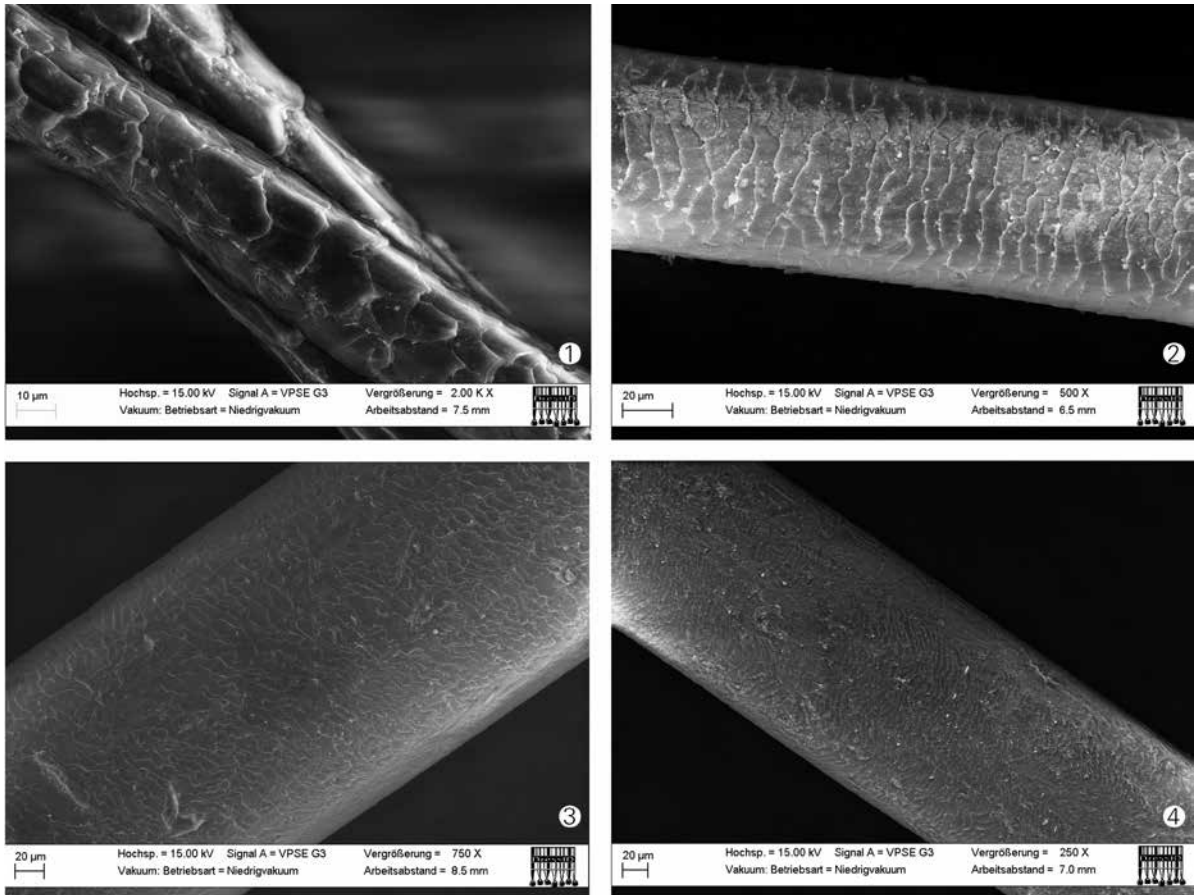
⁶⁹ Pucher 2004, 309–311.

⁷⁰ See Frei 2013. – von Holstein 2013.

⁷¹ Brandt *et al.* 2011. – Frei *et al.* 2009. – Mannering *et al.* 2012, fig. 3.11.

⁷² Benecke 1994, 244.

⁷³ Bazzanella *et al.* 2005.



in the cemetery of Solduno, Switzerland⁷⁴, in a middle La Tène period grave. Only recently textiles from the fine wool of the Kashmir goat have been published; the fragments were found at Lattes in France, dated to c. 470–460 BC⁷⁵, the object is interpreted as an Etruscan import.

The **horse**, which was used as a domesticated animal in Central Europe⁷⁶ since at least 4,000 BC, is distinguished by its long tail hair. Although they are too stiff to be spun well, they are very useful for processing directly due to their length and stability. Horse hair from the tail (Fig. 23.3) was used as weft threads for some bands from the Early Iron Age site of Hallstatt and the

Fig. 23. Samples of animal hair under the scanning electron microscope: sheep wool (1), goat hair (2), horse hair (3), badger hair (4). Curt-Engelhorn Centre for Archaeometry at the Reiss-Engelhorn Museums in Mannheim.

⁷⁴ Rast-Eicher 2008, fig. 27, Grave D20.

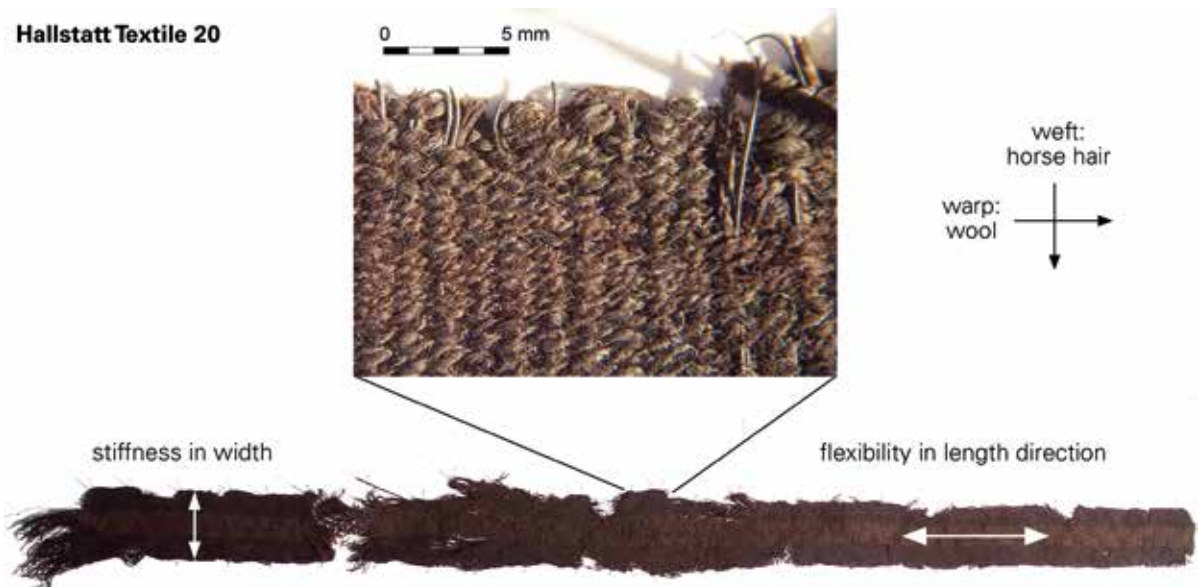
⁷⁵ Landes 2003, 137–138, No. 10–6.2. The result of the fibre analysis is disputed.

⁷⁶ Benecke 1994, 294–295.

Early La Tène site of Dürrnberg⁷⁷ – in two tablet woven borders and one warp-patterned repp band used as a belt. The special qualities of this material were utilised very appropriately. These bands should be flexible in their longitudinal direction, but steady and firm across their width (Fig. 24). Anyone who has ever worn a soft cloth band as a belt and was angry about the fact that it curls up is aware of the problem. The stiff horse hair made sure that the shape of the band was always stable in its width.

Fig. 24. Band with horse hair from the salt mines at Hallstatt, Austria, Early Iron Age.

Contemporary finds of textiles⁷⁸, for which a horsehair thread system was used, were discovered in the burial ground at Uttendorf in Pinzgau (Early Iron Age). A tabby woven fabric with a similar weft of horsehair was found corroded to an iron blade in a Hallstatt period grave from Hirschaid in Bavaria. Likewise interesting is the find of horse tail hair from the bog of Damendorf 1934, dating to the Late Bronze Age, Montelius period V. In this case, braided and twisted horse hair was used to decorate a leather case. The woman from Skrydstrup, discovered in a



⁷⁷ Grömer 2013, 55. – Grömer and Stöllner 2011, fig. 6.

⁷⁸ Uttendorf: Moosleitner 1977, 115–117. – Hirschaid: Hundt's analysis in Pescheck 1972, 268–269. – Damendorf: Van der Sanden 1996, 95, fig. 123. – Skrydstrup: Broholm and Hald 1940, 20. – Hald 1980.

tree coffin and dating to c. 1,300 BC, wore a hairnet braided from horse hair.

A band made of horse hair was found together with a woollen cloth at Cromaghs, Armoy in Ireland⁷⁹, dating to c. 800 BC. The cloth was wrapped around a small hoard of bronze tools, placed in a bog, with the horse hair ornament on top. Both warp and weft are described as unspun single hairs of black horsehair woven into a herringbone 2/2 twill weave. The exquisitely worked band of horse hair has tassels on each end and displays an extremely high standard of skill.

For all finds of textiles with horse hair discovered so far, dark, heavily pigmented tail hairs were used.

Hair of wild animals

Evidence for fabrics made of badger hair (Fig. 23.4) seem more like a curious side note, but it does show that prehistoric people used any suitable material for their purposes. Textiles consisting of badger hair⁸⁰ were found in the chieftain's grave from Hochdorf, according to the analysis by Johanna Banck-Burgess⁸¹. Yarn made of badger hair was processed in various weaving techniques. Under the cushion layers of the ornate bronze couch (*klinē*), on which the deceased was laid to rest, a fine, tabby woven badger fabric was found. The fine wool of this wild animal was spun and plied into fine threads of 0.3 mm diameter. Additionally, patterned tablet weaves were made from the fine hair of the under-coat of the badger and decorated with hemp bast. Coarser badger hairs were also discovered in the same grave; the hair was sorted out and eliminated before spinning. These fibres appear to have been used as pillow and mattress filling in the prince's grave. This find illustrates both the careful preparation of this rather unusual material as well as the creative and efficient use of natural resources.

⁷⁹ Wincott-Heckett 2012, 433–435.

⁸⁰ For comments on finds of badger hair in graves see Rast-Eicher 2008, 50.

⁸¹ Banck-Burgess 1999. Weaves of badger hair 102–103.

Identification errors made by early archaeological textile research are perpetuated in the popular scientific literature to this day. When the first microscope images of fibres of the wool textiles from the Nordic Bronze Age and Iron Age (from oak coffins and bogs) were released at the beginning of the 20th century, deviations from the usual sheep's wool of modern times were noted: the threads consisted of very thick fibres along the well-known fine wool hair. It was not considered that very coarse stiff hair could have belonged to the natural coat of primitive prehistoric sheep breeds. It was thus concluded from the fibre images that deer hair must have been added to the mix⁸². This theory has been scientifically refuted since the late 1930s⁸³, and today's researchers are confident that the fleece of sheep was not mixed with other hair.

2 Preparatory work

The step from the raw material to the spun thread is an essential element in the manufacturing process, as the preparatory treatment is a significant factor for the quality of the final product. The care taken and the time spent, as well as the application or omission of individual manual steps, may lead to coarser, more irregular threads or to fine, uniform and shiny material, from which top-quality products can be manufactured. We know the full range of different qualities of end products from the textiles of the Central European Stone to Iron Ages. However, only a few pieces of equipment have been recovered archaeologically from the fibre preparation processes. Most of our knowledge currently comes from portable artefacts such as loom weights and spindle whorls, and finished textiles. More research is needed, employing new methods and technologies to identify the cultivation plots, work surfaces and activity areas associated with all of the steps of collecting and preparing the raw materials.

To produce fibres, first of all the availability of the raw material is important, pastures for breeding animals or the land to be used for flax cultivation. Further, work surfaces are needed, on which the material is spread out, dried, threshed, sorted and combed. Space for storing the raw material and the processed spun fibrous material must also be available. In the study of prehistoric settlements all these necessary open spaces are difficult to attribute to specific activities, because space also was used for multiple purposes.

⁸² For example von Stokar 1938, 103–134.

⁸³ Cf. Schlabow 1976, 31–33. – Discussion see Möller-Wiering 2012, 126–127.

The advantage of using wool as a fibre over flax is that herding sheep does not require prime agricultural land. In fact, non-agricultural areas can be utilised as pastures. Wool does not require ploughing, sowing, weeding or harvesting, and it is less affected by weather conditions. Fewer herders are needed to tend the flock in order to produce a greater volume of fibre than would be generated by the same people cultivating flax⁸⁴.

The steps in the fibre preparation will now be explained by the examples of the two most common plant and animal fibre materials – flax and sheep wool. To understand the working process, references to ethnographic records and folklore are used.

2.1 Preparation of flax

The labour-intensive and lengthy process of flax preparation by hand was part of farmer's life until the mid-20th century in Central Europe. Today, these activities are continued only in ethnographic open-air museums, where they are brought to life again⁸⁵. The various tools and equipment applied in these museums were not necessarily used in this form in prehistory. In general, very few tools are present in the archaeological material that can be associated with treatment of flax.

According to ethnographic records, the process (Fig. 25)⁸⁶ follows certain rules that were probably similar for prehistory; only a few deviations have been found so far. At harvest, the flax stalks were pulled by hand so as not to curtail the length of the fibres to be obtained by separation of the lower plant parts. In the Neolithic period, the plants were possibly cut⁸⁷. The seed capsules were removed by rippling or combing and processed separately as an oil source. As shown in ethnographic museums, the flat bundle of flax is pulled through large iron combs

⁸⁴ See Gleba 2012, 222.

⁸⁵ For example open-air museum Stübing in Styria, <http://www.freilichtmuseum.at/en/> (last accessed 30th July 2014).

⁸⁶ Cf. Barber 1991, 13–14. – Körber-Grohne 1994, 370–371. – Leuzinger and Rast-Eicher 2011, 3643–3646. – Wild 1988, 21–22.

⁸⁷ Kind comment by A. Rast-Eicher. Rast-Eicher and Dietrich (in press).

during this processing step. In prehistoric times this may have been done by hand only or possibly coarser heckling tools (Fig. 30) might also have served to remove seed balls.

To facilitate separation of the usable fibres from the rest of the plant mass, the stems have to undergo a biological process in which the plant stems are retted. For this purpose, the plants are either soaked in water for about two weeks or spread on a meadow and exposed to rain and dew for about 3 to 5 weeks. These wet conditions cause the cell walls to ferment in the cortical layer as bacteria loosens the fibres from the core and bark. This makes it easier to separate the fibre bundles from both the wooden parts in the stem and the outer skin. Pits used for retting flax were found in connection with the settlement of Frydenlund of Funen, Denmark⁸⁸. Fragments of flax capsules from those pits have been dated to the Nordic Late Bronze Age (800–410 BC) and Pre-Roman Iron Age (420–350 BC).

Fig. 25. Treatment of flax according to a historic chalcography in the local museum Gallneukirchen, Austria.



⁸⁸ After Mannering *et al.* 2012, 104.

After drying, mechanical force is required in order to separate the fibres from the woody parts. For this, flax was broken and beaten with a wooden mallet on a flat surface well into the 20th century in rural areas. Scutching followed, in which the stems were struck over a narrow edge to remove the bark and woody splinters. They were rubbed, swung and beaten to remove the last of the extraneous wood particles. In prehistoric times, these operations were probably accomplished by hand with stones or wooden clubs. The subsequent combing and hackling with a flax hackle separates the flax lengthwise, smoothens and orders the fibres. The material was drawn through the teeth of a heckle board, until the fine, good quality fibres were separated from the short fibres (tow) and remaining wood particles. Ethnographic examples of European flax heckles are designed like brushes – boards with many rows of metal prongs. Thanks to careful examination of the Swiss lake-dwellings, we know different types of equipment that could have served as flax hackles (see pages 72–74).

Some Roman authors⁸⁹ discuss flax growing and cultivation techniques, such as Pliny the Elder, Varro or Columella, all describing similar techniques. In ancient sources there is no information on the amount of fibre that could have been obtained from a field of flax, but Eva Andersson-Strand⁹⁰ presented some calculations of yield in rural Denmark in the 20th century, based on a 100 m² field:

- 100 m² = 1 working day to pull the flax stems by hand
- 100 m² = ca. 25 kg yarn in different qualities + 14 kg of lower quality fibres (tow) for ropes *etc.*
- 25 kg yarn = 287,500 m thread
- 11 threads per cm in warp and weft = 2,200 m thread per m² = 130 m² fabric

2.2 Preparation of wool

The coat of sheep as well as other animals consists of different fibre types. One type is the thicker, stronger kemp (long guard hair) with a diameter between *c.* 50 and 100 μm and a thick medullary canal, which is visible under the microscope. The kemp forms the coat's surface and repels water from the animal. The finer wool fibres form the undercoat and are characterised

⁸⁹ After Gleba 2008, 69.

⁹⁰ Andersson Strand 2010b, 11.



Fig. 26. Hallstatt salt mine: Bronze Age wool with kemp hairs.

by a delicate wavy texture. Their primary function is the thermal insulation of the animal. The length and thickness of sheep hair depends on the breed of sheep, the season and the climate. Wool hair of medium quality has a thickness of about 30 to 60 μm ; finer qualities have diameters less than 30 μm , sometimes less than 6 μm ⁹¹.

The view through the microscope (Fig. 26) of Middle Bronze Age threads from Hallstatt clearly shows that fine and coarse fibres were mixed⁹². At that time, apparently, the wool of the primitive domestic sheep was not sorted according to fineness in a targeted manner. Microscopic analysis of threads from the Iron Age provides information about improvements in fibre processing techniques since the Bronze Age and on the development of the coat of sheep through breeding. The fibres in the Iron Age threads are much more homogeneous, and coarse kemp is only rarely found.

Basic steps of processing wool

The preparation of wool is much easier and more direct than that of flax. Primitive sheep breeds, as well as many other animals, naturally shed their hair on a seasonal basis; primitive sheep moult in spring or early summer. Staples of sheep fleece can be plucked as they shed, and in principle, they can be processed further without intermediate steps through twisting

⁹¹ Rast-Eicher 2008. – Ryder 1973.

⁹² Cf. Rast-Eicher 2013, 172–175. – Rast-Eicher and Bender Jørgensen 2013.



with fingers or spinning with the spindle. Through selective processing of the wool, however, a substantial increase in the quality of the yarn material can be achieved. At least the teasing of the fleece by hand, mechanical cleaning or washing in water to remove coarser and finer dirt particles are already presupposed in the earliest times. Ethnographic evidence further shows that wool could be beaten with a bow to separate the fleece fibres (Fig. 27.1). The process of carding, which is done by means of two boards filled with hooks (cards), is also well known from ethnography and folklore (Fig. 27.2). Wool fleece is placed between the cards, which are placed face to face and drawn in opposite directions, so the fleece is broken up like cotton wool. If the wool is not very dirty, it can be spun even before washing, in which case the wool wax, lanolin, is very beneficial to the spinning process.

Fig. 27. Preparation of wool. Striking wool with a bow from Kuşadası in Turkey, August 1995 (1), carding by hand from Matmata in Tunisia, July 2008 (2).

It may be assumed for prehistoric periods that sheep's wool was harvested or plucked by hand at the time of moulting in order to avoid losses. Even with today's breeds of sheep that are close to primitive forms, harvesting the fibre is done this way. The fine



Fig. 28. Late Iron Age shears from Mannersdorf, Austria.

undercoat is released earlier than the guard hairs and can thus be easily selected, as Karl Schlabow recorded⁹³:

'The following observations could be made in North Friesland during the production of particularly smooth threads. The wool is not, as usual, sheared. When the wool is ripe, the sheep are first washed. After drying, only the long wool is pulled by hand jerkily in the fibre direction so that a kind of sliver-like band forms, similar to roof tiles set neatly one next to the other. It is easy to understand that fleece prepared in such a way, consisting of smooth and long hair can be spun into a very fine and uniform thread with the appropriate skills.'

At what point in the history of textile crafts people began to shear sheep is not entirely clear. The wool researcher Michael Ryder⁹⁴ suggests that it went hand in hand with the development of sheep breeds from those with natural hair change to those with continuously growing hair at c. 1,000 BC in Anatolia. Cutting hair would in principle be possible with any type of knife. Flint knives are available from the Stone Age, various types of copper, bronze and iron knives later on. Shears, however, are particularly practical and quick for cutting the continuously growing wool of sheep, which no longer naturally moult. This particular breed would then go hand in hand with the invention of shears for sheep-shearing. Shears as tools first appear in Central Europe from the La Tène period, more precisely in the second half of the 4th century BC (Fig. 28)⁹⁵. All known examples of sheep shears are made of iron. In fact, their invention is tied to the use of iron, which is more springy than bronze⁹⁶. Interestingly, these shears which can be up to 20 cm in length, are frequently found in men's graves (see page 274).

⁹³ Schlabow 1974, 173. – See also Wild 1988, 14–17.

⁹⁴ Ryder 1997.

⁹⁵ E.g. Pottenbrunn, Lower Austria: Rams 2002. – Dürrnberg Grave 9, 10/2, 24/2: Penninger 1972. – Northern Italy: Gleba 2008a, 173.

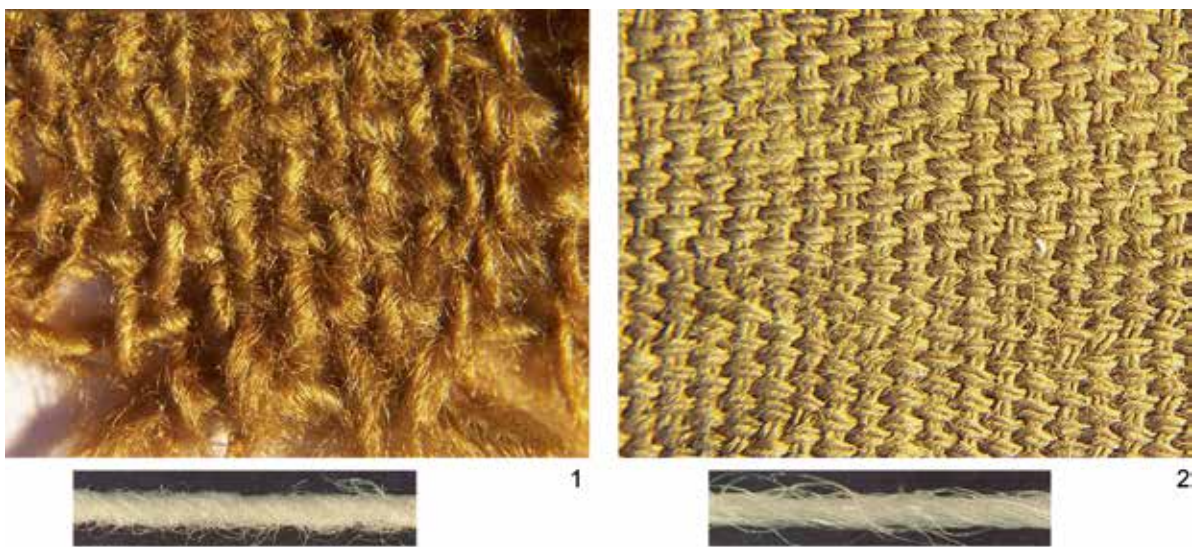
⁹⁶ Barber 1991, 29.

Preparation steps for influencing the properties of wool

Further observations on the fibre quality can be made directly on the original archaeological material. In addition to the different proportion of coarse and fine fibres in the yarn, another phenomenon has been noted through direct comparison between Bronze and Iron Age textiles from the salt mine of Hallstatt.⁹⁷ In Bronze Age fabrics dating to c. 1,500 to 1,200 BC, the fibres within a thread are quite irregularly oriented. On the same site, nearly 800 years later, the Iron Age fibre threads normally lie parallel (Fig. 29), although 'fluffy' threads as they were known from the Bronze Age still occur. This may look like an insignificant detail, but it has far-reaching implications. For threads, in which the fibres are frizzy, the fleece was only lightly prepared. It was probably teased apart, cleaned, beaten and even possibly roughly combed. To achieve fibres lying parallel within a thread, however, requires a much larger investment of time, especially by careful and repeated combing. This process results in a shiny and water-repellent thread.

Microscopic analysis was used for more hints about wool processing⁹⁸ in the Hallstatt material, looking at the direction of the fibres within the threads. The more the fleece had been combed,

Fig. 29. Hallstatt salt mines: Iron Age wool of various qualities: yarns with tangled fibres (1) and parallel fibres (2).



⁹⁷ Grömer 2005a, 27–28.

⁹⁸ Rast-Eicher 2013, 170–172, e.g. fig. 60.

the more variation there is in the direction of the scales of the fibres and the greater the parallel alignment of fibres.

Another sophistication of the Iron Age, particularly popular in the eastern Hallstatt areas, is the spin pattern (Fig. 97). Its effect relies on the fact that s- and z-twisted yarns reflect light differently and thus, if the yarns are arranged in groups, the textile appears in a fine stripe tone-on-tone pattern. This subtle patterning goes hand in hand with the way wool is combed, as only smooth threads with their parallel fibres optimally support this effect. With 'fluffy' threads it would hardly be worth the effort – the stripe effect of the s- and z-threads would only be poorly visible.

Different methods of preparing the wool before spinning are used even today. The basic procedures are carding and combing, which result in different qualities of the carded wool yarn, called woollen yarn (*Streichgarn*), and combed or worsted yarn (*Kammgarn*)⁹⁹. The combed top (*Kammzug*), a narrow band with parallel fibres, is produced from good quality wool in an intensive and lengthy process of combing. The worsted yarn spun from this combed top is smooth and uniform, the short fibres have been combed out and the fibres are parallel to the usually sharply twisted yarn, which also makes it water repellent. The carded woollen yarn, in contrast, is spun into a rather loosely twisted thread. It has a coarse appearance with protruding fibres, but it is more elastic, moisture absorbent and warming than worsted yarn. In addition, it is easier to felt due to the protruding hairs.

Through the different treatment of the fleece the properties of the wool yarn can be changed from soft and fluffy to smooth, shiny and firm. These different characteristics were known, selected and deliberately achieved in the Central European Iron Age. However, the previously discussed qualities of prehistoric yarns cannot be directly equated with modern woollen or worsted yarns, as machine processing requires completely different preparatory and spinning techniques. In this context only details

⁹⁹ Eberle *et al.* 1991, 45–46. – Barber 1991, 20. – Wild 1988, 18–19.

of fibre preparation that were already known in prehistory will be pointed out.

During the investigation of Iron Age textiles from Switzerland¹⁰⁰ it was discovered that sorted wool was already being processed into textiles in the Hallstatt period. At the end of the Celtic era, in the late 1st century BC, sheep were bred with much finer wool than had been the case in earlier centuries.

Various pieces of equipment must have existed for the preparation of fibre material. Wooden boards with thorns, such as the ones described below, would be suitable for carding. In principle, any type of comb can be used for combing wool – however, finer-toothed devices are necessary for fine, worsted qualities. Iron combs, which may be used for the preparation of wool, appeared during the La Tène period in Switzerland. The wool was combed with a warm iron comb to retain the straight long fibres, while the short fibres were discarded. Such aligned wool fibres in threads were detected from La Tène contexts in Switzerland.¹⁰¹

In ancient Greece, the preparation of the wool fleece for spinning had developed into a complex workflow, shown in pictorial representations and written sources, and through specialised equipment. According to Anastasia Pekridou-Gorecki,¹⁰² the wool was pulled slightly apart after washing and combing and somewhat rotated to connect the fibres with each other. A roving, a narrow band of processed wool fleece with fibres carefully aligned, similar to a combed top, was produced that could then be spun into fine yarns. Three different methods were in use for that purpose: the wool was either processed solely by hand or on the bare leg; the third possibility was the creation of the roving on the clay *epinetron*, a device in the form of a hollow brick (half-round ceramic plate), which was placed on the knee and thigh of one leg.

¹⁰⁰ Rast-Eicher 2008.

¹⁰¹ Rast-Eicher 2012, 392, fig. 19.24.

¹⁰² Pekridou-Gorecki 1989, 16–20, fig. 3–6. – Barber 1991, 77, Epinetron: fig. 2.45.

2.3 Archaeological finds of tools for fibre preparation



Fig. 30. Two-pronged bone tools from Attersee in Austria, Late Neolithic.

Surveying the archaeological literature, a few artefacts are again and again linked to the preparation of fibre materials for textile production¹⁰³. From the Neolithic wetland settlement of Egolzwil, Switzerland, for example, we know bundles of blackthorn. Such hard, pointed devices are useful for the preparation of flax. Blackthorn branches are very durable and so fine that they can untangle the material well. Tips of animal ribs tied together, such as the ones from Zürich-Mozartstrasse or the double-pronged bone tools from the Attersee in Upper Austria (Fig. 30) might have served to hackle or riffle flax. Flax heckles need to have long spikes or teeth to attain sufficient tension for separating and cleaning flax fibre as it is pulled through the device. Another device from the Neolithic period was already recognised as a textile tool in 1937 through the pioneering work of Emil Vogt on Stone Age wickerwork and weaves: the hackling board from Lattringen¹⁰⁴ is a board in which the thorns of blackthorn were set.

In addition to these Late Neolithic finds, some devices are also known from the late La Tène period, *i.e.* the centuries before the Christian era. We know slim, rectangular wooden boards with holes and handle¹⁰⁵ (Fig. 31) from Liptovska Mara, Slovakia, and Hallstatt Dammwiese, the latter with thorns still stuck in the board. They would be useful devices for hackling flax. Perhaps these Iron Age devices were also employed for carding wool (Fig. 32). Functionally they are very similar to hand carding tools known from ethnographic records. If they were indeed used for carding by hand, the older hypothesis¹⁰⁶, that those were only used from the Middle Ages onwards, would be refuted. The fuller's teasel (*Dipsacus sativus*) was not, as often thought, used to comb the wool, but for , raising the nap on the surface of a finished fabric¹⁰⁷.

¹⁰³ Zürich and Egolzwil: Rast 1990, fig. 2. – Attersee: Willvonseder 1963–1968. – Lattringen: Vogt 1937. – For a discussion on functional experiments, see Rast-Eicher 1997, 304.

¹⁰⁴ Vogt 1937, fig. 72/6–7.

¹⁰⁵ Cf. Belanová and Grömer 2010.

¹⁰⁶ Cf. Barber 1991, 22.

¹⁰⁷ See also Goldmann 1990, 432–433.



Liptovska Mara II



Hallstatt-Dammwiese

Fig. 31. Hackling boards from Hallstatt-Dammwiese in Austria and Liptovska Mara in Slovakia, Late Iron Age.



Fig. 32. Reconstructions of the hackling board of Hallstatt-Dammwiese in use. Made by Wolfgang Lobisser.

Of course it is conceivable that the heckle boards from Liptovska Mara and Hallstatt were also used as tools for finishing textiles by rising a nap.

Combs of various kinds have been recovered from various Neolithic contexts, for instance from Arbon Bleiche 3¹⁰⁸. Well known examples were found in the water-logged settlements of northern Italy, dating to the Early and Middle Bronze Age. These multifunctional artefacts can be used as toiletry articles for combing and/or pinning up hair, but they also can be employed to prepare wool or even for weaving, where they are useful for beating in the weft. Fine-toothed wool combs made of iron are mainly known from Roman times¹⁰⁹, where images provide evidence of how they were used. In Avenches, Switzerland, a wool comb was found along with a silver cup dating to the 1st/2nd century AD, which shows a man (!) combing wool¹¹⁰.

3 Yarn manufacture: spinning

There are different ways to produce yarn from fibres: they can either be spun or plant fibres can be spliced into yarns¹¹¹. With the latter technique, bundles of flax fibres, 60–90 cm long, are stripped from their stalks and spliced, so that the ends of the fibre bundles overlap one another for a few centimetres. The overlapping section has some twist inserted into it so the splice will hold, cemented by natural pectin in flax. Archaeological evidence for splicing has recently been recovered in Neolithic Swiss textiles¹¹². Most common, however, and later in development is spinning.

Today, few people are aware how time-consuming the production of clothing for the household is. Many hours of the daily workload were dedicated to textile work, especially to spinning, in previous eras. Spinning is known from fairy tales, for example, when Sleeping Beauty picks her finger on the spindle and falls into a deep sleep until she is awoken by the Prince. Some phrases and proverbs still reference spinning, for example ‘*to spin a yarn*’ = ‘to tell a very long and usually fanciful story’, ‘*to spin (something) out*’ = ‘to make (something) take a very long time’. A ‘*spinster*’ is the technical term for an un-

¹⁰⁸ Arbon Bleiche: Leuzinger 2002, 101. – Northern Italy: Bazzanella *et al.* 2003, 141–142.

¹⁰⁹ Wild 1970, 25–26; 1988, 19, fig. 10.

¹¹⁰ Rast-Eicher 2008, 161–162, fig. 228–229.

¹¹¹ Barber 1991, 47, 145. Splicing is particularly associated with Egyptian linen, fig. 2.8 and 2.9.

¹¹² Leuzinger and Rast-Eicher 2011.

married woman, *i.e.* who has nothing to do except spin.¹¹³ Also, a modern English term describes the female branch of a family as the 'distaff side'.

Spinning is a very meditative activity, during which – granted sufficient mastery of the craft – one has plenty of time to think. In addition, spinning is very sociable. Even in the period around the Second World War it was customary in the Upper Austrian Mühlviertel region that women from neighbouring farms gathered together with their spinning wheels for the '*Rucka-Roas*', a meeting at which the women spun together, exchanging news and gossiping as well as talking about personal matters and problems¹¹⁴. Perhaps it was this female exchange of information that was not welcome to all and was judged negatively in the German language. '*Die spinnen!*', literally '*they are spinning*', also means 'they are crazy'. An interesting example in English is a '*spin doctor*', someone who 'spins' interpretations (usually deliberately incorrect or misleading), from actual research to influence public opinion¹¹⁵. The fact that proverbs such as these are deeply rooted in our use of language shows how important spinning was as an activity in times past. But how does spinning actually work?

The basic principle of spinning with a **hand spindle (drop spindle)**¹¹⁶ is very simple: by inserting twist (rotating the spindle), relatively short fibres are connected into a thread of any length. Whether this happens with a hand spindle or, after some technical development, with the spinning wheel is not relevant. No later than from the beginning of the Neolithic period (in Central Europe from c. 5,600 BC) there is archaeological evidence that human ingenuity invented a new tool to aid the tiresome process of twisting threads by hand, which simplified and accelerated the process. The spindle was created from a wooden rod of approximately 20–30 cm length with a weight (whorl) impaled on the lower third. The weight of the spindle whorl facilitates the thread formation by drawing the

¹¹³ Kind comment by John Peter Wild, Manchester, Great Britain, January 2014. For the term 'distaff gender' see Hornby 1995. – German proverbs include '*der Geduldsfaden reißt*', '*man hat den Dreh raus*' or '*die spinnen*'.

¹¹⁴ Kind comment by Anna Riener, farmer on the z'Oberwinkl country estate, Altenberg near Linz, Upper Austria, January 1999.

¹¹⁵ Kind comment by Roderick B. Salisbury, October 2014.

¹¹⁶ Barber 1991, 39–78. – Crockett 1977. – Wild 1988, 25–29.

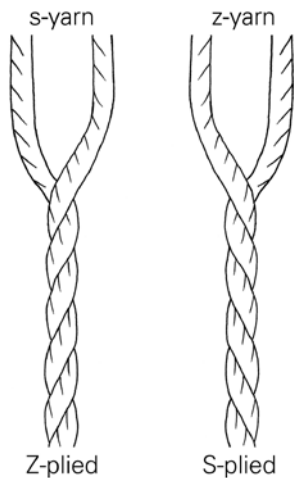


Fig. 33. Threads: s- and z-yarn, as well as plied yarn twisted together to form Z-and S-plied yarn.

thread downwards in rapid and uniform rotation. The spindle may be turned clockwise or counter clockwise, resulting in a right or left-twisted (s or z) thread (Fig. 33).

During spinning (Fig. 34), the spindle, already attached to a starting thread, is set in rotation. The end of the thread and the wool fleece is held in the left hand, while the spindle is set into motion with the right hand¹¹⁷. Drawing out fibres evenly from the mass and pulling and twisting gently, the rotation twists the loose fibre material, immediately forming a thread. When it has become a certain length, the thread is wound on the spindle. After winding the yarn, the end of the thread is secured to the tip of the spindle again, so that the spindle can hang freely on the starting thread once more, and the spinning process can be repeated: drafting and arranging the wool mass into the desired thickness of the thread, twisting the thread by turning the spindle, *etc.* When the spindle is finally full, the thread must be unwound. This is the basic spinning technique for a simple yarn from sheep wool.

Fig. 34. Sequence of motions: spinning wool with the suspended spindle.

The **spinning wheel**, especially the treadle wheel that until recently was still used in rural communities, is a relatively late technological advancement; in comparison to the hand spindle, which is more than 7,000 years old, the spinning wheel dates back only 600 to 800 years¹¹⁸, the treadle wheel only about 500 years.



¹¹⁷ It might be the other way round, if you are left handed.

¹¹⁸ For general information on the spinning wheel, cf. Sporbeck 1996, 472–480. – Crockett 1977.



The older type of wheel, the great wheel (c. AD 1250–1300), has a horizontally positioned spindle, which is moved via a belt driven by a large wheel (Fig. 35.1). The whorl as a centrifugal mass became redundant. The drive wheel was set into rotation by hand; the other hand drafts the fibre against the spindle. The twisting of the yarn as well as the subsequent winding are still separate operations.

Fig. 35. Hand spinning wheel from Kuşadası in Turkey, August 1995 (1), spinning wheel from Galicia, early 20th century (2).

Only the **treadle wheel** (Fig. 35.2), which came in use in Central Europe towards the end of the Middle Ages in the 15th century AD, combined spinning and winding into a single operation. Again, the spindle is mounted horizontally on the spinning wheel and is rotated via a flywheel by a foot pedal. The thread runs through a feed hole and a flyer onto the bobbin. There is a speed difference in the rotational speed of the flyer and the bobbin that is the key point of the mechanism: it leads to simultaneous twisting (spinning) and winding of the spun thread. Through this mechanism, which enables the twisting of the yarn and winding up the thread only by varying the yarn tension, a continuous and un-interrupted fibre processing is possible. With the hand spindle, in contrast, it is necessary to interrupt the spinning to wind up the yarn.

3.1 Different spinning techniques with the hand spindle

The basic operation of the hand spindle has already been discussed. However, different spinning techniques emerged¹¹⁹, which were common in different regions or were used for specific raw materials.

Fig. 36. Spinning in different techniques: spinning with a supported spindle, Matmata in Tunisia, July 2008 (1), flax spinning with a long distaff, watercolour from Romania, 1895 (2).

The drop spindle can be used hanging on the thread that is currently being produced (Fig. 34). It is also possible to allow the spindle to run in a ceramic bowl or on the floor (supported spindle) so that gravity does not act on it (Fig. 36.1). This technique is ethnographically documented for some North American Indian tribes, in North Africa and in Tibet¹²⁰. The spindle in the ceramic bowl might be the preferable technique to letting the device run



¹¹⁹ Barber 1991, 41–51.

¹²⁰ Cf. Hirschberg and Janata 1986, 131. – See also Crawfoot 1931.

on the floor, so that the precious thread material will not get dirty. It is also possible to rotate the spindle horizontally while holding it in the hand.

The individual spinning techniques are on the one hand regional traditions, but are also related to general working techniques. Spinning with the drop hand spindle has, among other advantages, the advantage that one is not bound to a place like with the spinning wheel or when spinning with a ceramic bowl. Spinning can be done whilst sitting, standing, and – with a little skill – even while walking. It is quite conceivable that in Central European prehistory the spindle was always carried on the body, so that it could be used effectively whenever the opportunity for spinning arose; for example, when longer distances had to be walked.

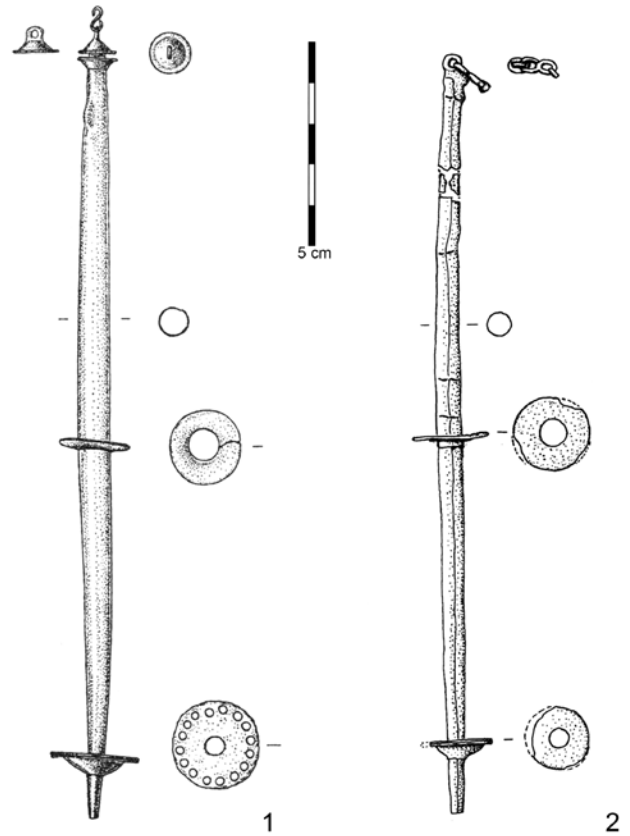


Fig. 37. Short distaff from Unterradlberg, grave 4018 (1) and Mautern-Burggartengasse, grave 397 (2), Roman period.

When spinning sheep wool, the fleece may be held in the hand and spun from there, or attached to a distaff and spun. With flax and other long plant fibres, however, a distaff has to be used. A distaff is a rod of sufficient length for the material being worked (about 90 cm long for flax), on which the combed flax is fixed and plucked down with both hands during the spinning process (Fig. 36.2). The distaff may be held under the arm or stand on its own on a stand. The rest of the work process is the same: turning the spindle, drafting the fibres, winding up the thread, continuing spinning.

Further refinements are possible even for sheep's wool: if a combed top is used for spinning, a prepared narrow band of wool fleece (described above), then this would also be wound on a distaff. This step in the work process facilitates fine spinning. Short distaffs that are held in the hand are not suitable for spinning plant fibres, but are good for spinning a carefully prepared roving. The presence of distaffs in the archaeological record as

well as on Early Iron Age images goes hand in hand with the development towards ever finer and more uniform yarn qualities during the Bronze and Iron Ages, in part even those with parallel fibres. Short distaffs appear in the archaeological record in metal form from the Iron Age, for instance from a grave of Frög¹²¹, Austria, and from the Late Antique cemeteries of Unterradlberg und Mautern¹²² (Fig. 37). Ancient Greek vase paintings¹²³ often depict short distaffs used in textile processing; the spinning woman on the sheet bronze rattle from Bologna¹²⁴ also spins roving from distaffs (Fig. 147). Objects identified as distaffs made of luxury materials have been found in wealthy burials of the Villanovan and early Etruscan cultures in Northern Italy¹²⁵. Such distaffs most likely functioned as status symbols.

One of the earliest pictorial representations of a long distaff for spinning flax from the extended area around Central Europe has been presented by Anastasia Pekridou-Gorecki¹²⁶, although she did not identify the device as a distaff. The image on the inside of a red-figure kylix (5th to 3rd century BC) shows a spinning woman in front of a rack. This represents a tall wooden rod on a stand with struts at the top. The flax fibres are wound round the struts and could then be pulled off with both hands for spinning.

In addition to spinning yarn, the spindle is also used to ply two or more single yarns in order to obtain a stronger and more durable plied yarn. To do this, two or more single yarns spun in the same direction are led together onto the spindle, the spindle rotates and after twisting the plied yarn is wound up as usual. Plying takes place in the opposite direction to the twisting direction of the single yarn, which stabilises the yarn. If the single

¹²¹ Frög Tumulus 50, Grave 1: Tomedi 2002, 161–162, pl. 17. The interpretation as spindle has to be questioned.

¹²² Unterradlberg, Grave Verf. 4018: J.-W. Neugebauer 2001, fig. 43/7. – Mautern, Grave 397: Grömer 2003. Roman period distaffs see also Gostenčnik 2012.

¹²³ After Barber 1991, 75. – Pekridou-Gorecki 1989.

¹²⁴ Gleba 2008a, fig. 7.

¹²⁵ Gleba 2012, fig. 9.12.

¹²⁶ Pekridou-Gorecki 1989, fig. 14.

yarns have been spun towards the left (z-yarn), they are plied clockwise; an S-ply thread is formed (Fig. 33).

It should be mentioned briefly here that the use of yarns of different spin directions can be an indication of regional differences in production traditions¹²⁷. Also, in some periods and regions of prehistoric Europe single spun yarn is preferred, whilst in other regions more plied yarns are processed, which are more durable and better withstand the mechanical stress during weaving. In the eastern region of the Hallstatt Culture, for instance, single yarn was used for both thread systems, while in the western Hallstatt region plied yarns were used at least for one of the thread systems.

3.2 Archaeological finds of spinning tools

Finds of complete spindles are extremely rare, although discoveries have been made in the circum-alpine lake settlements¹²⁸, for instance the Late Neolithic wooden spindle shaft with wound up yarn from Twann in Switzerland or the Bronze Age wooden spindles from Fiavè, Italy. The spindle from Arbon Bleiche 3 with the spun material still intact (Fig. 38) has already been mentioned whilst discussing lime bast as a raw material. More complete spindles (shafts with attached whorls) have been recovered from the same site.

The raw material for spindle shafts has most often been identified as hazel (*Corylus* L.) or viburnum (*Viburnum* L.), for instance from the Neolithic lake dwellings of Switzerland¹²⁹. The spindle shafts found are usually pencil thick and have a minimum length of 20 cm.

Spindle whorls are very common amongst the archaeological material, as they are usually made of fired clay, or, in rare cases, of stone or bone, so they preserved well over the millennia (Fig. 39).



Fig. 38. Complete spindle from the wetland settlement Arbon Bleiche 3 in Switzerland, c. 3,370 BC.

¹²⁷ See Banck-Burgess 1999, 84–85. – Bender-Jørgensen 1992. – Rast-Eicher 2008, 167–169. – Contributions in Gleba and Mannering 2012.

¹²⁸ Twann: Dunning 1992, 46, fig. 6. – Fiavè: Bazzanella *et al.* 2003, 137–138.

¹²⁹ Rast-Eicher 1997, 304.

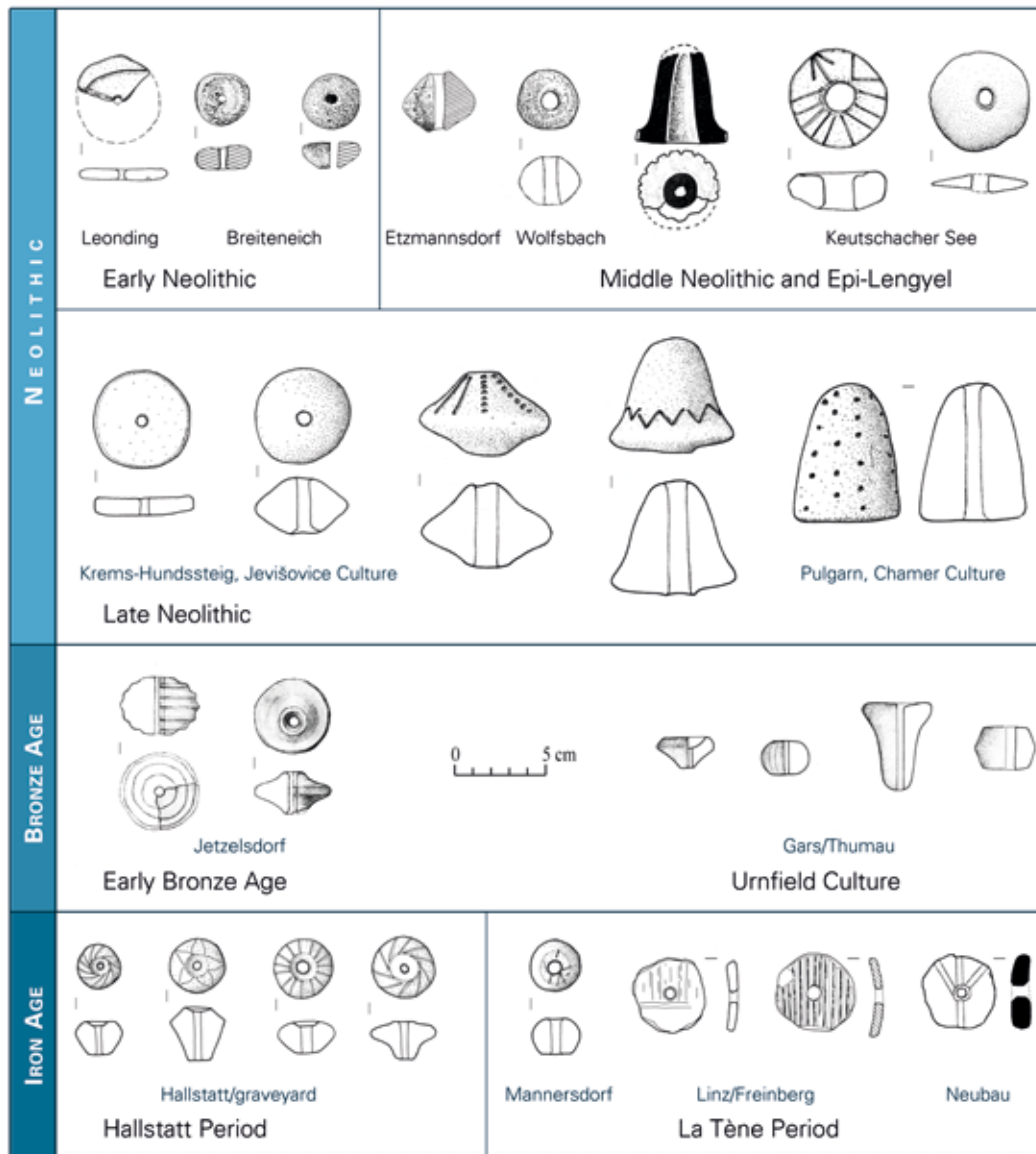


Fig. 39. Different shapes and sizes of prehistoric spindle whorls from Austria.

In the framework of this book it is not possible to provide a full typological overview¹³⁰ of spindle whorls, as it is often done by archaeologists after sorting the archaeological material. It is clear, however, that the functional aspect of the spindle whorl

¹³⁰ Summary of Central European finds: Germany: Möller-Wiering 2012, 127–129. – Italy: Bazzanella 2012, 210–211; Gleba 2008a; 2012, 227–229, 234–236; 2013, 4–6. – Slovakia and Czech Republic: Belanová-Štolcová 2012, 309–314; Belanová-Štolcová and Grömer 2010. – Switzerland: Médard 2012, 369–370; Rast-Eicher 2012, 382.

as a fly-wheel cannot be subject to drastic shape variations, although there are some variations in the different time periods. Their form and especially their ornamentation vary according to fashion trends and fads, which have always existed and still do today.

The earliest finds of spindle whorls from Austria¹³¹ date to the beginning of the Neolithic period, the time of the first farmers (Linear Pottery Culture, c. 5,600–4,900 BC). Spindle whorls made of pieces of broken vessels are known from the Upper Austrian site of Leonding near Linz. In this early form of recycling, ceramic sherds were simply broken into the desired size, the edges ground smooth and a hole punched into the middle. Particularly large and heavy spindle whorls (up to 100 g) were produced in Late Neolithic, in the Cham and Jevišovice Cultures around 3,000 BC; finds are known, for example, from Krems-Hundssteig or Pulgarn near Steyregg. The whorls have many different shapes and types of decoration. Smaller, disk-shaped to spherical whorls were found in other Late Neolithic cultures such as the Horgen Culture in Switzerland with the site Arbon Bleiche¹³².

At the beginning of the Bronze Age, spindle whorls are rather rare finds in Austria; among the few examples are those from the Early Bronze Age settlement of Jetzelsdorf in Lower Austria. Maybe purely wooden spindles were used at that time¹³³. Spindle whorls from the Late Bronze and Early Iron Ages, in contrast, are abundant. These are small, delicate and beautifully designed in shape, such as those from Gars/Thunau and Hallstatt. In the Late Iron Age the spindle whorls were again made of pot sherds, such as the La Tène pieces from Neubau near Traun or Linz-Freinberg. The archaeological contexts of spindle whorl finds may be lost items in settlement areas and beyond, but they were sometimes added as grave goods in cremation and inhumation burials; in the latter, spindle whorls are often found near the arms or hands. Those textile tools played a major

¹³¹ For further references see Grömer 2004 (2006). – Belanová-Štolcová and Grömer 2010.

¹³² Leuzinger 2002, 115–117.

¹³³ Compare spindles with wooden whorls from Bronze Age pile dwellings in Northern Italy: Bazzanella *et al.* 2003, 137.



Fig. 40. Early Iron Age spools and spinning whorls from Bad Fischau in Austria.

role as grave goods especially during the Early Iron Age in the eastern Hallstatt area (see chapter C).

In addition to the archaeological finds of the tools there are, albeit rarely, some representations of spindles from Central European prehistory. It should be mentioned briefly that representations of spinning are very common motifs in the ancient civilizations¹³⁴, such as in Egyptian paintings, sculptures and hieroglyphs or on Greek ceramics. In our area, the most interesting pieces are the vessel from Sopron (c. 700 BC) and the Villanovan sheet bronze rattle (*tintinnabulo*) from Bologna (Fig. 146 and 147), which both depict a woman with a spindle and short distaff amongst other human representations.

As the last step after spinning, the spun (or plied) yarn material could then be stored until it was needed for weaving or sewing; the thread was either kept on a stick or left on the spindle. There is also some evidence from the Stone Age that threads were

¹³⁴ Barber 1991, 39–78.

wound up into balls of yarn¹³⁵. Ceramic bobbins or spools¹³⁶ may also fulfil the purpose of a thread depository, and they have been found occasionally from the Neolithic to the Iron Age, both in settlements and graves. They consist of about 5–7 cm long cylinders with slightly protruding flanges (Fig. 40).

3.3 Weights of spindle whorls and associated yarn qualities

The weight of the spindle depends *inter alia* on the size of the whorl, its raw material (whether it is made of ceramics, wood, glass or stone) and how much yarn has already been spun and wound up on it. These are at first purely physical facts. What is interesting is whether the different shapes and sizes common in prehistory result in different handling techniques and different end products.

The Late Neolithic spindle whorls from Switzerland, for example from Arbon Bleiche, usually weigh 16 to 40 g¹³⁷, but can be up to 80 g in weight. The 100 g ‘bombastic’ examples from the Late Neolithic Cham and Jevišovice cultures (Fig. 39) are extremes¹³⁸. Among other textile equipment, numerous Early Bronze Age whorls were preserved in the lake dwellings of Lago di Ledro, Italy. They are spherical to disk-shaped and have weights ranging from 15 to 50 g, with an average of 30 g¹³⁹.

Overall, the typological development of spindle whorls from the Neolithic period onwards results in a refinement and reduction in size of the tools, a process which culminates during the Hallstatt period, when very light (5 to 20 g) and extremely carefully executed whorls with ornaments were common. At the fortified Hallstatt period hillfort of Smolenice Molpír in

¹³⁵ E.g. Molina di Ledro, Italy (Early/Middle Bronze Age): Bazzanella 2003, 173. – Switzerland: Vogt 1937.

¹³⁶ E.g. Gleba 2008, 140–148. – Grömer 2006a, fig. 5.

¹³⁷ Leuzinger 2002, 119, fig. 151.

¹³⁸ Grömer 2004 (2006).

¹³⁹ Bazzanella *et al.* 2003.

Slovakia¹⁴⁰, for example, about 2200 spindle whorls (Fig. 131) and 200 loom weights were found, which probably indicate that this site was of outstanding importance to textile production. The weights of the whorls were predominately between 6 and 26 g, with an average of 15.8 g.

Through hands-on experience and experimental archaeology¹⁴¹ the world of prehistoric people can often be better understood than through purely theoretical considerations. Spinning as a technique is relatively easy to learn, but to gain the skill level of prehistoric people takes years. Today, a 'hobby' craftsman rarely reaches the refinement of a craftsman who has been practicing spinning since childhood.

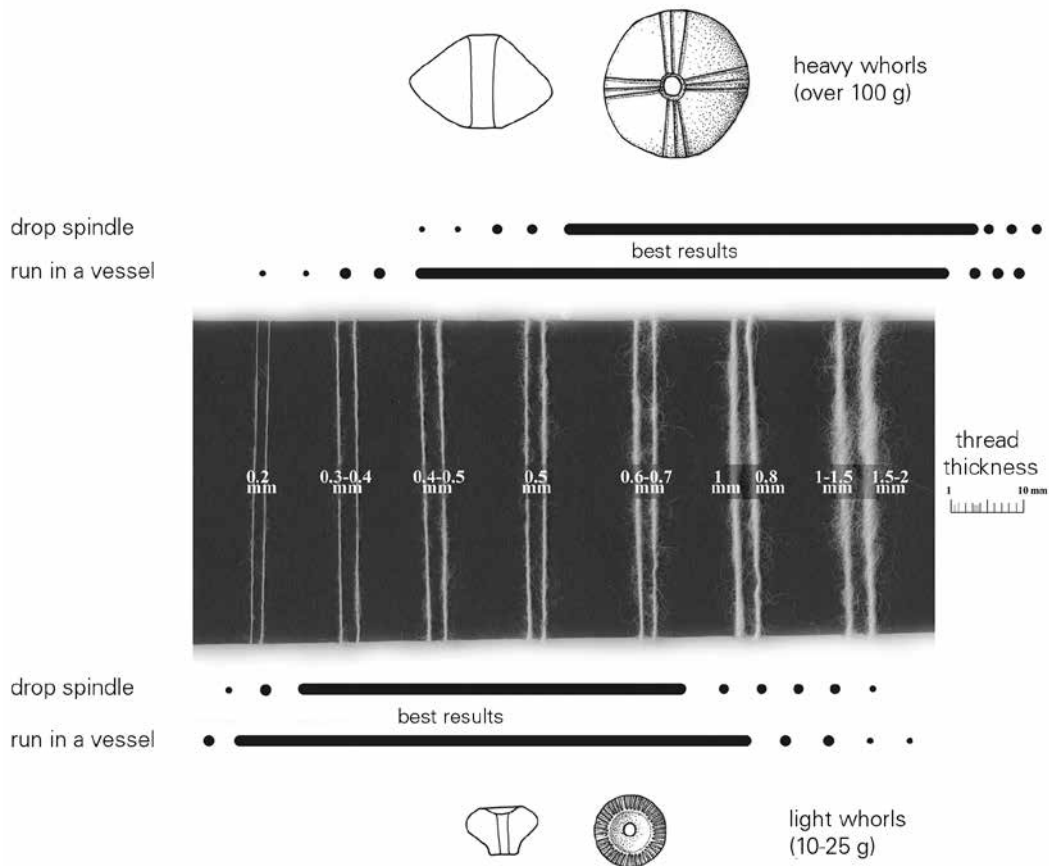
On the basis of spinning experiments¹⁴² it was found that the weight and the shape of the spindle can have a direct impact on the resulting thread. This raises the question of whether and in which spinning technique these tools can provide the necessary thread sizes due to their shape and size. A series of technical experiments was conducted to evaluate rotational frequency and its duration on original spindle whorls dating from the Neolithic to Late Antiquity, as well as to test spinning of different thread sizes with original finds.

Flax and wool was experimentally spun to threads of different strengths (Fig. 41) with original spindle whorls from the cemetery of Hallstatt (8–12 g) and the heavy spindle whorls from the Late Neolithic Jevišovice Culture settlement Meidling/Kleiner Anzingerberg (over 100 g). The weight, and thus the size of the whorl, is crucial when used as drop spindle. Large and heavy spindle whorls put a lot of weight on the thread on which the spindle hangs. When trying to produce a thinner wool thread

¹⁴⁰ Belanová-Štolcová and Grömer 2010.

¹⁴¹ About experimental archaeology generally see Coles 1973. – Textile craft experiments: Mårtensson 2007, fig. 2.

¹⁴² Grömer 2005b with details about the experiments and test results on original spindle whorls. Experiments have been conducted to determine rotation time and rotational frequency (number of rotations in a given time period). See also the experiments of the 'Tools and Textiles Research Program' of the Centre for Textile Research Copenhagen: http://ctr.hum.ku.dk/research/tools_and_textiles_/, last accessed 3rd Dec. 2009). Mårtensson 2007. Andersson Strand 2010a.



of about 0.4 mm thickness, a large and heavy spindle whorl can cause the thread to tear. This happens particularly when the animal hair used for yarn production consists of rather short individual fibres, which only mesh with each other slightly in the finished yarn. The light whorls, such as those from the cemetery of Hallstatt, are especially suited for the production of the finest wool yarn common in the Hallstatt period. They are, however, less suited to produce thicker wool qualities, for which their low weight and the lower moment of inertia are responsible.

Fig. 41. Comparison of wool thread sizes achieved with spindle whorls of different weights.

The spinning of plant fibres such as flax, hemp or nettle is completely different. The already processed raw material with longer fibres is attached to a distaff. The spindle is rotated with one hand, and the thread is pulled with the hands, which, with a bit of practice, is a much faster procedure than spinning wool. The long fibres overlap each other over longer stretches, which minimises the risk of rupture. Even for the production of a thin

thread of flax, heavier whorls (about 30 g) are preferable, since the thread twists faster due to the increased momentum of a larger and heavier whorl. Spindles that are too light achieve a high speed when first rotated, but they slow down after a very short time, which means that they cannot process the rapidly emerging thread.

Under ideal conditions thread thickness and spindle whorl size are correlated (Fig. 41). The shape of the whorl – whether conical, bell-shaped or disk-shaped¹⁴³ – further exerts some influence.

The influence of the weight decreases when the spindle runs in a bowl or on the floor. In this context for most of the spindle weights it does not really matter which raw material and what thread size is spun. A heavier whorl increases the centrifugal effect and in comparison to lighter whorls prolongs the rotation of the device. In the few prehistoric representations, however, it is always the drop spindle that is used.

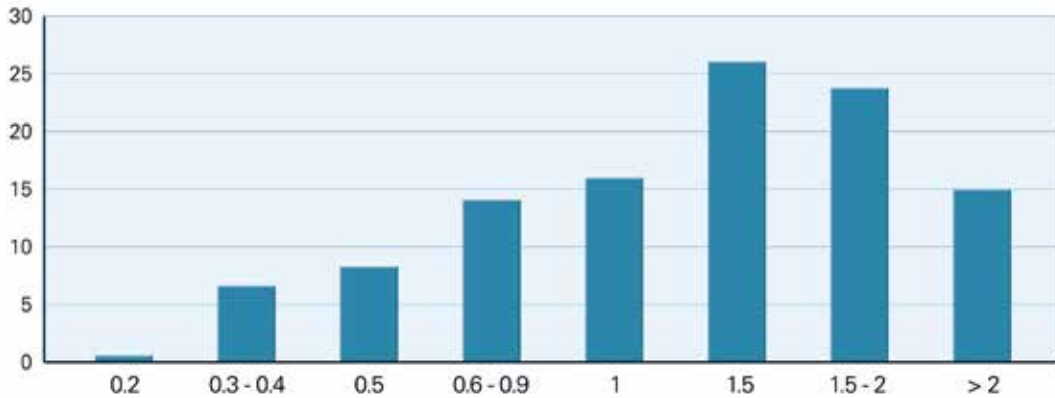
Yarn qualities can also be determined on original finds, and the measurements can be brought together with the results of experimental archaeology. Both single yarn and plied yarn have been found in wetland settlements of the Stone Age¹⁴⁴, sometimes in unwoven condition. In part, they are wound onto remains of spindles, with spindle shafts still preserved. In other cases, the yarn has been carefully wrapped into balls. The thread sizes of these yarns are sometimes very fine, like in a ball of flax yarn only 0.5–0.7 mm in diameter from the Zürich-Kanalisation at Seefeld from the Late Neolithic Horgen Culture.

The aforementioned spindle from Arbon Bleiche 3¹⁴⁵ is especially interesting as it constitutes a snapshot of the past. It is a working tool with a whorl of 21 g and thread of lime bast of 0.7 mm thickness. The find clearly demonstrates that with a whorl of c. 20 g in weight plant fibres could be spun into a thread of 0.7 mm in thickness.

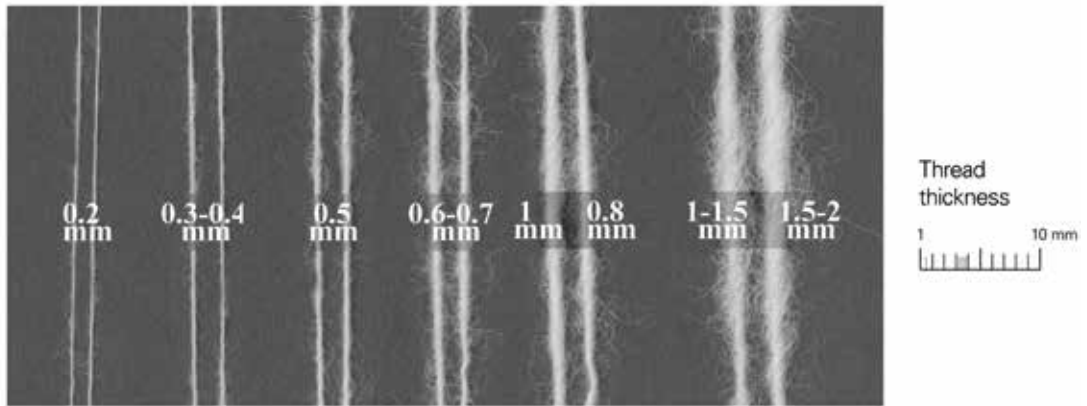
¹⁴³ Andersson Strand 2010b, 12–15. – Cf. experiments in Kania 2010 and 2013. – Verhecken 2010.

¹⁴⁴ Cf. Rast-Eicher 1997, 315. – Images of various balls of yarn in Vogt 1937, fig. 73–78.

¹⁴⁵ Leuzinger 2002, 119.



Bronze Age



Hallstatt Period

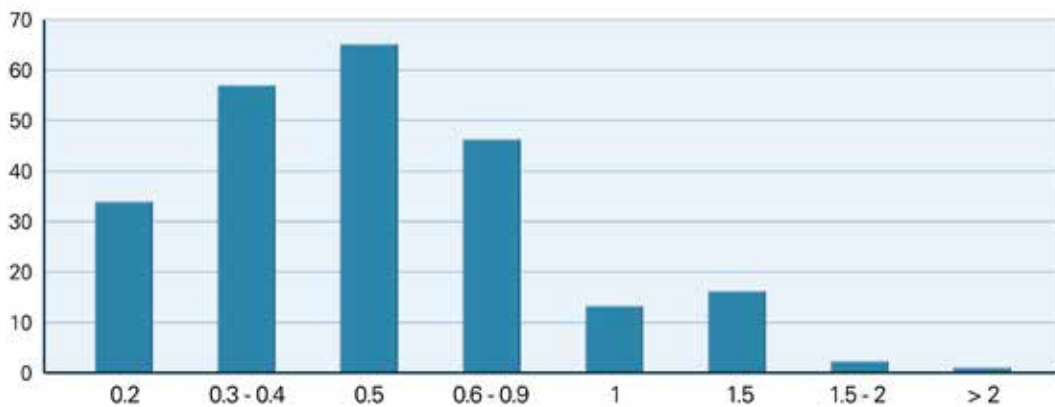


Fig. 42. Comparison of thread sizes of Bronze Age and Early Iron Age wool textiles from the salt mines of Hallstatt, Austria.

Early Bronze Age textiles preserved at lakeside settlements in northern Italy consist of fine threads of flax, which were also usually plied. The thread thickness ranges between 0.5 and 0.7 mm¹⁴⁶ for the plied yarn.

In contrast to these fine, relatively thin threads of flax known from Neolithic and Early Bronze Age contexts, the very thick woollen threads that were used in textile production from the Middle Bronze Age onwards are particularly conspicuous. Bronze Age wool yarns are significantly thicker than the yarns of earlier linen textiles. Similar wool yarn qualities can also be observed in contemporary Scandinavia. The question must remain of whether this phenomenon reflects different spinning techniques developed for different fibres or the preference and taste of the Bronze Age people. The various fabric qualities of wool cloth from the Middle Bronze Age to the Hallstatt period

Fig. 43. Hallstatt: Iron Age textile with yarns of 0.1 to 0.2 mm thickness.



¹⁴⁶ Bazzanella *et al.* 2003. – Bazzanella and Mayr 2009.

can be elucidated best with the finds from Hallstatt¹⁴⁷ (Fig. 42). These finds are representative for thread thicknesses in Central Europe in general. In the Middle Bronze Age, thicker strands of wool yarn with a diameter between 1 and 2 mm are common, although both thicker, and rarely finer yarn qualities also occur. In the Hallstatt period much finer yarn qualities can be observed; the most popular thread diameters range from 0.3 to 0.5 mm.

Thin threads could have been spun from long flax fibres relatively early in the Neolithic period. With sheep wool, which is characterised by shorter fibres, the spinning and weaving techniques were refined at the end of the Bronze Age to the extent that in the Hallstatt period thin yarns up down to 0.1 mm diameter (equivalent to today's sewing thread) were achieved. Early Iron Age craftspeople also managed to weave these very fine yarns without plying them, a sophistication that is mainly found in the eastern area of the Hallstatt Culture and the site of Hallstatt itself (Fig. 43). Whorls of different weight classes have been found from all prehistoric periods: perhaps these specialised tools reflect the production of varying types of thread¹⁴⁸.

The strength of the twist of the yarn is important for further processing. Tightly twisted and therefore stable yarn made of combed fleece is often used for the warp threads and for tablet weaving. Loosely twisted yarn makes a good weft for absorbent and warm textiles. The textiles found in the salt mines of Hallstatt¹⁴⁹ cover the whole range of possibilities – they were most likely deliberately designed by Iron Age craftspeople with specific properties in mind (see also fibre preparation).

4 Weaving techniques

Weaving was a highly valued craft in ancient times. The symbolism of weaving was embedded in society to the degree that in the Ancient Greek language weaving became a synonym for

¹⁴⁷ Grömer 2013, fig. 17.

¹⁴⁸ Belanová-Štolcová and Grömer 2010, 11–15.

¹⁴⁹ Cf. Grömer 2013, 59–60; see also key word 'twist angle' in the glossary.

planned action. This thinking even found its way into poetry, for instance in the comedy *Lysistrata* by Aristophanes (Aristoph., *Lys.*) (premiered in 441 BC). In a conversation with a magistrate the eponymous heroine compares politics in a humorous way to the various stages of textile production¹⁵⁰. The appreciation of high-quality textiles went so far that women skilled in weaving were considered important war trophies¹⁵¹.

A variety of weaving techniques were available to prehistoric people. As we know from the archaeological finds, certain methods and tools were applied purposefully from very early on to produce textiles for a specific use. The finds of the Hallstatt and Dürrnberg salt mines¹⁵² in particular provide a treasure trove of material for textile archaeologists. Again, it is the prehistoric textiles themselves which reveal technical details of the manufacturing process – even if they are incompletely preserved. There are narrow bands with simple selvages. These bands were used for various purposes, as belts, straps, bandages, trimmings for larger textiles, etc. Several weaving techniques can be distinguished among these bands on the basis of the weave type and patterning. Large-scale fabrics for clothes were most likely produced on the warp-weighted loom in Central European prehistory, which is evidenced by the countless finds of loom weights from prehistoric settlements. Even small fragments of large textiles produced on the warp-weighted loom can be identified by their starting border (see details below).

The process of weaving generally involves yarn systems that are interlaced with each other, so that a fabric is formed. One might note that this is also the case with braiding or plaiting. In principle, weaving, as well as plaiting mats, can be effectively done by guiding the weft by hand alternately over and under the warp threads. Such a weaving process is still taught to children in kindergartens and elementary schools to train dexterity.

Real weaving, however, differs from plaiting by the fact that the weaving device allows a mechanical creation of a weaving

¹⁵⁰ Pekridou-Gorecki 1989, 25–26.

¹⁵¹ Cf. Eibner 2000/2001, 108–115.

¹⁵² Hallstatt: Grömer 2013. – Dürrnberg: Stöllner 2005.

shed¹⁵³. It is therefore no longer necessary, as with plaiting, to move each element individually and to place the thread under or over individual warp threads by hand. The weaving device (heddle rod) makes weaving more efficient and faster because the whole series of threads are moved simultaneously. With the loom, man invented one of the first ‘machines’ in human history – one of the first complex devices that allow a mechanised operation. Like other achievements of the Neolithic, this principle was first developed in the Fertile Crescent, somewhere between Turkey and northern Iraq¹⁵⁴.

4.1 Band weaves: narrow repp bands

Narrow repp bands with a width of approximately 1 to 2 cm appear again and again in the archaeological material. As separately woven bands, unicoloured or patterned, they are known, for example, from the Bronze Age copper mining site of Mitterberg, Austria, or from the Iron Age salt mines of Hallstatt¹⁵⁵. They were produced from both single and plied yarns. The latter technique makes them even more stable and tear-resistant. Repp bands were also used as starting borders for weaving. In this function, they are known from the Neolithic period (see pages 118–119).

Bands can also be identified as decorative elements in arts. The hems of many garments depicted on the works of situla art¹⁵⁶ are adorned with bands. The bands are often represented with dashed lines, which could indicate the structure of repp bands. The weaving device used for the production of these bands cannot be exactly determined from the appearance of the final product. Possibilities include the use of rigid heddles or a band weaving tool with short heddle rods and spacing cords.

¹⁵³ Plaiting and weaving are technically only peripherally related: Whilst plaiting works with at least two active thread systems, weaving has one active thread system, the warp, and a passive thread system, the weft. For systematics, see Seiler-Baldinger 1994.

¹⁵⁴ Cf. Barber 1991, 79–122.

¹⁵⁵ Mitterberg and Hallstatt: Grömer 2006b; 2013, 69–70.

¹⁵⁶ See chapter E. – Situla art in general: Lucke and Frey 1962. – Turk 2005.

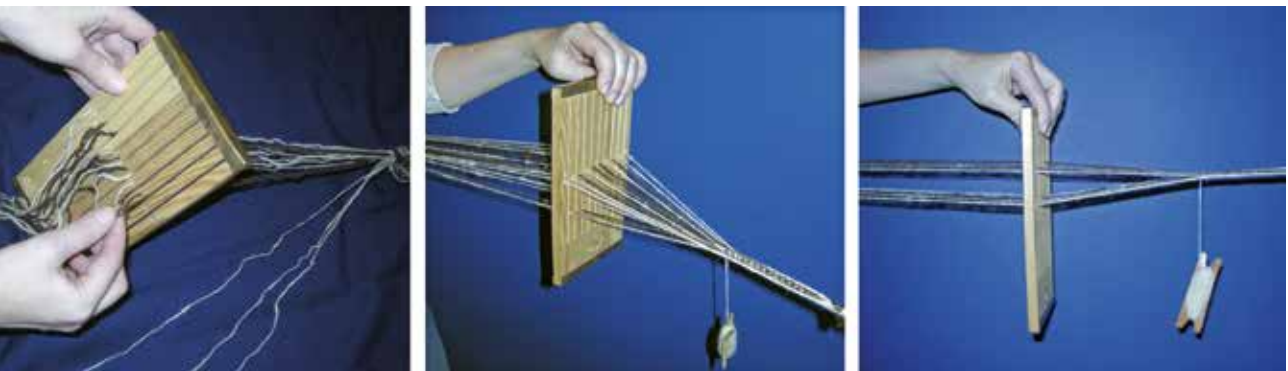
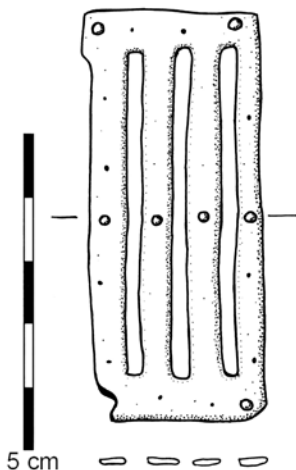


Fig. 44. Band weaving with the rigid heddle: preparing the warp and the two weaving sheds.

Archaeological evidence of rigid heddles date to the Roman period; in Central Europe, one was discovered in Lauriacum, Enns in Upper Austria (Fig. 45)¹⁵⁷. The device consists of a small board of wood or bone, a flat frame with alternating slots and slants with holes through which the warp threads passed. A heddle rod weaving device, on the other hand, is made purely from wooden sticks and threads. The difficulties with the preservation of wood aside, these could only be identified as weaving equipment if they were discovered in situ, with the work piece still attached. No such a device has yet been identified in the archaeological materials in Europe.

Fig. 45. Rigid heddle from Lauriacum/Enns, Austria, Roman period.

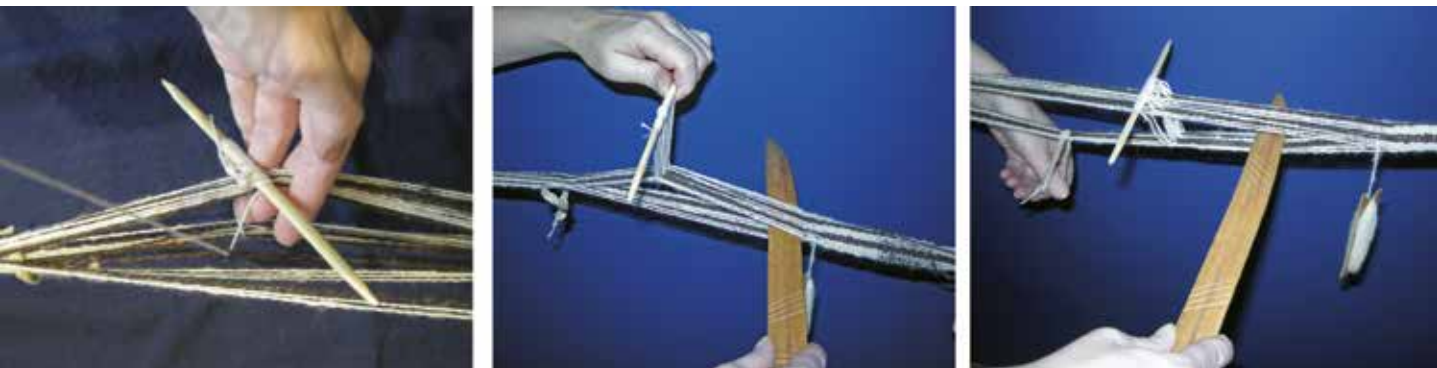


The **production of repp bands** is very simple and particularly clear with rigid heddles¹⁵⁸. The warp threads are prepared at the desired length and alternately passed through the holes and slots of the rigid heddle (Fig. 44 and 47). By raising or depressing the heddle, two different sheds could be opened, the one above, the other below the general level of the warp. The weft is then inserted into the shed.

The ribbed structure of repp is formed by the dense arrangement of the warp threads, so that the fibre density of one thread system is at least twice the one of the other. In some bands the weft threads are packed so firmly that the warp threads almost cover the weft threads. This binding is preferably used for narrow bands, as it gives the weaving greater strength.

¹⁵⁷ Gostenčnik 2012, fig. 29d.

¹⁵⁸ Wild 1988, 38–39, fig. 27.

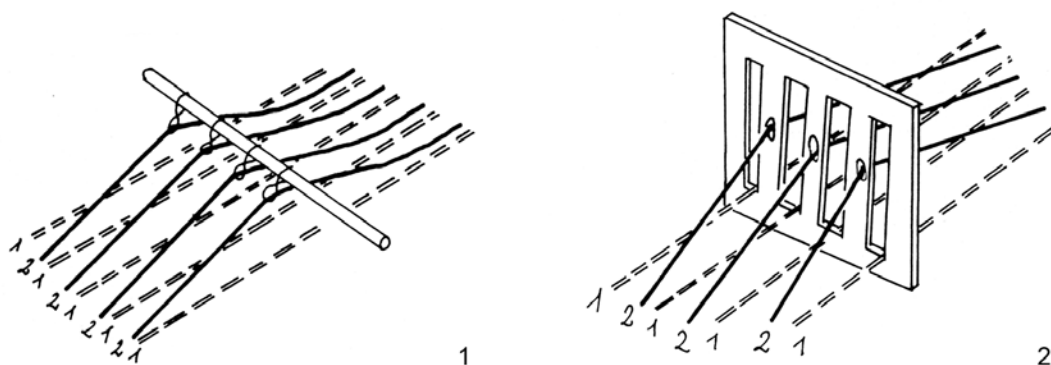


Exactly the same textile structure of repp band can also be produced without a special rigid heddle. Working with a heddle rod weaving device (Fig. 46) is probably the original technology. When warping, an upper and lower layer of thread is already created by passing the threads around a warping device in a circular manner; the distance between the upper and lower level of the warp is fixed by means of a separating rod or string. Now the threads of the bottom layer are fixed to the heddle rod while passing them through the upper layer. When the warp is tightened, the weaving can begin. The shed is formed by moving the heddle rod.

Fig. 46. Band weaving with a heddle rod: attaching the heddle rod and the two sheds.

The attachment of the warp when working with a rigid heddle or heddle rod is most often horizontal, knotted between two fixed points or a fixed point on the weaver's body. Vertical mounting, with weights or on a frame, is also possible. Devices for weaving bands are very flexible, and handling is done according to regional weaving traditions and also according to individual preferences.

Fig. 47. Scheme of making the shed with heddle rod (1) and rigid heddle (2).



From this simple, narrow heddle rod weaving device, other forms of weaving tools can be derived. If one extends the heddle rod in width and secures a wider warp to a stationary frame, the vertical hanging warp threads can be weighted with loom weights and the warp-weighted loom emerges. Widening the distance of the warp threads, the heddle and dividing rod, and attaching the warp on both ends on rods results in a two-beam loom. This weaving equipment is mounted horizontally and used close to the ground, resulting in the horizontal ground loom, which is, for example, typical for Ancient Egypt¹⁵⁹. The tubular loom, a two-beam vertical loom¹⁶⁰, is also derived from this principle, but stands upright.

This does not mean, however, that it is proposed here that the different weaving techniques have evolved from band weaving. Different devices probably emerged at the same time, benefiting from active exchange.

4.2 Broad bands in different weave types

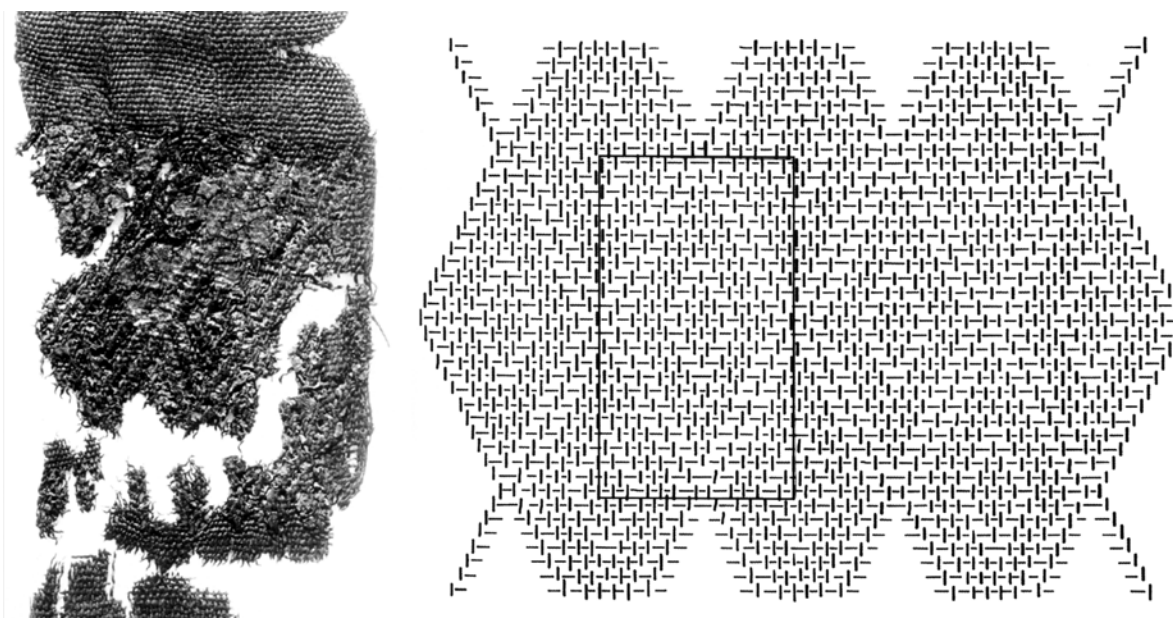
In addition to the repp bands up to 2 cm wide, wider bands are also found among the prehistoric materials. These were made in other weave structures than repp and are made in techniques similar to those for large-sized textiles produced on the warp-weighted loom. The bands are sometimes decorated (see pages 185–188); the selvages are usually designed by a simple return of the weft thread. Wider bands occasionally have repp structure at the selvages.

Bands with a width of 10 to 15 cm have been discovered at various lake dwelling sites of the Neolithic period – provided they could be reconstructed because two selvages were preserved¹⁶¹. Bands of tabby weave were found in Feldmeilen-Vorderfeld. The bundles of bands were amongst the charred remains of a settlement dating to the second half of the 4th millennium BC

¹⁵⁹ Barber 1991, 83–91 and fig. 11.1.

¹⁶⁰ Cf. Goldmann 1990. – Hald 1980. – Stærmoose-Nielsen 1999, 124–125.

¹⁶¹ Cf. Winger 1995, fig. 51. Textiles from Zürich/Utoquai, Feldmeilen/Vorderfeld or Montéliér/Platzbünden. – Médard 2010, 2012.



and had been rolled up before their final deposition. The various bands dating to the Late Neolithic from archaeological sites in Switzerland are always made from flax with plied threads and often have reinforced selvages. These side edges are discussed in more detail in the chapter on the warp-weighted loom.

Fig. 48. Early Bronze Age band from Molina di Ledro in Italy with woven diamond pattern.

A few examples from the abundance of material from the Bronze and Iron Ages will be discussed here¹⁶²: A band of 10 cm was found in the Early Bronze Age site of Unterteutschenthal, Germany. Particularly well known are the contemporary bands from Northern Italian wetland settlements in Molina di Ledro, site Ledro A. The magnificent 6.8 cm wide band is fully preserved at 2 m length and has ends decorated with a rhomboid pattern (Fig. 48). Another example from the same site has the same length, is 2.2 to 3 cm wide and has fringes on one end. Wider bands are also known from the Hallstatt site, including a 17 cm wide Bronze Age band with ribbed surface. Bands around 9 cm width in twill weave and a 4.2 cm wide repp band with brocade pattern date to the Hallstatt period (Fig. 49).

¹⁶² Unterteutschenthal: Schlabow 1959. – Ledro: Bazzanella *et al.* 2003, 161–163. Bazzanella and Mayr 2009. – Hallstatt: Grömer 2013, 70, *e.g.* HallTex 20, 22 and 58.

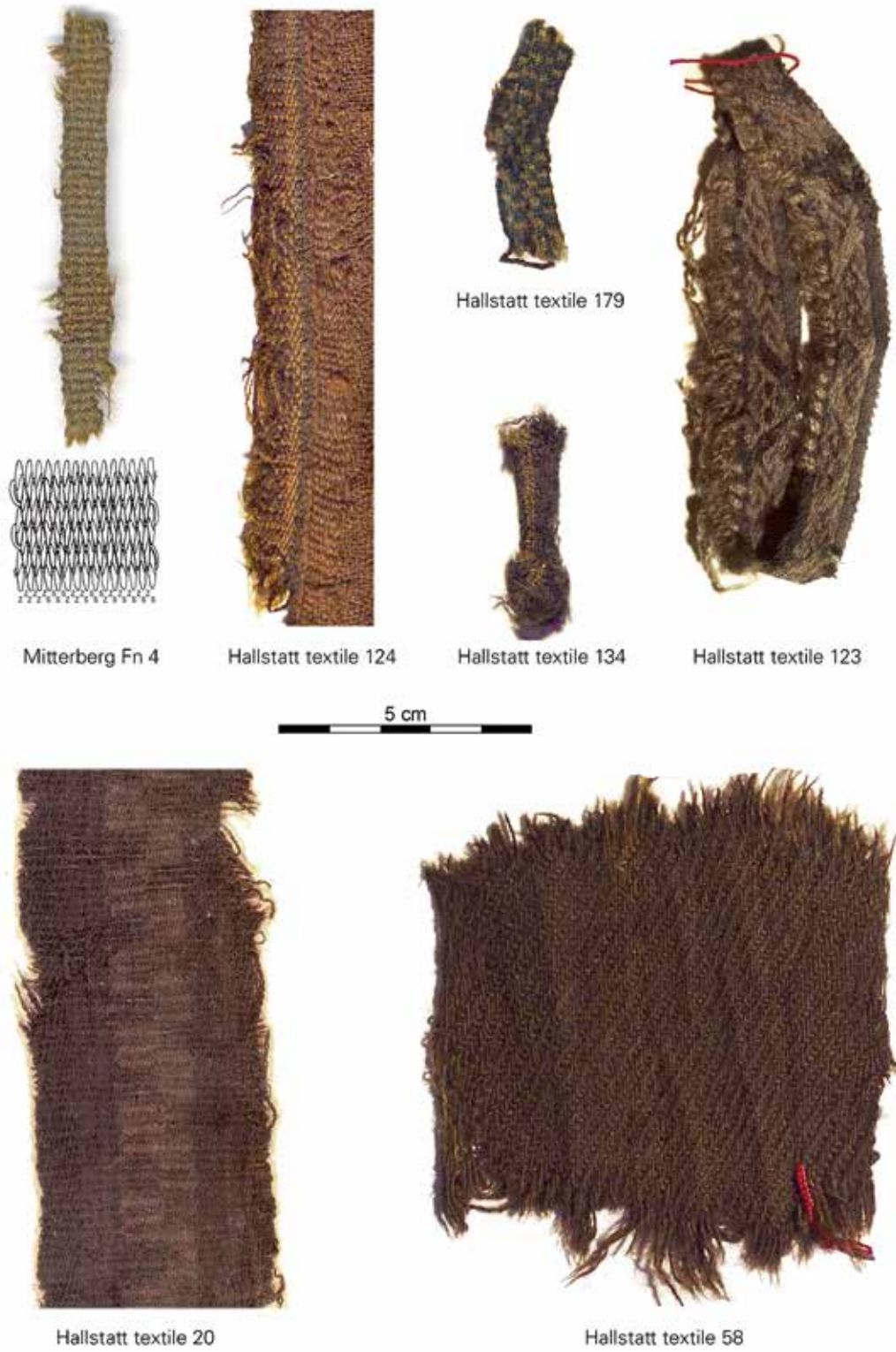


Fig. 49. Different woven bands from Mitterberg, Bronze Age, and Hallstatt, Iron Age, both Austria.



The weaving equipment used here is even more difficult to reconstruct than for the narrow repp bands. The large number of warp threads (for a 8.5 cm wide twill band from Hallstatt with a warp density of 13 threads per cm, 115 warp threads have been counted)¹⁶³ speaks against the use of a rigid heddle, which would have to be very wide. Heddle rods can be easily used for variants of tabby weave as well as for more complex weaves such as twill – only their number and way they are mounted varies (Fig. 50). Whether the set-up was carried out horizontally or vertically cannot be determined for prehistoric weaves. Nor do we know whether the weaves were mounted on a frame. For bands of this width it is advantageous to mount the warp threads on both ends and arrange them in the desired width. Simply tying the start and the end of the warp in a knot would make it difficult to achieve the desired width, particularly at the beginning. Rods that could have been used to hold the warp were, for example, discovered in Vinelz on Lake Biel, Switzerland, dating to

Fig. 50. Modern band weaving device with four heddle rods by Ingrid Schierer.

¹⁶³ Grömer and Rösel-Mautendorfer 2013, Iron Age catalogue, HallTex 11.



Fig. 51. Band weaving with crescent-shaped loom weights. Reconstruction by Karina Grömer and Ludwig Albustin.

the 27th century BC¹⁶⁴. The rods have thickened endings, which might prevent the warp from slipping off.

Annemarie Feldtkeller¹⁶⁵ suggested an interesting reconstruction of a band weaving device as it could have been used in the Neolithic period (Fig. 51). It is based on the findings of kidney or crescent-shaped loom weights, which are also known from Late Neolithic contexts in Austria¹⁶⁶. The width of the bands which could have been produced with such a device corresponds well to the late Neolithic fabric remnants from the lake site settlements.

¹⁶⁴ Winger 1995, fig. 50. The pieces are fragmented and alternative interpretations, *e.g.* as ends of bows, are possible.

¹⁶⁵ Feldtkeller 2003.

¹⁶⁶ Grömer 2006a, fig. 18.

After completing the weaving process, it is advisable to secure the warp ends in some way, so that the bands are stable at the ends. Only a few Central European pieces are well enough preserved that it can be observed how prehistoric people have designed the ends. On one band (interpreted as a belt) from Lago di Ledro¹⁶⁷ this problem was solved by braiding and partially knotting of the ends.

An example of the infinite creativity concerning the band ends is the repp belt from Itzehoe¹⁶⁸ from the Nordic Bronze Age; its end is designed as a tassel with 10 cm long cords. These consist of braided warp ends to which additional threads were added to increase the volume of the tassel.

4.3 Tablet weaving

Tablet weaving¹⁶⁹ was already known in Central Europe in prehistoric times, but this craft was practiced well into the modern era in the Persian world, Turkey, China, India, Burma and Iceland.

The earliest evidence for this technique from our latitudes is found in the form of the typical square tablets¹⁷⁰ with holes in the corners. One such piece was discovered in the Late Bronze Age layer 6 (¹⁴C-dated to 1,400–1,075 BC) of the site Abri Mühlthal I, Göttingen district in Germany. The square bone tablet is 3.5 cm wide, 3.7 cm long and 0.4 cm thick. It is perforated at the corners and has circular eye ornamentation on one side (Fig. 52.1). The weaving tablet was found in context with other textile equipment, a fragment of a spindle whorl and a polishing stone (to smooth hems). Additional examples are known from an Iron

¹⁶⁷ Bazzanella and Mayr 2009, fig. 18.

¹⁶⁸ Ehlers 1998, 37, 43.

¹⁶⁹ Collingwood 1982. – Hansen 1990.

¹⁷⁰ Abri Mühlthal: Grote 1994, part I/1, 149; part I/2, pl. 101/2–3. – Dejbjerg: Collingwood 1982, pl. 1. – El Cigarralejo: Hundt 1968, fig. 5. Square, ceramic tablets with perforated corners are also found in the late Neolithic of the Iberian Peninsula (Cardito Rollán 1996, 124) and in the Lengyel Culture around 4,900–4,300 BC in Central Europe (e.g. Urban 2000, 92). The use of these objects for tablet weaving has not been ultimately confirmed due to a lack of contemporaneous fabrics in this technique.

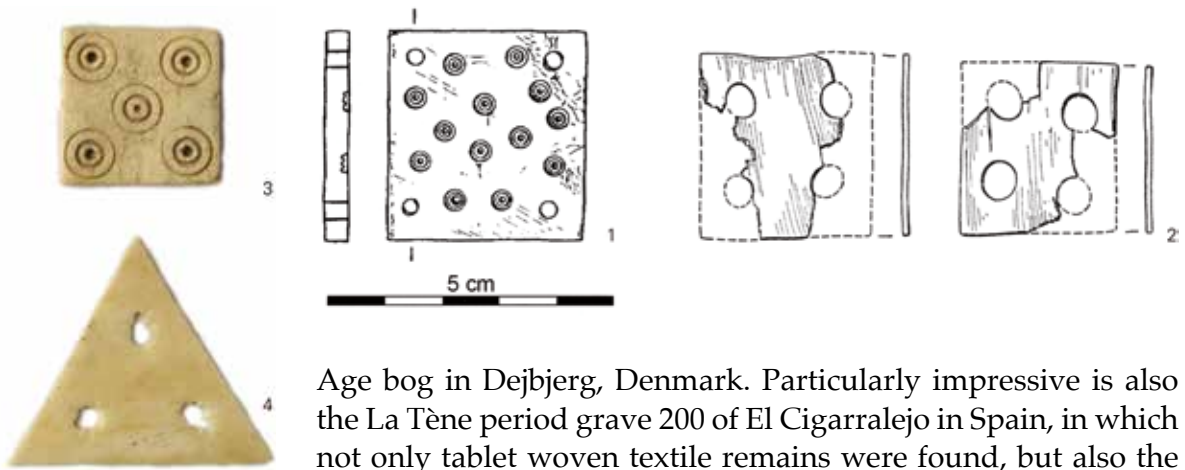


Fig. 52. Archaeological finds of weaving tablets: Abri Altmühltal I in Germany, Late Bronze Age (1), El Cigarralejo in Spain, Grave 200, La Tène period (2), Carnuntum, 1st century AD (3–4).

Age bog in Dejbjerg, Denmark. Particularly impressive is also the La Tène period grave 200 of El Cigarralejo in Spain, in which not only tablet woven textile remains were found, but also the associated tools – thin weaving tablets made of boxwood with a length of 3 cm (Fig. 52.2). From the Roman period, we know of numerous square and triangular weaving tablets (Fig. 52. 3–4), especially in the Northern Provinces¹⁷¹.

The ‘Ramses Belt’ from Egypt, *c.* 1,200 BC, and three linen bands dating to the 22nd Dynasty (945–745 BC) have long been considered the oldest evidence of tablet weaving. This has been refuted by Peter Collingwood in his rigorous studies¹⁷². The earliest secure finds of textiles produced in this weaving technique date *c.* 1,500–1,200 BC. Heidemarie Farke examined a starting border on a Middle Bronze Age textile from the burial mound group in Schwarza, Germany¹⁷³, and identified it as having been made with tablets with four holes in the corners. This find is now complemented by one recent find from the Bronze Age area of the Hallstatt salt-mine (*c.* 1,500–1,200 BC), a tabby textile with tablet woven starting border patterned with blue warp stripes (Fig. 53)¹⁷⁴.

The numerous well-preserved textile finds from the Iron Age testify that tablet weaving was a fully developed art at the time. Complicated pattern types and a variety of different techniques were being used. Particularly splendid examples have

¹⁷¹ Gostenčnik 2012. – Wild 1970.

¹⁷² See Collingwood 1982, 10–11 for a reconsideration of finds that were identified as tablet weaves in older literature.

¹⁷³ Burial mound C1, textile 13c: Farke 1993, 111.

¹⁷⁴ Grömer 2013, 87, catalogue 312, HallTex 288.

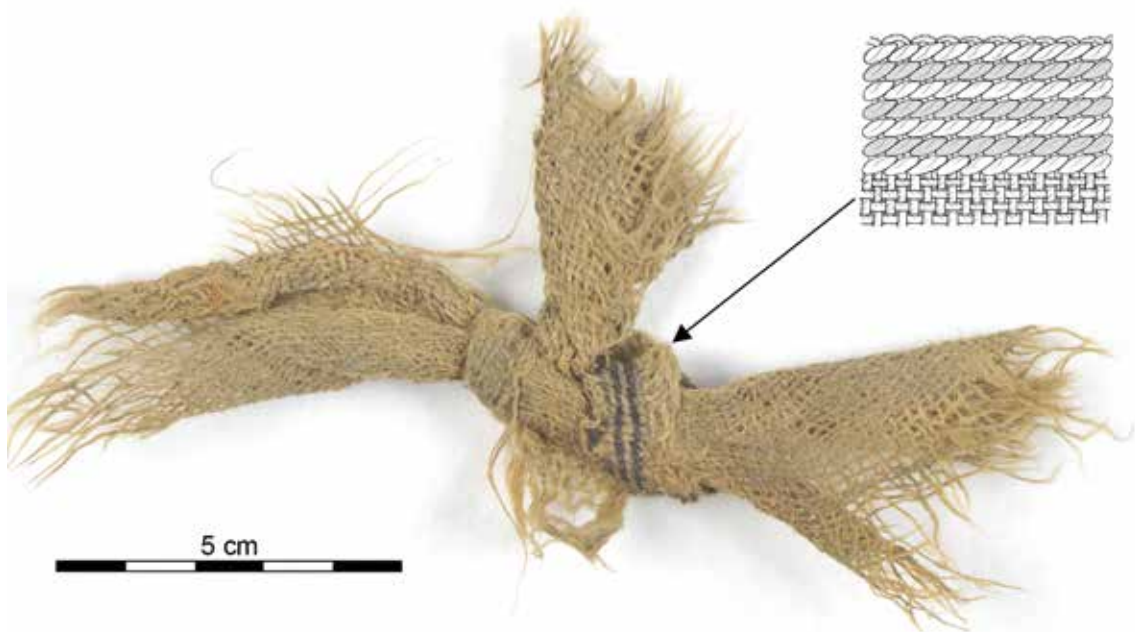


Fig. 53. Hallstatt, Austria: Bronze Age textile with tablet woven border.

been found in the Hallstatt chieftain's grave of Hochdorf, Germany¹⁷⁵. Tablet woven bands also decorate the cloaks and capes from Verucchio, Italy¹⁷⁶. Most tablet weaves from Austria were discovered in the Iron Age sites of the Hallstatt and Dürrenberg/Hallein salt mines¹⁷⁷.

The most spectacular find concerning tablet weaving dates to around 800 AD. A fully mounted device was discovered in the grave of the 'Viking Queen' Asa in Oseberg, Norway¹⁷⁸: a loom with a mounted warp for tablet weaving with 52 tablets and a partly woven band.

Tablet woven textiles were held in high esteem in the past because of their extraordinary load-bearing capacity. Small, decorative bands were most often produced. They are very durable and can be stretched without tearing; they do not even tear when one of the warp threads is broken, as the warp strands usually

¹⁷⁵ Ræder Knudsen 1999, 80–82. – Further examples of tablet weaves from Central Europe: Grömer and Stöllner 2011.

¹⁷⁶ Cf. Ræder Knudsen 2012.

¹⁷⁷ Hallstatt: Grömer 2013, 87–88. – Dürrenberg: Ræder-Knudsen and Grömer 2012.

¹⁷⁸ Collingwood 1982, 16–17, pl. 5.

consist of four threads twisted together. Moreover, complicated and colourful patterns can be produced with simple means in tablet weaving.

Tablet weaves were used as trimmings for garments and as belts in prehistoric times for these reasons. Sometimes they were directly woven together with other textiles on the loom, sometimes they were produced separately and then sewn on a fabric.

The resources and tools needed for the handling of tablet weaving are very simple. No loom or weaving frame is needed; the tablets and two fixed attachment points suffice. Nevertheless, a large number of patterns and fabric structures can be produced. Within a single band an amazing variety of pattern variants is possible.

The width of the textile is determined by the number and diameter of the warp threads, as is the case with other weaves. The number of tablets is arbitrary. In prehistory and the early historic period, up to 178 tablets were used, for example in the splendid *Prachtmantel* from Thorsberg in Germany, dating to the 3rd and 4th centuries AD¹⁷⁹.

The weaving process, the technique of combining warp and weft threads, is not based on intersecting the thread systems by raising and lowering a heddle rod, but on an entirely different principle. The fabric is formed by rotating the tablets (Fig. 54). The threads are led through the holes of the tablets, which are then given quarter or half turns. The weft is passed through the gap (shed) between the upper and lower threads and so the warp is converted into a fabric. The weft is not visible in the textile; it appears only at the turning points when the rotational direction of the tablets is changed.

Before mounting the tablet weave on the weaving devices, the required number of warp threads must be cut to the desired length. Then the warp threads are individually pulled through the holes in the tablets. As soon as the warp is stretched and

¹⁷⁹ Schlabow 1976, fig. 109–118.

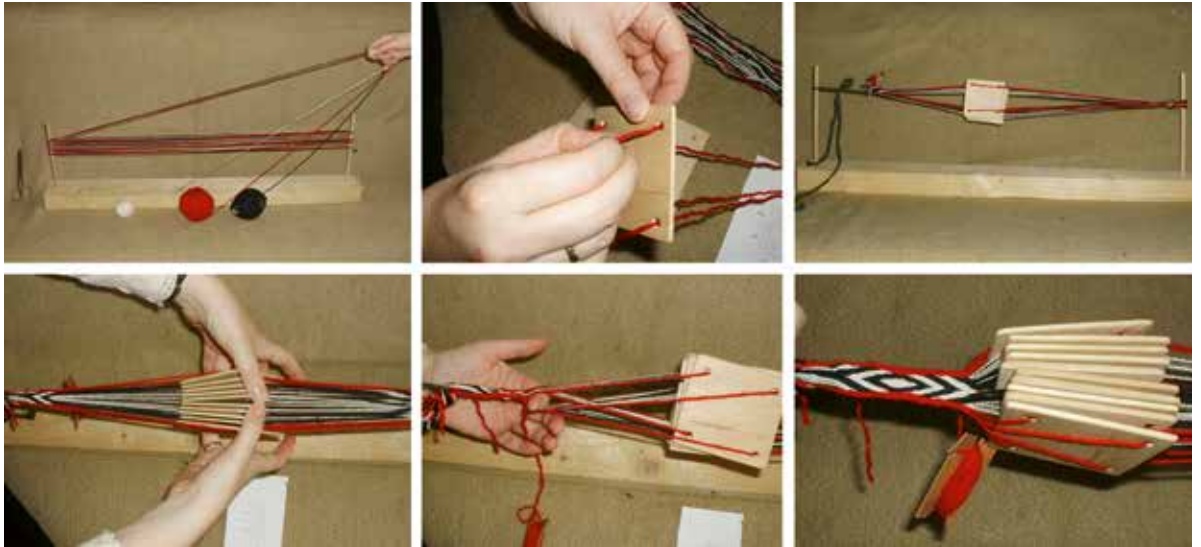


Fig. 54. Tablet weaving: steps of production from the warping to the finished textile.

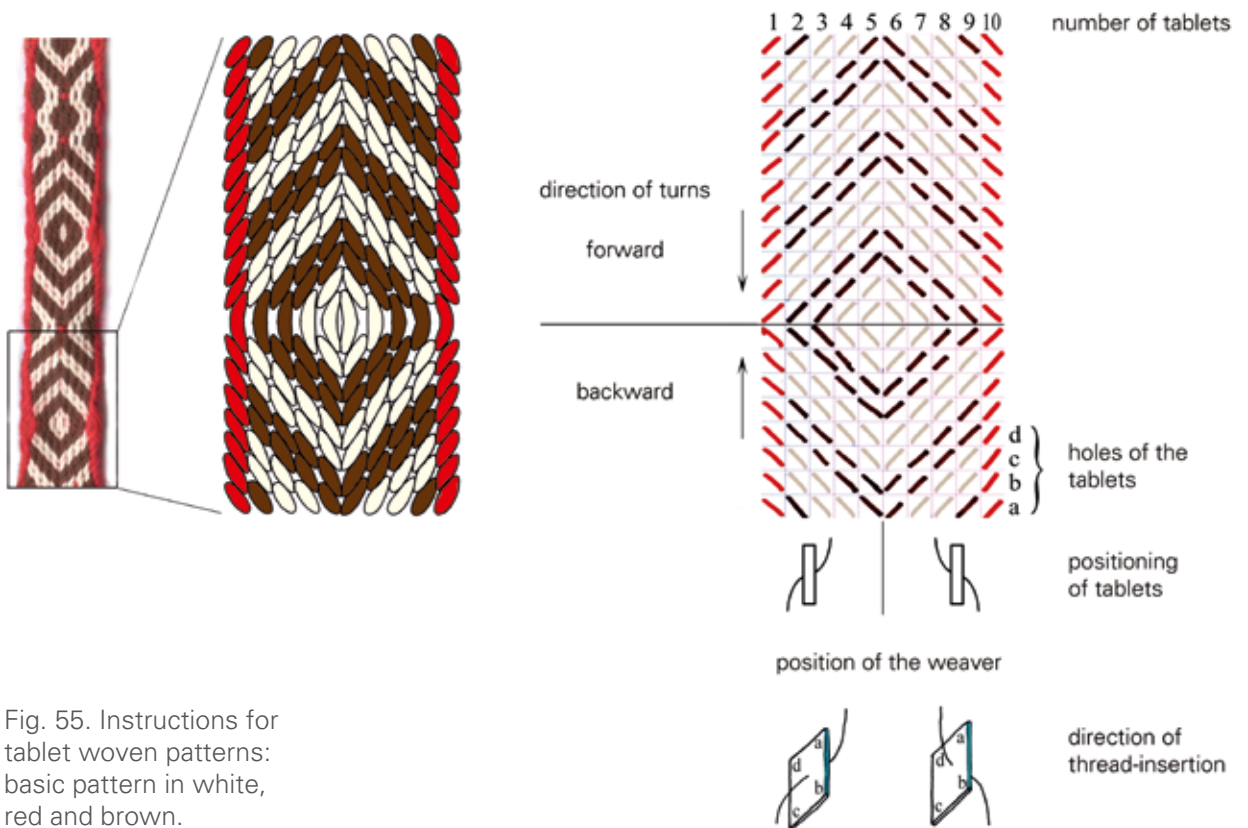


Fig. 55. Instructions for tablet woven patterns: basic pattern in white, red and brown.

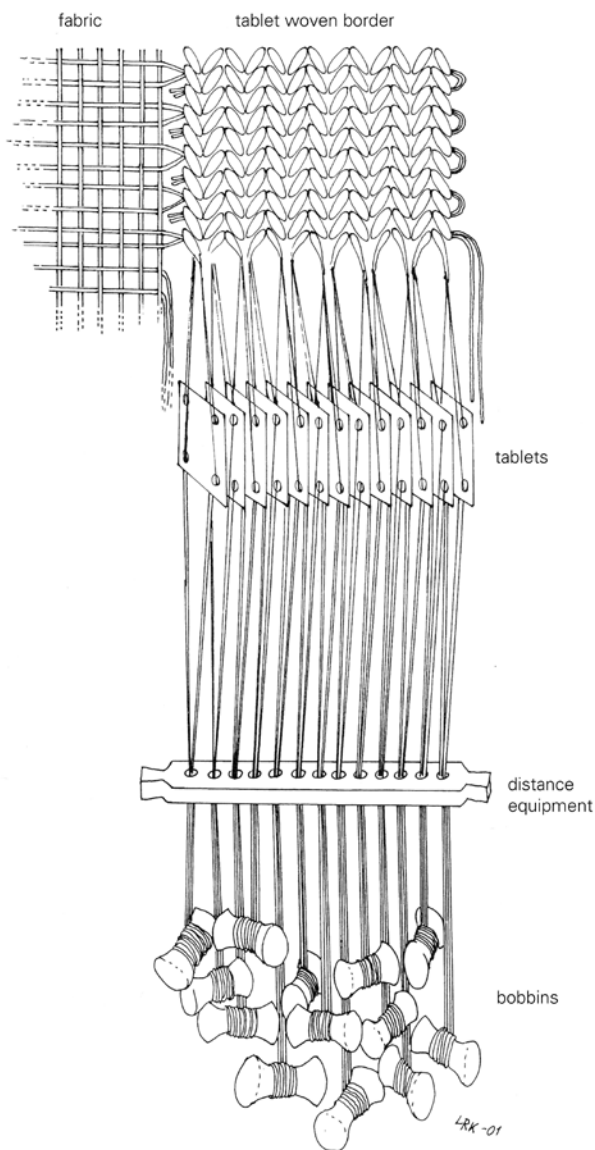


Fig. 56. Using spools and spacers for tablet weaving.

mounted so that the tablets are all parallel, the insertion of the weft thread can begin.

During the weaving process, the tablets are turned on the tense warp in a quarter turn, forming a shed (Fig. 54, below). The result of this rotation is that a different warp thread comes to the top each time. The twist direction of the warp 'cords' – S or Z twisting – is determined by the direction of the entry and the rotational direction of the tablets. Since the remainder of the warp is also turned by the rotation, the direction of rotation needs to be changed from time to time. These changes of rotation allow different patterns, which are a characteristic feature of tablet weaving.

Depending on the combination of colourful threads used in the warp and the arrangement of the threads that run through the holes, various patterns are possible. The rotation direction of the tablets is another component of the motif design. When all tablets are turned back and forth alternately, a zigzag or diamond pattern forms in the fabric, like in the present example (Fig. 55). Reversing the rotation direction of the pattern is reflected in the longitudinal pattern of the fabric.

Other than this simple binding technique, there are many more options for design. For more complicated motifs (see pages 180–185) some of the individual tablets have to be rotated forwards, others backwards, before leading the weft thread through the shed. Turning the tablets around their own axis results in further complex patterns.

Metal components, beads, tassels and fringes can also be woven into the band. By using additional weft threads (brocade weft) it is possible to weave complex pictorial patterns. This technique was especially popular in the Middle Ages, when even gold and silver threads were inserted¹⁸⁰.

Iron Age contexts from Italy delivered interesting evidence for the use of spools, spacers and clasps for the elaborate production of tablet woven borders on the garments of Verucchio¹⁸¹ (Fig. 56), which were directly woven onto the textiles.

4.4 Textiles from the warp-weighted loom

People today are especially fascinated by the warp-weighted loom¹⁸², primarily because of its primeval appearance in comparison to the complexity of modern looms, but also because of its impressive functionality.

Most striking are probably the weights that stretch the warp threads and the position of the textile at the upper end of the device (Fig. 57.2). To today's onlookers, a loom in which the shed is cast upwards seems strange and technically immature. On the warp-weighted loom the cloth is formed at the top and the working face ('fell') slowly creeps downwards. After inserting the weft yarn, the weaver beats each insertion firmly upwards into place against the main web.

The procedure used and the form of this loom varies slightly according to time and region – in this case, prehistoric Europe. When setting up this type loom, no large space is required to accommodate the device in a house (living space or workshop). A warp-weighted loom just leans against the wall. A horizontally mounted ground loom, however, requires much more space, because it covers the floor. This was common in warmer areas

¹⁸⁰ E.g. Collingwood 1982, pl. 197–198.

¹⁸¹ Ræder Knudsen 2012, 259–261, fig. 11.10–11.14. – For tools, see Gleba 2008a and 2012.

¹⁸² Basics of the warp-weighted loom and the work process: Hofmann 1964.



Fig. 57. Krems-Hundssteig in Austria, cylinder-shaped loom weights from Late Neolithic (left), reconstruction of a warp-weighted loom for plain weave in Archeopark Schnals (right).

such as the Middle East or in Egypt¹⁸³, where working could be also done outside due to the favourable climate.

The warp-weighted loom is known from numerous **illustrations** on Greek vase paintings¹⁸⁴. It is also depicted on Central European finds, which are few but frequently shown in the lit-

¹⁸³ Barber 1991, 83–91, fig. 11.1.

¹⁸⁴ E.g. Pekridou-Gorecki 1989. – Greek vase paintings are cited and reproduced in almost any work on prehistoric and antique textiles. For a detailed compilation, see Stærmosé-Nielsen 1999, 144–147.

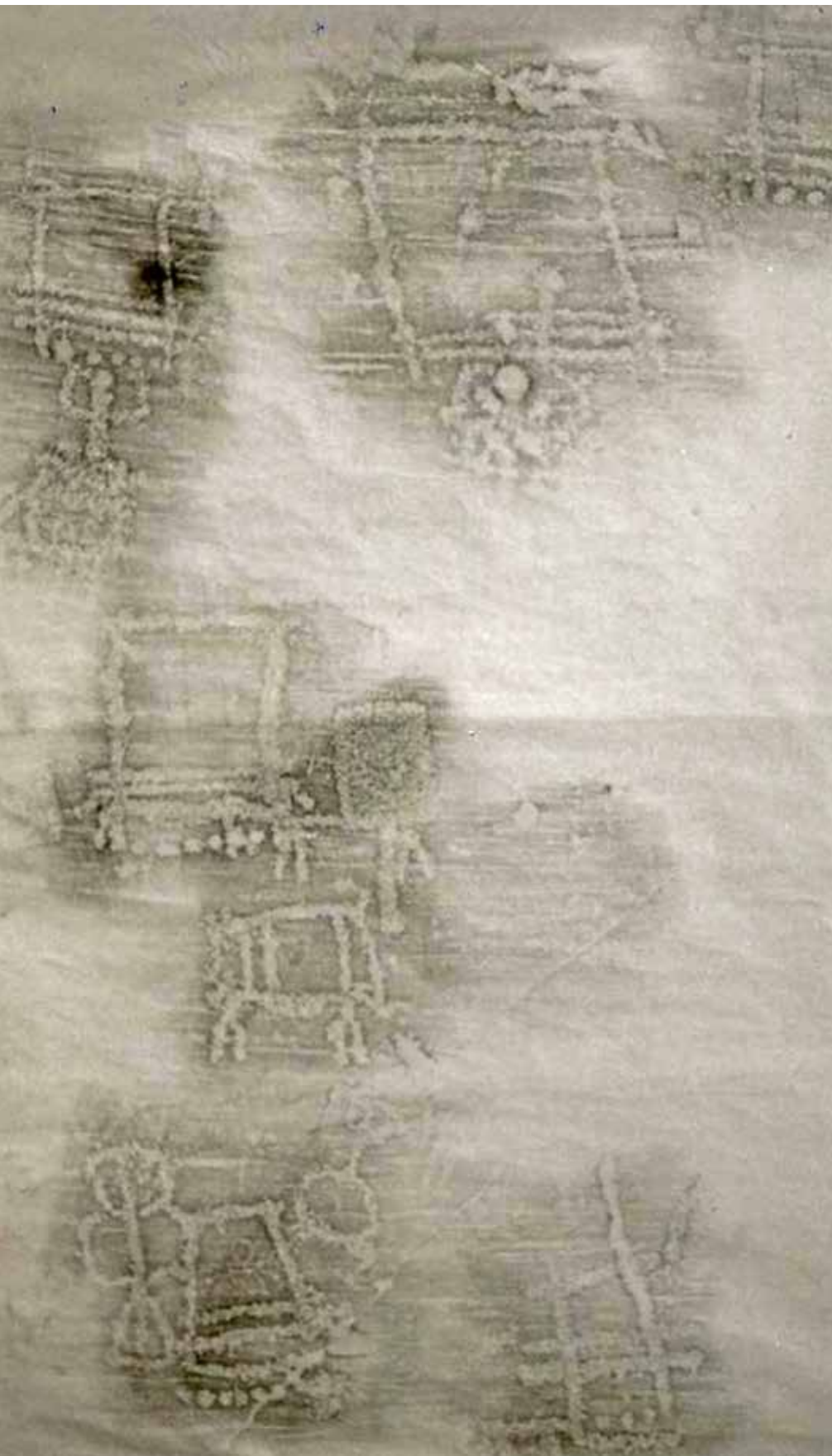


Fig. 58. Val Carmonica in Italy, rock art representations of warp-weighted looms.

erature¹⁸⁵ (Fig. 146 and 147): the conical necked vessel from Sopron in Hungary, the sheet bronze rattle from Bologna and the wooden throne from Verucchio, Italy, all date between c. 800 and 500 BC. The rock art depictions from the Val Camonica in the Italian Southern Alps are much harder to date. At the site of 'Grande Roccia' near the village Naquane, a large number of looms are shown in engravings in the rock (Fig. 58)¹⁸⁶. According to Emmanuel Anati, they date to the Bronze Age, a period around 1,200 BC, although other authors, like Erich Schumacher, suggest a younger date, between 800–500 BC.

The people who created those prehistoric images of looms most likely did not intend a technically correct, naturalistic representation of the device. Nevertheless, some principles of the loom construction can easily be determined: the upright timber beams, the loom weights, the heddle rod and the fixed shed rod. In the Iron Age images (Fig. 147) the woven cloth can also be seen schematically. Particularly noteworthy are the details on the conical necked vessel from Sopron¹⁸⁷, which present the weaving process: the end of the weft thread is wound into a ball, the woven textile is marked by hatching. Perhaps the incised structure even indicates that twill is woven, or does it reflect a specific pattern? Archaeological evidence of warp-weighted looms frequently comes in the form of **loom weights**¹⁸⁸, which have been produced since the Neolithic period and are mainly found in settlements. They prove that even Neolithic farmers mastered the weaving of large-size cloth¹⁸⁹ Loom weights dating to the late 6th millennium BC are the earliest evidence of the warp-weighted loom from south-eastern Europe¹⁹⁰. Due to the good preservation of ceramic loom weights, a substantial body of information is available for archaeological investigation. A complete over-

¹⁸⁵ Verucchio: Von Eles 2002, 235–237. – Bologna: Gleba 2008a, fig. 7. – Sopron: Eibner 1980.

¹⁸⁶ See Anati 1994, 158–159. – Schumacher 1983. – Zimmermann 1988.

¹⁸⁷ Eibner 1980.

¹⁸⁸ Overview of Central European finds: Germany: Möller-Wiering 2012, 127–129. – Italy: Bazzanella 2012, 210–211; Gleba 2008a; 2012, 227–229, 234–236. – Slovakia and Czech Republic: Belanová-Štolcová 2012, 309–314; Belanová-Štolcová and Grömer 2010. – Switzerland: Médard 2012, 369–370; Rast-Eicher 2012, 382.

¹⁸⁹ Fine fabrics in twining techniques can be produced in addition to weaves on a warp weighted loom. See Rast-Eicher 1997; 2005.

¹⁹⁰ Barber 1991, 93.

view of the Central European finds of loom weights would, however, go beyond the scope of this book. Instead, a brief outline of some details of sites from Austria and Slovenia will be given here.

Neolithic and Bronze Age types of loom weights are very large, heavy and coarse. Their shape is spherical to cylindrical¹⁹¹. The earliest in situ find of a loom (Fig. 57.1) in Austria was made on the fortified hilltop settlement Krems-Hundssteig (Jevišovice Culture, c. 3,100 BC)¹⁹². The loom weights were found in three rows parallel to the wall of a pit house at a length of 1.20 m. Stone slabs encountered to the left and right could have served to support the frame.



Fig. 59. Flat, oval Iron Age loom weight from Hallstatt, Austria.

Late Bronze and Early Iron Age loom weights are usually shaped like truncated pyramids. Occasionally they may also be disc-shaped or oval with a decentralized hole, such as a find from Hallstatt (Fig. 59). Some loom weights from the eastern area of the Hallstatt Culture are marked with signs on the top end; dots, crosses, dashes, etc. are, for instance, found on the loom weights from Burgstallkogel near Kleinklein in Austria¹⁹³. We do not know why the Iron Age people marked their loom weights. Perhaps the signs were marks of the manufacturers of the weights (potters) or the owners and users (weavers). The signs may also have been important markers for the weaving process. For weaving patterns achieved with the weft wrap patterns (flying shuttle technique), for instance, marked loom weights would have been useful to easily identify specific points in the textile.

Very interesting loom weights were recovered from the Hallstatt period hillfort of Molpír near Smolenice in Slovakia¹⁹⁴. Two small loom weights from House 17 show exceptional decoration consisting of animals, humans and geometric motifs (Fig. 60). Su-

¹⁹¹ E.g. Grömer 2006a, fig. 5.

¹⁹² Pieler 2001, 503–505, fig. 59. – Grömer 2006a.

¹⁹³ Dobiat 1990. See comment on crafts by Walter Slonek.

¹⁹⁴ Stegmann-Rajtár 1998, 278–282.



Fig. 60. Smolenice Molpír, Slovakia: Pyramid-shaped loom weights, one with anthropomorphic decoration, Early Iron Age.

sanne Stegmann-Rajtár interpreted these pieces as ‘loom weight idols’ used for ritual or religious purposes.

Pyramidal loom weights were also found in the La Tène period. It is, however, noteworthy that the total number of loom weights found in settlements is now significantly lower compared to the Hallstatt period. Perhaps a new type of loom was introduced in the La Tène period¹⁹⁵. It may be a two-beam loom, as depicted on a Hallstatt period vessel from Rabensburg (see below).

Various forms of loom weights, which developed over time, are presented here. Is there a difference in the finished fabric depending on the type of loom weight used? Late Neolithic to Middle

Bronze Age weights are very large, heavy and roundish. Late Bronze Age and Early Iron Age loom weights are narrower and disk-shaped or pyramidal. In addition, in the Iron Age there are various weight classes¹⁹⁶ ranging from heavy loom weights with a similar weight to the ones used in the Neolithic period, to significantly lower weights.

According to **archaeological experiments**¹⁹⁷, a weight per thread of about 30–40 g is optimal for stretching the warp of a loom in order to achieve a well balanced textile. It is the thread diameter that defines the appropriate tension to a large extent, as Eva Andersson Strand¹⁹⁸ points out, but the amount of tension required is also affected by how hard the thread is spun, the fibre quality and the degree of fibre preparation. If too much tension is applied, the thread will break; if the tension is not sufficient, it will be more difficult and time-consuming to change the shed. The shape of the loom weights has functional significance as well: the 800 g, narrow disc-or pyramid-shaped weights of the Iron Age need less space than an equally heavy spherical loom

¹⁹⁵ Cf. Stöllner 2005, 173.

¹⁹⁶ E.g. different loom weights of the large loom from Kleinklein. Dobiát 1990.

¹⁹⁷ Andersson-Strand 2010a. – Mårtensson *et al.* 2009.

¹⁹⁸ Andersson-Strand 2010b, 18.

weight of the Neolithic period. Weaving with Iron Age weights thus enables a higher thread density of warp (Fig. 61).

These theoretical considerations coincide fully with the archaeological finds of textiles: Early Iron Age weaves on average have much higher densities than those from the Neolithic to Middle Bronze Age. The change of loom weight shapes and types can therefore be explained as a technological change as part of an effort towards finer textiles. As an example, the fabric qualities from the salt mines of Hallstatt, which have yielded hundreds of prehistoric textiles, are listed here (Fig. 62). Textiles from the Bronze Age areas of the salt mine (c. 1,500–1,200 BC) are compared to those of the Early Iron Age mines (c. 800 to 400 BC)¹⁹⁹. Coarser wool fabrics with a textile density of less than 5 threads per cm prevail in the Bronze Age, whereas Hallstatt period fabrics are finer with a main density of 11 to 20 threads per

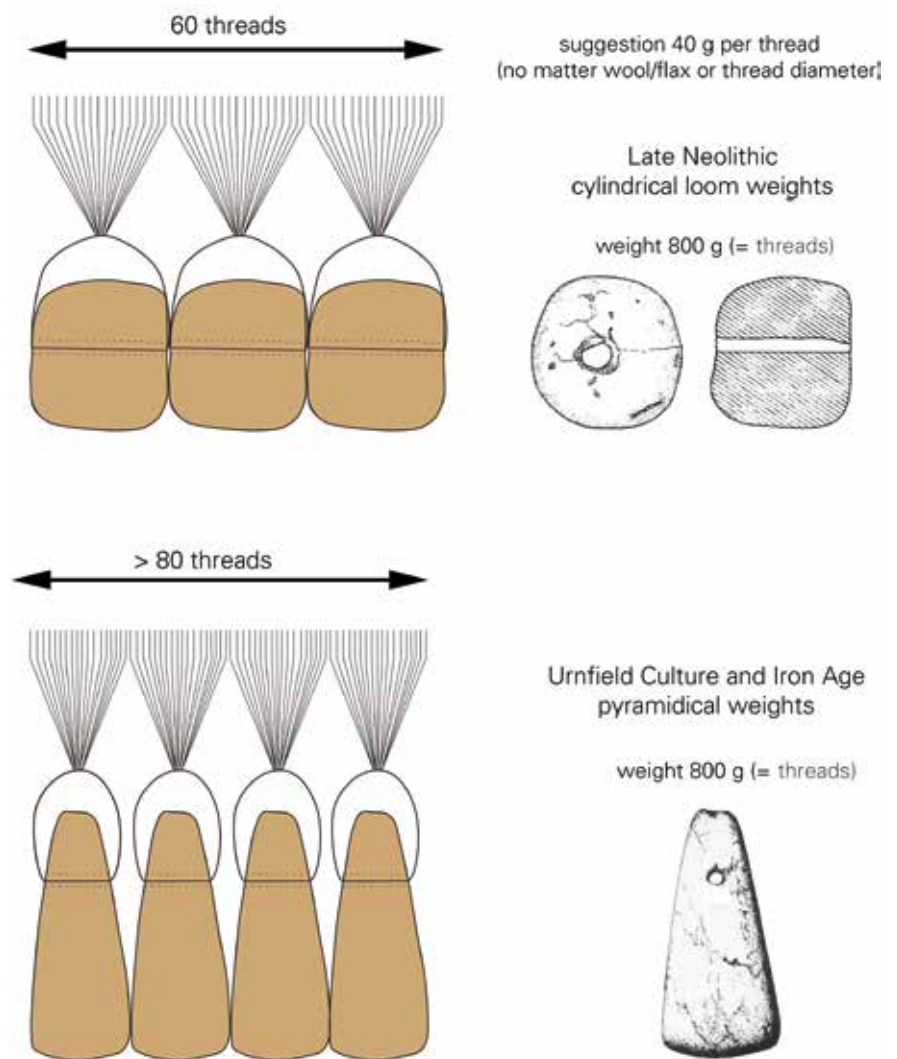


Fig. 61. Thread distances in the weave correlating to shapes of loom weights in the Late Neolithic and Iron Age.

¹⁹⁹ Grömer 2013, 62–65, fig. 20.

cm²⁰⁰. Textiles woven in basket weave with fine threads can even reach densities of up to 40 threads per cm, with a thread diameter of 0.1 to 0.2 mm. Considering the simplicity of the available equipment, this is a remarkable achievement by the Hallstatt craftspeople.

Of particular interest are prehistoric finds of loom weights that are found just as they were arranged on the loom while working. In the millennia between their deposition in the soil and the excavation of the loom, the wooden frame structures and the woven product have decomposed completely. What remains are the rows of loom weights in the houses and in some cases even traces of the posts of the frame.

Such rather rare finds offer invaluable information about warp-weighted looms. From the length of the loom weight rows, the approximate width of the fabricated textile can be deduced. The analysis of *in situ* finds of Iron Age looms (rows of loom weights) in Austria and Slovakia²⁰¹ revealed interesting insights. There appear to be three standard sizes of looms during the Hallstatt period. Narrow looms with a width of only 60 to 90 cm are known from sites like Stillfried²⁰²; they were obviously used to produce narrow textiles. The standard width of 120 to 160 cm occurred much more frequently, for instance at Michelstetten in Lower Austria²⁰³ and for Loom 2 from House 1/02 of Nové Košariská, Slovakia²⁰⁴ (Fig. 63). Fabrics of this width may very well be made by one person or in cooperation between two persons.

Looms with a width of over 3 meters²⁰⁵ are again rare. Until recently, this type was only represented by the 3.70 m wide loom from Kleinklein in Austria, with over 148 pyramidal loom weights. The exceptional context on a hillfort was interpreted

²⁰⁰ Comparable thread counts can be found all over Central Europe: Bender Jørgensen 1992. – Möller-Wiering 2012. – Grömer 2012. – Rast-Eicher 2008; 2012.

²⁰¹ Cf. Belanová-Štolcová and Grömer 2010.

²⁰² Eibner 1974.

²⁰³ Lauermaun 2000, 19–20, fig. 18–19.

²⁰⁴ Čambal and Gregor 2005, 37. – Belanová-Štolcová 2012, 312–314, fig. 15.6. – Štolcová and Zajonc 2015.

²⁰⁵ Hafnerbach: Preinfalk 2003, fig. 12. – Kleinklein: Dobiak 1990. – Freundorf: Blesl and Kalser 2005, 88.

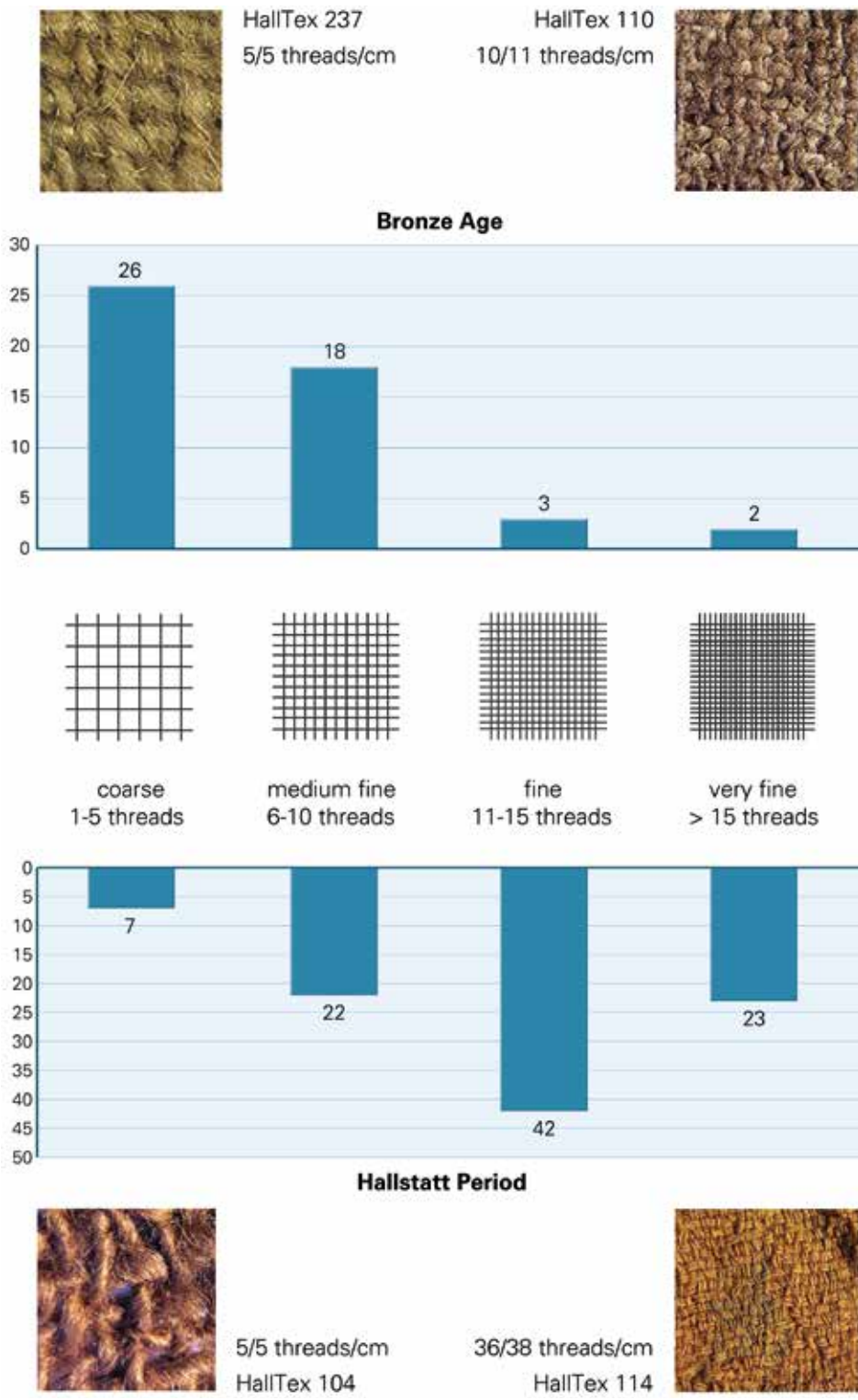
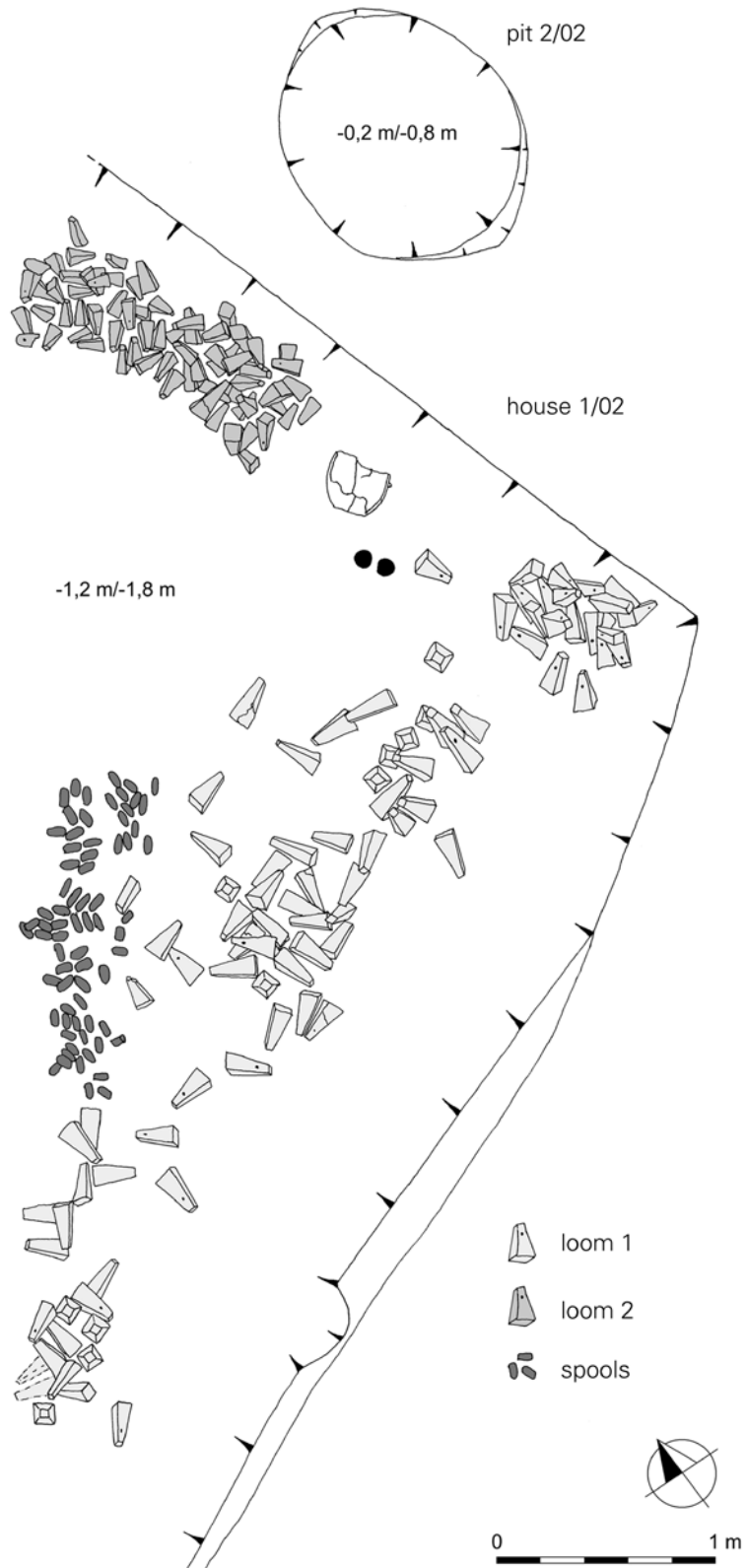


Fig. 62. Examples of different weave densities of wool fabrics from the salt mines Hallstatt in Austria, Bronze and Iron Ages. Details of original textiles 1 cm each.

Fig. 63. Excavated corner of House 1/02 at the Early Iron Age settlement of Nové Košariská in Slovakia, with two looms (short and long).



in terms of a special production in conjunction with the local elite buried in the nearby necropolis. Lately, however, there is increasing evidence that large looms are not purely linked to the production of special textiles for status display in (fortified) hilltop settlements. Large looms have also been excavated in the Iron Age lowland settlements such as Hafnerbach (Fig. 150) and Freundorf, both Lower Austria. The loom from Hafnerbach even had a width of 4 m.

At many sites where rows of loom weights have been found, there is also a ceramic vessel nearby.²⁰⁶ Did such a vessel serve as a container for yarn balls, or was it filled with water, to moisten the yarn? Weaving wool or linen with a moist weft thread produces a soft and flexible material that can be more easily compressed into a dense textile.

Other **implements** needed for weaving on warp-weighted looms (and other weaving devices) include tools with which the weft in the shed can be beaten up²⁰⁷: weaving swords and weaving combs. A pin beater, a bone implement pointed at both ends, is another weaver's aid for releasing knots and tangles. Each craft worker is aware of the fact that both the character of a particular tool as well as its handling has an effect on the final product²⁰⁸. A weft purely beaten up by hand results in a lower weft density, as less pressure can be applied. The resulting fabric is rather soft and supple. In contrast, if the weft is beaten in with a long, heavy weaving sword, the result is a much denser weave. The weaving comb only has a small contact area with the textile when it is beaten in, so slightly irregular and wavy weft lines can typically be seen on the finished fabric when this device was used. Such fabrics were discovered among the Bronze Age and Iron Age textiles from Hallstatt²⁰⁹.

²⁰⁶ Schierer 1987, 81–82.

²⁰⁷ Wild 1988, 33–35, fig. 23.

²⁰⁸ Cf. Hammarlund 2004; 2013.

²⁰⁹ See Grömer and Rösler-Mautendorfer 2013, HallTex 247, 248 (Bronze Age); HallTex 104 (Iron Age). – Hammarlund 2013.



Fig. 64. Weaving swords from Hallstatt-Dammwiese in Austria, late La Tène period.

Wooden weaving swords could be identified amongst the finds from Neolithic and Bronze Age wetland settlements²¹⁰, for instance the well-known, 68 cm long weaving sword from Wetzikon-Robenhausen in Switzerland. Smaller examples of weaving swords with 13–16 cm length as well as weaving combs are known from Fiaavè in Trentino, northern Italy (15th century BC, Middle Bronze Age II). From Hallstatt-Dammwiese, a settlement dating to the late La Tène period, wooden objects have been recovered that may be interpreted as weaving swords as well (Fig. 64)²¹¹. Similar objects of the same period were found in Fellbach-Schmieden and Porz-Lind in Germany²¹². Additional weaving swords, including objects made of bone, were identified amongst the small finds from the Magdalensberg in Carinthia²¹³ and date to the mid-1st century BC to the mid-1st century AD.

Starting borders

How does weaving on the warp-weighted loom start? First, a specific number of warp threads have to be prepared with a specific thread count so they can be attached to the cloth beam. To avoid hanging hundreds of threads on the loom individually, a starting border can be used. This technique was already perfected in the Neolithic. The starting borders added more work, but fulfilled an important technical purpose: they sorted the warp yarns and spaced them regularly. In addition, the starting border strengthened and decorated the fabric edge that anchored the main warp to the cloth beam. The edges of a fabric are the most vulnerable to wear and tear, and thus required the prehistoric weavers to take extra steps to reinforce them wherever possible to make the textile more resilient.

Various types of starting borders are known from the Neolithic lakeside settlements in Switzerland²¹⁴. The textile fragment

²¹⁰ Bazzanella *et al.* 2003. Fiaavè: 141, Wetzikon-Robenhausen: 228–229.

²¹¹ Kind comment by Hans Reschreiter, Natural History Museum Vienna. These pieces might also be interpreted as wooden parts of architecture.

²¹² Von Kurzynski 1996, 14–15.

²¹³ Gostenčnik 2013, fig. 4.5c.

²¹⁴ See Médard 2010; 2012, 371, fig. 18.8–18.11.

from Gachnang/Niederwil-Egelsee²¹⁵ (Fig. 65), for example, was made in a tabby weave from fine plied yarns of flax with a thread diameter of only 0.3 to 0.5 mm. The fabric has a density of 8–9 threads per cm. It has a repp starting border as well as repp selvages; one of the selvages is preserved at a length of c. 1 m. The textile belongs to the later Pfyn Culture and dates to c. 3,650 BC. It was found rolled up at the time of discovery.

Repp starting borders (Fig. 66) with widths of 1 to 1.5 cm are frequent among the Bronze Age and Iron Age textiles from the salt mines in Hallstatt. In Hallstatt alone there are several different variations of repp borders, which are distinguished by the different ways the yarn is led, as well as by the use of different thread types: single, plaid or paired yarn (Fig. 67).

The oldest tablet-woven starting borders²¹⁶ were identified on a tabby from Schwarza, Germany, dated to the Middle Bronze Age. A contemporary (c. 1,500–1,200 BC) textile was recently found in Hallstatt, with the same features (Fig. 67, HallTex 288). From the Iron Age onwards, starting borders in tablet weave are common, such as the one from the late Hallstatt period grave from Bescheid in Germany²¹⁷. The '*Prachtmäntel*', luxury cloaks of the Roman period especially are often characterised by very wide tablet woven borders²¹⁸.

Warping and weaving of the starting border are also known as pictorial representations, on the famous sheet bronze rattle from Bologna. As described by Elizabeth Wayland Barber²¹⁹, two women are shown working together, one operating the rigid heddle for the starting border, the other one guiding the threads (Fig. 147). A particularly striking find representing this particular step in the weaving process is the warp from Tegle²²⁰



Fig. 65. Tabby weave from Gachnang/Niederwil-Egelsee in Switzerland with starting border and repp selvages, Late Neolithic, c. 3,650 BC.

²¹⁵ Hasenfratz und Raemaekers 2006, 67, fig. 80.

²¹⁶ Schwarza: Farke 1993, 111. – Hallstatt: Grömer 2013, 72–74, fig. 25 and catalogue 312, HallTex 288.

²¹⁷ Banck-Burgess 1999, 66.

²¹⁸ Cf. Schlabow 1976: Cloak from Hunteburg (fig. 64–74), Damendorf (fig. 80–81), Thorsberg (fig. 109), Vehnemoor (fig. 126). Some with tablet woven selvages.

²¹⁹ Barber 1991, 116, fig. 3.32.

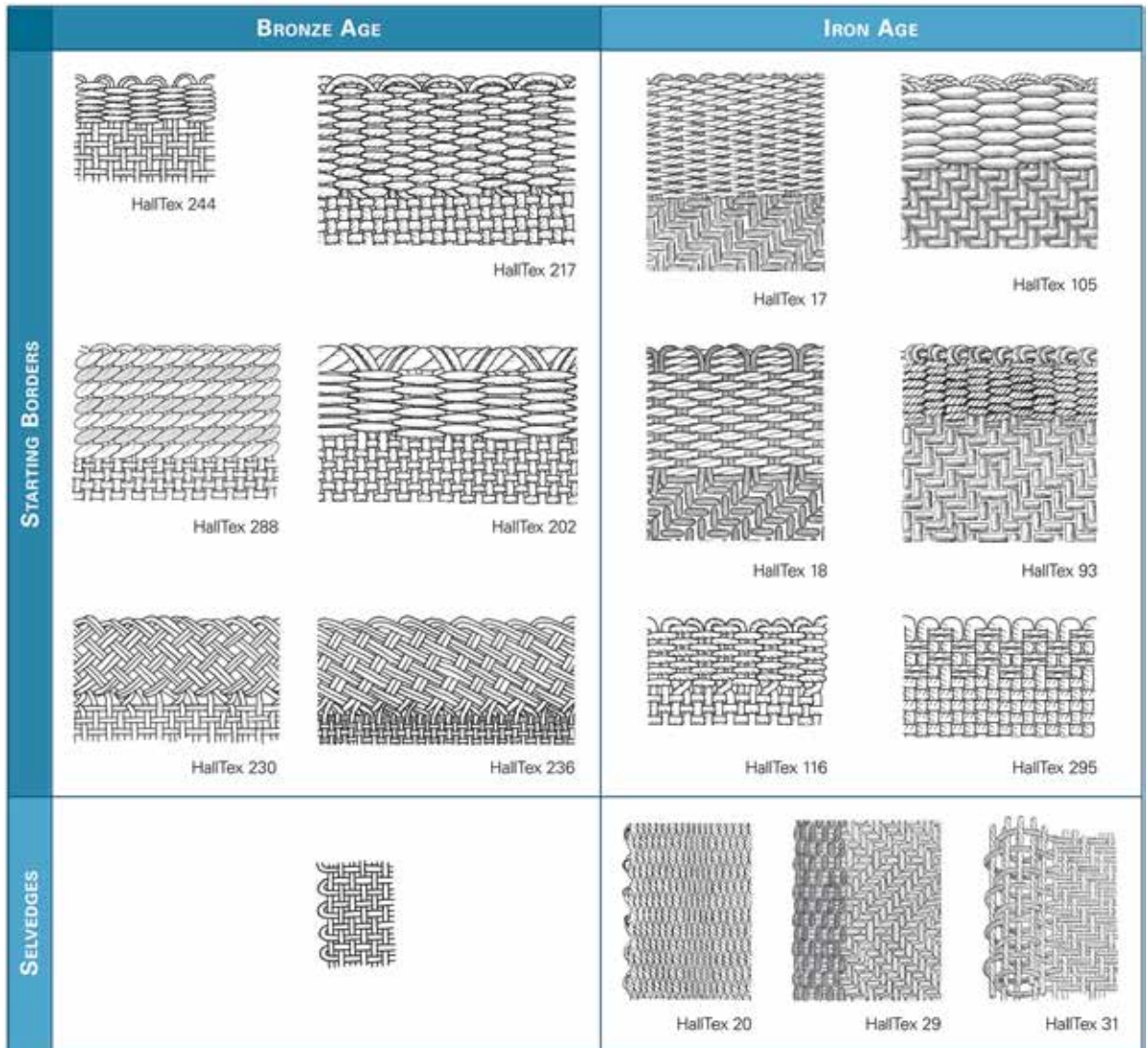
²²⁰ Halvorsen 2012, 284, fig. 13.8.



Fig. 66. Making a starting border and attaching the fabric to the loom. Created at the Open Air Museum Schwarzenbach, Austria in 2005.

in Norway, which was ready prepared for weaving with a tablet woven starting border, but deposited at this stage in a bog between the 3rd and 5th centuries AD.

The **practical use of a starting border** was demonstrated by the archaeologists Bianca Mattl, Helga Rösel-Mautendorfer and Silvia Schwärzler in an experiment during the Celtic Festival 2005 at the Open Air Museum at Schwarzenbach in Lower Austria (Fig. 66). First, the warp of the repp band is prepared, which has to be somewhat longer than the intended width of the fabric on the warp-weighted loom. These warp threads are mounted on



a band weaving device, for instance a rigid heddle. For the next step a warping device, a device for counting, measuring and arranging the warp threads before they are attached to the loom, may be used; alternatively, simple wooden pegs driven into the ground can be used. The band is now woven using the rigid heddle loom. The weft yarns of the repp band serve as future warp threads of the entire fabric: the threads are passed through the shed and then drawn out around the pegs to obtain the desired length. The repp band is then attached to the cloth beam of the warp-weighted loom. The hanging threads – ideally bundled half for the front and half for the rear position – are weighed

Fig. 67. Different starting borders and selvedges from the Bronze and Iron Age salt mines of Hallstatt, Austria.

in front and behind the dividing rod with loom weights. The rear row of threads is attached to the heddle rod and weaving in simple tabby weave can begin. The transition between the starting border and the weave itself is often handled with great care. This can be marked by a change in the density of the weft threads, supplementary threads or even in crossing threads under the starting edge in the nexus between the starting border and the main weave. This technique is especially suited for tabbies and quite common in Neolithic and Bronze Age textiles²²¹ (see Fig. 67, HallTex 217).

Selvedges

The simplest, most basic version of a selvedge²²² is produced simply by inserting the weft in the next shed, after that has been created – a simple return of the weft into the textile after looping around the last warp thread. Producing a well-proportioned fabric on a warp-weighted loom, however, needs skill! This particularly applies to the selvedges. Even with great care the selvedges tend to be irregular and loose. Therefore, the endeavour to produce the strongest possible selvedges, which is also beneficial when the textile is used, can be seen in the textile finds from early on.

Repp-like edges, obtained through a dense set of warp threads in this area, perhaps even weaving an extended border with paired warp threads taken up and paired threads left off every two picks are the earliest solutions to this problem and have been known since the Neolithic period, for instance at Gachnang, Switzerland²²³.

The textiles from the salt mines of Hallstatt again provide numerous examples of different selvedges (Fig. 67) that made the textiles perfectly straight, parallel, solid, and aesthetically pleasing. Complex selvedges in repp or twill weaves are also possi-

²²¹ Compare Grömer 2013, 74–75. – Médard 2012, 371, fig. 18.11. – Rast-Eicher 2005, fig. 13–16.

²²² Barber 1991, 116–118. – Wild 1970, 63–64.

²²³ Médard 2012, 371.

ble. One could critically comment that amongst the examples described as starting borders, some may in fact be more complex side edges, particularly those that show double threads merging into the main weave from the repp band without crossing threads.

The repertoire of the selvages includes the hollow selvedge from the Hallstatt period (Fig. 67, HallTex 31), as it is found on a twill piece from the salt mine in Hallstatt²²⁴. For hollow selvages, the weft thread is guided through the main textile and led back at the edge through an additional tablet woven band through eight warp threads of the edge. The result is a hollow selvedge that reinforces the fabric. This technique is known from the Nordic Late Bronze Age onwards (Montelius V, c. 900–740 BC)²²⁵.

Flat tablet woven bands may also serve as selvages, again evidenced by the *'Prachtmäntel'* of Northern Europe. The special weaving technique, in which the tablet weaving devices are mounted at the side of the heddle rods for the main fabric of the warp-weighted loom, has been thoroughly explained by Karl Schlabow²²⁶. On the other hand, it is also possible to weave tablet woven bands onto the sides of a textile once it is completed, using the cut and disentangled warp and/or weft threads of the main weave as weft for the tablet band. A very elaborate example of this was found at Verucchio in Italy.²²⁷ Another method, which was found on the Vehnemoor cloak, is to weave a tablet woven border to the edge of a fabric using the loops of the selvedge to interlink with the main weft thread of the tablet border.²²⁸ In Central Europe, tablet woven selvages are sometimes woven as side borders with the textile and at other times manufactured separately and sewn to the corresponding textile²²⁹.

²²⁴ Hundt 1960, pl. 20–21, fig. 3–5. – Grömer 2013, 77–78, fig. 25; HallTex 31, 34, 254.

²²⁵ Broholm and Hald 1940, 249, 314, fig. 37/2.

²²⁶ Schlabow 1952.

²²⁷ Ræder Knudsen 1998; 2012.

²²⁸ Möller-Wiering and Ræder Knudsen 2013, fig. 6.

²²⁹ E.g. band woven onto the main fabric from Hochdorf: Banck-Burgess 1999, 104. – Attached band from Hallstatt: Grömer 2005a and 2013, 69–72. – Overview in Grömer and Stöllner 2011.

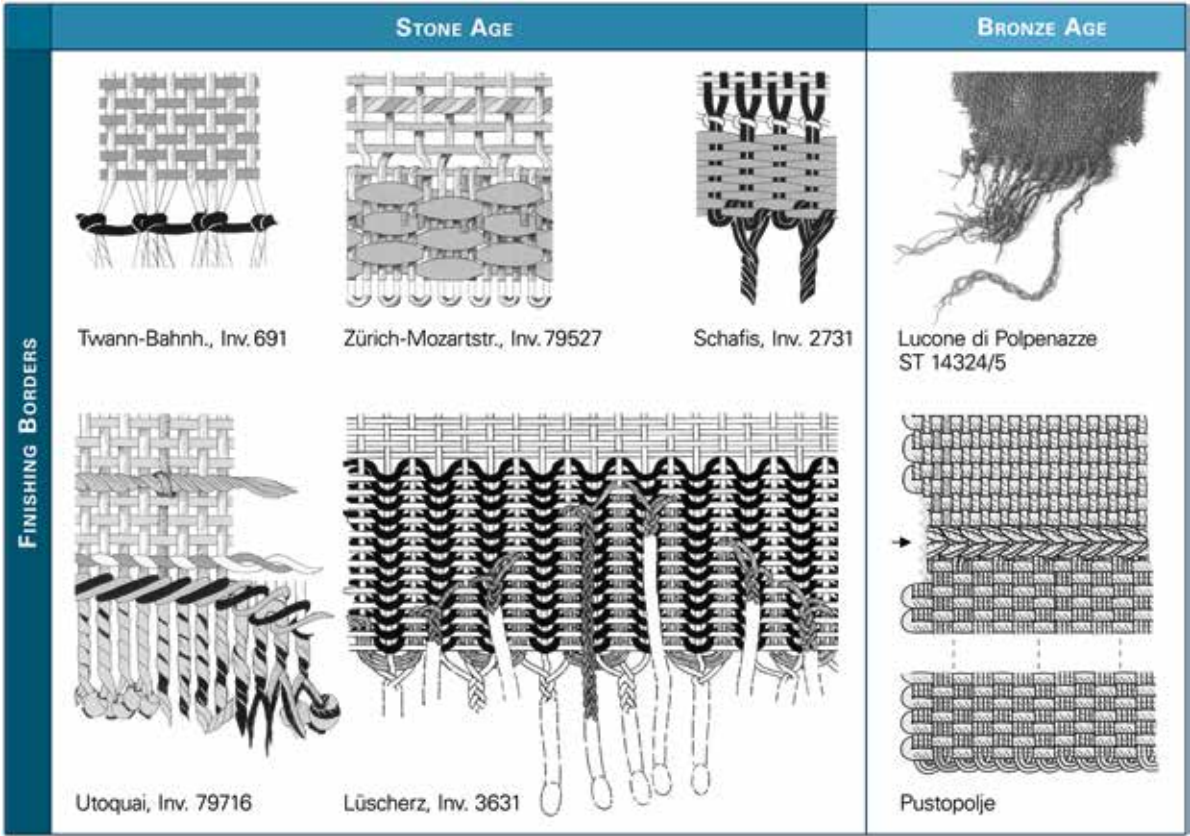


Fig. 68. Neolithic and Early Bronze Age finishing borders.

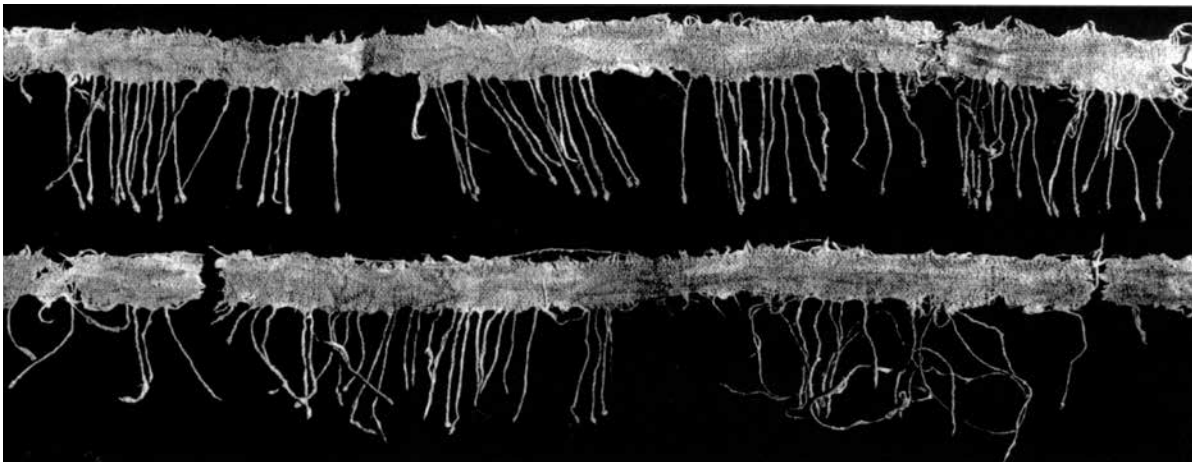
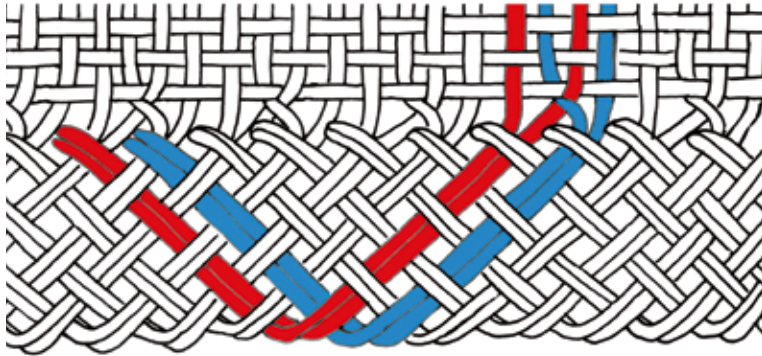


Fig. 69. Tabby woven fabric with plied fringes from Dürrenberg near Hallein, Austria, Late Iron Age.



Finishing borders and fringes

When the fabric is finished to the extent that it can be removed from the loom, it is advisable to fix the warp threads so that the fabric does not unravel at this point. This is particularly important if the cloth is used as such without further processing. Pre-historic people also had many different ideas of how to make the lower end of a textile more appealing: perhaps the finishing of a textile was made according to individual preferences and the skills of the weaver. The most obvious way of finishing textiles are fringes – braided or twisted and fixed by knots at regular intervals. Even Stone and Bronze Age fabric edges are carefully trimmed with fringes (Fig. 68), as the finds from famous Swiss and northern Italian sites like Zürich-Mozartstrasse, Lüscherz, Wetzikon-Robenhausen and Lucone di Polpenazze show²³⁰. The creative handling of the material allows for many design options: the fabrics from Robenhausen had the fringes wrapped with threads and knotted or designed by plying the warp threads or by braiding. Fringes are also known as Iron Age design elements²³¹, for instance from Dürrnberg (Fig. 69). Above all, the *'Prachtmäntel'* of the Nordic Iron Age are often adorned with fringes, particularly the cloaks of Thorsberg.

Garments with fringes also appear in pictorial representations. The warriors with spear and shield on the second frieze of the Situla Arnoaldi from Bologna, for example, wear outer garments

Fig. 70. Bronze Age textile with braided border from Hallstatt in Austria.

²³⁰ Generally: Médard 2010; 2012, 373–376. – Zürich: Rast-Eicher 1997, 319. – Robenhausen: Vogt 1937, fig. 87–89, 90–91, 100. – Lucone di Polpenazze: Bazzanella *et al.* 2003, 192.

²³¹ Dürrnberg/Ferro-Schachtricht, Nr. 1357: Stöllner 2002, pl. 309/1357. – Thorsberg: Schlabow 1976, fig. 123.

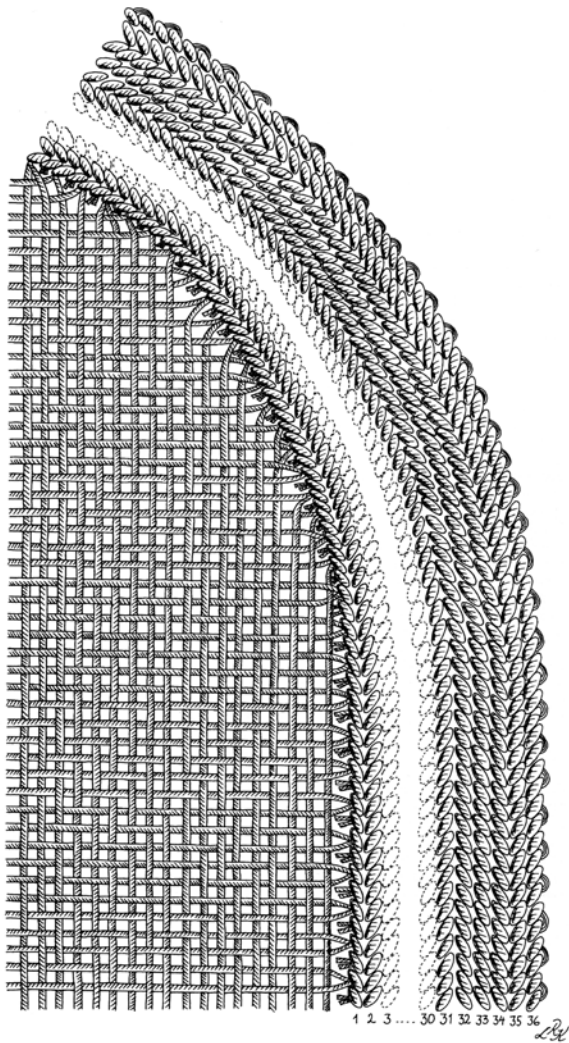


Fig. 71. Verucchio, Italy: finishing a textile with a woven-on tablet border, Early Iron Age.

In Pustopolje, Bosnia and Herzegovina²³⁶, a technically complete textile (now torn into many fragments) dating between 1495 and 1,435 calBC was found in a grave. It is a wool tabby with a repp starting border, a main weave with simple selvages and an elaborated, 9 cm wide finishing border. It begins with two

with fringes, also the belt plate of Vače indicates garments with fringes²³².

Another design possibility for the finishing of the weave is to make a braided border. The technique of braided borders is familiar in Central Europe from the Bronze Age finds of Hallstatt²³³. On a coarser fabric with thread diameter of 1.5 to 2.5 mm, a braided band was generated by taking the threads in pairs and braiding them diagonally (Fig. 70). Since the threads cross each other at the transition from the primary textile to the braiding, it could also be a braided starting border. Braided borders are very popular in the Nordic Bronze Age²³⁴. They are often used as finishing edges in textiles that have been made on the two-beam vertical loom.

The skilful prehistoric artisans also managed to finish the warp ends with bands and tablet weaves – again, the Late Neolithic finds from Switzerland, Zürich or Wetzikon-Robenhausen²³⁵, can be mentioned as examples for band weaving techniques, the Nordic ‘Prachtmäntel’ for examples of tablet weaves.

²³² Lucke and Frey 1962, pl. 14.

²³³ Grömer 2013, 76–77, fig. 27.

²³⁴ Geijer and Ljungh 1937, 273–275, fig. 6. – Sundström 2010, 233–234.

²³⁵ Rast-Eicher 1997, fig. 312.

²³⁶ Bender Jørgensen and Grömer 2012, fig. 4. – Car 2012.

opposed rows of twining made with paired yarns, concluding the main weave, followed by a wide repp 4/1 border (Fig. 68). The twining divides the end of the s-twisted warp threads of the main web into pairs that become the weft of the finishing border in two steps. Each pair of those threads was inserted into a shed of the finishing border, turned back into the next shed along with a fresh pair of warp ends and cut just below the twining.

Even complicated techniques such as tablet weaves woven onto curved cut selvages are known from the Iron Age. The reconstruction of the cloak of Verucchio²³⁷ in Italy dating to the 8th or 7th century BC has demonstrated this impressively. The ends of the fabric cut in a semi-circle are frayed deliberately and the exposed fabric yarns are used as weft yarns for the tablet weave (Fig. 71). The tablet woven band is woven onto the textile in a rounded shape and serves as a finishing border. The skill of the craftspeople managing such a technique is of the highest quality.

Warp-weighted loom with a single shaft for tabby and tabby variants

The basic process of weaving on a warp-weighted loom has already been discussed. Human ingenuity, however, developed further technical refinements, namely looms with a single and looms with multiple shafts. In the Neolithic and Bronze Age, weaving was normally done with one heddle rod and a dividing rod. With this simple set-up, whereby each second thread is attached to the heddle rod, the shed is made by raising and lowering the heddle rod, and weaving is performed in a rhythmic sequence of passing the weft through the shed. A simple tabby weave emerges (Fig. 72.1–2), in which the density of the warp and weft threads is relatively balanced in this set-up.

In addition, the character and the properties of a textile can be influenced by certain decisions the weaver takes. If the thread position of one thread system of a weave is significantly denser than the other, a ribbed tabby, weft- or warp-faced, or a repp emerges. In the latter case, one thread system is at least twice as

²³⁷ Von Eles 2002. fig. 94 and 104. – Ræder Knudsen 2012, fig. 11.3.



Fig. 72. Textiles from Hallstatt in Austria, Early Iron Age: examples of tabby weave (1–2) and variants repp (3–4), basket weave 2/1 (5) and basket weave 2/2 (6). Different scales.

dense as the other, rendering the latter invisible (Fig. 72.3–4). Such a fabric is stiff, thick and not very flexible. By alteration of the thread count, also different effects can be achieved. A weave can be open by using few thin threads per centimetre or condensed by packing the threads closer together. This is described in textile terms with thread count (threads per cm) and cover factor²³⁸. Both are technical features of the weaving procedure, chosen with the purpose of the finished product in mind. Open weaves are gauze- or net-like, transparent, soft and very elastic. Very dense weaves, on the other hand, are more tear-resistant, resilient, stiff and not very flexible, but they have good thermal properties.

In this simple set-up with a single shaft loom, more creativity is possible by doubling the number of threads (Fig. 72.5–6). When double threads are used as warp or weft and single threads in the other thread system, it results in basket weave 2/1. If double

²³⁸ Andersson Strand 2010b, 15–19, fig. 2.5. – Grömer 2013, 62–65, fig. 21. – Hammarlund 2004.

threads are used for both the warp and the weft, a basket weave 2/2 is obtained. The weaving process itself remains the same as for tabby.

The earliest tabby textiles are known from Jarmo in northern Iraq and Çatalhöyük in Anatolia²³⁹ and date to *c.* 7,000–6,000 BC. This is an indication that the cultural achievement of weaving has its origins in the Fertile Crescent. From there, this art of weaving spread to the south and north, reaching Central Europe in the Neolithic.

Fabrics in tabby weave are known in Central Europe²⁴⁰ from the beginning of the Neolithic. Scattered across the large distribution area of the first Central European farmers' culture, the Linear Pottery Culture around 5,500–4,900 BC, small-scale traces of tabby weave fabrics are occasionally found as imprints on potsherds and pieces of clay. Examples include the finds from Luleč in Moravia or Hessenrode in Germany. We just do not know whether the textiles were already made on a warp-weighted loom or were the product of a band weaving loom. Many examples of tabby fabrics come from the Late Neolithic circum-alpine lake dwellings. In most cases, they are also small fragments of textiles, such as a densely woven flax fabric from Zürich Mozartstrasse (Cortailod Culture, *c.* 3,900 BC). From the Neolithic to the Middle Bronze Age, tabby weaves occur almost exclusively, although a few ribbed variants like the textile from Franzhausen in Lower Austria (Fig. 98) or Straubing-Ortler, both Early Bronze Age, have been discovered. In the Hallstatt period, twill weaves that are more complex are preferred over the tabby weaves. In the Late Iron Age, however, tabby again becomes popular, especially in the middle and late La Tène period²⁴¹. In 2008 Antoinette Rast-Eicher has provided a good review of this trajectory based on the Swiss textile finds. The transition back to tabby weave occurred slightly early in Austria, evidenced by the early La Tène finds from Dürrnberg near Hallein, where more

²³⁹ Cf. Barber 1991, 126–128. – Özdöl Kufllu 2014.

²⁴⁰ Hessenrode: Lüning 2005, 52. Suggests flax as fibre plant. – Luleč: Kostelnikova 1985, fig. 1. – Zürich: Rast-Eicher 1997, 322. – Franzhausen and Hallstatt: Grömer 2006b. – Straubing: Möller-Wiering 2012, 129. – Dürrnberg: von Kurzynski 1996, 34. – Stöllner 2005, fig. 6.

²⁴¹ Cf. Belanová-Štolcová 2012, 314–317. – Grömer 2012, 44–47, pl. 1.1. – Rast-Eicher 2008; 2012, pl. 19.5.

than two-thirds of the fabrics are made in tabby weave. Tabbies are also predominant in the Central European provinces Germania, Raetia, Noricum and Pannonia of the Roman Empire²⁴².

Basket weave as one of the variants of tabby is known in the Mediterranean very early on, as Neolithic and Early Bronze Age finds from Turkey or Spain²⁴³ demonstrate. The earliest evidence of basket weave in Central Europe²⁴⁴ comes from Vösendorf, Austria, where a textile fragment was found in a Late Bronze Age cremation grave. Other basket weave textiles were recovered in the early Hallstatt period cemetery Uttendorf in Pinzgau and in Hallstatt.

Warp-weighted loom with multiple shafts for twill variants

Twill as a decorative structure in basketry techniques was already known from Neolithic finds. Imprints on the bottom of a vessel of the late Lengyel Culture (mid-5th millennium BC) from

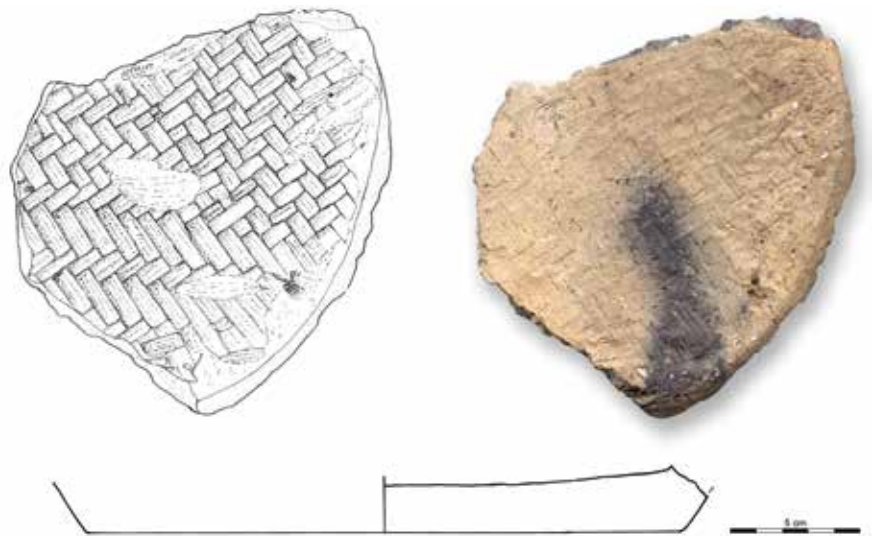


Fig. 73. Imprint of a mat at the base of a ceramic pot from Michelstetten in Austria, mid-5th millennium BC.

²⁴² Cf. Gostenčnik 2012, 82–84. – Grömer 2014, 33–35, fig. 17. – Möller-Wiering and Subbert 2012, 171–174.

²⁴³ Turkey: Çatalhöyük, Neolithic. Barber 1991, 127–128. – Spain: Mazarrón (Murcia), Bronze Age. Alfaro 2012, fig. 16.7.

²⁴⁴ Vösendorf: Grömer 2006b. – Talaa 1991. – Uttendorf: von Kurzynski 1996, 26, no. 84a and c. – Moosleitner 1992, fig. 23. – Hallstatt: Grömer 2013, 60–62.

the settlements of Michelstetten in Lower Austria (Fig. 73) and Hódmezővásárhely-Kökénydomb and Tiszaföldvár-Téglagyár, Hungary²⁴⁵, for example, evidence complex mats of rushes or grasses. The structure of the Michelstetten imprint is a 2/2 and 2/4 twill with diagonal ridges. Such a structure can be relatively easily achieved when braiding by hand, but how can this structure be achieved on a loom in a mechanised way? This requires a sophisticated lifting and lowering mechanism for the warp threads, allowing multiple shafts (or heddle rods) to be used on a warp-weighted loom.

For more complex weaves, the warp-weighted loom had to be expanded with multiple shafts (heddle rods), which constituted one of the largest changes in weaving technology before the invention of the foot-treadle loom during the Middle Ages. Not only the loom itself, but also its handling changed with more complex binding methods, both in the preparatory work as well as in weaving.

Whereas tabby requires every second thread to be attached to a heddle rod, three heddle rods have to be used for the simplest twill variant – the 2/1 twill. The first, second and third thread are each attached to the first, second and third heddle rod respectively. By raising and lowering of the various rods in a certain sequence, the sheds are formed through which the weft yarn can be passed to weave the textile.

For other types of twill four heddle rods are usually used. Ethnographic observations, for instance from Iceland, show that a 2/2 twill can also be produced by using three heddle rods and one dividing rod²⁴⁶.

The more complex the weave, *e.g.* herring-bone or diamond twill, the more complicated is the sequence of lifting and lowering the individual heddle rods as well as the assignment of individual threads to a heddle rod (demonstrated here on the warp-weighted loom with four heddle rods, Fig. 74). With 2/2 twill the warp threads are drawn in a uniform sequence on the

²⁴⁵ Michelstetten: Grömer 2006a. – Hungarian finds: Richter 2010, fig. 34.2–34.3.

²⁴⁶ Cf. Broholm and Hald 1940, 305. – Hoffmann 1964, fig. 91. – Stærmosse Nielsen 1999.

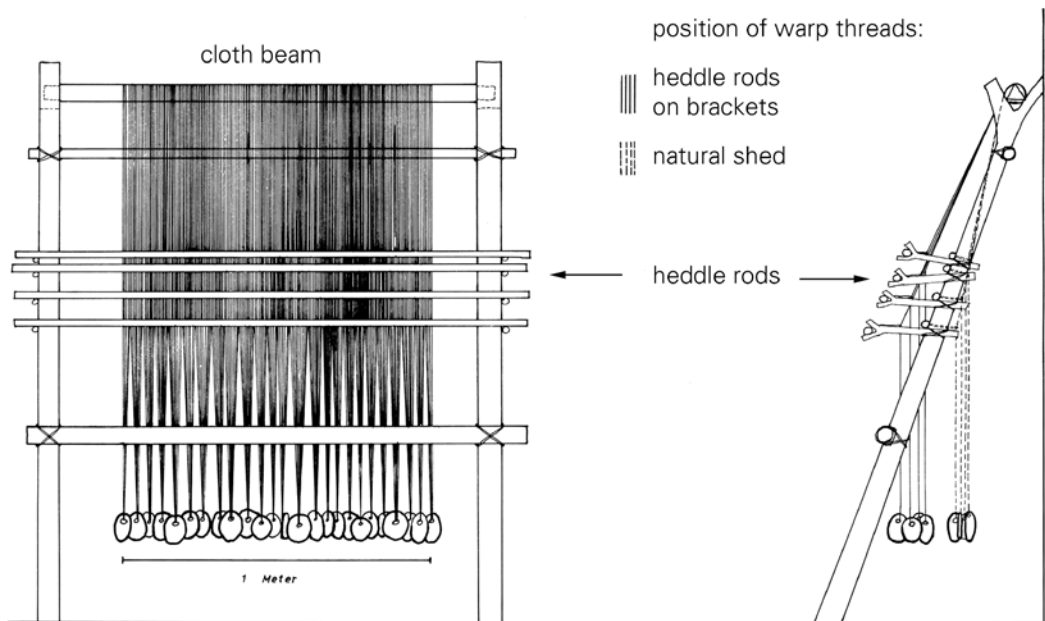


Fig. 74. Reconstruction of a multiple shaft warp-weighted loom.

heddle rods, whereas for (longitudinal) herring-bone twill or horizontal broken twill the sequence of the thread-up varies, so that the direction of the ridge results in dislocations or symmetrical peaks from Z to S-slant and vice versa.

Vertical broken twill can, however, also be woven with the same thread-up as simple twill weave by raising the shafts in a different sequence than for the 2/2 twill. After a certain number of weft threads the inclined lines of the 2/2 twill can be woven in reverse, which forms the point of the chevron.

In assessing this loom development, **experimental archaeology** provides helpful insights. Interestingly, even archaeological findings offer indirect evidence for the weaving of twill – provided there excellent preservation and documentation conditions are present. Ingrid Schierer based her experiments on the Late Bronze Age loom from Gars-Thunau in Lower Austria²⁴⁷ (Fig. 75). Three rows of loom weights were found there parallel to the wall of a house. The organic parts had decayed, and after thousands of years, the rows of loom weights were recovered by archaeologists. To understand, what type of weave was

²⁴⁷ Schierer 1987, 44.

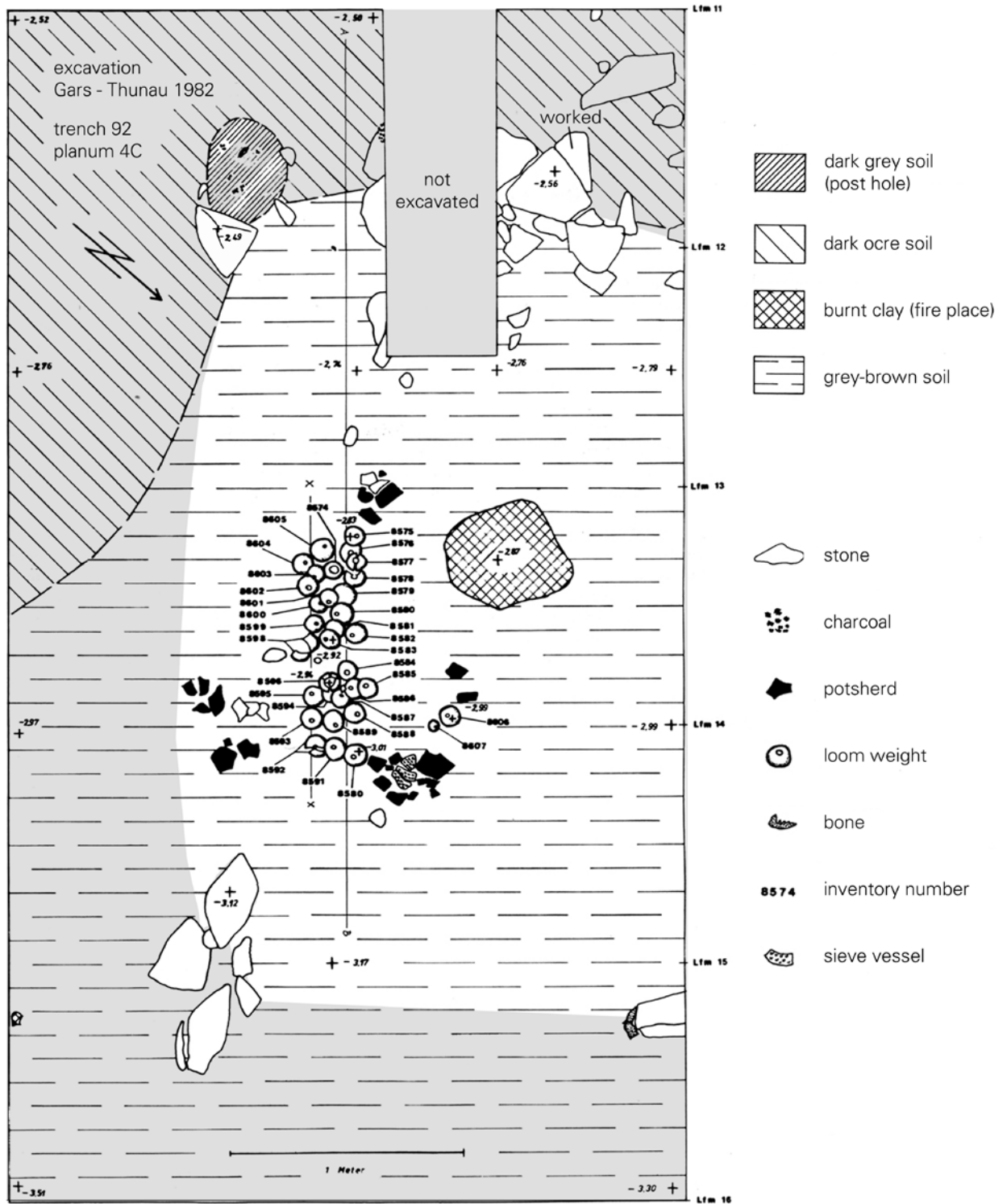


Fig. 75. Loom at the Late Bronze Age settlement of Gars-Thunau, Austria. Rows of loom weights in situ, area of hut highlighted.

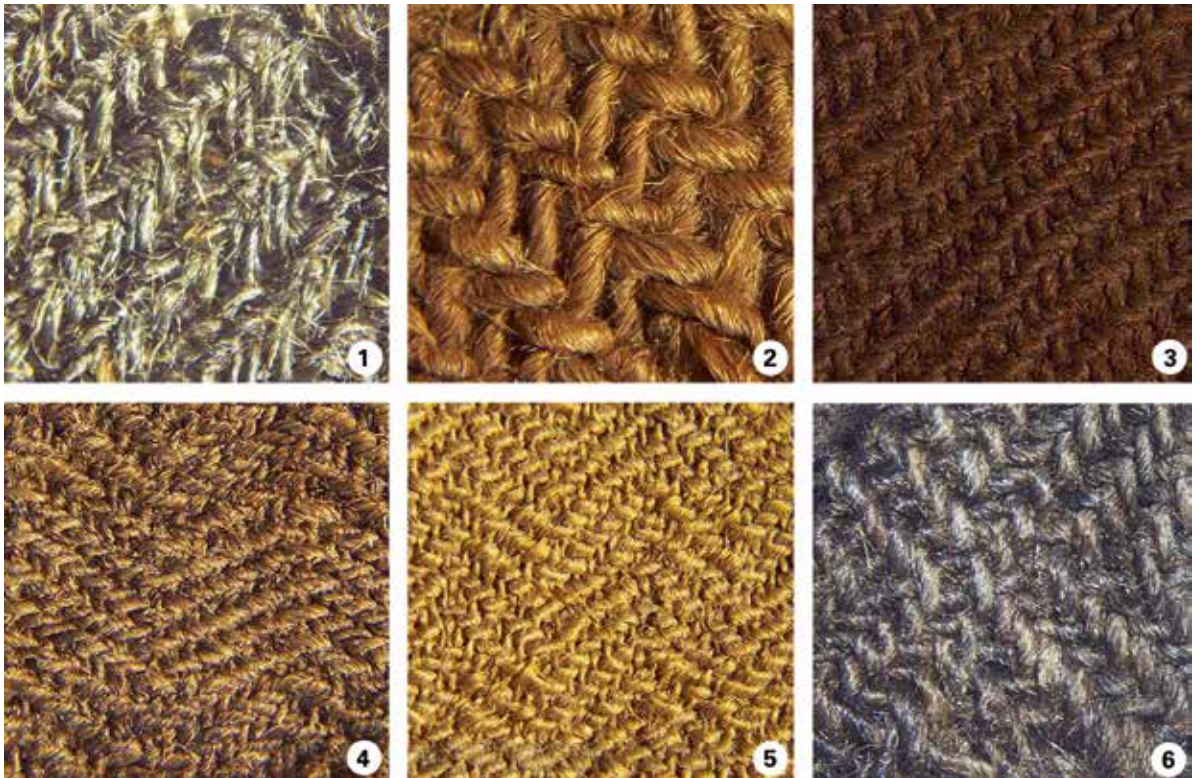
produced on this loom, experiments were carried out. Schierer repeatedly mounted a loom with various bindings (tabby and twill) and different positions of the shafts. She then destroyed the loom by cutting the threads, knocking it over or burning it to simulate the circumstances the prehistoric loom might have been subjected to before it was covered by soil. The exact position of the loom weights were recorded and evaluated meticulously in every experiment. The type of weave and the required sheds have the most significant influence on the pattern of loom weights in the ground. Tabby weaves with one natural shed result in two distinct sets of weights found in rows, whereas twill with additional sheds results in more closely spaced loom weights. Several rows of weights or a large heap of weights are typical arrangements for twill. The specific way in which the loom weight rows from Gars-Thunau were found suggests with high probability that a twill fabric was woven on the loom immediately before it was destroyed.

Experimental archaeology also helps to reveal how much time the manufacture of woven fabrics took. The weaving team of the Düppel Museum near Berlin²⁴⁸, with decades of experience, managed to produce a 3 by 2 m large twill cloth on a warp-weighted loom in 529 hours of work. The spinning of the warp and weft threads with a hand spindle alone amounted to 332 hours.

Taking a look at the **pictorial representations** of textile equipment from prehistory, it should be noted that even the earliest representations of looms from Val Camonica (Grande Roccia/Naquane) often show looms with multiple shafts²⁴⁹ (Fig. 58). No matter whether the date of the rock art is Bronze Age or Early Iron Age, it coincides with the finds of twill from both the Middle Bronze Age or Iron Age parts of the Hallstatt salt mines. Two heddle rods are also recognisable on the Early Iron Age conical necked vessel from Sopron (Fig. 147). The hatching depicted on the woven part of the textile may represent the structure of a 2/2 twill.

²⁴⁸ Pfarr 2005.

²⁴⁹ Schuhmacher 1983. – Zimmermann 1988, fig. 2–5.



The development of twill is regarded as one of the major turning points in textile history. As pointed out before, twill weaving requires a loom with a more complex set-up including multiple sheds, marking the appearance of a more complex technology.

Fig. 76. Textiles from Hallstatt, Early Iron Age: Examples of twill variants: 2/2 twill (1-3), broken twill (4-5), diamond twill (6). Different scales.

What archaeological evidence from **original textiles** can further underline these ideas? Twill weave appears in Central Europe around the Middle Bronze Age, with the earliest finds from Hallstatt (c. 1,500–1,200 BC)²⁵⁰. From Bronze Age Hallstatt we know of two fragments of 2/1 twill fabrics of flax as well as two fragments of complex wool twill with point repeat. The latter is most remarkable, as particularly fine threads with a thread diameter of 0.3 mm were processed in pairs; in addition, the fabric was coloured blue with dyer's woad.

A pattern in twill structure already appears on a small section of a tabby woven belt from Lago di Ledro (Fig. 48) dating to

²⁵⁰ Grömer and Rösel-Mautendorfer 2013, Bronze Age catalogue, HallTex 26, 27, 211, 275.



Fig. 77. Textile from Hallstatt, Early Iron Age: transition from basket weave to twill.

the Early Bronze Age. This is, however, merely a decoration on a tabby woven band and does not prove the use of a loom with multiple shafts. Another well-known early trace of twill is the imprint on a ceramic sherd from Malanser in Liechtenstein dating to the 14th century BC²⁵¹ and the late Bronze Age finds from Gevelinghausen in Germany.

By the end of the Urnfield Culture and the beginning of the Iron Age in the 9th and 8th centuries BC, twill is the most popular type of weave in Central Europe²⁵²: this is what Lise Bender Jørgensen²⁵³ has termed the ‘twill horizon’.

²⁵¹ Bazzanella *et al.* 2003, Lago di Ledro: 161. – Malanser: 273. – Gevelinghausen: Hundt 1974.

²⁵² Banck-Burgess 1999. – Bender Jørgensen 1992; 2005. – Gleba 2012, 228–229. – Möller-Wiering 2012, 130–131. – Rast-Eicher 2008, 2012.

²⁵³ Bender Jørgensen 1992, 120.

Complex binding variants (Fig. 76) of varying degrees of difficulty such as twill with point repeat, herring-bone twill or diamond twill bear witness to the creativity of Hallstatt period craft-people. These fabrics are usually made of wool. Twill is characterised by an attractive pattern, but also improves the thermal efficiency of the weave compared to tabby, because the yarns float over the surface of the fabric and thus sometimes several layers of threads come to lie on top of each other. In addition, twill fabric is more supple and can be stretched diagonally to the thread direction. It is therefore relatively elastic. The advantages of this binding come to best effect with sheep's wool.

To illustrate the wealth of material, a few examples of early Iron Age twill variants from the salt mines of Hallstatt²⁵⁴ will be singled out here (Fig. 76). Twill variants from Hallstatt testify to the highest level of textile craft and are usually characterised by fine threads and high textile densities.

A particular example of the skill of weavers is known from this site²⁵⁵: they even had the knowledge how to switch during the weaving process from basket weave to 2/2 twill (Fig. 77). A larger reddish brown textile and a wide band show this procedure. The following method is conceivable: The warp is mounted with four heddle rods (denoted by the numbers 1-4). Basket weave can be woven by raising rods 1 and 2 together, passing two weft threads through the shaft. Rod 3 and 4 are then lifted together and a further pair of weft yarns is passed through the shaft. For the 2/2 twill the heddle rods have to be lifted in the following order: 1+2, 2+3, 3+4 and 4+1.

Twill becomes increasingly less popular in Central Europe during the La Tène period, as can be observed from the numerous Iron Age textiles²⁵⁶. Amongst the textiles from the early La Tène salt mines at Dürrnberg²⁵⁷ 2/2 twill and sometimes 2/1 twill may be encountered in low numbers; creative variants like twill with point repeat or even diamond twill no longer appear. Tabby

²⁵⁴ Grömer 2013, 60–61, fig. 19; see also Iron Age catalogue.

²⁵⁵ Grömer and Rösler-Mautendorfer 2013, Iron Age catalogue, HallTex 64, 263.

²⁵⁶ Rast-Eicher 2012, pl. 19.5.

²⁵⁷ Stöllner 2005, fig. 6.

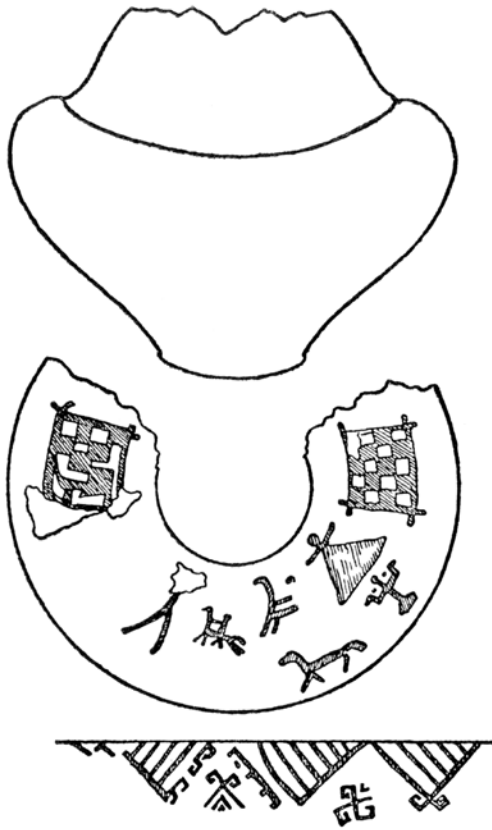


Fig. 78. Conical necked vessel from Rabensburg in Austria with graphite painting of persons with a loom, Early Iron Age.

weave clearly dominates in the middle and late La Tène period of Switzerland²⁵⁸. This continues in the Roman period in the Central European provinces where twills more or less disappear²⁵⁹. On the other hand, twill weaves are still popular in Northern Europe around the beginning of the Common Era²⁶⁰, generally recognised as an indicator that the textile technology of the Early Iron Age is shifting from Central Europe to the north.

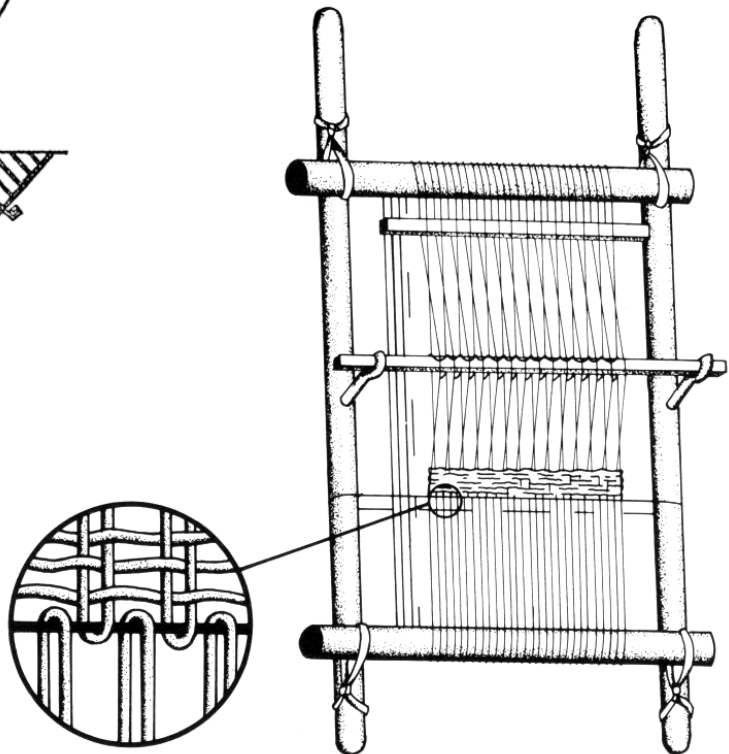


Fig. 79. Schematic two-beam vertical loom with tubular warp.

²⁵⁸ Rast-Eicher 2008, 170–171.

²⁵⁹ Gostenčnik 2012, 82–84, fig. 2.12–2.13. – Grömer 2014, 33–35, fig. 17.

²⁶⁰ Cf. Mannering *et al.* 2012, 110–114. – Möller-Wiering 2012, 132–133. – Möller-Wiering and Subbert 2012, 157–163 (*Germania Libera*).

4.5 Other types of looms

One depiction of a loom from Central Europe may point to a different type of loom than the warp-weighted loom. A painting on a conical necked vessel from Rabensburg in Lower Austria²⁶¹ (Fig. 78), dating to the Hallstatt period, shows a woman and a square frame, which might be a weaving frame or a two-beam loom with chequered cloth, and perhaps a warping stand. There is no archaeological evidence for the existence of such a weaving device, since it does not have loom weights – they are replaced by another horizontal beam linking the uprights.

Two-beam vertical looms, in which the warp is prepared in the round, are frequently evidenced by Danish bog finds²⁶². A fabric woven on the two-beam vertical loom can be identified by the tubular warp, whereby the warp threads end in loops at each end of the textile. A particularly impressive example of a garment woven on such a device is the round-woven tube dress from Huldremose²⁶³. Since complete or nearly complete garments are absent in Central Europe, tubular textiles have so far not been identified in the archaeological material. Some researchers argue²⁶⁴ that braided starting- and finishing borders are characteristics of textiles made on the two-beam (tubular) vertical loom (Fig. 79). Could this mean that the Bronze Age fabrics with braided edges from Hallstatt were made on such a loom?²⁶⁵

Two-beam looms are well known, at least in the Mediterranean world, for instance from Egypt. Such devices can be mounted vertically or horizontally and are found as beauti-

²⁶¹ Franz 1927, 97, fig. 1. – This image might also be interpreted in a different way; maybe it was a net for fishing or hunting – comparable to images on the situla art, as pointed out by Katharina Rebay-Salisbury, pers. comm. June 2014.

²⁶² In a study Karen-Hanne Stærmosen-Nielsen could clearly identify 22 textiles of the Nordic Early Bronze Age (c. 1,400–1,100 BC) from Denmark, which were clearly woven on a two-beam vertical loom, including cloaks, tops, blouses, skirts and footwear. Stærmosen-Nielsen 1999, 124–125.

²⁶³ Hald 1980. – Mannering *et al.* 2012, fig. 3.11.

²⁶⁴ Stærmosen-Nielsen 1999, 124–125.

²⁶⁵ Cf. Grömer 2013, 76–78.

fully designed miniature models, which were used as grave goods, as well as shown in art²⁶⁶. Written sources indicate that two-beam looms were also common amongst the Romans. Seneca mentioned in the 1st century AD that textiles were no longer made on warp-weighted looms in his time (Sen., *Ep.* 90.19–20).



Fig. 80. Dyer's woad (*Isatis tinctoria*) is one of the oldest cultivated dye plants. The leaves contain precursors of the blue pigment indigotin. From former cultivation the plant has escaped into the wild as a so-called feral plant, and now occurs in the natural vegetation e.g. in the Wachau, Lower Austria. Harvest takes place in the first year by cutting the woad leaf rosettes. The flowers and fruits develop in the second year.

5 Dyeing

(Regina Hofmann-de Keijzer)

To decorate the living space, objects and clothes with colour seems to be a basic human need. The colourants were found in minerals, plants and animals. Water-insoluble mineral pigments were applied as paint to stone, wood, leather, textiles and skin. The dyeing of textiles, in contrast, was performed in liquid dye baths. To create durable textile dyeings prehistoric people had to solve two problems: first, stable colourants had to be found in plant and animal materials, then dyeing techniques had to be developed that enabled them to fix soluble dyes permanently to the fibres or to dye them with insoluble organic pigments. Organic dyes could be obtained relatively simply from certain plants, lichen and insects. Special skills were in demand for the production of organic pigments, such as indigotin from woad and Tyrian purple from sea snails. Preserving colourants for later use or transport required drying of the dyestuffs.

²⁶⁶ Cf. Barber 1991, horizontal ground loom: fig. 3.2–3.6. Vertical two-beam loom: 113–115, fig. 3.29, 3.30.



5.1 Prehistoric people discover colourants and dyeing processes

Analytical results of dyes reveal that the oldest finds of coloured textiles originate from a time in which dyeing was already well developed. Let us travel back into prehistory to understand how the colour palette for textile dyeing could have been discovered.

Prehistoric people perceived numerous colours in their vicinity, which they wanted to transfer to their clothing. The yellow, blue, red and violet should be as radiant as certain flowers and fruits, the green like the leaves of the trees. Unfortunately, this could not be achieved with the colourants present in flowers or fruits, the anthocyanins, nor could the chlorophyll that makes leaves green be used to dye textiles durably and beautifully. It was easy to find out, however, that the bark of trees, certain herbs and galls²⁶⁷, which have already been used for tanning leather, could create stable shades of brown – from reddish brown to yellow brown – on textiles. Tannins are amongst those chemical compounds which bond to the textile fibres without any additives. This dyeing technique, direct dyeing, could be applied for creating brown colours. In addition to the tannins only a few

Fig. 81. Experimental vat dyeing in the laboratory of the University of Applied Arts Vienna, Department of Archaeometry: The vat was made with natural indigo and the reducing agent sodium dithionite. Wool fleece, wool yarn and wool fabric are submerged in the greenish yellow liquid. After lifting the textile material into the air, reaction with oxygen causes a colour change from yellowish green via green to blue.

²⁶⁷ Galls are irregular plant growths which are stimulated by the reaction between plant hormones and powerful growth regulating chemicals produced by some insects or mites. They often contain tannins.

other dyes can be used for direct dyeing, such as the red dye orcein from orchil which has to be prepared from certain lichens, the brown dye juglone from the green parts of walnut trees (*Juglans regia*, Juglandaceae) and the yellow dye crocetin from the stigmata of saffron (*Crocus sativus*, Iridaceae).

Dyeing blue was only possible in Europe after people brought woad (dyer's woad, *Isatis tinctoria*, Brassicaceae, Fig. 80) from the East and developed a special dyeing technique, the so-called vat dyeing. First, they had to discover that the blue pigment indigotin could be obtained from precursors occurring in green woad leaves²⁶⁸. The water-insoluble organic pigment indigotin was suitable for painting on textiles, but not for dyeing until prehistoric people succeeded in transforming woad blue into a greenish-yellow liquid (vat) by adding water and urine or potash and allowing the mixture to ferment. In this way they had prepared a vat in which fleece, yarn or fabric could be submerged. People must have been amazed when they removed the textile material from the vat for the first time. When exposed to the air, the colour changed from greenish-yellow to green and finally to blue (Fig. 81).

It was probably easy to figure out that textiles can be dyed yellow with almost all yellow flowers and green parts of plants. This is due to the yellow flavonoids, which occur in nearly all plants. Red colours, however, could only be achieved with some dyeing materials. The most colourfast red dyes in nature, the anthraquinones, can be found in the rhizomes of the Rubiaceae (madder, or bedstraw family) and in some female scale insects. These soluble yellow and red dyes cause initially neither deep nor durable dyeings. They are so-called mordant dyes and need to be fixed on the fibres by means of mordants such as tannins and metal salts of aluminium, iron and copper. For preparing a mordant bath, tannins or metal salts had to be dissolved in water to treat the textiles before or after the dyeing process. The mordants could also be put directly into the dye bath. Also fermentation processes cause brighter and more stable colours²⁶⁹. Due to their chemical properties, animal fibres could be dyed

²⁶⁸ Hartl 2012, 35. – Hartl *et al.* 2015a.

²⁶⁹ Vajanto 2014; 2016.



in bright yellows and reds whereas plant fibres received less intense shades. Mordants could have been used to influence the hue. Aluminium containing mordants (gained from clubmoss, alunite or alum shale) do not change the colour of the dye while mordants containing copper or iron (metal, metal alloys, metal salts, or iron containing mud from fens) and tannins (*e.g.* from barks or galls) cause a darkening of the colours. Yellow dyes yield olive-green shades with the addition of copper mordants, and olive-green to brownish shades with iron mordants. The discovery of mordant dyeing added an additional colour to the palette – black. Iron mordants mixed together with tannins result in iron gall black.

The combination of different dyeing materials and dyeing techniques was necessary to obtain even more shades of colour. Shades of green different to olive green – known from leaves and grasses were only achieved through a combination of vat dyeing for blue with woad and mordant dyeing with yellow dyes. Durable violets, similar to the juice of blackberries or blueberries,

Fig. 82. Investigation of samples from Hallstatt textiles by transmitted-light microscopy.

could have been obtained by vat dyeing for blue with woad and dyeing with red mordant dyes.

5.2 Scientific investigations of textile dyes

The materials and techniques used in historic textile dyeing are extensively studied, but this is not the case for prehistoric textiles. However, research on prehistoric textile finds from Austria, Bosnia-Herzegovina, Denmark, France, Germany, Italy, Luxembourg, Norway and Sweden has been performed (Fig. 84)²⁷⁰. In order to study prehistoric dyeing techniques, coloured fabrics, yarns and fibres are examined by chromatographic techniques. High-performance liquid chromatography with photo diode array detection (HPLC-PDA) requires a thread sample of at least 0.5 cm length, ultrahigh-performance liquid chromatography with photo diode array detection (UHPLC-PDA) requires a smaller sample size with a thread length of about 0.2 cm²⁷¹.

The textile samples are examined by reflected-light microscopy prior to sampling and prior to dye analysis, additionally the fibres are investigated by transmitted-light microscopy (Fig. 82). The aim is to choose the optimal fragment for analysis and to observe whether the weave, yarns and fibres are dyed regularly or irregularly.

The chemical elements present in fibres and contaminations are analysed by scanning electron microscopy with energy-dispersive X-ray analysis (SEM-EDX)²⁷². In this analysis, the focus is on the elements aluminium, iron and copper, which could originate from mordants. Studying the mordants of archaeological textiles is rather difficult, since these elements can additionally

²⁷⁰ Balzer, Peek and Vanden Berghe 2014. – Banck-Burgess 1999. – Bender Jørgensen and Walton 1986. – Geimer 2007. – Gleba 2012. – Gleba 2014a. – Hofmann-de Keijzer, Van Bommel and Joosten 2005. – Hofmann-de Keijzer *et al.* 2013. – Milcent and Moulherat 2000. – Rast-Eicher and Vanden Berghe 2015. – Stöllner 2005. – Vanden Berghe, Gleba and Mannering 2009. – Van Bommel, Joosten and Hofmann-de Keijzer 2013a–c. – Walton 1986. – Walton 1988. – Walton Rogers in Banck-Burgess 1999.

²⁷¹ Joosten and Van Bommel 2008. – Joosten *et al.* 2006. – Serrano *et al.* 2013.

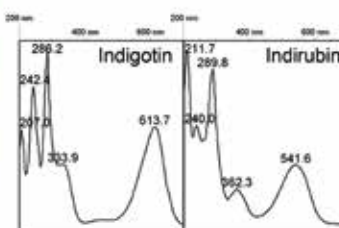
²⁷² Joosten and Van Bommel 2008.

penetrate textiles from the archaeological environment, such as soil, minerals and metals.

The optimal method for the identification of textile dyes today is high-performance liquid chromatography with photo diode array detection (HPLC-PDA)²⁷³. HPLC is a chromatographic technique in analytic chemistry used to separate the components in a mixture and to identify each component. During sample preparation, the dyes are first extracted with the non-polar solution dimethylformamide (DMF) and next by acid extraction. Afterwards, an extract is prepared, which is injected into the column of the HPLC equipment (Fig. 83 left).

The column is filled with a stationary (solid) phase. As soon as a mobile phase (mixture of solvents) passes through the column, the dyes advance with the mobile phase but are retained due to adsorption to the stationary phase. The components are separated due to differences in adsorption, chromatographic properties and solubility in the mobile phase. Each dye leaves the column at a certain time, the retention time shown in the chromatogram (Fig. 83, top right). When a component leaves the column, the PDA-detector measures an UV/VIS absorption spectrum of

Fig. 83. Left: HPLC-PDA equipment at the Cultural Heritage Agency of the Netherlands in Amsterdam (RCE). Top right: HPLC-PDA chromatogram of a Bronze Age Hallstatt textile sample (HallTex 211) dyed with woad. Bottom right: spectra of indigotin and indirubin.



273 Joosten and Van Bommel 2008.

this substance (Fig. 83, bottom right). A dye is identified when both its retention time and its UV/VIS absorption spectrum correspond to a reference dye. In case only one parameter is corresponding the component cannot be identified but shows only a similarity to a reference dye (Fig. 84)²⁷⁴. This may be due to degradation or the lack of the appropriate reference material.

In fragile archaeological textiles, the identification of dyes is hampered because the chromatogram shows a baseline disturbance (small bump). This is probably caused by acid hydrolysis during sample preparation which partly dissolves the degraded wool (Fig. 83, top right). Furthermore, dyes are often present in low concentrations that cause spectra slightly different to those of higher concentrations of identical dyes. Additionally, there is still a lack of analytical data of prehistoric textiles and appropriate reference materials.

The results of the analytical investigations of dyes allow different conclusions²⁷⁵. If no component is detected by HPLC-PDA analysis, this does not mean that the textile was not dyed, because degraded dyes could have diminished below the detection limit of the analytical system. If unknown coloured (especially yellow) components are detected in archaeological textiles in low concentration, the origin cannot be determined. They can be components originating from plants of the archaeological environment as well as degradation products of the dyes and fibres. Therefore, it is not always possible to conclude whether a textile is dyed or not.

Proof that a textile was dyed is obtained as soon as a coloured component is recognized as a dye and it can be excluded that it originates from the archaeological environment. When a specific dye cannot be identified it can sometimes be assigned to a certain class of dyes, for example to the yellow flavonoids or the red anthraquinones. This allows a conclusion regarding the applied dyeing technique or the colour fastness.

²⁷⁴ Hofmann-de Keijzer *et al.* 2013, 136–141.

²⁷⁵ The possibilities and limitations of dye analysis in prehistoric textiles are discussed in Hofmann-de Keijzer *et al.* 2013, 136–141. – Joosten and Van Bommel 2008.

Only those vegetable and animal dyeing materials that leave a characteristic chemical fingerprint on the dyed textiles can be identified. This fingerprint usually consists of major and minor components, which can be detected in certain concentrations. The identification of dye plants in prehistoric textiles is difficult because knowledge about their exact chemical fingerprints remains limited. Both locally grown and cultivated plants are possible candidates for a dye plant. Furthermore, both textiles and dye materials might have been traded over long distances. A variety of dyeing materials must therefore be considered. Moreover, the minor components that are characteristic of a dyeing material's fingerprint may degrade during long periods since deposition and now lie beneath the detection limit of the HPLC system. The degradation processes of dyes under special depositional conditions in salt mines or peat bogs have not yet been investigated sufficiently. Despite these limitations, it is possible to find out the sources of the dyes. Conclusions regarding textile manufacturing and trading can only be drawn once a dye plant or dye insect has been identified. If the origin of the textile is not within the distribution area of this plant or animal, it can be concluded that the dyeing material, the dyed yarn or the dyed fabric has been imported.

5.3 Archaeological evidence of organic colourants

The oldest finds of inorganic pigments in cave paintings are over 20,000 years old; the oldest finds of organic colourants, however, date to the period of the early civilizations of Egypt, India and America²⁷⁶. The use of organic colourants has been identified in textiles, on jars and other supports²⁷⁷. Since both the dye and the dyed textiles are of organic origin, preservation of these materials requires specific conditions, such as the dry desert climate of Egypt, Israel, India and Peru, the salt of Hallstatt and Dürrenberg in Austria, and ice (tombs of the Scythians)²⁷⁸. Textiles found in bogs often appear uniformly brown coloured due to the influence of humic acids. Nevertheless, traces of dyes can be detected by HPLC-PDA in these textiles that give clues to their original colours²⁷⁹.

²⁷⁶ Schweppe 1993, 17–59.

²⁷⁷ Koren 2008. – Seefelder 1982, 21–22 (fig.).

²⁷⁸ Kurgan 5 of Pazyryk in the Altai Mountains contained the oldest evidence for a carpet dating to the 5th–4th century BC (Han 2008, 50).

²⁷⁹ Vanden Berghe, Gleba and Mannering 2009.

Opposite page:
Fig. 84. Dyes detected
in European textile
finds from the Bronze
Age and Iron Age.
Explanations: small
caps: main dye; small
letters: minor dye;
s.t. +: sometimes
together with; +:
identified; +?: possible
identified, that means
that the retention time
or spectrum is slightly
different to those of a
dye; ○ indicate records
that probably derive
from the archaeological
environment; *: the
LUTEOLIN-APIGENIN-type
found in Hallstatt
textiles is included in
the LUTEOLIN-apigenin-
type. A-H (second
column) indicate type
of analysis and research
team and for literature
sources see page 470.

In recent years, the dyes of prehistoric textiles have been analysed, including the prehistoric Hallstatt textiles from the Bronze and Iron Age (Fig. 84).

Investigation of the dyes in prehistoric Hallstatt textiles

The colours of the Bronze Age (1,500–1,200 BC) and Early Iron Age (800–400 BC) textiles from Hallstatt in Austria were investigated as part of an interdisciplinary research project²⁸⁰. The dye and element analysis were carried out at the Cultural Heritage Agency of the Netherlands (RCE) in Amsterdam²⁸¹. Simultaneously, dyeing experiments were performed by using fermented woad vats; and a reference collection of dye plants and dyed wool was established to optimize the interpretation of analytical results of prehistoric samples dyed with woad, red and yellow dyes²⁸². Based on the analytical results of prehistoric samples, reproductions of Iron Age ribbons were made with materials and textile techniques (spinning, dyeing and weaving) which were similar to the prehistoric techniques²⁸³. In addition, contemporary textile art emerged inspired by the Hallstatt textiles²⁸⁴.

Tannins for dyeing brown and black

The presence of ellagic acid and other tannic acids, as detected by HPLC-PDA, proves the use of tannins, although whether these were used as dyes or as mordants remains unclear. It is also not possible to identify the tannin plant. Barks, herbs, leaves and galls may have served as sources of tannins. Archaeological finds of tannin-bearing pomegranates (*Punica granatum*,

²⁸⁰ 'Dyeing techniques of the prehistoric textiles from the salt mine of Hallstatt – analysis, experiments and inspiration for contemporary application', Austrian Science Fund (FWF), Translational Research-Program [L 431-G02]. – Hofmann-de Keijzer, Van Bommel and Joosten 2005. – Hofmann-de Keijzer *et al.* 2005. – Hofmann-de Keijzer and Van Bommel 2009. – Hofmann-de Keijzer *et al.* 2013.

²⁸¹ Joosten *et al.* 2006. – Joosten and van Bommel 2008.

²⁸² Hartl 2012. – Hartl *et al.* 2015a.

²⁸³ Rösel-Mautendorfer, Grömer and Kania 2012. – Hartl *et al.* 2015b.

²⁸⁴ Hofmann-de Keijzer, Kern and Putz-Plecko 2012.

| Origin | Detected dye or pigment | Indigoid dyes | | Red anthraquinone dyes | | | | Red components | | | Yellow flavonoid dyes | | | | | | |
|---|------------------------------|------------------------|------------------|--------------------------------|----------------------------|-----------------|-------------|--------------------------|---------------------|-------------------|------------------------|----------------------------|-----------------------------|---------------|-----------|-----------------------------|---------------|
| | | Wood | Shellfish purple | Rubiaceae | | Insects | | Polygonaceae, Rhamnaceae | Orchil from lichens | Flowers or fruits | Unknown plants | Flavones | | Flavonols | | | |
| | | | | PURPURIN-type | PURPURIN-alizarin-type | Dye madder-type | Kermes | | | | | Cochenille-type | LUTEOLIN / s.t. + apigenin* | APIGENIN-type | RHAMNETIN | QUERCETIN | Unknown plant |
| Performance of dye analysis | INDIGOTIN / s.t. + Indirubin | 6,6'-DIBROMO-INDIGOTIN | PURPURIN | PURPURIN / alizarin / rubiadin | ALIZARIN / s.t. + purpurin | KERMESIC ACID | CARMIC ACID | CHRYSOPHANOL, EMOCIN | ORCEIN | Anthocyanin dye | Unknown red components | LUTEOLIN / s.t. + apigenin | APIGENIN EQUIVALENT | RHAMNETIN | QUERCETIN | Unknown (yellow) components | Tannins |
| Bronze Age | | | | | | | | | | | | | | | | | |
| Pustopolje, Bosnia-Hercegovina ¹¹ 1670 BC (+/- 120 years) | A | | | | | | | | | | | + | | | | | + |
| Mitterberg, Austria ²¹ 16 th c. BC | A | | | | | | | | | | | | | | | | o |
| Hallstatt, Austria ²¹ 1500-1200 BC | A | + | | + | | | | | | | | + | + | | | | + |
| Radfeld, Austria ⁴⁹ 11 th /10 th c. BC | B | | | | | | | | | | | o | | | | | o |
| Iron Age | | | | | | | | | | | | | | | | | |
| Hallstatt, Austria ²¹ Hallstatt period, 800-400 BC | B | + | | | + | | + | | + | + | + | + | + | + | + | | + |
| Verucchio, Italy ⁵¹ 8 th c. BC | C | + | | + | | | | | | | | | + | | | | + |
| Sasso de Furbara, Italy ⁶¹ 8 th c. BC | D | + | | + | | | | | | | | | | | | | |
| Vedretta di Ries, Italy ⁷¹ 8 th – 6 th c. BC | D | + | | | | | | | | | | | | | | | |
| Hochdorf, Germany ⁸¹ Late Hallstatt period, 6 th c. BC | E | + | | | | + | | | | | | + | | | | | + |
| Hohmichele, Germany ⁸¹ Late Hallstatt period, 6 th c. BC | E | + | | | | | | | | | | | | | | | |
| Grabenstetten, Germany ⁸¹ Hallstatt period | E | + | | | | | | | | | | | | | | | |
| Dürnberg, Austria ⁸¹ Latène period, 6 th – 2 nd c. BC | F | + | | | + | + | | | | | | | + | | | | + |
| Glauberg, Germany ¹⁰¹ Early Latène period, 420/380 BC | D | + | | | | + | | + | | | | | | | | | o |
| Altrier, Luxembourg ¹¹¹ Early Latène period, c. 430 BC | D | + | | | | + | | | | | | | | | | | |
| Sainte-Geneviève-des-Bois, France ¹²¹ Early Latène period, 450-400 BC | G | + | | | | + | | | | | | | | | | | |
| Padova, Italy ¹³¹ 5 th c. BC | D | | | + | | | | | | | | | | | | | |
| Strozzacapponi, near Perugia, Italy ¹⁴¹ 2 nd c. BC | D | | + | | | | | | | | | | | | | | |
| Peat bog textiles, Denmark, Norway ¹⁵¹ 520 BC – AD 410 | D | + | | | + | | | | | | | + | + | | + | + | + |
| Grave textiles, Denmark, Norway, Sweden ¹⁶¹ AD 1-520/540 | H | + | | + | + | | | | | | | + | | | | | |

Punicaceae) are known from pharaonic Egypt (from 1,500 BC) where they could have been used as food, for dyeing and tanning²⁸⁵. Among the oldest textiles in which tannins were detected are those from the Bronze Age salt mines of Hallstatt (Fig. 84). Although brown colours are relatively easy to achieve with tannins because they bind directly to the fibres, tannins have so far rarely been detected in prehistoric textiles. The reason could be that brown colours were simply obtained by using brown sheep wool²⁸⁶. Tannins were mainly found in blue and black textile fragments from prehistoric Hallstatt. The tannins were therefore most likely used for the shading of blue or were possibly combined with iron-containing materials to achieve black²⁸⁷. The detection of ellagic acid together with other dyes such as luteolin rather refers to its use as a mordant; in cases where no indication was found of a mordant dye, it is most likely that the dye did not survive the burial conditions²⁸⁸. It is also possible that plants used for yellow or red dyes additionally contained tannins.

Woad blue and shellfish purple

Plants that contain precursors of the blue pigment indigotin were named indigo plants²⁸⁹. Already in prehistoric times, techniques were developed to gain the blue pigment and to use it as a vat dye for textile dyeing. If the blue pigment indigotin is detected in a textile by itself or in combination with the red minor component indirubin, it can be concluded that the dyeing is due to an indigo plant (Fig. 83 chromatogram and spectra). Which indigo plant was used cannot be determined by chemical analysis. Indigo derived from tropical and subtropical *Indigofera* species (Fabaceae, or legume family) has been used in the Indus Culture (Mohenjo-Daro, c. 2,300–1,700 BC) and was probably

²⁸⁵ Forbes 1964, 123.

²⁸⁶ Grömer and Rösler-Mautendorfer 2013, 259.

²⁸⁷ Hofmann-de Keijzer, Van Bommel and Joosten 2005, 64. – Hofmann-de Keijzer *et al.* 2005, 923–926. – Hofmann-de Keijzer *et al.* 2013, 156–157. – Grömer and Rösler-Mautendorfer 2013, 257, 372, 410, 412, 427, 471, 491.

²⁸⁸ Vanden Berghe, Gleba and Mannering 2009, 1918.

²⁸⁹ Cardon 2007, 335–408.

also known in Pharaonic Egypt²⁹⁰. The use of indigo seemed to have only minor importance in the Roman Empire²⁹¹. Even if long-distance trade cannot be excluded, the use of indigo in prehistoric Europe seems highly unlikely.

Woad (dyer's woad, *Isatis tinctoria*, Brassicaceae; Fig. 80) is native to the Caucasian steppes and from Southwest Asia to eastern Siberia. Due to cultivation as well as unintentional displacement, it was spread as far as India, East Asia, North Africa and most of Europe²⁹²: Blue-dyed plant fibres from the Neolithic cave in France (de l'Adouste near Joursque, Bouches-du-Rhône) are often regarded as the oldest European find of woad. Numerous finds of woad are known from prehistoric Europe and most of them date from the Iron Age. Imprints of five fruits of woad were found on pottery from the settlement Heuneburg in southern Germany (Hallstatt Culture, c. 6th to 5th century BC). Woad fruits were present in a pot from the Iron Age Ginderup in Denmark and in Iron Age deposits on the northwest coast of Germany (1st to 2nd century AD). Parts of a woad plant were discovered in the Late Hallstatt/Early La Tène period chieftain's grave at Eberdingen-Hochdorf. Archaeologists working on a rural settlement site at Roissy²⁹³, north of Paris, found 104 woad seeds in a storage pit dated to the 5th or 4th century BC. As they were found together with other cultivated plants, it is suggested that woad was already cultivated and intentionally sown in that period. The finding of parts of woad at Iron Age Dragonby (1st century BC to 1st century AD) proves that the plant was available already in the Roman period in England. Before this archaeobotanical evidence was available, it was already known through Caesar's report that woad was used by the Britons for body painting (Caesar, *B.G.* 5.14)²⁹⁴. Pliny the Elder mentions the same use by female Britons (Plin., *Nat. Hist.* 22.2–3). Textile

²⁹⁰ Indus valley: Böhmer 2002, 217. – Egypt: Germer 1985, 74–75.

²⁹¹ Forbes 1964, 111–112.

²⁹² Distribution: Hegi 1919, 4/1. – Iron Age finds, including map: Hofmann-de Keijzer *et al.* 2013, 143–145. – De l'Adouste: Banck-Burgess 1999: 86. – Barber 1991: 227 – Cardon 2007: 374 – a critical consideration of this find is given in Hofmann-de Keijzer *et al.* 2013, 143–144. – Northwest coast of Germany and Heuneburg: Körber-Grohne 1967 – Körber-Grohne 1981. – Ginderup: Jessen 1933. – Hochdorf: Stika 1999.

²⁹³ Zech-Matterne and Leconte 2010.

²⁹⁴ See also Van der Veen, Hall and May 1993, 367, 370.

dyeing with woad is well documented in the Roman period; its processing including subsequent vat dyeing is described in the *Papyrus Graecus Holmiensis*²⁹⁵.

From dye analysis on prehistoric textiles, it is evident that dyeing with woad has been applied in Europe since the Bronze Age; in the Iron Age it is one of the most frequently used dyeing techniques (Fig. 84)²⁹⁶. The oldest indigotin dyed find from Hallstatt is dated to the Bronze Age (Christian-von-Tuschwerk, 1,500–1,200 BC)²⁹⁷ and from Scandinavia to the Iron Age (Rebild, 4th to 3rd century BC)²⁹⁸. Archaeological finds confirm that the supposed indigo plant of the Bronze and early Iron Age in Europe can only be woad.

Tyrian purple (Imperial purple, Royal purple, mollusc purple, shellfish purple) was gained from the hypobranchial glands of Mediterranean Muricidae (murex snails), especially from the banded dye-murex (*Hexaplex trunculus*, syn. *Murex trunculus*), additionally from the spiny dye-murex (*Bolinus brandaris*, syn. *Murex brandaris*) and the red-mouthed rock-shell (*Stramonita haemastoma*). The glands contain precursors of indigoid dyes that – under the influence of light and oxygen – build 'purple pigments' from reddish to bluish hues. This is due to the indigoid dyes indigoid dyes 6,6'-dibromo-indigotin (red), dibromo-indirubin (red), monobromo-indigotin (red), indirubin (reddish violet), monobromo-indigotin (violet) and indigotin (blue) which occur in different concentrations²⁹⁹. As these components are insoluble in water it was necessary to prepare a vat for textile dyeing.

²⁹⁵ Germer and Körbelin 2005; P. Holm. = *Papyrus Graecus Holmiensis, Recepte für Silber, Steine und Purpur*, ed. O. Lagercrantz. Uppsala and Leipzig 1913. (Arbeten utgifna med understöd af Vilhelm Ekmans Universitetsfond 13).

²⁹⁶ Hofmann-de Keijzer *et al.* 2013, 141–147.

²⁹⁷ Grömer and Rösel-Mautendorfer 2013, 269, HallTex 211.

²⁹⁸ Vanden Berghe, Gleba and Mannering 2009, 1919–1920.

²⁹⁹ Koren 2013. – Koren and Verhecken-Lammens 2013.

Recently, shellfish purple has been identified in three samples of calcified textiles from 2nd century BC tombs at Stroz Zacapponi, near Perugia, Italy³⁰⁰.

Mordants for yellow, red and black

The most important textile dyes for yellow (flavonoids) and red (anthraquinones) are mordant dyes that need to be fixed on the fibres by means of mordants. Both tannins and metal ions can achieve this. The use of mordants containing aluminium, iron or copper is easy to ascertain by element analysis for textiles that do not originate from archaeological contexts. This is not the case with archaeological textiles, since the elements of aluminium, copper and iron additionally can penetrate the textiles from minerals or metals present near the textile in the archaeological context. Only in the case of two black textiles from Bronze and Iron Age Hallstatt there is an indication that the element iron could originate from a mordant. Iron was detected together with an ellagic acid-equivalent, pointing to the use of tannins. Probably an iron gall black was used³⁰¹.

The use of metal salt mordants is confirmed by Pliny (Plin., *Nat. Hist.* 35.42)³⁰². He describes how Egyptian dyers in the 1st century AD managed to dye fabrics in different colour-shades in a dye bath prepared from madder after pre-treatment in different liquids. Alum was the most important mordant from antiquity onwards. There is a term for alum in Egyptian hieroglyphics and in cuneiform inscriptions and the Leiden Papyrus X and the Stockholm Papyrus (end of 3rd or the beginning of 4th century AD) contain several recipes for dyeing wool to create imitation purples by using the 'Phrygian stone' (most probably alunite) as a mordant³⁰³. It is not known whether alunite and/or alum shale were already being used for textile dyeing during prehistoric times in Europe. Other sources for aluminium are plants of the

³⁰⁰ Gleba 2014a, 152.

³⁰¹ Hofmann-de Keijzer, Van Bommel and Joosten 2005, 59, 64. – Hofmann-de Keijzer *et al.* 2005, 924–925; 2013, 156–157. – Grömer and Rösler-Mautendorfer 2013, 257, 491.

³⁰² Germer and Körbelin 2005.

³⁰³ Cardon 2007, 21–39.

Lycopodiaceae family (clubmoss) that accumulate aluminium salts in the cell sap. The use of clubmoss as a mordant is proven for Coppergate, York (9th–11th century AD)³⁰⁴. Furthermore, iron-containing mud from fens could have been used as mordant. Copper and iron acetates possibly were made by treating copper, bronze and iron objects with vinegar. Prehistoric dyers could have used metal vessels for dyeing as well as added metal objects to the dye bath. It is known from dyeing experiments that plates made of copper, bronze and iron release the necessary metal ions for mordant dyeing into the mordant or dye bath³⁰⁵.

Abundance of yellow dyes

Numerous plants contain yellow textile dyes (flavonoids) and are therefore suitable for dyeing yellow. Some of them are detected in prehistoric textiles (see Fig. 85 and 86). Interestingly, the overwhelming majority of yellow dyes detected in prehistoric textiles consist of the flavons luteolin and apigenin. Only in a few cases the flavonols quercetin and rhamnetin have been identified³⁰⁶. Possibly the dyers preferably use plants that supply durable yellows. Nowadays it is known that the flavon group – and luteolin in particular – stands out among flavonoids as having a better lightfastness than yellow dyes of the flavonol groups³⁰⁷. Another explanation is that luteolin and apigenin were degraded more slowly than the other flavonoids due to the preservative qualities in bog and salt environments³⁰⁸.

It is difficult to confirm the chemical fingerprint of any particular yellow-dyeing plant, since so many plants can be used as flavonoid sources. If the main component in a historic textile is the yellow luteolin and the minor component apigenin, weld (*Reseda luteola*, Resedaceae, see Fig. 85) could be the source of these flavons. Weld is native to the Mediterranean and West

³⁰⁴ Kenward and Hall 1995. – Hall 1996.

³⁰⁵ Edmonds and Hofmann-de Keijzer 2005. – Hundt 1959, 84–85.

³⁰⁶ Hofmann-de Keijzer *et al.* 2013, 151–154. – Vanden Berghe, Gleba and Mannering 2009.

³⁰⁷ Cardon 2007, 171.

³⁰⁸ Hofmann-de Keijzer *et al.* 2013, 152–153. – Vanden Berghe, Gleba and Mannering 2009; 1914.

Asia and has been spread as a cultivated plant to Central Europe³⁰⁹: finds of weld seeds are known in Central Europe as early as the Neolithic, in Switzerland, from the Bell Beaker culture in Hungary, from the Late Hallstatt/early La Tène period chieftain's grave at Eberdingen-Hochdorf, Germany, from the La Tène period Fellbach-Schmidlen, Germany and from the Roman Age in Dragonby, England.

In most of the prehistoric Hallstatt textile samples³¹⁰, luteolin is the only dye or the main dye, with apigenin as minor dye. Sometimes luteolin and apigenin occur in equal concentrations or an apigenin-equivalent is the main dye. This can have various causes. In prehistoric weld dyeings luteolin could have originally occurred in higher concentrations than the apigenin but the luteolin degraded more quickly under conditions in salt mine. It is also possible that luteolin and apigenin were present in equal amounts in the weld used during the Hallstatt Culture. The higher content of apigenin may also be attributed



Fig. 85. Weld, *Reseda luteola*, is one of the oldest cultivated dye plants reaching a height of 50 to 150 cm. The leaves, blossoms and stems contain yellow dyes.

³⁰⁹ Distribution: Janchen 1956-1960. – Archaeological finds including map: Hofmann-de Keijzer *et al.* 2013, 151–152. – Switzerland: Lundström-Baudais 1978. – Körber-Grohne 1994. – Schibler *et al.* 1997. – Hungary: Gyulai 2003. – Hochdorf: Stika 1995. – Fellbach: Körber-Grohne 1999. – Dragonby: Van der Veen 1996.

³¹⁰ Hofmann-de Keijzer *et al.* 2013, 151–154, specific terms (*e.g.* in fig. 84): LUTEOLIN-apigenin-type means that luteolin is the main dye and apigenin is the minor dye; LUTEOLIN-APIGENIN-type means that luteolin and apigenin occur in equal concentration; APIGENIN-type means that an apigenin-equivalent is the main dye.

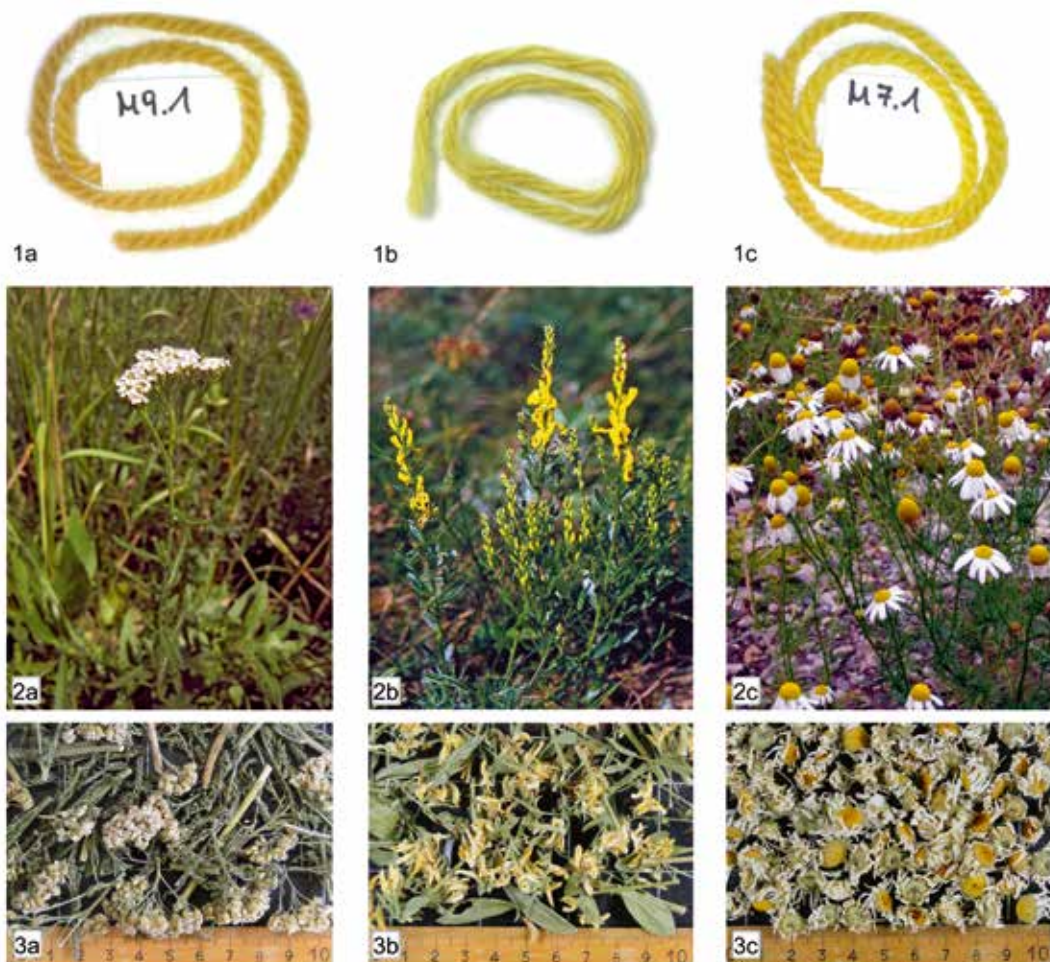


Fig. 86. Experimental dyeing with dye plants for yellow, performed by Anna Hartl, BOKU Vienna. a Yarrow, *Achillea millefolium*. b Dyer's broom, *Genista tinctoria*. c Scentsless chamomile, *Tripleurospermum inodorum*, 1 wool dyed with plants, 2 flowering plants, 3 plant parts collected for dyeing.

to another plant that has been used alone or together with weld. In addition to weld, other plants can be sources for 'luteolin-type'-dyeings, for example saw-wort (*Serratula tinctoria*, Asteraceae) and dyer's broom (*Genista tinctoria*, Fabaceae, Fig. 86.b)³¹¹. Dyer's broom can only be identified as source for textile dyeing if genistein, a typical minor compound, is detected next to luteolin and apigenin, but in prehistoric textiles, it can

³¹¹ Cardon 2007, 171, 178, 180. – Hofenk de Graaff 2004, 215.



be missing due to degradation. HPLC analysis of wool experimentally dyed with yarrow (*Achillea millefolium*, Asteraceae, see Fig. 86.a) and dandelion (*Taraxacum officinale*, Asteraceae) showed luteolin and apigenin, sometimes in the same ratio as in weld-dyeings³¹². Source for the 'apigenin-type' dyeings could be the scentless chamomile (*Tripleurospermum inodorum*, Asteraceae, see Fig. 86.c) which yield dyeings with the apigenin-equivalent detected as the main dye in Hallstatt textiles³¹³.

The yellow flavonol quercetin is detected in fragments from Iron Age Denmark and Norway³¹⁴. The detection of quercetin

Fig. 87. The detection of the red dye purpurin in this Bronze Age textile from Hallstatt (HallTex 205) indicates that rhizomes of Rubiaceae species, presumably bedstraw species (*Asperula* spp. *Galium* spp.), were used for dyeing.

³¹² Hofmann-de Keijzer *et al.* 2013, 153.

³¹³ Hartl 2012. – Hofmann-de Keijzer *et al.* 2013, 153.

³¹⁴ Vanden Berghe, Gleba and Mannering 2009, 1916–1917. – The detection of quercetin in some Iron Age Hallstatt textiles mentioned in earlier publications cannot be upheld in the light of recent interpretations, see Hofmann-de Keijzer *et al.* 2013, 153.



Fig. 88. Experimental dyeing with dye plants for red, performed by Anna Hartl, BOKU Vienna. a Dyer's woodruff, *Asperula tinctoria*; b Wood Bedstraw, *Galium sylvaticum*, c Lady's Bedstraw, *Galium verum*, 1 wool dyed with rhizomes, 2 flowering plants, 3 rhizomes collected for dyeing.

without any minor compound is of no use when the aim is to identify the dye plant, since quercetin occurs in 60% of all plants³¹⁵. The detection of the yellow flavonol rhamnetin in textiles from Danish peat bogs and of a rhamnetin-equivalent in Iron Age textiles from Hallstatt points to the use of buckthorn species (*Rhamnus* sp., Rhamnaceae) in the Iron Age³¹⁶.

³¹⁵ Whiting 1981.

³¹⁶ Hofmann-de Keijzer *et al.* 2013, 154. – Vanden Berghe, Gleba and Mannering 2009, 1916.

Rare red dyes

Anthraquinones, the most durable red textile dyes that are found in nature, are rare and occur mainly in the Rubiaceae family and in dye insects. In non-archaeological textiles most of these dyeing materials can be easily identified by their chemical fingerprints. For archaeological textiles, however, this is not always the case. It is proven that the rhizomes of Rubiaceae were used since the Bronze Age and that in the Iron Age the most important red colourants were already known: bedstraw and madder from the Rubiaceae family³¹⁷, the dye insects kermes, Polish and/or Armenian cochineal and possibly orchil, a dyeing material obtained from lichens³¹⁸ (see Fig. 84).

Rubiaceae for red

The detection of the red anthraquinone purpurin in Bronze Age textiles from Hallstatt (Fig. 87) demonstrates that rhizomes of Rubiaceae were already being used as dyeing materials in the Bronze Age³¹⁹. In one Iron Age textile beside purpurin the anthraquinones rubiadin and alizarin were detected. Dyeings with the main dye purpurin (purpurin-type) are usually attributed to bedstraw species (*Asperula* and *Galium* species) native to Europe, along with wild madder (*Rubia peregrina*)³²⁰ native to the Mediterranean. Most likely the roots of bedstraw were used in Central and North Europe (Fig. 88.b-c); they are also mentioned as the main source of purpurin in Danish textiles from the Iron Age³²¹. In wool experimentally dyed with different bedstraw

³¹⁷ More research is necessary to know whether anthraquinones which are detected in prehistoric textiles can be assigned to certain *Galium* and *Rubia* species as the composition and concentration of anthraquinones is not only influenced by the plant source but also by the dyeing technique and the degradation of the dyes. Therefore in Fig. 84 not the plants are mentioned but three dyeing-types. PURPURIN-type means that only purpurin was detected; PURPURIN-alizarin-type means that purpurin is the main dye and alizarin is the minor dye; dye-madder-type means that alizarin is main dye.

³¹⁸ Hofmann-de Keijzer *et al.* 2013, 159–161. – Vanden Berghe, Gleba and Mannering 2009, 1918.

³¹⁹ Grömer and Rösler-Mautendorfer 2013, 263–264, 299–301. – Hofmann-de Keijzer *et al.* 2013, 147–150.

³²⁰ Böhmer 2002, 118, 122.

³²¹ Walton 1988, 155.



Fig. 89. Madder, *Rubia tinctorum*, is one of the oldest cultivated dye plants. The red dyes are gained from the rhizomes, underground growing stems.

textiles from Norway, suggesting that either madder or the dyed textile may have been traded long distances³²⁶. Beside madder, other Rubiaceae species seem to be used also in later periods, because purpurin-type dyeings were found in Scandinavian textiles (400–520/540 AD), in two Danish grave finds and in a tablet-woven band from a tunic found in the grave-mound at Högom in Sweden³²⁷.

species beside purpurin, the anthraquinones rubiadin and alizarin were detected³²².

Dyeings performed with rhizomes of madder (Dyer's madder, *Rubia tinctorum*, see Fig. 89) are determinable by the presence of two red anthraquinones, alizarin as the main dye and purpurin as minor dye³²³. The original distribution area of this ancient cultivated plant is located in southeast Europe and southwest Asia. It was used by the Egyptians, Greeks and Romans; in the Roman Empire it was cultivated in Italy and Gaul³²⁴. It seems, however, that the cultivation of madder in other parts of Europe did not begin before the early Middle Ages³²⁵. Madder was identified in Iron Age textiles from Dürrenberg (Austria, 6th–2nd century BC), Denmark (Skærso, 1st century BC) and in Late Roman

³²² Hofmann-de Keijzer *et al.* 2013, 147.

³²³ Böhmer 2002, 122. – Hofenk de Graaff 2004, 93.

³²⁴ Bender Jørgensen and Walton 1986, 185. – Cardon 2007, 119–121. – Hofenk de Graff 2004, 94. – Walton 1988, 154–155.

³²⁵ Hofenk de Graaff 2004, 94. – Ploss 1989, 8.

³²⁶ Bender Jørgensen and Walton 1986, 185. – Stöllner 2005, 169–170. – Vanden Berghe, Gleba and Mannering 2009, 1920. – Walton 1988, 154–155.

³²⁷ Hofenk de Graaff 2004, 125.

Insect dyes for red

Other important anthraquinone dyes for red are derived from female scale insects (dye insects)³²⁸, which could be collected from different host plants. Kermes, mentioned in the *Papyrus Graecus Holmiensis*, is derived from kermes insects (*Kermes vermilio*), which live on the kermes oak (*Quercus coccifera*, Fagaceae) on the coasts of the Mediterranean Sea (Fig. 90) and contain kermesic acid as the main dye. Two other scale insects of the old world provide carminic acid as the main component (cochineal-type). Females of Polish cochineal (*Porphyrophora polonica*) lived in Eastern Europe on roots of Caryophyllaceae (carnation plants), especially on the perennial Knawel (*Scleranthus perennis*) and were gathered during the Middle Ages for dyeing purpose. The Armenian cochineal (*Porphyrophora hameli*) was found in the region of Mount Ararat on the roots of two different host plants, both grasses (Poaceae; also called Gramineae). The differentiation of textile dyeings produced from these cochineal insects seems to be possible by quantitative analysis of the main and minor dyes in historic textiles by HPLC³²⁹. Due to the degradation of minor components in prehistoric textiles, the source of carminic acid cannot be determined.

Dye insects were used to achieve certain dark shades of blue and black in Iron Age textiles from Hallstatt. They contain a red component similar to carminic acid³³⁰. Possible sources are the Polish cochineal or the Armenian cochineal. Even without a clear identification, however, these textiles prove far-reaching trade relations, because these scale insects are not native to the most probably production area of the Hallstatt textiles in Central Europe³³¹.

³²⁸ Böhmer 2002, 203–214. – Cardon 2007, 635–656. – Hofenk de Graaff 2004, 52–91.

³²⁹ Cardon 2007, 649. – Wouters and Verhecken 1989, 393–410.

³³⁰ Grömer and Rösel-Mautendorfer 2013, 412, 491–492. – Hofmann-de Keijzer *et al.* 2013, 150.

³³¹ Grömer 2013, 93–94.



Fig. 90. Mediterranean kermes oak (*Quercus coccifera*) with kermes (females of the scale insect *Kermes vermilio*).

After the opening of the insect, the eggs are visible (top).

Image by Manuel Alvarado, www.biodiversidadvirtual.org.

*Kermes*³³² was found in Iron Age textiles from Dürrnberg in Austria, from Sainte-Geneviève-des-Bois (Les Ronces) in France, from Altrier in Luxembourg and from Hochdorf and Glauberg in Germany. Since kermes could only have been collected in the Mediterranean area, either the dye, the dyed yarn or the finished fabric must have been imported to Central and North Europe. In case of the textiles of Hochdorf, where local production is evidenced by the weaving technique used, whether kermes was imported or dyed yarns from an imported textile were recycled is therefore subject to debate³³³.

³³² Dürrnberg: Stöllner 2005, 169–170. – Sainte-Germaine-des-Bois: Milcent and Moulherat 2000, 307, 314. – Altrier: Rast-Eicher and Vanden Berghe 2015. – Hochdorf: Walton Rogers 1999 – Glauberg: Balzer, Peek and Vanden Berghe 2014, 2–8. – The evidence of kermesic acid in a Hallstatt textile is no longer sustainable: Hofmann-de Keijzer et al. 2013, 150.

³³³ Walton Rogers 1999, 244.

Unknown components

In prehistoric textiles from Hallstatt and other sites many unknown components are detected (Fig. 84)³³⁴. Among the components found in prehistoric Hallstatt textiles is a red dye similar to orcein, which may point to the use of lichens in the Hallstatt period, a yellow component resembling crocetin and a red dye that may belong to the anthocyanin dyes. Sometimes unknown red dyes are found in significant amounts. Maclurin-equivalents occur in Bronze Age textiles from Hallstatt, Pustopolje, Bosnia-Herzegovina (1670 BC ± 120 years)³³⁵, Mitterberg, Austria (c. 16th century BC)³³⁶, Radfeld, Austria (11th/10th century BC)³³⁷ and in Iron Age Hallstatt textiles³³⁸. The maclurin-equivalent detected in the Bronze Age textiles is similar to a component found in wool experimentally dyed with the roots of purple gromwell (*Buglossoides purpureocaerulea*, Boraginaceae). However, alkannin, the main dye of purple gromwell, was not detected in any of these prehistoric textiles³³⁹. It is also possible that these components originate from the archaeological environment.

5.4 Textile dyeing in the Bronze and Iron Ages

In addition to the scientific investigations of original textiles and the study of written sources, experimental archaeology serves to enhance the knowledge in the field of prehistoric dyeing techniques (Fig. 91)³⁴⁰. Dyeing experiments and dye analysis have demonstrated how the entire colour palette of prehistoric textiles could have been produced. Blue was dyed with woad by vat dyeing. Yellow dyes were obtained from various flavonoid plants, and precious red dyes were acquired from rhizomes of

³³⁴ Hofmann-de Keijzer *et al.* 2013, 150–154. – Vanden Berghe, Gleba and Mannering 2009.

³³⁵ Bender Jørgensen and Grömer 2012, 58. – Van Bommel, Joosten and Hofmann-de Keijzer 2013.

³³⁶ Grömer 2012, 31, fig. 1.2. – Van Bommel, Joosten and Hofmann-de Keijzer 2013b.

³³⁷ Walton Rogers 1998. – Van Bommel, Joosten and Hofmann-de Keijzer 2013c.

³³⁸ Grömer and Rösler-Mautendorfer 2013, 413, 450.

³³⁹ Hofmann-de Keijzer 2013, 153–154.

³⁴⁰ Hartl and Hofmann-de Keijzer 2005. – Hartl *et al.* 2015a; 2015b.



Fig. 91. Experimental setup with various dried dye plants, dye bath and dyed yarns.

bedstraw and madder and from dye insects. Element analyses have been unable to determine if mordants were used to fix yellow and red dyes. It seems that tannins have not been used for dyeing brown, but as mordants or in combination with iron to obtain black colours.

Dyeing black in a bog pit can be considered as an ancient dyeing technique³⁴¹. In prehistory, dyeing could have been performed using a similar method. The technique was applied to linen until historical times in Poljčane (Slovenia), before a dyer settled near the area in 1850. How was this dyeing method carried out? In the autumn a dye pit was dug, which was filled with water, peat (probably containing iron), bark, wood chips, 'Knopper' galls³⁴², fresh walnut shells and alder catkins, all well mixed. The pit was covered for months, stirring occasionally. During winter, the women processed flax, spun, wove and sewed the garments that were dyed in spring and summer. First, the garments were pre-dyed repeatedly in 'Knopperwasser', an extract prepared from the galls mentioned above, for several times. Then this extract was additionally put into the dye pit and the garments were immersed overnight. During the day, they were dipped repeatedly into the dye pit and dried between the dippings. This process of dyeing overnight and dipping during the day was repeated four times to obtain a deep black colour.

³⁴¹ Mautner and Geramb 1932.

³⁴² The German term *Knoppern* (singular: *Knopper*, f.) denominates a particular kind of oak galls produced by the gall wasp *Andricus quercuscalicis* laying its eggs in developing acorns. Their tannin content is believed to be particularly high, making them the favoured kind of galls used for tanning.



Fig. 92. Microscopic image of a natural brown and a white woollen fibre dyed with woad. Indigotin aggregates are visible as blue dots at a high magnification. Dark brown to black colours were obtained by dyeing brown wool with woad blue.

The yield of direct and mordant dyes is increased by crushing or pulverising the colouring material, by soaking and by heating. Dye baths that were not heated may have been prepared in ceramic pots in prehistory. These could especially be used for woad dyeing in fermented vats. Textiles that are dyed in cold dye baths prepared with direct or mordant dyes had to remain there for a long time, days or even weeks. Heating would shorten the time required for mordanting and dyeing.³⁴³

The planning of a particular hue began with the selection of the material to be dyed. If the intention was to obtain blue, green or yellow woollen textiles, white wool was selected³⁴⁴. Particularly dark black shades were obtained by dyeing pigmented brown and black wool with woad blue. This procedure is known from the Iron Age onwards (Fig. 92). A black Iron Age Hallstatt textile made of pigmented wool was dyed with woad, red and yellow dyes, tannins and probably iron containing material to achieve

³⁴³ The rediscovered historical methods for mordant dyeing include pulverising the dyeing material, soaking it in water over night and heating it to about 80°C for one to three hours depending on the type of material. The processes of pre-mordanting with alum as well as the dyeing (direct and mordant dyes) can be completed within an hour when the dye bath is heated to c. 80° C.

³⁴⁴ Hofmann-de Keijzer 2013, 146–147. – Ryder 2001, 230–232.

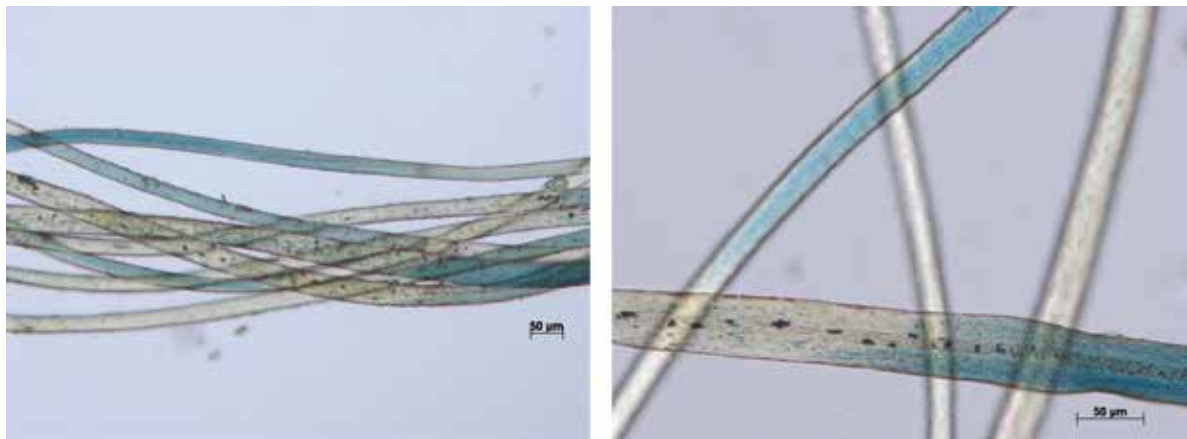


Fig. 93. Microscopic images of woollen fibres from a Bronze Age Hallstatt textile (HallTex 211). It was dyed with woad after weaving, which caused undyed fibre sections. Indigotin aggregates are visible as blue dots at a high magnification.

iron gall black³⁴⁵. Indigotin on natural brown coloured wool was detected in a black fabric from Altrier (Luxembourg)³⁴⁶.

Investigating woad dyed textiles by reflected-light and transmitted-light microscopy shows whether dyeing was performed after spinning or weaving. In both cases undyed fibre sections occur because either the vat or the oxygen could not penetrate into these parts (Fig. 93). So-called indigotin aggregates are often seen on dyed parts of woad-dyed prehistoric textile fibres³⁴⁷. Dyeing of fabrics can be proven if threads show dyed and undyed parts (Fig. 94). In places of densely superimposed threads, blue dyeing was prevented. Yarn dyeing is to prove on densely spun yarns that remain undyed in their centre. Although it is impossible to proof the dyeing of fleece microscopically, it is likely that this was common.

The materials and techniques for wool dyeing have already been discovered in the Bronze Age³⁴⁸. Vat dyeing for blue was performed with woad. Red was obtained from the rhizomes of Rubiaceae, possibly bedstraw species. Plants provided the flavonoids luteolin and apigenin for dyeing yellow and tannins for dyeing and mordanting. Multi-stage dyeing for black was

³⁴⁵ Hofmann-de Keijzer, Van Bommel and Joosten 2005, 64. – Hofmann-de Keijzer *et al.* 2005, 924–925; 2013, 146, fig. 49d. – Grömer and Rösel-Mautendorfer 2013, 491.

³⁴⁶ Von Kurzynski 1996, 41.

³⁴⁷ Bruselius Scharff and Ringgaard 2011.

³⁴⁸ Hofmann-de Keijzer and Van Bommel 2008, 113. – Hofmann-de Keijzer *et al.* 2013, 142–159.



performed by combining woad blue with yellow dyes, tannins, and probably iron gall black³⁴⁹.

During the Iron Age, the use of woad, bedstraw, luteolin/apigenin- and tannin- containing plants continued. The palette of red and purple was expanded by madder, scale insects, Tyrian purple and possibly orchil. In the case of madder and scale insects, which were not native to the places of the textile production, trade of dyeing materials, dyed fleece, yarns or fabrics have to be considered. The palette of yellow was enlarged by buckthorn species and possibly saffron.

A yellow fragment from Hallstatt was dyed in a single process with weld or another luteolin and apigenin yielding plant (Fig. 96.1). Double dyeing for green³⁵⁰ by using a woad vat for blue and another dye bath for yellow is known from Hallstatt (Fig. 96.2), Dürrnberg and Denmark: Indigotin was detected in combination with the flavonoid dye luteolin in Danish peat bog textiles, indicating that green was the desired colour. A large amount of time and effort was devoted to the manufacture of bluish-black to black textiles. These hues were obtained by double dyeing with woad and tannins or by shading woad blue with yellow and/or red dyes, tannins and possibly iron-

Fig. 94. Woollen threads of a Bronze Age textile (HallTex 211) from Hallstatt showing dyed and undyed parts, suggesting that woad dyeing was performed after weaving.

³⁴⁹ Grömer and Rösel-Mautendorfer 2013, 257.

³⁵⁰ Dürrnberg: Stöllner 2005, 169. – Denmark: Vanden Berghe, Gleba and Mannering 2009, 1918. – Hallstatt: Hofmann-de Keijzer *et al.* 2013, 157.

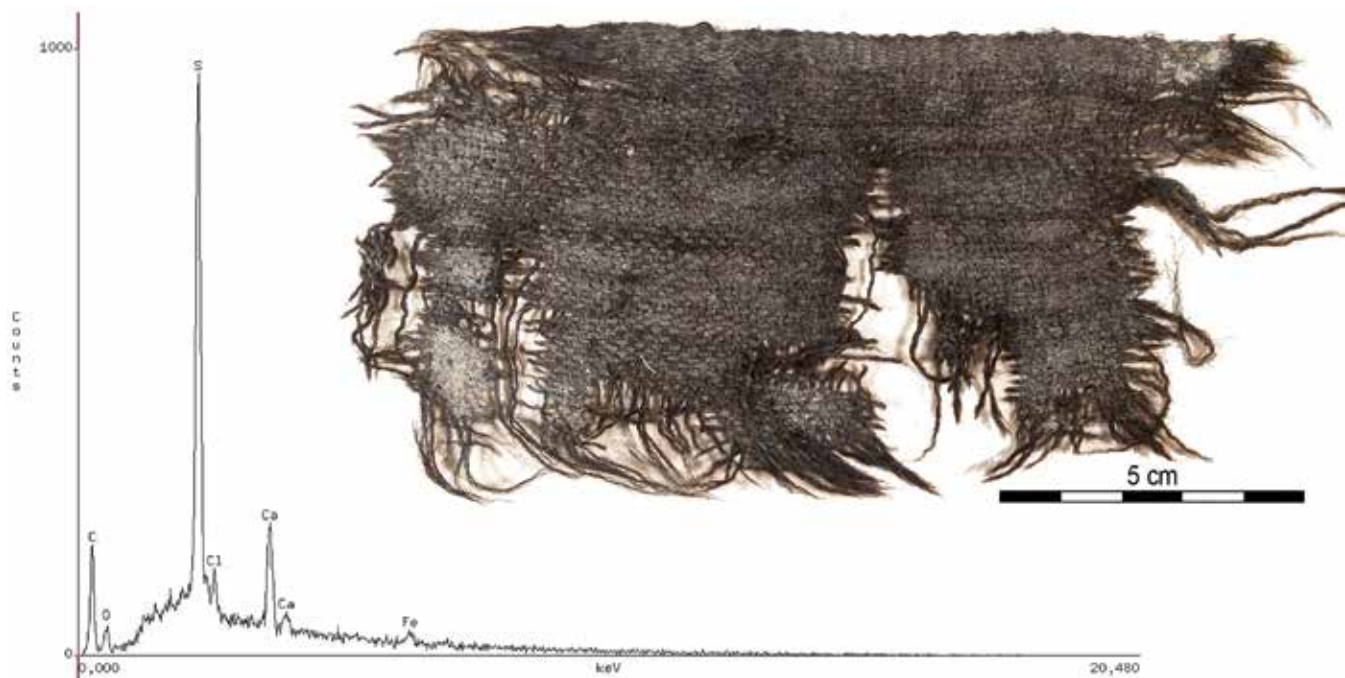


Fig. 95. Bronze Age textile from Hallstatt (HallTex 110). Multiple dyeing processes resulted in the black colour. Woad was used for blue and a luteolin and apigenin containing plant for yellow; brown dyeing tannins were presumably combined with an iron containing mordant to obtain iron gall black. Bottom: SEM-EDX spectrum of a fibre from the black textile.

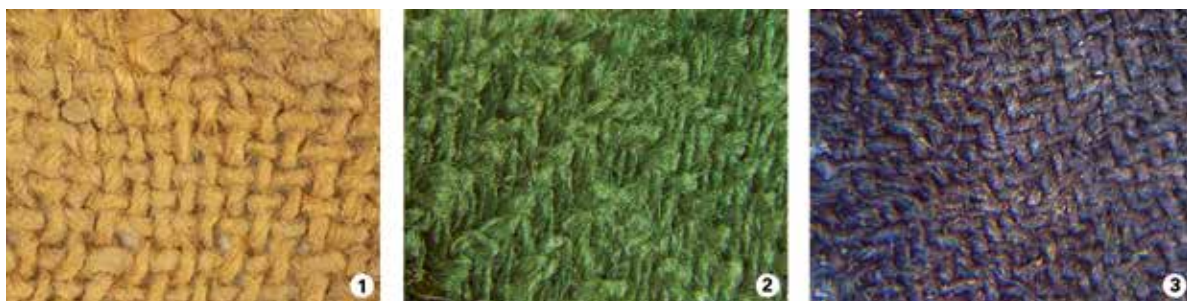


Fig. 96. Dyed Iron Age textiles from Hallstatt: yellow (HallTex 78), dyed with a luteolin and apigenin containing plant such as weld (1). Green (HallTex 122), achieved by combining dyeing blue in a woad vat and dyeing with a plant containing yellow mordant dyes (2). Blue (HallTex 137), woad blue shaded with tannins, yellow and red dyes, possibly including a red dye from orchil (3).

gall black³⁵¹. This is known from Hallstatt (Austria), Eberdingen-Hochdorf (Germany), Altrier (Luxembourg) and Norway. The woad dyeings of Iron Age Hallstatt textiles were shaded by tannins yellow and/or red dyes. Among these red dyes are unidentified red dyes and dyes possibly originating from scale insects and orchil (Fig. 96.3)³⁵². The great emphasis on blue and black shades in Hallstatt textiles suggests that these colours were very popular for garments, as they provided a suitable contrast to the polished and shiny bronze and iron jewellery.

6 Patterns and designs

The human inclination to adorn and decorate is universal – in prehistoric times as well as today. This is perhaps most readily apparent in the creative variety of decoration on ceramic vessels, the most common legacies of pre-Roman times, which fill many museum collections and countless books. Nevertheless, modern people often imagine the fabrics of prehistoric people (especially for clothing) as drab and unadorned. The attentive reader in the first half of the 20th century, however, would have already been taught an alternative view. Emil Vogt introduced Stone Age textiles from Switzerland into discussion, including ornate textiles from Wetzikon-Robenhausen³⁵³, in 1937. With great care and attention, he described Neolithic twining, netting and weaving techniques.

The colourful, sometimes checked textiles from the Iron Age salt mines at Hallstatt³⁵⁴ have also been known for a long time: some of them were recovered as early as 1849 and have been on exhibition in the Natural History Museum of Vienna for more than 100 years.

³⁵¹ Hallstatt: Hofmann-de Keijzer, Van Bommel and Joosten 2005, 59, 64. – Hofmann-de Keijzer *et al.* 2005, 924–925; 2013, 156. – Hochdorf: Walton Rogers 1999, 243–245. Altrier: Von Kurzynski 1996, 41. – Norway: Walton 1988, 153–154.

³⁵² Grömer and Rösel-Mautendorfer 2013, 412, 430, 414.

³⁵³ Vogt 1937, 52, fig. 84–86.

³⁵⁴ Hundt 1987. – von Kurzynski 1996. – Grömer 2013, 83–85.

People have always been skilled in applying different techniques to adorn, refine and improve the appearance of textiles, as the following list of decorative techniques shows. For this purpose, different coloured yarn material was used, as well as different supplementary techniques, the addition of foreign materials such as beads or metal, or decoration by sewing (embroidery). In Central European Prehistory, decorative techniques that were applied during weaving were generally preferred.

Even in prehistoric times, the design of textiles was bound to the prevalent style of the time. Patterns that were produced on textiles during the weaving process can also be found on other groups of materials. It has even been suggested that textile designs, for instance the structure that forms when making mats and baskets, were amongst the earliest decorative designs that then influenced all other areas. Gottfried Semper, a gifted architect of the 19th century, who, among others, designed the Natural History Museum in Vienna, remarked that textile art is the primary art (*'Urkunst'*) par excellence. In his comprehensive two-volume work entitled 'The style in the technical and tectonic arts' (*Der Stil in den technischen und tektonischen Künsten*) he wrote that *'all arts, not excluding ceramics, derive their types and symbols from textile art, whilst textile art itself arises completely independent and builds its types of itself or borrows them directly from nature'*³⁵⁵. Considering the 'braided band' design and patterns of angled hooks on the vessels of the middle Neolithic (Lengyel Culture, mid-5th millennium BC), one is inclined to agree.

Certain techniques such as embroidery, tablet weaving or different supplementary techniques in weaving also allow for transferring designs typical to the taste of their time onto the fabrics, just as they are found on ceramic vessels or metal objects³⁵⁶. Mutual influence among crafts with their individual options and constraints of design can be observed for prehistoric times as well.

³⁵⁵ Semper 1860. Drittes Hauptstück. Textile Kunst. A. §4. *'daß alle anderen Künste, die Keramik nicht ausgenommen, ihre Typen und Symbole aus der textilen Kunst entlehnten, während sie selbst in dieser Beziehung ganz selbständig erscheint und ihre Typen aus sich heraus bildet oder unmittelbar aus der Natur abborgt.'*

³⁵⁶ Grömer 2013, fig. 30. – Grömer and Stöllner 2011, fig. 3–4.

6.1 Weaving decoration: structure and spin patterns

The visual effect of structural patterns is produced by creating a specific fabric relief through weaving techniques or the use of different yarns. The first design elements for structuring the fabric surface are primarily the various binding techniques in weaving – they clearly stand out from the smooth, regular surface structure of a simple tabby weave. Simple design options include basket weave with its cube-shaped structure and different twill variants resulting in different diagonal structures. These, as well as repp and tablet weaving, have already been discussed together with the archaeological evidence for different types of looms.

Structural patterns on textiles also can be created by the use of different kinds of threads. From Öhningen-Wangen in Germany³⁵⁷, a late Neolithic linen web made of S-plied thread is recorded, which has a pattern effect caused by the use of some thicker threads, 2–6 threads together at a time in warp and weft. A fine wool textile with alternating one z-yarn and one plied yarn (S3z) in one system was found in the Late Bronze Age settlement at Staré Město (Czech Republic)³⁵⁸. The use of plied yarn thus creates a fine ribbed surface.

A special, decorative pattern very characteristic of the Hallstatt period is the **spin- or shadow pattern** (Fig. 97). This is possible because differently spun yarns (s- or z-twist) have specific visual effects; they appear lighter or darker depending on whether light falls parallel or at an angle on the twisted fibres. By arranging alternating groups of s- and z-yarn in a textile, a striped pattern is visible under appropriate lighting. This sophisticated tone-on-tone pattern is taken to the extreme by the use of s- and z-spun yarns in both thread systems – the result is a fine checked pattern.

For the manufacture of spin patterns, the threads have to be specially prepared. Good quality raw material, preferably combed, is needed to spin very smooth yarns to ensure that this special effect comes out well. Moreover, yarn of different rotational di-

³⁵⁷ Médard 2010, 206. Her pattern drawing shows a spin pattern of alternating S-plied and z-single yarn in warp and weft. On the photos just S-plied yarns are visible.

³⁵⁸ Belanová-Štolcová 2012, 309.

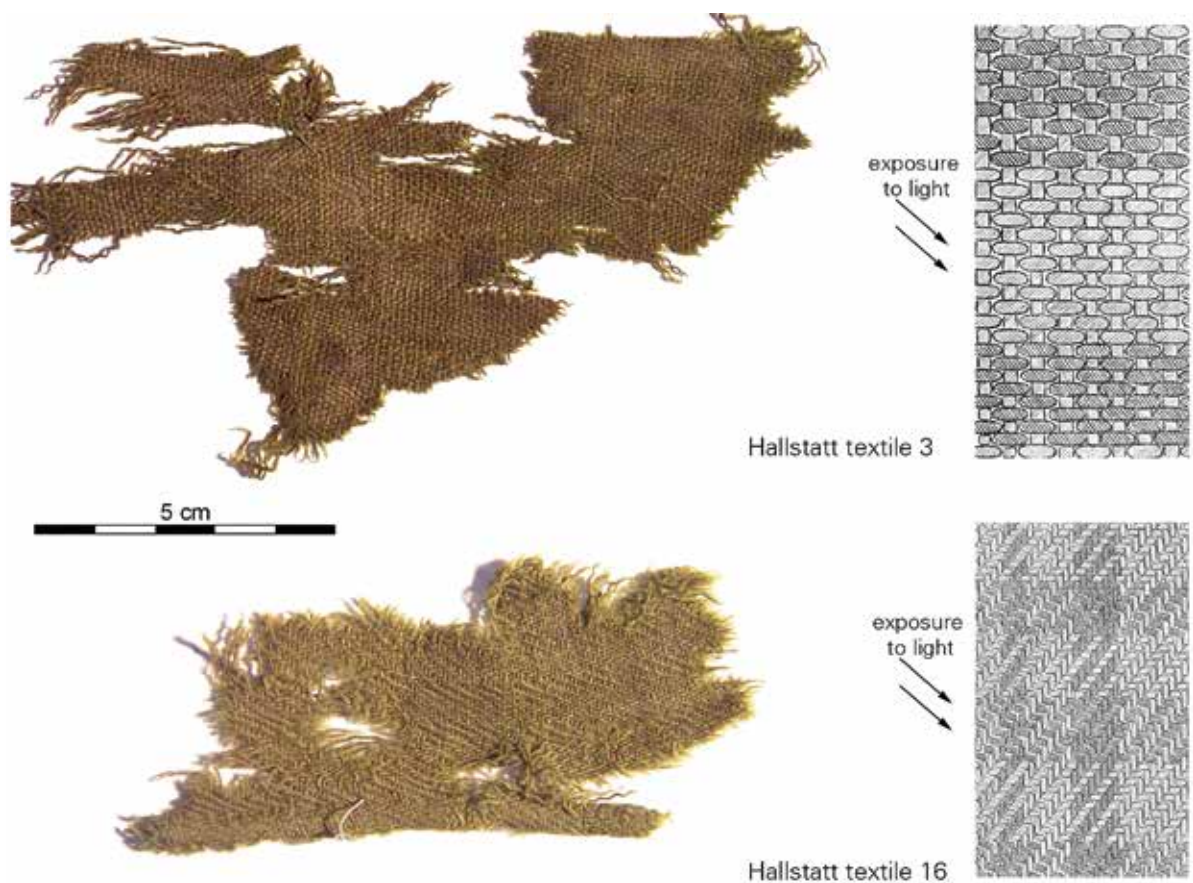


Fig. 97. Spin patterns from Hallstatt, Early Iron Age. Top: in one thread system, bottom: in both thread systems.

rections (s- and z-yarns) has to be produced. Special care also has to be taken when warping, since the pattern is determined by the grouped arrangement of the threads. The extra effort the spin pattern required was taken into account, although this fine patterning has no optical effect at a distance, but is only perceived at close range. Spin patterns, however, are not only distinguished by their sophisticated aesthetic effect, but they also enhance the cohesion of the weave due to the use of differently twisted threads. Spin patterns thus stabilise the textile and counteract rolling up and shape distortion.

Spin patterns were made with very sharply twisted single yarns and used in tabby, basket and twill weaves. They are extremely popular in the Early Iron Age³⁵⁹ and are often found in corroded

³⁵⁹ Banck-Burgess 1999, 53. – Bender Jørgensen 2005. – Grömer 2013, 81–83, fig. 28. – Gleba 2012, 228. – Möller-Wiering 2012, 131.

textile remains from graves as well as in the salt mines of Hallstatt. Before this type of design experienced its heyday in the Hallstatt period, experiments in the structuring of surfaces by using yarns of different spin rotation had already been conducted in the Late Neolithic and Middle Bronze Age. Examples³⁶⁰ were found at Mühlbach-Hochkönig/Mitterberg or the Bronze Age parts of the Hallstatt salt mine, both in Austria. Only one or two s-and z-yarns alternate in most of these cases.

Spin patterns lose their importance in the La Tène period in Central Europe, although isolated finds³⁶¹ come from the salt mines of Dürrnberg or Early La Tène period graves from Switzerland. They almost disappear and are not at all common during the Roman period in the Central European provinces³⁶². In contrast, spin patterns appear between 500 and 0 BC in Northern Europe and remain common during the Roman Iron Age³⁶³.

At the Roman fort Vindolanda, founded in Britain *c.* 85 AD, a striking juxtaposition of Iron Age and Roman textiles has been observed. A high proportion of the *c.* 600 textile finds may be argued to be products of weavers working in Iron Age traditions. They include checked and striped patterns achieved by contrasting coloured yarns or yarns of contrasting spin directions³⁶⁴.

6.2 Weaving ornaments: colour patterns

Patterns on large-sized textiles

The pattern and design of prehistoric textiles primarily follow the laws inherent in the craft: threads of different colours quickly result in stripes when yarns of different shades alternate in one thread system. This equally applies to dyed yarns

³⁶⁰ Cf. Grömer 2006b, fig. 6. – Grömer and Rösel-Mautendorfer 2013, Bronze Age catalogue HallTex 217, 225.

³⁶¹ Dürrnberg: Grömer and Stöllner 2009, 112. – Switzerland: Rast-Eicher 2012, 388.

³⁶² See Grömer 2014, 33–35.

³⁶³ Cf. Mannering *et al.* 2012, 103–111. – Maik 2012

³⁶⁴ Wild 2012, 454.

and different natural colours of sheep's wool. A check pattern inevitably arises when this principle is applied to both thread systems. The choice of the sequence and the number of different threads defines the appearance of the pattern.

Stripes as a decorative principle are known from the Late Neolithic period. These early stripe patterns, however, are made as pick-up weaving with floating threads and tone-on-tone (see Fig. 106, page 186). Stripes made of yarns of different colours are known from the Early Bronze Age. A striped linen textile from a rich woman's grave from Franzhausen, Lower Austria³⁶⁵, for example, dates to c. 2,000 BC (Fig. 200). The textile remnants were found in a bronze head dress and form a fine repp structure of flax with stripe pattern, discoloured and greenish from the corroded bronze (Fig. 98). Uniform groups of 6 strands of dark brown plied yarn alternate with wider blocks of bright, greenish brown threads. The fabric is very fine with 0.4 mm diameter S-twisted plied yarns in both thread systems and a fabric density of 17/7 threads per cm.

Bronze Age finds of colour patterns remain exceptions, but patterned fabrics were extremely popular in the Hallstatt period. They are no longer simply patterns with different natural shades, but colourful striped and checked designs with dyed yarns that have been combined effectively. According to recent dye analyses on the textiles from Hochdorf³⁶⁶ and Hallstatt³⁶⁷ (see chapter B5), weld was primarily used for yellow, woad for blue and orchil for red, a dye that can be produced from lichens, amongst others. Valuable, imported dyes are also among the colours used in the Hallstatt period, for instance the red colouring of the kermes scale insects, native to the Mediterranean. Various dyes and dyeing techniques were combined to achieve certain hues. Both fleece and yarns were dyed, for instance for striped or checked pieces. To achieve a homogeneous uniform colour for monochrome cloths and garments it was easier to use undyed yarns and treatment in dye baths after weaving.

³⁶⁵ Grömer 2006b, Grave 110.

³⁶⁶ Banck-Burgess 1999, 86–89. – Analyses by Walton Rogers 1999, 240–246.

³⁶⁷ Hofmann *et al.* 2005, 69–72.; 2013, pl. 2, fig. 55.



Fig. 98. Early Bronze Age linen fabric with stripes from Franzhausen in Austria.

The checks of the Iron Age became a trope in reports on the barbarian tribes in Central Europe in the centuries before the Christian era. According to Diodorus Siculus, a Greek historian of the 1st century BC: *'The clothing they wear is striking – shirts which have been dyed and embroidered in varied colours, and breeches, which they call in their tongue bracaë; and they wear striped cloaks, fastened by a brooch on the shoulder, heavy for winter wear and light for summer, in which are set checks, close together and of varied hues.'* (Diod., *Hist.* 5.30,1)³⁶⁸. The checks in particular are regarded as typical for the Celts, and an allegedly unbroken tradition is said to survive in the Scottish Tartans³⁶⁹. Checked patterns were,

³⁶⁸ Translation after: http://penelope.uchicago.edu/Thayer/E/Roman/Texts/Diodorus_Siculus/5B*.html (last accessed 31 August 2014).

³⁶⁹ The earliest example of a checked twill found in Scotland comes from a hoard with roman coins from Falkirk (last coin dates to 230 AD). Wincott Heckett 2012, 437. Scottish clan tartans are a relatively modern nationalist invention.

however, in Central Europe popular even before the formation of Celtic tribes in the Iron Age, as evidenced by colourful finds from the Iron Age areas of the Hallstatt salt mines and the blue and red checks on twill fabrics from the early Celtic princely grave of Hochdorf. Pre-Etruscan peoples of Italy also appreciated checks, as finds from the Villanovan necropolis Sasso di Furbara in Central Italy (8th century BC) demonstrate³⁷⁰. Furthermore, there are a number of checked fabrics amongst the garments from the northern European bogs of the pre-Roman and Roman Iron Age³⁷¹.

Hallstatt period textiles from the eponymous site give us plentiful insights into the particularly colourful textile art. Checks appear here in different versions and colours (Fig. 99)³⁷². Combinations of colour and spin direction patterns as well as checked patterns on twill are typical. Generous checks emerge from dyed warp and weft threads, woven in larger groups of colour-matched threads. This, for instance, can result in a high-contrast two-tone block pattern of brown and black checks (Fig. 99.5). Another piece of textile with a dark brown background in diamond twill was decorated with bright triple stripes (Fig. 99.6). On another example, olive green fabric in chevron twill with point repeat was decorated by checks made with wide double stripes in one thread system and a band of four thin strips in the other (Fig. 99.8).

Houndstooth and shepherd's check (Fig. 99.9–10) are also no modern inventions: they are formed by a colour change of groups of three to six bright and an equal number of dark threads of the warp and weft in twill weave. Through this weaving technique, the small checks do not appear like the blocks on a chess board, but have a characteristic pattern by optical extension of the corners of the checks. Different variants of these patterns are common in Hallstatt.

Interestingly, the checked and striped fabrics from Hallstatt are always only designed with two contrasting colours. The slightly

³⁷⁰ Banck-Burgess 1999, Hochdorf: 54. – Sasso di Furbara: 45, 231.

³⁷¹ Hald 1980. – Mannering *et al.* 2012, 104, fig. 3.9

³⁷² Grömer 2013, 83–85.

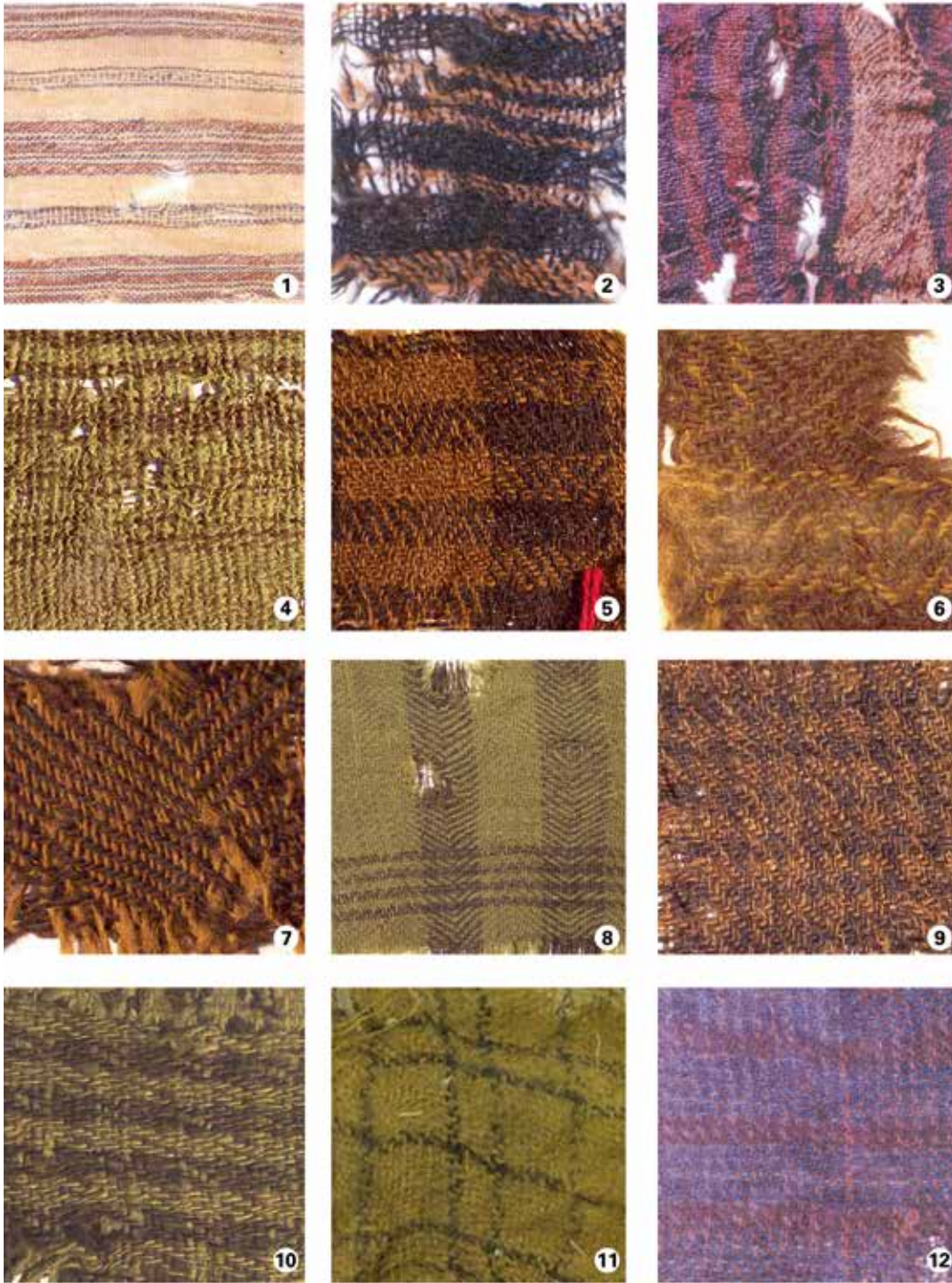


Fig. 99. Checked and striped fabrics from the salt mines Hallstatt (4–10) and Dürrnberg (1–3, 11–12), Iron Age.

later checks from Dürrnberg³⁷³, in contrast, sometimes incorporate three colours. An example is the fine, blue-yellow shepherd's check additionally adorned with red stripes (Fig. 99.12). Coloured striped fabrics are known from Iron Age Hallstatt, and in a wide variety from the salt mines at Dürrnberg (Fig. 99.1–3). The striped, multi-coloured fabrics from this site – like the few checked fragments – are designed usually as tabbies with vibrant colours, especially in the combinations yellow (natural colour), blue and red.

Repp bands: decorating with coloured warp

The same decorative principle of block-wise colour change in the warp was also used to make repp with colourful threads of different shades of colour. The use of different coloured warp threads is not very complicated, and stripes created through the structure of the weave have been detected in large-size textiles dating to the Neolithic period. Nevertheless, coloured patterned repp bands are absent in the archaeological material from Central Europe before the Hallstatt period.

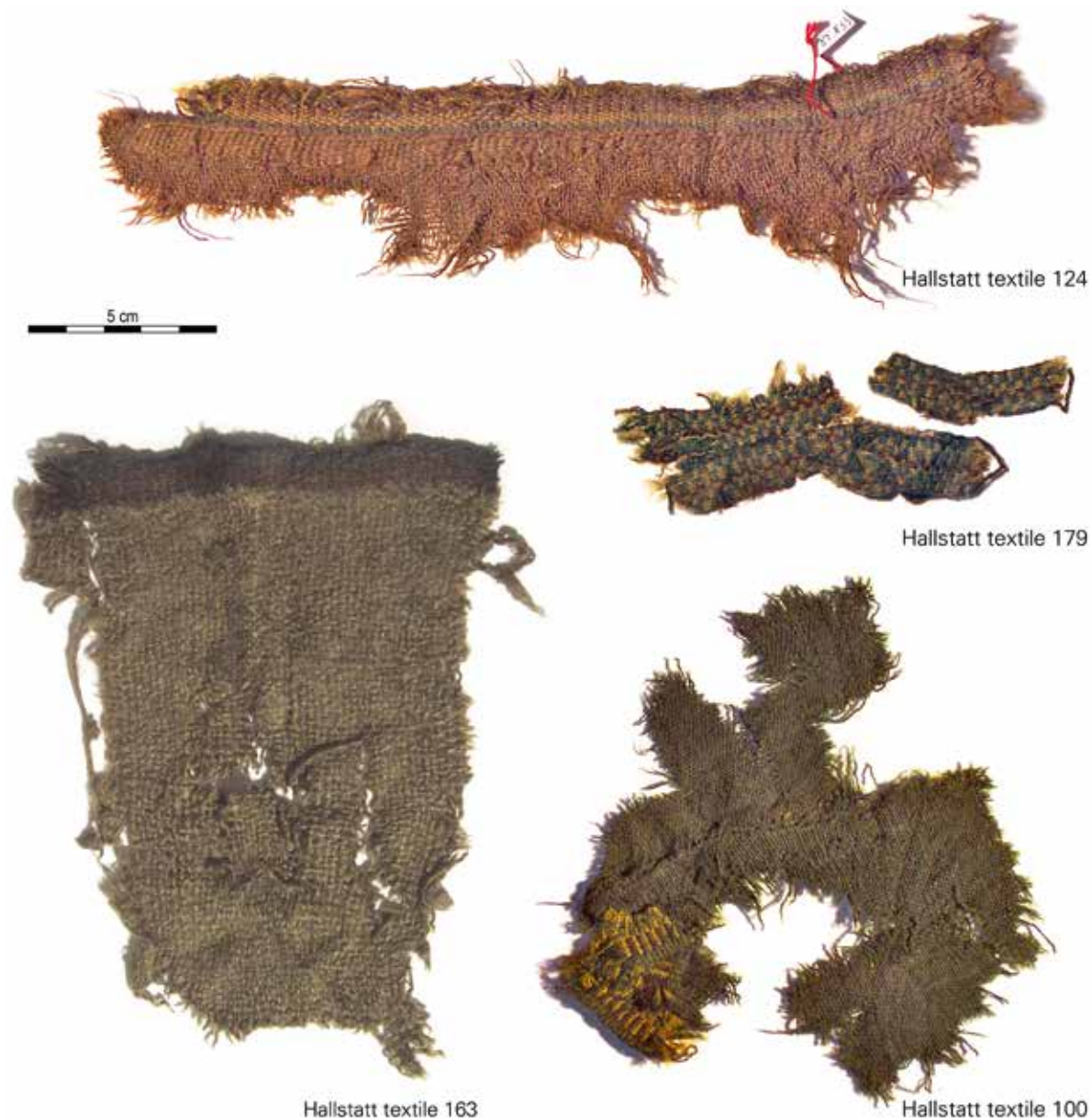
The textiles from Hallstatt³⁷⁴ clearly demonstrate how even simple repp bands can let pleasing patterns emerge (Fig. 100). Different coloured warp threads determine the pattern by their arrangement and sequence. The weft is uni-coloured; it cannot be seen because of the dense arrangement of warp threads. Colour patterned repp borders occur in different variants in Hallstatt: in transverse and longitudinal stripes or as checked motifs in polychrome design. Primarily yellow, green, blue and brown tones are found.

The typical design of repp bands was also transferred back to larger textiles. Fragments of a large warp-faced tabby fabric made of wool were discovered in grave VI at the Hohmichele³⁷⁵, showing the ribbed structure with a striped pattern caused by the use of different coloured threads. Repp bands are not only

³⁷³ Stöllner 2002, pl. 6; 2005.

³⁷⁴ Grömer 2013, 85–87.

³⁷⁵ Hundt 1962, fig. 5, pl. 33–34.



discovered as textile finds, but also in contemporary representations. People were often represented in their (festive) clothes on the works of situla art (see chapter E). Incised bands and borders can often be identified at the hems of garments, which may indicate repp by the dashes in the illustrations (e.g. Fig. 221.29–30). It is evident from the finds from Hallstatt that coloured repp bands were used to finish and reinforce textiles.

Fig. 100. Colour patterned repp bands from the salt mines in Hallstatt, Early Iron Age.

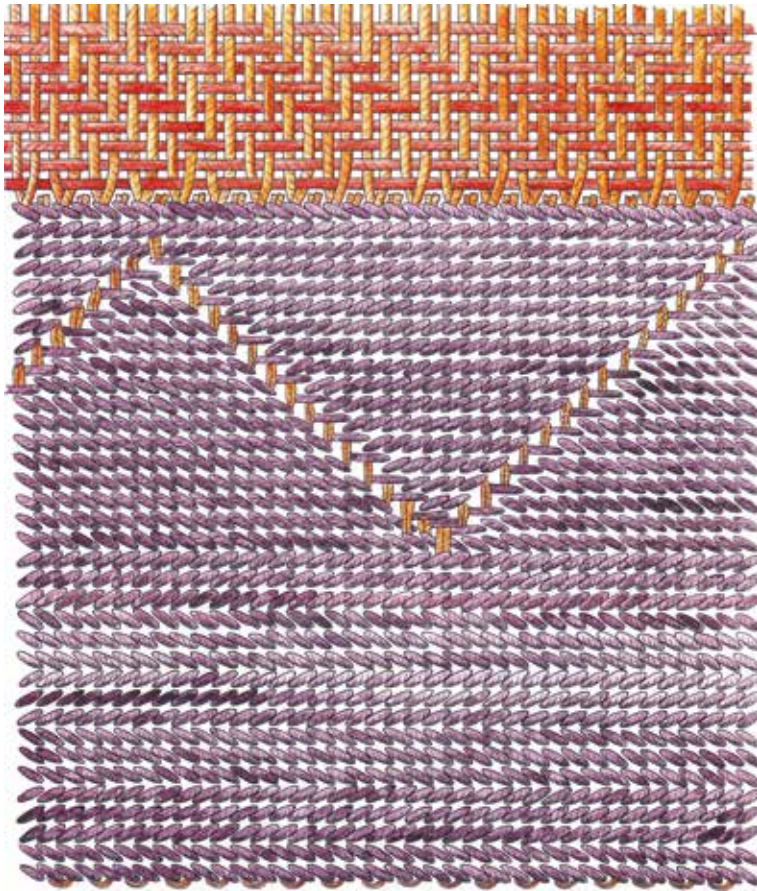


Fig. 101. Structure pattern from Cloak 2 from Verucchio in Italy, Early Iron Age.

Patterned tablet weaves

Tablet weaving is a traditional handcraft to make patterned bands. Great creativity is inherent in the craft, which manifests itself in the many possibilities of the pattern design. Essential for the design motif are the choice of colours for the warp, but also the way the tablets are placed and the direction of rotation during weaving. The creative use of this technology allows the design of various decorative motifs. Simple tablet woven patterns are, for instance, stripes. They arise when for each tablet a different colour of the warp threads is used. By continuous rotation of the tablets, a structure of

different coloured 'strings' arises arranged next to each other. This simple principle of decoration first appears at the end of the Middle Bronze Age in Europe, as a new find from Hallstatt testifies³⁷⁶ (Fig. 53). Striped design is further found in early Iron Age bands from Hallstatt as well as from the '*Prachtmäntel*' of the Nordic Iron Age³⁷⁷.

Structural patterning is also a possible decorative principle inherent in tablet weaving. Cloak 2 from Verucchio in Italy has a wide tablet woven border with a triangular pattern, formed by changing the turning direction of the tablets. In addition, it has stripes formed by tablets turned in opposite directions (Fig. 101)³⁷⁸.

³⁷⁶ Grömer 2013, 87.

³⁷⁷ Schlabow 1976, e.g. fig. 119, Thorsberg. – Möller-Wiering and Subbert 2012, fig. 6.7.

³⁷⁸ Ræder Knudsen 2012, fig. 11.2–11.5. – von Eles 2002, tav. XXI/1, XXII.



Dürrnberg textile 4470



Hallstatt textile 123



Hallstatt textile 186



Hallstatt textile 152

Fig. 102. Complex tablet weaves from Hallstatt and Dürrnberg, Iron Age.

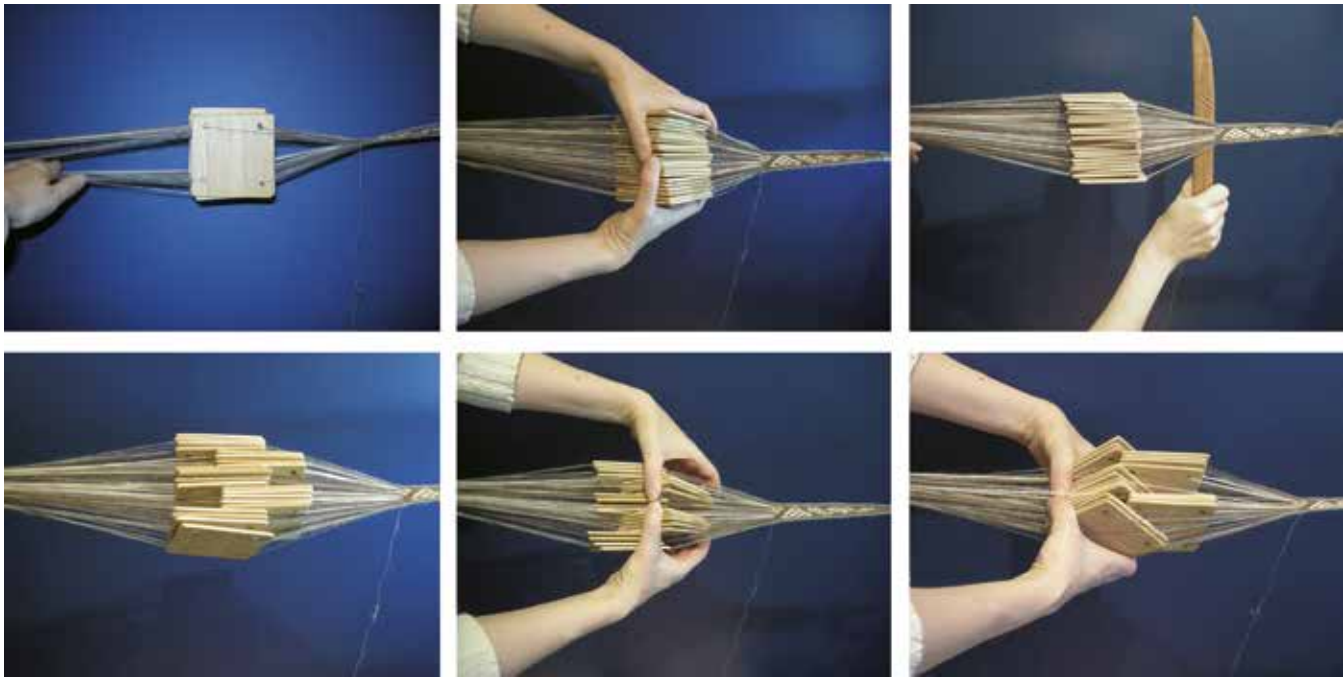


Fig. 103. Tablet weaving: producing complex patterns by turning individual tablets back and forth.

Similarly, there are colour patterns that have been woven in a complex manner. From the Iron Age onwards, the production of complex motifs in tablet weaving technique was mastered³⁷⁹. Prominent examples³⁸⁰ can be found in the Hallstatt period elite grave from Hochdorf and in the salt mines of Hallstatt or Dürrnberg. In most of the tablet weaves from other sites, including the patterned one from Apremont in France, the original colour has unfortunately not survived. Only the binding structure can be reconstructed from these pieces. The recognisable changes in the rotation patterns were most likely not only structural patterns with uni-coloured yarns, but included coloured warp threads to form a colourful pattern lost to us today.

The motifs of patterned tablet weaves from the Iron Age salt mines in Hallstatt³⁸¹ (Fig. 102) include meanders, filled triangles and diamonds, which are repeated in sections. The patterns come

³⁷⁹ Pattern techniques from prehistoric Central Europe with catalogue: Grömer and Stöllner 2011.

³⁸⁰ Hochdorf and Apremont: Banck-Burgess 1999, 70, fig. 40–41. – Ræder Knudsen 1999. – Hallstatt: Grömer 2013, 87. – Dürrnberg: Grömer and Stöllner 2011, 109–111. – Ræder Knudsen and Grömer 2012.

³⁸¹ For detailed descriptions of the reconstructions of the tablet weaves see Grömer 2005a.

to best effect by the choice of colours, which often includes a yellow-beige colour pattern on dark, two-coloured background (green and dark brown shades). The simple technique of tablet weaving has already been discussed (see pages 104–107). For complex designs such as the ones used for bands from Hallstatt, the individual tablets are moved separately (Fig. 103). In one stage of the work process, certain tablets have to be turned back or forwards, before the weft thread is passed through the shed. By flipping the tablets over, other effects may be created.

An example of a complex pattern of an Iron Age band from Hallstatt (Fig. 104) provides a case in point. Reworking the pattern showed that the meander and triangular motifs of the featured band are a far cry from the simple basic rotational dynamics of tablet weaving. The combination of different forward and back rotations of the tablets at each individual entry testifies to the spatial understanding and concentration on the part of the craftsperson. Today, reworking the pattern after written instructions is not too difficult; errors can be repaired if there are accurate, detailed instructions. These complex rotations necessary for the patterns (in the complex band HallTex 123 there are more than 70 different rotation sequences), however, raise the question of how this was done without written instructions as a memory aid in prehistoric times. Were these complicated patterns planned, the rotational sequences denoted and perhaps passed on with the assistance of songs and rhymes?

Anthony Tuck notes in comparison with ethnographic evidence:

‘Fabrication processes of complex woven patterns require the commitment to memory of a substantial amount of numerical and colour-related information. Virtually any pattern or design that is incorporated into the weave of a textile can be reduced to numeric sequences, given the structure of warp and weft. Modern observation of traditional weavers in India and Central Asia suggests that this numerical information may have first emerged in the form of memorized, rhythmic chants that allowed the weavers to both remember patterns and reproduce them as frequently as required. Moreover, the linguistic and poetic associations between weaving and singing preserved in several Indo-European languages also suggest that these chants were, at some

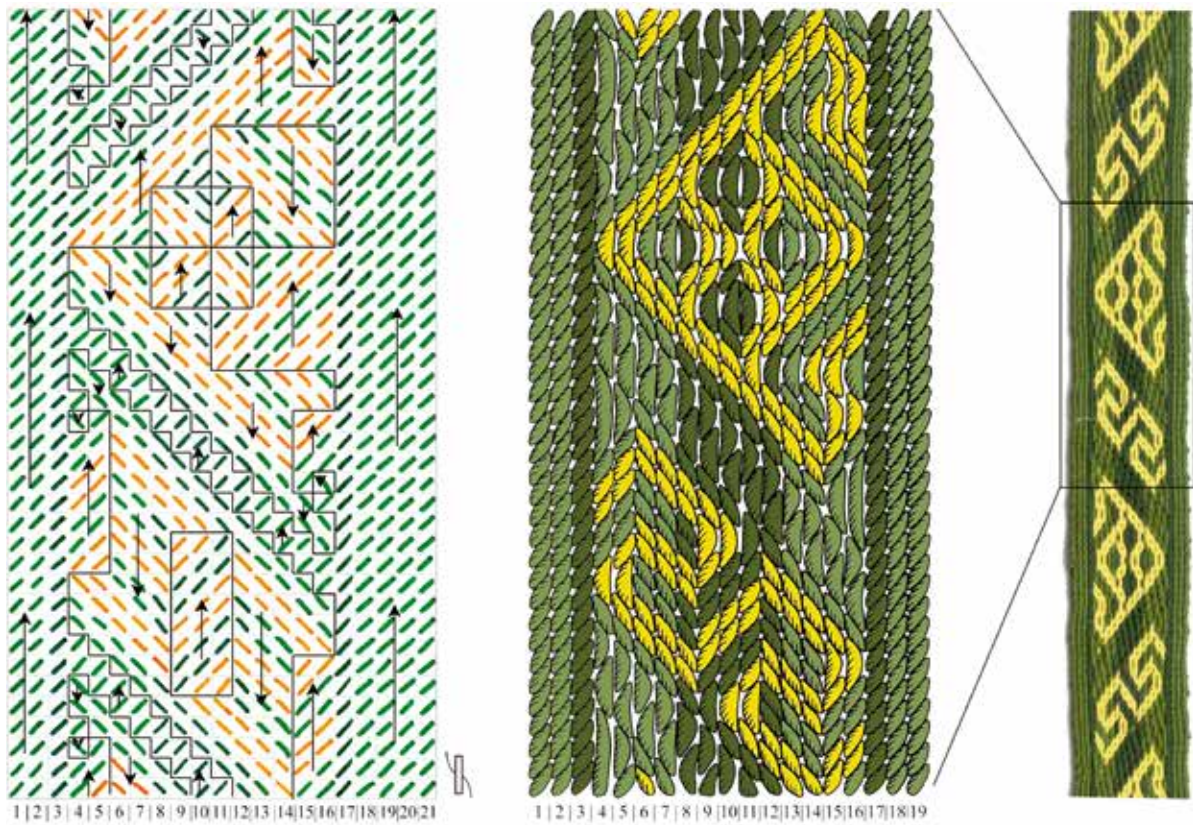


Fig. 104. Tablet woven textile from Hallstatt, Early Iron Age: pattern for Hallstatt textile 123.

*point, sources of rhythmic or possibly metrical narration in their own right'*³⁸²

Another issue that arose from experiments to rework the tablet weaves from Hallstatt³⁸³ concerns the labour investment and time needed to weave the bands (Fig. 102). By pure theoretical analysis of the pattern it would not have been possible to recognise that it took three times as long to produce band HallTex 123 than for the middle band (HallTex 186), and six times as long as for the bottom band (HallTex 152). This could also indicate how valuable the individual textile bands might have been.

³⁸² Tuck 2006, 539.

³⁸³ Grömer 2005a, 88–89.



Particularly striking examples of tablet woven pattern come from the princely grave of Hochdorf³⁸⁴ (Fig. 105). The motifs of these bands are strongly geometric, for instance opposing diagonal structures, angle hooks, meanders such as merlon meander diamonds, braided bands and swastikas, usually bounded by diamonds. The patterns are usually arranged in zones, with regular sequences, some with marginal limits. Some of the tablet weaves from Hochdorf were manufactured with a different technique to the Hallstatt finds, as the tablet weaving specialist Lise Ræder Knudsen impressively demonstrated. Although 4-hole-tablets were used to produce them, only two holes were actually stocked with thread, and the tablets were turned in opposite directions.

Fig. 105. Tablet woven textiles from the princely grave of Eberdingen-Hochdorf in Germany, reconstructions.

6.3 Floating threads in warp or weft

Simple tabby woven fabrics were decorated in pick-up weaving with floating thread systems for a fine tone-on-tone relief pattern already at the end of the Neolithic. The earliest textile

³⁸⁴ Banck-Burgess 1999, 125. – Reconstruction of the weaving technique: Ræder Knudsen 1999, 75–79. – Banck-Burgess 2012a, fig. 5.3–5.5.

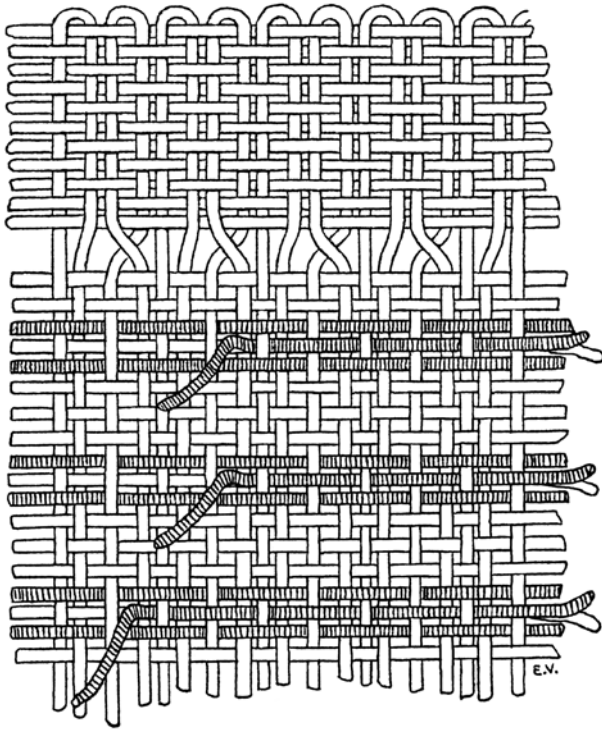


Fig. 106. Wetzikon-Robenhausen in Switzerland: Late Neolithic textile with relief pattern.

with a striped pattern in relief is known from Wetzikon-Robenhausen, Switzerland³⁸⁵ (Fig. 106) and dates to the Late Neolithic. The stripes on Textile 3 and 11 were made by additionally inserted weft threads, which float over the tabby woven base fabric in a 'twill-like' manner. This gives the appearance of dense horizontal stripes with relief effect in the weave. These striped patterns were entered by hand during the weaving process.

A fine, 2.09 m long and 6.8 cm wide band of woven flax has been found in Molina di Ledro, northern Italy³⁸⁶, dating to the Early Bronze Age (Fig. 48). This band with a tabby base weave is probably a belt which has been decorated in pick-up weaving with a diamond pattern at the ends. The decorative motif is repeated

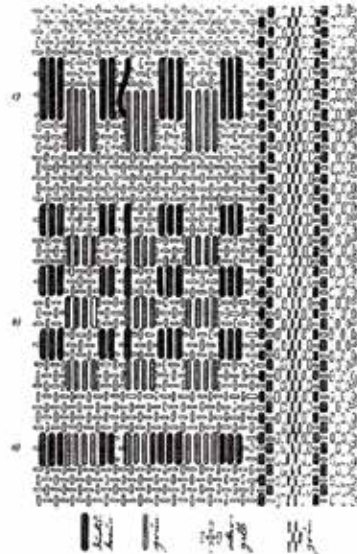
on two segments of the ground weave and creates concentric lozenges. During the fabric production, the pattern was designed with floating weft threads, which zonally skip the warp. It has been demonstrated that simple sticks have been used to weave the ornament.

A new way of weaving colour patterns appears in the Iron Age – weaving with floating warp threads parallel to the main web, a complementary warp-weaving. A solid weave with repp-like surface made of black wool, a belt band, comes from the Early Iron Age parts of the salt mines of Hallstatt³⁸⁷. The weft of horsehair gave the textile stability (Fig. 24). The decoration was first described as 'brocade chess-board pattern' in reddish brown on black wool. Recent dye analysis revealed that

³⁸⁵ Vogt 1937, 32–33. Textile 3: 72–73, fig. 84–86. Textile 11: 73, fig. 108–109. – Médard 2010, 211, 224

³⁸⁶ Bazzanella *et al.* 2003, 161.

³⁸⁷ HallTex 20. First description Hundt 1959, 85–89, fig. 12–13, pl. 10, 26, 27. – Grömer 2013, 85–86, catalogue 339–341.



1



2

the pattern consisted of at least four different colours – today they are too dark to see them clearly. Some red and yellow components were found in the brown threads; green threads were also dyed blue with woad. The 4.2 cm wide belt features a colour pattern with floating warp threads, a chequer board design of reddish-brown, green and black threads in the centre of the band. There are ten dark brown plied yarns with a higher density than the other colours on both sides next to the selvages, forming stripes (Fig. 107.2).

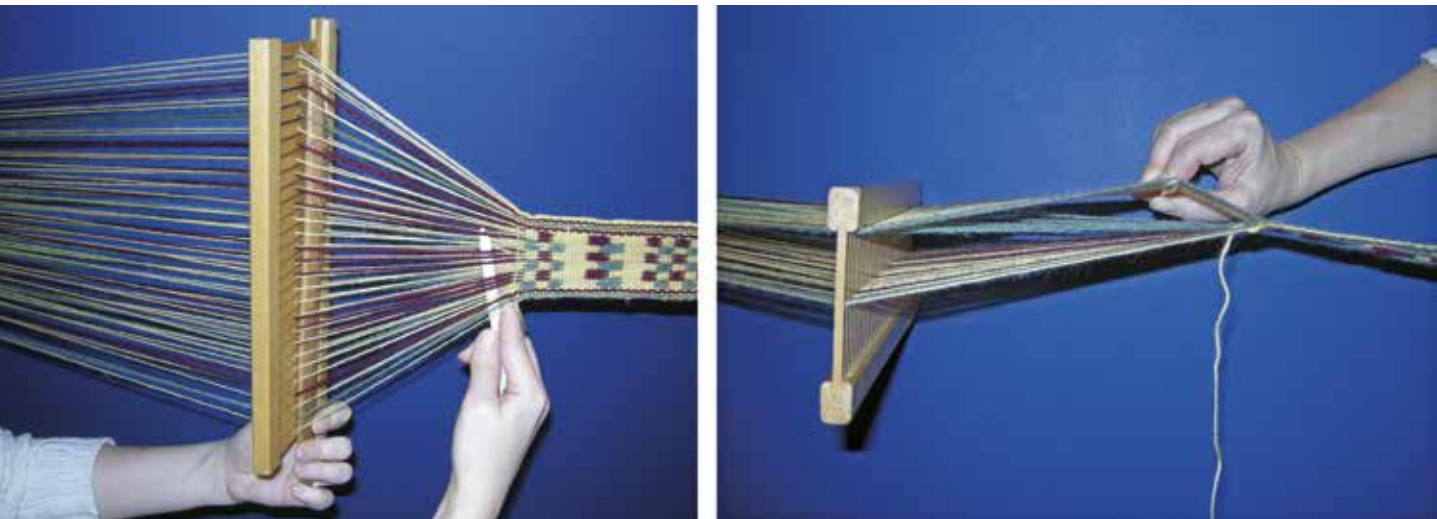
Fig. 107. Bands with floating warp threads: Dürrenberg (1), Hallstatt, Austria (2), Iron Age.

Another band from Dürrnberg³⁸⁸, which was found wrapped around a broken tool handle at its discovery in the salt mine (see chapter D), was unfortunately lost in the turmoil of the Second World War. Detailed descriptions, drawings and photos, however, suggest the tabby woven base fabric was ochre-coloured; additional floating dark brown and green threads result in a checkerboard and stripe pattern (Fig. 107.1). Wool was specified as the base material.

For both bands additional warp threads in contrasting colours have been used to complement the base fabric. These were woven in, creating a pattern, which appears in zones on the front and the back side. Technically speaking, these Iron Age textiles show a compound weave, a weave with three thread systems (main warp, pattern warp and weft)³⁸⁹. The main warp can be designed in different basic weaves (*repp*, *tabby*, *etc.*). The Iron Age artisans were able to add decorations by the additional thread system of the pattern warp. These threads form a considerable colour contrast to the base fabric.

Fig. 108. Weaving a band with floating warp patterns.

Several practical tests have revealed that such fabrics can be produced with different techniques. In the simplest variant, the



³⁸⁸ Klose 1926, 346–348, fig. 1: scheme of the pattern. – Photo of the fabric with wooden handle see Kyrle 1918, fig. 60–61.

³⁸⁹ Terminology following Emery 1960, 163.

holes or slots of the rigid heddle had double threads (pattern threads and yarns of the base weave) passing through them, moved by means of little supplementary rods (Fig. 108). In another weaving method for this pattern, a multiple shaft weaving device is used, wherein the pattern threads are fixed to special heddle rods and brought into the desired position. In weaving, there are many possible ways to achieve a given pattern. Although the pattern is created directly during the weaving process, it almost looks like embroidery.

6.4 Inserted elements

Playfully incorporating decorative elements by knotting and braiding in a twined or woven textile surface was already part of the creative repertoire of the Stone Age. Various methods to incorporate decorative elements during weaving of textiles have been developed very early on³⁹⁰.

Weft wrap technique ('flying shuttle technique',
"Fliegender Faden")

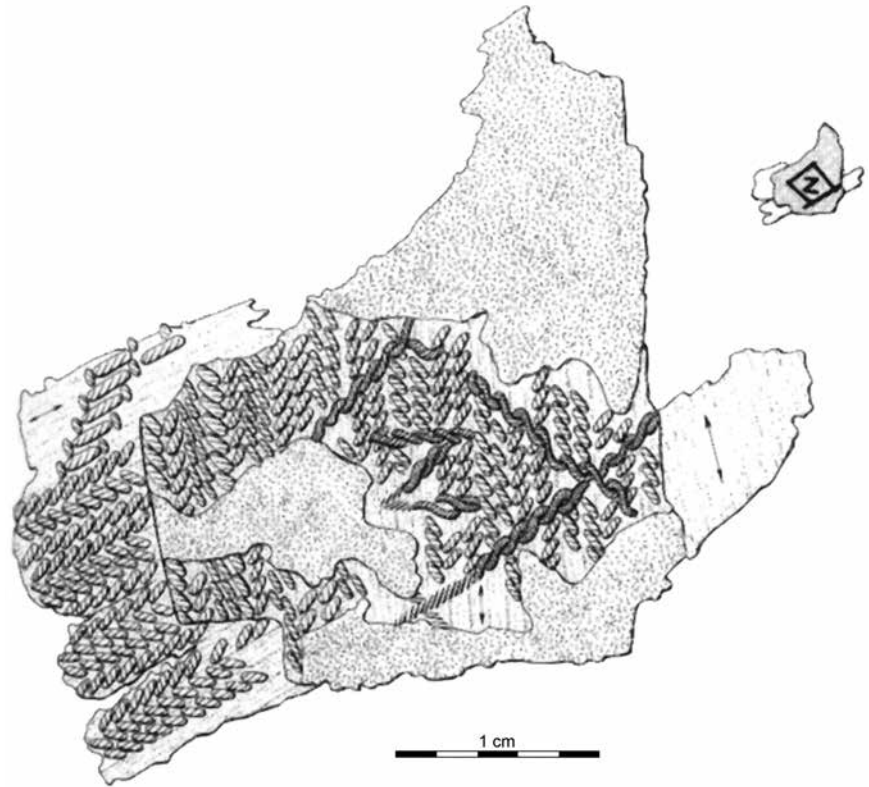
Among the many possible pattern techniques, one that also works with floating threads, is the introduction of motifs by means the weft wrap technique during weaving. These patterns appear similar to embroidery. Johanna Banck-Burgess³⁹¹, however, discovered upon close examination of some finds from Hochdorf, that the pattern thread was added to the textile by wrapping around the warp threads in the fabric during weaving.

Sumptuous weaves in this technique were mainly found in late Hallstatt period elite burials, such as the one from Hochdorf and

³⁹⁰ Médard 2010, 2012. – Rast-Eicher 1997. – Vogt 1937.

³⁹¹ Banck-Burgess 1999, 55–63 detailed description of the technique. – Banck-Burgess 2012a, 142, 148.

Fig. 109. Eberdingen-Hochdorf, Germany: tablet woven textile from the princely grave with a decorative motif in weft wraps, late Hallstatt period.



Grave VI from the burial mound Hohmichele³⁹² near the fortified hilltop settlement Heuneburg. They underline the high degree of skill involved in the textile production. The repp textile from Hohmichele, Grave VI, was organised in ornamental zones, decorated by the weft wrap technique and finished with tablet woven selvages. The preserved fragment shows a band of meanders with hooks as well as another decorated band with double squares on their tips, in which a swastika was set; triangles were woven into the interstices of this repeating pattern. Fragments of tablet weaves were found on a red shroud from Hochdorf, which was also decorated in the weft wrap technique.³⁹³ Diamonds and an element in the form of the letter Z are visible (Fig. 109).

³⁹² Hundt 1962, 206, taf. 36–39. Here described as embroidery. Detail photos see Banck-Burgess 1999, fig. 19–22.

³⁹³ Banck-Burgess 1999, fig. 58; 2012, fig. 5.11.

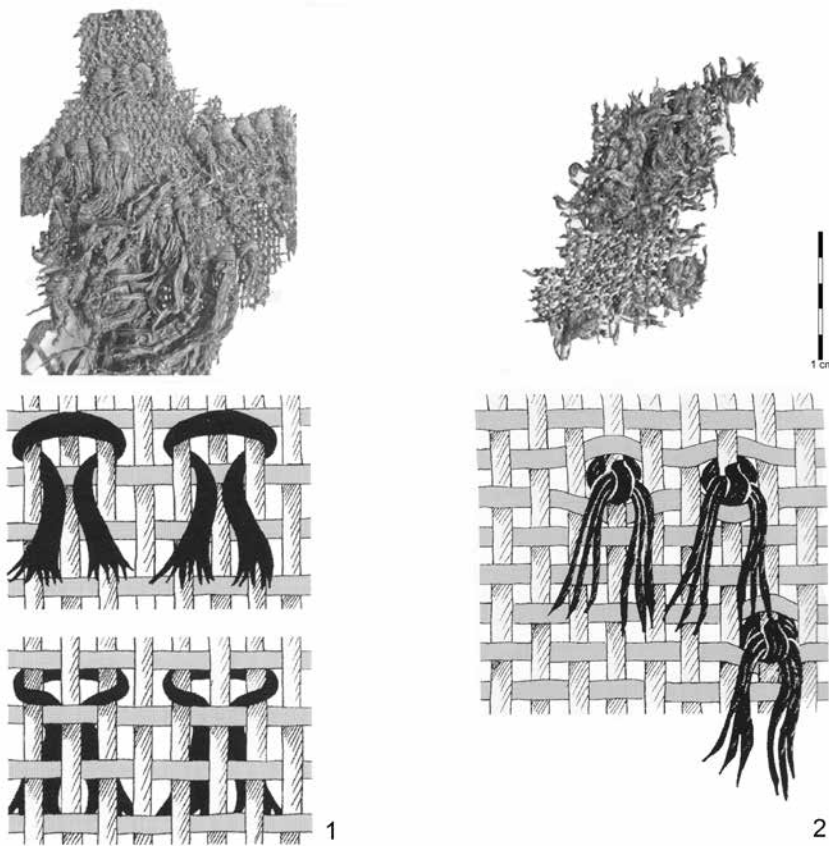


Fig. 110. Late Neolithic textiles with pile from Switzerland. Zürich-Mythenquai (1), Twann-Bahnhof (2).

A particularly well known textile, considered a prime example of the weft wrap technique, is the Bronze Age weave from Irgenhausen, Switzerland³⁹⁴. Recent research has demonstrated, however, that the ornament was made as embroidery rather than in weft wrap technique (see pages 201–202). This confusion makes clear how similar the weft wrap technique and embroidery appear.

Incorporation of fringes and wool pile

The various techniques of creating pile go far back to the Neolithic period³⁹⁵. Already the surfaces of various textiles in twining and matting technique were given a fur-like appearance

³⁹⁴ Rast-Eicher 2012, 381. – Vogt 1937, 76–90.

³⁹⁵ Médard 2010, 163, 164, 203, 214.

by the incorporation of additional fibres. Pile was added to a weave of linden bast from Zürich-Mythenquai (Corded Ware Culture, dendrochronologically dated to 2680 BC). Pile binding on woven or twined bast textiles not only increased the protection against the cold and wind, but also against rain. Late Neolithic and Early Bronze Age weavers incorporated pieces of thread into their textiles in several creative ways, as examples from Zürich-Mythenquai and Twann-Bahnhof suggest (Fig. 110). This is a technique also used for twined and plaited fabrics. The wetland settlements of northern Italy³⁹⁶ in particular revealed many finds. Various twisted fringes knotted in textiles were found on several Early Bronze Age textile fragments from Lucone di Polpenazze.

Fringed borders on the textiles from Lucone di Polpenazze in Italy are interpreted as having symbolic significance, as suggested for fringed rectangles depicted in the rock art of the Val Camonica³⁹⁷.

The insertion of additional wool pile, piles that were woven into the textile to create a furry surface effect, is another design element. An Iron Age find from Hallstatt³⁹⁸ (Fig. 111) incorporated wool pile as loops during weaving. These form a pile on one fabric side, whilst the other side of the fabric has a smooth plain woven surface. The additional fulling of this olive green fabric, decorated with a coloured repp band, was most likely intended to increase the warming effect.

This incorporation of wool pile into textiles is a design principle well known in the Nordic Bronze Age. It served as a so-called '*Krimmerbesatz*', a decoration for hats or cloaks, easily visible for instance on the man's cloak from Trindhøj, Denmark³⁹⁹. Fine pile units of two to three wool threads twisted and knotted together were also stitched into the surface of domed hats which were found in a number of men's graves. Were these hanging flocks

³⁹⁶ Bazzanella *et al.* 2003, Lucone: 188. Molina di Ledro: 170–171.

³⁹⁷ Bazzanella 2012, 208.

³⁹⁸ Grömer 2013, 79–80, Iron Age catalogue HallTex 163.

³⁹⁹ Bender Jørgensen 1986, 289. – Broholm and Hald 1940, 27–29. – Mannering *et al.* 2012, fig. 3.8.



and threads of wool meant to imitate fur? Was the reason for this significant additional effort the need for warmer fabrics or was the decorative element in the foreground?

Fig. 111. Hallstatt, Early Iron Age: fabric with loops on one side, matted surface and sewn-on repp border. Front and back.

Incorporation of metals

People even used metal elements to beautify cloth in the course of the various Bronze Age developments of textile decoration. According to Peter Wells⁴⁰⁰, the sparkle or shininess of an object can be an important aspect of attraction and be applied to hold visual attention. The effect of glitter, especially of gold, dazzles viewers who see them in bright light, may it be direct sunlight or the light of a large fire. Metals reflect light, whereas textiles do not – the interaction with light works in different ways.

In the Late Bronze Age, between the 12th and 9th century BC, some finds of gold threads, which originally may have been

⁴⁰⁰ Wells 2008, 45.

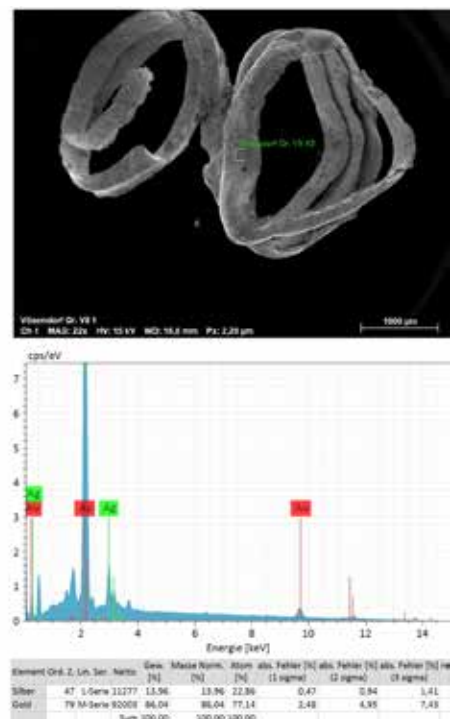


Fig. 112. Gold thread from a Late Bronze Age urn grave from Vösendorf, Austria.

integrated into textiles, appear in today's Austria and Hungary⁴⁰¹. They represent remains from shrouds or clothing deposited together with the cremated remains in ceramic urns, as well as in settlements and gold hoards.

Fine, delicate gold wires were discovered in two Late Bronze Age urn graves from Vösendorf (Fig. 112). Since the finds were rescued under difficult circumstances during the Second World War, there are unfortunately no detailed descriptions or reports. Perhaps these gold wires were once incorporated into a magnificent cloth which was given to the dead as a grave furnishing.

A hoard from Óbuda in Hungary (Fig. 113) dating to the 11th century BC contained gold threads (the base textile has disappeared), larger gold plates, gold hair fillets and gold discs. This combination can be understood as remnants of a high ranking person's garments.

⁴⁰¹ Vösendorf, Graves 10/VII and 11/VIII: Talaa 1991, fig. 33. – Óbuda: Barth 1988/89. – Várvoölgy: Müller 2012, 117–119.



In a recent Late Bronze Age hill fort excavation at Várvölgy in Hungary, a gold hoard was found containing thin gold ribbons produced by sophisticated technology. It is suggested that the heavily coiled bands were used on a garment.

Fig. 113. Gold threads from Óbuda in Hungary, c.1,100–1,000 BC.

Gold threads were also used as luxurious items to decorate textiles of the wealthy strata of society in the Early Iron Age. Hohmichele, Grave I⁴⁰², contained an 11.5 cm wide fringed belt interwoven with gold sheet strips. Fine, 0.2–0.3 mm wide gold threads were also found in Grafenbühl⁴⁰³ (late Hallstatt period) with impression marks that indicate a tabby woven base fabric. The sharp folds recognisable on the strips speak for the use of a very dense, slightly thicker repp-like fabric. The bends on the gold strips from Grafenbühl suggest their use as brocading pattern weft. Most likely, the stripes floated over several warp yarns of the base fabric and thus achieved a complex pattern.

⁴⁰² Hundt 1962, 211, pl. 1/4.

⁴⁰³ Banck-Burgess 1999, 39, fig. 10.

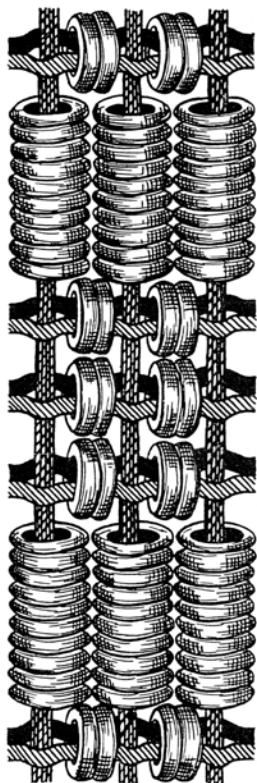


Fig. 114. Brno-Židenice in Moravia: Early Iron Age fabric with metal rings.

The phenomenon of the use of gold threads is well known from the Eastern Mediterranean and the Near East⁴⁰⁴. Gold threads were incorporated into fabrics, and gold bracteates or appliqués were sewn onto garments by Assyrian or Babylonian gold weavers. Early literary sources, written down at the beginning of the 1st millennium BC, for instance the Old Testament (Exodus 39.3) or the Homeric Epics, speak of gold textiles. The *Odyssey* praises the golden robe of Eos (Homer, *Od.* 14.468-502) and in the *Iliad* (which historians date from the end of the 9th century BC) hundreds of golden tassels on Athena's aegis are mentioned (Homer, *Il.* 2.530). The spiral ends from Vösendorf may be interpreted in this light.

The very thin and delicate gold threads were attached very carefully to the textiles. The finds from Vösendorf show that golden strips were wound more or less loosely around an organic core (which did not survive), in this case thicker cords. Sometimes the golden strips were wound around broader elements – such as textile bands or leather strips of 7–8 mm width (Óbuda, Várvolgy). These could even have been woven in or attached to the ready woven band (Fig. 113).

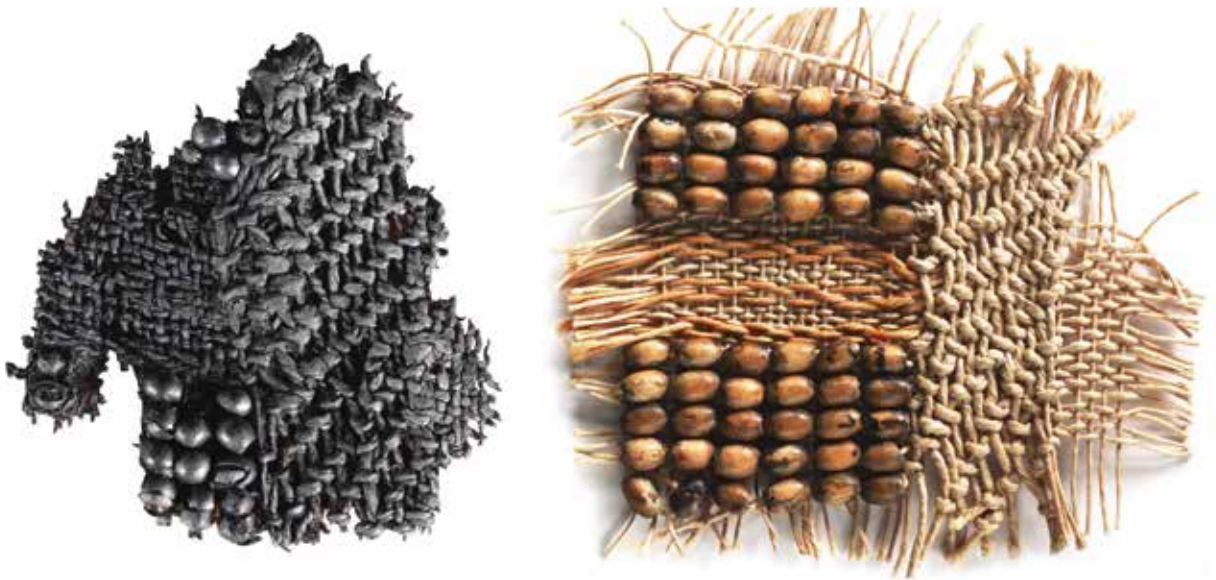
The incorporation of metal rings into textiles during weaving is first found on textiles dating to the Early Iron Age (Ha C). A well-known find from Brno-Židenice⁴⁰⁵ of the Moravian Horákov Culture was found in association with an inhumation grave; hundreds of bronze wire rings were closely fixed to the warp and weft thread system of thin, woollen plied yarn to form patterns. The double weft wrapped the warp and led through the rings (Fig. 114). Assemblages of rings packed densely together have also been found in contemporary graves from Mairersch in Lower Austria⁴⁰⁶.

The ring decoration in the famous early La Tène grave of the 'princess' from Waldalgesheim deserves to be mentioned. Bronze wire rings of different diameter and thickness, still in their original

⁴⁰⁴ Gleba 2008c.

⁴⁰⁵ Hrubý 1959, 33–37, pl. 6–7. Vilém Hrubý interprets them as fragments of chainmail, which is rather doubted by Hans-Eckart Joachim (Joachim 1991, 117).

⁴⁰⁶ Berg 1962, pl. 5/2 (Grave 26), 21/1 (Grave 72) and 27/1 (Grave 86).



context through oxidation, have been preserved⁴⁰⁷. The threads running through the rings were determined as S-twisted yarns of 0.4 mm thickness in black wool. The rings have apparently been arranged in various ornamental zones, woven or braided in. A band-like warp-faced tabby woven from black wool had dense rows of spirals wired in the middle and a series of transverse bronze wire spirals at the outer edges. Another pattern zone was made of fine, parallel wire tubes connecting to rows of smaller tubes arranged crosswise; they were also fixed with plied yarn of black wool. Overall, the find is interpreted as part of a breast adornment, which consists of several zones of patterns.

Fig. 115. Late Neolithic textile from Murten in Switzerland, Swiss National Museum (Inv. No. A-11008). Original and reconstruction.

Incorporation of organic elements: beads or seeds

Organic materials that people found pretty and appealing were also incorporated in textiles while weaving, leading over to the discussion on appliqués. A combination of different techniques can be found on the Late Neolithic example from Murten in Switzerland⁴⁰⁸ (Fig. 115). Although it is unique in its

⁴⁰⁷ Hundt 1995, 141–147, fig. 104–106.

⁴⁰⁸ Vogt 1937, fig. 62–64.

design, it gives good insights into the mind-set and creativity of Stone Age craftspeople. They tried, unencumbered by technical norms, to combine the different groups of material and manufacturing methods to create something specific. In the example from Murten, plaiting was employed to combine two pieces of tabby woven fabric. The textile is decorated with seeds, which were given openings by obliquely cutting the two ends. The seeds were sewn to the textile with needle and thread, as evidenced by the fact that at one point, a thread of the fabric is pierced. Next to the two zones with seed embroidery three stripes of patterning with floating weft are also visible.

Tabby woven fabrics with inserted organic elements (plant seeds, *Lithospermum*) are also preserved from the Late Neolithic and Early Bronze Age wetland settlements of Switzerland and northern Italy. The textile remnant of Molina di Ledro, site Ledro A⁴⁰⁹, for example, is decorated with plant seeds; unfortunately it is too fragmented to recognise a specific pattern.

6.5 Patterning with needle and thread

Creativity with needle and thread is almost endless. From the Bronze Age at the latest, the art of sewing with different types of stitches was already perfected (see pages 218–222). All the techniques of hand-sewing of pre-industrial times, even to this day, were in principle already developed. The sewing of clothing can be traced back to the Palaeolithic, when predominantly leather and skins were processed. What could be more natural than to sew on decorative elements or to create patterns by cleverly guiding a thread with a needle in a leather or woven surface – to embroider?

Appliqués

The most impressive find of appliqués from very early times is the 25,000-year-old burial of two children from Sungir in Russia⁴¹⁰,

⁴⁰⁹ Bazzanella *et al.* 2003, 168.

⁴¹⁰ Bader and Lavrushin 1998.



c. 200 km east of Moscow. Thousands of bone beads were found in the grave, which could be accurately reconstructed as parts of decorative attachments to clothing.

Fig. 116. Hallstatt, Grave 360. Watercolour painting of the Early Iron Age grave context and jewellery (only 150 of the original 3,000 bronze buttons are still preserved).

Across times and cultures, bone, bronze and sometimes even gold objects were found in graves that may have served as sewn-on decorative elements, *i.e.* as applied to clothes. It is impossible to deliver a comprehensive list in this context; three beautiful Early Iron Age contexts will suffice as examples. Very early on, especially precious finds came to light during the excavations in the Hallstatt cemetery, for instance during the 1846 to 1863 excavation campaigns by Johann Georg Ramsauer. His reports are characterized by meticulous descriptions and documentation (Fig. 116) using water colour drawings. In the description of Grave 360 the excavator noted: *'A skeleton four feet deep in soil and firm gravel in a 7 feet long and 3 feet wide clay coffin [...], the whole skeleton from the upper body until the pelvis covered with ¼ inch sized bronze buttons, stuck to the bones. The whole corpse must have been wrapped in an embroidered half-coat, which, after the traces must have been of leather or an unknown fabric ... [Comm.: the enumeration of individual pieces of jewellery follows] ... then*

*the cloak embroidery with 3,000 bronze buttons.*⁴¹¹ This constitutes a fine example of how a garment was decorated with thousands of little bronze appliquéés. From the old descriptions, however, it unfortunately remains unclear whether the base carrier was leather or textile.

The elite Grave X of Mitterkirchen also dates to the Hallstatt period. In Burial Chamber 2, the grave of a woman, thousands of bronze knobs were discovered covering the upper body and legs (Fig. 137.3). These may also be interpreted as parts of a splendid cloak (see pages 390–391).

The ceremonial garments from the princely tomb 89 in Verucchio, Italy⁴¹² are of interest in this context. Rows of paired stitching holes were found on the semi-circular cloaks decorated with tablet-woven borders around the edges. They appear to be the traces of appliquéés, as their diameter and the distance between the two holes correspond exactly to the perforation present in the bottom side of a series of cone-shaped amber knobs found in the tomb. The cloak's edges were presumably decorated with the beautiful amber buttons. The decorative elements fell off when the sewing thread, probably of plant fibre, disintegrated.

Embroidery and pattern sewing

Embroidery is a well-known phenomenon in the ancient Mediterranean, in Egypt or Archaic and Classical Greece (e.g. Koropi).⁴¹³ In Central European prehistory embroidered patterns are generally rarer than those directly created during weaving. Recent research, however, has revealed more and more findings: under the microscope, it is often possible to distinguish

⁴¹¹ Original records of J. G. Ramsauer in the year 1846: *'Ein Skelet 4 Fuß tief in erde und auf festen Schotter gelegen, in einem 7 Fuß langen und 3 Fuß breiten Thonsarg [...], über den Oberkörper bis Hüften um das ganze Skelet ¼ Zoll grohse Bronzknöpf an die Knochen angeklept waren, muhs die Leiche in einen gestickten Halbmantel gehüllt gewesen sein, welcher nach den vorhandenen Spuren von Leder oder anderem unbekanntem Stoff gewesen sein dürfte ...* [comment: this is followed by a description of the jewellery] ... *dann von der Mantlstickerei bei 3000 Bronzknöpf.*' after Kromer 1959, 94.

⁴¹² Stauffer 2012, 245–247, fig. 10.4–10.6.

⁴¹³ Egypt: Barber 1991, 121, 153, 159–162. – Greece: Spantidaki and Moulherat 2012, fig. 7.16.



Fig. 117.
Reconstruction of the
decorated textile from
Pfäffikon-Irgenhausen
in Switzerland, Bronze
Age.

between an embroidery thread, piercing through the threads of the weave and a wrapped or floating pattern thread, running between the warp threads.

Several Early Bronze Age fragments of flax fabrics in tabby weave with embroidered loops as pattern-forming elements have been found in the pile dwelling of Molina di Ledro, Northern Italy⁴¹⁴. Similar surface embroidery covers the sleeve and neck opening of the Bronze Age blouse from a female oak coffin burial at Skrydstrup, Denmark⁴¹⁵.

The well-known patterned fabric of Pfäffikon-Irgenhausen⁴¹⁶ (Fig. 117) from a Swiss lake dwelling was first published jointly with Stone Age finds from Switzerland. Towards the end of the

⁴¹⁴ Molina: Bazzanella *et al.* 2003, 170. '*ricamo a festoni*' = festoon embroidery. – Skrydstrup: Broholm and Hald 1940, fig. 138; Mannering *et al.* 2012, 101.

⁴¹⁵ Broholm and Hald 1940, 97, fig. 138.

⁴¹⁶ Vogt 1937, 76–90, fig. 112–150. – Rast-Eicher 2003, 226–227; 2012, 381.

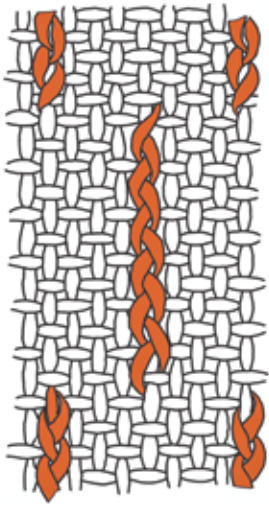
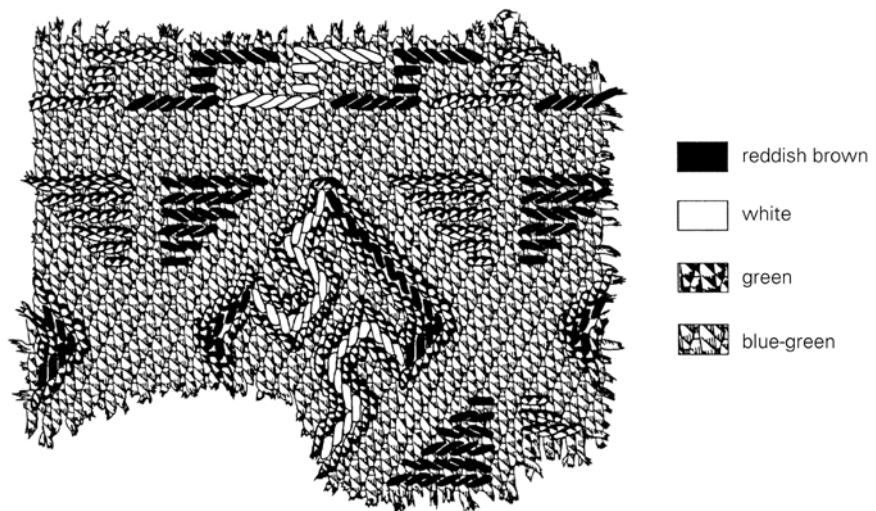


Fig. 118. Glauberg in Germany, Tumulus 1, Grave 1. tabby textile with pattern threads in plait-like structure, c. 400 BC.

20th century, the age of this unique piece was accurately determined by ¹⁴C-dating. With a calibrated date of 1685–1493 calBC it can now be dated to the transition from the Early to the Middle Bronze Age. The textile, preserved in several fragments, was manufactured in tabby weave with flax threads of 0.5 mm diameter. It is patterned in a complex way, which gave rise to many ideas as to how it had been produced. Emil Vogt, who first described the textile in detail in 1937, suggested brocade, patterned with floating threads, creating triangles and chequer board motifs. He also included schematic drawings of the complex way the threads were guided – they partly float in weft direction, partly in warp direction, but also diagonally. The direction depends on the different pattern zones, which are very varied and complex. The pattern consists of large, filled triangles, separated by horizontal bands with broad checkerboard pattern, surrounded by bands in small checks. It has been suggested that the textile had been decorated in a weft wrapping technique using floating threads (*fliegender Faden*). According to the latest research, however, it is a piece of embroidery⁴¹⁷, as some of the threads had been pierced.

Recent investigations of the princely tombs at Glauberg⁴¹⁸ (date c. 420/380 BC) unveiled some new patterned textiles of interest.

Fig. 119. Dürrenberg, Austria: twill fabric fragment from the salt mine with pattern, Early La Tène period.



⁴¹⁷ Rast-Eicher 2012, 381.

⁴¹⁸ Balzer, Peek and Vanden Berghe 2014, fig. 6.



Fig. 120. Embroidered fabric from Nové Zamky in Slovakia, La Tène period.

In tumulus 1/grave 1 a distinctive fabric was found (Fig. 118) among the other grave goods of the early Celtic warrior. It is a dense tabby textile with a half-basket-weave border and decoration of regularly situated pattern threads that show a plait-like structure. It seems feasible, that this kind of pattern was made with needle and thread after the fabric was woven.

Among the Iron Age textile finds from the salt mines of Dürrnberg/Hallein⁴¹⁹ (Fig. 119) was a decorated fragment which also gave a hint to its process of manufacture. It has a twill base fabric with a coloured pattern showing S-hooks, carried out in green, white and reddish brown threads. There was a central pattern zone of merlon meander as well as triangles in reddish brown and green in the spandrels. The way the threads were guided also suggests embroidery as the technique rather than weft wraps.

⁴¹⁹ Von Kurzynski 1998, fig. 8.

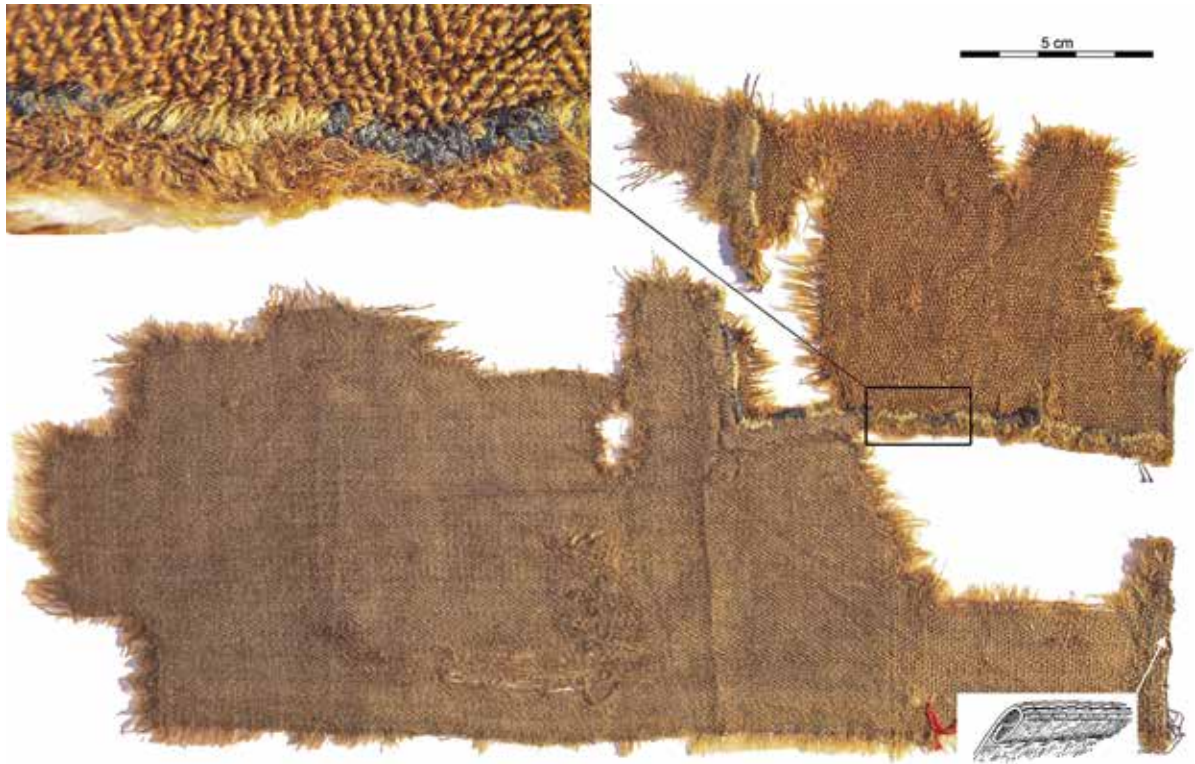


Fig. 121. Hallstatt salt mines: Early Iron Age textile with decorative stitching.

A clear example of embroidery is the well-known textile that had been stuffed into a leg ring made of bronze sheet (see chapter D), found in a early La Tène grave from Nové Zámky⁴²⁰ in Slovakia (Fig. 120). The tabby woven flax fabric has very distinct puncture holes in which some embroidery threads of red wool are still preserved. Some gathering of the textile along the stitches can be observed. It is certain that this is a piece of embroidery rather than a textile decorated in floating thread technique, because the threads in the latter technique would have a smooth surface and the pattern threads would not leave large holes. The pattern of Nové Zámky was described as an S-pattern or as interlocking trumpet motifs. The embroidered motif appears less angular than the strong geometric woven patterns. The motif of the embroidery, the trumpet pattern, is typical of the early La Tène art style.

⁴²⁰ Pieta 1992. – Belanová 2005, fig. 3, 4 and colour pl. 20.

Decorative stitching from the salt mine Hallstatt⁴²¹ (Fig. 121) can also be considered embroidery in the broadest sense. On a large piece of textile, a rectangular part was carefully attached and the seam on the front side was covered with slip stitches, which were executed in two colours, blue and white, for a decorative effect. The same textile also carries four rows of stem stitches on the rolled hem, again in blue and white to match the decorative design of the slip stitches.

The earliest embroidery known from Britain is a twill fabric in a La Tène burial at Burton Fleming. The textile had an elaborate border, which was composed of a band in plain weave with closely packed weft alternating with a checked pattern created on the intervening areas of twill by needle-inserted threads⁴²².

6.6. Painting on fabrics

In many prehistoric cultures, the use of colour pigments played a major role. It is one of the oldest ornamental techniques; first traces of the use of colour go back to the Neanderthals. Various objects painted with patterns, and especially the impressive cave paintings at Altamira and Lascaux⁴²³, demonstrate the importance of colour images even for Palaeolithic people. The most common examples of colour from archaeological contexts are painted ceramic pots. In Central Europe, the Middle Neolithic Lengyel Culture⁴²⁴ is famous for shapely ceramics with sophisticated incised and painted patterns (Fig. 122). Red and yellow from ochre, white from calcite, or kaolinite clays (titanium oxide) and black from charcoal were used and applied in geometric motifs.



Fig. 122. Painted pottery from Herzogenburg in Austria, Middle Neolithic.

⁴²¹ Grömer 2013, 88–89. – Rösel-Mautendorfer 2013, 115–116, Iron Age catalogue HallTex 64 and 153.

⁴²² Crowfoot 1991, 119–120, 125.

⁴²³ Clottes 2003.

⁴²⁴ Urban 2000, 80–92.



Fig. 123. Clay stamps 'pintadera' from Stillfried-Ziegelei and Hadersdorf, Austria, Middle Neolithic, c. 4,500/4,600 BC.

circular design and square criss-cross-pattern are known from Hadersdorf and Stillfried/Ziegelei in Austria (Fig. 123). The latter stamp dates to the Lengyel Culture and on the face side still remains of red pigments (red ochre ?) can be identified. This object has been used to stamp circles with red colour. Pintadera with more elaborate design can be named from early Copper Age sites like Zwerndorf in Austria, Drama in Bulgaria or Caverna delle Pollera and Arma dell'Aquila in Italy (Fig. 124). We can see dots arranged in rows or zig-zag lines, sometimes accompanied with lines; spirals and lines composed to intricate designs. The habit to use such stamps for decoration maybe originated in the Mediterranean region.

There are plenty of reasons to suspect that clothing made of textile or leather might have been similarly adorned with painted or printed décor. The smooth surface of a tabby weave is actually ideal as a base for painting. The lack of contemporary textile finds with painting, however, means this idea cannot be substantiated.

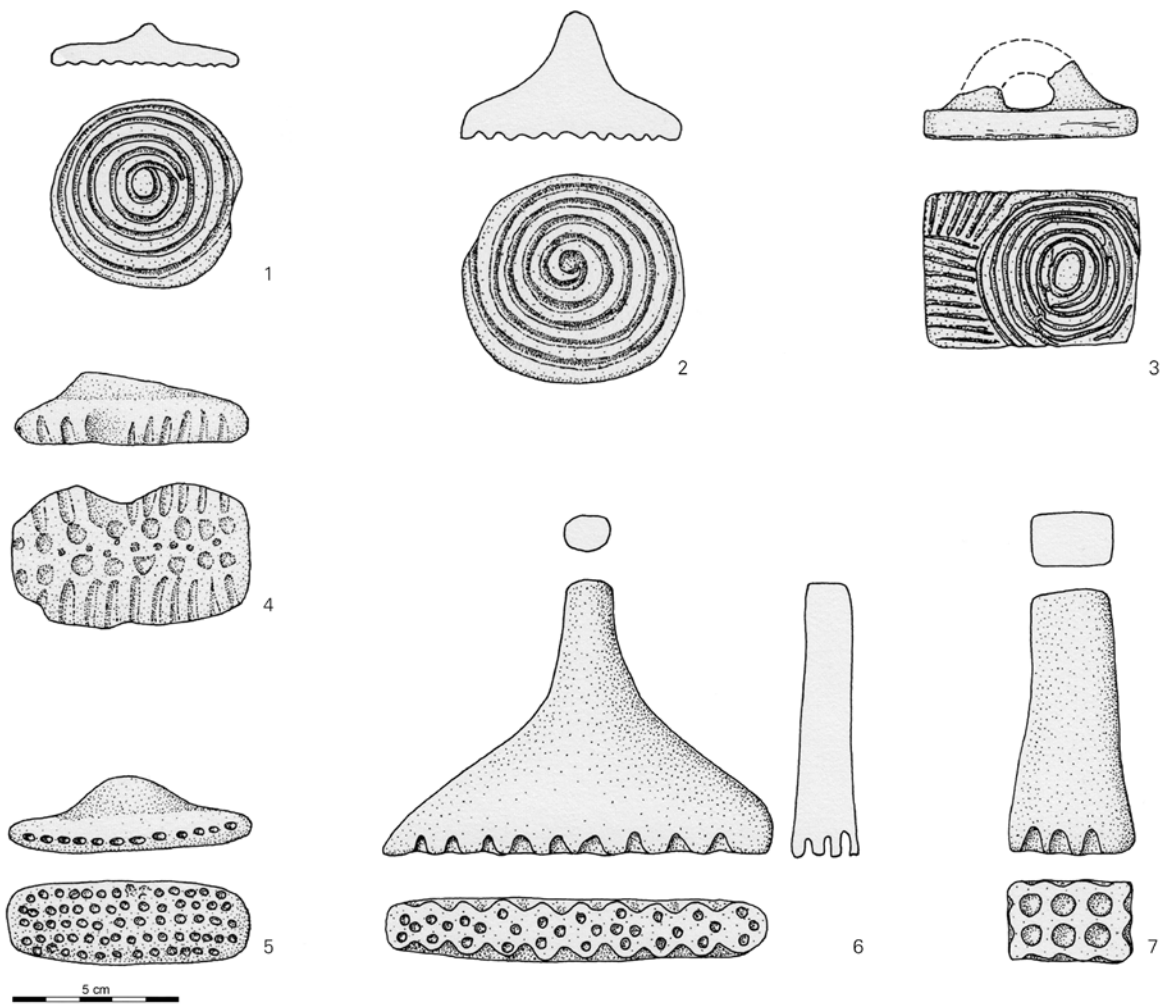
Also the Iron Age Hallstatt Culture, for example, was strongly inspired by colour. Strong contrasts, such as the black-red-paint on ceramics are characteristic for this period⁴²⁶. In textile

Coloured daub – remnants of house walling – even suggests that the dwellings were colourfully decorated. A female figure from Falkenstein in Lower Austria is decorated with a painted pattern on the lower body (Fig. 179).

It has sometimes been suggested that the little clay stamps (*pintadera*) found all over Neolithic Europe⁴²⁵ could have been used equally well for printing cloth (textile or leather) or for decorating human skin. From Middle Neolithic, clay stamps with

⁴²⁵ Von Duhn 1927/1928. – Austrian finds: Lenneis *et al.* 1995, fig. 47/11. – Ruttkay 1993/1994.

⁴²⁶ *E.g.* Kern *et al.* 2009a, 121. – Urban 2000, 271, 274.



craftsmanship, the design principle of strong, deep colours was implemented by heavy treatment of base textiles in dye baths or weaving generous colour patterning with dyed yarns. Painted fabrics have not yet been discovered among the numerous excellently preserved coloured fragments from the Austrian salt mines. It is easy to understand that the less well-preserved, mineralized fragments of textiles from graves also did not reveal any painted colour.

The lack of painted fabrics may be explained by the fact that any possible applied paint dissolves under moist conditions where textiles are preserved (such as in wetland settlements, swamps or salt mines). Nevertheless, the researchers of the Centre for

Fig. 124. Clay stamps, early Copper Age, c. 4,300–3,900 BC. Dietsberg, Austria (1), Salmano, Bulgaria (2), Drama, Bulgaria (3), Caverna delle Pollera, Italy (4), Arma dell'Aquila, Italy (5), Zwerndorf, Austria (6–7).

Textile Research in Copenhagen succeeded in finding evidence of a painted textile in a recent analysis of Iron Age bog finds from Denmark⁴²⁷. A complete rectangular cloth with a painted pattern of wavy lines was discovered in Ømark in Denmark, dating between 390 and 200 BC. Is this a singular find or an indicator of substantial gaps in the archaeological evidence? We do not know.

Recovery of painted fabrics is more likely under dry preservation conditions, for example from Egypt⁴²⁸ or Greece⁴²⁹. There remain rare finds, most likely due to the state of research and preservation. Most finds were unearthed on the Crimean peninsula, then belonging to the Greek Empire. The floral, ornamental or figural ornaments on clothing as depicted on Greek vases could have also be achieved by other techniques, for instance kilim techniques (tapestry weaves), which have been found in graves of the 5th to 4th century BC, *e.g.* from the so-called royal Tomb of Philip II at Vergina⁴³⁰. For these, coloured weft threads are used which are only passed through the shed to the extent the pattern requires.

7 Finishing of fabrics

The finishing of fabrics includes all steps of the production sequence that take place after taking the textile off the loom and serve to enhance their quality⁴³¹. They contribute significantly to the appearance of the finished product. Different techniques of finishing are employed depending on raw material and the intended use. According to Klaus Tidow⁴³², the former head of

⁴²⁷ Friendly comment by Ulla Mannering. Project 'Textile and Costume from Bronze and Early Iron Age in Danish collections', painted textile mentioned in Mannering *et al.* 2010, 266.

⁴²⁸ Barber 1991, 145–146. The earliest painted textile is a pre-dynastic (first half of the 4th millennium BC) cloth found in a tomb at el-Gebelein, Egypt. The plain weave was painted in red, black and white with scenes of boating, hunting and funeral rites.

⁴²⁹ Pekridou-Gorecki 1989, painted textiles: 50, fig. 26. – See also Banck-Burgess 1999, 62–63. Catalogue p. 227–229. Sites: Kerameikos, Koropoi, Lefkandi and Vergina.

⁴³⁰ Spantidaki and Moulherat 2012, 195–296, fig. 7.17.

⁴³¹ Gleba and Mannering 2012, 17. – *Cf.* Wild 1970, 84–85; 1988, 57–58.

⁴³² Tidow 2005.

the Textile Museum Neumünster in Germany, the most important methods for treating wool fabrics in pre-industrial times are teasing the surface, raising the nap, washing, fulling, drying, trimming the surface and pleating. For linen fabrics, bleaching and smoothing were common procedures. As Tidow emphasises, there is little evidence for finishing fabrics in Prehistory, as there are few conclusive archaeological finds, pictures or written sources.

For archaeological textiles, it is difficult to decide if visually recognisable features in their present state represent conscious steps of finishing; they could have also arisen from use and secondary use as well as from deposition and decomposition in the soil.

7.1 Finishing wool fabrics

According to medieval records and images, **teasing the surface** was used to remove contaminants from the textile and compensate for irregularities. This was achieved with an iron, tweezers-like teasing device. Tweezers are indeed sometimes found in Iron Age graves⁴³³ as well, but these multifunctional devices were most probably used for cosmetic or medical purposes. Efforts to establish a direct relationship between textiles and tweezers have been unsuccessful for Central European prehistory.

By **raising the nap**, a fine fibre-pile was produced on the surface of wool fabrics⁴³⁴ to make them both softer and warmer. The device used for this process is either the head of the cultivated teasel (*Dipsacus fullonum*) or a brush with needles, as shown on a Roman wall painting from Pompeii⁴³⁵. In the Roman world, the raising was also done with a board covered with hedgehog skin. The hackling board discussed on pages 72–73 (Fig. 31) would also serve this purpose. Subsequently, the raised nap was trimmed with shears until it was even.

⁴³³ E.g. graves from Dürrnberg: Pauli 1978, 260–261.

⁴³⁴ Goldmann 1990.

⁴³⁵ Cf. Wild 1970, 180.

Fulled wool textiles are characterised by a strong surface compression and felting. Sometimes such characteristics can be traced on archaeological finds. Whether this surface structure was induced deliberately by fulling or occurred accidentally by use, perhaps also during the storage in the ground, must be determined separately for each individual piece. Among the Bronze Age and Iron Age textiles from the salt mines of Hallstatt, some pieces appear to have been deliberately fulled⁴³⁶. Their surface is fulled so strongly that the woven structure is no longer clearly visible (Fig. 125). Further fulled textiles are known from the Early Bronze Age site Unterteutschenthal in Germany, from Castione dei Marchesi in Italy or from the garments of the Nordic Bronze Age⁴³⁷.

The first step in the fulling process⁴³⁸ is the addition of a fulling agent such as fuller's earth (hydrated aluminium silicates) or stale human urine to clean fat from the wool. The woven material then needs to be kneaded, stomped and pounded in wet and warm conditions until the surface is matted and condensed. The degree of fulling can be intentionally controlled, and depends on the intensity of the fulling process. The textile shrinks during fulling, as the wool fabric is compressed in both the warp and weft directions; resilience and abrasion resistance is thus enhanced. The fabric becomes denser, thicker, water resistant and very durable. Fulled wool textiles are still worn throughout Central Europe, especially in inclement weather. Most popular are the '*Loden*' cloaks of the Alpine areas in Austria⁴³⁹.

Fulling is also evidenced in written sources from Roman times, as the separate profession of the fuller (*fullo*)⁴⁴⁰ existed. These craftsmen played an essential role in the textile economy – both in refining newly woven clothes and in the care and mainte-

⁴³⁶ Grömer 2013, 80–81, e.g. HallTex 95 or 223.

⁴³⁷ Unterteutschenthal: Schlabow 1959, 118–120. – Castione: Bazzanella 2012, fig. 8.12. – Denmark: Broholm and Hald 1940, 17, 27; Mannering *et al.* 2012, 97–102.

⁴³⁸ Barber 1991, 216–217. – Schlabow 1974, 187. – Tidow 2005, 370–371. – Wild 1988, 57–58.

⁴³⁹ See for example 'Lodenwalke Ramsau': <http://www.lodenwalker.at/cms/index.php?id=40> (last accessed 20 June 2014).

⁴⁴⁰ Detailed in Flohr 2013.



nance of used clothes. A tomb stone from the Roman period (1st century AD) found in Sens, France⁴⁴¹, shows the activity of a fuller graphically. He stamps a fabric with his feet in a square tub. Behind him hangs a cloth drying on a pole.

Fig. 125. Fulfilled textile from the salt mines in Hallstatt, Early Iron Age, with surface detail.

Real felt is not based on fulling woven textiles, but made directly from loose fibres without spinning and weaving. Felting is about matting wool or hair together into a stable fabric⁴⁴². Evidence for felt from the Central European Hallstatt Culture was found at the cave sanctuary Býčí skála in Moravia⁴⁴³.

According to Tidow⁴⁴⁴, the next step in the process is **stretching and drying** the washed and fulled cloths to get them back into a uniform length and width. As is the case for pressing, stretching and drying is conceivable for prehistory but cannot be detected. A first-century wall painting from a fuller's shop

⁴⁴¹ Wild 1970, fig. 73.

⁴⁴² See Barber 1991, 215–216.

⁴⁴³ Cf. Rast-Eicher 1995, 168–169.

⁴⁴⁴ Tidow 2005.

in Pompeii depicts a clothes press. Garments were compressed between boards that could be screwed down.⁴⁴⁵

The Verucchio textiles⁴⁴⁶ provide the first possible evidence for **pleating** in Europe⁴⁴⁷. A ceremonial garment in the shape of a long sleeveless tunic with open sides and curved lower edges (Object A), made of balanced wool twill, possesses a remarkable structure. On the surface of the garment, a regular system of folds in both directions could be detected under a strong lateral light. The folds form small rectangles of about 4 by 3 cm and have been deliberately made. As the pleats run over the tablet-woven borders, it seems certain that the pleating was done after the garment had been finished. When pleated, the garment must have looked quite different than it does today. Its shape was optically minimised and it would have looked more like a *chiton*⁴⁴⁸ than a wider fitting sleeveless tunic.

7.2 Finishing linen fabrics

Linen fabrics were treated by **bleaching** and **smoothing**. Smoothing was done in order to give the fabrics a shiny and plain surface. Smoothing with rounded smoothing stones produces an even, closed surface. Smoothing pieces of glass have been detected in north-western Europe at the times of the Roman Empire⁴⁴⁹ (Fig. 126). Smooth polished pebbles can just as well be used for smoothing, although finds of such pebbles in archaeological contexts are rarely interpreted in this light.

In the literature so far, only one find of a smoothing stone has been found in the context of textile work: finds from the rock shelter of Mühlthal I⁴⁵⁰, Germany, an overhanging rock in a gorge,

⁴⁴⁵ Croom 2002, 24–25, fig. 4.

⁴⁴⁶ Stauffer 2012, 249–250, fig. 10.10 and 10.11 (pleated pattern).

⁴⁴⁷ The complete shirt from Tarkhan in Egypt, c. 3,000 BC, made from fine spliced linen, is the oldest pleated garment known so far. Barber 1991, 147, fig. 5.2.

⁴⁴⁸ *Chiton* is a generic term for a Greek tunic, more fitted to the body than the Roman *tunica*. See Cleland, Davies and Llewellyn-Jones 2007, 32, 200–201.

⁴⁴⁹ Wild 1970, 84–85. – Gostenčnik 2014, 83–84.

⁴⁵⁰ Cf. Grote 1994, part I/1, 141–149; part I/2, pl. 101,3.



indicate a seasonally used space – amongst others as well – for textile work. The Late Bronze Age Layer 6 contained a weaving tablet, a fragment of a ceramic spindle whorl and a smoothing stone made of a small pebble, probably from chert. It was ground down on all sides to a cube with rounded edges and polished well. Charcoal from Layer 6 is ^{14}C -dated to the period between 1,400–1,075 calBC.

Fig. 126. Smoothing piece from Magdalensberg in Austria, c. 50 BC–50 AD.

In general, however, neither the process of smoothing nor the subsequent bleaching is yet well attestable for prehistory. Bleaching is no longer visible on the original textiles themselves after a long period in the ground. Unbleached linen looks grey. Bleaching of linen with natural means⁴⁵¹ is a procedure that was practiced in Central Europe until well into the 20th century. The traditional method of bleaching linen to give it a white appearance was laying it out on meadows and spraying it with water during the summer months. The gentle release of ozone from the greenery bleaches the textiles slowly. A similar method was used in the early 20th century in Upper Austria, as an ethnographic example of bleaching linen from the farm Riweinhof in Alberndorf shows (Fig. 127). How far back into history this technique extended, however, is unknown.

⁴⁵¹ Hess 1958, 298–299.



Fig. 127. Bleaching laundry at Riweinhof in Alberndorf in Austria. Painting from the local museum Gallneukirchen, c. 1910.

7.3. Washing and Dyeing

In addition to these special finishing methods for wool and linen, dyeing, described in chapter B5, can also be listed amongst the finishing techniques.

Washing textiles is a process that today is seen as common and necessary. Literary evidence from Ancient Greece and the Roman Empire explains the tools, implements and detergent ingredients⁴⁵² needed for washing. Archaeological indicators for washing and/or dyeing workshops⁴⁵³ include washing equipment such as water supply, basins, heating, drains, drying areas and workbenches. In addition, dyestuffs, mordants and tools such as pounders or grinders are necessary. Many ancient

⁴⁵² Barber 1991, 240, 274. – Pekridou-Gorecki 1989, 52–53.

⁴⁵³ Alberti 2007, 59–61, fig. 9.1.

Mediterranean sites are generally accepted as probable, if not certain examples of places for washing and dyeing, as they contain large-scale equipment for the treatment with liquids. The best-known sites are Pompeii, *offectoria* VII.ii.11 (Italy, 1st century AD), Barcelona (Spain, 2nd century BC) or Athribis (Egypt, Roman period). In Roman times, the fuller (*fullo*, working in a *fullonica*)⁴⁵⁴ is responsible for the maintenance of used clothes – he washed and degreased clothes with alkaline chemicals, removed stains and pollution and polished the surface so that garments felt smooth and looked regular. There is evidence for lead tags (*tesserae*)⁴⁵⁵ from the Roman Provinces Noricum and Pannonia, which state names, professions, numbers and signs, names of colours and garments, wages and prices – some of them referring to the *fullonicae*. An interesting detail is the occurrence of the words *fullo* and the names of colours together on tags used in fulleries, such as those found in the hoard of Kalsdorf in Austria. This combination indicates that a fullery did also offer dyeing of garments or re-dyeing of faded clothes.

Washing of wool and textiles is hard to recognise in prehistoric Central Europe, because large- or even medium sized implements for treatment with liquids have not been identified so far. Traditionally, the mere washing of clothes has not required large, industrial-type establishments as described above. There is just indirect evidence for washing, which is dyeing. It is necessary to remove the lanolin (wool fat) from the fibres for the dyeing process to be successful. Removing fat means washing – treating with potash (potassium carbonate, K_2CO_3) or soap (Soapwort, *Saponaria officinalis* L.)⁴⁵⁶. Pliny the Elder (*Nat. Hist.* 19.18) mentions that liquid obtained from the root of soapwort was used for washing wool and made it whiter and softer. There were also various clays used for cleaning, such as Fuller's earth that has been found in Pompeii. Pliny (*Nat. Hist.* 35.196–198) describes several types of clays used for cleaning and whitening textiles⁴⁵⁷. Dyeing is proven for Central Europe

⁴⁵⁴ Flohr 2013. – Wild 1988, 57–58.

⁴⁵⁵ Gostenčnik 2013, 75–76. – Radman-Livaja 2013.

⁴⁵⁶ Archaeological evidence for potash in a jar at Tell Beit Mirsim: Albright 1941–43, 59. – Soapwort: Karg and Märkle 2012, tab. 1.

⁴⁵⁷ After Gleba 2008, 77.

at least from the Middle Bronze Age onwards (see chapter B5). If washing wool was known, we may also assume that textiles, especially garments, were occasionally washed – if only to prolong their use. We know that garments were used for a very long time, since marks of repair, mending and patching are common features of prehistoric textiles.

8 Sewing and tailoring

(*Helga Rösel-Mautendorfer*)

Fig. 128. Sewing needles from different Early Iron Age graves at Hallstatt, Austria.



Fabric, leather or fur pieces have been sewn together with needle and thread since the origins of clothing in the Palaeolithic. Complete garments are rarely found, and the preserved textile pieces are usually very small. Nevertheless, many of these finds indicate that a range of different sewing techniques were used at the time. The oldest Central European textile finds with stitching are from the Neolithic period in Switzerland. Textile finds with hems were found in Wetzikon-Robenhausen, Feldmeilen-Vorderfeld, Lüscherz and Vinelz. Two textiles joined edge to edge by a seam were found in Zürich. Sewn-in fringes appear on fabrics from Zürich and Twann.⁴⁵⁸ The most spectacular sewn leather and fur garments are associated with the find of the Iceman.⁴⁵⁹ Since organic materials are preserved only under special conditions, insights into sewing techniques are limited. More information is provided by Bronze Age garments found in Danish oak coffins, where complete clothing ensembles were found in Borum Eshøj, Muldbjerg, Storehøj, Trindhøj and Skrydstrup (Denmark).⁴⁶⁰ For the Bronze Age in Central Europe the finds from Hallstatt (Austria)⁴⁶¹, Molina di Ledro (Italy) and Irgen-

⁴⁵⁸ Médard 2010, see 168, 192–219, 238–239.

⁴⁵⁹ Egg and Spindler 2009.

⁴⁶⁰ Broholm and Hald 1940. – Mannering, Gleba and Bloch Hansen 2012, 89–118.

⁴⁶¹ Hundt 1959, 1960, 1967, 1987. – Rösel-Mautendorfer 2011. – Grömer *et al.* 2013.

hausen (Switzerland)⁴⁶² as well as the Iron Age finds from Hallstatt⁴⁶³ and Dürrenberg (Austria)⁴⁶⁴ are most important for the investigation of sewing techniques. Sewing was not only used to connect pieces of fabric or to fix hem edges, but also served as an ornament (see pages 198–205) with decorative stitching and embroidery.

The addition of trimmings and other decorative elements such as bronze knobs and decorative buttons is one of the tasks of the seamster or seamstress. Furthermore, the repair of fabrics, stuffing and patching did play a large role in the field of sewing technology.

8.1 Tools

The most important tool for sewing is the needle. In prehistoric times, needles were made from bone, antler, bronze and iron, and are, unfortunately, rather rare. The sewing needle with eye⁴⁶⁵ is a technical achievement, that accompanied humans since the Palaeolithic period, although one can sew with a needle without an eye as well. Neanderthals most likely knew how to sew, and for certain anatomically modern people of the Upper Palaeolithic. It can be assumed that holes were made with awls and that needles with notches for clamping the thread were in use. Bone needles with an eye from Grubgraben near Kammern (Austria) and from Petersfels in Hegau (Germany) prove that sewn leather and fur clothing was used at least since the Gravettian at around 20,000 BC. In the Stone Age, needles and awls were produced from bone, and needles made of bronze were added in the Bronze Age. Late Bronze Age bronze needles were found, for example, in Möringen (Germany). Hallstatt period bronze needles were discovered in Hochdorf (Germany) and Hallstatt (Austria) (Fig. 128). The

⁴⁶² Bazzanella *et al.* 2003.

⁴⁶³ Rösel-Mautendorfer 2013, 99–117. – Harris 2012, 61–97.

⁴⁶⁴ Stöllner 2002. – Grömer and Stöllner 2009, 105–157.

⁴⁶⁵ Finds of needles: Grub-Kranawetberg: Natural History Museum Vienna, research by Walpurga Antl-Weiser. – Petersfels: Stradal and Brommer 1990, 7. – Möringen: Bernatzky-Goetze 1987, pl. 106. – Kundl: Lang 1998, pl. 34. – Manching: von Kurzynski 1996, 16, fig. 16.

needles are of different lengths and thicknesses. A very fine needle from Hochdorf, for example, with a length of only 1.7 cm, was probably used for sewing very fine fabrics. Late Iron Age needles are known from Kundl in Tyrol (Austria), and iron sewing needles from Manching (Germany).

Evidence for tailored garments was found among Bronze Age textiles, especially in the finds of blouses from Jutland (see pages 230–232). Amongst the textiles from Hallstatt are fabrics dating to the Middle Bronze Age that have been cut obliquely or in an arc to the direction of the threads. The textiles were cut with knives or blades at that time. Both stone and metal blades are suitable for this task, but the cutting has to be done on a hard surface, for example on a wooden board or a flat stone. From the Late Iron Age onwards the newly invented shears could be used for cutting fabric. The earliest finds of iron scissors date to the La Tène period (Fig. 28), for instance from the Austrian sites Mannersdorf or Pottenbrunn.⁴⁶⁶

8.2 Types of stitches in prehistory

Some textile, leather and fur finds with stitches, seams and hems date back to the Neolithic period. The few stitched textile finds from this period have been sewn with different types of stitches:⁴⁶⁷ The running stitch was used on a textile find from Çatalhöyük in Turkey to fix a hem, for example; a complete garment, dating to about 3,000 BC, was found in Tarkhan in Egypt. All seams and hems of the long-sleeved tunic were sewn using the overcast stitch or hem stitch. The same is true for Neolithic textile finds from Switzerland with whipped hems. These three types of stitches are also most commonly found in the prehistoric archaeological material and are the simplest stitches in sewing by hand.

⁴⁶⁶ Finds of shears: Mannersdorf: pers. comm. Peter Rams!; In seven men's and four women's graves a total of twelve shears were found. – Pottenbrunn: Rams! 2002, 86-87. '... these tools for cutting appear from phase Lt B1 in graves of the Iron Age north of the Alps.'

⁴⁶⁷ Barber 1991, 129 (Çatalhöyük), 147–148 (Tarkhan). – Médard 2010 (Switzerland).

Overcast stitch⁴⁶⁸ (Fig. 129) and **hem stitch**⁴⁶⁹ show the same stitch pattern and are executed in the same way, by stitching over the edge of the fabric and thus securing the different layers of fabric. However, the stitches serve a different purpose, one for joining fabric surfaces, the other for hemming. Whilst the hem stitch is clearly named after its function, overcast stitch refers to the type of execution. In Lorna Knight's *'The Sewing Stitch and Textile Bible'*, overcast stitch is described as a stitch for hand sewing, which is used to clean up edges and prevent fraying. It is also used to connect non-fraying fabric pieces. Simple hem stitch consists of a series of small, oblique stitches that attach a hem⁴⁷⁰. Examples of overcast stitch can be found on the leather clothing of the Iceman (see p. 341–347). Bronze and Iron Age textile finds also show overcast stitch and hem stitch as the most common variants. It is used for sewing fabrics together, attaching hems and applying borders or patches. It is known primarily in northern European finds of tunics and trousers of the Iron Age.⁴⁷¹ Overcast stitch is worked very tightly to create a decorative pattern in the Early Iron Age. This variant is named trailing stitch.⁴⁷² Worked alternately in blue and white, this stitch adorns the edge of an attached patch on a Hallstatt period fabric (Fig. 121).⁴⁷³

Running stitch (Fig. 129) is also used for textiles in Hallstatt. The simplest of all stitches occurs when the needle passes alternately over and under the base fabric at regular intervals.⁴⁷⁴ In the *Sewing Stitch and Textile Bible* this stitch is described as a simple row of stitches in which the thread forms a regular, dotted line. Short stitches form a seam, and longer stitches serve as basting stitches to temporarily hold two textiles together⁴⁷⁵. Unlike the Neolithic example from Çatalhöyük, this

⁴⁶⁸ De Dillmont 1886, 9. – Knight 2008, 37. – Morrell 1987, 33. – Rösel-Mautendorfer 2011; 2013, 100–101.

⁴⁶⁹ Morrell 1987, 33. – Rösel-Mautendorfer 2013, 100–101.

⁴⁷⁰ Knight 2008, 37 (overcast stitch), 33 (hem stitch).

⁴⁷¹ Schlabow 1976. – Möller-Wiering 2011. – Möller-Wiering and Subbert 2012, 149–181.

⁴⁷² Butler 1979, 33. – Rösel-Mautendorfer 2013, 101.

⁴⁷³ Mautendorfer 2005, 47. – Grömer and Rösel-Mautendorfer 2013, 385–387.

⁴⁷⁴ de Dillmont 1886, 5. – Gillow and Sentance 1999, 172. – Morrell 1987, 32. – Rösel-Mautendorfer 2013, 101.

⁴⁷⁵ Knight 2008, 28.

overcast stitch



hem stitch



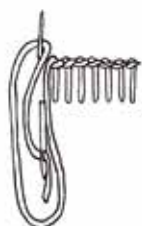
running stitch



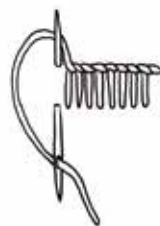
stem stitch



tailor's buttonhole stitch



buttonhole stitch



back stitch



chain stitch



Fig. 129. Different types of stitches used in prehistory, with examples from the salt mines in Hallstatt, Bronze and Iron Age.

stitch type is used as a decorative stitch in the Early Iron Age. A textile find from Hallstatt shows a row of running stitches in a contrasting colour to the fabric as an ornament worked parallel to the actual seam (Fig. 129).⁴⁷⁶ An extraordinary find in terms of the sewing technique is the embroidered La Tène

⁴⁷⁶ Hundt 1960, 139–142. – Grömer and Rösel-Mautendorfer 2013, 354–356.

textile from Nové Zámky (Slovakia). It shows a diamond- or trumpet-shaped embroidery motif that has been achieved by using running stitches of different lengths (Fig. 120).⁴⁷⁷

Optically similar to running stitch is **back stitch**.⁴⁷⁸ In contrast to the broken row of running stitches, back stitch shows a continuous line, which is achieved by stitching back the needle. A Neolithic find from Schaffis (Switzerland)⁴⁷⁹ shows such a row of back stitches in the fabric. However, this was not sewn onto the finished fabric, but worked in during the weaving process by regularly wrapping the weaving thread around two warp threads. After the selvedge, two weaving threads were always wrapped with a kind of back stitch to fix the threads and then the weaving was continued in tabby weave. This example shows that this stitch has possibly been developed from a wrapping technique. In prehistoric times, however, this stitch is very rare. In some cases, it is difficult to determine whether one is dealing with back stitch or stem stitch, because the back of stem stitch always shows a back stitch. A textile with multiple stem stitch rows at the hem is known from Hallstatt.⁴⁸⁰ This edge is usually interpreted as a decorative seam, but if this selvedge was connected to another textile, it is possible that rows of back stitches were sewn and the edges were hemmed afterwards.

Bronze and Iron Age textiles from Hallstatt were sewn with **stem stitch** (Fig. 129).⁴⁸¹ It is a linear stitch, in which the thread lies either to the right or to the left of the needle. The stitch is worked at a slight angle, with the next stitch always starting halfway up the last stitch. Colourfully designed stem stitch rows appear to have been decorative motifs for selvedges.⁴⁸² Embroidery with combinations of stem, back, running and a kind of cross-stitch adorn the famous Bronze Age 'art textile' of Irgenhausen (Switzerland) (see Fig. 117).

⁴⁷⁷ Belanová 2005, 177–179. – Pieta 1992, 52–65.

⁴⁷⁸ Butler 1979, 71. – Morrell 1987, 32. – Rösel-Mautendorfer 2013, 102.

⁴⁷⁹ Barber 1991, 135–136. – Vogt 1937, fig. 92.

⁴⁸⁰ Grömer and Rösel-Mautendorfer 2013, 385–387.

⁴⁸¹ Butler 1979, 43. – de Dillmont 1886, 43. – Knight 2008, 102. – Rösel-Mautendorfer 2013.

⁴⁸² Grömer and Rösel-Mautendorfer 2013, 385–387.

Blanket stitch or **buttonhole stitch**⁴⁸³ (Fig. 129) is sewn along the selvedge, with each stitch intertwined with the previous one. To achieve this effect, a loop is formed under the needle and the needle is pulled through, so that the thread remains along the edge. A textile from Molina di Ledro in Italy is embroidered with blanket stitches.⁴⁸⁴ Blanket stitches are also quite common in the Hallstatt salt mines.⁴⁸⁵ Some of the textile remains from the Bronze Age site Christian-von-Tuschwerk (Hallstatt in Austria) have seams that have been fixed with blanket stitches over the entire width of the seam. The edge of a textile from the Early Iron Age Kilbwerk (Hallstatt in Austria) was sewn together and finished with another piece of fabric with a dense row of tailor's buttonhole stitches.⁴⁸⁶ Unlike the Bronze Age finds the thread was pulled from the opposite direction around the needle, which results in a knotted edge, just as is common in hand-sewn buttonholes today.

For completeness, **chain stitch**⁴⁸⁷ (Fig. 129) should be mentioned here, too, although it does not occur in Central Europe before the Middle Ages (for example, on the Bayeux Tapestry). It does appear, however, in 14th century BC Egypt. The tomb of Tutankhamun contained a tunic and another textile fragment from the 18th Dynasty, which are embroidered with chain stitches.⁴⁸⁸ Chain stitch is used both as a fill stitch and to stitch in line. The thread is first formed in a loop and then the needle is passed through the fabric at the beginning of the loop like in the running stitch and thus fixes the end of the loop. The next stitch is inserted at the end of the first loop, forming a shape similar to a chain link. The top side of the stitch row shows a chain and the back shows a straight, closed stitch line.⁴⁸⁹

⁴⁸³ See Bridgeman and Drury 1978, 315, 317 for a definition and description of the technique of this stitch. – Butler 1979, 123. – de Dillmont 1886, 42. – Knight 2008, 31. – Peter 1926, 57. – Rösel-Mautendorfer 2011. – Rösel-Mautendorfer 2013, 102–103.

⁴⁸⁴ Bazzanella *et al.* 2003, 170.

⁴⁸⁵ Mautendorfer 2005, 43, fig. 4 (Bronze Age), fig. 5 (Hallstatt period).

⁴⁸⁶ See Butler 1979, 127 for technical details of the stitch. – Rösel-Mautendorfer 2013, 102–103. – For the find: Grömer and Rösel-Mautendorfer 2013, 421–422.

⁴⁸⁷ Butler 1979, 166. – Gillow and Sentance 1999, 178–180.

⁴⁸⁸ Stradal and Brommer 1990, 14–15 (Bayeux Tapestry). – Barber 1991, 159–162 (Textiles from Tutankhamun's grave).

⁴⁸⁹ Gillow und Sentance 1999, 178.

8.3 Seam and hem types in prehistory

Connections between at least two pieces of fabric are referred to as seams; they are usually located on the inside of a textile object. Hems, on the other hand, are used to overcast selvages and are therefore found on the edge of the textile object. Finds of simple seams are known from the Neolithic, for instance from the garments of the Iceman, who died over 5,300 years ago in the Ötztal Alps. The garments were made of tree-bast, grass, leather and fur. The garments of leather and fur were sewn with overcast stitches⁴⁹⁰ done with sinew.

Top seams (top sewing)⁴⁹¹ regularly occur on textiles from Hallstatt, wherein the fabric edges are bound together with overcast stitches (Fig. 130). After the work, the fabric edges lie together when the seam is opened out. This seam is used on large textiles as well as for the attachment of an edging braid. Various edge types can be connected⁴⁹²: two edges that have been over-stitched, two cut edges, two turned edges, one overstitched edge with a woven selvedge, two woven selvages, one cut edge and a woven selvedge. There are two basic ways to execute this seam: one can either place the two layers of fabric together and bind the edges with overcast stitch; the second possibility is to arrange the fabric edges so that they abut and can be sewn together in this position. It is almost impossible to tell the difference from the finished seam. The oldest sample of a top seam was found in Zürich (Switzerland).⁴⁹³ In this Late Neolithic find, two textiles were placed edge to edge and sewn together with overcast stitch.

⁴⁹⁰ Egg and Goedecker-Ciolek 2009, 62. – Spindler 1995.

⁴⁹¹ Kania 2010, 95. – Morrell 1987, 8, 21.

⁴⁹² Cf. Grömer and Rösel-Mautendorfer 2013, see catalogue for: neatened edges: HallTex 55 (IA), pp. 372–373; two cut edges: HallTex 133 (IA) pp. 465–466; two turned edges: HallTex 141 (IA), pp. 474–475. HallTex 44 (BA) pp. 254–255; neatened edge with woven selvedge: HallTex 43 (IA) p. 362; two woven selvages: HallTex 124 (IA), pp. 453–454; cut edge and woven selvedge: HallTex 163 (IA), pp. 494–495.

⁴⁹³ Médard 2010, 239.

Another type of seam on Hallstatt textiles is the **whipped lapped seam**. For this seam, two layers of fabric are taken together, one over the other, and stitched along the width of the seam. Such a seam has been sewn over with overcast stitch on a Bronze Age textile from Hallstatt.⁴⁹⁴ On HallTex 286 (Fig. 136), dating to the Iron Age, the layers of fabric were joined using blanket stitches (buttonhole stitches).⁴⁹⁵ Evidence of overlaying fabric edges when sewing pieces together was also found on Bronze Age Danish blouses.⁴⁹⁶ The cut edges were laid over each other to make a seam at the centre of the shirt's back, which were then secured with overcast stitching, unlike the Hallstatt textiles where the thread was worked across the entire width of the seam.

Apart from simple seams, **counter hem seams** were found in Hallstatt as well. In this type of seam, the cut edges are folded and fastened wrapped into each other. Through this clasping of the edges a clean and strong seam emerges (Fig. 130).⁴⁹⁷ This seam is similar to the flat fell seam, which is still common today. The two seams differ in terms of the use of stitches. Linear stitches such as running stitches, back stitches or stem stitches were used for making a flat fell seam. For making a counter hem seam, the fabric is fixed on both sides with overcast stitches instead. Flat fell seams are very durable and are therefore particularly used, for example, for the inner side seams of blue jeans today. Flat fell seams are today worked by machines in the following way: the two layers of fabric are folded into each other and fixed by two parallel seams. While line stitches (running, back- and stem stitches) were known in the Iron Age, the seams on the Iron Age Hallstatt-Textiles were worked as counter hem seams with overcast stitches. In Hallstatt the counter hem seam is often used to combine weaves of different types or colours.⁴⁹⁸ Finds of body lice in the seams of a Hallstatt textile indicate that the find is clearly the remains of a piece of clothing and can serve

⁴⁹⁴ Bronze Age HallTex 238/1: Gengler 2005, 140–14. – Grömer and Rösel-Mautendorfer 2013, 296.

⁴⁹⁵ Iron Age HallTex 286: Grömer and Rösel-Mautendorfer 2013, 556–557.

⁴⁹⁶ Broholm and Hald 1940. – La Baume 1955, fig. 89. – Hald 1980, 159.

⁴⁹⁷ Mautendorfer 2005, 43–44. – Rösel-Mautendorfer 2013, 104–105.

⁴⁹⁸ *E.g.* Grömer and Rösel-Mautendorfer 2013, 496–497 (HallTex 164), 529–530 (HallTex 195).

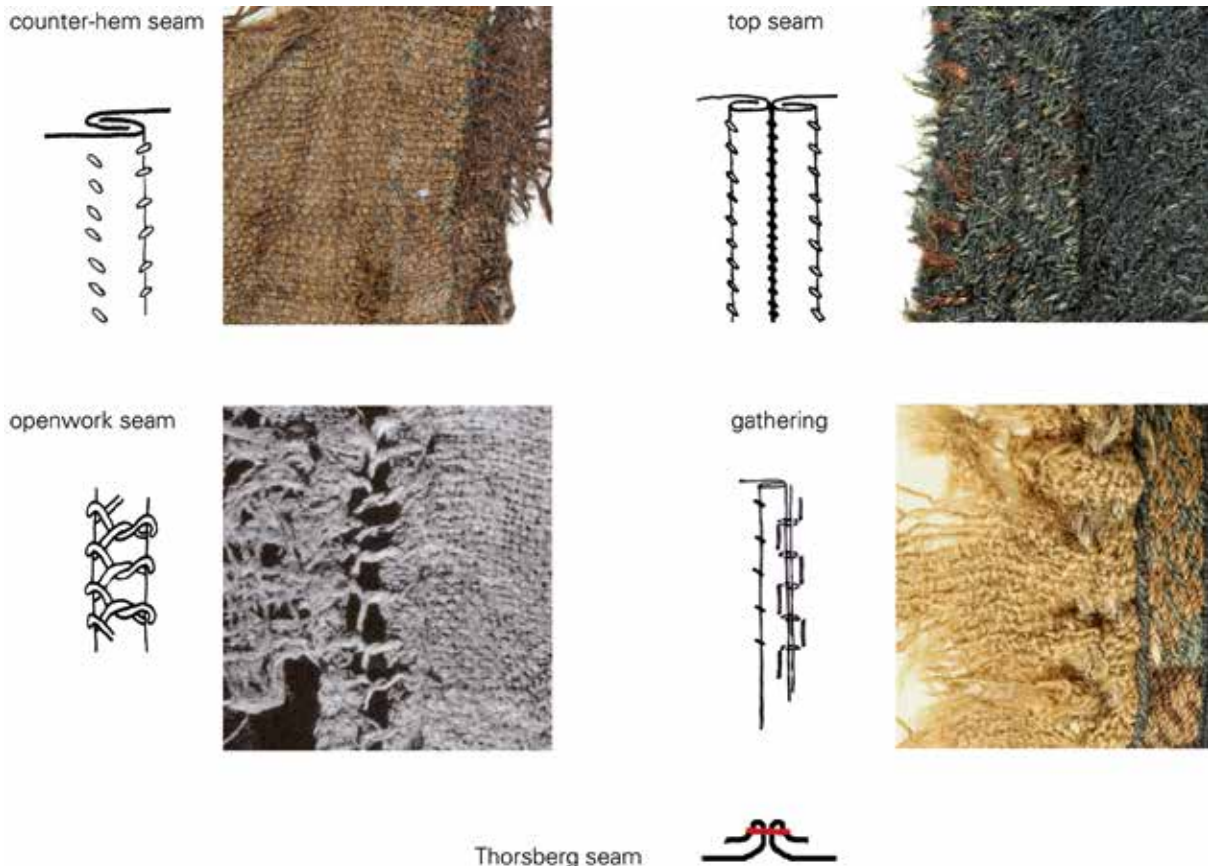


Fig. 130. Different types of seams with examples from Hallstatt and Dürrnberg, Iron Age, and the Thorsberg seam.

as evidence for the use of the counter hem seam for making garments.⁴⁹⁹ The counter hem seam was also a feature of the Dürrnberg textile finds.⁵⁰⁰

Iron Age finds⁵⁰¹ from Dürrnberg (Austria) (Fig. 130), from Huldremose (Denmark) and Damendorf (Germany) are known for their **openwork seams**, using a special form of looped stitches. They constitute, apart from their function to join fabric elements, also a very decorative pattern. This stitch also adds stretch and flexibility to the item.

⁴⁹⁹ Hallstatt Textile 32: Hundt 1960, 137–138. – Grömer, Rösel-Mautendorfer and Reschreiter 2013, 127–128.

⁵⁰⁰ Objekt A256: Stöllner 2002, pl. 15.

⁵⁰¹ Damendorf: Schlabow 1976, fig. 248. – Dürrnberg: Stöllner 2002, pl. 373. – Huldremose: Mannering, Gleba and Bloch Hansen 2012, 106, fig. 3.9.

A special feature is the **Thorsberg seam**.⁵⁰² In contrast to the usual connection of a double layer of fabric, the folded edges of the fabric are also sewn in this textile, creating an extremely durable seam by connecting four layers of fabric.

A further type of seam is the **gathering**, for which the textile is drawn together with one or more rows of running stitches. An example of this is a torn-off sleeve with attached tablet-woven band from the Dürrenberg salt mines,⁵⁰³ in which the width of the sleeve was adjusted to the length of the band by gathering. Another find of a slightly gathered fabric comes from Nybøl in Denmark. The Bronze Age grave find with a width of 9.5 cm and a length of 97 cm has four parallel rows of running stitches. Perhaps a pleated effect was desired, or the fabric had to be adjusted to a smaller size.⁵⁰⁴

Decorative seams are used exclusively for ornamental design and have no functional, connecting function. Decorative seams are characterized by the conscious use of coloured sewing threads, often in contrast to the colour of the fabric. Clear examples of decorative seams were found on two related textile finds from Hallstatt, in which a row of running stitches was worked parallel to the seams. In addition to the seams also stitch lines may have been used as decorative elements. Examples of such seams are the two-coloured seams on finds from Hallstatt.⁵⁰⁵

Two types of **hems** can be found (Fig. 131): hems folded twice and hems folded once, with one edge neatened. Not only the cut edges were neatened in prehistory, but selvages were also folded, handled and strengthened by a hem. The hems are usually attached with hem stitches, but running stitches and blanket stitches are also common.

On the textile finds from Hallstatt salt mine there is a noticeable difference in the working of hems between the Bronze Age and the Iron Age. During the Bronze Age, most hems were worked

⁵⁰² Kania 2007, 279. – Schlabow 1976, 76–77.

⁵⁰³ Rösel-Mautendorfer 2009, 115–117. – Grömer and Stöllner 2009, 115–117.

⁵⁰⁴ Bergerbrant, Bender Jørgensen and Fossøy 2013, 247–267.

⁵⁰⁵ Grömer and Rösel-Mautendorfer 2013, 385–387 (HallTex 64), 484–485 (HallTex 153).



with blanket stitch or overcast stitch over the entire width of the hem as whipped hems. This type of finishing hems was already evident in the Neolithic period, as shown by finds at Wetzikon-Robenhausen in Switzerland.⁵⁰⁶ A special feature are the Bronze Age textiles from the Christian-von-Tuschwerk/Hallstatt in Austria. The hems are designed differently and the edge itself is often additionally reinforced. Many hems are

Fig. 131. Different types of hems from the salt mines of Hallstatt in Austria: Bronze and Iron Age finds.

⁵⁰⁶ Hallstatt: Rösel-Mautendorfer 2013, 106. – Wetzikon-Robenhausen: Médard 2010, 168, 226.

fixed with blanket stitches or overcast stitches over the whole width of the hem. On one piece of textile, a hem attached by hem stitches was reinforced along the outer edge by overcast stitches, which reach into the centre of the hem. On another piece, a cord was sewn onto the hem for reinforcement.⁵⁰⁷ Those textiles are mainly made of coarser and stronger fabric. Due to the specific context and signs of wear, they have been interpreted as ‘haulage cloths’.

Hems of Iron Age textiles from the salt mines in Hallstatt were exclusively fastened with hem stitches; no hem edges were found that resemble those of the Bronze Age, when textiles were fixed over the entire width of the hem with stitches. In two cases⁵⁰⁸ the hem has been worked with a line stitch: one is a Bronze Age find, with a row of stem stitch, and the other is an Iron Age find, which has running stitch. Most fragments of hems are parallel to warp or weft. However, there is also a round hem, a hem at an oblique angle relative to the direction of the threads of the fabric, and a hem that is worked around a corner, extending from a straight piece of thread over the corner to an oblique piece. These details allow insights into cutting techniques. In the Early Iron Age, textiles with round hems and perhaps armholes or angular finishing lines can be expected.⁵⁰⁹

Tidying of seam allowances may, however, be undertaken for technical reasons, as in hems. Where the remains of stitches are found on the outer edges of hems, this is not a hem but the tidying of a seam, in other words it is part of the seam. In most cases only threads belonging to a seam are present, and rarely does the attached fabric survive. The remains of stitches on the edges of woven borders also point to a previously attached cloth.⁵¹⁰

Similarly, we know bands which were used to finish hems, since several ribbons fixed to textiles are part of the Hallstatt textile collections. For example, a 22 cm long, tablet woven band sewn

⁵⁰⁷ Grömer and Rösel-Mautendorfer 2013, 274 (HallTex 216, BA).

⁵⁰⁸ Grömer and Rösel-Mautendorfer 2013, 250–251 (HallTex 26, BA), 353–355 (HallTex 34, IA).

⁵⁰⁹ Mautendorfer 2005, 44–45. – Rösel-Mautendorfer 2013, 111–112.

⁵¹⁰ Rösel-Mautendorfer 2013, 106.



together in circular fashion might have served as the end of a sleeve⁵¹¹ (Fig. 132).

From the Dürrenberg salt mines⁵¹² a torn sleeve with tablet woven band attached is known (Fig. 130 and 132.2). In contrast to the finds from Hallstatt, where the edges of the fabric and the border were sewn together with overcast stitches, this band was attached with running stitches, in which one stitch on the band alternates with one stitch on the weave. Further evidence for ribbons that have been sewn onto textiles can be found in contemporary works of art. On the bronze figurine from Idrija pri Bači in Slovenia (Fig. 228) and on images adorning situlae (Fig. 132 and 221) braids can be recognized at the hems of sleeves and garments.⁵¹³

Fig. 132. Affixed borders and representations of borders on Iron Age images: Hallstatt, A (1), Dürrenberg, A (2), Sopron Várhely, Hu (3–4), Situla Vače, Slo (5).

⁵¹¹ Grömer and Rösel-Mautendorfer 2013, 451–452 (HallTex 123).

⁵¹² Rösel-Mautendorfer 2009, 115–117.

⁵¹³ Mautendorfer 2005, 47–48.

8.4 Examples of prehistoric dressmaking patterns

Information on dressmaking patterns and cutting techniques in prehistoric times can be inferred from a few preserved garments. Some of them exhibit considerable skill and refinement.

The Copper Age Iceman from the Tyrolean Alps⁵¹⁴ (see pages 341–347) had garments with interesting sewing details, but also interesting cutting and design details. All items of his clothing, including the leggings and the fur cap, were sewn together with overcast stitches.

The upper body wear, a kind of jacket, was composed of rectangular pieces of goatskin. The assembling of the clothing using strips of different coloured materials is visually striking. The selection of animal skin strips of colours ranging from bright to dark makes this jacket a very decorative piece of clothing. To what degree sewing the jacket from narrow pieces of fur might have been an advantage for fitting the garment to the body can no longer be evaluated today. An indication that the joining of strips had an impact on the fit can be observed on the Iceman's loincloth, which is approximately 1 m long. It is put together of tailored, slightly fitted, cut goat leather strips, again assembled with overcast stitches. With this sewing technique, the loincloth fits better to the body shape than if cut from a whole piece.

Sensational discoveries from the Nordic Early Bronze Age (15th–13th centuries BC) come from Muldbjerg, Trindhøj, Borum Eshøj, Skrydstrup and Egtved in Jutland/Denmark. Complete clothing was found in oak coffins from these sites.⁵¹⁵ Both men's and women's garments often have multiple seams. While the men's wrap around garments are mostly composed of multiple pieces that had been cut, the centrepiece of the women's blouses are made from a single piece of fabric (Fig. 191). Sewing and cutting techniques of these pieces of upper body wear is very interesting. The shape stands out from the wrapped and belted garments, such as the men's coats from Trindhøj and Muldbjerg

⁵¹⁴ Egg and Goedecker-Ciolek 2009, 73–88. – Spindler 1995.

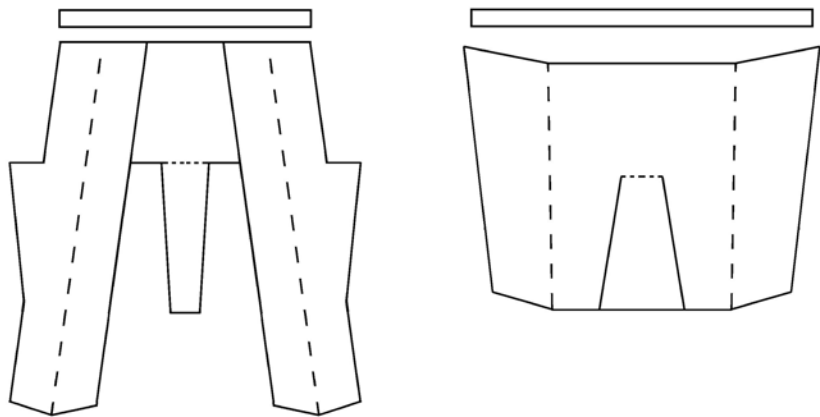
⁵¹⁵ Hald 1950; 1980, 67–69 (men's coats), 67–69, 95–97 (women's skirts), 92 (blouse). – Mannering, Gleba and Bloch Hansen 2012, 96–102. – Nienholdt 1961, 1.



or the women's skirts from Borum Eshøj or Skrydstrup. Analysis showed that the Bronze Age blouses from Borum Eshøj and Skrydstrup were tailored specifically to ensure a certain fit. The approximately rectangular material of the female blouse was cut crosswise from both sides in the lower third, then folded towards the middle and sewn together. The remaining material was folded down and sewn together with the lower fabric tube. Some of these blouses have been extended with additional fabric strips. The top fold was cut in horizontally for the neck opening (Fig. 191). The seams were worked with overcast stitches, wherein the fabric layers were overlaid without neatening and stitched together. Due to the structure of the fabric the seams were durable and functional. This kind of processing may indicate that this type of clothing was originally made of leather, fur or felt. In contrast to textiles, these materials do not fray and therefore do not need to be neat-

Fig. 133. Reconstruction of the Thorsberg trousers by Katrin Kania. Although astonishingly tight, the trousers allow full mobility for the wearer.

Fig. 134. Simplified dress pattern for Iron Age trousers, according to findings from Thorsberg and Marx-Etzel, Germany.



ened. The neckline and sleeve hems of the woven material were stitched. The neckline of a blouse from Borum Eshøj was finished with two rows of blanket stitches; the sleeve ends were worked in a similar way⁵¹⁶.

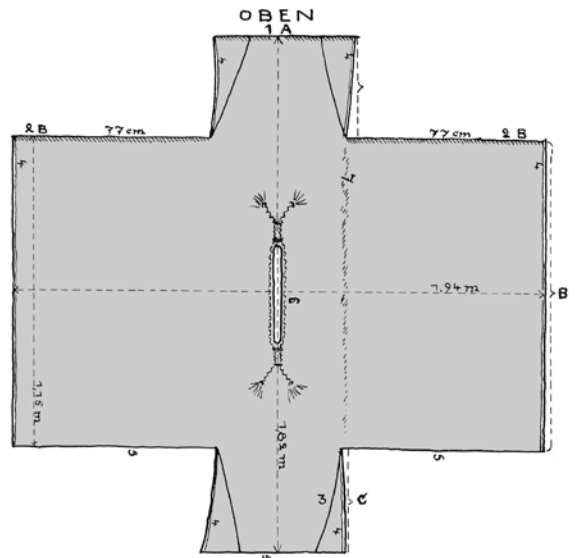
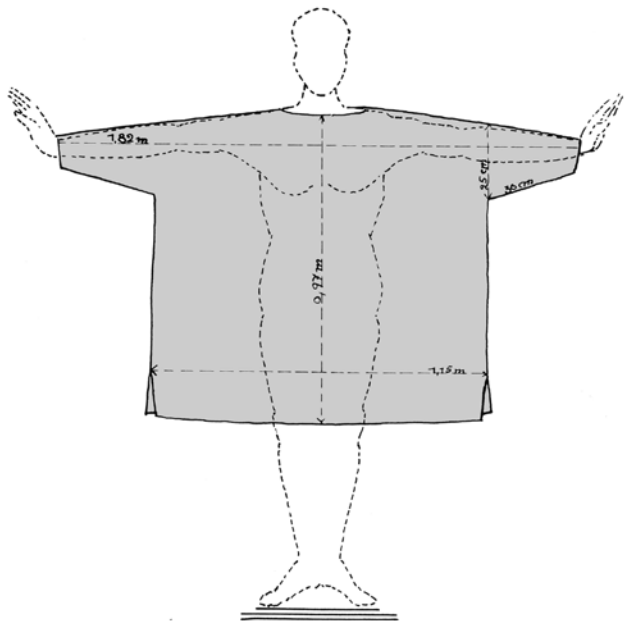
In addition to the Bronze Age blouses, some Iron Age garments also have remarkable dressmaking patterns. A pair of leggings to be worn under other garments and a pair of leggings as outerwear, both made of wool (Fig. 214), are known from the Vedrette di Ries glacier (Rieserferner) in South Tyrol in Italy⁵¹⁷. While the right legging of the undergarment was stitched together on the inside with simple overcast stitches, the inside of the left legging had a narrow strip of plaited fabric inserted. It is possible that this thin band had an impact on the fit due to the oblique thread direction, since fabrics with oblique thread direction are always more elastic than those with straight thread direction.

The weave type of the textile has further influence on the elasticity of the material and thus on the fit. An impressive example of such considerations when tailoring are the trousers from Thorsberg in Germany⁵¹⁸. The long, narrow trousers with attached socks have a rather unusual cut, which is designed so that it takes the leg muscles into account, lies on the body like a second skin and stretches slightly during motion (Fig. 133).

⁵¹⁶ Hald 1980, 69–71, 84–85.

⁵¹⁷ Bazzanella *et al.* 2005, 151–160. – Gleba 2012, 224, fig. 9.3.

⁵¹⁸ Möller-Wiering 2011, 48–53. – Schlabow 1976, 76–77. – Technical considerations about the trousers and their fit can be found in Kania 2007, 277–290. – Nienholdt 1961, 7–9.



In contrast, the breeches of Marx-Etzel in Germany⁵¹⁹ are very wide trousers, which were worn gathered at the waist with many folds. The dressmaking pattern is technically interesting because the main piece consists of a single, roughly rectangular piece of fabric. A wedge was inserted from below for the crotch and folded up, then the sides of the fabric were folded towards the centre and the trousers were sewn together (Fig. 134).

Fig. 135. Tunic of Reepsholt, Germany, dimensions and basic form.

Amongst the Iron Age garments worn on the upper body, the Thorsberg⁵²⁰ tunic again stands out (Fig. 210). The long-sleeved tunic does not have stitched side seams, as would be usual, but instead has bands on the side edges, which served to close the garment. This raises the question of whether considerations on the (tight) fit have led to this unusual side seam solution.

Deviations from the usual dressmaking patterns can also be observed on the tunic from Reepsholt in Germany⁵²¹ (Fig. 135). The wide tunic has integrated sleeves, while the other tunics either have sleeves sewn on or are sleeveless.

⁵¹⁹ Schlabow 1976, 79–80. – Möller-Wiering and Subbert 2012, 161.

⁵²⁰ Möller-Wiering 2012, 42–48.

⁵²¹ Möller-Wiering and Subbert 2012, 162. – Schlabow 1976, 73–76.

In addition to complete garments, some textile fragments, such as the ones from the Hallstatt salt mines, can be used to infer dressmaking patterns. The comparison of textile fragments with Iron Age representations shows that many of the design elements such as dividing seams, curved hems and border lining can also be found in the archaeological material. Three different groups of such details were actually found: sewn border lining, curved or inclined tailored hems and elements composed of several pieces of fabric. All three groups have been recognised on Iron Age representations more or less frequently⁵²².

An example of such a textile fragment, which could be interpreted as a piece of clothing because of the stitching, is a very coarse, tabby woven fabric, which was recovered from Iron Age Hallstatt (Fig. 136.1)⁵²³. Despite the coarseness of this textile, it represents important steps of finishing a textile object: dyeing, stitching and surface treatment. The textile was dyed with rhizomes of a Rubiaceae species and woad; today the fabric appears brown with a reddish hue⁵²⁴. The textile also has a heavily felted surface, either through use and wear or through an intentional fulling process. Intentional fulling results in a waterproof surface. A waterproof surface would optimize this garment in addition to the warmth provided by using a coarse and heavy fabric for a cape. A closer look offers interesting insights into sewing techniques, which are an important step as well, as sewing forms a functional item out of a plain fabric as taken from the loom. The two pieces of the same fabric are joined together in a very special way. The seam runs about 2 cm parallel to the edge of one part of the fabric. The second part was slightly eased and fixed with blanket stitches, sewn from the inside of the object with a 1.1–1.2 mm thick thread of matching colour. The stitches are only visible on the plain inside of the object. On the outer edge of the fabric the seam has fringes inserted every 2 cm. The single fringe is put through a loop and pulled down. They differ a little in colour from the main weave and appear darker. The thread diameter

⁵²² Rösel-Mautendorfer 2011.

⁵²³ Hallstatt Textile 286: Grömer and Rösel-Mautendorfer 2013, 556–557.

⁵²⁴ Hoffmann-de Keijzer *et al.* 2013, 135–162, 148

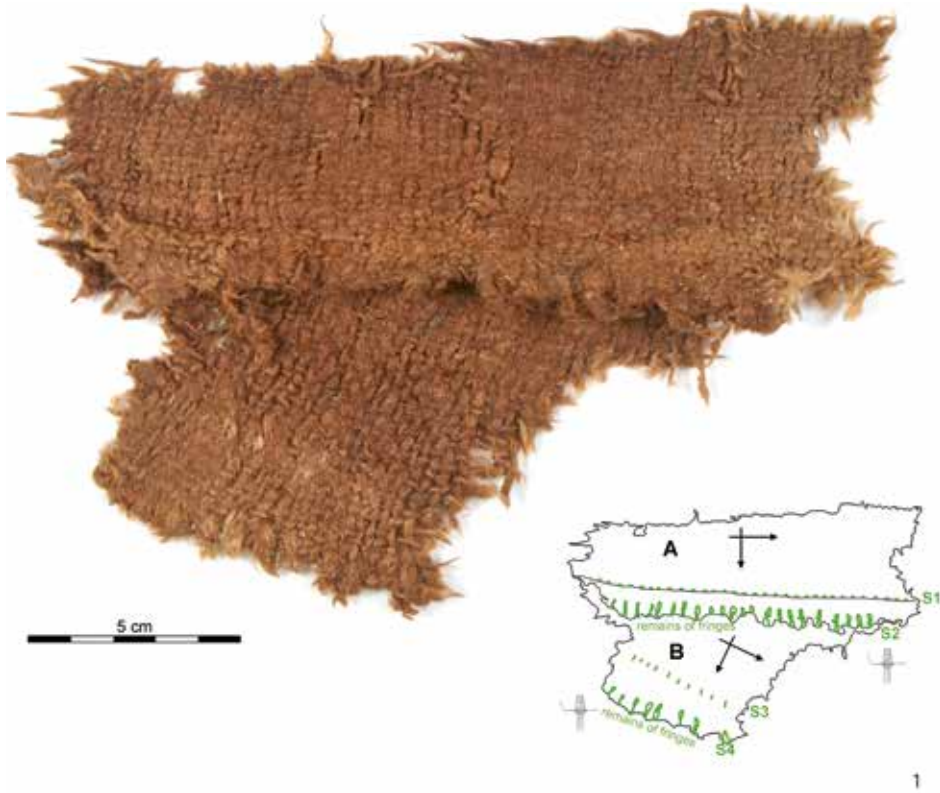


Fig. 136. Hallstatt textile with fringes (1), depiction of Hooded Spirits (2).

of the fringe is like that of yarns of the main weave (1.4–1.8 mm). On the second part of the object there are also remains of a seam and inserted fringes. Possibly other parts were sewn in the same way⁵²⁵.

The position of the seams and the even rows of fringes as well as the adjustment of the thick, soft and warm fabric with felted surface and the exclusive dye lead to the interpretation that this fragment is the remnant of a specific product, and that the finishing steps were intentionally selected. Maybe the fabric was part of a garment, *i.e.* a hood, such as the one we know from a depiction of Hooded Spirits (*Genii cucullati*) from Housesteads in England (Fig. 136.2) or the bronze figurine from Trier in Germany⁵²⁶. The fulled surface and the warm, thick and windproof fabric would serve that purpose perfectly.

8.5 Prehistoric pictorial sources of seams and hems

Further information on tailoring and sewing is provided by prehistoric representations of people in their clothes. While sewing is not always necessary to produce a three-dimensional textile garment from a two-dimensional textile – some corded skirts, wrapped skirts, cloaks and loincloths do not need a seam – in most items of clothing nevertheless seams are needed to obtain the desired garment shape. Depending on the level of abstraction, details like seams, attached bands and ribbons can sometimes be identified in prehistoric human images (Fig. 132)⁵²⁷.

On the majority of human representations,⁵²⁸ a wide variety of garments can be differentiated, but only few show evidence of seams and hems. Especially in the Early Iron Age, human representations are often so elaborate and detailed that technical

⁵²⁵ Grömer and Rösel-Mautendorfer 2013, 556–557. – Rösel-Mautendorfer 2013, 115–116.

⁵²⁶ *Genii cucullati* from Housesteads/Great Britain: Birkhan 1999, 246, fig. 366. – Figurine from Trier: Birkhan 1999, 359, fig. 677.

⁵²⁷ Mautendorfer 2005, 41–54.

⁵²⁸ Dobiat 1982. – Eibner 1997, 129–132; 1980, 63, 65–66. – Nebelsick *et al.* 1997, 125, fig. 46.



Fig. 137. Representations of sewn-on buttons on Iron Age pictorial sources: vessel from Sopron, Hungary (1), situla from Este-Benvenuti, Italy (2). – Grave find with bronze buttons, Mitterkirchen, Austria (3).

information on sewing may be extracted. Abstract and rather geometrically rendered human representations from the Early Iron Age (Fig. 221) were found on pottery vessels from Sopron (Hungary), Kleinklein (Austria), Nové Košariská (Slovakia) and from southern German sites, for example Kirchenreinbach, Reichersdorf, Pettenhofen and Dietldorf. Figures with a triangular garment represent the largest group.

Above all, the decorations and designs inside the figures maybe point to textile details. Patterns, bindings, dividing lines, ornaments with circles and lines could be evidence for the fabric structures and their ornaments. Comparisons with finds from Hallstatt show that contemporary textiles have the same patterns (see chapter B6). There are also hints to which sewing techniques were used. Hatched, narrow, parallel limited areas could represent attached braids, as they are well known



Fig. 138. Representations of seams on Iron Age pictorial sources: garments assembled of various parts on a vessel from Sopron Várhely (1), compared to a composite textile from the salt mines in Hallstatt (2).

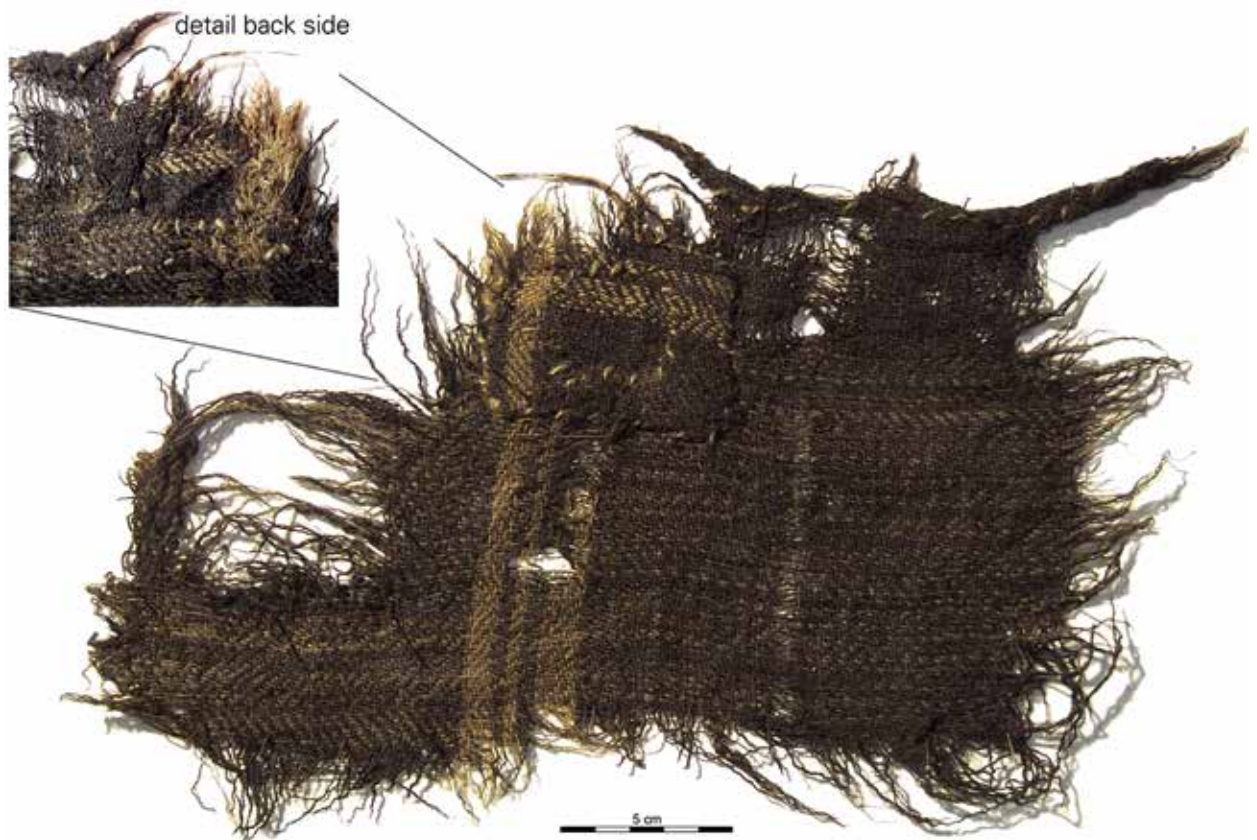
in the archaeological material from Hallstatt⁵²⁹. Other garments are decorated with dots or circular rings, which may represent decorative bronze buttons sewn onto the garments⁵³⁰ (Fig. 137). Such bronze buttons are known, for example, from the luxurious coat of Mitterkirchen in Upper Austria and from graves of the cemetery in Hallstatt.

Other human figures show strongly divided triangles, which may represent garments composed of several pieces of fabric (Fig. 138). Again, there are examples for such pieces in the archaeological material from Hallstatt⁵³¹. Later representations, such as the early La Tène fibula from Dürrenberg (Fig. 223) or the figuratively decorated scabbard from Hallstatt (Fig. 175 and 222) also give evidence for seams and braids.

⁵²⁹ Grömer 2005b, 24–25. – Mautendorfer 2005, 47–48; 2007, 266–267.

⁵³⁰ Kromer 1959. – Mautendorfer 2007, 267–268. – Pertlwieser 1987, 64.

⁵³¹ Mautendorfer 2005, 49–50.



8.6 Patches and repairs

An important task in the context of sewing is also the mending of clothes. There is evidence from as early as the Neolithic period for patches and darns. In addition to the original seams of the clothes of the Iceman, which are done with sinew, there are neatly done repairs with a double z-plyed yarn of animal hair and rather coarse ones with grass and tree-bast⁵³². Repairs can be found furthermore on the textile finds from Hallstatt. One piece of textile had a rectangular patch sewn on (Fig. 139); it was attached by taking the pattern of the original material into consideration. A Bronze Age find shows a plain woven darn next to the seam⁵³³. Amongst the northern European bog finds

Fig. 139. Patched piece of fabric from Hallstatt, Early Iron Age.

⁵³² Egg and Goedecker-Ciolek 2009, 62.

⁵³³ Mautendorfer 2005, 43, pl. 10.

there are some patched garments⁵³⁴. For example, the early medieval tunic of Bernuthsfeld in Germany has no fewer than 45 irregular shaped patches of different sizes, making it seem as if the majority of the patches were the starting material for the garment. That means, recycled material formed the basis of the garment. The Iron Age cloaks of Damendorf and Dätgen (Germany) have also been repaired with several patches.

Some sewn textiles from prehistoric Hallstatt were obviously in secondary use. Some of the seams still seem to have originated from the first processing and are most often finished with smooth, same colour stitches. Next to these, the same textile finds also show coarse and uneven stitches, often worked with stronger and differently coloured threads. These cases are secondary seams, and they provide good evidence for recycling and reworking of textile material, for whatever function.

Sewing technology forms the link between the textile surface and the worn garment, making it an integral part of textile processing. Investigations of seams and hems lead to important insights into applied techniques and craft knowledge; further, they allow researchers to draw conclusions about the way textile garments looked like and how they were worn on the body.

⁵³⁴ Schlabow 1976, 72–73, fig. 149 (Bernuthsfeld), fig. 76, (Damendorf), fig. 83 (Dätgen). – Möller-Wiering and Subbert 2012, 161 (Dätgen, Damendorf).

C Textile craft in prehistory

Textile hand craft, which was an important part of the daily workload for thousands of years, has become completely irrelevant to modern life. Today, textiles for clothing or other purposes are produced by the mechanisms of global market economy in low-wage countries, and textile craft in Central Europe is only carried out in the high-priced segment of the arts and crafts or exercised by individuals purely as a hobby.



Only in the rarest cases is a larger part of the work process accomplished by a modern person in the Western World. A jumper may be knitted from purchased yarns, or perhaps wool fleece is felted creatively. Only very few people spin, dye, or weave and have the capability to produce everyday objects. Typically, clothing and textiles today are bought cheap and disposed of quickly. This has become possible by the dramatic loss of value that textiles have experienced. This detachment of textile from craft work stands in stark contrast to the situation in earlier times.

In the depths of history, it quickly becomes apparent that textile production shaped the lives of people in the past. Even today, proverbs and figures of speech provide a window into the past, in which textile production was omnipresent. For instance, we refer to *'the distaff side of the family'* or a *'dyed-in-the-wool'* conservative, a drunken man *'weaves his way down the road'* and *'shuttles back and forth'*.⁵³⁵ Let us track back 2000 years.

We are well informed about Roman textile production⁵³⁶, thanks to written records. Textiles were already produced *en masse*, and a specialized craft profession had emerged, including fullers, tailors, weavers, *etc.* Textiles were produced at home, or in workshops such as dyeing and fulling mills, and distribution and sale were undertaken by cloth merchants. The Igel Column⁵³⁷ provides interesting data on the latter. Through papyri, we even know about apprentice contracts,⁵³⁸ wages and prices. In an ancient version of a 'global market economy', textiles could be manufactured in Egypt, for instance, and delivered across the Roman Empire to Judea, Central Anatolia (Capadocia) or even to the province of Britannia for the military. Clothing, soft furnishing, yarn and prepared raw materials

⁵³⁵ Kind comment by John Peter Wild, Manchester, Great Britain, Jan. 2014. German examples include *e.g.* „*der Geduldsfaden reißt*“, „*der Handlungsfaden einer Geschichte wird weiter gesponnen*“ or „*man macht blau*“.

⁵³⁶ Cf. Droß-Krüpe 2011. – Gleba and Pásztoakai-Szeőke 2013. – Wild 1970.

⁵³⁷ *E.g.* Bender Jørgensen 1992, 132–133, figs. 160–165.

⁵³⁸ Droß-Krüpe 2011.

were traded and exchanged into every corner of the Roman Empire, and even as far as India and Central Asia.⁵³⁹

Valuable written sources such as these are much sparser for the centuries before the Roman occupation in Central Europe. The Roman writer Livy (Liv., 21.31.8) indicates that the Gallic tribe of the Allobroges, residents of eastern France, supplied the army of Hannibal with warm clothes during the Second Punic War (218–201 BC).⁵⁴⁰

How was the textile production in Central Europe organized all those millennia ago, from the Stone Age to the Iron Age? Were textiles produced at home, or were there craft specialists, and what do we know about the people who worked in the textile trade, about the places in which they produced and lived?

1 Levels of production: household, specialised and mass production

The development of agriculture and animal husbandry at the beginning of the Neolithic period revolutionized many technological and social developments. In relation to textile craft, during the Neolithic the technological and material bases were created which in principle remained valid until today⁵⁴¹. Wool and flax still play an important role today, even after the invention of synthetic fibres. The spindle and the mechanics of the loom were, in all simplicity, already perfectly designed in the Neolithic, and most spinning and weaving machines still work according to the same basic principles. In the Neolithic, we have the first evidence for weaving on the warp-weighted loom. Since this is large, heavy, and not an easy device to transport, especially in its mounted state, its use seemed to depend on permanent settlements. For the nomadic lifestyle of the Palaeolithic

⁵³⁹ See Droß-Krüpe 2013.

⁵⁴⁰ After Timpe 1981, 54.

⁵⁴¹ The basic spinning procedure as well as the basic weave types still exist today, even the main sewing techniques.

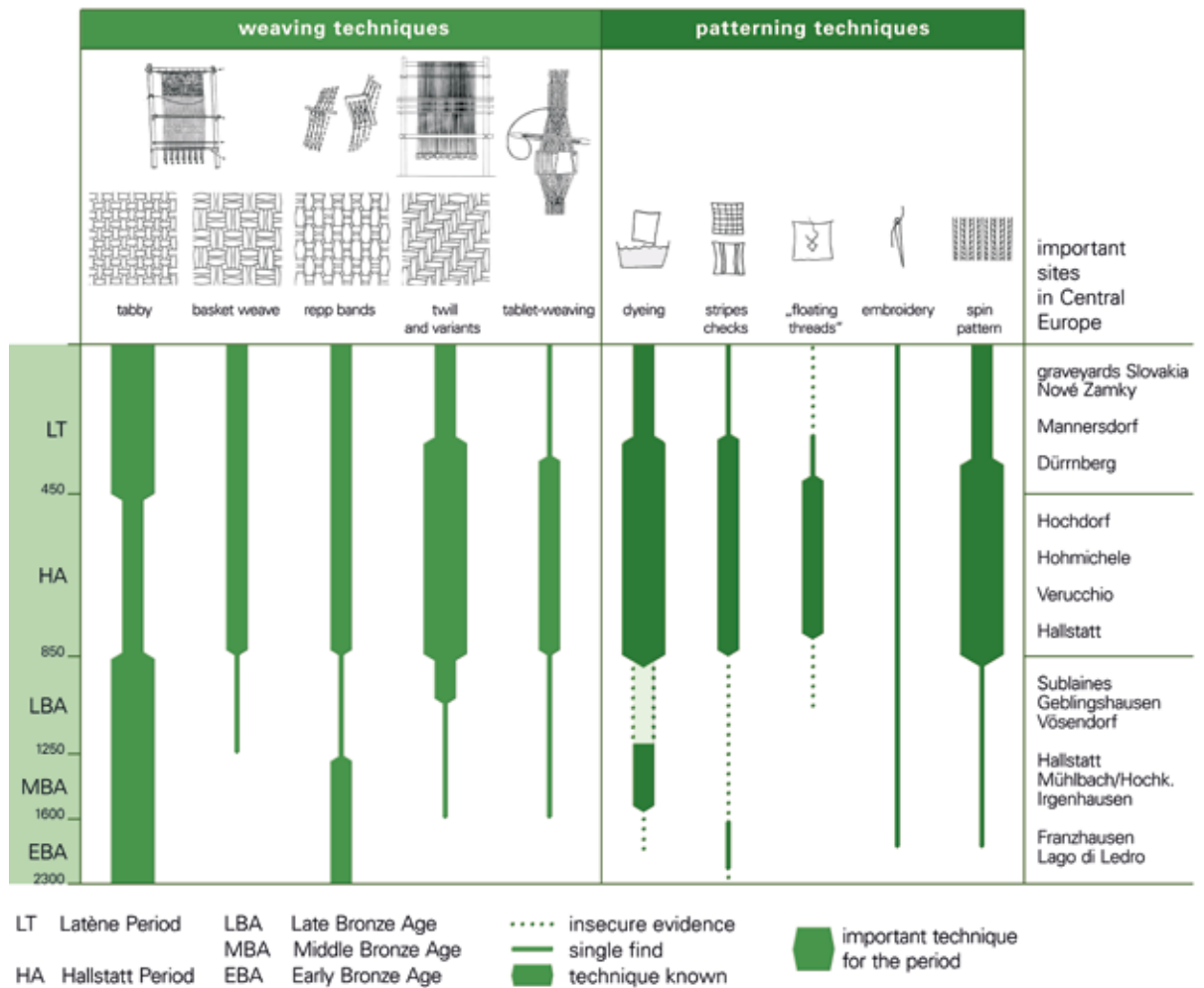
and Mesolithic, the warp-weighted loom made little sense, and neither did the cultivated fibre plant flax (*Linnum usitatissimum*). Flax is a demanding and high maintenance crop and already presupposes developed agriculture. In principle, however, the processing of plant fibres – especially grass and bast – originated long before the Neolithic⁵⁴². The nomadic hunters and gatherers of Central Europe already knew the various technologies of basketry, braiding, knotting, twining and netting. During the Neolithic and the Bronze Age, the long fibres of flax were worked into fine fabrics, but methods of working wool with its shorter fibres developed especially in the course of the Bronze Age. In the Early Iron Age, extremely fine yarns were spun and further processed. This change has to be seen in connection with successes in sheep breeding⁵⁴³.

In the Neolithic and Early Bronze Age weaving of large-scale fabrics on the warp-weighted loom included just simple tabby weave and its variants like repp. In addition to looms for large textiles, equipment for weaving bands can be found from the Neolithic period. In contrast to the loom, which was fixed in place, the weaving of bands is mostly a mobile technique that can be carried out at different locations if necessary. Most band weaving techniques are based on the principle of raising and lowering thread systems similar to the manufacturing principles on the warp-weighted loom. It is unknown whether ribbon weaving first developed and the system was then further developed for large-scale fabrics or vice versa. Tablet weaving emerged in Central Europe in the Middle Bronze Age – a technique that made complex patterns possible and that experienced its first heyday in the Hallstatt period.

After the invention of weaving in the Neolithic period, different methods were used to decorate fabrics. A creative repertoire of applying and inserting decorative elements was developed. Sewing on elements and designs with floating weft threads are techniques that had already been applied in the Late Neolithic and the Bronze Age. A special fondness for striped and checked fabrics can be observed in the Iron Age. Even sophisticated

⁵⁴² Cf. Bender Jørgensen 2013b. – Rast-Eicher 2005. – Soffer *et al.* 2000.

⁵⁴³ Cf. Rast-Eicher and Bender Jørgensen 2013. – Ryder 1982; 1992.



techniques such as spin patterns were very popular with creative Hallstatt Period craftspeople. In Central Europe, these patterning techniques have their roots in the Bronze Age, as does both dyeing and twill. First experiments to expand the loom with multiple shafts for the manufacture of twill are known from Middle Bronze Age finds in the salt mines of Hallstatt. Complicated weaves on multi-shaft looms were particularly popular in the Hallstatt period to produce high quality fabrics with ever finer yarns. At the end of the Iron Age, tabby became popular again, woven on simple, single-shaft looms. Compared to the Hallstatt period the number of loom weights in the settlements decreases, probably due to the introduction of a new type of loom in Central Europe – the two-beam loom.

Fig. 140. General development of weaving and decoration techniques from the Bronze to the Iron Ages in Central Europe.

Noticeable improvements in preparing the raw material and in spinning itself – especially in the yarn qualities achieved – went hand in hand with the refinement of weaving techniques from the Neolithic to the Iron Age. In the Bronze Age, wool fleece was taken from primitive sheep and usually processed complete with kemp and woolly hair. Yarns made of well prepared wool fleece can be observed in the Hallstatt period. The fine, well-sorted and combed fibres lie parallel like a combed top (*Kammzug*) and thus give the yarn a certain shine. Only with thread material of such fine quality could spin- or shadow patterns be produced in the Hallstatt period.

This brief overview of prehistoric textile craft (Fig. 140) shows that we need to move away from a primitivist perspective. Was it only the lonely textile worker in her dark cabin who created all these products, or can we paint a different picture of the craftspeople involved in textile production? How was textile craft organized?

Following a general theoretical model by Eva Andersson-Strand from the Centre for Textile Research in Copenhagen, the level of textile production (Fig. 141)⁵⁴⁴ can be seen as developing from household production in its simplest form over various stages of specialization until mass production began. Household production, however, never lost its importance. The following considers, whether this theory can also be applied to the prehistory of Central Europe. For this purpose, the definition of Andersson-Strand will be cited in the introduction of each section, followed by a discussion of the level of development considered possible for the prehistory of the study area.

In the absence of written sources, only a synopsis of the various archaeological sources, the finds from settlements and graves in Central Europe as well as our knowledge about the social organization at the time, can provide information on this subject. The textiles themselves provide important information on the state of development of textile craft.

⁵⁴⁴ For definitions of *household production*, *household industry*, *attached specialist production* and *workshop production for trade*, see Andersson 2003a, fig. 1.

| HOUSEHOLD PRODUCTION | HOUSEHOLD INDUSTRY |
|--|--|
| <ul style="list-style-type: none"> • Production solely covers the household's own needs • Household members possess knowledge and skills needed • Raw materials commonly accessible • Knowledge of manufacturing processes widespread | <ul style="list-style-type: none"> • Production scale beyond needs of producers • Organized at household level • Surplus used for trade, exchange or tax • Production when spare time is available • Work not full time occupation |
| ATTACHED SPECIALIST PRODUCTION | WORKSHOP PRODUCTION FOR TRADE |
| <ul style="list-style-type: none"> • Production by specialists • Craftsmen supported by and dependent on patron • Work main occupation on full time basis • Specialist's skills enhanced by full time occupation • Better quality products • High quality products as desirable gifts • Control of skills add to patron's power | <ul style="list-style-type: none"> • Direct production for market • Items practical and standardised • Production volume high • Great demand for products • Work full time occupation • Time costs per item reduced to minimum |

1.1 Household production

As defined by Eva Andersson-Strand household production is characterized by the fact that goods are primarily produced for domestic requirements (Fig. 141). The demand for raw materials is ensured by home production or trade with near neighbours. Household production also assumes that craft knowledge and skills are widespread within the community. Textile craft was probably organized as household production in the rural village communities of Stone and Bronze Age Central Europe⁵⁴⁵. Textile tools appear on a regular basis in households of the Linear Pottery Culture by c. 5000 BC. Bronze Age settlements in Switzerland were examined in detail and the location of textile tools such as spindle whorls, loom weights or needles was mapped. In the Late Bronze Age villages of Greifensee-Böschen, Eschenz-Insel Werd and Zug-Sumpf, several houses with loom weights were detected. Researchers interpret these findings to mean that this kind of work took place in a domestic setting and there are no signs yet of a significant specialization in weaving⁵⁴⁶.

Fig. 141. Characteristics of household production, household industry, specialization and mass production from Eva Andersson-Strand.

⁵⁴⁵ Cf. Médard 2012, 370.

⁵⁴⁶ After Rast-Eicher and Reinhard 1998, 286.

The rather simple textiles of the Stone and Bronze Age, many of which were made in tabby weave, suggest that these basic techniques have been commonly mastered and practiced. Like other things in daily demand – food sourcing, making and repairing tools *etc.* – textiles were probably mostly made by those persons or households who needed the products. The farmhouses and village communities were essentially self-sufficient in those early periods. Economic models could be developed based on outstanding research on Swiss lake dwellings from the Stone and Bronze Age, which show how the annual work of farmers might have looked and how self-sufficiency worked⁵⁴⁷.

Household production in the sense defined above was, of course, widely distributed throughout prehistory, the Middle Ages and the modern era, especially in rural areas, in addition to other forms of production.

1.2 Household industry

Household industry is a further stage of production (Fig. 141). According to Andersson-Strand, household industry is still organized at the level of a household, but a surplus is produced that goes beyond mere subsistence. The additional goods emerging from household industry can then be used for exchange and trade. Craft production is not conducted on a full-time basis, but production is slotted in when time can be spared. How can this model be applied to craft production in prehistory? Economic and social data emerging from certain prehistoric societies are important: from the Bronze Age in Central Europe at the latest, trade and exchange with a range of different goods is attested. There are various gradations of trade and exchange, from barter trade within the neighbourhood to long-distance trade⁵⁴⁸. Especially in terms of bronze and its components copper and tin, as well as in terms of the metal products produced from it, 'real' trade is conceivable, that is the exchange of standardized goods, which can be ensured by casting bronze products. The Early Bronze Age ring

⁵⁴⁷ See Schibler *et al.* 1997.

⁵⁴⁸ See theories and models in Lang and Salač 2002.

and rib ingots (Fig. 142) such as the ones from Perschling in Lower Austria⁵⁴⁹ are frequently found in large numbers – up to several hundred items in a single find. These appear in identical forms all over Central Europe and a kind of weight standardization could even be detected. From an economic point of view it is therefore possible to speak of a means of payment before money. Traders, who moved from village to village with their goods, were probably a common sight from the Early Bronze Age onwards. Archaeologists are even able to reconstruct trade routes.

Societies became more and more stratified during the Bronze Age, although the roots of this social development can be traced back to the Copper Age. From the Early Bronze Age onwards, craftspeople, farmers and warriors can be clearly differentiated in Central Europe⁵⁵⁰, since specific objects were found in their graves. Traders, for example, can be indirectly inferred through trade goods, such as Baltic amber. According to these economic and socio-political considerations, it is quite conceivable that Bronze Age textiles produced in household indus-

Fig. 142. Hoard of ring ingots from the Early Bronze Age settlement of Perschling, Austria. The approximately 250 bronze ring ingots weigh 51 kg altogether.



⁵⁴⁹ Krenn-Leeb 2006, fig. 6–7.

⁵⁵⁰ For the social structure of the Bronze Age and the economic factor bronze, see Kristiansen and Larsson 2005. – Urban 2000, 140–142. – Vandkilde 2007.

try were traded via a bartering system⁵⁵¹. The clearest evidence for this assumption comes from the site Hallstatt in Austria's Salzkammergut region. Salt mining is attested in Hallstatt⁵⁵² from the 15th century BC, the Middle Bronze Age, at the latest. It is the oldest salt mine in Europe, and operates to this day. The intensive research on mining (see pages 304–307) brought clear evidence that the entire mining process was highly organized, and that a strict division of labour prevailed. For example, there were miners specialized in breaking salt and others for transporting it out of the mines. The current state of research suggests that at the salt mining centre of Hallstatt, large parts of the population were directly involved in the mining operation and thus their working capacity for the manufacture of other everyday products was probably minimal during the Bronze and Iron Ages. In addition, space for arable land is limited by the topographic position of the site in an alpine area at a lake surrounded by steep slopes (Fig. 143).

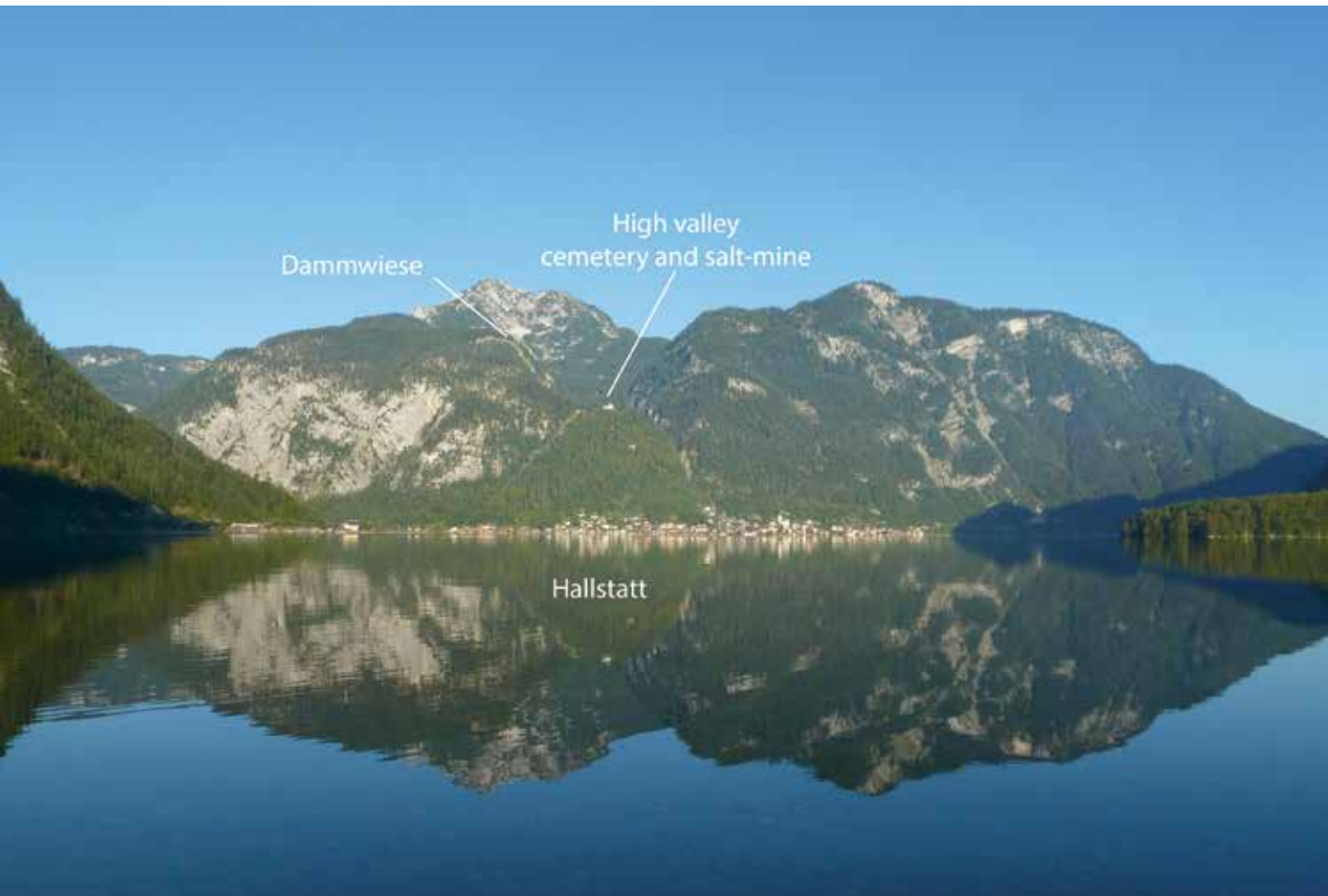
It is therefore to be expected that food and everyday goods that were manufactured in other contemporary settlements, as well as some of the mining equipment, was traded in and brought to Hallstatt from the surrounding areas in exchange for salt. For the time period between the 15th and 12th century BC, there is evidence that wooden handles of picks used in the Hallstatt salt mine Christian-von-Tuschwerk came from outside the valley or region⁵⁵³. Wood analysis demonstrates that the commonly used knee-wood handles (*Knieholzschäftungen*) were made of oak wood derived from the northern Alpine foreland (with a southern border along the north shores of Traunsee and Attersee lakes), a distance of at least 40 km to Hallstatt.

It is also quite conceivable that many of the excellently preserved textiles found in the salt mines were not produced in Hallstatt itself, but were imported instead. The manufacturing sites may have been located in the Upper Austrian Alpine foot-

⁵⁵¹ Intensive textile industry including trade is known in the Mediterranean region at the same time, for instance the palace economy at Knossos, Greece. Cf. Harris 2012. – Killen 2007. – Militello 2007.

⁵⁵² For a comprehensive discussion, see Kern *et al.* 2009a. – Kowarik and Reschreiter 2011.

⁵⁵³ Grabner *et al.* 2007.



hills. Plenty of resource-rich areas with pastures for sheep or arable land for growing flax and dye plants are located there. In the future, isotope analysis of wool⁵⁵⁴ may substantiate evidence for the circulation of textiles and the raw materials used in their making. Household industry is the most likely production level, in particular for the Bronze Age.

Fig. 143. Hallstatt in Austria, topographic position of the salt mines and the cemetery.

⁵⁵⁴ For finds from Denmark and methods of analysing, cf. Frei *et al.* 2009. – von Holstein 2013. – Frei 2013.

1.3 Attached specialist production

The next level of production is specialization, of which there are different forms. Specialization may include individuals, groups of people, villages or regions. These may provide special products based on particular raw materials, local conditions or manual skills. Specialization can be carried out part-time or on full-time basis, throughout the year or seasonally⁵⁵⁵.

Eva Andersson-Strand defines specialist production for textiles as follows (Fig. 141): The work of the specialist is done on a full-time basis, and technical skills and knowledge are extended in order to create higher quality products. The persons involved in specialist production are often dependent on a patron, who feeds and supplies them. Goods produced in this way can now also serve as precious gifts or for exchange. A further feature of this production level is the complete control and authority over the craftsmen the patron exercises, including their expertise and the training of further specialists working for him.

In the Mediterranean area, the available written sources attest to such specialization from quite early on. Administrative records of the Mycenaean kingdoms of Crete and the Greek mainland (15th to 12th centuries BC), written in Linear B script on clay tablets⁵⁵⁶, yield information on two broad categories of textiles. First are fine cloths produced in specialist weaving workshops, made with high levels of labour division within the workforce. Second are domestically produced textiles, acquired by the palaces through taxation. Similar systems were also in use in archaic Greece, where within the household (*oikos*), the residence of an aristocrat, high status women and their female servants (*amphipoloi*) were responsible for weaving⁵⁵⁷. Textile production of a household played an important representative role for aristocrats, but clothing was also a valuable asset for gift-giving and

⁵⁵⁵ For theoretical considerations on the different forms of specialization, see Costin 1991, 4–43.

⁵⁵⁶ E.g. from Pylos: *pe-ki-ti-ra* 'combers of wool'; *ri-ne-ja* 'linen workers'; *a-ke-ti-ri-ja* 'decorators of cloth'; *a-pu-ko-wo-ko* 'head band makers'; *ra-pi-ti-ra* 'sewing woman'; Del Frio *et al.* 2010. – Killen 1985; 2007. – Militello 2007. – Rougemont 2007, 48.

⁵⁵⁷ For considerations on the *oikos* economy in archaic Greece and the importance of textiles, see Barber 1991, 283–298, Wagner-Hasel 2000, 105–107 (textiles as mementos and duties), 141–148 (weaving duty).

votive offerings to the gods. High levels of specialization in the area of the Villanovan and Etruscan civilizations can be inferred from various finds and features. These include the textiles of Verucchio⁵⁵⁸, the special grave goods such as spindles and distaffs made from precious materials such as bronze, silver, amber and glass, as well as depictions of textile work, exemplified by the *tintinnabulum* (bronze sheet rattle) from Bologna (Fig. 147) or the wooden throne from Verucchio. These finds substantiate the idea that women with high social status were practicing textile craft (and had the permission to do so)⁵⁵⁹. Such developments occurred under the patronage of elites and were motivated by the need to produce status markers and prestige goods like textiles. The display of luxury goods as seen in the archaeological record is closely mirrored in the behaviour of warrior aristocracies in the Homeric poems, reflecting the ideological system underlying the behaviour, beliefs and values of Orientalizing Mediterranean elites. In Italy between the 10th and the 7th century BC, part of the textile production shifted from making subsistence products to the manufacture of non-essential, luxury and surplus goods.

What was the situation in Central Europe? Is it possible to assume a higher production level than household production or household industry in pre-Roman times? Consulting the archaeological material, finds and findings of the Early Iron Age in Central Europe appear more than striking⁵⁶⁰. In contrast to the Bronze Age, elaborately produced fabrics are now preferred over simpler weaves. These are high-quality fabrics, made with large expenditure of time and employing special skills. Sometimes they are very complicated pieces whose production exceeded the abilities of the average craftsperson and required a specialist. Examples include the textiles in the princely grave of Hochdorf or those from the Early Iron Age parts of the Hallstatt salt mines⁵⁶¹. One can find an incredible creativity, reflected by the use of different patterns, weaves (see chapter

⁵⁵⁸ Cf. von Eles 2002, 192–234. – Stauffer 2012.

⁵⁵⁹ Cf. Gleba 2007; 2008a, 190–194; 2013, 2–3, 9–11.

⁵⁶⁰ Cf. papers in Gleba and Mannering 2012. – Grömer 2012. – Smolenice-Molpír: Belanová-Štolcová 2012, 312.

⁵⁶¹ Hochdorf: Banck-Burgess 1999, 2012a. – Hallstatt: Grömer 2013, 81–87.

B) and colours. We know complicated tablet-weaves, complex weave types such as diamond twill, dyeing with imported dye-stuffs such as insect dyes. The fineness achieved in the yarns and fabric density evidence an enormous amount of work. This picture of Hallstatt textiles leads one to think of a specialized form of production, because the production of such pieces requires persons who had the time, skills and know how to create these representative products. The precious textiles must have been valued and appreciated within the community, but in addition, resources to produce them must have existed (especially a surplus of work time, but also other expenses for imported dyes, *etc.*). However, this can only be seen in the context of a complex social development that allowed or encouraged this more elaborate work on the production of textiles.

For the Central European prehistory, the following scenario is possible: the Early Iron Age was marked by great social changes⁵⁶², caused, in part, by the availability of a new material – iron. Not only were the various craft technologies affected by the changes, but the entire social fabric of the time. The society was hierarchically structured even more than before. Those at the top of the hierarchy can be traced in ‘princely tombs’ and represented themselves by an extravagant lifestyle. This is likely to have favoured the splendour of the textile art of the Hallstatt Culture, which has to be interpreted in the context of the contemporary culture of representation. Again, the precious textiles from the princely grave of Hochdorf can be quoted as an example. Perhaps status definition and the visualization of social status was achieved through textiles and clothing. Contemporary archaic Greek epics attest that the visual potency of a person ‘*charis*’ is also tied to their clothing⁵⁶³.

It is therefore quite possible that in the Central European Hallstatt period we see for the first time the products of specialists in the textile crafts, even if this is supported only by the textiles themselves, and not by written sources. The patrons mentioned in the definition of specialization given by Andersson-Strand, for which such quality products were made, could have been

⁵⁶² Kristiansen 1991, 19–20. – Urban 2000, 227–229. – Vandkilde 2007.

⁵⁶³ Wagner-Hasel 2000, 152–163; 2006.

members of the Hallstatt period nobility. Therefore, we can suggest a specialized textile production, especially for the Early Iron Age elite, and possibly for the wealthy as well⁵⁶⁴. To what extent an exchange of products and labour took place within the community, or whether a supra-regional resource exchange existed, is not clearly ascertainable for the textile sector. Nor do we know whether the relevant specialists were completely exempt from every-day activities and other duties within the community. However, the complex textile products are a clear indication that a non-negligible expenditure of working time, highly specialized knowledge and expertise was invested in their production in the Hallstatt Culture.

It is also possible that some of those products were made in the surrounding countryside, while others had to be imported over long distances (which may be verified by the use of exotic raw materials such as dyestuffs or exotic weaving or patterning techniques and designs). Textiles circulated not only through trade but were also an important part of the gift exchange system and formed an essential part of the dowry⁵⁶⁵. Gift exchange was practiced among the elite members of communities and involved luxury items, including textiles, garments and jewellery, as well as implements that held symbolic values, such as spindles and distaffs. Unfortunately, it is not possible to estimate the quantity of production that was the work of specialists and the quantity that was carried out in household production. Both modes of production developed alongside each other. There is little doubt that textile manufacture was practiced at all levels of society and was one of the most labour-intensive occupations.

⁵⁶⁴ See also Rast-Eicher 2008, 190.

⁵⁶⁵ For exchange, textile trade and gift giving see Gleba 2013, 12–14. – Mauss 1954. – Wagner-Hasel 2006.

1.4 Workshop production and large-scale industry for trade

The last stage of specialization conceivable for prehistory is workshop production for trade and large-scale industry for trade. According to Andersson-Strand (Fig. 141), the modes of workshop production turn out standardized, simple and mass-produced goods quickly and directly for the market. This is based on a developed economy with solid customer circles. The goal is a large output of goods produced with the cost per unit reduced to a minimum by production efficiency. For the next step in textile production, large-scale industry for trade, production takes place on a full-time basis and exclusively for sale. It requires capital investment and extensive product distribution.

Certainly, the latter production form is attested in the Roman period⁵⁶⁶. Earlier evidence for workshop production is known from the Mediterranean world. The textile production in the Mycenaean Palaces of the 14th and 13th centuries BC seems to have been state-controlled. In the Linear B tablets of Crete, flocks of hundreds of ewes, rams and wethers are mentioned, with a calculated amount of 100,000 animals under palatial control. This means a total of about 10,300 units of wool per year, *i.e.* 52,000 kg, processed by thousands of workers, and a production of about 5,000–7,000 pieces of cloth, 10 kg each.⁵⁶⁷

Is there evidence for workshop production in prehistoric Central Europe? In Austria, we know of more than 600 textiles from the La Tène period salt mines at Dürrnberg near Hallein⁵⁶⁸, plus other finds from graves at various sites⁵⁶⁹. The research on salt mine textiles from Dürrnberg revealed that the fabrics differ greatly from those of Early Iron Age Hallstatt.

The Dürrnberg textiles no longer show that exuberant creativity of fabric qualities, weave types and patterns that characterize

⁵⁶⁶ Cf. Bender Jørgensen 1992, 130–133. – Wild 2003.

⁵⁶⁷ See Killen 1985, 108.

⁵⁶⁸ Von Kurzynski 1996 and catalogue in Stöllner 2002. – See von Kurzynski 1996, 35–36, for notes on standardization.

⁵⁶⁹ Grömer 2012.

the textiles from Hallstatt. Simpler, clearer forms now prevail: patterns are mostly stripes (vertical warp stripes), fabric structures include tabby weaves, basket weaves and, less frequently, simple variants of twill⁵⁷⁰. Even with the thread diameters and weave densities, a certain standardization can be noted. These are still high quality products, but compared with the textiles of the Hallstatt period they can be produced faster and more easily. A loom for weaving tabby is set up more quickly than one for weaving twill, and weaving tabby is faster, as the specific sequence of lifting and lowering the heddle rods does not have to be considered. The same is true for the patterns: vertical stripes arise during weaving without further action when the warp yarns are defined and set accordingly. When producing checked patterns, the weft yarns have to be counted and groups alternated. The differences in the textiles are remarkable, as the finds from Hallstatt and Dürrenberg originate from the same region (they are 55 km apart from each other as the crow flies), and the settlements and salt mines from Dürrenberg are just slightly younger than those of Hallstatt and also partly overlap in terms of chronology. In addition, at both localities, the same preservation conditions are present in the refuse layers of the salt mining operation. Wealthy communities who were heavily involved in the European trade and maintained cultural contacts in all geographic directions inhabited both sites.

It is apparent from the Dürrenberg textiles that an efficient production with a maximum output was desired, although a few specially decorated pieces are amongst the finds, too. The special structure of the Dürrenberg production and trade centre⁵⁷¹ has probably favoured this mode of production. The Dürrenberg encompassed, apart from a well-organized mining industry, separate workshops for various products (*e.g.* wood and bronze objects, glass and iron goods, jet arm rings *etc.*) in the settlements. An extensive net of economic connections enabled the distribution of the goods produced. If one compares all of the recorded textiles of the Late Iron Age from Austria, Moravia and Slovakia⁵⁷² to the research results from Dürrenberg, the result is a uni-

⁵⁷⁰ Stöllner 2005, fig. 6.

⁵⁷¹ Brand 1995. – Stöllner *et al.* 2003, 123–126, 152–155.

⁵⁷² Belanová 2005; 2007; 2012. – Grömer 2012.

form impression, despite different contexts and different uses of individual pieces. This development towards standardized mass-produced goods with only a few different types of weaves (usually simple tabby weave, standardized weave densities and thread sizes) is also observed in the La Tène grave finds of the area. A similar picture emerges from the textiles found in Switzerland dating to the middle La Tène period⁵⁷³.

Furthermore, standardization and functionalization are both apparent from the work equipment. From the La Tène period onwards, more and more spindle whorls were made from broken pieces of pottery that were rounded and pierced (Fig. 39). The individual, creative forming and ornamentation of a whorl is no longer important. Instead, the purely functional aspect of the spindle is emphasized, and this is a further indication of mass production. Standardization of tools indicates that they were produced on a larger scale than before (and less carefully). This corresponds to the intensification of textile making activities and a demand for the appropriate equipment. In addition to the standardization of the old implements, certain new tools make their appearance during the La Tène period, indicating new techniques. Iron shears are one example, revolutionizing the way raw material was collected, maybe hand in hand with the development of sheep breeds with non-shedding fleece⁵⁷⁴.

Similar dynamics are noticeable in other material groups or crafts of the La Tène period. Pottery, for example, which like the textile industry is usually considered a conservative craft, was also produced within the household from the Stone Age onwards. Archaeological ceramic analysis targets various elements such as the shape of the vessels, the mode of decoration and the production technique. These analyses form the common 'tool-kit' for archaeologists, as ceramics are, at least numerically, the most significant finds in Central European prehistory. Pottery production in the Hallstatt period in Austria and its neighbouring countries can be described as labour-intensive individual production, which, in comparison to Bronze Age pottery production, looks slightly cluttered and 'baroque' in both shape and or-

⁵⁷³ Rast-Eicher 2008; 2012.

⁵⁷⁴ Cf. Gleba 2013, 6. – Ryder 1992, 137.



namentation, but also of high quality⁵⁷⁵. The potter's wheel was introduced from the middle of the La Tène period,⁵⁷⁶ and the mode of production shifted from household to mass production. This had notable repercussions on pottery forms and decoration (Fig. 144). Vessel forms that could be quickly and easily fabricated using the potter's wheel were now preferred. Decoration is limited to grooves, lines and ridges that were worked into the surface whilst turning the wheel. The vessels were thus standardized and functional, and especially in the case of fine goods, of excellent quality. A similar development can also be observed for the ancient art of wood craft, as woodturning comes up in the La Tène period.

Is this a manifestation typical of the Late Iron Age period? Had society developed so far, have crafts become so specialized, that even traditional household techniques like pottery and textile manufacture had changed to mass production?⁵⁷⁷ The full transition to mass production would mean the separation into different professions with full-time employment in the various sectors, specialized workshops, *etc.* The archaeological sources can provide no certainty, but it is conceivable that in the La Tène

Fig. 144. Ceramics of the Early Iron Age (1, hand-made) and the Late Iron Age (2, wheel-thrown).

⁵⁷⁵ For a short introduction to the pottery of the Hallstatt period, see Nebelsick *et al.* 1997, 65–70. For representative pottery, see 116–122. – Urban 2000, *e.g.* 281, fig. on 271.

⁵⁷⁶ Cf. Neugebauer 1992, 94–98.

⁵⁷⁷ See also the reflections in Rast-Eicher 2008, 188–189. – For specialization and mass production in pre-Roman Italy, see Gleba 2007, 75.

period in Central Europe the first manifestations of workshop production for trade emerged besides the household industry. The Romans expanded this mode of production towards a large-scale industry for trade as they expanded their Empire around the turn to the Common Era⁵⁷⁸.

The Roman trading outpost at Magdalensberg in Austria (c. 50 BC to 50 AD)⁵⁷⁹ is located at the interface of the Central European Iron Age and the Roman advance towards the Danube in what later became the province of Noricum. Here, merchandise was sold in wholesale quantities from all over the Mediterranean. In addition, workshops organized by the merchants' staff, or at least in close cooperation with the workshop owners, were occupied with the manufacturing of different goods. The textile tools and lead tags (*tesserae plumbeae*) found at the site give a good glimpse of the textile workshop production and trade in this period. There is a very extensive collection of textile implements from the site, which represents virtually every aspect of manufacture. The large level of the production can also be seen by the total amount of tools, e.g. 1,070 spinning implements (including spindle whorls, hooks, distaffs and complete spindles), about 200 loom weights and 373 needles. As sewing or mending was one of the main activities in the Magdalensberg textile business, shears were also needed for tailoring; the presence of tailors is confirmed by graffiti on the walls of a warehouse and on lead tags (e.g. the term *sutor* on graffiti with reference to cloaks). As suggested by Kordula Gostenčnik the number of textile tools implies that many of the inhabitants on the Magdalensberg must have earned their living working in the textile business.

In the Roman Empire, mass production can be found in all the provinces, with special products of each region for the Roman market. For the province of Noricum, today in Austria, different wool fabrics and high quality iron products are mentioned in written documents. According to Diocletian's Edict on Maximum Prices⁵⁸⁰, dating to AD 301, various wool garments were exported from Noricum; specified are *birrus Noricus den. decem*

⁵⁷⁸ Cf. Gostenčnik 2012. – Möller-Wiering and Subbert 2012, 169–170. – Wild 1970.

⁵⁷⁹ Cf. Gostenčnik 2013, 62–66, fig. 4.2–4.5.

⁵⁸⁰ Lauffer 1971.

milibus; banata Norica duplex den. viginti milibus; fedox Noricus optimus den. decem milibus; singilio Noricus den. mille quingentis (Ed. Diocl. 19, 47.55.59; 33,24). In listing the enigmatic *banata* and *fedox*, the Edict echoes old regional traditions of clothing.

For the Iron Age of course we do not know, what percentage of the required textiles were made by specialists or in mass production. Here it can only be said that in addition to the household industry attested in prehistory, higher levels of production are also conceivable.

To sum up, textile crafts were focused on the domestic sphere in the Neolithic and Bronze Age. As items of consumption, textiles ranged from the necessary to the luxurious. The production of staple goods was localized in household production from the Neolithic to the Iron Age. An interesting aspect is the production of luxury items for status display and gift exchange (maybe long-distance) between elites⁵⁸¹. This led to the development of highly specialized and skilled craftsmanship and an exchange network, which included resources and object circulation (e.g. special dyestuffs such as insect dyes, tablet woven items, fine qualities and patterned items). Hallstatt period textiles such as examples from Hallstatt or Hochdorf have to be seen as the work of specialists. In the Late Iron Age, the demand for goods by a growing population in large centralized settlements led to a development of more organized modes of production, such as workshop production, and trade in these necessary products⁵⁸².

⁵⁸¹ Wagner-Hasel 2000 and 2006.

⁵⁸² Cf. Gleba 2013, 1.

2 The sociology of textile crafts

After general considerations on craft organization, more sociological questions emerge. Who were the people that produced the textiles, what was their gender, their age, and what relationships did they have with each other? It is also interesting to ask for whom certain products were made: who owned the elaborate and expensive textiles, and who was allowed to use them? To use modern terminology, not only the producers, but also the consumers of textiles are a group of people that require closer examination. Again, the absence of written sources allows only a vague picture to emerge. The available archaeological sources must be checked with special care as to their consistency. In the following, we restrict our investigations to the Iron Age of Central Europe, as we have here the best sources that can be evaluated; the focus is back on the territory of today's Austria.

In prehistoric times, the dead were equipped with the things that they needed for a life in the hereafter. **Graves and cemeteries** are therefore a significant source for addressing a range of different research questions. The social status of a person within a community can be inferred from grave goods and jewellery. Jewellery and metal components of clothing also give information about what the person wore at the funeral (see pages 324–326); here we are confronted by persons as consumers and users of textile products.

Concerning the textile crafts, there are other interesting messages in the graves. Whether specific devices were added only to certain groups of people in terms of age and gender can be investigated. Tools for the textile sector are spindle whorls, needles, loom weights and spools, as well as shears and knives. In different periods from the late Bronze Age to the La Tène period and in different regions of Central Europe, it seems that there were certain rules as to which and how many tools were given to the dead as grave goods. Particularly in the eastern Hallstatt area, but also in the inner Alpine area, spindle whorls are typically found in women's graves. But what do these tools



Fig. 145. Spindle whorl with Gallo-Roman inscription from Autun in France, 1st century BC.

in the grave mean⁵⁸³? Does a spindle whorl in a grave indicate that the buried person exercised this craft, and others didn't? Alternatively, are spindle whorls perhaps the symbols of a specific status, a social role or a symbol of womanhood in general?

Spindles may be so much a symbol of the feminine that they had acquired an erotic connotation. Reference to Late Iron Age finds from France can be made with a wink. Whatever prompted the people, they have left spindle whorls with distinct Gallic and Gallo-Roman inscriptions⁵⁸⁴. A taste of the sayings: *moni gnatha gabi buđđutton imon* – 'come on, girl, take my kiss' on a spindle whorl from Saint-Révérien or *geneta vis cara?* – 'dear girl, do you want?'. The spindle from Autun also calls for *nata vimpi curmi da* – 'pretty girl, give [me] beer' (Fig. 145). Did the spindle serve as a gift of love? In Roman times, the spindle was presented at the wedding as a symbol of the duties of a woman⁵⁸⁵. Spindles also were associated with sexuality and conception from Late Medieval times onwards⁵⁸⁶. Even in Central European folklore, similar thoughts can be found, for instance when in the Alpine region wooden distaffs were decorated with love symbols or carved

⁵⁸³ Cf. comments in Gleba 2008a, 171–174. – Lipkin 2013.

⁵⁸⁴ After Birkhan 1997, 1091–1092. – Lambert 2002, 323. See also http://www.asnc.cam.ac.uk/spokenword/g_autun_sens.php (last accessed 15th Jan. 2015).

⁵⁸⁵ Cf. Barber 1991, 283–298; 1994. – Cottica 2007. – Larsson Lovén 2007. – Stewart 2003.

⁵⁸⁶ Stewart 2003.

with the initials of lovers, a tradition that continued into the late 19th century⁵⁸⁷.

However, this humorous digression into the erotic symbolism of a craft tool should not blind us to other aspects. Does a tool in the grave indicate a high or low status in society? Perhaps the devices in the graves do not reflect the everyday reality of a person's workload, but rather a religious and symbolic meaning. This is partly considered for the pictorial representations of textile work. For the following considerations, it is now assumed that the tools in the graves have something to do with craft activities of the deceased.

Iron Age art⁵⁸⁸ offers many more or less detailed illustrations of people and their clothes, especially on works of situla art and as decorations on pottery, on statues and figurines as well as human-shaped brooches (for details see pages 395–398, 409–412). Scenic representations found on the pottery of the eastern Hallstatt area and situla art give insights into stories that take us to the imagination of Iron Age people (or only the upper class?). There are scenes of music and dancing, processions, parades, drinking scenes, wagon rides, hunts – as well as images of textile work. The familiar scenes can be found on a bronze rattle plate from Bologna, Italy, the back of the wooden throne from Verucchio, Italy, and on a conical shaped vessel from Sopron, Hungary. Interestingly, no other crafts are represented by the contemporary artists of Central Europe. There are no images of bronze casting, woodturning, carving bone or making pottery – crafts, which similar to the production of textiles, constituted significant work in the everyday life of Iron Age people.

The next question is therefore who is actually represented in the textile scenes. Were they (female) craft specialists or just 'housewives' in their daily duty? As far as gender is identifiable, only women are shown engaged in textile work. Elizabeth Barber and Alexandrine Eibner⁵⁸⁹ have dealt with the symbolic and

⁵⁸⁷ Cf. Grieshofer 2004, 125–129 with examples from Switzerland, eastern France, Austria and Italy, also from Romania and the territories of the former Yugoslavia.

⁵⁸⁸ Huth 2003. – Lucke and Frey 1962. – Reichenberger 2000. – Turk 2005.

⁵⁸⁹ Barber 1991, e.g. 358–359, 372–373. – Eibner 2000/2001.

ritual importance of the textile craft. They analysed Iron Age figures from Central Europe and related them to grave finds from the same area. To interpret them, they also considered and compared written and pictorial sources from ancient Greece. In antiquity, textile work was one of the noblest and most important responsibilities of women, as also described in the Homeric epics (Homer, *Il.* 6.490–493)⁵⁹⁰. The symbolism that inhabits a spindle in ancient Greece and Rome not only connects the item to the status of the mistress of a house (the spindle is also the symbol of the married woman), but also marks it as an attribute of female deities. Textile crafts had their own place in mythology⁵⁹¹. For our research questions, it is especially important that detailed scenes of various textile processes are recognizable in the images: spinning, sectional warping, weaving.

Written sources, reports by ancient authors⁵⁹² on late Iron Age communities of Central and Northern Europe, offer almost no starting points for our questions. Technical descriptions of crafts in general and textile production in particular were not an issue that would have excited ancient authors or interested their readership. Even today, different things of everyday life are mentioned in general reports, newspapers and magazines, but not the exact description of each step of production, which is assumed to be known. Ancient historians rather described what appeared unusual to the authors and their readers, and a person with spindle or a loom was certainly not unusual, as they were present everywhere. Products that were important for business did, however, received some attention – coats in the textile sector, for instance.

2.1 Consumers – people using textiles

For the most part, for our particular questions, archaeological sources only allow us insight into the more affluent part of the Iron Age population in Central Europe. In temperate Europe,

⁵⁹⁰ Cf. Barber 1991; 1994. – Wagner-Hasel 2000.

⁵⁹¹ Cottica 2007, 221–225. – Larsson Lovén 2007.

⁵⁹² For reports of ancient historians on crafts of the Iron Age, see Timpe 1981. For textile production and dyeing 54–55.

textiles are only preserved in graves when sufficient metal items (jewellery, large bronze objects) are present, onto which they can corrode (see pages 23–24). In ‘poor’ graves without metal grave goods, usually no fabrics have been preserved. Textile preservation is therefore restricted to the graves of the wealthy middle class and the rich. Particularly splendid and elaborately crafted fabrics are preserved in the metal-rich princely graves such as Hohmichele or Hochdorf, Germany⁵⁹³. We are thus well informed about the exquisite textiles of the upper class. La Tène period textiles from graves in Switzerland often have finer qualities of cloth associated with precious objects. In these cases, the textile quality expressed through thread count seems to be a marker of the social status of the deceased⁵⁹⁴.

Images of textile products also occur on objects in Iron Age art; they show garments in particular and how they were worn. They are – if you will – a picture from a consumer’s perspective. Situla art in particular⁵⁹⁵ provides richly decorated representations of men, women and – rarely – children in their (best?) costumes: men with tunics, long coats and various hats, swallowtail doublets and trousers, women with long dresses and veils. Again it must be remembered that it is primarily the upper class that is shown, assuming that these are not purely symbolic-mythological scenes. There are certainly no pictures of everyday life of the general population (see pages 329–332). The very detailed account of the chequered fabric patterns, the belts, bands and ribbons, with which the dress was decorated, are particularly striking on the works of situla art. This in turn can be set in context with the exquisite textiles from the Iron Age part of the salt mines in Hallstatt⁵⁹⁶ – they actually appear to be very realistic.

The high quality, elaborately patterned textiles from the salt mines in Hallstatt thereby raise the question whether these reflect the clothing of the general population of the rich mining

⁵⁹³ Hochdorf: Banck-Burgess 1999, 2012a and b. – Hohmichele: Hundt 1962.

⁵⁹⁴ See Rast-Eicher 2012, 389.

⁵⁹⁵ Frey 2005. – Lucke and Frey 1962. – Turk 2005.

⁵⁹⁶ Grömer *et al.* 2013, with reference to other researchers such as Hans-Jürgen Hundt and Katharina von Kurzynski.

community of Hallstatt. The fabrics were brought into the mines as rags, where they served various functions after their first use as garments (chapter D), *e.g.* as binding material. Recent studies on the skeletal remains of the Hallstatt cemetery⁵⁹⁷ in the high valley suggests that a large part of the local population was active in the salt mining industry. In comparison with other contemporary burials, the cemetery of Hallstatt is characterized above all by its wealth. It is not surprising that the textiles found in Hallstatt sometimes are very exquisite. Can the findings of fine and patterned textiles from the Iron Age parts of the Hallstatt salt mine be interpreted to the effect that they were available to a broader (and in comparison to other Hallstatt communities generally more affluent) population?

Unfortunately, for the most part our sources are silent regarding other settlements. It is only noticeable that the wealthy graves with metals also contain the finest fabrics in the whole area of the Hallstatt Culture. Of the patterns, only the spin direction patterns are preserved due to the lack of recognizable colours in metal corrosion preservation. As consumers of the fine and intricate textiles of the Hallstatt period in Central Europe, only the wealthier strata of the population and the elite have so far been identified. The textiles that were used by the poor, however, are difficult to grasp.

The Villanovan textiles from graves at Verucchio, Italy, are, as Annemarie Stauffer⁵⁹⁸ mentions, a testimony to sophisticated weaving methods and patterning techniques. Complex tablet woven borders, spin patterns, sewn on amber buttons and exquisitely shaped garments of high quality cloth show a high degree of skill in making garments. Moreover, dyestuff analyses give a clear idea of colours used and preferred by the contemporary aristocracy. The various garments from the princely tombs reflect social importance as well as individual wealth; they are symbols of status and identity.

⁵⁹⁷ Skeletal remains: Doris Pany in Kern 2009a, 136–141. – Grave goods: Kern *et al.* 2009. – Kromer 1959.

⁵⁹⁸ Stauffer 2012, 10–11.









Fig. 146. Sopron-Várhely in Hungary, Tumulus 27. Conical-necked vessel with spinning and weaving scene, Early Iron Age.

2.2 Producers – people involved in textile handcraft

An important sociological aspect relates to those persons who were employed in the textile crafts. As already mentioned, the Iron Age people of Central Europe have sometimes depicted textile work in their art.

Very well known, and shown in almost every scientific and popular book on prehistoric textiles, is the ‘urn of Sopron’ with a spinning and weaving scene. This Hallstatt period conical-necked vessel was found in Tumulus 27 of the cemetery

| | | | | |
|--|---|---|--|---|
| <p>Sopron-Várhely Tumulus 27 conical-necked vessel</p> | |  | |  |
| | preparation | spinning | warping | weaving |
| <p>Bologna Arsenale Militare Tomba degli Ori tinnabulum</p> |  |  |  |  |

Sopron-Burgstall (Várhely)⁵⁹⁹, Hungary (Fig. 146), in the grave of an 18 to 20-year-old woman. It did not contain the cremation, as the term ‘urn’ used repeatedly in various publications suggests, but was a container for drink. The young woman received many grave goods: more vessels completed the dinner set, whilst jewellery, glass beads, a bronze neck ring and a harp brooch constituted the personal objects in the grave. It is very revealing that the woman did not only have the vessel with the spinning and weaving scene in her grave, but also specific tools for this craft: two ceramic whorls are the remains of her spinning tools. The wooden spindle shaft and the spinning material of wool or flax are unfortunately gone.

Fig. 147. Pictorial representations of textile crafts in the Iron Age.

The ornaments on the conical-necked vessel now deserve closer examination: several persons images are incised into the neck of the vessel (Fig. 146 and 147); the woman at a large warp-weighted loom dominates the scene. In addition, we see a woman with a spindle and two women with hands raised – a hint of a dance? A fifth, smaller (male?) figure is situated right next to the loom holding a lyre. The entire composition reveals that spinning and weaving was done by women, in a charming, atmospheric (perhaps mythological) scene with music and dance.

⁵⁹⁹ Eibner 1980, Burial mound 27: 133–141, pl. 224–236.

Equally famous is the bronze plate rattle (*tintinnabulum*) of Bologna, Arsenale Militare necropolis 'Tomba degli Ori', Italy⁶⁰⁰, dating to c. 630 BC. This object is decorated on both sides with scenes in which women do textile work. More details of the work process can be found: On one side of the rattle, two women seated on throne-like chairs dress their distaffs for spinning; in the register above a woman is standing with spindle and distaff. On the other side of the object, different activities are shown which belong to the sphere of weaving. At the bottom, two women are busily weaving a starting border necessary for the warp-weighted loom, *i.e.* a basic activity for textile production. Above, a lady is shown sitting on a throne and operating the warp-weighted loom, while another woman hands her a vessel, probably with wool in it. Again, all depicted persons are female. Not only spinning and weaving, but also preparing the (wool) fleece and weaving a starting border for the warp-weighted loom were therefore accomplished by women (Fig. 147).

The throne from Verucchio, *tomba del trono*, has been dated to the end of the 8th or the beginning of the 7th century BC. The scenes carved on the inside of the back rest illustrate the cycle of textile production including wool washing, spinning, weaving and finally, garment manufacture⁶⁰¹. All persons involved seem to be women.

Another important piece of evidence for the gender of the textile craftspeople can be interpreted from the graves – on the assumption that the tools were added because of real life activities. The grave goods, in general, reflect the importance of textile making and a desire on the part of the living to show that the deceased had been involved in this essential task⁶⁰².

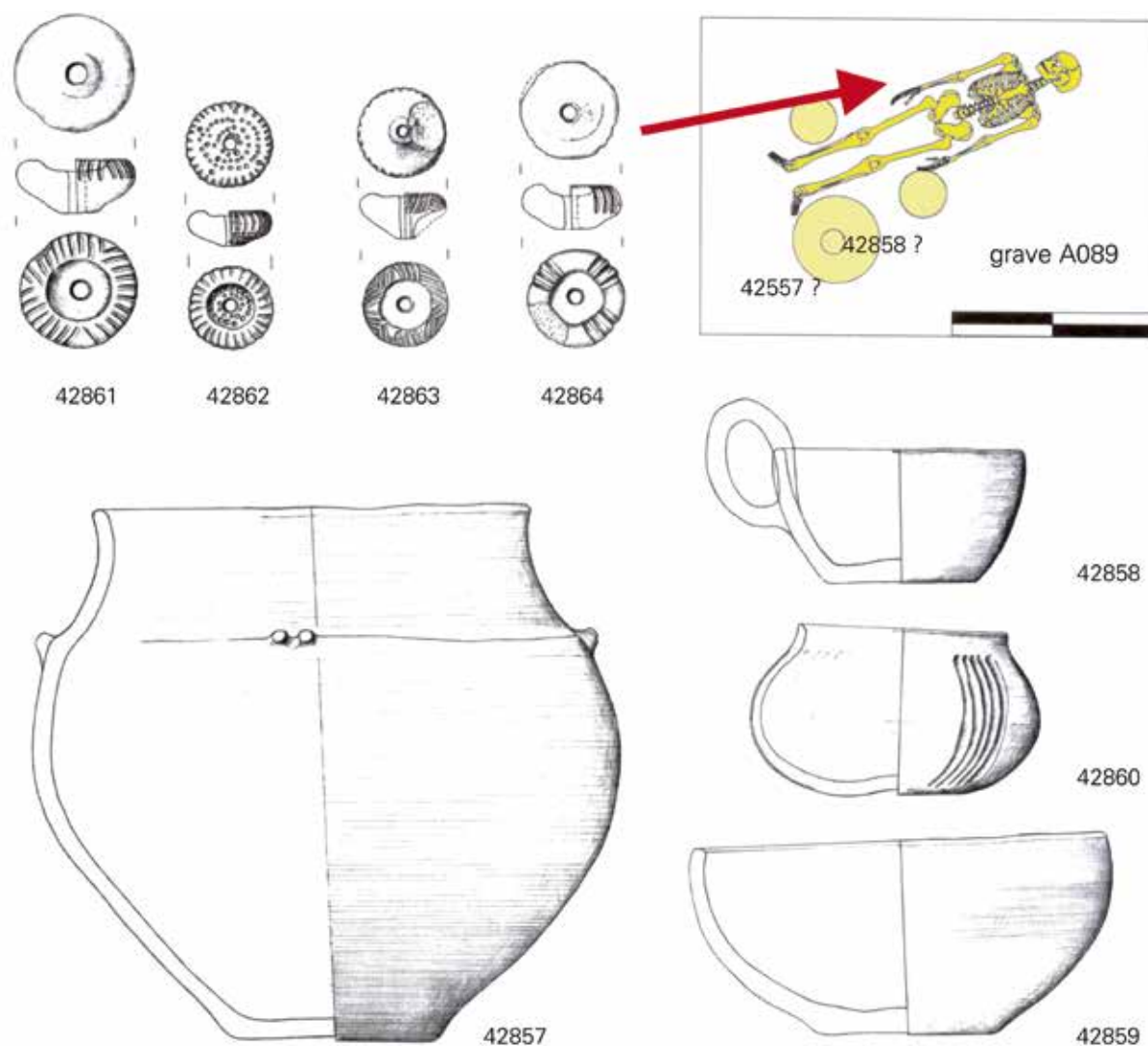
Statzenhof in Lower Austria⁶⁰³ may serve as an example here. Dating from 800–600 BC, it is a typical cremation cemetery of the rural periphery in the Kalenderberg group of the Eastern Hallstatt area. The cemetery contains 373 graves, most of which

⁶⁰⁰ Morigi Govi 1971. – Cf. Gleba 2007, 72, fig. 11.1; 2008a, 28–30.

⁶⁰¹ Gleba 2007, 72.

⁶⁰² Cf. Lipkin 2013.

⁶⁰³ Rebay 2006.



(90 %) are cremations. The dead were usually equipped with numerous vessels, which formed part of a drinking and dining set for the life after death. The animal bones found partially together with knives in the graves represent the remains of food offerings. Personal objects are jewellery and remnants of clothing accessories such as pins, brooches, glass beads, belt hooks and bracelets. As tools, spindle whorls, needles, knives and whetstones were included in the graves; male graves contained weapons such as axes or spears. Twelve percent of the graves in Statzendorf contained textile tools – if the sex of the buried individual could be determined, it was always a female burial. Archaeologist Katharina Rebay-Salisbury, who analysed this

Fig. 148. Statzendorf, Austria: Early Iron Age Grave A089 with spindle whorls. The grave has a low social index.

cemetery, conducted social index calculations in order to better understand the social rank of the persons buried within this cemetery. She attempted to assign each grave a value according to the quality and quantity of grave goods (*e.g.* the number and size of vessels, number and type of metal objects including the metal weight *etc.*) as well as the labour expenditure put into the construction of the grave. For evaluating the textile crafts, it is interesting to see that spindle whorls and needles occur in both 'poor' and very 'rich' graves, including the grave with the top social index of 100. Through this cemetery, at least, it can therefore not be verified that textile tools were associated with a particular social group. The number of spindle whorls also does not help here. In grave A089 with low social index, for instance, four spindle whorls were found (Fig. 148), and in richer graves sometimes only one.

The Hallstatt period cremation graves of Uttendorf in Pinzgau (Salzburg), dated to the 8th century BC,⁶⁰⁴ revealed ten very rich women's graves that contained sets of loom weights – enough for a small loom. These are in part manufactured and decorated very exquisitely; some of them were made of stone (serpentine). These loom weights can already be classified as luxury goods and characterize the status of these women; in poorer graves such loom weights do not occur. Interestingly, the textile tools show traces of the effects of fire. It is therefore likely that in the ritual cremation of the dead body a complete loom was burnt together with the dead woman on the funerary pyre. Finally, the loom weights with traces of fire were placed as a grave good next to the urn in the grave. These findings however are exceptionally, since this burial custom is normally restricted to the areas south of the Alps.

Not only spindle whorls and loom weights, but also ceramic spools and metal distaffs were found in the Hallstatt period cemetery of Frög in Carinthia⁶⁰⁵. The latter are especially unusual finds east and north of the Alps. Many other examples of the addition of textile equipment to graves could be listed. The fact is that, especially in the Early Iron Age in women's

⁶⁰⁴ Moosleitner 1992.

⁶⁰⁵ Tomedi 2002, 159–162.

graves, textile tools are quite common in both cremation and inhumation graves. At the end of the Iron Age, textile tools are generally found much less frequently in graves than in the Hallstatt period. La Tène examples of graves with textile equipment such as needles, spindle whorls, loom weights and the newly invented shears include burials at Pottenbrunn, Lower Austria, and Dürrenberg near Hallein, Salzburg⁶⁰⁶.

Who were these persons, buried with textile tools? The interesting thing is that the spindle whorls and loom weights are usually placed in women's graves. Only in a few exceptional cases, does such a device appear in a man's grave. In Pottenbrunn, grave 565, a 55 to 60 year-old man was buried wearing a bronze and silver finger ring and he had a spindle whorl in the grave. What does this mean? Is a spindle whorl in a man's grave an appreciative or derogatory commentary on this person's activity, or is it a neutral way of marking that this man pursued spinning activities? Does such a grave furnishing emphasise the skill in exercising the craft and therefore its importance to the community?

Furthermore, it should be noted that the images and the graves only illustrate a specific part of the workflow in textile production (Fig. 15): according to these sources spinning and weaving is attributable to women in Iron Age. But what about the other production steps, such as shearing sheep, treating flax, combing wool, dyeing, and cutting or sewing the fabrics? Not all of these are found on contemporary depictions. Other than spinning and weaving devices, only sewing needles and shears of various sizes are represented in graves. These sewing and cutting tools are rare, and, moreover, they occur in the graves of both men and women. Shears are versatile tools for textile work. They are useful for a range of different activities, starting with shearing sheep and weaving – from cutting threads to finishing the textile, hanging and cutting the suspension of the loom weights – and finally, for cutting and sewing the finished fabric. In addition, there is also the possibility that needles and shears were used for working other materials, for instance leather. We therefore have no direct archaeological evidence of the sex of the

⁶⁰⁶ Pottenbrunn: Ramsel 2002. – Dürrenberg: Penninger 1972, e.g. pl. 2, 3, 11, 14.

persons who were responsible for the shearing of sheep, for the preparation of the raw material flax, for dyeing, tailoring and sewing. It is relatively clear only for spinning and weaving, that these activities were (mostly?) carried out by women.

The social status of these women is also not precisely known. As in the Greek *oikos* economy, there may be high status senior women (as those very rich women from the graves of Uttendorf in Pinzgau), who produced high quality products together with their servants – perhaps similar to Penelope and Andromache from the Homeric epics⁶⁰⁷. But who were the people of the ‘general population’ buried with textile equipment, such as the ones we find in every Hallstatt period cemetery? Were these poor women who had to spin for their upkeep or were they ‘housewives’, who, in addition to their daily duties of food preparation, childcare and other household activities, also did some textile work? It is significant here that not every woman had textile tools in her grave, so the addition is perhaps a sign of a certain status, or possibly points to the aptitude in the craft⁶⁰⁸ exhibited by these women – especially when several spindle whorls were added in the grave.

It should further be mentioned that the frequent occurrence of shears in men’s graves can also be interpreted sociologically. For Antoinette Rast-Eicher,⁶⁰⁹ shears as grave goods, especially in men’s graves from the 2nd half of the 4th century BC, indicate a social and economic change. The invention of shears for sheep shearing goes hand in hand with the breeding of sheep with continuously growing wool. These sheep of mixed wool without natural fleece shedding could be kept in large herds and the fleece could be cut quickly. The quantity and quality of wool from these breeds clearly rose significantly, as a raw material that was also appropriate for sale and trade. According to these reflections, Rast-Eicher considers the shears in rich graves (especially male burials) as an attribute of a herd owner. The wealth that the large flocks of sheep embodied is also evident in the writings of Roman authors, for instance when the ancient

⁶⁰⁷ Cf. Barber 1994, 153–154, 207–231. – Eibner 2000/2001, 108–110.

⁶⁰⁸ Social status of women in the textile industry, see Gleba 2008a, 174–175. – Lipkin 2013.

⁶⁰⁹ Rast-Eicher 2008, 156. – See also Gleba 2012, 234–235.

historian and geographer Strabo (c. 63 BC to AD 18) mentions that tributes were paid in sheep (Strab., *Geogr.* 11.10.).

2.3 Textile craft organisation – division of labour?

Considerations as to the gender of the textile craft workers leads to the question of the organization of the craft and the division of labour. As household production, textile craft is just one of many activities that were done when no other, more urgent tasks (agriculture, acquisition of food and water, *etc.*) had to be undertaken. Before the invention of sheep shearing in the La Tène period, wool was recovered by plucking in spring, when the long-haired coat of early sheep breeds naturally fell out after the winter⁶¹⁰. The individual steps of plucking, sorting, spinning and weaving were probably not always carried out sequentially, but also side by side. Spinning with a hand spindle is also an excellent 'side-activity' when walking great distances, caring for animals, babysitting, *etc.* Can we tell whether all the steps of production from raw material preparation to spinning, weaving and sewing were in the hand of one person (of one woman?) or whether in the Iron Age different (groups of) people were responsible for different parts of the workload?

In general, textile crafts are based on various, always repetitive and sometimes tedious procedures, some of which are more time-consuming than others. The processing of fibres to material that can be spun lasts between days and weeks, depending on the raw material; that is, whether it is wool or flax respectively. Spinning is also very time consuming and takes weeks or months, while weaving a textile from the required amount of yarn proceeds more quickly; even that, however, requires days to weeks⁶¹¹. The cutting and sewing of a garment as the last step in the production sequence (if the piece of cloth is not used directly from the loom), can then be accomplished relatively quickly compared to the time spent for raw material preparation, spinning and weaving.

⁶¹⁰ Barber 1991, 29–30.

⁶¹¹ Cf. Andersson 2003b, 46–48. – Andersson Strand 2010. – Pfarr 2005.

Within the workflow, there are also activities that require specialized knowledge. Various decorating and colouring techniques or tablet weaving with its complex patterns cannot be accomplished easily without a learning phase and practice. On the other hand, there are also activities in which even small children can help, such as cleaning and plucking of wool. Is there any archaeological evidence that can tell us how many people worked together or whether we have specialized workers for specific production steps? Again, we encounter major challenges in the absence of written sources, but we can turn to the grave evidence on this topic. Interestingly, in some graves there are 'tool kits', sets of multiple tools that are functionally related.

Grave 56 of Uttendorf in Pinzgau, Salzburg⁶¹², for instance, is characterized as a very rich woman's grave by the exquisite jewellery (six brooches, finger and arm rings, belt plate, necklaces, *etc.*). In addition, a set of tools comprising seven stone loom weights, one spindle whorl and an iron knife was discovered in her grave. This represents a sufficient kit for making thread, cutting and weaving. Another example comes from the cemetery of Frög⁶¹³, Carinthia, Tumulus 159, grave 1, with a spindle and four spools for winding the spun yarn.

The cemetery of Statzendorf⁶¹⁴, Lower Austria, has probably been most intensely studied in terms of craft kits. Most spindle whorls were found in the graves together with multi-functional knives or sewing needles. Particularly noteworthy is the rich woman's grave A014 (Fig. 149), in which six spindle whorls and a needle box were laid down beside her feet. A knife was found next to her right hand. The devices for making yarn, cutting and sewing, were considered important enough to be added to the grave-furnishing by the members of this wealthy woman's community.

⁶¹² Moosleitner 1992, 42.

⁶¹³ Tomedi 2002, pl. 76.

⁶¹⁴ Rebay 2006, 2007.

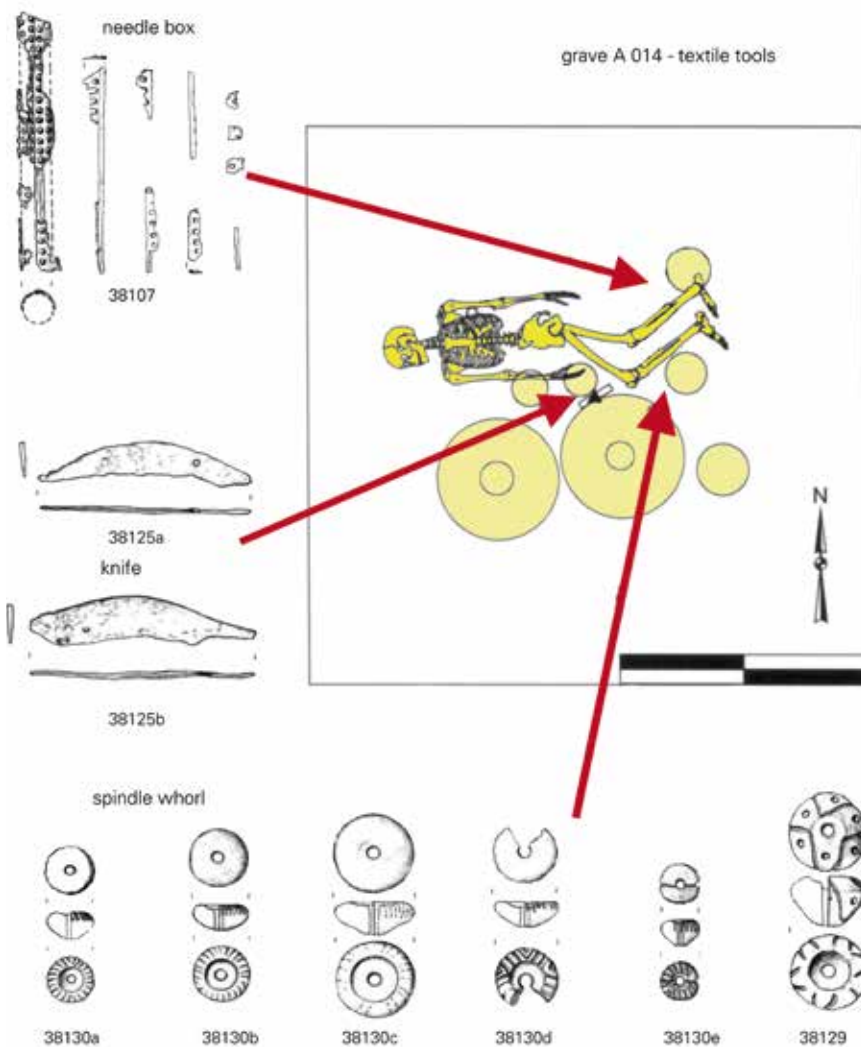


Fig. 149. Statzendorf, Austria: Early Iron Age Grave A014 with high social index. Only the relevant selection of tools and textile equipment from the grave is shown.

What evidence do the craft sets provide, in relation to the organization of the craft?⁶¹⁵ We sometimes find multiple tool sets together in one grave, including tools for spinning, weaving and sewing. These devices point to the whole textile production process from its beginning (spinning) to its end (sewing). This may mean that the entire workflow was in the hands of only one person – in these cases at any rate; but usually we find only one textile tool per grave. Can we then assume that just this one activity (such as spinning) was carried out exclusively by the person in the grave?

⁶¹⁵ See also Lipkin 2013, 26–27.

A certain level of cooperation can be assumed for the Iron Age, so that single individuals did not have to conduct all necessary activities by themselves. Finds of textile tools and their contexts in settlements underline this interpretation. From the Hallstatt period, several findings of looms are known: they are indicated by rows of loom weights and in some cases, additionally by stake holes that supported the wooden frame structure. The looms reach widths of up to three or four meters, such as the ones from Hafnerbach (Fig. 150) or Kleinklein, both in Austria⁶¹⁶. The warp of the loom of 3.70 m width from Kleinklein in Styria was strung with 107 loom weights. This in turn had a (still measurable) total weight of at least 118 kg! When weaving on such a large loom, the lifting and lowering of the shafts required moving a considerable proportion of this weight – 60 kg for each shaft of a two-shafted loom. Nowadays, this would correspond to a very excessive workout in a gym. Considering the width of the loom, mounting these heavy shafts in their respective weaving position would have required the work of at least two people. The passing of the weft thread through the shed is much easier with a more than 3 m wide loom when several people are working together. This kind of teamwork, several women weaving at the same time on a loom, is shown repeatedly on Greek vases⁶¹⁷.

On the textiles themselves, when they were found in good condition, a trained eye may spot information as to whether several persons worked together. Danish bog finds, like the big cloaks, were analysed by Margarethe Hald⁶¹⁸, who found that the weft threads in these textiles often cross each other, shifting from one row to the next right in the middle of the textile. It is possible that several weft bobbins were in use at once and that several women were weaving simultaneously, passing the bobbins to each other as they met somewhere in the middle and then changing the shed. Unfortunately, we do not find such complete Iron Age cloths in Central Europe, but through close analysis on the bigger fragments of textiles found in Hallstatt, Austria, such weft-crossings could be detected.⁶¹⁹ Another hint for the organi-

⁶¹⁶ Kleinklein: Dobiak 1990, 50–58. – Hafnerbach: Preinfalk 2003.

⁶¹⁷ Barber 1994, fig. 3.6. – Pekridou-Gorecki 1989, fig. 2.

⁶¹⁸ Hald 1980, 152, fig. 139–140.

⁶¹⁹ Grömer and Rösel-Mautendorfer 2013, Iron Age catalogue, e.g. HallTex 104.



sation of work is provided by other details on the textiles. In the salt mines of Hallstatt, a number of woven fragments with seams were found. Some of the sewing threads are made with the same wool as the weave⁶²⁰, which may indicate that the weaving and sewing was carried out by one person with the same wool. Perhaps the yarn for the seam was just taken from the hem of the textile itself. In the latter case, the spinner/weaver and sewer of the cloth may not have been the same person. The same can be said for the textiles where the sewing threads are different from the woven fabric.

Research on the division of labour naturally goes hand in hand with considering the level of production, be it household industry, specialization or mass production. The more advanced the level of production was, the more likely is a distribution of the different steps of the production process among different persons. For now, the organization of the textile crafts cannot be assessed with certainty for pre-Roman times, but at least some form of cooperation must have existed. It is also not clear whether the groups of people working together, which are attested at least for the teamwork on large looms, were recruited from family

Fig. 150. Remains of a loom of 4 m width in situ, from the Early Iron Age settlement of Hafnerbach, Austria.

⁶²⁰ Rösel-Mautendorfer 2013, 107–108.



face side
BORIO
SAVI (filius)



face side
SCIINDO
FVLLO



back side
SAGA VLKISIA
NAX (s)VTOR(i)
EXCIS(ori)
AVR (eum) ✕VNVM



back side
PM
IIS
XIS

Magdalensberg

Flavia Solva

Fig. 151. Roman lead tags from Austria with names of textile occupations (highlighted in red).

members⁶²¹ or other pools of people. The actual distribution of different production steps on different groups of people can also presently not be resolved on the basis of current research.

Specialised textile professions are first tangible in the northern Alpine provinces in the Roman Imperial period. Lead tags (*teserae plumbeae*) (Fig. 151)⁶²² from the Magdalensberg and Flavia Solva in Austria, as well as from Siscia in Croatia, mention professional titles such as 'fullo' for fullers and 'sutor' and 'excisor' for tailors. Lead tags were used by textile craftspeople as labels for wool, cloth and garments entrusted to the care of fullers and dyers. Whether a division of labour for textile work was already in place in the Iron Age is unsure, but it is certainly possible.

3 Sites of production

In the settlements from the Stone Age to the Iron Age, textile production is mainly traceable through archaeological finds of equipment and tools. These have already been mentioned in this chapter. Especially for the early periods, it is assumed that textile crafts took place as household production, so they are linked to the houses. From the Iron Age, we expect that the production

⁶²¹ For theoretical considerations, see Costin 1991, family based industries, 15.

⁶²² Gostenčnik 2012, 78-81. – Martijnse 1993. – Radman-Livaja 2013.



of textiles was carried out by specialists or in early mass production. In this chapter, the question of the places of production for textiles in the first millennium BC in Central Europe will be addressed.

In Iron Age Central Europe, we know of four different types of settlements: isolated farmsteads, small villages (Fig. 152), lowland settlements in the countryside and central settlements. The latter were usually founded on hilltops, with fortifications such as ditches, ramparts and walls. These were the seats of the nobility, which exercised some control over the local resources, trade and thus over the population. Special sites were also important transport hubs for long-distance trade, as at the Heuneburg⁶²³ on the upper Danube in Germany. In the middle La Tène period, town-like settlements, the *oppida*, emerged.

Imagine a scene of everyday life in an Iron Age village – children playing, men and women pursuing the various daily chores: fetching water, cooking, making tools, possibly even building or repairing a house – and of course textile work is also performed.

Spinning fibres into thread is a lengthy process, and it would have been conducted whenever possible: when walking long distances, supervising children, fetching water or herding sheep.

Fig. 152. Reconstruction of the Iron Age settlement of Schwarzenbach, Austria. Planning and construction: Wolfgang Lobisser VIAS, Vienna Institute for Archaeological Science. – Living History performance, European Science Night, October 2007.

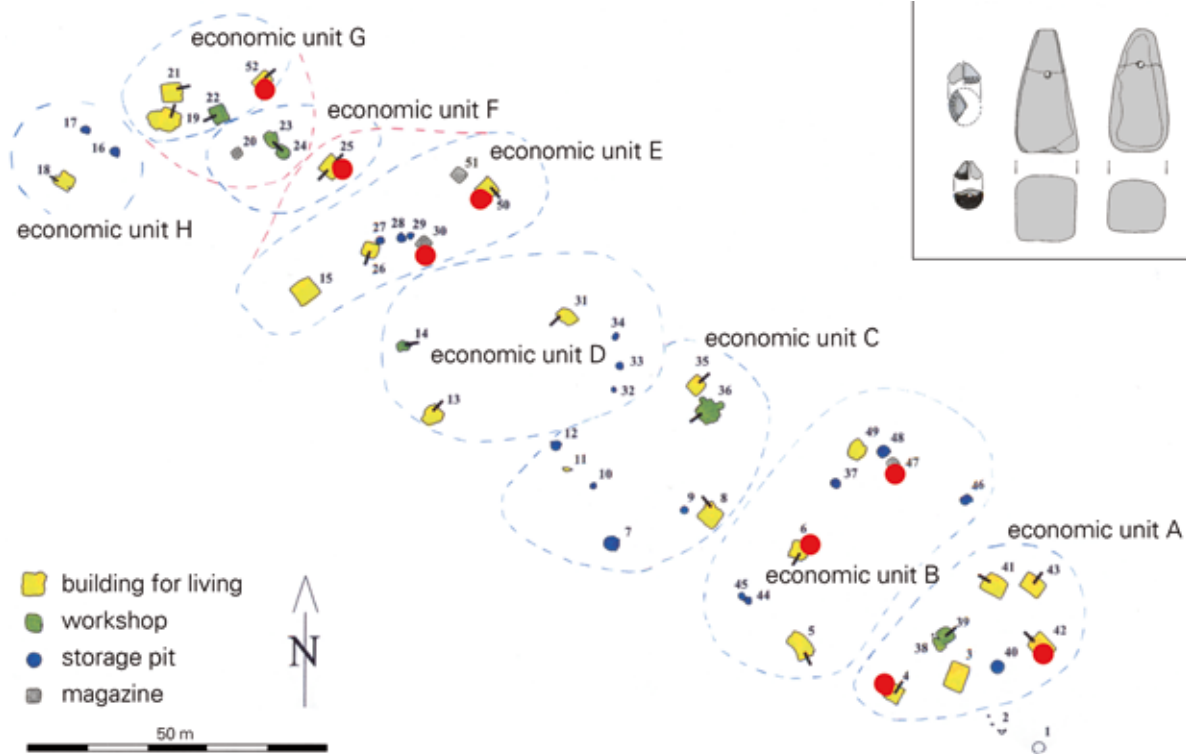
⁶²³ Kimmig 1983.

The spindle and a small stash of spinning material could be carried easily, and the spinning process can be interrupted at any time. Weaving on the loom, in contrast, is an activity that is likely to be tied to a particular place, usually the house. The rock art researcher Emmanuel Anati detected two warp-weighted looms under the loom representations of the Val Carmonica⁶²⁴ in northern Italy, which are carried by two people. Is the warp-weighted loom a device that was brought from one place to another in its mounted state at will, for example when the weather was nice to the outside, and back in when it started to rain? W. Haio Zimmermann doubts this view, as the warp-weighted loom is a construction of multiple parts, which, mounted with warps and weights, is only held together by its own weight when leaning at an angle against a wall. The warp-weighted loom would be too unstable in the mounted state, too heavy and unwieldy to be carried around. We may therefore consider weaving on the warp weighted loom as a static activity. Devices for weaving bands, however, could easily be brought into the open air in good weather, as could be done with sewing work.

The archaeological traces that we find mirror the dynamics of the described activities. Whorls are found where they were stored or where they were lost during handling: in the house, but also outdoors in the whole settlement or even in the surrounding fields and meadows. The loom is bound to its place in or leaning against the house, perhaps in the open air under a shed roof. The settlement refuse, the unnecessary or broken objects, lost artefacts left behind when abandoning a house, form the 'cultural layers' that provide the research base of settlement archaeology. A review of findings from various Iron Age settlements on the territory of today's Austria and Slovakia⁶²⁵ revealed that every settlement of which larger parts had been excavated included textile equipment such as spindle whorls and loom weights. Even needles and, from the La Tène period onwards, shears were discovered.

⁶²⁴ Anati 1994. – Zimmermann 1988, 31–32, fig. 5 and 6. See also here for a discussion on carrying warp-weighted looms and Emmanuel Anati's research.

⁶²⁵ See Belanová-Štolcová and Grömer 2010. – Belanová-Štolcová 2012.



The modern excavations and researches at Göttesbrunn in Lower Austria⁶²⁶ (Fig. 153) unearthed one of the smaller lowland settlements. The village was inhabited between the 7th and 6th centuries BC, and like the cemetery of Statzendorf already presented, belonged to Kalenderberg group, a local group of the Hallstatt culture in Lower Austria and Burgenland. In this settlement, houses and workshop units were identified – those pits, utilitarian buildings, *etc.*, which, taken together, form a farmstead. In most of these workshop units textile tools were found. This suggests that for most members of the settlement, textile work can be presumed.

Fig. 153. Göttesbrunn, Austria: map of the Early Iron Age settlement with finds of textile tools marked in red.

A central place of the Late Iron Age in Austria was the Dürrnberg near Hallein⁶²⁷, a salt trading centre, market place and production site with the main settlement dating from the 6th to the 1st centuries BC. Many finds, especially numerous textiles from the salt mine, date to the early La Tène period. Many cemeteries

⁶²⁶ Griebel 2004.

⁶²⁷ Stöllner 2002, 2005.

and settlement sites from the Dürrenberg include equipment for textile work such as spindle whorls, loom weights, needles and shears⁶²⁸. Also the settlement areas were systematically investigated. Mapping groups of finds, the spatial development of the settlement was elucidated and the organization of this site by traces of workshops and production areas. In addition to the salt mining, which forms the foundation of the economy on the Dürrenberg, evidence of the production of luxury objects such as jet bangles and metal jewellery can be found in the early La Tène layers. Throughout the duration of the settlement, the production of food and wood was also essential to the inhabitants of the Dürrenberg, just like metalworking, pottery production and textile work. The salt trade at local and regional level fostered contacts to Bavaria and the neighbouring regions towards the north west, to the southern Alpine region and later, even to Bohemia and the Germanic areas. The mapping identified several workshop areas on the settlement of the Dürrenberg, which could be indicative of specialization or workshops. Bronze casting, for instance, was most likely conducted on the Ramsaukopf, a smaller hilltop just northwest of the main residential area, whilst the final assembly of bronze and gold objects was carried out in workshops in the southern part of the settlement, for example the glass production. In addition to these special workshops, it is now interesting to investigate the distribution of textile tools within the settlement. Loom weights, spindle whorls (during the La Tène period mainly made of broken pieces of pottery), sewing needles and shears could be documented in all excavated areas and in almost every house. Houses were built in log cabin technique, as demonstrated in the Ramsautal. Does this distribution prove that textile work was conducted as household production, as was the case in Göttlesbrunn? Can it be accepted that a major production site such as the Dürrenberg did not have textile production for trade – mass production or at least household industry? So far, no appropriate special workshops for the mass production of textiles has been identified. The textiles themselves, however, indicate that weaving was already operating at a large scale, as set out at the beginning of this chapter. Maybe this large-scale production was spread over the whole settlement.

⁶²⁸ Brand 1995, with further references. Map of the textile tools: fig. 84.

The Hallstatt period hillfort of Smolenice-Molpír in Slovakia (second half of the 7th to beginning of the 6th century BC) can clearly be identified as a centre of textile production. Numerous loom weights have been found, and the number of recovered and analysed spindle whorls (Fig. 154) amounts to 2,100 pieces⁶²⁹ and is thus considerably higher than in other contemporary settlements. It is particularly striking that the 200 loom weights from the hilltop settlement are frequently decorated with special ornaments (Fig. 60). As usual in the Hallstatt culture, there are very small whorls with only 3 g, the average weight is 16 g and only a few whorls weigh more, up to 60 g. Similar distributions of spindle whorl weights have also been found in other Hallstatt settlements in Austria. Light spindle whorls produce fine yarns (0.1 to 0.7 mm), which mirrors the fineness of contemporary textile qualities. The textile finds from the Iron Age parts of Hallstatt salt mines, testify this⁶³⁰. According to Tereza Belanová-Štolcová⁶³¹, the hillfort of Smolenice-Molpír with its rich collection of finds of local as well as foreign origin demonstrates that the settlement played a significant role in long-distance trade. The textile tools indicate that fine textiles and clothing of high quality could have been produced at the site and served to represent the power and status of its inhabitants. The enormous number of spindle whorls suggests that spinning was in the hands of specialists, who were occupied with this activity on a full-time basis. They could have worked for a patron, who desired to have the best quality products, not only for himself, but also for gift exchange and trade.

The special position of Smolenice-Molpír aside, is there further evidence for differences in the textile production in the various settlement types? Were textile products made in central settlements, with inhabitants of high social status, different from those in rural lowland communities, inhabited by people of lower social status, who focused mainly on farming and domestic crafts?

A separate discipline of science, sociology, deals with such issues. It approaches general human behaviour and all aspects

⁶²⁹ Belanová 2007, 41–43. – Belanová-Štolcová 2012, 311–312.

⁶³⁰ Grömer 2013, 56–58, fig. 17 on the right.

⁶³¹ Belanová-Štolcová 2012, 312.

Fig. 154. Smolenice-Molpír, Slovakia: spindle whorls from the Early Iron Age hillfort.



of social life. According to the theories of sociologist Immanuel Wallerstein,⁶³² there are differences between the centres of a community and the peripheries – to put it bluntly between city and countryside. In the Iron Age, the centres are the (fortified) hilltop settlements, whilst rural villages provide the periphery. Wallerstein considered that everyday products were made in the periphery, whereas in the centres, lucrative products were made for trade. Raw materials and goods for daily needs must be imported from the peripheries. Can this model be applied to the textile production of the Iron Age? To investigate this question, the striking findings of loom weights were chosen as objects to examine. In some cases, loom weights were found in rows on the floor, showing how the loom was left when leaving or destroying a house.

As already emphasized, looms of up to 90 cm width, looms between 1.20 and 1.90 m width and looms of 3 to 4 m width can be distinguished during the Hallstatt period (see pages 114–117).

⁶³² Wallerstein 1974, 301–305.

Is there a difference between the loom widths of smaller settlements and central settlements? When the 3.70 m wide loom was discovered 40 years ago on the hilltop settlement of Kleinklein⁶³³, it was the first finding of its kind. Such a large loom surely was built to create a very exceptional textile and was operated by several people. The researchers had to assume that such a complex device and the special fabrics produced should be interpreted in terms of specific tasks (possibly in the ritual sphere). Was this textile intended for the residents of this princely seat, an elite family buried in huge round barrows near the settlement? The images on Greek vase paintings spring to mind – high status women working together on oversized looms.

Recent research has shown that such large looms for the production of wide, elaborate weaves were not restricted to central places⁶³⁴, but were also present in smaller lowland settlements such as in Hafnerbach in Lower Austria. The loom found in this location has a width of about 4 m. No significant difference has been identified so far between the textile tools and weaving equipment from smaller lowland settlements and hilltop settlements. The discoveries of textile tools testify that textiles were produced anywhere in the Iron Age in Central Europe, be it as household industry or within a more specialized form of production. Individual settlements such as Smolenice-Molpír, where, compared to the ‘normal’ settlements, a multiple of the standard textile equipment was found, are likely to have been centres of textile production of the time. Perhaps a workshop of Hallstatt era textile specialists was located here.

Next to working space another important resource needed for weaving is light, especially when weaving complex patterns. So far, this has not been a topic in research on Central European material. Some recent investigation, carried out for the site of Olynthus in Greece⁶³⁵, shows the potential. By studying the domestic assemblages Olynthus, the role of natural light in the selection of a space suitable for weaving also has been explored as well as artificial lighting. The studies demonstrated that access

⁶³³ Dobiak 1990.

⁶³⁴ Belanová-Štolcová and Grömer 2010. – Preinfalk 2003.

⁶³⁵ Moullou 2013.

to light is a key to the choice of room for weaving. Weaving should not only be thought of as day-time activity using natural light, but also with artificial light such as oil lamps or torches. The story of Penelope, working on the loom at night, is literary evidence for that. Readers of the *Odyssey* will remember that Penelope held her suitors at a bay for over three years while she wove a cloth, unravelling secretly at night what she wove each day (Homer, *Od.* 2.94-110).

4 Conclusion

After the detailed description in chapter B of the different techniques that lead from the raw material to the finished product, further consideration is given here as to the level of production, the sociology of the craft, the organization of labour and the places of production. Again, many issues can only be touched upon by way of example. There is no linear, continuous development from the simple to the complex; the simpler textiles do not disappear in the light of more complex production techniques. The various proposed levels of production – household production and household industry, specialization and mass production may well have coexisted. Some products and findings of the Hallstatt period suggest that they were produced in specialization, while for the La Tène period the quality and appearance of standardised weaves indicate the beginning of mass production. In the Iron Age, as well as in much later times, household production of textiles remains an important part of the overall volume of production and never quite disappears even in the industrial era up to the Second World War.

Whenever we want to approach the craftspeople behind the archaeological objects, we quickly reach our limits: crafts in general and textile crafts in particular were of little interest to ancient historiography. Archaeological finds from the Neolithic to the Iron Age are almost all we have available to shed light on the organization of the textile crafts, of the people working in this sector and their lives and workplaces. Especially numerous are our sources from the end of prehistory in the Iron Age. The

woman with the spindle in the Iron Age and in the Mediterranean world, especially in ancient Greece and Rome, becomes a *topos*, an ideal image. Spinning and weaving are not only simple crafts, but they symbolise feminine virtues and ideals.⁶³⁶ Weaving also becomes a metaphor for destiny; the divine female spinners Klotho, Lachesis and Atropos spun the threads of life, measured and cut them. Many ancient myths revolve around women's textile arts based on this analogy.⁶³⁷

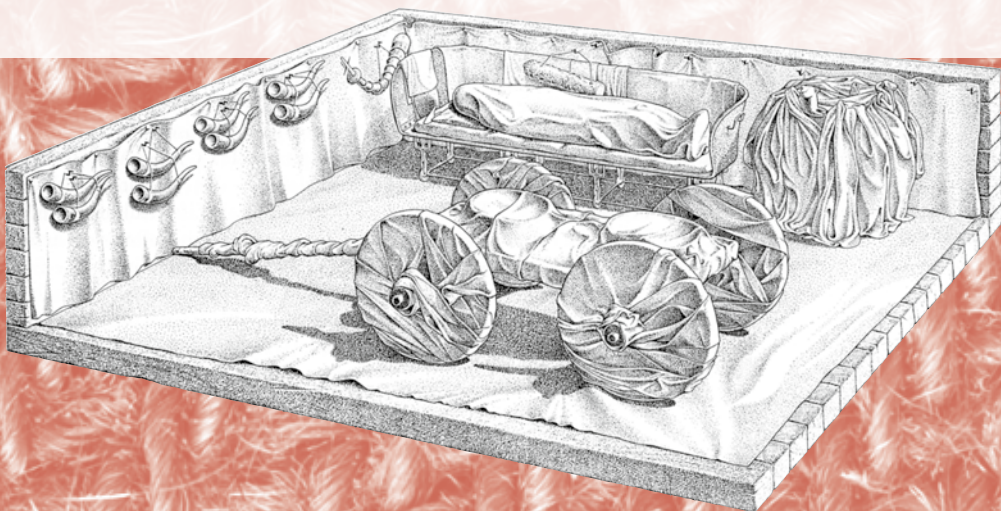
From pictorial representations and objects found in the graves, it seems that spinning and weaving in the Central European Iron Age were carried out primarily by women. Whether sheep shearing, dyeing, fulling, tailoring and sewing were also amongst the female tasks is uncertain. It is also unknown whether the individual steps of production were split between different people or groups of people, or if indeed different textile professions already existed, as they did later in Roman times. Textile work was an important part of the daily workload, and the necessary steps of production were a familiar sight in the everyday life of every prehistoric population. In each village, even in the larger population centres, one would have encountered someone with a spindle in the hand, producing threads. One could admire the craftsmanship of those who wove intricate pieces of tablet woven bands. The loom was a normal household appliance and the colourful splendour of the freshly dyed yarns and fabrics – hung out and stretched to dry – enlivened the scene.

⁶³⁶ Barber 1994, 232–256. – Eibner 2000/2001. – Larsson Lovén 2013, 122–124.

⁶³⁷ For the metaphorical meaning of weaving, see e.g. Vogelsang 1986.

D From clothes to household textiles: fabric use in prehistory

In a public outreach programme on 'Iron Age Textiles' at the Natural History Museum in Vienna, participants were asked which roles textiles might have played in the life of prehistoric people. The first idea associated with textiles was always that they were probably used for making clothes.



After considering this question in contrast to the purposes textiles serve today, a discussion broke out as to whether carpets, blankets and cleaning cloths, or even curtains, pillowcases and mattresses were conceivable for the 'primitive' pre-Roman societies.

Considering the prehistoric textile remains from Central Europe more closely, versatility in the use of textiles can be scientifically proven. The shape of complete objects reveals something about their former function, *e.g.* as item of clothing, transport bag *etc.* Most archaeologically recovered textiles, however, are not completely preserved, but are at best torn, and most often only fragments are recovered. Frequently, only a few square centimetres are preserved, for instance when they are attached onto metals (see preservation of textiles, pages 20–32). Apart from the overall appearance, various technological criteria as well as the archaeological contexts are essential for the interpretation of fragmented textiles.

Criteria in terms of textile technology include the structure of a weave, the fineness and the density of the weave, and the thickness of the threads. The raw material from which the fabric is made also plays a major role in its use, as each type of raw material has very specific properties⁶³⁸. These were known to prehistoric people through generations of use and they knew very well how to exploit them. Linen, for example, is very durable and resistant to abrasion; the wet fibre is even more tear-resistant than the dry fibre. The smooth surface of the fibre has cooling properties. Linen is absorbent and absorbs moisture quickly, but just as quickly dries again. In the use as a garment, this supports the climate control system of the body in hot temperatures. In contrast, wool has temperature-regulating properties and is therefore very good for warm clothing, especially when using bulky yarns producing a very thick fabric. Wool fibres are stretchable, flexible and elastic. Another property of wool is its flame resistance. An important feature of wool is also that it can be felted: wool fibres can be processed without spinning and weaving and turned into a felt fabric. Weaves can further be altered by fulling,

⁶³⁸ Properties of flax: Eberle *et al.* 1991, 14–15. – Harris 2010, tab. 18.2. Properties of sheep wool: Eberle *et al.* 1991, 20–21. – Harris 2010, tab. 18.2.

which changes the properties of the textiles; they become thicker and denser, therefore water resistant and warmer. Other raw materials used by prehistoric people to make textiles include other animal hair such as goat hair or the tail hair of the horse, the latter mainly used to improve form, stiffness and stability of textiles. Different functions thus required different properties, which in turn demanded different choices and careful planning at various stages of textile production.

In addition to the overall appearance of the weaves and their technical characteristics, context is crucial for a functional interpretation of prehistoric textiles⁶³⁹. Archaeological findings usually encompass an analysis of the context in which the textiles (or other artefacts) were recovered⁶⁴⁰. Contextual information is gained by the specific monitoring of an excavation, for example by documenting the spatial relationship of the findings to each other. The spatial location of the finds within a feature, for instance in a grave, a house, *etc.* is also observed. Important archaeological evidence and findings are further remains of walls, floors, and discolorations of the soil; their extent, thickness, consistency, *etc.* is documented three-dimensionally in all details, using photos, tachometric recording, plans and descriptions. The context of the artefacts is particularly important for the interpretation of fragmented textiles. Shapeless rags, recorded directly next to a skeleton, are most likely remnants of the clothing or maybe shrouds. Textile remains similar in weave type and quality that were found in a settlement between the planks of a log building, they can probably to be explained in view of their context as sealing material.

Archaeological textile fragments that adhere directly to other objects, for example when they are attached on metals, are investigated using micro-stratigraphic⁶⁴¹ methods. These determine the exact location of the textile in relation to the associated artefact. A textile fragment located right next to a knife blade and in turn covered by wood is most likely to be interpreted as the remains of the interior textile lining of a wooden sheath.

⁶³⁹ See Gleba and Mannering 2012, 3–4. – Harris 2012.

⁶⁴⁰ Eggert 2001, 46–99. – Hodder 1987. – Renfrew and Bahn 2005. – Roskams 2001.

⁶⁴¹ See Hägg 1989, 431–435.

On the other hand, textile residues located at the pelvis bone of a skeleton on the inside of a belt buckle, *i.e.* the side facing the body, are most probably parts of a belted garment.

1 Clothes

A significant portion of the textiles produced in prehistoric societies was probably used for clothing. The history of clothing is described in the next chapter. Various sources are combined to create a picture of the costume development from the Stone Age to the Iron Age in Central Europe. Preserved garments of textile and leather, image sources (Fig. 155), written sources (for the Late Iron Age), as well as decorative objects, metal dress accessories and the location of costume components in graves all contribute to our interpretations. That clothing – in addition to the primary purpose of protection against weather conditions such as heat, rain, snow, wind, *etc.* – already had many other functions in prehistoric times, such as representation or marking of group membership, is amply demonstrated by examples of intricately designed prehistoric textiles.

The finds of complete Bronze and Iron Age garments from northern Germany and Denmark⁶⁴², where not only bog bodies were found, but also magnificent robes apparently deposited in bogs as offerings, are especially numerous. One such site is Thorsberg in Germany, a famous place of sacrifice of the 1st to 3rd centuries AD. Among the organic offerings are 24 wool fabrics, including famous ‘ostentatious cloaks’ (*Prachtmäntel*).

From the pre-Etruscan Villanova Culture, particularly from Verucchio in Italy, a number of Iron Age garments of different shapes are known⁶⁴³. Regrettably, apart from the ‘leggings’ from Vedrette di Ries, Italy⁶⁴⁴, no complete Iron Age garments have been recovered or could be reconstructed from Central Europe.

⁶⁴² Cf. Broholm and Hald 1940. – Mannering *et al.* 2012. – Möller-Wiering and Subbert 2012. – Schlabow 1976.

⁶⁴³ Stauffer 2012. – von Eles 2002.

⁶⁴⁴ Bazzanella *et al.* 2005; 2012.



Fig. 155. Images on the Situla of Vače in Slovenia, Iron Age.

The stock of materials obtained, however, provides clear insights into the technical achievements of the time. Some technical design elements for cutting and sewing, for instance from the salt mines in Hallstatt⁶⁴⁵, are useful for reconstructions. Nits and lice of the human body louse (*Pediculus humanus corporis*) discovered

⁶⁴⁵ Rösel-Mautendorfer 2007; 2013.

in textiles from Hallstatt⁶⁴⁶ lead to the conclusion that the garment pieces were actually worn, because body lice are bound to their human habitat. The lice are of no further significance to the reconstruction of historical costumes, but they deliver further insights into the everyday circumstances of life for prehistoric people.

From the Hallstatt textiles, we are able to detect careful resource-management in form of mending and patching of textiles (see pages 239–240). The Iron Age cloaks of Damendorf and Dätgen (Germany)⁶⁴⁷ have also been repaired with several patches. Usually it can be deduced that the fabrics a garment is made of, was woven for this purpose (primary function). There are also hints for secondary use. A famous example for a garment made entirely from patches is the tunic from a bog body from Bernuthsfeld⁶⁴⁸ in Germany, dating between the 7th and 9th century AD. Recycled material formed the basis of the garment. It is a heavily worn tunic with sleeves which was patched out of 45 pieces of wool cloth, consisting of twenty different fabrics in nine different weave type.

2 Textiles in funerary practice

Textiles played an important role in funerary rituals. This includes on the one hand the clothes worn on the body by the dead, and on the other hand, we can expect funerary shrouds, with which some bodies were covered or wrapped prior to burial. Traces of a shroud have been recovered in tomb 3 at Osteria dell’Osa, Italy, 9th century BC, identified by the rectangle of small bronze rings and buttons that were probably sewn onto the edge of the cloth (Fig. 156)⁶⁴⁹. Sometimes brooches or pins were discovered in ‘unusual’ places in inhumation graves, for example a fibula at the feet of the deceased in grave X of Nebingen,

⁶⁴⁶ Grömer, Rösler-Mautendorfer and Reschreiter 2013, 127–128, fig. 41; HallTex 32, 34, 40, 292. – About body lice: Buxton 1947.

⁶⁴⁷ Möller-Wiering and Subbert 2012, 161.

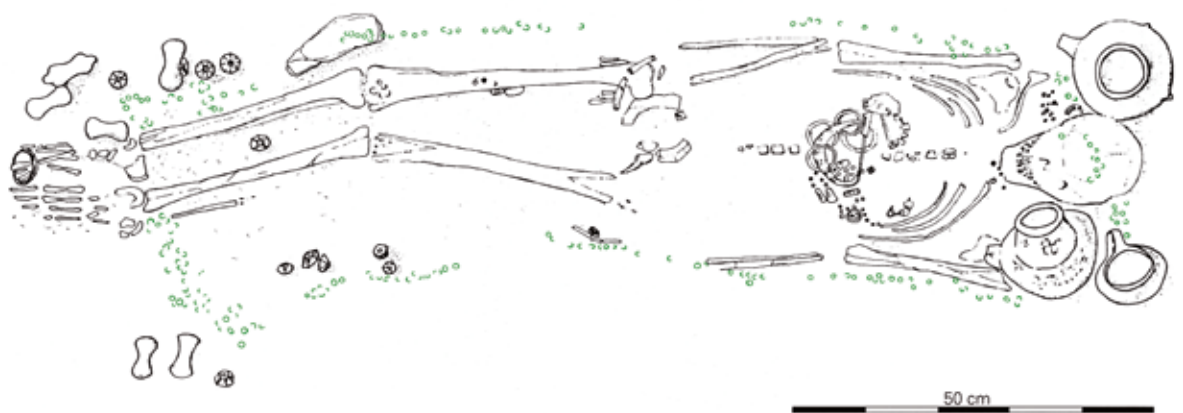
⁶⁴⁸ Farke 2001, 129–136.

⁶⁴⁹ Bietti Sestieri 1992, fig. 3a.391. – Gleba 2012, fig. 9.6.

Germany⁶⁵⁰. This can be interpreted to mean that brooch held together a cloth that wrapped the body. Even with cremation burials the cremated remains were sometimes wrapped in a textile or the urn was covered⁶⁵¹. This expresses a very careful handling of human remains. In Iron Age Italy, linen in particular was used to wrap cremated bones in the burial ritual. This practice is also described by Homer for the burials of Hector and Patroclus (*Iliad* 34.796 and 23.254), which is assumed to have been adopted by the elites throughout the Mediterranean during the Iron Age, e.g. attested to in Vetulonia or Veio, Italy.

Particularly during the Iron Age, it was customary to wrap grave goods in pieces of cloth, 'pack them', so to speak. Specifically, swords and other weapons were often heavily wrapped in the late Hallstatt and early La Tène periods. In the cemetery at Hallstatt, it was documented that for some swords the iron blade was directly wrapped in textile bands⁶⁵² (Fig. 157). Recently, in Matran, Switzerland, a sword was found in an early Hallstatt period grave. The adherent organic layers in direct contact with the iron surface of the sword blade were identified as wood and probably a thin layer of leather from the scabbard; the entire object had been wrapped in a tablet-woven band of 2 cm width⁶⁵³.

Fig. 156. Traces of a shroud (bronze rings, highlighted in green) from Osteria dell'Osa in Italy, 9th century BC.



⁶⁵⁰ Banck-Burgess 1999, chapter 1.2.2.

⁶⁵¹ Fath 2012, 72–73, fig. 1. – Gleba 2014b, 136–141.

⁶⁵² Kern 2005, 8, fig. 10.

⁶⁵³ Rast-Eicher 2012, 384 and fig. 19.7.

Not only were more or less narrow textile bands used to cover weapons, but larger fabrics were also used. In the case of Gemeinlebarn, an early La Tène warriors grave⁶⁵⁴, a larger piece of finely woven tabby was folded carefully over the scabbard of the sword (Fig. 158). In this case, the weapon was placed next to the deceased with his right hand lying on the scabbard together with the mineralized textile remains. Interestingly, there was also an imprint of human skin from the wrist of the warrior.

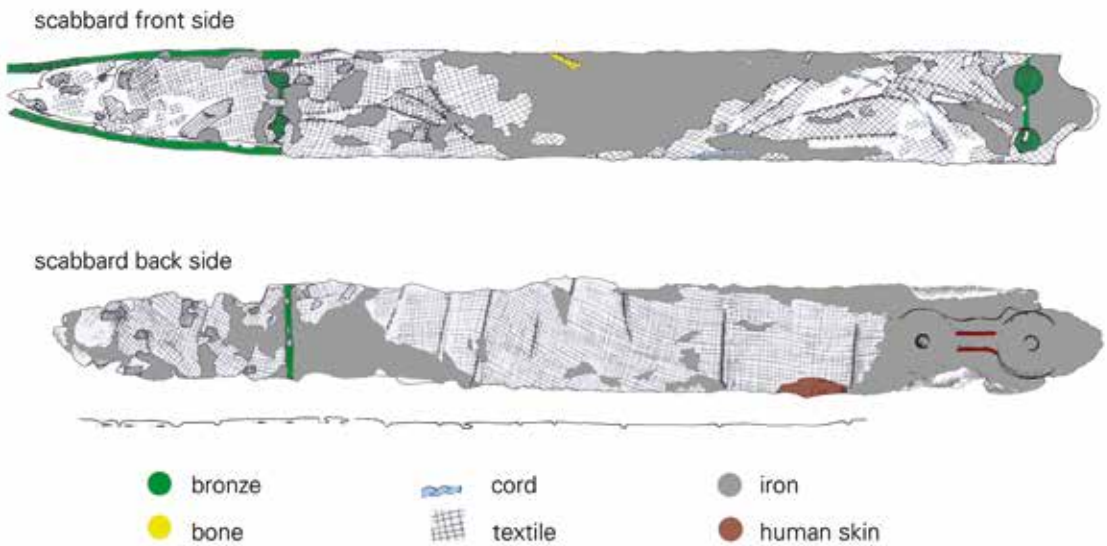
Unfortunately, we usually do not know whether the packaging material, the pieces of cloth, was made specifically for this purpose (primary use) or whether they were old, recycled textiles⁶⁵⁵ (secondary use). It is also unknown which kinds of beliefs have led to a concealment of the dead and their grave goods. Perhaps there was a taboo forbidding the placement of bare metal in the grave. Maybe the burial goods were covered to render them invisible at the entrance into the otherworld. Practical reasons could also have led to this custom, for instance textiles soaked with grease and oil could have been wrapped around iron objects to prevent corrosion.

Fig. 157. Cremation grave at Hallstatt with a sword wrapped in fabric. Location in the grave and detail, Early Iron Age.



⁶⁵⁴ Preinfalk and Preinfalk 2014, 45–48.

⁶⁵⁵ The textiles from Hochdorf were produced especially for this burial. Banck-Burgess 2012a, 142–143.



In northern Germany (Lower Saxony, Schleswig-Holstein and Mecklenburg-Western Pomerania) between 500 and 150 BC, very open, veil-like weaves (*Schleiergewebe*) were found in the graves⁶⁵⁶. They are very fine loose tabbies with 0.2 mm thread diameter and have a very low cover factor. Usually they were used as cover or wraps of different grave goods in cremation

Fig. 158. Scabbard from a warrior's grave at Gemeinlebarn in Austria with textile cover and imprint of human skin, Late Iron Age.

⁶⁵⁶ Banck-Burgess 1999, 34, fig. 6–8.

graves. Those veil-like fabrics can perhaps be interpreted as special weaves for the dead.

We are especially well informed about textiles in the late Hallstatt period chieftain's grave of Eberdingen-Hochdorf an der Enz, Germany⁶⁵⁷. This grave offers very good preservation conditions for organic materials due to its numerous metal finds. In the burial mound measuring roughly 6 m in height and with a diameter of 60 m, an approximately 40-year-old man was buried around 550 BC. The rich grave offerings and the great expenditure of labour put into this burial identify the deceased as a member of the Hallstatt Culture elite. The deceased was buried with magnificent jewellery items such as a gold neck ring and bracelet, amber beads, several brooches to close the garment (fibulae of bronze and gold) and a gilded sheet belt. His shoes and the dagger were also decorated with gold fittings. A hat made of birch bark completed the outfit. Everyday objects (nail clipper, razor and comb) should perhaps ensure a neat appearance after death. A quiver with arrows and an axe, a lance and an iron knife constituted the weaponry set. Some of the items were placed together on the wagon box of a four-wheeled wagon. The physical welfare of the prince had also been taken care of. The grave contained a huge bronze cauldron imported from the Mediterranean for 500 litres of liquid, originally filled at two-thirds with mead. An extensive feasting and drinking set secured that the prince could host banquets after death. In the same grave were found nine drinking horns, decorated by golden ribbons, a golden drinking and scooping bowl and, piled onto the wagon, the eating utensils with three bronze serving dishes and nine plates. One of the most spectacular finds, however, is the 2.75 m long ornate bronze couch (*klinē*), on which the deceased was placed to rest.

The splendour of the grave goods, which should ensure a good life for the prince after death, is underscored by the textile equipment. Although the textiles were only preserved as small fragments, the textile archaeologist Johanna Banck-Burgess⁶⁵⁸

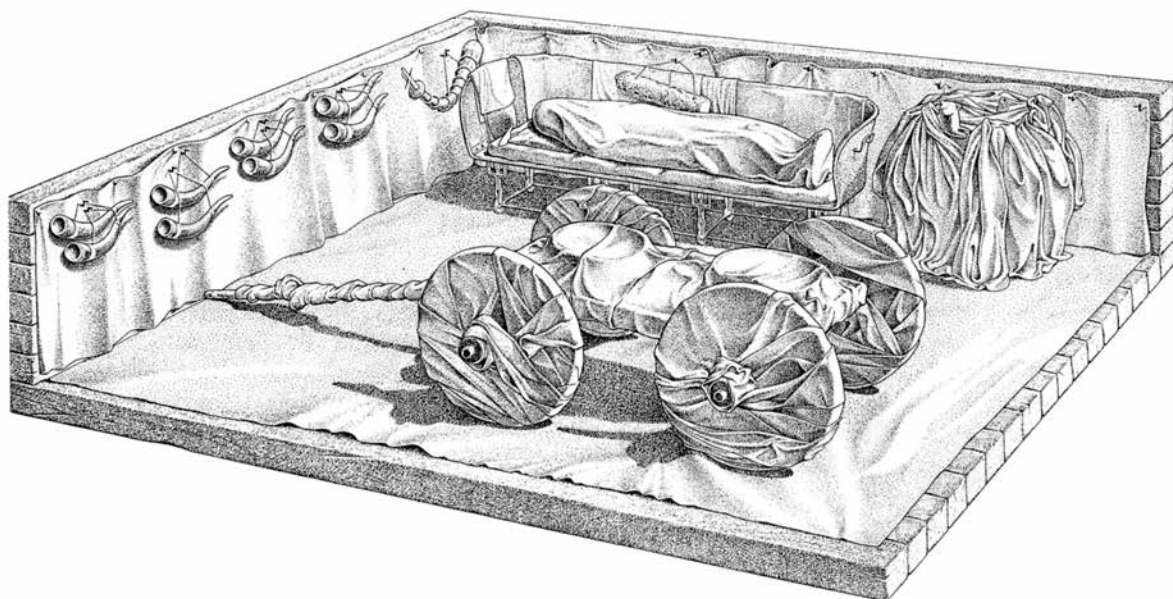
⁶⁵⁷ Biel 1985. – Banck-Burgess 2012b.

⁶⁵⁸ Banck-Burgess 1999. Wall tapestry 120–121, floor covers 124, couch 97–98; for the entire assemblage see added maps. – Banck-Burgess 2012a.

succeeded in reconstructing the specific use of the various weave fragments in painstaking detail (Fig. 159). The burial chamber was completely lined with textiles. Fabrics were spread on the floor as a floor cover; at one point, there was also an animal skin. The walls of the wooden grave chamber were decorated with wall hangings in richly varied compilation, over which the drinking horns were hung. Precious tablet woven bands with complicated patterns adorned the wall hangings of twill, which were fastened with iron hooks onto the wall. Bronze fibulae also served to drape the wall cladding.

Several organic layers were discovered on the bronze couch, which were identified as mattresses, pillows, blankets or other decorative fabrics. The layer directly above the couch included two hemp bast weaves over a striped textile, on which a mattress was placed. The mattress cover was made of fine hemp repp filled with badger hair and small parts of plants. A small mat made of grass, covered with a burlap cloth made of badger hair, served as a pillow for the dead, judging by the location of the find under the head of the deceased. On top of the cushion layers, a wool cloth of twill weave was draped in many pleats, as well as several layers of a very fine fabric. Furthermore, most of the objects in this grave were originally wrapped

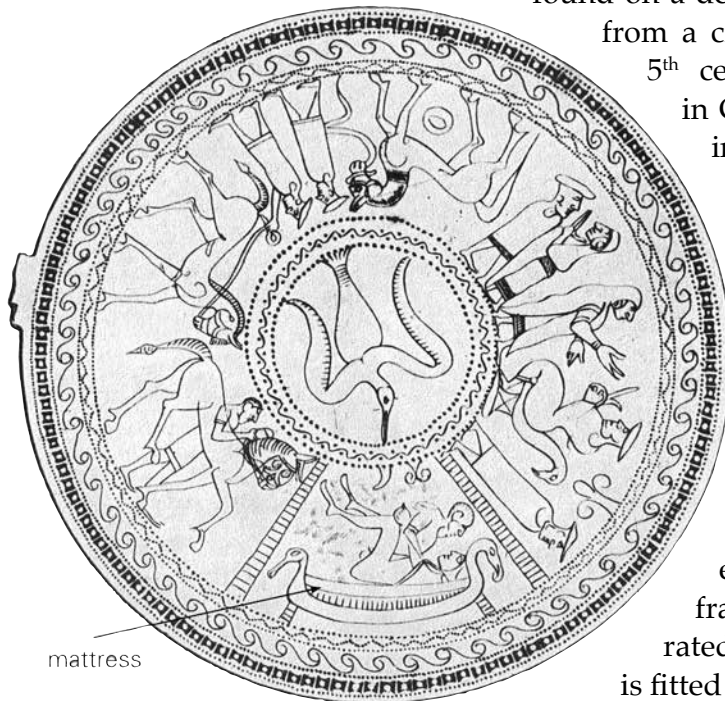
Fig. 159. Reconstruction of the textiles in the Early Iron Age princely grave at Eberdingen-Hochdorf in Germany.



in textiles, even the wagon and the wheels were covered. Similarly, the large bronze cauldron was wrapped in many precious materials. This rich textile equipment in the grave of Hochdorf not only gives us plenty of insights into the burial customs, but possibly also into the every-day use of textiles.

3 Soft furnishings: wall hangings, cushions and similar items

Fig. 160. Mirror of Castelvetro in northern Italy: representation of a bed with mattress, Iron Age.



Which roles did textiles play in addition to their function as clothes in the daily life of prehistoric societies? We know contemporary figurative representations, mainly from the Iron Age works of situla art⁶⁵⁹, in sufficient realism to recognize details. An interesting scene illustrating 'household textiles' was

found on a decorated bronze mirror from a cremation grave of the 5th century BC discovered in Castelvetro di Modena in northern Italy⁶⁶⁰ (Fig. 160). On the back of the mirror, various scenes are arranged in a circle, amongst which a sex scene is most notable. The bed on which the couple enjoys the pleasures of love is very comfortably equipped. It has a bed frame with ends decorated with birds' heads and is fitted with a mattress.

⁶⁵⁹ Lucke and Frey 1962. – Turk 2005.

⁶⁶⁰ Lucke and Frey 1962, pl. 21–22.

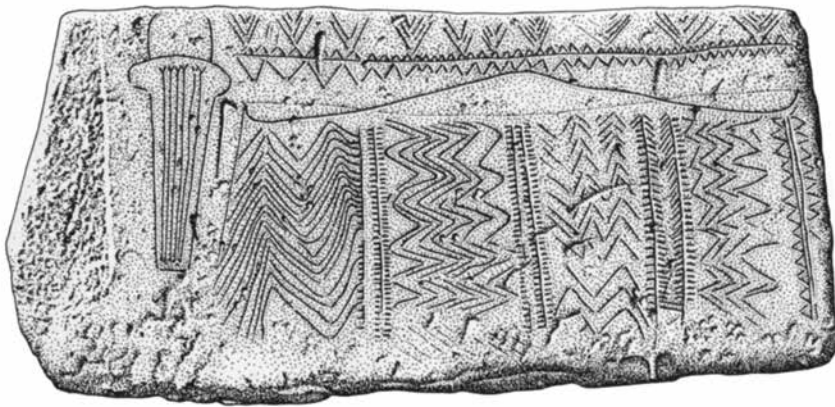


Fig. 161. Megalithic grave of Leuna-Göhlitzsch in Germany with the representation of a wall hanging, c. 3,000 BC.

Preservation conditions for textiles, which belonged to the interiors of homes, are worse than hopeless in Central Europe, but such 'household textiles' do appear as part of the grave furnishings. Wall hangings, floor coverings, mattresses and pillows, such as the ones from the Hallstatt chieftain's grave from Hochdorf described above, were probably not only used for the tombs of the dead, but also made life more pleasant for the living, especially of course for the wealthy classes⁶⁶¹. Household textile accessories were common features of wealthy homes in contemporary cultures, for instance in the homes of the Etruscans and Greeks⁶⁶².

The Greek historian Polybius reported that the Celtic tribe of the Boii in the eastern Alps and northern Italy, like other tribes at the beginning of the 2nd century BC, used straw beds, on which bed sheets and blankets were spread (Polyb., *Hist.* 2.17)⁶⁶³. In general, the interior of the residential and official buildings of the leading social class of the Iron Age must therefore not be thought of as primitive. Situla art further shows neatly shaped turned wooden furniture: shelving, benches, seats (thrones) and beds (see, e.g., Fig. 155 or 176). Without these wooden furnishings or textile products, it is difficult to imagine life in mud brick, log or pit houses.

⁶⁶¹ Banck-Burgess 2012a, 2012b.

⁶⁶² For images of mattresses on Etruscan sarcophagi, see e.g. Massa 1989, 36–37.

⁶⁶³ After Birkhan 1997, 1055. For bed sheets and blankets, cf. Strabo, *Geog.*, 4.4.3.

Mats used for floor coverings and wall hangings are known in Central Europe from the Neolithic period. Mats woven from grass, reeds, *etc.* were found, for instance, in the Swiss lake dwellings⁶⁶⁴. Of particular interest to the interior design of this very early time is the megalithic grave of Leuna-Göhlitzsch in Germany⁶⁶⁵ dating to the Late Neolithic (*c.* 3,000 BC). Inside the stone tomb, an engraving was found, once painted in red and black, which most likely represents the interior of a house (Fig. 161). A bow and a quiver of arrows are hanging on the wall and a wall covering can be seen, apparently consisting of a mat with twill structure. Such plaited structures have also been found on a Middle Neolithic mat imprint from Michelstetten in Austria⁶⁶⁶ (Fig. 73).

4 Sacks and bags for transportation

Woven fabrics have been, and continue to be, used for containers. From the settlement Hornstaad/Hörnle I at Lake Constance in Germany, dating to the Late Neolithic at *c.* 3,800 BC, we know of a small purse made of tabby woven flax. It is the simplest basic shape of a bag, which consists of a round piece of cloth and a drawstring to gather the fabric at the edge⁶⁶⁷.

Interesting evidence for the use of textile containers for salt hauling comes from the Bronze Age salt mines of Hallstatt⁶⁶⁸ (Fig. 162), where textiles played an important role in the workflow of the mining organization. Salt production can be traced back to the Neolithic period *c.* 7,000 years ago by the finds of stone axes and antler picks. The mining processes date to the Middle Bronze Age at the latest, from *c.* 1,500 BC, but the economic heyday of salt production was during the Early Iron Age. The salt trade brought great wealth to this rather inhospitable and

⁶⁶⁴ Rast-Eicher 1997.

⁶⁶⁵ Müller-Karpe 1974, pl. 499, A1. – Sherrat 1998, 118.

⁶⁶⁶ Grömer 2006a, fig. 13.

⁶⁶⁷ Müller 1994, fig. 4.

⁶⁶⁸ Kern *et al.* 2009a. – Kowarik and Reschreiter 2011. – For haulage textiles see Grömer, Reschreiter and Rösel-Mautendorfer 2013, 121–125, fig. 40.

remote area at the foot of the Dachstein Mountain in the Alps. This is also reflected by the rich grave goods of the world famous cemetery in the Hallstatt high valley, which became eponymous for the Hallstatt period, the early part of the Pre-Roman Iron Age c. 800–400 BC.

How may we imagine the salt mining, and what roles did textiles play within the production process? Giant mining halls were built in the Bronze Age (Fig. 162), where salt layers were followed up to a depth of 120 meters underground. Small chunks of salt (*Hauklein*) were severed from the walls and the ceiling with picks and placed in leather carrying bags before they were packed into textile sacks or hauling bands and brought through the vertical shafts leading to the surface. A part of the way led over wooden stairs such as those discovered at the site of Christian-von-Tuschwerk. Through the scientific dating method of dendrochronology, the staircase was found to have been built in the mountain around 1343/1344 BC⁶⁶⁹. It is the oldest wooden

Fig. 162. Bronze Age salt mining at Hallstatt. Artist's impression by Dominic Gröbner, scientific advice by Hans Reschreiter.



⁶⁶⁹ Reschreiter and Barth 2005.

staircase in Europe. The haulage textiles filled with chunks of salt were drawn with ropes of lime bast through the chutes from the mine to the surface, from where the salt could be distributed further.

The textiles that have been interpreted as functional elements in the mining-operation, such as carrying sacks or haulage cloths, were found as fragments in a special archaeological context. A site within the salt mine, the location of a shaft leading from the salt exploitation gallery to the surface, was identified as a 'filling station' (the place where the salt was transferred from the leather bags used in the mine to textile sacks for further transport). The textiles (Fig. 163) have uniform characteristics: they consist of very dense, strong weaves that were made in tabby weave from woollen threads 1.5 to 2.5 mm thick. Sometimes the surfaces are felted (by fulling?), which makes the fabric more resistant to wear. The edges of the bags are reinforced, either by starting borders or strong rolled hems designed to add stability, or by hemmed buttonhole stitches. There are many indications that the haulage textiles were made specifically for this purpose. However, we do not know their exact form; that is whether the textiles were sewn as sacks or used as simple blankets, filled with salt and tied up⁶⁷⁰.

The textiles played an essential role as transport containers in the organization of work of the Bronze Age salt mines of Hallstatt. Interestingly, the production strategy changed in the Iron Age. Large salt slabs are removed now, whereas the small-sized lumps of salt that were much sought-after in the Bronze Age remain in the mountain as residue. The woollen haulage sacks or cloths that constituted an important link in the transport chain for centuries are no longer in use. Nevertheless, numerous textile remnants are also found in the Iron Age parts of the salt mine, but they have to be interpreted differently.

Plenty of evidence for the use of textile sacks and bags comes from the Roman period, both from archaeological finds as well as from epigraphic and iconographic sources⁶⁷¹.

⁶⁷⁰ Both possibilities are discussed in Grömer, Rösel-Mautendorfer and Reschreiter 2013, fig. 40.

⁶⁷¹ Linscheid 2011. – Wild 2003, 38–39.



Fig. 163. Hallstatt, Bronze Age salt mines: remnants of woollen transport sacks.

5 Recycling: binding material, bandages, packaging material, caulking material

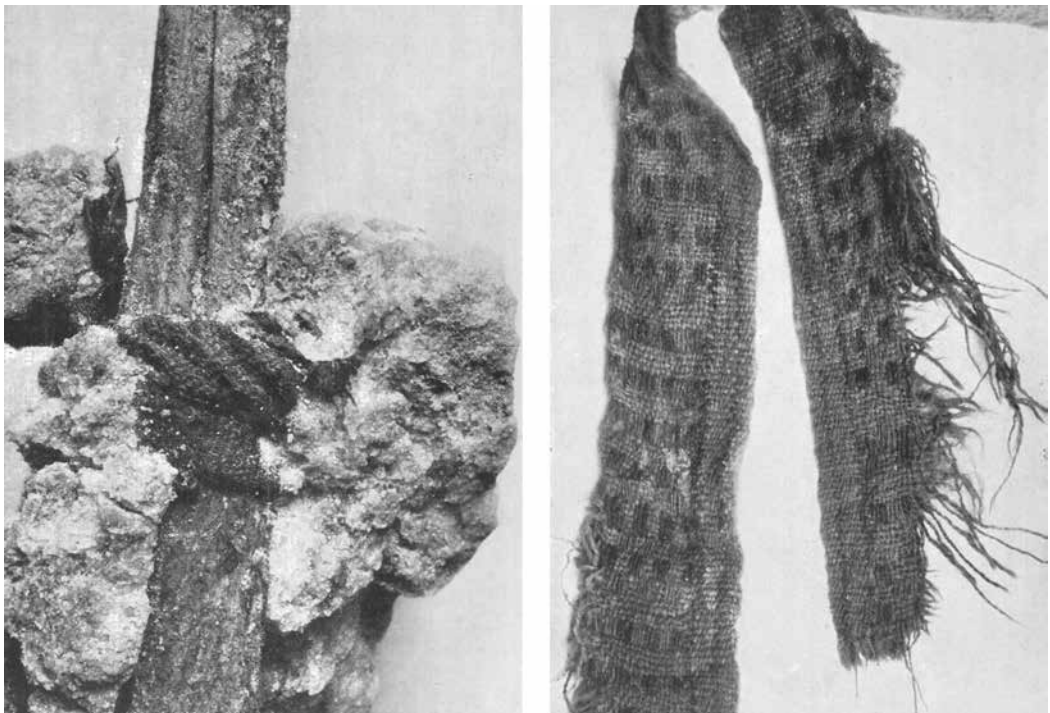
The finds from the Iron Age salt mines of Hallstatt (East Group, c. 9th to 4th centuries BC) and the slightly younger Dürrnberg⁶⁷² (late 6th to 3rd/2nd centuries BC) provide insights into the resource management of the 1st millennium BC. Textile production is very

⁶⁷² Dürrnberg: Stöllner 2002; 2005. – Hallstatt: Grömer, Rösel-Mautendorfer and Reschreiter 2013, 130–134.

time-consuming and thus expensive. The evidence for targeted recycling of waste textiles shows that textiles were much appreciated as raw materials and fully exploited till the end.

The textiles from the Iron Age salt mines are sometimes very fine, of high quality and beautifully patterned. To a large extent, they probably represent the remains of garments, torn into small shreds and left behind in the overburden of the mountain. At the time of their discovery, (the first textiles were found in the salt mine of Hallstatt in 1849), the question already arose as to whether these pieces of fabric could have come from the work clothes of the miners. However, it is clear for the Iron Age mining in Hallstatt at least that the miners were working in large mining halls, not in narrow tunnels, so that the risk of tearing clothes while working was not very high. Current research⁶⁷³ assumes that textiles were gathered above ground, *i.e.* specifically collected in the settlement outside the mine and brought into the mountain as consumables. Interestingly, even today,

Fig. 164. Dürrnberg-Hallein, site Hinterseng: patterned band in secondary use, wrapping a broken tool handle, Iron Age.



⁶⁷³ Grömer, Rösel-Mautendorfer and Reschreiter 2013, 130–134. – Reschreiter 2005, 14. – Stöllner 2005, 161, 171. – Von Kurzynski 1996, 33.



Fig. 165. Hallstatt, Early Iron Age salt mines: textiles tied in a knot.

although salt is mined with the latest technology, the custom of having a ‘rag box’ (*Fetzenkiste*) around remains common. Here, modern miners gather used pieces of textiles to take into the mines and use as necessary, for example to clean the pneumatic hammers and other tools.

Pieces of textiles torn into strips are also known from prehistoric Hallstatt and Dürrnberg. Some pieces of cloth are knotted (Fig. 164 and 165), and sometimes two textiles are tied together by a knot; there are also knots of bast material⁶⁷⁴. These material remains were apparently used as makeshift bandage material. A particularly impressive example of the kind comes from the site of Hinterseng/Dürrnberg⁶⁷⁵: an elaborately coloured patterned fabric band was discovered there in the middle of the 19th century, which was knotted around a broken tool handle (Fig. 164). The primary purpose of this beautifully designed piece of textile

⁶⁷⁴ Stöllner 2002, fig. 12 and pl. 4/1375, 5/1674. – Grömer, Rösel-Mautendorfer and Reschreiter 2013, 130–134.

⁶⁷⁵ Kyrle 1918, fig. 60. This find remains lost since World War II. In the Dürrnberg salt mines many repaired tool handles were found, for instance at the site Ferro-Schachtricht. Stöllner 2002, pl. 109, 111, 140 or 178.

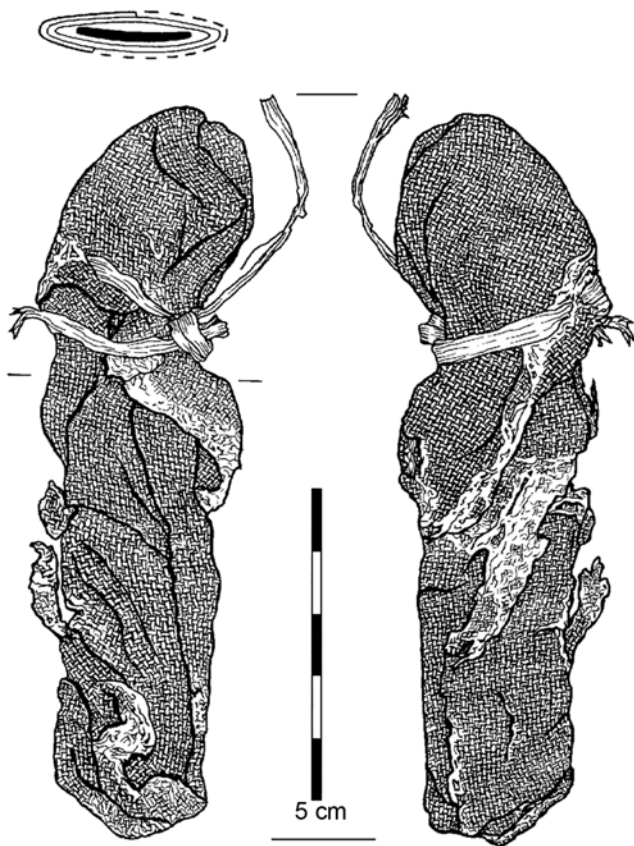


Fig. 166. Dürrenberg near Hallein, Austria: wound dressing for a finger, Late Iron Age.

At the Ferro-Schachtricht site a bundle of cloth was discovered, which looked inconspicuous during the archaeological excavations. On closer examination, it turned out that this soft, light-coloured linen fabric was rolled up in the form of a finger and fixed in this form with bast (Fig. 166). It is probably an 11 cm long finger bandage, a wound dressing for a finger. Plant remains were found within the bundle, and although they have not yet been fully analysed, they may have served to stop bleeding or to promote wound healing⁶⁷⁷. The medical usage of linen bandages is also described in Roman times⁶⁷⁸ by Galen in *De fasciis*, while Pliny the Elder (*Nat. Hist.* 19.21) states that the nap of linen cloths, especially that which comes from ships' sails,

work was probably in the area of clothing, but it was finally – to use a modern term – recycled and used for repair work.

Cords and ropes of various types of tree bast and grasses were used as binding material in the Hallstatt and Dürrenberg mines. If those were not readily available, strips of cloth, leather strips or young, elastic twigs were apparently also used⁶⁷⁶. Most likely, the fabric scraps were used for several hygienic and/or sanitary purposes in the mountain, as cleaning rags or for cleaning hands and face, possibly also as a kind of 'toilet paper'. Conclusive evidence for the latter use has not yet been found, although human faeces are frequent finds in the salt mines. It is noteworthy that direct evidence for the use of fabric for medical purposes has been recovered at the Dürren-

⁶⁷⁶ Cf. Kern *et al.* 2009a, 64–65. – Stöllner 2002, *e.g.* pl. 9–10.

⁶⁷⁷ Stöllner 2002, pl. 200, 354; Nr. 2817; Textile catalogue 23.

⁶⁷⁸ After Gleba 2008a, 68.

is used as a medicine. This, again, documents the recycling of textiles.

A number of textile remains have been discovered in the copper mines of Mitterberg/Mühlbach in the Austrian Alps dating *c.* 1,600 BC. Interesting clues as to the use of 'recycled' textiles in the Bronze Age are documented by one well-known piece. According to the old records, the textile was found in the Bronze Age ore mining site within an insulating layer⁶⁷⁹. This protective insulation was intended to prevent ground water from above penetrating the part of the copper mine in which work was being carried out. For this purpose, a wall of wooden planks was erected across the pit to half the height of the shaft, which was supported by a stone and sand fill. The textile rags, along with moss, served as caulking material stuck between the clay-lined wooden planks.

The use of textiles as caulking material for boats is a well-known phenomenon of the 1st millennium AD. Various textile types were found, for example, between the planks of the Nydam boat from a bog in southern Jutland, Denmark, which is dated to *c.* 310–320 AD.⁶⁸⁰ Apparently, no special type of fabric was produced for caulking; only reused material was employed for this purpose.

Another very different kind of secondary use of fabrics is the production of La Tène arm and leg rings, made from hollow sheet bronze. Sets of leg rings occur in pairs in female inhumation graves of the early and middle La Tène period, especially in Lower Austria, Moravia and Slovakia⁶⁸¹. To stabilize the thin sheet of metal, the hollow rings were formed around a filling of clay, sand, wood, or even around firmly twisted pieces of textile (Fig. 167). The filling was designed to protect the shape of the hollow object during manufacture and wear. The textiles recovered from the rings are usually fully organic and well preserved. The textiles used are always tabby woven fragments of flax; it is natural to assume the recycling of waste textiles for this purpose.

⁶⁷⁹ Klose 1916, 35, fig. 45–46.

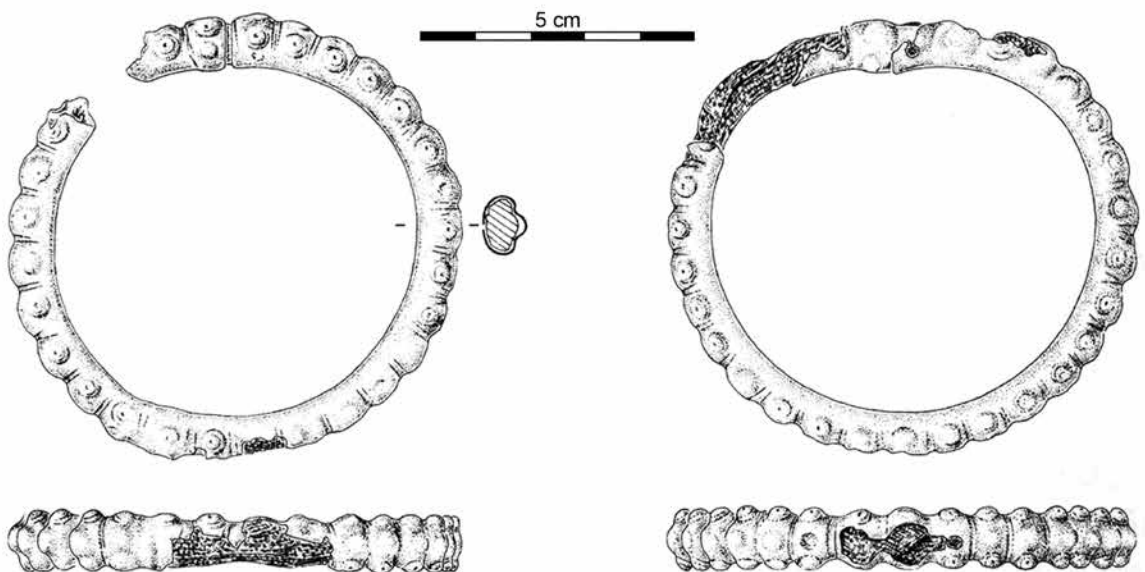
⁶⁸⁰ Möller-Wiering 2011, 93–94.

⁶⁸¹ Finds from Lower Austria: *e.g.* Müllauer and Ramsel 2007. – Finds from Moravia and Slovakia: Belanová 2005; 2012, 314–320, fig. 15.11–12.

A particularly beautiful example of leg rings is the set from Grave 9 from Nové Zámky in Slovakia⁶⁸². In the two hollow rings around the ankles of the buried woman several fragments of a tabby woven fabric were discovered, which were decorated with red wool embroidery (see Fig. 120). Slovakian researchers also discuss the possibility that the textiles worn in rings on the body may have had an additional symbolic function. Whether the idea of 'recycling' rags was important or whether perhaps the filling of rings with textiles had magical-ritual connotations is difficult to decide.

There is also ample evidence for textile recycling in prehistoric graves, as not every piece of fabric can automatically be interpreted as a remnant of the deceased's clothing. The wrapping of grave goods (see above) was mainly an Iron Age custom: in particular, weapons such as swords, daggers or knives were wrapped. These textiles are often only preserved in a mineralized state. It is therefore rather difficult to decide whether the corresponding fabric pieces were made specifically for this purpose, or whether used textiles were prepared for the wrapping.

Fig. 167. Mannersdorf/Leithagebirge, Austria: leg rings from the Late Iron Age Grave 217 with textile filling.



⁶⁸² Pieta 1992.

6 Technical use and utilitarian textiles: scabbards, belt linings, interlinings

Textiles also were used for ‘technical’ purposes, as when something had to be bolstered or covered with cloth, which is a practice that continues today. A find from Berg/Attergau⁶⁸³ in Austria, for instance, illustrates that the magnificent Iron Age sheet bronze belts were padded on the inside and covered with fabric to ensure a good fit. Excavation and subsequent conservation revealed the following (Fig. 168): The sheet bronze belt

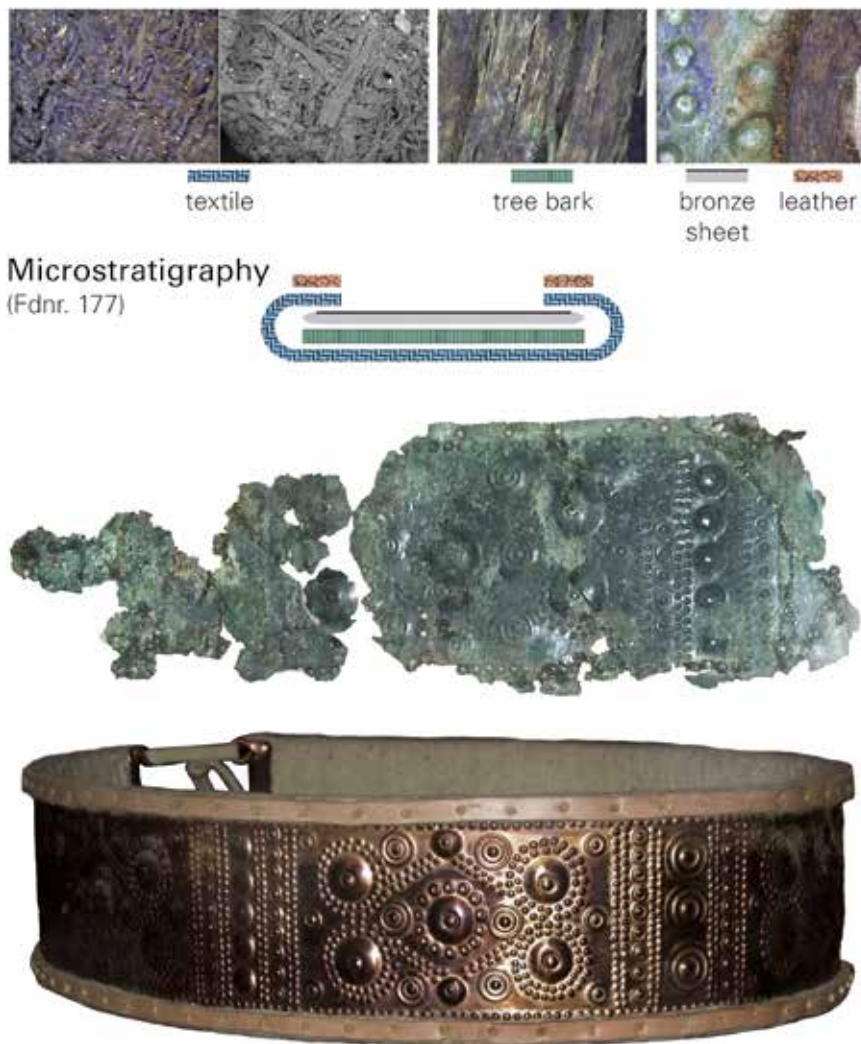
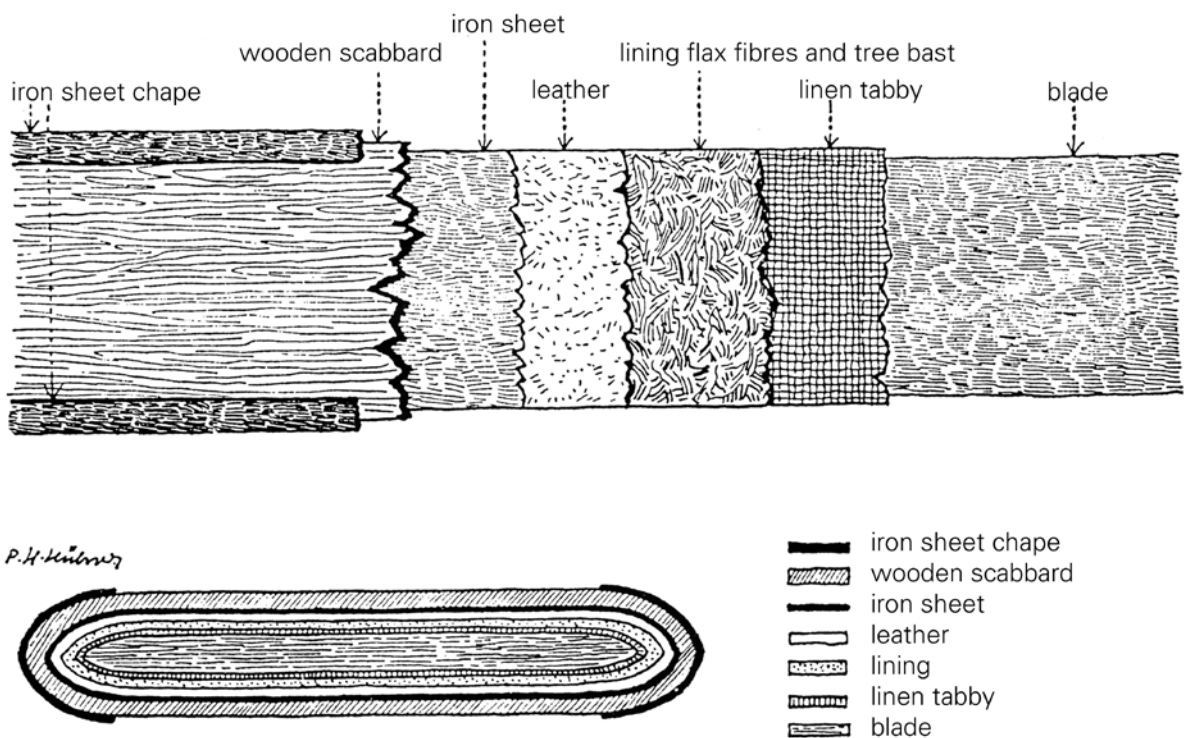


Fig. 168. Berg im Attergau, Austria: Original parts and diagram of the belt construction. Reconstruction by Wolfgang Lobisser, VIAS.

⁶⁸³ Trebsche *et al.* 2007, 65–67, fig. 101.

was found in the cremation grave of a 30 to 50-year-old individual buried under a Hallstatt period burial mound; organic remains still adhered to the belt. During the minute examination and study of microstratigraphy in the restoration workshop, it was found that the sheet belt had a lining comprised of several organic layers; strips of thick bark were found directly under the metal. This inside of the belt was lined with a multi-layered fine twill weave. The fabric was wrapped around the edge of the plate, where it was covered on both edges with a leather strip and fastened by means of small wooden nails. Other sheet bronze belts spanning the body, for example from the cemetery of Hallstatt⁶⁸⁴, also show rows of holes along the edges. These attest that the belts were fixed to or lined with organic material; conceivable materials include leather or, as in the case of Berg im Attergau, bark or textiles.

Fig. 169. Horath, Germany: Reconstruction of the textile and leather linings of a Late Iron Age scabbard.



⁶⁸⁴ Kromer 1959, e.g. Grave 255 (pl. 36) or Grave 459 (pl. 75). – Cf. Kern, Lammerhuber and Schwab 2010, belt plate from Grave 367 and 459.

Further examples of the use of fabrics for technical purposes are offered by the finds of textiles in the context of weaponry: textiles for the construction of sword and dagger sheaths were used from the Bronze Age⁶⁸⁵. These were used both as external linings, such as for the finds from Kosel, as well as for interlinings, such as for a find from Friedrichsruhe (both Northern Germany, Bronze Age Montelius III). There are also finds of Hallstatt sword sheaths, such as from Gomadingen-Steingebronn, that were made from double wood shells with fabric wrapping (probably drenched with adhesive). The remains of a lined wooden scabbard of a La Tène sword from Horath, Germany, show yet another possibility. The scabbard consisted of several layers of wood, iron sheet metal and an organic upholstery made of leather, linen fibres and tree bast, with an innermost layer of linen fabric (Fig. 169).

Technical secondary use can be postulated for the fabric from the Urnfield hoard of Sublaines, France. The textile was found inside the socket of a bronze axe, leading Hans-Jürgen Hundt⁶⁸⁶ to assume that the textile served as plugging material to fix the wooden shaft securely to the metal socket. Similar finds of fabrics wedged into the socket of socketed tools are known from England and Scotland, from Late Bronze Age contexts.⁶⁸⁷ Textile and leather pieces were also used in the Iron Age mines at Dürrnberg, to wedge the picks (*Bergeisen*) into the wooden shafts⁶⁸⁸. About 12×4 cm large, rectangular leather or fabric strips were inserted into the forked shafts to attach the metal blade on this interlining.

Even for pottery production, woven textiles as well as mats sometimes served technical functions. Mat imprints were found on the bottom of Neolithic pots at Michelstetten in Austria and Hódmezővásárhely-Kökénydomb in Hungary⁶⁸⁹. From the lat-

⁶⁸⁵ Kosel, Friedrichsruhe: Bender Jørgensen 1986, 229. – Ehlers 1998, 181–182, 194–195. – Gomadingen: Zürn 1987, fig. 32. – Horath: Haffner 1976, 230, fig. 62.

⁶⁸⁶ Hundt 1988, 261.

⁶⁸⁷ England: Sommerleyton: De Roche 2012, 446. – Scotland: Nydie mais, Fife and Pyotdykes: Wincott Heckett 2012, 432.

⁶⁸⁸ Stöllner 2002, e.g. pl. 120 (textile) and pl. 190 (leather).

⁶⁸⁹ Austria: Grömer 2006a. – Hungary: Richter 2010, fig. 34.1–34.4. – Poland: Bender Jørgensen 1992, fig. 110.

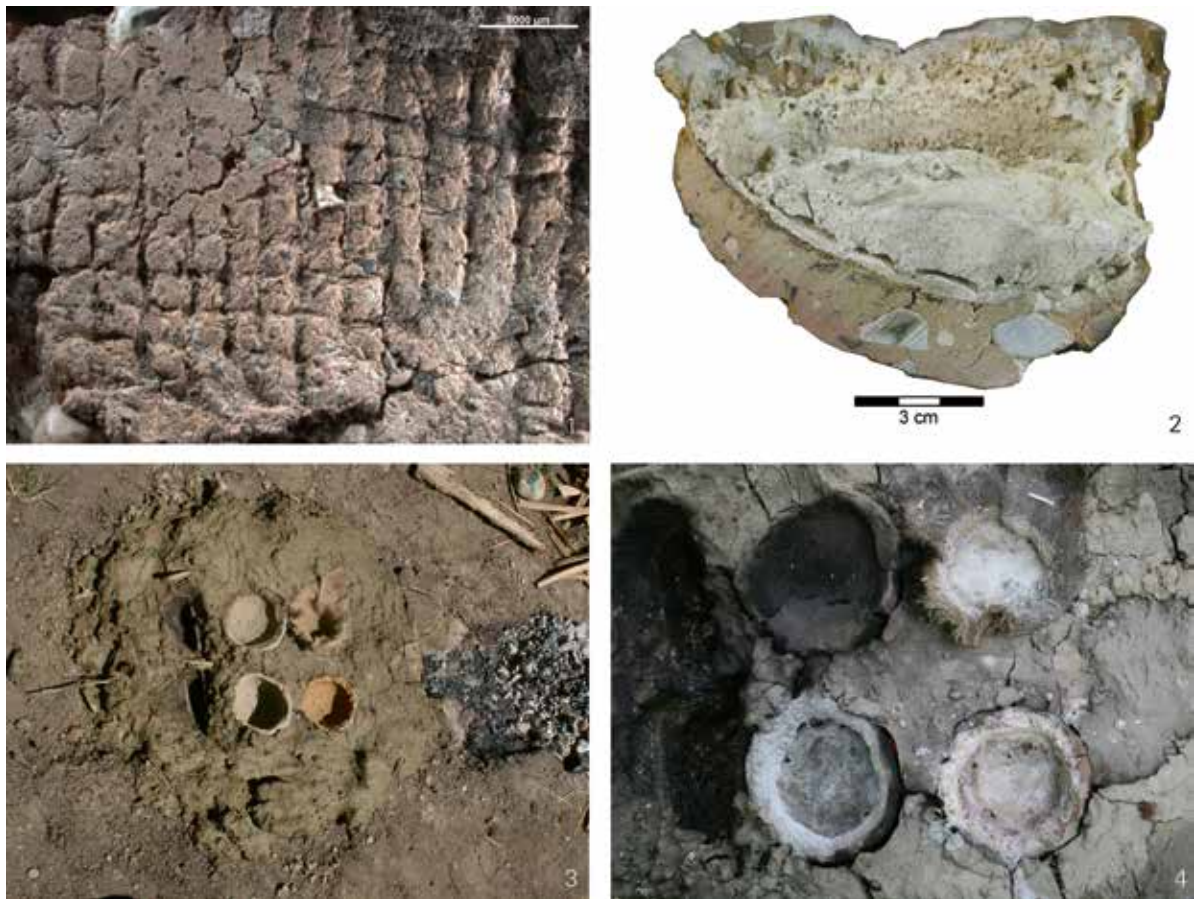
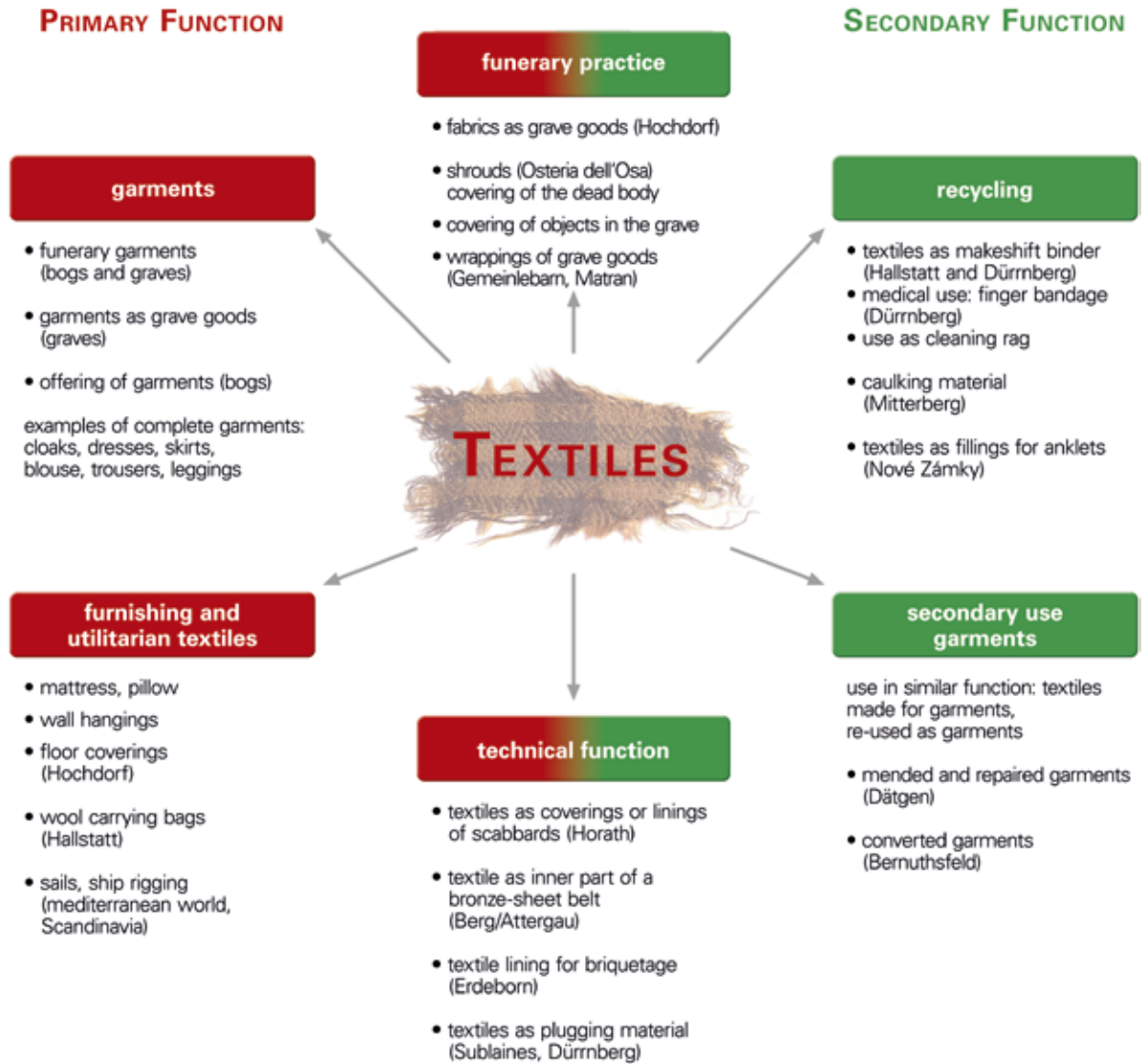


Fig. 170. Textile imprint on a briquetage-fragment from Erdeborn in Germany, beginning of the 1st millennium BC (1). Experiments: Cross-section of a vessel with textile and crystallized salt (2). Reconstruction of the briquetage-furnace (3), crystallized salt from the heating process (4).

ter location, as well as from Bilce Złote in Poland, imprints of tabbies were found. In these cases, the imprints were not added to the unfinished vessel as a decoration, they just appeared, because the vessel was put on a mat or textile by the potter during manufacture; therefore, the fabric or mat is a technical implement.

The flexibility and elasticity inherent in textiles was exploited when they were used at the late Bronze Age to early Iron Age salt production site in Erdeborn in Germany⁶⁹⁰. There, ceramic vessels (*briquetage*) were filled with brine, and heated until the water evaporated and the salt could be harvested. Sometimes, traces of textiles were found inside the vessels (Fig. 170.1), where they might have been used in the production process of

⁶⁹⁰ Ipach 2015. – Ipach, Scherf and Grömer 2014.



the vessel or for the production of the salt – to serve as a layer between the vessel and the salt clump. The textile traces are on one hand coarse tabbies, like one coarse veil-like textile and on the other hand a twill fabric. The experiment proved (Fig. 170.2–4), that if the brine is heated in a vessel covered with textile, the salt crystallizes along the textile structure (Fig. 170.2).

Fig. 171. Use of textiles in prehistoric Europe according to archaeological finds.

7 Conclusion

The archaeological context and the specific characteristics of prehistoric textiles provide many clues as to their former use (Fig. 171). Not every piece of woven fabric that has been found in a prehistoric grave or salt mine served as clothing. One can also distinguish between primary and secondary function of textiles. Most often, the primary function would be the use of new fabrics for clothing, but textiles for industrial and technical use might also have been produced primarily for this function. Hints of secondary uses (recycling or reuse until the final wear) are found mainly in the textiles from the salt mines, but also from graves, *e.g.* when they are used in La Tène arm rings. On page 240 we pointed out that we also know garments made of recycled material, which means we can trace here secondary use as well.

The functional interpretation of textile residues further demonstrates that textiles played a role in every area of human life – as clothing, as household textiles, soft furnishings and as aids in various activities – in the domestic, ritual and religious spheres, in grave rituals as well as sacrifices.

Another important use of textiles – for sails and ship rigging – has been omitted here, as this study focuses on the largely land-locked Central Europe. This use was, however, of importance throughout the prehistoric Mediterranean world, even for the Etruscans, as well as in Scandinavia⁶⁹¹.

⁶⁹¹ Cf. Gleba 2012, 283–234. – Möller-Wiering 2007.

E Clothing in Central European Prehistory

The use of clothing is deeply rooted in human behaviour, and is one of those types of behaviour that clearly distinguish us from animals. It is not known exactly what factors in the evolution of humankind caused us to cover our body with clothes. Was it purely the obvious, to meet the body's need for protection against cold, heat or other influences?



The sense of chastity (or shame) – for the development of clothing as allegorically reported in the Bible – was surely not the reason. This only occurs after the covering of the body has become an ingrained habit and the contrast between ‘naked’ and ‘clothed’ comes to consciousness, leading to nudity being perceived as immoral. Did the custom of clothing derive from wearing hunting trophies or from camouflage when stalking wild animals? It is not clear whether the natural hair cover all over the body assumed for previous species of mankind – similar to our closest relatives the chimpanzees – disappeared after the advent of clothing or whether the introduction of clothing is a result of the loss of the hair. Does the development of clothing reflect the interaction between biological and behavioural cold adaptations subsequent to the expansion of humans to colder climate areas? The question of when the first forms of clothing appear therefore is an exciting one. Using DNA analysis to trace the evolutionary split between head and body lice, researchers recently concluded that body lice evolved from head lice approximately 190,000 years ago. This means that the use of clothing can be traced back at least this far.⁶⁹²

The term clothing is also more than complex. In modern terms it encompasses everything that people use to cover their bodies. In a broader sense, clothing also includes headgear and footwear, jewellery and accessories, since they all shape the overall appearance of a person⁶⁹³. Archaeological research on costume and clothing generally deals with the evaluation of jewellery and clothing accessories made of metal (especially belt components, pins and brooches)⁶⁹⁴. Recently, a useful analytical categorisation for the study of dress in prehistoric archaeology has been established by Marie Louise Stig Sørensen⁶⁹⁵. She distinguishes between cloth, *i.e.* the textile itself, and clothing, that is the garment constructed from cloth. Items of clothing together with belts or brooches, *i.e.* dress fittings, footwear, headgear and in the broadest sense, even hair and beard style, are subsumed under the term ‘costume’.

⁶⁹² Hunting theory: Koenig 1978. – Cold adaption theory: Gilligan 2007. – Body lice: Bower 2010.

⁶⁹³ Cf. Eicher and Evenson 2015, 2–27. – Reich 2005. – For definitions in ethnography, see Cordwell and Schwartz 1979. – Feest and Janata 1989, 161–163.

⁶⁹⁴ *E.g.* Pabst-Dörrer 2000. – Ramsel 2002, 2011, 2014a. – Wels-Weyrauch 1994.

⁶⁹⁵ Definition of clothing and costumes in archaeology after Sørensen 1997; 2010.

When attempting to write the history of clothing before the Romans, one encounters limitations all too quickly. Very few complete prehistoric garments are preserved, which only allow sporadic insights into the costume of individual regions or certain narrow time periods. With the interpretation of human images, one has to question whether accurate pictorial representations of contemporary costumes were at all the intention of the image. Written sources, which may shed light on the names of certain garments, their production or their function, are not available except for the latest Iron Age. This chapter presents the sources and evidence that archaeologists can use to reconstruct prehistoric clothing, and the aspects of source criticism that have to be considered.

1 Sources for the history of pre-Roman costume

1.1 Complete garments

The complete garments from Bronze and Iron Age in Northern Europe are all too enthusiastically embraced by writers of costume history, as if the full range of prehistoric clothing could be reconstructed from these few pieces⁶⁹⁶. The alternative picture given in older books about costume history is that pre-Roman 'savages' are represented with fur and skins slung over their bodies.

It is essential to note here that complete pieces of garments are rarely obtained, and they come from different time periods, cultures and regions of prehistoric Europe. In addition, they derive from different find contexts, such as from graves or sacrificial deposits. This raises the question of whether it was everyday clothes or special pieces that were put into graves or sacrificed. Even with relatively complete ensembles that have been pre-

⁶⁹⁶ E.g. Lenning 1982. – Bruhn and Tilke 2004, e.g. pl. 21, Bronze Age to Roman. – Leventon 2008, 38–39, 43. – Thiel 2000, with references and further sources.

served in rare cases, one must always bear in mind that even these may be missing significant parts through selective preservation conditions. Iron Age bog finds in northern Europe, for example, consist of only the organic raw materials that stem from animals, not from plants. We are thus well informed about various garments made of leather or wool fabrics, but largely ignorant of linen fabrics from these cultures. It is quite conceivable that the Tollund Man⁶⁹⁷, strangled and dumped in a bog during the 3rd century BC, who was found wearing only a leather cap and a leather belt, might in fact have been wearing a linen tunic. The exact shape of this garment could theoretically differ substantially from contemporary woollen outerwear.

Only rarely has a prehistoric person in full costume been as immediately and directly encountered, such as the Iceman, found 3,210 m above sea level in the Ötztal Alps in Southern Tyrol in 1991⁶⁹⁸ (Fig. 12). An unfortunate victim of either an accident or a hostile act, this Copper Age man's garments and belongings have survived in the ice since *c.* 3,300 BC. Due to his accidental death, his costume is an important example of mountain equipment used during Alpine crossings at that time.

A counterpart to the Stone Age alpine equipment of the Iceman is an ensemble discovered a year later, on the verge of the melting snow field of the Vedrette glacier in the Tyrolean Alps at 2,850 m altitude⁶⁹⁹. Here were found two pairs of leggings, leg warmers made of wool as well as socks and scraps of leather shoes. Again, this is warm, functional clothing for the alpine environments, in this case dating to the Iron Age between the 8th and 6th century BC.

However, the garments of the Iceman represent a specific, isolated case of clothing worn by a prehistoric man during his lifetime, found and observed in context. A large part of the complete garments or costume components with textile residues,

⁶⁹⁷ Van der Sanden 1996, 20. – Van der Plicht *et al.* 2004, 482–483. – Cf. Mannering *et al.* 2012, 104.

⁶⁹⁸ Spindler 1995. – Spindler *et al.* 1995.

⁶⁹⁹ Bazzanella *et al.* 2005.

however, are derived from burials, which warrants a few critical methodological remarks.

What about the bog bodies⁷⁰⁰? In Northern Europe, especially in northern Germany, Denmark and Ireland, people originating from different periods were discovered during peat digging in the 19th and 20th centuries. They ended up in the bog for a variety of reasons, whether accidental victims on their way through the bog, as intentional burials or, as is often assumed, they were the subject of the death penalty or human sacrifice.

Less than half of the bog bodies are equipped with clothes, but this is partly due to differential preservation conditions (page 28) or incomplete recovery. If garments were found with a bog body, the persons were not always dressed correctly. Some garments were found wrapped around the body, at other times the clothing was deposited under the head. The garments of the bog bodies could in principle represent clothing worn during their owner's lifetime, but for those people who came into the bog through certain rituals, such as the victims of sacrifice and punishment, their clothing might have been specially selected. This in turn might have expressed a certain status in society (that of a human sacrifice or criminal, for example). The same might apply in the cases where the person's head was partly or completely shaven, as for example the Yde Girl or the 'Windeby Girl'⁷⁰¹, who according to recent DNA analyses was actually a male; both bodies date to around the time of the birth of Christ.

Complete items of clothing are also known from offerings without associated human sacrifice. Between the 1st century BC and the beginning of the 5th century AD members of the West Germanic tribe of the Angles offered various objects into the Thorsberg Moor, Germany⁷⁰². The offerings consisted of weapons,

⁷⁰⁰ Mannering *et al.* 2012. – Möller-Wiering and Subbert 2012. – Schlabow 1976. – For a summary on the bog bodies, see Van der Sanden 1996, clothing: 120–134, hair: 164, circumstances of death: 154–165, interpretations: 166–181.

⁷⁰¹ Gill-Robinson 2006. – Windeby and Yde: Van der Plicht *et al.* 2004, 485–486. – Van der Sanden 1996, 32.

⁷⁰² Schlabow 1976, 23, cloaks and tunics: 61–70, fig. 109–130, trousers 76–77, fig. 162–174, wraps 89–90, fig. 226–231. – See also Möller-Wiering and Subbert 2012.

Opposite side:
Fig. 172. Upflamör
south of Reutlingen,
Germany.
Reconstruction of the
burial with over-long
needles and leg spirals
connected by chain
links, 14th century BC.

shields, horse harnesses, clothes, wooden objects, tools and jewellery. Amongst the most outstanding finds were a Roman cavalry mask, Roman helmets, coins and objects marked with runes. Among the textiles found in bogs there are a number of garments among the deposited offerings: five splendid cloaks, a tunic, two pairs of trousers and two pairs of leg wraps.

1.2 Textiles in graves

Although conditions are unfavourable for the preservation of organic material in the moist central European climate, textile remains are sometimes found in graves, preserved through contact with metal (see Fig. 9). Textiles preserved in such a way are usually very small in size and the surface structure often is only preserved as an impression in the corrosion layer. Nevertheless, they are an important source of information about prehistoric textiles. Through detailed observations of the find contexts, the role the textiles played in the grave may be evaluated, for instance if they were part of the garment of the deceased, a part of the shroud, or wrapped around an object⁷⁰³. It is important to decide if the garments in the grave represent the clothes worn during lifetime, or if they constitute a special costume for the dead⁷⁰⁴, which was made only for the funeral.

In a study of the jewellery from Middle Bronze Age female burials in Central Europe, the prehistorian Bert Wiegel⁷⁰⁵ found that the rings exhibited strong signs of wear. It can therefore safely be assumed that this was a costume worn during life. This means that these people wore their rings in their lifetime and took them to their grave. According to Ulrike Wels-Weyrauch⁷⁰⁶, however, other evidence of jewellery and costume elements from the same time period suggest that they should, at least in part, to be regarded as costumes for the dead. She argues that the '*Beinberge*' (rings or cuffs with spiral ends) worn on the legs and connected

⁷⁰³ Compare Gleba 2012, 230; 2014b.

⁷⁰⁴ Sørensen 1997; 2010, 55.

⁷⁰⁵ Wiegel 1994, 165.

⁷⁰⁶ Wels-Weyrauch 1994, 59, fig. 55–56C. – Cf. Grömer, Rösel-Mautendorfer and Mückler 2012, 139–140.

by a chain of links could have hardly be worn during lifetime, as they make it impossible to walk. Similarly the extra-long pins which are frequently found in that period do not appear particularly advantageous and practical in everyday life (Fig. 172).

The large textiles found in the princely tombs of Verucchio in Italy⁷⁰⁷ shed some light on this question as well. Two cloaks were found in tomb 89. Traces of wear, such as holes left by the fibulae, prove that they had been used previously. Numerous paired stitches were documented on the left shoulder of cloak 1, demonstrating that they were clearly not woven exclusively for the burial.

Ultimately it cannot be proven if the objects in a grave were part of the personal property of the dead and used during their lives, or if they constitute gifts from relatives and friends⁷⁰⁸. This applies as much to pottery grave gifts as to the jewellery. It is clear, however, that the grave goods, including the costume, mirror what the community wanted to express about the sex, the age and the status of a person.

What do we know about the clothing materials of the living? The textile remains from the Neolithic and Bronze Age lake dwellings or the textile finds from the salt mines of Hallstatt and Dürrenberg could (among other uses, see chapter D) represent remnants of clothing. Direct evidence that textile pieces from these contexts were formerly worn as clothing was found in the form of unwanted



⁷⁰⁷ Stauffer 2012, 249.

⁷⁰⁸ For methodological considerations, see Kurz 1997, 125–130. Clothing is there considered to be personal property in real life.

parasites clinging to the textiles of the Hallstatt salt mine. In several cases, the rags were recognised as former garments through the discovery of nits and human body lice⁷⁰⁹. The body louse is a parasite adapted to humans and lives most comfortably at human body temperature, preferably in the hair or clothing. The body louse is therefore only found in textiles that were in direct contact with the human body. It is currently thought that the textiles from the Iron Age areas of the Hallstatt salt mine were at least partly used as clothes before their secondary use; whether as everyday attire or special costume is uncertain.

In addition, insights can be gained as to raw materials of the textiles, their structures, qualities, patterns and colours. For instance by comparing the data from the Hallstatt salt mine with the textiles of culturally similar and contemporary cemeteries, such as those from the eastern Hallstatt area⁷¹⁰, it is apparent that they have the same range of weaves and subtleties. Although colour patterns can no longer be preserved due to the unfavourable preservation conditions by metal corrosion in graves, it is possible to observe patterns produced by spin direction. These matches indicate that the textiles used during a person's lifetime were similar to those in the grave. The local Hallstatt population, however, might not be typical in the sense that it was most likely a wealthy community based on salt mining and trade, as is inferred from the rich grave goods found in the Hallstatt cemetery. Similarly the textiles preserved in the Hallstatt graves also represent more affluent people. Under conventional conditions textiles are only – if at all – preserved in graves with sufficient metal objects, so that textiles have the chance to corrode onto them. Again, this is certainly not the poorest sector of society.

1.3 Clothing accessories and jewellery from graves

Before the invention of press studs, zippers and Velcro, clothing was fastened in a variety of different ways. These devices

⁷⁰⁹ Grömer, Rösel-Mautendorfer and Reschreiter 2013, 127–128; HallTex 32, 34, 40, 292. – For lice, see Ryder 2003.

⁷¹⁰ Compare Belanová-Štolcová 2012, 310. – Bender Jørgensen 2005. – Grömer 2012, 43–44.

are referred to in archaeology as dress fittings, dress fastenings and clothing accessories. These include belt buckles, buttons, brooches and pins. Clothing accessories are designed according to the characteristic style and design of the period, as they serve a decorative purpose in addition to their practical function. They sometimes even carry a symbolic content⁷¹¹. The symbolism may be inherent in the material, the shape, and the motives of the decoration or even in the positioning of the object on the body.

Archaeological costume research is primarily concerned with the evaluation of jewellery and clothing accessories made of metal⁷¹², because finds of textiles in graves are so rare. Certain conclusions about the costume can be drawn from the position of dress elements, especially when the objects are positioned on the body according to their function as fasteners. Metal components such as belts, pins and fibulae in graves without textile preservation indicate which part of the body was belted, and where the clothes were held together by pins or fibulae (Fig. 173). The appearance of the corresponding piece of clothing (upper garment, tunic, cloak, dress, *etc.*) has to be inferred by comparison with pictorial sources or exceptional preserved finds. The analogies are frequently borrowed from geographically or chronologically distant places, which is of course problematic. Due to a lack of other evidence, the Neolithic and Bronze Age garments from Central Europe are most often reconstructed from the Nordic costumes from oak coffin burials as a reference, even though they belong to a completely different cultural context.

The interpretation of the positioning of the metal items in graves presents other problems. In rich graves there are often more dress elements present than strictly needed. They may at times be found in the correct location, but at other times may not have had a functional role as garment fasteners (Fig. 242)⁷¹³. This can lead to confusing costume reconstructions⁷¹⁴. In each individual case close observation of the objects in the grave is required

⁷¹¹ This is particularly well researched in ethnography, e.g. Feest and Janata 1989, 161–164.

⁷¹² E.g. Pabst-Dörrer 2000. – Wiegel 1994.

⁷¹³ E.g. the cemetery of Münsingen, Switzerland, where surplus fibulae were found in a number of graves. Hodson 1968, 56–63, Grave 122, 132, 140, 149, 157, 161, 168 or 184.

⁷¹⁴ E.g. Negroni Catacchio 2007, fig. 8–10.

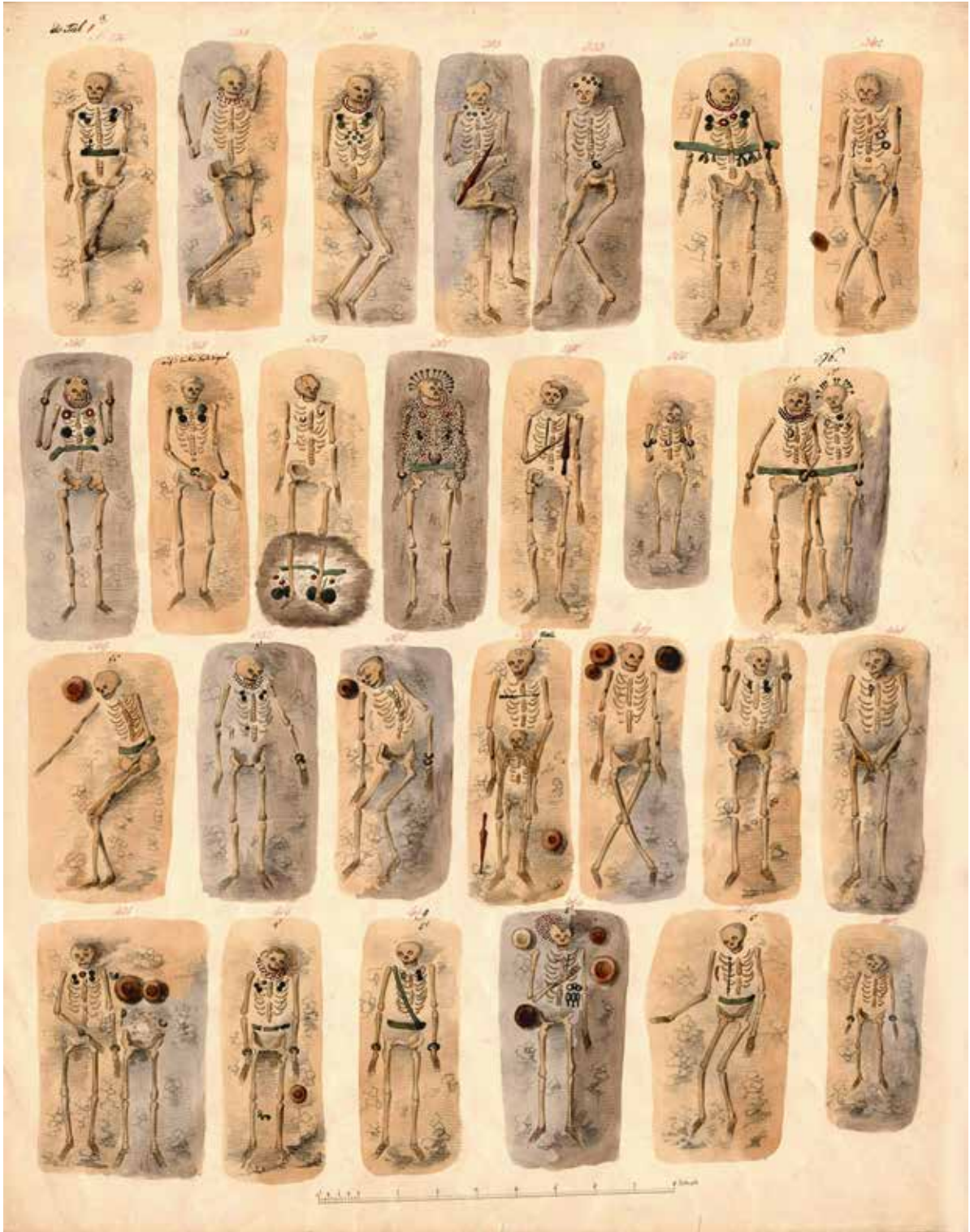


Fig. 173. Cemetery of Hallstatt, Early Iron Age: Watercolour painting of grave findings from Johann Georg Ramsauer's documentation in 1846.

to decide which dress accessories fastened clothing, which may be considered as grave gifts and which ones had other functions, for instance to fasten shrouds.

1.4 Pictorial sources

Pictorial representations of people in prehistoric times occur in many variants. This is just a short overview; detailed explanations can be found in the sections on the individual periods. Various types of idols, figurines and stelae made of clay, stone, bone, ivory or metal provide sources with the greatest time depth. Human images reach as far back as the Palaeolithic period, with one of the most famous examples being the Venus of Willendorf⁷¹⁵ (Fig. 174) dating to c. 29,500 BC.

Ceramic figurines made in Central Europe and the famous stone stelae from the alpine areas of northern Italy and western Switzerland and France are particularly significant for the Neolithic⁷¹⁶. There are very few human representations from the Central European Bronze Age⁷¹⁷, but in the Early Iron Age figurative art occurs more frequently, for instance as metal figurines or monumental stone statues such as the Glauberg Warrior⁷¹⁸. Iron Age fibulae with human representations complete the inventory of available pictorial sources.

Anthropomorphic images on pottery, found in the Stone and Iron Ages, provide another source of evidence. These images are executed in the typical decorative techniques of the time, such as incision (Fig. 175), relief, painting or impression. Iron Age sheet bronze objects were also decorated with human figures, both in punching and repoussé as well as using a chasing technique.

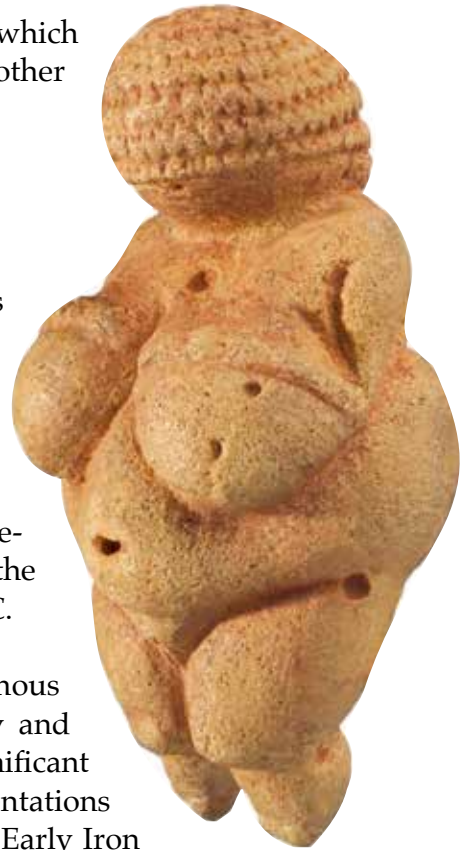


Fig. 174. Venus of Willendorf, Austria, c. 29,500 BC.

⁷¹⁵ Female figurine found in Willendorf, Lower Austria. Most recently: Antl-Weiser 2008.

⁷¹⁶ *E.g.* Hansen 2007. – Müller-Karpe 1974, pl. 602–603. – Winingen 1995, fig. 7–9.

⁷¹⁷ Bronze Age figurines with depictions of clothing are known from the Nordic Bronze Age (Broholm and Hald 1940, fig. 192–193) and from Hungary, Romania and Serbia (Müller-Karpe 1980, pl. 326–327).

⁷¹⁸ Exhibition catalogue Glauberg 2002, fig. 70–71.

Fig. 175. Sword scabbard from Hallstatt, Grave 994, Early La Tène period.



Prehistoric human figures sometimes provide immediate and direct insights of clothing. They may also be misleading, as they may not reflect everyday life, but instead may be standardised iconographic motifs, be influenced by religious aspects or represent extraordinary situations. Even if they depict everyday life sceneries, they are only snapshots and say more about the language of images than about the clothing of everyday life⁷¹⁹. The attention to detail, with which clothing accessories and jewellery are depicted, varies depending on the intention of the artist when creating the image. It is necessary to take into account levels of abstraction, as well as the individual skill of the artists and the representational limits of the material in which the image is executed. These are crucial to the interpretation of pictorial sources.

Particularly well-known are the pictures on bronze buckets, called situla art, which serve as good examples for the interpretations of human representations. The situlae (the Latin word for bucket) were used as wine containers, and are found between the Po River in northern Italy and the Danube between the 6th and 4th century BC⁷²⁰. The situla art was created following Medi-

⁷¹⁹ *E.g.* Paetz gen. Schieck 2013. – Schierer 1996, 6–8.

⁷²⁰ Frey 2005. – Lucke and Frey 1962. – Turk 2005.

terranean models and shows detailed figurative friezes of processions and musicians, chariot drivers and competitors, riders and warriors, hunting and sacrifice scenes. Situlae were not the only bronze objects decorated with these picture scenes; other types of vessels such as cists (cylindrical bronze buckets), trays and lids as well as belt plates, belt buckles or helmets were likewise decorated. It is tempting to see the typical Hallstatt period attire in the wealth of detail represented in situla art, particularly when it comes to representations of clothing. However, Etruscan pictorial sources were generally used as models for situla art, although local traits may be detected.



How can these pictures be interpreted? As the situla from Kuffarn in Lower Austria was found in a grave in 1891 (Fig. 176), Father Lambert Karner from the nearby Göttweig monastery interpreted the images in a lecture to the Anthropological Society in Vienna as follows:

*'... the whole scenery is, in my view, a funny story set in a pub. Slowly and ponderously the landlord swings two empty situlae, walking to the cellar to refill them. In contrast to the fat landlord, the thin waiter pours the guest a drink with a laughing face and the little boy that looks up to him is just waiting for the moment in which the hat falls from his head ...'*⁷²¹

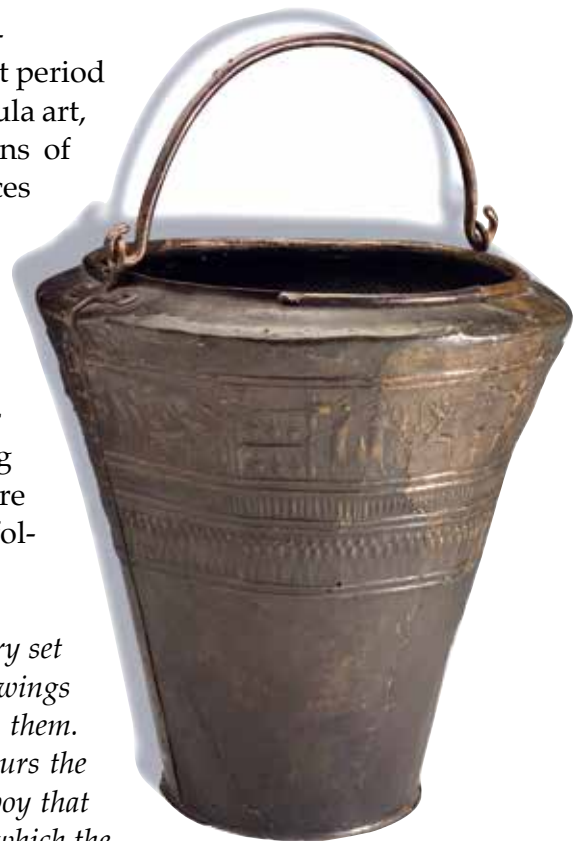


Fig. 176. Situla of Kuffarn in Austria, Iron Age. Drawing of the 'tavern scene' described by Father Lambert Karner.

⁷²¹ Sitzungsberichte, Monatsversammlung der Anthropologischen Gesellschaft in Wien am 15. Dezember 1891. Vortrag von Pater Lambert Karner. Mitteilungen der Anthropologischen Gesellschaft Wien XXI, 1891, [68] – [71]:

'... die ganze Scenerie ist, nach meiner Ansicht, eine lustige Wirtshausgeschichte. Der behäbige Wirth schwingt zwei leere Situlen, er geht in den Keller, um sie wieder zu füllen. Im Gegensatz zu dem dicken Wirthe schänkt der dünne Kellner mit lachendem Gesichte dem Zecher ein, und das Büblein, das da emporschaut, wartet auf den Augenblick, in welchem ihm der Hut vom Kopfe fällt ...'

Today the scene is interpreted as a princely royal household in which an enthroned member of the elite is represented. Otto Hermann Frey⁷²², a specialist for situla art, sees general representations of the lifestyle of the Early Iron Age nobility in the situla images. According to the dissent interpretation of Christoph Huth⁷²³, however, the representations do not reflect an everyday or festive reality, but rather cosmological ideas. As such, they served the glorification of the dead as well as the religious legitimation of claims to power. Whether representing mythological transfiguration or presentation of the 'high society', the content of the images does not reflect everyday scenes among the general population. Instead, festive activities, most likely of the elite, are represented. Thus, the clothes shown on the situlae are most likely festive costume, possibly of the upper class, and probably incorporate symbolic elements.

1.5 Written Sources

Apart from a few dedications written in the Etruscan alphabet by the Raeti and Venetians, inhabitants of the south alpine area, there are no indigenous written sources from Central Europe⁷²⁴. In the Late Iron Age, however, there were repeated contacts between the Greeks (and later the Romans) and the 'barbarians' living towards their north; *i.e.* people who did not speak the Greek language and, in the ears of the Greek, only stammered. Writings of ancient ethnographers and historians such as Posidonius (135–51 BC) or Diodorus Siculus, who wrote a 'universal history' in 54 AD, include reports on these northern barbarians. The Roman general Julius Caesar, for example, detailed the steps he had taken during the 58–51/50 BC campaigns in the Gallic (now French) regions in his famous *Commentarii de bello gallico*, which are read in Latin in humanist schools in Austria to this day.

⁷²² Lucke and Frey 1962.

⁷²³ Huth 2005, 522–527.

⁷²⁴ Urban 2000, 323–325.

Reports of ancient authors sometimes discuss the clothing of peoples living towards the north⁷²⁵ at the threshold of written history. It is very tempting to use precisely those written sources to reconstruct clothing and lifestyle of the Late Iron Age population of Central Europe. In doing so, the following considerations are important: What was the intention of the writer of the report⁷²⁶? Was the aim to provide the most accurate description possible about the Celts? Were individual items of clothing mentioned to stereotypically label a group regardless of what was actually worn in everyday life? Today, clichéd descriptions would mention the *sari* for Indian women or the *Dirndl* for Bavarians. For the Romans, it is particularly the trousers that differentiate northern peoples as '*gens bracata*' (people wearing trousers) in contrast to '*gens togata*' (people wearing the toga). Were platitudes used in the writings to convey a sense of the alien, barbaric and primitive to the readers? Julius Caesar used his *commentarii*, which include descriptions of people and geography, for political purposes. He wanted to stress the importance of his campaigns and the benefits of conquering these peoples. The emphasis on wildness, strangeness and savagery was used to justify Roman rule.

2 Clothing through the ages

Based on the considerations above, it is obvious that it is not possible to provide a comprehensive overview of clothing before the Romans. Also everyday clothing of the entire prehistoric population cannot be reconstructed. Examples of garments from specific regions, cultures and social classes may, however, be highlighted.

In the following sections, an attempt will be made to interpret archaeological textile finds in terms of the history of costumes, based on the existing source material and with considerable caution. As in this book as a whole, the focus here is on textiles

⁷²⁵ For a summary, see von Kurzynski 1996, 68–71.

⁷²⁶ For considerations on source criticism, see e.g. Fuchs and Oltrogge 2013.

from the Neolithic to the Late Iron Age in Central Europe⁷²⁷. The invaluable finds of complete garments from Northern Europe will also be discussed, as these are exceptional sources of information, at least for that region. It should be emphasized that only shadowy outlines can be sketched. The present work is not intended to be a comprehensive identification key for prehistoric clothes, since the current source material does not allow definitive conclusions.

Due to the lack of literacy, which denies us a glimpse on the names of items of clothing in most cases, standard modern English terms are used to describe the pieces, such as tunic, mantle/cloak, trousers and blouse. It is important not to imagine these garments too much like the modern forms. A Bronze Age 'blouse' does not have a button tab, but is more like a T-shaped shirt to slip on. Similarly, a 'mantle' or 'cloak' does not have any sleeves, and describes blanket-like coats, wraps and covers.

3 Neolithic

Let us begin our discussion with the Neolithic period from the 6th millennium BC. It is the time in which people in our region first became sedentary, lived in fixed settlements (villages), farmed and practiced animal husbandry – a way of life that in principle is still in existence today. The first indications of spinning and weaving in Central Europe exist from these early farming cultures in the form of spindle whorls and loom weights.

In this period evidence for clothes is extremely rare. Although we have a complete costume ensemble from the Iceman, remains of clothes and textile fragments are otherwise few and far between. Pictorial representations illustrate the appearance of clothing – at least for those garments that Neolithic people felt appropriate to represent on ritual figurines and anthropomorphic stelae. In this part of human history, metal was rarely used, and when it was, only in limited quantities. Bone dress elements

⁷²⁷ Primarily Austria and neighbouring countries Italy, Switzerland, Germany, Czech Republic, Slovakia, Hungary, Slovenia and Croatia.

in graves, however, can sometimes be used to help our understanding of clothing.

3.1 The first farmers in the Early and Middle Neolithic

The first farmers of the Neolithic in Central Europe represented humans in the form of small, highly stylized ceramic figurines⁷²⁸. The figurines of the Linear Pottery Culture (Fig. 180.1–5) c. 5,500–4,900 BC are usually found in settlements and are usually highly fragmented. The figurines are often ostentatiously decorated with angle, meander or triangle motifs. The same kind of incised decoration is found on pottery at the same time, so it appears familiar to the potters and was part of their skill set. It is difficult to identify clothing items on these figurines; angular designs are a frequent decorative element on the back of the figures, often interpreted as a costume element or as the representation of the ribs. A well-known representative of this type is the figurine from Bicske, Hungary (Fig. 180.3). Some incisions on the figurines may perhaps be interpreted as tops with V-neck, others as leg wraps (both feet are shown, indicating separate leg covers). A grave find from Hainburg-Teichtal in Austria⁷²⁹, dated c. 5,100 BC, sheds a light on such a garment type, as shell beads were found around the knees of a 2–2.5 year old child. It also had a row of beads around neck, waist and both elbows. Did the child wear a tunic-like shirt with elbow-long sleeves and kind of leg covers, decorated with beads around the knees (Fig. 177)?

The makers of the small statuettes paid great attention to detail. The Linear Pottery figurines show some interesting hairstyles (Fig. 180.4–5), for example the ‘curly head’ of the female figure from Eilsleben, Germany. On the head of the Ostheim figurine,



⁷²⁸ Hansen 2007, pl. 498–509. – Kalicz 1998, fig. 5. – Lüning 2005, 213–268 with images. The very abstract images are here interpreted as realistic and a direct representations of clothing and sewn decorative elements, which is controversial.

⁷²⁹ Krenn and Krumpel 2008, KG Hainburg an der Donau. Fundberichte aus Österreich 47, 2008, 21–22. – Umgeher-Mayer *et al.* 2011, 7, fig. 9–10. Thanks to Alexandra Krenn-Leeb, UHA Vienna, for the permission to use the photos, who prepared a monograph about the site of Hainburg/Teichtal.



Fig. 177. Early Neolithic burial of a two-year-old child from Hainburg-Teichtal in Austria.

also from Germany, the incised lines might represent braids that were pinned to an exquisite hairstyle at the top and back of the head⁷³⁰. Are there other sources that tell us more about this creative manner in dressing the head? Hair combs and shells were found, for instance, in contemporary cemeteries in Bavaria⁷³¹ (Fig. 178 left), where they were found in the head area and were most likely part of elaborate and artistic hairstyles. The small shells were possibly worn in a hair net or sewn onto a cap.

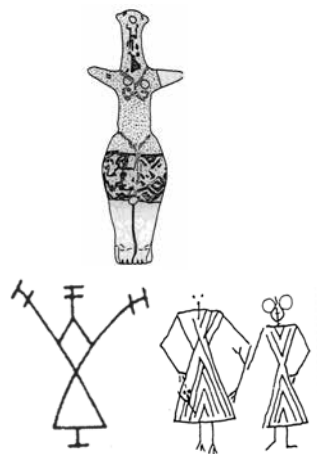
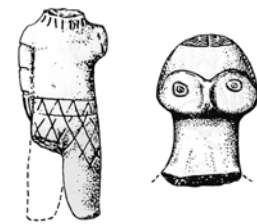
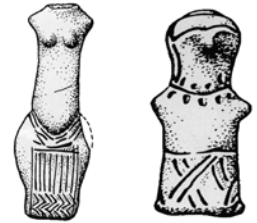
⁷³⁰ Engelbrecht, Kühltrunk and Ramminger 2003, 317–323.

⁷³¹ Nieszery 1995, examples with clothing accessories in the head and pelvic areas: pl. 13, 26, 50, 52; Aiterhofen-Ödmühle Grave 32, 68 and 139, 143.

The 'Sickle God' from Szegvár-Tűzköves in Hungary⁷³² is a well-known example of a Tisza culture clay figurine. It is interesting in this context because of the belt around its waist. Other than the belt, this idol and another like it from the same site are 'nude'.

A few human representations were found among the incised decorations on pottery⁷³³ of the Linear Pottery Culture and Middle Neolithic cultures. One of the rare examples is an abstract human composed of two opposing triangles from Hausen in Germany, dated to c. 5,100 BC (Fig. 180.1). This type of representation is seen more clearly on the 'beaker of Murr' in Germany (Fig. 180.14) from the Münchshöfen Culture c. 4,000 BC. Again we see two triangles, but this time with a clear head, arms and legs. This form of representation may indicate a simple belted garment that was gathered at the waist, as shown by the significant drapery. This kind of dress could have served well as an everyday garment. Such a garment fits the findings from the Linear Pottery graves in Bavaria and Upper Austria, where shell fasteners are sometimes found in the pelvic area, indicating a belted item. In Aiterhofen-Ödmühle, Germany, for example (Fig. 178), spondylus shell belt closures with v-shaped angles were found in male graves, whereas females were buried with round mussel belt plates. The dress elements made of bone from the Middle Neolithic also show an emphasis on the waist, such as the ornate belt decorated with about 50 studs in the grave of an adult woman from Haid in Austria⁷³⁴ (Fig. 178).

From the Middle Neolithic, the Lengyel Culture c. 4,900–4,300 BC, a large number of ceramic female figurines are known from Austria, Hungary and Moravia. These figurines are, however, consistently unclothed, which is unfortunate for clothes research. The figurines are frequently discovered in the circular ditches of sacred sites, which might point to their use in ritual. The figures might represent ancestors, priestesses or godlike figures; perhaps they served as votive figures for various ceremo-



⁷³² Csalog 1959. – Korek 1987. – Trogmayer 1992.

⁷³³ Examples from Sondershausen and Murr in Neumaier 1996, fig. 26 and pl. XVI.

⁷³⁴ Haid, Grave 75. Kloiber *et al.* 1971, fig. 6. – Lenneis, Neugebauer and Ruttkay 1995, fig. 44.

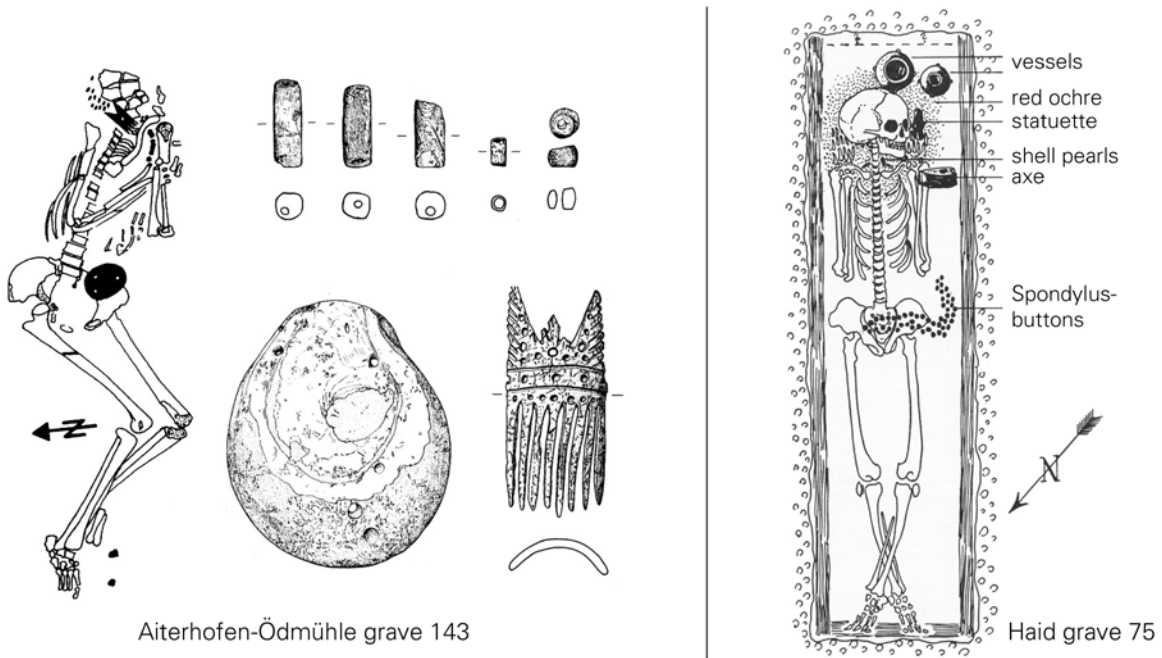


Fig. 178. Early and Middle Neolithic graves with costume components. Left: Aiterhofen-Ödmühle in Germany, right: Haid in Austria.

nies or rites. Interestingly, they are usually found (intentionally or accidentally?) broken⁷³⁵.

Among the few figurines that provide further details as to their hair, jewellery and clothing, the ensemble from the circular ditch system of Sé, Hungary⁷³⁶ (Fig. 180.7–10) is particularly striking. Researchers have discovered more than 130 mostly fragmented statuettes, some of which include representations of loincloths, aprons and belts.

A rather common hairstyle of the Lengyel figurines (Fig. 180.10) is hair combed back from the face to the back, with pronounced receding hairlines, which are rendered as three interlocking curved lines at the hairline. The lines at the back of the head and on the back, arranged as parallel zigzag lines, either indicate loose, wavy or curly hair, or possibly braids. As far as it is possible to ascertain from these fragmentary figures, the hairstyle

⁷³⁵ See e.g. Kalicz 1998 or Hansen 2007, 319–320 for interpretations.

⁷³⁶ Kalicz 1998, fig. 30–37.

seems to be typical of females which are recognizable by the indication of breasts⁷³⁷.

Particularly noteworthy is the painted figurine of Falkenstein in Lower Austria⁷³⁸ (Fig. 179). The hair is painted in black and there is a red (copper?) necklace with twisted ends. The red line around the waist can clearly be identified as a belt. For the black ornamentation in the leg area different interpretations are possible: it could be explained as body paint or even tattooing, but possibly also as a painted garment such as a loincloth or a painted dress.

The language of art of the Lengyel Culture is marked by colour. This is evident on magnificently painted ceramic vessels, painted in white, yellow, red and black (Fig. 122); the fineness of design is unparalleled. There are also indications that the walls of the houses were painted in a similar way as paint residue was identified on the clay plaster. It is therefore conceivable that clothes – whether made of leather or textile – were decorated with colour. Moreover, if we accept the case of the figure from Falkenstein, it would have been a belted, tight fitting garment, as the body contours are clearly visible. Whether the figure of Falkenstein wore a coloured piece of clothing or body paint, she definitely made a statement of creativity, which reflects the symbolic realm of ritual figurines (votives, ancestral representations, *etc.*) rather than the representation of everyday clothing and decoration.



Fig. 179. Figurine from Falkenstein in Austria, Middle Neolithic.

3.2 Late Neolithic – Copper Age

In the 5th millennium BC the Vinča Culture is widespread in Serbia, western Romania, Hungary and south-eastern Bosnia. The ceramic figurines⁷³⁹ from the time between 4,500 and 4,300 BC are well known; they consist of mostly standing female figurines with large, protruding eyes and a triangular face (Fig. 180.11–13), which some researchers interpret as a mask. In the late Vinča phases, seated figurines also occur. Without wanting

⁷³⁷ E.g. figurines from Strelice (CZ), Unterpullendorf (A) and Sé (HU) Hansen 2007, pl. 512–514.

⁷³⁸ Lenneis, Neugebauer-Maresch and Ruttkay 1995, 100.

⁷³⁹ Hansen 2007, pl. 246–249. Chronology: fig. 200–202. – Müller-Karpe 1974, pl. 449.

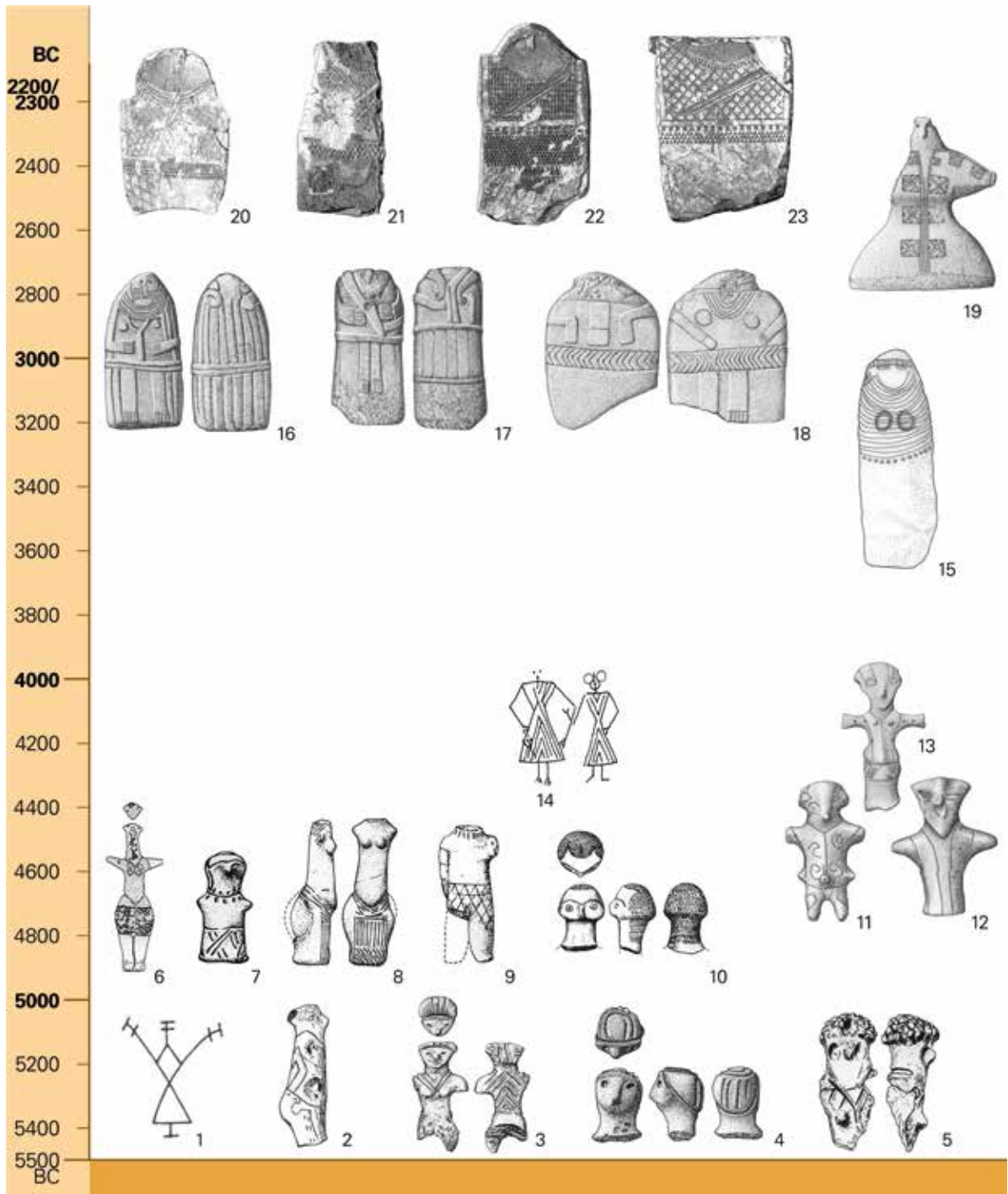


Fig. 180. Neolithic human figurines with garments: Sondershausen, Germany (1), Nerkewitz, Germany (2), Bicske, Hungary (3), Ostheim, Germany (4), Eilsleben, Germany (5), Falkenstein, Austria (6), Sé, Hungary (7–10), Vinča, Serbia (11–13), Murr, Germany (14), Arco, Italy (15), Stone stelae from southern France (16–18), Ceramic figurine from the Ljubljana Bog, Slovenia (19), Stone stelae from Sion, Switzerland (20–23). Not to scale.

to over-interpret these sometimes richly ornamented statuettes, it is striking that their silhouette is usually composed of a tight fitting top and a skirt or a belted dress, fitting the body shape closely. The top has a V-neck and various vertical lines. This could either represent the front opening of a garment similar to a caftan, or it may represent panel seams. Perhaps, however, this element is simply about decoration.

If these lines do actually constitute functional items of the clothing – as a garment openings and various composite parts – they would be of the same basic construction type of an item of clothing with front opening known from the composite garment of the Iceman *c.* 3,300 BC (Fig. 185).

A ceramic figurine dating to the end of the Neolithic from the Ljubljana Moor in Slovenia (Fig. 181.2)⁷⁴⁰ represents this even more precisely. The figure is shown with a long, open front robe with long sleeves. The front opening is ornamented with squares with cross-hatching filled with dots. This representation could – if it indeed represents a contemporary robe – be interpreted as a decorative ritual dress. On the other hand, just this kind of button – square buttons made of bone with incised crosses and dots – is known from the Bell Beaker Culture in Central Europe, for instance from Giengen in Germany⁷⁴¹ (Fig. 181.1). The Ljubljana figurine might represent a garment that was open at the front and was closed with buttons and cords at the chest level. On the figurine, this fastening principle was perhaps shown in an accentuated way with enlarged buttons.



The Iceman

In Central Europe, the only complete ensemble of stone age clothing is the ensemble of the Iceman, found in the Ötztal Alps

⁷⁴⁰ Korošec & Korošec 1969 dealt with the chronology and typology of finds from the Ljubljana Moor. She dates the figurines (pl. 1) to period Ig I (Laibach Vučedol Culture, *c.* 3,000–2,500 BC). After the decoration and finds of Bell Beaker buttons with the same decoration pattern as on the figurine, a dating to period Ig II is equally conceivable (Bell Beaker Culture, *c.* 2,400–2,200 BC).

⁷⁴¹ Seidel 1995, 34.



Fig. 181. Bell Beaker buttons from Giengen in Germany (1), figurine from the Ljubljana Bog in Slovenia (2), Late Neolithic. Different scales.

in Southern Tyrol⁷⁴² at c. 3,210 m above sea level. The Iceman was fully clothed at time of death c. 3,300 BC and lay face down on a large stone block. As the ice that had covered him for five millennia melted, the head and back first became visible and vulnerable to wind and weather. The garments of the chest and stomach area as well as on the legs are thus better preserved. When the ice mummy was recovered in 1991, he was still wearing parts of the leggings and shoes on his feet. The other clothes were fragmentary and found scattered all over the site. They were restored in the Römisch-Germanisches Zentralmuseum in Mainz in painstaking detail and examined together with other objects and the mummy itself by an international team of experts. The bearskin cap was not discovered until a year later when further excavations of the site were carried out.

The clothing of the Iceman included the following items (Fig. 183): the leggings, one for each leg, were made of goat skin, for

⁷⁴² Egg and Spindler 2009. – Fleckinger 2011, 23–27. – Spindler 1995, for clothing see 153–170. – Wininger 1995. <http://www.archaeologiemuseum.it/en> (last accessed 9th May 2014).

which the sections were stitched together finely with animal tendons⁷⁴³. In principle they are two individual leggings, which came up to the thigh to a height of around 65 cm and were held with double straps on a belt of calf leather. Deer fur straps were sewn on the foot of the leggings to prevent them from slipping when walking. These in turn were held in place by the shoes.

In addition to the leggings, the Iceman wore a loincloth made of goat-skin. When dressing, this was slipped between the legs, drawn up to the waist and passed under a belt, the ends then hung down freely to the knee level. Such combination of leggings and loincloth is reminiscent of certain recent styles of Native American clothing. Iceman's loincloth was stitched together with over-stitch using animal sinews and long, narrow goat leather thong; it is about 33 cm wide and was originally about 1 m long.

The belt that held both leggings and loincloth was originally about 2 m long and 4 to 4.8 cm wide and was worn wrapped twice around the body. A pouch in the belt contained and kept dry various tools such as an awl, a flint scraper and other flints as well as a tinder fungus. This finesse in itself highlights the ingenious and well thought out design of every detail in the Iceman's clothing.

The shoes deserve special attention as they are composed of a sophisticated three-layer construction with exterior shoe, inte-



Fig. 182. The Iceman. Reconstruction by Kennis.

⁷⁴³ Egg and Spindler 2009.



Fig. 183. The Iceman:
layers of clothing:
leggings, loincloth,
shoes, upper garment,
cap, grass cloak.

rior shoe and padding (Fig. 184). The oval-shaped sole is made of brown bear fur with the hair side turned inwards. The upper part consists of red deer fur. Inside, closest to the foot, a net of lime bast cord is fixed to the sole with two wide leather straps. Since the upper leather is secured by the same slots but offset, on the sole, a gap of approximately 1.5 cm is formed between the net and the upper leather. In this space a layer of hay was inserted, which served as thermal insulation and padding. Both the internal net and the upper leather are attached to the sole with leather straps. The ankle opening was wrapped with cord of bast to finish it in the upward direction and to prevent water getting in. The shoe design is understood through the impressive reconstructions by Anne Reichert; these have been tested in practice.⁷⁴⁴ In fact, it was found that the shoes are very functional, comfortable and warm; in rainy weather, however, they were not waterproof. The leather strap that runs across the sole

⁷⁴⁴ Reichert 2013, 95–96, fig. 6.31–6.34.



constitutes a kind of 'profile' and prevents slipping on stony ground.

The upper body of the Iceman was covered by a caftan-like upper garment made of goat skin (Fig. 185), which was worn with the fur side out: When it was made, light and dark fur strips were assembled in a pleasing manner with fine seams. The garment is now highly fragmented and the back and shoulders are especially poorly preserved, so it remains unclear just how the sleeves were designed. It was probably worn open at the front or held together with a belt, as there are no alternative closing devices.

A hemispherical cap of bearskin served as headgear and was worn with the fur side out. It had been stitched together from several pieces of fur and two leather straps were used as a chin strap.

In addition to the clothing and clothing components made of fur, there are a number of items of plant materials. Parts of a twined textile of Alpine grass were discovered, which are either interpreted as fragments of a grass cloak (Fig. 186), a resting mat or a rain cover worn over the head, and their interpretation remains controversial.

The pair of leggings have clear traces of use-wear and plenty of scuffs. The upper garment was equally used for a long time, indicated by dirt on the inside and significant traces of perspiration. The garments were originally sewn together with animal tendons

Fig. 184. Reconstruction of the Iceman's shoes by Anne Reichert. Left: interior construction with twined nets.

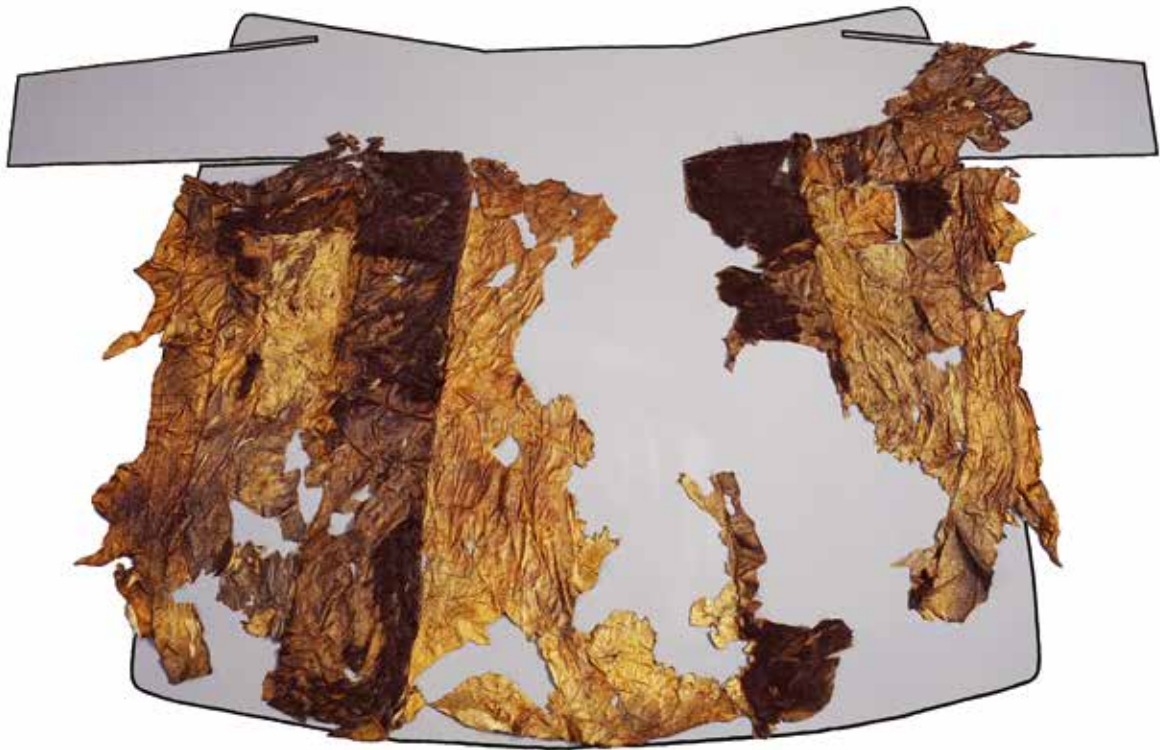


Fig. 185. The Iceman:
upper garment
made of goatskin.

in fine stitches, but they show multiple marks of repair, sometimes with hasty bast cord or grass stitching. All in all, the Iceman's clothes are a very functional ensemble, which prove how well equipped this person was to the high altitude environment.

Another find from the alpine region is evidenced for this type of clothing. In 2003, parts of further leg coverings were discovered under a melting glacier on the site of Schnidejoch⁷⁴⁵ in the Bernese Alps in Switzerland at an altitude of 2,756 m. They are leggings of similar type to those of the Iceman, made of leather pieces sewn together neatly with lime bast. Remains of one-piece shoes have also been discovered.

⁷⁴⁵ Suter, Hafner and Glauser 2006, 499–522.



Fig. 186. Grass cloak of the Iceman according to the exhibition at the Museum of Archaeology in Bolzano, Italy.

Finds from Lake Dwellings

Our knowledge about garments of the late Neolithic is significantly enhanced by the discoveries from the waterlogged lake dwellings of northern Italy, southern Germany and Switzerland, where textiles made from plant materials were found⁷⁴⁶.

⁷⁴⁶ For Switzerland, see e.g. Médard 2010; 2012. – Rast-Eicher 1997. – Northern Italy: Bazzanella *et al.* 2003; 2012. – South Germany: Feldtkellner and Schlichtherle 1987.

A wide variety of textile craft products was unearthed in the Neolithic lake dwellings including plaited baskets and baskets made in wickerwork, sieves, fish traps made in twining techniques, various knotted nets and mat-like basketry of coarse and fine quality. These findings clearly show the extent to which textile products from plant materials were present in all areas of daily life.

Among the identifiable clothing components⁷⁴⁷ from the Late Neolithic in Central Europe are shoes from plant material (Fig. 187). The settlement of Allensbach on Lake Constance in Germany included the remains of various sandals made of lime bast worked in basketry techniques. Fragments of bast sandals were also found in Sipplingen on Lake Constance as well as at Lake Zurich and Lake Neuchâtel, Switzerland.

Of particular interest to textile research are the cone-shaped baskets, made water repellent with pile of oak and lime bast that have been found in Hornstaad and Wangen on Lake Constance and dating to *c.* 4,000 to 3,200 BC. They have the appearance of conical hats, although they are usually found incomplete (Fig. 188). This form of hat is known from later periods as well, for example from the hat made of twigs from the Bronze Age lake-dwelling of Fiavè in northern Italy⁷⁴⁸ and the conical hat

Fig. 187. Different shoes of the Neolithic period. Reconstructions by Anne Reichert.



⁷⁴⁷ Feldtkellner and Schlichtherle 1987, hats: fig. 2–3; shoes: fig. 5–8. – Experimental Archaeology see Reichert 2013, 86–89, hats: fig. 6.13–6.20, shoes fig. 6.24–6.25.

⁷⁴⁸ Bazzanella *et al.* 2003, 146–147.



made of birch bark of the 'Celtic prince' from Hochdorf⁷⁴⁹. Other larger textiles in twining techniques and plaiting with similar pile from the Swiss lake-dwellings might have belonged to capes that functioned as rain protection. Overall, the fabrics made of plant fibres in various twining techniques are so fine that they could easily have served for clothing purposes alongside woven textiles.

Fig. 188. Reconstructions of Neolithic hats from Seekirch and Wangen in Germany. Model: Moriz Mautendorfer. Reconstructions by Anne Reichert.

Late Neolithic stone stelae

The art of the Neolithic offers more imposing and monumental pieces than small figurines and carvings on pottery. Large stone sculptures⁷⁵⁰ representing humans are known from the Copper Age (Fig. 180).

The stone stela of Arco IV, South Tyrol, dating to the first half of the 3rd millennium BC, is particularly interesting. It shows a woman with a veil artfully draped around the head, shoulders and upper body (Fig. 180.15). This veil is fitted with round decorative elements at the hem and is held in place with a wide headband, which is additionally decorated with spirals around the



⁷⁴⁹ Biel 1985, 44–45.

⁷⁵⁰ For monumental statues see Bocksberger 1978. – Müller-Karpe 1974, pl. 602–603. – Pedrotti 1995. – Winingen 1995, 128.

ears. Copper spirals are known from the beginning of the Copper Age, for example those recovered from Stollhof in Austria, dating to c. 4,000 BC⁷⁵¹. Other stelae from Southern Tyrol, from the sites of Arco and Laces, show that the back was covered by a garment element composed of long rectangular strips. This may be interpreted as analogous to the clothing of the Iceman, as a fur tunic or coat. Both a belt and leg wear are sometimes depicted in the hip region, which is structured with wide stripes.



Amongst the best known carved stone representations of people are the stone stelae from southern France and western Switzerland (Fig. 180.16–18), which were made in the 3rd millennium BC, slightly after the time of the Iceman. Men and women can be distinguished in the representations by breasts and the addition of male attributes such as bows and arrows as well as battle axes. These stelae most likely represent high-ranking persons or ancestors. In the male statues, stunning belt buckles and shoulder straps across the right shoulder representing a baldric are interpretable as clothing components. Below the abdomen, the body is only represented schematically, and the legs and toes are indicated by vertical bars. The belts are sometimes decorated with a herringbone pattern, which might indicate a textile origin. For women, broad necklaces and striped cloaks are striking (Fig. 180.16). These suggest heavy drapery rather than garments composed of stripes. Again, images of belts and jacket-like upper garments occur. Markes or lines next to the legs suggest some kind of clothing below the abdomen.

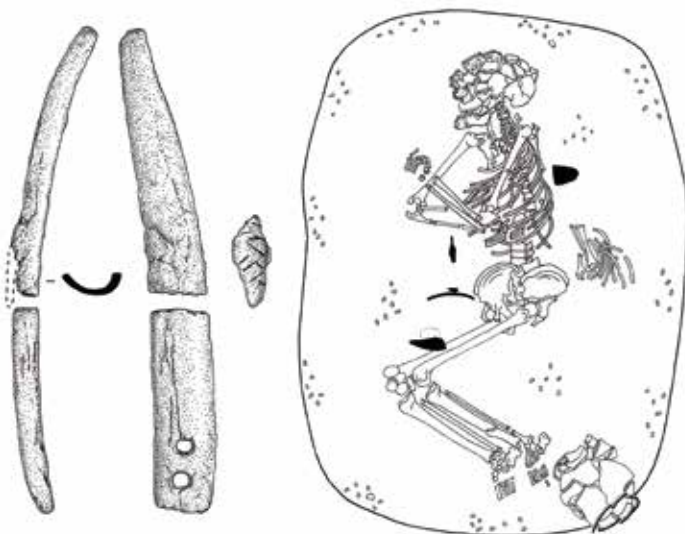
Other stone stelae, for instance the stelae representing abstract human figures excavated in Sion-Petit Chasseur in Valais, Switzerland and dated to the end of the 3rd millennium BC, are even more difficult to interpret in terms of clothing (Fig. 180.20–23). The stelae of Sion have no obvious indication of sex, such as female breasts, so the gender is assigned via recognizable objects and attributes. Those monuments that are provided with daggers, battle axes or bows and arrows are interpreted as male; the anthropomorphic stelae with necklaces, belts with looped ends and belt bags are viewed as female representations. The abstract design of the stelae hardly permits statements

⁷⁵¹ Urban 2000, 102–103.

about the clothing; at best, belts are discernible. The figures do, however, show rich ornamental patterns in the areas that should obviously be covered by clothing (especially clothing of the upper body). These patterns correspond in turn to the ornamental schemes of contemporaneous ceramics of the Bell Beaker Culture. There are attempts to connect the representations on the stelae with patterns on textiles⁷⁵². Above all, such patterned textiles as shown on the representations have been in use in the Early Bronze Age in northern Italy. A specific example is the 2 m long linen band from Molina di Ledro, which is decorated by two woven rhombic patterns at one end (Fig. 48).

We do not know very much about how clothes were fastened in the Neolithic period. Various forms of belt buckle appear again and again from the Linear Pottery to the Bell Beaker Cultures, especially in the Corded Ware Culture around 2,700–2,500 BC⁷⁵³. A bone hook was found in the waist region of a male's grave from Franzhausen in Austria (Fig. 189)⁷⁵⁴.

Fig. 189. Bone hook from Franzhausen in Austria, Late Neolithic Corded Ware Culture, and reconstruction.



⁷⁵² Rast-Eicher 2005, 125–126, fig. 19.

⁷⁵³ For a summary of belt fasteners, see Peška 2001.

⁷⁵⁴ See Neugebauer-Maresch 1994, fig. 6/4. Grave Verf. 1301. The copy was made by Wolfgang Lobisser within the framework of the project 'The Neolithic period in Traisental' (FWF, project number P18131-G02, Daniela Kern).

Different designs of buttons made of ceramics or bone appear now and then in the Late Neolithic of Austria, Bavaria, Czech Republic, Slovakia, Switzerland and Hungary⁷⁵⁵. We do not know exactly what purpose the numerous buttons in Bell Beaker graves served. They may have been clothes fasteners or purely decorative trimmings. The textile researcher Antoinette Rast-Eicher succeeded in finding a button hole⁷⁵⁶ on a textile fragment from Switzerland dated to *c.* 2,600 BC.

3.3 Neolithic clothing: conclusion

Which materials were used for clothing during the Neolithic? Woven textiles are known from the Linear Pottery Culture, but only as impressions of tabby woven textiles. Although textiles preserved from the Neolithic period (for instance from the Late Neolithic lake dwellings of Switzerland and southern Germany) are usually no larger than about 15 cm wide bands⁷⁵⁷, one can assume from layers of loom weights that larger fabric widths were also achieved. These would be suitable for the production of woven garments. In general it can be stated that textile production during the Neolithic was largely focused on plant fibre⁷⁵⁸ processing. Based on the available evidence, it was only during the Bronze Age that the manufacturing of clothes from wool became prevalent in Central Europe.

Until the 1990s, it was assumed that woven clothing was predominant during the Neolithic because of the textile and tool evidence, particularly the spindle whorls and loom weights found along with early farming cultures. The discovery of the Iceman in 1991 changed this picture dramatically. A completely preserved ensemble of garments of a person from the Neolithic period was discovered – without a single woven clothing item! The Iceman wore tanned furs and skins as well as fabrics of grass and bast, made in netting and twining techniques. Perhaps

⁷⁵⁵ Swiss finds: Rast-Eicher 2005, fig. 18. – Bell beaker finds: Kern 2006, with a list of known sites.

⁷⁵⁶ Rast-Eicher 2005, fig. 17.

⁷⁵⁷ Wininger 1995, 181–182, fig. 51.

⁷⁵⁸ *Cf.* Médard 2010. – Rast-Eicher 2005.

this is because he was hiking wearing high alpine equipment. Just like today, in the Neolithic different climatic conditions and the changing seasons required various forms of clothing. The obvious differences between the footwear of the Iceman and the light bast sandals from the lake dwellings emphasise this fact.

An array of garments made of leather, fur and plant fibres of various kinds was in place in the Neolithic. The latter are supported by ample evidence, especially from the pile dwellings in the area around the Alps. Plant fibres were processed in various techniques such as plying, twining and braiding of fine yarns and fabrics. Weaving did not necessarily play the main role in the design of garments. However, it is important to stress that the technical bases for the production of woven clothing were developed in the Neolithic period (see chapter B).

It also should be noted that although there are plenty of human representations from the Neolithic – engravings on vessels, clay figurines and large stone sculptures – we must recognize a high level of abstraction in them in addition to the expression of symbolism. This means that representations of clothing cannot perhaps be taken as direct evidence for the appearance of garments⁷⁵⁹.

4 Bronze Age

From the Bronze Age onwards, the increasingly frequent use of metal – especially bronze – provided ample opportunities to adorn clothing. An increasingly differentiated social system emerged between *c.* 2,300/2,200 and 800 BC, in part through the use of bronze. New craft techniques evolved, and this was a time of many innovations in textile production (see chapter C).

We find evidence for clothes in different regions of Bronze Age Europe, and we must consider, of course, that they come from different cultures. The various kinds of sources – complete gar-

⁷⁵⁹ As a negative example, the clothing reconstructions in Milicevic 1984 may be cited, which interpret every detail of the figures in a naturalistic way.



Borum Eshøj.

Fig. 190. Women's costume from Borum Eshøj in Denmark, dendrochronologically dated to 1344 BC.

ments from the graves of the Nordic area in Denmark, dress accessories in tombs in Central Europe and figurines from the Balkans and Carpathian area – represent challenges in terms of interpretation.

4.1 Garments of the Nordic Bronze Age

The complete garments recovered from oak coffin graves in Denmark and northern Germany enable the identification of concrete differences in the clothes of women, men and children⁷⁶⁰. The burial and grave goods indicate that we are dealing with important members of society. The oak coffins are dated by dendrochronological investigations of the tree rings to the time between 1,468 and 1,266 BC⁷⁶¹; the great majority of oak coffins date between 1,390 and 1,340 BC, which represents a narrow time frame.

In general, the Bronze Age garments are of coarser wool fabrics and made in tabby weave. Although the individual garments appear to be of a relatively monotonous brown hue due to their preservation in the soil, decorative textile items such as cord embroidery or the incorporation of metal elements have been used to visually enhance the textiles. In part, the garments show strong traces of use, so it is assumed that they were also worn during the lifetime of the deceased – whether as every day or festive costume can no longer be determined.

Women's clothing from oak coffins

The women's graves usually contain an ensemble consisting of a blouse and a long skirt reaching to the ankles. The latter has a rectangular shape and is gathered and held at the hip with a woven belt. The upper part of the skirt is folded and thus partially obscures the belt. The skirt is long and drags on the ground. Some of the finely woven belts from northern European graves

⁷⁶⁰ For the garments of the Nordic Bronze Age generally, see Bergerbrant 2007. – Broholm and Hald 1940. – Hald 1980. – Mannering *et al.* 2010; 2012, 97–102; 2015. High quality images can be found on the website of the National Museum Copenhagen: <http://oldtiden.natmus.dk> (last accessed 8th May 2014).

⁷⁶¹ Randsborg and Christensen 2006, 115–117.

are decorated with elaborate tassels at the ends. Leather shoes or sandals complete the attire. Long, elegant coiffuring of hair was apparently typical for women who wore the skirt-blouse combination. The hair was frequently covered by a sprang hairnet (Fig. 190)⁷⁶².

The fitted women's blouse of the Bronze Age deserves special attention (Fig. 191). It was made especially efficiently from a rectangular piece of cloth; a few cuts through the fabric and two seams on the back and under the arms were sufficient to shape the garment. In some items, more strips of fabric were joined as an extension at the hip. The neck and the shoulders are sometimes finished with stitching and embroidery, with the blouse of Skrydstrup, Denmark⁷⁶³ as an example. The analyses of Hans Christian Broholm and Margarethe Hald have revealed that the cut, the dimensions and also the sewing techniques of these blouses were derived from leather and fur processing technologies.

A particularly interesting ensemble comes from the grave of a 16–18 year old woman who has become known as the 'Egtved Girl' (Fig. 192). A female's blouse, a corded skirt, a woven belt with tassels and a large spiral-ornamented and spiked bronze plate were found in a c. 1370 BC grave from Denmark. The young woman wore woollen shoes on her feet. The corded skirt is a garment that looks extremely extravagant in both production and appearance to today's viewers. A solid waistband was produced in repp, from which cords of 38 cm length hang down in close succession. The skirts cords are formed by a fringe extended along the length of the repp waist band and were held together at the bottom with other cords. This skirt is wide enough to allow it to be wrapped around the waist twice, so that a relatively dense garment is created that nearly reached to the knees. Remnants of such corded skirts were found in further 30 graves in Denmark and Schleswig-Holstein. The cords were also sometimes adorned by bronze sheet metal tubes, such as the one

⁷⁶² Sprang is a technique used to produce textiles by lifting and lowering parallel stretched threads, consequently interlinking, intertwining or interlacing these threads. This produces a net-like, elastic braid, highly flexible and stretchable, a characteristic equally useful in clothing and for other purposes (bags *etc.*). Cf. Seiler-Baldinger 1994.

⁷⁶³ Broholm and Hald 1940, 88–95.

from the burial of Ølby in Denmark. It has recently been demonstrated that corded skirts were an arena for individual craftspeople to display their personal taste and skill⁷⁶⁴. Contemporary figurative depictions of this garment come from Itzehoe (Beringstedt) in Germany, and Grevensvænge and Fårdal in Denmark⁷⁶⁵; the latter in the form of a knife handle, the others are bronze figurines.

The corded skirts have inspired a range of interpretations as to their function, origin and symbolism⁷⁶⁶. Elizabeth Barber even goes back to the Palaeolithic to search for the origin of these garments, which she traces to the Venus figurines such as the one from Gagarino in Russia. Inga Hägg⁷⁶⁷ sees precursors of the corded skirts in some bast fabrics of Neolithic lake shore settlements. Representations of ornamental aprons on statuettes of the Neolithic Lengyel and Vinča Cultures also contribute to interpretations (e.g. Fig 180.8).

No dress pins were found at the shoulders of women's graves of the Nordic Bronze Age in Denmark. The use of a tailored blouse that stays close to the body makes an additional fastening unnecessary. Cloaks appear to be uncommon in women's oak coffin burials from the early Nordic Bronze Age. Only in later times is a fibula sometimes found, which shows that a cloak was added to the costume just as in men's graves. Otherwise, various accessories such as big belt disks and combs worn at the

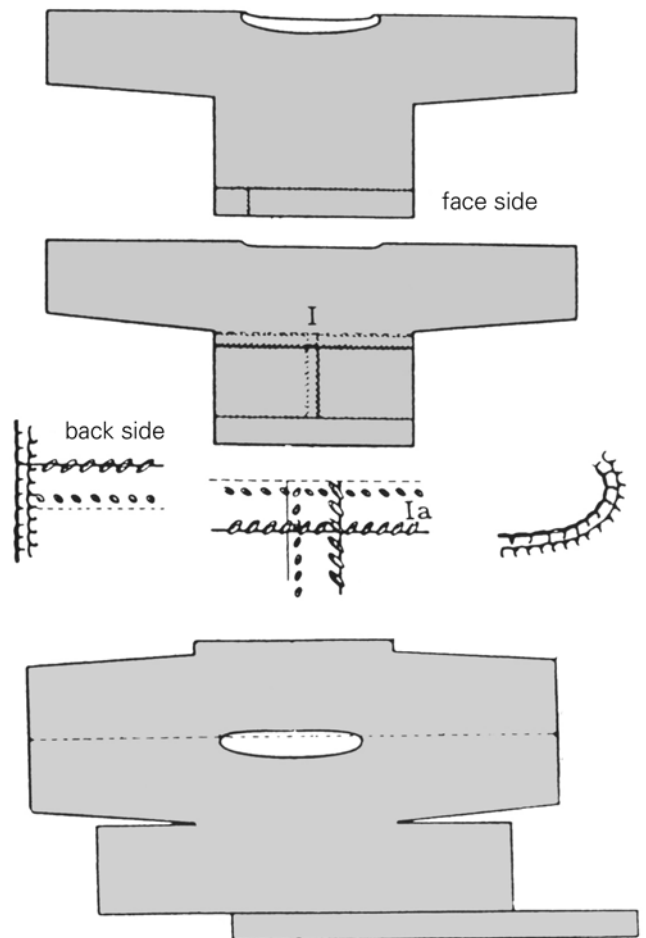


Fig. 191. Dress pattern of a Bronze Age woman's blouse.

⁷⁶⁴ Fossøy and Bergerbrant 2013.

⁷⁶⁵ Cf. Broholm and Hald 1940, fig. 192–193.

⁷⁶⁶ Barber 1991, 256–257, fig. 11/5. – Hägg 2006, 111.

⁷⁶⁷ Hägg 2006, 111.



Fig. 192. The garments of the Egtved Girl from Denmark, c. 1370 BC. Blouse and string skirt.

garment only covered the torso, hip and thigh to just above the knee. The garment was designed as an approximately rectangle, which was composed of several pieces of textile. An experimental reconstruction of this garment⁷⁶⁸ made it clear that a high level of comfort and flexibility was achieved by the arrangement of the various pieces of textile.

An oval-shaped cloak was used in Scandinavia, placed on the shoulders in a self-supporting way. For the cloak of Trindhøj, the Bronze Age crafts people used a thick, felted woollen fabric, which additionally incorporated c. 10,000 wool pile stitches to achieve a fur-like appearance.

belt completed the appearance of women. Furthermore, Bronze Age women loved to adorn themselves with neck, arm and finger rings.

Men's costume from oak coffins

Two different forms of clothing are known for men from Northern Europe, both of which were supplemented by a cloak and cap. Men wore either a wrap-around garment worn around the waist, or a loincloth, such as the one from Borum Eshøj (Fig. 193).

A special clothing item of the Nordic Bronze Age is a men's garment worn like a mini wrap-around dress (Fig. 194). Complete garments have been found in Trindhøj and Muldbjerg, Denmark. The cloth was wrapped under the arms around the upper body and held on the body diagonally over one shoulder by leather straps on the two upper corners of the fabric. Due to the short length of the wrap-around this

⁷⁶⁸ Broholm und Hald 1940, 147, fig. 188.

Footwear in the form of foot wraps and leather shoes as well as various forms of caps complete the ensembles. The example of a round cap with pile stitches (*Krimmerbesatz*) is worth mentioning. This cap has a hemispherical shape and consists of three layers of felted and stitched fabric; hundreds of threads were knotted onto the outside. There were also hemispherical caps with pile stitches made of heavily felted textiles in several layers that obscure technical and constructional features. Simpler caps are undecorated, constructed of small pieces of woven cloth sewn together.

Textile fragments similar to the Muldbjerg wrap-around were found on a male bog body from Emmer-Erfscheidenveen, in the Netherlands, dated to 1,370–1,215 calBC⁷⁶⁹. They are sewn and hemmed with darker yarn than the cloth. A sheep-skin cap and a shoe made of deer skin were found in direct relation.

Dress pins are repeatedly found in men's graves, always a single one that was probably used to fasten the cloak. The belt is indicated by a belt hook that can be found in the pelvic area. Other components of men's graves of the Nordic Bronze Age include toiletry items that serve body and hair care (razor and tweezers) and underline the value of a well-groomed appearance. The appearance of men is completed by weaponry of varying composition, including swords, daggers, axes or spears. Metal ornaments such as individually worn arm rings or one or two

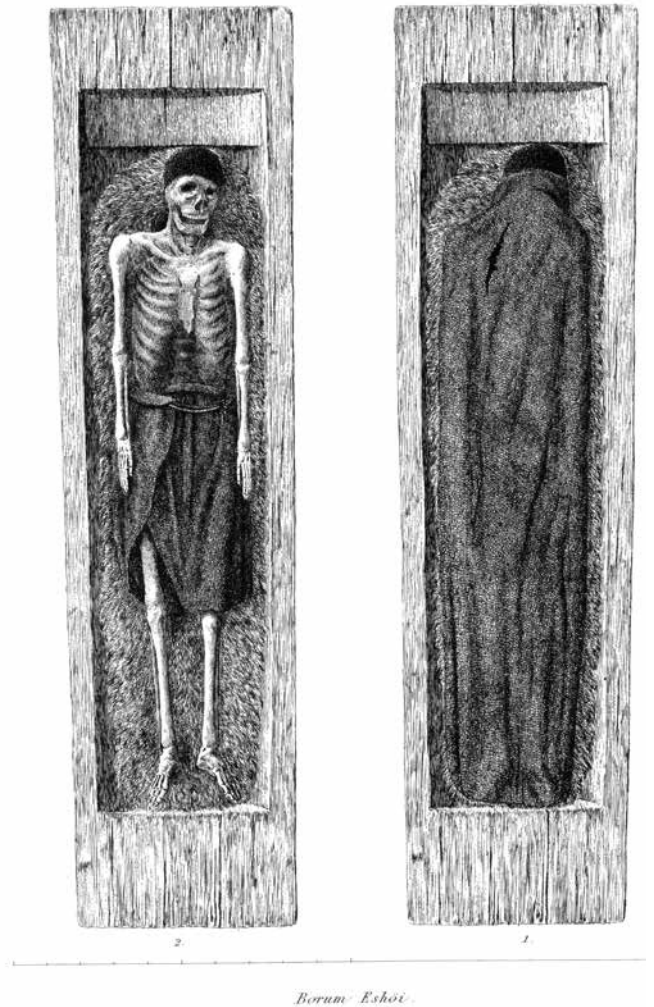


Fig. 193. The grave of a man from Borum Eshøj in Denmark, dendrochronologically dated to 1348 BC.

⁷⁶⁹ Comis 2003, 193–196. – van der Plicht *et al.* 2004, 482 and 487.

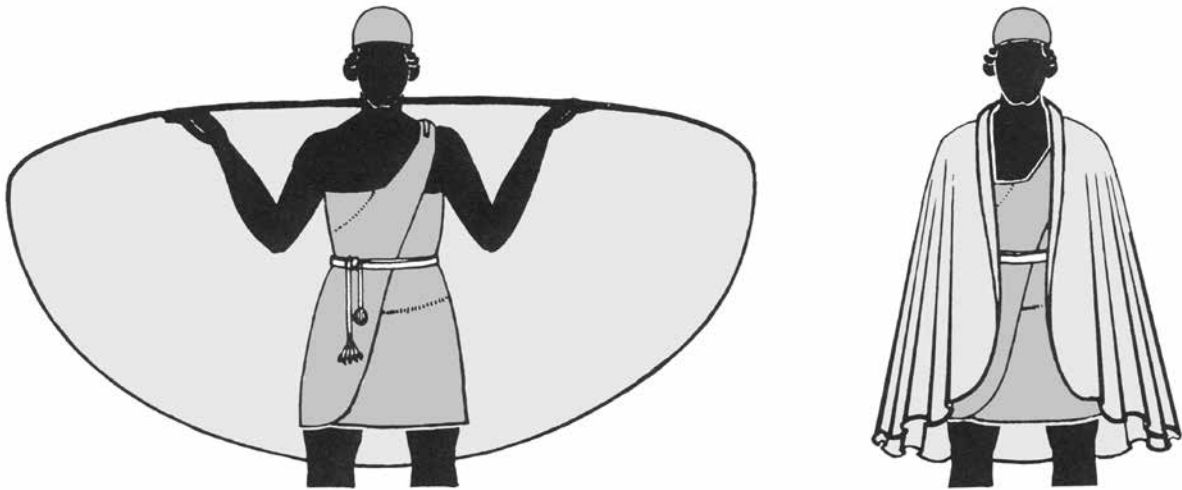


Fig. 194. Bronze Age men's clothing from Northern Europe: wrap-around garment, cloak and cap.

gold wire hair spirals are rare in men's graves and may have to be understood as symbols of status and rank.

4.2 Evidence for Bronze Age clothing in Central Europe

Complete garments from the period between c. 2,300 and 800 BC are absent in Central Europe. The textile fragments that have survived stem mainly from the northern Italian lake-dwellings or the Bronze Age salt mines of Hallstatt, and give us an approximate idea of cloth qualities in this region. Amongst them are primarily simple and coarse fabrics, but also some finer flax or wool fabrics in tabby weave; dyed fabrics or twill sometimes occur, but decorated pieces are rare. At the end of Bronze Age, gold threads were found, pointing to the luxury textiles used by the wealthy.

In South-Eastern Europe a technically complete woollen textile was found in Pustopolje, Bosnia and Herzegovina⁷⁷⁰, where it was used as a shroud in a male grave (Fig. 195). Recent ¹⁴C dates suggest a date of 1,495–1,435 calBC. The textile is 3 × 1.7 m in size and rectangular; it was woven in plain tabby with repp starting and end borders. The textile is best described as a blan-

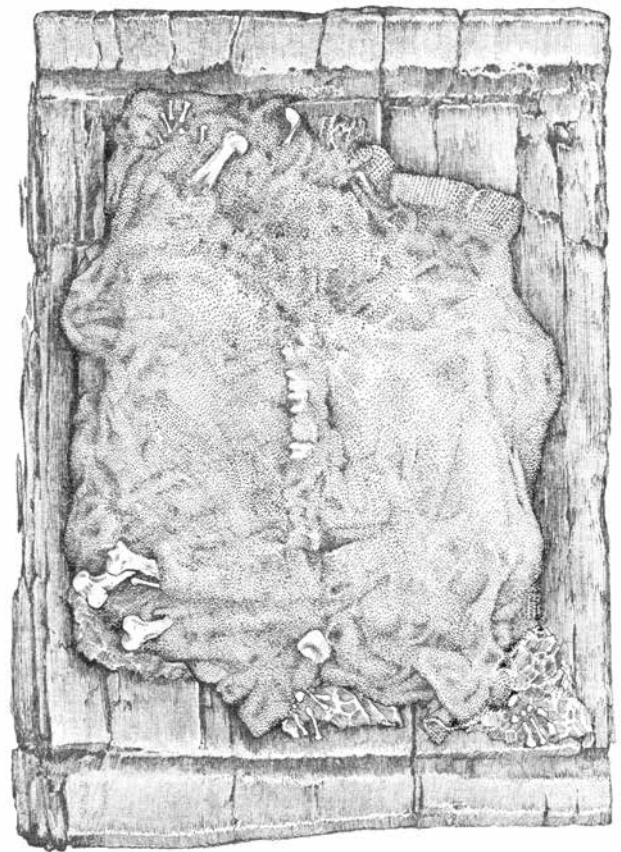
⁷⁷⁰ Benac 1986. – Bender Jørgensen and Grömer 2012, fig. 4. – Car 2012.

ket but may have been used as a draped garment, held in place by pins and belt. It does not show any evidence of tailoring.

Pictorial representations of people are almost absent from this period. Small clay figurines from the Middle Bronze Age, however, were found in South Eastern Europe, in Hungary and the areas of Serbia and Romania (Fig. 196)⁷⁷¹. In their expressiveness, exuberant décor and level of abstraction, these figurines are similar to the ones known from the Neolithic in this area. The Romanian figurines in particular are only realistic in part, and probably have to be interpreted in terms of cult and ritual. In the cemetery of Cîrna in Romania, they are frequently found in urns, and, when an age classification of the cremated bone has been attempted, the figurines occur primarily in graves of children. Since the figurines resemble adults with pronounced hips, it is rather obvious that the figurines do not represent the deceased. It seems that these human representations are no children's toys, but idols or images of gods⁷⁷².

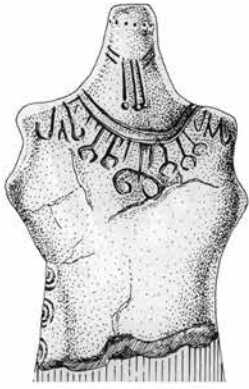
Some general observations about the nature of the clothing can be made, however, regardless of whether the pieces are to be interpreted as cultic or profane. The overall silhouette of female figurines of the Middle Bronze Age displays a tight top and a wide, flaring skirt. Feet and footwear are not visible. Patterns in the chest area, which can easily be identified as typical contemporary ornaments (Fig. 208), are striking in statuettes from Hungarian, Serbian and Romanian find spots. A heart-shaped pendant as shown on the figures can also be found in the cemeteries of the region. But how do we

Fig. 195. Large textile from Pustopolje in Bosnia and Herzegovina, Early Bronze Age.



⁷⁷¹ Kovács 1977, 58–59. – Müller-Karpe 1980, pl. 326, 327.

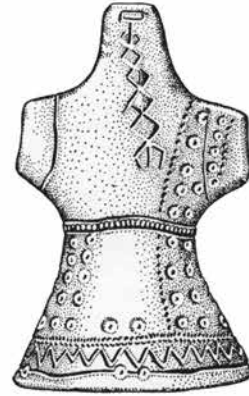
⁷⁷² Müller-Karpe 1980, 689–693.



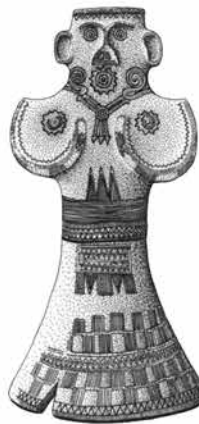
Babska



Lower Danube Region



Dubrovac



Klicevac



Dupljaja



Čirna



interpret the lush decor of the 'skirt' such as the one seen on the figurines from Cîrna? This kind of decoration mirrors typical contemporary sets of motif, which are also found on pottery and bronze objects of the same region⁷⁷³.

Textile finds from the northern Italian lake-dwellings, particularly from Lago di Ledro, and the splendid Swiss textile from Irgenhausen, radiocarbon dated to 1685–1493 calBC, are more or less richly decorated⁷⁷⁴. Dyed fabrics and twill weaves do occur, although the majority of Bronze Age textiles are produced in tabby. The fabric from Irgenhausen with triangles and checkerboard design to some degree mirrors the décor system of the Klicevac figurine – despite the fact that it was found in a different part of Europe.

A rich source of information on Bronze Age costume in Central Europe is offered by the Early to Middle Bronze Age necropolises in which several metal clothing components were placed in the graves. In contrast to the subsequent Urnfield Culture, necropolises contain inhumation burials. Therefore, the exact location of the objects in the grave is generally known, and can provide clues to the clothing used in the grave. As mentioned above, it is not clear whether the clothing in the burials represents daily attire, summer or winter clothing, or dress for special occasions, or specific costume of the dead. A difference between richer and poorer grave furnishing is noticeable, which suggest a certain stratification of society. The fact that this status is acquired not only through merit, but also inherited, is evident from the fact that some child burials already display a certain level of wealth.

In the framework of this book, there is not enough space to discuss fine details of chronology, typology and spatial distribution of the individual jewellery and costume components. These have been dealt with at length in many scientific papers and no doubt there are many regional peculiarities of note. However, certain basic trajectories may still be recognized in the Central European Bronze Age, for instance certain rules by which the

Opposite side:

Fig. 196. Middle Bronze Age figurines from Hungary, Serbia and Romania.

⁷⁷³ Müller-Karpe 1980, pl. 317–320, 324–325. Jewellery, metal objects and decorated ceramics comparable to the figurines.

⁷⁷⁴ Bazzanella *et al.* 2003. – Vogt 1937.

ornaments were placed on the body, as well as combinations of individual costume items.

Early Bronze Age

In the Early Bronze Age of Central Europe between c. 2,200 and 1,600 BC, the metallic dress accessories especially emphasise the head, neck and chest area of women⁷⁷⁵. The dress accessories in Bronze Age men's graves, in contrast, are much more modest. Rich women's costume jewellery in the hip area is known from Bavaria, where *tutuli* (bronze tubes), cones, spirals or bronze sheet rolls were used to decorate a belt or even a piece of garment around the neck.

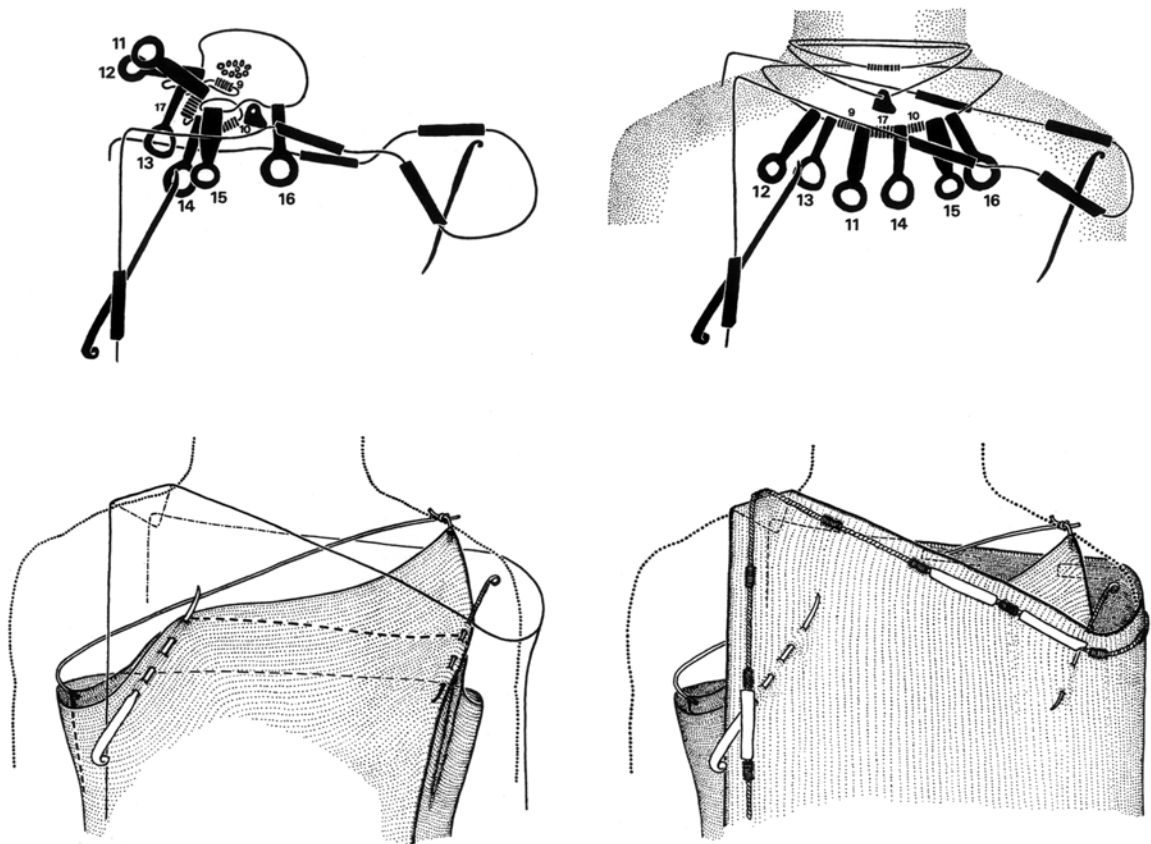
An Early Bronze Age male grave from Sion, Petit Chasseur, Switzerland⁷⁷⁶, is extraordinary (Fig. 197). Small bronze tubes were located in the front and at the back of the body, indicating where a border or reinforcement of a textile has originally been. Pins seem to have closed the garment, which made it possible to reconstruct how the textile was worn. In this case the reconstruction was based on the wrap-arounds known from Bronze Age.

The large Early Bronze Age cemetery of Franzhausen I in Lower Austria⁷⁷⁷ serves as an example from the Danube region. Its more than 700 inhumation graves allow plentiful insights about population, social ranking and of course about clothing components and jewellery. Both men and women wore neck rings, ornamental pins, arm rings and finger rings. Whereas men normally only have one pin in the chest area, women are equipped with two decorative pins and arm rings. Children received the same ornaments as adults, only in a smaller version. The men were equipped with weapons such as bronze and stone axes; boys of the elite also had daggers. It is an interesting social statement that even children were buried with the representative artefacts of adults. This indicates that wealth and status need

⁷⁷⁵ Cf. Seidel 1995. – Sørensen 1997, 100.

⁷⁷⁶ Bocksberger 1978, fig. 28. – Rast-Eicher 2012, 382–383.

⁷⁷⁷ Cf. Neugebauer 1994, 80–89, fig. 36–41. – Neugebauer and Neugebauer 1997.



not have been acquired personally, but that once acquired, it had repercussions on the family and was inherited. These children were privileged and intended to take up higher responsibilities within the community⁷⁷⁸.

Fig. 197. Early Bronze Age grave find from Petit Chasseur in Switzerland.

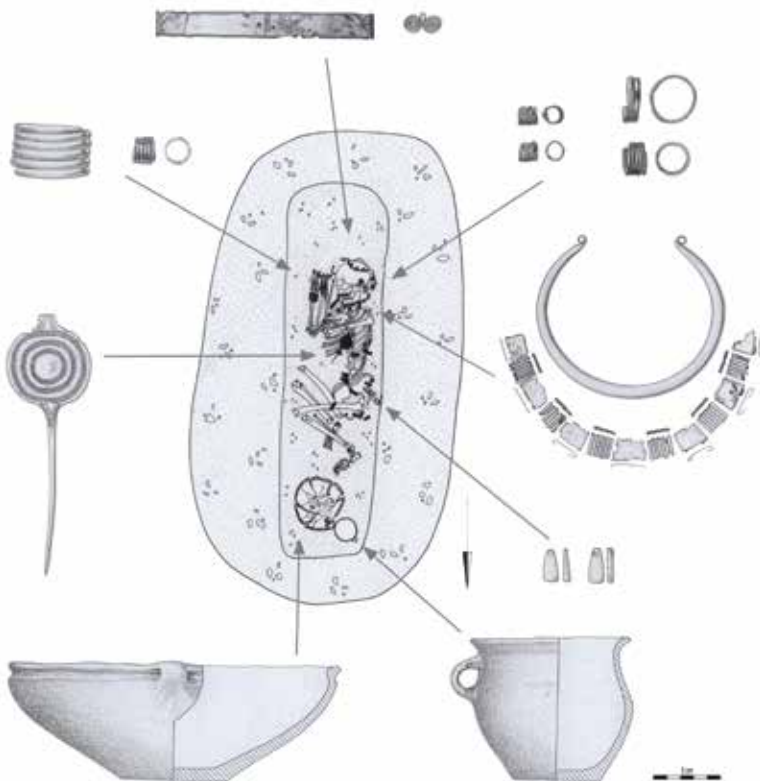
Particularly striking is the headdress of women in the form of headbands or leather caps, of which the ornate bronze metal strips are still preserved. Decorated sheet metal pieces also partly lined the neck segments of the dress. In some cases, many small snail shells were sewn onto the garment. Studded rings were used for the elaborate hairstyles of women and girls. Bronze ornaments, and bone and stone beads were popular as jewellery items. The metal ensemble of the women of high status can be well demonstrated by reference to two graves from Franzhau-

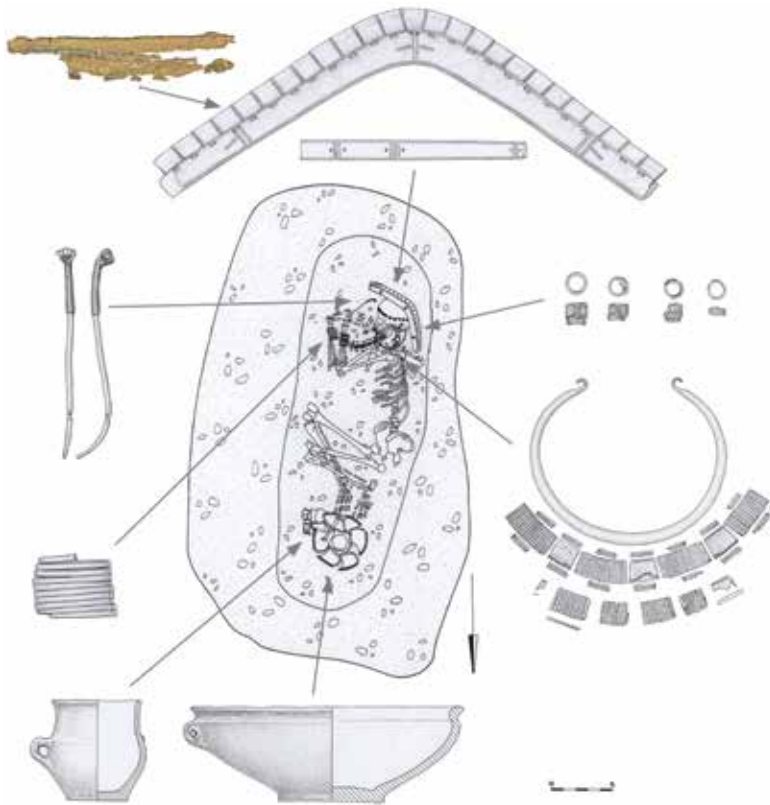
⁷⁷⁸ Children in historical times were normally encouraged to take over functions of the adult world as quickly as possible. Sofaer 2006b, 87–96.

sen. The woman in grave 747 (Fig. 198) wore a leather cap that was lined with spiral pendants. As in other women's burials, the hair was held together with bronze spiral rings. At the neckline the robe was decorated with sheet metal applications. She further wore a neck ring (*Ösenhalsreif*) as well as massive arm and finger spirals. Two large pins with disc heads were found at the shoulders, which most likely held a cape or cloak at the shoulders.

The rich woman from grave 110 was buried with a similar set of jewellery and costume components, but had an even more elaborate and conspicuous headdress (Fig. 199–200): a bronze cap ornament with bronze boss decoration. It consists of bent sheet metal strips held together with U-shaped bronze parts. The headpiece has a front- and backside (the first marked by a human representation), so it is thought to have been worn with its long side facing to the front. Within this elaborate bronze head-dress the remains of a striped textile were found (Fig. 98), which

Fig. 198. Franzhausen, Austria: Early Bronze Age Grave 747 with bronze objects and reconstruction. Model: Andrea Krapf.





probably belonged to a veil or other textile head cover attached to the headgear.

Fig. 199. Franzhausen, Austria: Early Bronze Age Grave 110 with bronze objects and reconstruction. Model: Susanne Mayrhofer.

Middle Bronze Age

An in-depth analysis of jewellery and metal dress accessories from the Middle Bronze Age Tumulus Culture in Central Europe, that is found across Hungary, Bohemia, Austria and Southern Germany⁷⁷⁹, observed a trans-regional pattern of costume, in which women are regularly equipped with two large pins in the shoulder/chest area (Fig. 201); it is rare that only one pin is encountered in women's graves. The question is whether different numbers of pins reflect a different style of clothing (different cut, different silhouette) or whether a similar garment was simply put together in another way.

⁷⁷⁹ Sørensen 1997. – Wels-Weyrauch 1978, 1994. – Wiegel 1994, 165–218.



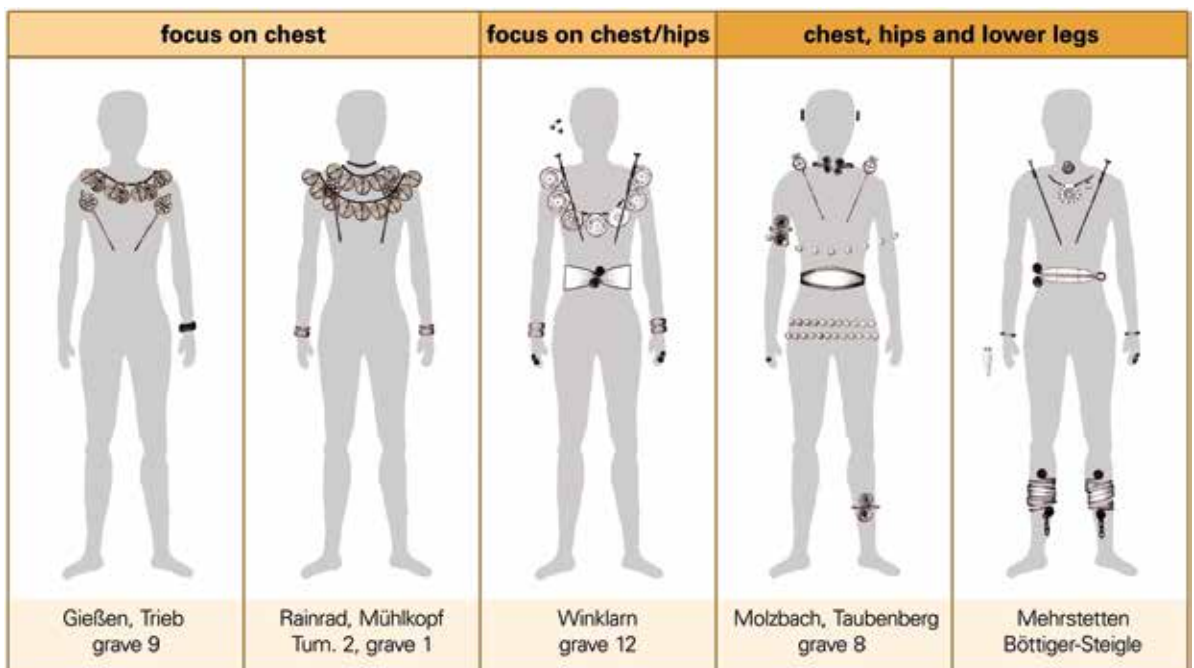
Fig. 200. Franzhausen, Austria: Excavation context of Grave 110 with elaborate headdress.

Some wealthy Middle Bronze Age female burials include massive sheet bronze spirals (*Beinberge*) that covered half the lower legs. Bronze rings worn on both upper and lower arms are also often found in the graves. The small, perforated decorative trim pieces (*tutuli*) are exclusively found in the pelvic area of female burials. The leather scraps sometimes found on their back indicate they were attached to some carrier material. There are also wide sheet bronze belts. Rich jewellery on neck and chest in female graves may sometimes appear outstanding (wheel pen-

dants or spiked disks Fig. 202, heart shaped pendants Fig. 208), for example the massive spiked disks found in a grave in Winklarn, Lower Austria⁷⁸⁰.

In isolated cases, a special headdress can be reconstructed from the metal constituents of Middle Bronze Age burials. Sometimes small fabric remnants are found which indicate a veil that was fastened with small bronze pins; at times a bonnet or cap is assumed. A representative headdress was, for example, found in one of the largest Middle Bronze Age necropolises of Central Europe, Pitten in Lower Austria⁷⁸¹. For the women, most richly adorned with bronze items and buried within this necropolis, a prominent position in society can probably be assumed. Two graves of 30 to 35-year-old women are at the top of the social pyramid, each carrying a magnificent diadem with neck plate. The ornamentation on these outstanding objects with bow and spiral decoration is an allusion to ancient Mycenaean art, which was formative for the European craft style of the middle 2nd millennium BC.

Fig. 201. Middle Bronze Age dress fittings and jewellery from woman's graves in Southern Germany and Austria.



⁷⁸⁰ Grömer, Rösel-Mautendorfer and Bender Jörgensen 2013, 222–224.

⁷⁸¹ Urban 2000, 180–184, with figures.



Fig. 202. Middle Bronze Age jewellery assemblage from Winklarn, Austria.

woman were found a necklace, bracelets and anklets as well as remains of a garment, covering the upper body and reaching to the legs. The garment was made of a simple tabby cloth. Around the neck, small beads of different colour were attached for decoration. Remains of a belt were found around the hips. The belt was made of a textile band, which was lined with tree bast to stabilize the item. Additionally the belt was adorned with nine big bronze buttons.

However, in the Late Bronze Age Urnfield Culture the dead were typically no longer interred in inhumation graves; rather the bodies were cremated and the remains deposited in urns. What kind of changing beliefs were behind this burial rite is not entirely clear⁷⁸⁴. For the reconstruction of clothing the new custom of cremation involves the problem that the exact location

Middle Bronze Age male graves⁷⁸² normally only had one belt hook and a single pin as clothing accessories. The pin is up to 35 cm long and located on the chest. The garment can thus be reconstructed as a belted robe closed by a pin over the chest – the massive pins suggest a cape or cloak of coarse material.

Late Bronze Age (Urnfield Culture)

A recently discovered grave from Grundfeld in Germany⁷⁸³ offers a glimpse on Late Bronze Age clothing. In the inhumation grave of a

⁷⁸² Wiegel 1994, 179–180.

⁷⁸³ Bartel and Voß 2005, fig. 50–52.

⁷⁸⁴ Rebay-Salisbury 2012.

of the dress elements on the body can no longer be analysed. From Neolithic onwards, no other prehistoric period is as difficult for textile research as the Late Bronze Age. The location of the dress elements in graves does not allow any conclusions on the way garments were worn. The bodies were either cremated with their clothes or in a special costume for the dead. Either way, the clothing is not accessible to us. Unburnt dress accessories and jewellery, however, were also added to the graves as grave gifts; they were either deposited in the urn or in the grave pit that contained the urn and other funerary vessels.

Characteristic jewellery sets⁷⁸⁵ that indicate certain clothing customs for Southern Germany and Austria can be worked out as following: Belt hooks and pairs of pins were still worn by women in the Urnfield Culture, just as in the preceding Early and Middle Bronze Age and the subsequent Hallstatt period, maybe worn on the shoulders. Female burials with just one pin are known from the late Urnfield period. In addition to the various belt components only one fibula is present in male graves, which could have closed the chest area of the garment or cloak at the neck, in analogy to the preceding and succeeding times.

4.3 Bronze Age head coverings and shoes

Considering all the Bronze Age costume components in Central Europe – from head to toe – only sparse information is available for headgear and shoes. A Bronze Age headdress is unique amongst the finds from the salt mines of Hallstatt⁷⁸⁶. A cone-shaped fur hat was discovered in the Hallstatt-Grünerwerk site (Fig. 203), which was sewn together of several parts with careful stitches. The hat was worn with the fur side inward. This piece can most likely be interpreted as a specific part of the clothing of Bronze Age miners.

Another conical headdress, made from branches, is known from the Bronze Age lake-dwelling Fiavè in northern Italy (Fig.

⁷⁸⁵ Lochner's contribution in Neugebauer 1994, 194–223.

⁷⁸⁶ Popa 2009, 102.



Fig. 203. Cone-shaped hood from the Bronze Age salt mines in Hallstatt.

204)⁷⁸⁷. This piece also has a narrow brim, which typologically transforms the cap into a brimmed hat. It is a headgear of a relative complex structure, conical with a narrow brim, located about 1 cm above the lower margin. The brim was probably intended either as decoration or as a reinforcement of the circumference of the headgear. For the making of the spiral structure, a framework was made of pine twigs, sectioned at the sides, straightened and bent in a circle. The framework was covered by a compact and continuous spiral coiling of twigs. This headgear is interpreted as a prestige or ceremonial object (helmet).

A vessel in the form of a shoe dating to the Late Bronze Age has been found in Unterhautzenthal in Lower Austria⁷⁸⁸, which gives us some insight into the footwear of the time. It has the shape of an ankle-high boot (Fig. 205). The areas of the toes and the instep are decorated by strokes which may indicate the folding of the leather or the lacing, which is actually characteristic for all shoes made of one piece of leather.

The discovery of a leather shoe is reported from much further north. The shoe comes from a bog at Buinerveen⁷⁸⁹ in the Netherlands, and is radiocarbon dated to the time between

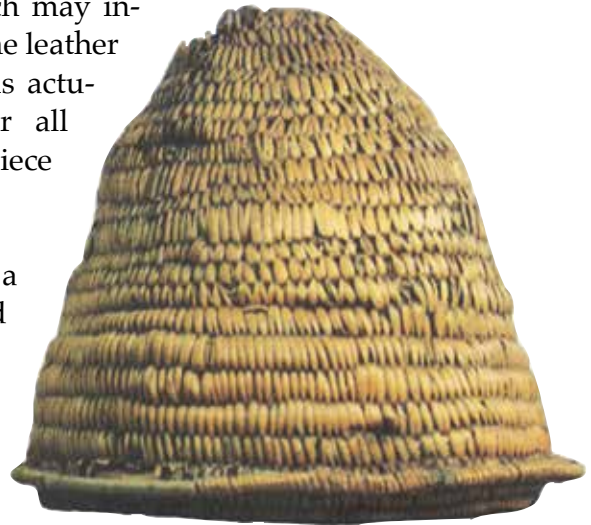


Fig. 204. Conical headdress from Fiavè in northern Italy, Bronze Age.

⁷⁸⁷ Bazzanella *et al.* 2003, 146–147.

⁷⁸⁸ Lauermaun 1991, fig. 2.

⁷⁸⁹ Groenman-van Waateringe 1974.

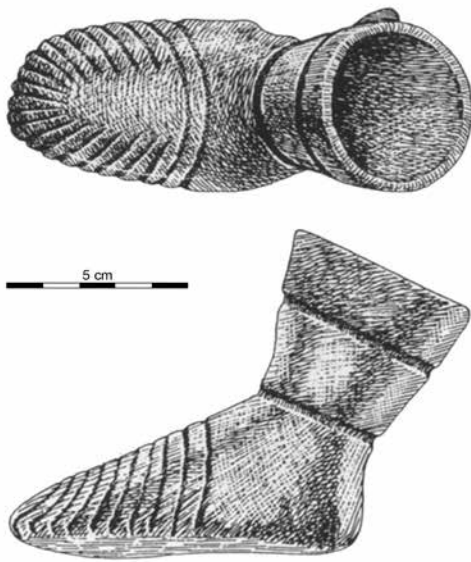


Fig. 205. Late Bronze Age boot vessel from Unterhautzental in Austria.

c. 1,500 and 1,300 BC. It is made from an oval piece of leather; a leather strap is threaded into slits close to the cut edge, it can be pulled to gather the leather over the instep. This type of a shoe can be worn either on the right or left foot without differentiation. Experiments⁷⁹⁰ suggest that the shoe was enclosed with a wide strap fed across the sole and which thus held the shoe to the bottom of the foot.

4.4 Interpretation

of Bronze Age sources in terms of costume history

Archaeologists can analyse Bronze Age jewellery and dress accessories in terms of regional and temporal differences. Shapes and styles, as well as the combinations of certain clothing accessories and jewellery items, change during the Central European Bronze Age. In the period between c. 2,200 and 1,600 BC, jewellery and clothes fasteners worn in Bohemia and Hungary were different from those of the Danube region of Lower Austria. Likewise, the shape and decoration of the jewellery changed in every region from the Early to the Late Bronze Age. Nevertheless, certain general patterns can be worked out as indicated above⁷⁹¹. The basic features include the head and chest (shoulder) area as main body areas to display jewellery and several ways of belting the robe. These features are the same in the various regions of Central Europe. Does this mean that the basic design of the garments was similar in design and cut and only the

⁷⁹⁰ Personal comment from Anne Reichert, 2010.

⁷⁹¹ Sørensen 1997, 100. – Wels-Weyrauch 1978, 1994.

(metal) accessories were subject to changes of fashion that allow us to assign specific types to a particular time or region?

Women's costume

What did the women's costume look like? What can we deduce from these rule-based basic sets known from Bronze Age graves in the Danube region? The length of the clothes can be indirectly traced by the clothing accessories on the arms and legs. It might be assumed that the representative ornaments worn on arms and legs were not completely covered by a cloth, because they were made to be seen. The skirts or dresses were probably not floor length. The rings on the upper arms may indicate that, at least at times, short sleeved garments were worn. Or were the upper arm rings simply worn over a long sleeve?

The Early Bronze Age findings from Großmain, Austria, provide interesting insights to answer the question of the sleeve length⁷⁹². A wide arm spiral was discovered on the forearm of a woman's grave, on which remnants of both the skin of the deceased and a medium-fine tabby woven textile were found (Fig. 206). The skin remains of the deceased indicate that the sleeve reached just above the mid-forearm, and that the arm spiral was partly slipped over the sleeve.

Bert Wiegel's⁷⁹³ observations of funerary finds of the Danube region demonstrate that the shafts of the pins were bent in different ways and thus adjusted to individual needs by those who wore them. Interestingly, some pins were found in the graves with the tip pointing upwards, towards the head, some downwards. Does this reflect the way they were used during life? What kind of garment could have been closed by these Early and Middle Bronze Age pins? The shafts of these pins are sometimes very thick, averaging a diameter of 5 to 7 mm. Fine textiles would have probably been destroyed by the multiple piercing with such thick pins. It is thus quite conceivable that coarser

⁷⁹² Grömer and Höglinger 2010, fig. 20.

⁷⁹³ Wiegel 1994.

materials such as capes and cloaks were fastened with such pins (Fig. 207).

Do the few ritual figurines from the Balkans dressed in long belted dresses reference the appearance of contemporary garments? The jewellery pieces worn in various positions around the neck would match the illustrations (Fig. 208). A complex pattern is further known from the cloth from Pfäffikon-Irgenhausen, Switzerland⁷⁹⁴, which can also be found on the figurines. However, important dress elements – the pins with which the upper garments were fastened – are usually missing on the human representations. These shoulder dress accessories are

Fig. 206. Early Bronze Age spiral arm ring from Großgmain, Austria, with mineralised textiles and human skin.

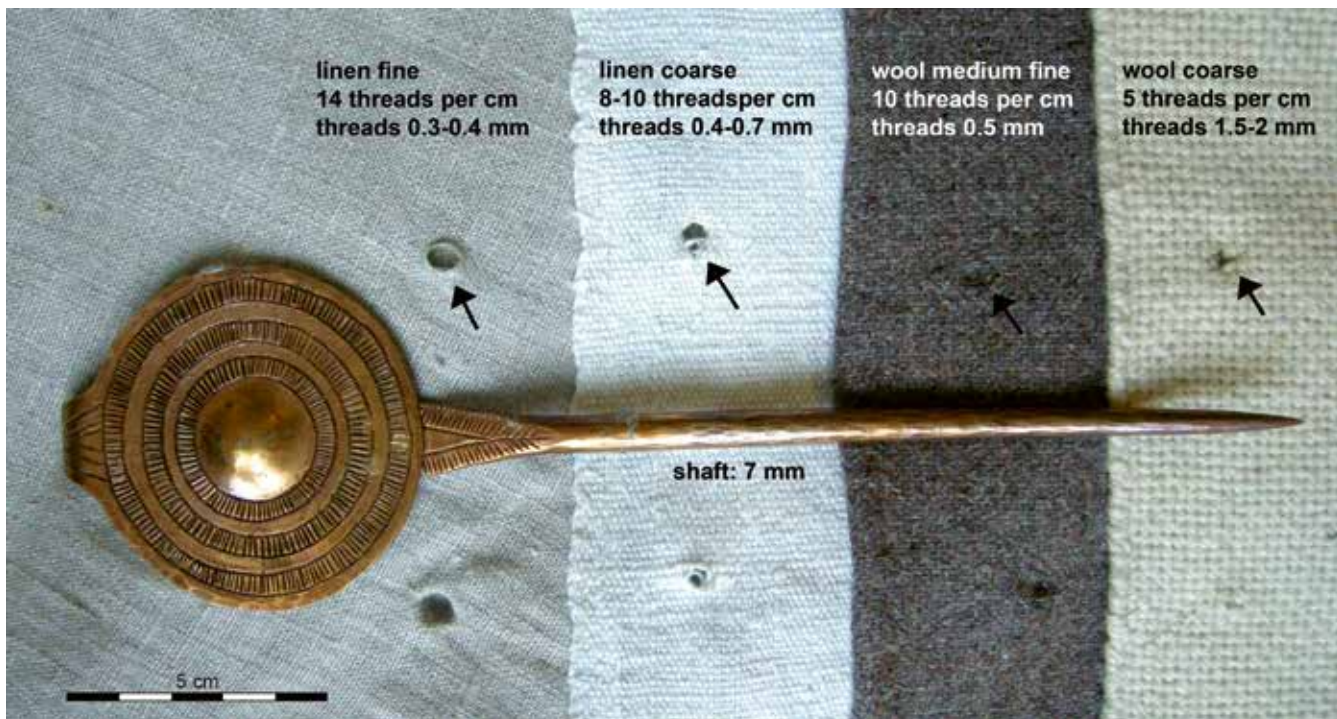


⁷⁹⁴ Vogt 1937, 76–90. – Rast-Eicher 2012, 380–381.

regularly found in the graves, but were not represented on the figurines.

According to these considerations, the Bronze Age representations and the finds from the graves do not completely line up. Perhaps what is found in the graves is a festive costume or a dress for the dead, and what is depicted on the figurines is a dress reserved for ritual functions. Could the typical women's costume of the Early and Middle Bronze Age be the blouse and skirt combination known from Northern Europe? Earlier Bronze Age textile research frequently combined the ensembles such as the one from Franzhausen or Winklarn in Austria with garment forms known from the oak coffins of the Nordic Bronze Age (see Fig. 198) to reconstruct complete costumes⁷⁹⁵. The two pins were interpreted to mean that the cloak was pinned to the blouse. It should be noted, however, that in the Nordic Bronze Age the cloak was neither fixed by two pins, nor worn by women, according to complete grave ensembles.

Fig. 207. Damage by a thick pin shaft to textiles of different qualities. Reconstruction of the Early Bronze Age disc pin found at Franzhausen in Austria.



⁷⁹⁵ See e.g. the reconstructions in Neugebauer 1994, fig. 41.

An alternative interpretation of the custom of closing a garment by means of two pins, which appears around 2,000 BC in Central Europe, is that a new type of garment was introduced – perhaps a tubular dress draped around the body, similar to the *peplos* of the Iron Age.

Important findings for the difficult interpretation of dress shapes are known from Schwarza in southern Thuringia⁷⁹⁶, where not only the metal dress components, but also the textiles have been preserved in the Middle Bronze Age barrows. Again, pairs of pins were found at the shoulders in women's graves. Analyses confirmed that the paired pins held together a rough cloth, although whether that of a *peplos* or a cape or cloak is unfortunately unclear. Underneath the cloth, an undergarment was apparently worn (a woman's blouse such as the ones known from the Nordic Bronze Age?). With the Thuringian finds, we have a connection between the Nordic clothing elements and the finds from the Danube region, by the coarse fabrics that have been fastened with paired pins on the shoulders.

The grave finds from Winklarn in Austria⁷⁹⁷ (Fig. 202 and 209) acted as a model to take up the challenge of recreating the costume of a wealthy Middle Bronze Age woman. She was buried with jewellery and dress fittings that appear almost theatrical, such as a wide belt of bronze, extremely long pins and a collar consisting of fourteen spiked bronze pendants. A series of different sources emphasize what her clothing might have looked like: the placement patterns of jewellery in Bronze Age graves

Fig. 208. Ceramic figurine from Babska in Hungary (1), compared to a Middle Bronze Age heart-shaped pendant from Asparn/Zaya, Austria (2).



⁷⁹⁶ Feustel 1958.

⁷⁹⁷ See Grömer, Rösel-Mautendorfer and Bender Jørgensen 2013.



Variant 1 Nordic type



Variant 2 Carpatian type



Variant 3 peplos type

Fig. 209. Experimental reconstructions of Middle Bronze Age costumes, based on the grave of Winklar in Austria. Model: Sandra Fellner.

from Central Europe, Bronze Age iconography, the textures of Bronze Age textiles, including a group of completely preserved garments from Denmark, and general tailoring principles. Each of these sources has its own rules and pitfalls. The variants of are educated guesses rather than factual certainties.

Men's costume

But what about male costumes? The pattern observable in the Central European graves, consisting of a belt and a single pin worn on the chest fits much better to what is known from the Nordic Bronze Age. Some of the textile remains from the Bronze Age part of the salt mine of Hallstatt⁷⁹⁸ in Upper Austria are very similar in design to those of the Nordic tree coffins – even the arched seams of the men's wrap-arounds and the finishing with buttonhole stitches are the same. Perhaps the Nordic men's costumes were also common garment forms in Central Europe.

⁷⁹⁸ Grömer 2013. – Rösler-Mautendorfer 2013. The textiles from the Bronze Age parts of the salt mine of Hallstatt are partly interpreted as remnants of clothing and partly as woollen sacks.

5 Iron Age

The Iron Age in the Danube region (between 800–15 BC) overlaps with the written history of the ancient Greeks and Romans. This era is characterised by the production of iron as the most modern and advanced working material, and by a very complex and differentiated social system with a high degree of craft specialisation. Textile crafts in the Central European Iron Age display a variety of techniques, patterns and colours. The innovations of the Bronze Age peak in the Hallstatt period (Early Iron Age, 800–400 BC) before simpler, mass-produced textile types began to prevail during the La Tène period (Late Iron Age, 400–15 BC) in the northern and north-eastern Alpine region – a harbinger of the Roman standardized production (see chapter C).

The available sources for reconstructing the history of Iron Age clothing are more plentiful than for previous eras in various parts of Europe. Again, it has to be emphasised that different types of sources come from different cultural groups and allow different interpretations. In contrast to the Bronze Age, figurative representations increase during the Iron Age, especially in the area of the eastern Hallstatt Culture. Direct encounters with prehistoric people are again made possible through their graves. After a time of almost exclusive cremation in the Urnfield Culture, the rite of inhumation is gradually reintroduced during the Hallstatt period. At the very end of the Iron Age, however, do ancient authors report directly on aspects of Celtic clothing. Moreover, only a few complete Iron Age garments have been found in Central Europe. Concrete examples of Iron Age garments have been discovered in the bogs of North Germany and Denmark.

5.1 Complete Iron Age garments from Northern Europe

The complete garments and ensembles from the pre-Roman and Roman Iron Age of Northern Europe represent a special treasure of European prehistory. Widely published in the major

publications of Margarethe Hald and Karl Schlabow⁷⁹⁹ during the 20th century, they now offer a tangible insight into the garments of the pre-Roman peoples at the edge of the Roman Empire, who were previously often imagined as ‘primitive’. The quality of the garments, their richness in shapes and forms, and their diversity of patterns are astonishing.

The circumstances of their discovery – the pieces were frequently discovered during peat cutting in the bogs – formerly led to a somewhat uncertain dating. In early publications, they were commonly classified as belonging to the Iron Age. Some of the pieces that were first thought to date to the pre-Roman Iron Age, such as the tunic of Bernuthsfeld, had to be correctly placed in the early Middle Ages⁸⁰⁰.

The fact that such well-known findings still offer surprises has recently been proven by researchers at the National Museum in Copenhagen and the Centre for Textile Research, who are currently reanalysing and evaluating the Danish bog finds⁸⁰¹. New radiocarbon dates and dye analyses have been performed on the textiles, so that we now have a clearer picture of the age and original appearance of the garments. Many of the known finds, such as those from Huldremose, Borremose, Elling or Tollund were confirmed to date between the 4th and 1st centuries BC. Isotopic tracing⁸⁰² hints at the origin of some of those important objects. The finds from Thorsberg in Northern Germany also have been the focus of a research project⁸⁰³. The Thorsberg place of sacrifice includes the discovery of long, narrow trousers with attached booties and five superb cloaks, one tunic and two pairs of calf wraps.

⁷⁹⁹ The following descriptions of finds are based on this literature: Danish finds: Hald 1980. – Mannering *et al.* 2012, 104–114. – Mannering 2015. – Finds from Schleswig-Holstein and Lower Saxony: Möller-Wiering and Subbert. – Schlabow 1976.

⁸⁰⁰ New dating of bog finds: Mannering *et al.* 2010, 261–268. – Van der Plicht *et al.* 2004.

⁸⁰¹ Mannering *et al.* 2012. – Van der Plicht *et al.* 2004. New data and high quality images from the National Museum Copenhagen: <http://oldtiden.natmus.dk>

⁸⁰² Frei *et al.* 2009. – Frei 2013.

⁸⁰³ Möller-Wiering 2011. – Möller-Wiering and Subbert 2012.

Garments for the upper body: tunics and cloaks

Shirt-like tunics⁸⁰⁴ ('*Kittel*'), sleeveless or with attached long sleeves, are frequent finds. The construction of the tunic, such as the one from Oberaltendorf in Germany, is usually very simple: rectangular pieces of cloth were sewn together at the shoulders and sides. The tunic was held with a belt around the waist. A very well preserved tunic is known from the Thorsberg Bog (Fig. 210). It was made from a 58 cm wide fabric in fine wool lozenge twill with reinforced selvages; two larger pieces with 95 cm length were used as front and back parts. The tunic was sewn together at the shoulders, fitted with a slightly rounded, carefully finished neckline and long sleeves of 58 cm. It was not closed at one side from the sleeve downwards, but could be fastened by cords at a distance of c. 5 cm.

Square to rectangular textiles with careful finished edges served as cloaks in the pre-Roman and Roman Iron Age, as they appear in images of defeated Germans on Roman victory columns⁸⁰⁵. According to these pictures, the cloak was placed over the shoulders and closed with a fibula on the right shoulder. The edges of the cloaks were worked very sumptuously, with up to 18 cm wide tablet woven bands. This is attested by the most prominent examples, the splendid cloaks ('*Prachtmäntel*') from Thorsberg and Vehnemoor in Germany dating to the 4th century AD. As both the original finds and the Roman pictorial sources demonstrate, they were also adorned with fringes. The cloaks sometimes measure a surprising size of up to 3 m in length and 1.8 m width. One of the two complete cloaks, which were wrapped around the bog bodies of Hunteburg in Germany (dated around 300 AD), had this size. With such a length the cloaks were folded over and worn doubled up. They thus offered better protection against rain, wind and snow, and could be used for many different purposes, for example as an additional blanket. The cloak of Dätgen, Germany, is smaller with dimensions of 1.62 by 1.46 m.

⁸⁰⁴ Cf. Schlabow 1976.

⁸⁰⁵ Schlabow 1976, 48–49.

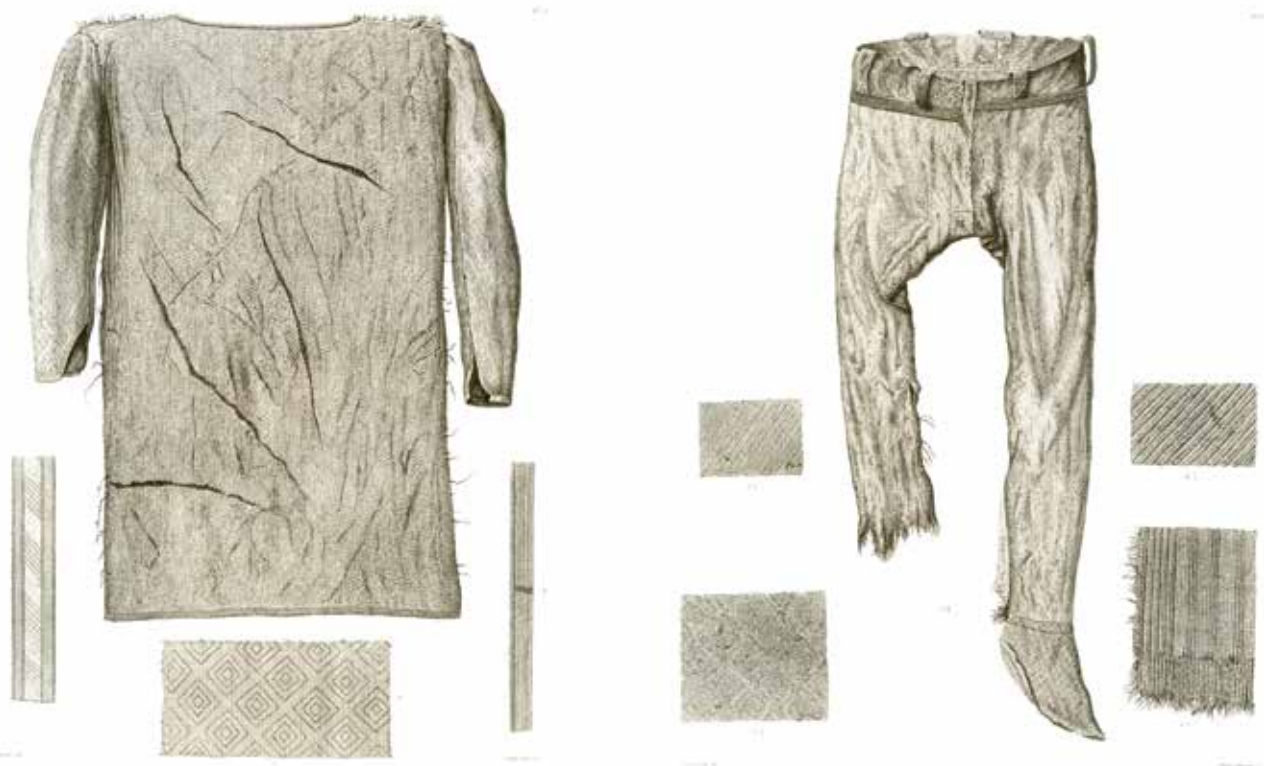


Fig. 210. Tunic and trousers from the Thorsberg Bog, Germany, 4th century AD.

Leg wear

Different types of trousers are known from the pre-Roman and Roman Iron Ages of Northern Europe⁸⁰⁶. Long tight trousers were found in Damendorf, short loose trousers in Marx-Etzel (all in Germany). The trousers from Marx-Etzel were made from one piece of diamond twill, which was cut and sewn firmly. They are the simplest form of trousers. All other trousers were composed of several different tailored parts. The form has little in common with the usual cuts of men's trousers in the Western fashion today. A remarkable feature is that early trousers are without a side seam. Each leg is wrapped by a piece of fabric with the seam pointing towards the inside of the leg. A square base piece is inserted for the required width at the buttocks. To have a comfortable fit, the base piece must follow the rounding of

⁸⁰⁶ Kania 2007. – Möller-Wiering and Subbert 2012. – Schlabow 1976. – van der Plicht *et al.* 2004 (dating).

the body. Sometimes wedges were inserted for the construction of Iron Age trousers or cuffs attached. The well-known trousers from Thorsberg (Fig. 210) are even fitted with belt loops. This singular piece of clothing is a pair of long, tight trousers with attached booties. The study of the pattern cutting of the Dätgen⁸⁰⁷ trousers, however, obtained that the cut differs from the other wool trousers found in Northern Germany, which have a more developed cut. It is more similar to linen trousers from Egypt and Syria (6th to 7th century AD).

In addition to trousers, there are foot wraps, which were wrapped around the calves to protect against cold and wetness. Two 1.05 m long and 10 cm wide woollen bands of twill were found with a bog body at Damendorf, dating to the first centuries AD. At the time of discovery, the deceased was stripped of all clothes and only covered by a cloak. The other items of clothing, the trousers, the foot wraps and shoes were found tied up in a bundle at his feet. We thus do not know how exactly the foot wraps were worn. The foot wraps from Søgårds Mose, Denmark, however, dating to the 2nd century BC were found at the legs of a bog body. The shins of the body were wrapped in bandages of 36 by 27–31 cm made of twill, which were tied with two woollen cords. Different types of shoes made of cow leather⁸⁰⁸ served as footwear in the Iron Age in Northern Europe, and have also been recovered in the bogs. Tunic, trousers and cloaks are attributed to men's clothes, even if not all of them were found with male bog bodies. The finds from Thorsberg⁸⁰⁹, for instance, were deposited as offerings in the bog.

Skirt, tube dress '*peplos*' and various capes

Clothes from the Ruchmoor near Damendorf in Germany represent what girls would have worn in the past. The finds were found near a 14-year-old girl discovered in a bog and included a woollen skirt of 30 cm length. It is worked in tubular form with a base circumference of 1.65 m and was strongly gathered at the

⁸⁰⁷ Zink and Kwaspen 2015. – Egyptian trousers: Kwaspen 2013.

⁸⁰⁸ Cf. Groenman van Waateringe 1974. – Mannering *et al.* 2012, 109, 112, fig. 3.17.

⁸⁰⁹ Möller-Wiering and Subbert 2012. – Schlabow 1976.



waist; the way the skirt stuck out from the waist of the wearer created a bold silhouette. In addition to this skirt, a cape made of deer fur was found near the bog body. According to the bog specialist Wijnand van Sanden, the garments of Ruchmoor date to the 9th century BC⁸¹⁰.

Women's clothing is known mainly from the Danish bogs. This includes scarves and capes worn with the fur side inwards. Particularly interesting are tubular garment pieces that are categorised either as ankle-length skirt or *peplos* dress depending on the length. These garments are either made of square pieces of cloth sewn together at the sides or worked in tubular form on a two-beam loom. The most famous example of such a tubular garment is the *peplos* from Huldremose (Fig. 211), which was discovered in a Danish bog, but unfortunately not in situ on a woman's body. The way the garment was worn was reconstructed by Margarethe Hald⁸¹¹ through analogy to the Greek *peplos* as follows: the tubular garment was folded, fixed at the shoulders with fibulae and belted. In fact, we do not exactly know how the find from Huldremose was worn; alternative interpretations are equally likely.

Not only was the famous dress found at Huldremose (Huldremose II, 180–50 calBC⁸¹²), but also a complete dress ensemble dating somehow earlier (Huldremose I, 192–61 calBC). It consists of a checked woollen skirt of 81 cm length, gathered at the waist, a scarf and a fur cape (Fig. 212). Various hair nets as parts of female clothing are also known from the Danish bogs.

Fig. 211. Bog finds from Huldremose (II) in Denmark: tube dress 'peplos', 180–50 calBC.

A tube-dress pinned directly at the borders to create the neck and arm openings was found in a grave at Hamerum, Denmark, 1st century AD (Fig. 213). Unfortunately,

⁸¹⁰ Van der Sanden 1996, 167.

⁸¹¹ Hald 1980, 358–365.

⁸¹² Mannering *et al.* 2012, 105, fig. 3.9 and 3.11.

no remains of the buried person except an elaborate coiffure were preserved, but the burial is interpreted as belonging to a young female. The dress was made of balanced 2/2 wool twill of red colour, is 95 cm long and 146 cm in circumference and may have reached to the knees of the deceased person⁸¹³. The textile is most likely woven on a warp-weighted loom, and the starting and finishing borders were sewn together to form a tube. At each shoulder the front of the cloth is gathered with the back. How both parts were kept together cannot be determined, because no (metal) pins are preserved. On top of the dress and around the back a more fragmented textile was found (second fabric), as well as a third fabric in the area of the knees. The use and shape of both cannot be determined.

5.2 Evidence for Early Iron Age clothing in Central Europe

Let us now turn our attention from the northern European region with garments dating to around the beginning of Common Era to Central Europe at the beginning of the 1st millennium BC.

Complete garments

What is the situation in the Central European Iron Age in terms of complete, intact garments? In 1734 a clothed prehistoric body was discovered preserved in salt during a visit to a sink work in the Hallstatt salt mine. A chronicler writes: *'... seen a strange corpse of a dead man, who presumably and to judge by his appearance must have been trapped and buried more than 400 years ago,*



Fig. 212. Bog find from Huldremose (I) in Denmark: skirt and fur cape, 192–61 calBC.

⁸¹³ Mannering and Ræder Knudsen 2013.

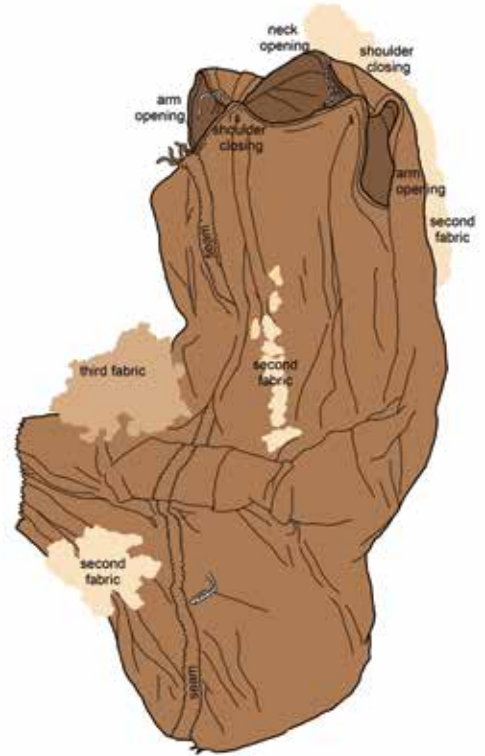


Fig. 213. Woman's grave from Hamerum in Denmark, 1st century AD.

*completely grown together with the mountain, but one still sees parts of his upper garments, and also some shoes on his feet ...*⁸¹⁴. This 'Man in Salt' was most likely an Early Iron Age miner. He was, after having been recovered from the mine, buried in the Christian cemetery of Hallstatt – what a loss for scientific research! Similarly, the salt mummies discovered in 1577 and 1616 in the salt mines of the Dürrenberg are no longer available. Unfortunately, we can therefore no longer speak of completely preserved gar-

⁸¹⁴ Weekly report (Werkerfaszikel, Wochenbericht) from the salt mine Hallstatt, 1734, 13th week, 1st quarter. Cited after Barth 1989, 9. '*... einen naderlichen Körper von einem Toten menschen gesehen, welcher muedtmasslich und deme ansechen nach, vor mehr als 400 Jahren muess verschidtet sein worden, massen Selbiger in das Gebirg föllig verwachssen, doch sieht man noch von seinem rockh etlich flöckh, wie auch die S.V. Schuech an denen füeßen ...*'

ment ensembles found directly on the body for Iron Age Austria.

A few single pieces of clothing are, however, available for study from Central Europe. Parts of work clothes, various caps and shoes⁸¹⁵ have been recovered from the two salt mining locations of Hallstatt and Dürrenberg.

From the Vedrette di Ries glacier (Rieserferner Gletscher)⁸¹⁶ on the border between Italy and Austria we know of two pairs of leg warmers (over-and-under-leggings) made of goat wool, as well as a pair of sewn woollen socks and remnants of shoes made of leather. The ensemble dates to the period from the 8th to the 6th centuries BC. It was found high in the Tyrolean Alps on the edge of a snow field, where they were left by Iron Age people over 2,500 years ago. These pieces, incredibly important to the Central European costume history, are exhibited in the South Tyrol Museum of Archaeology in Bolzano, along with the Neolithic Iceman. They are evidence for body attire most probably adjusted to cold periods.

The leg warmers (Fig. 214) have a common basic design, but differ in little details. They each consist of tubes of woollen fabric with a seam on the side. At the bottom end a tab is incorporated, which draws on the instep and protects this part of the foot from the cold, even when wearing shoes. The edges of the lower part of the protective and warming tabs are reinforced; the edges of the under-leggings are hemmed with a twill band. In each case a cord has been found in the area above the heel. The cord was used to securely attach the legging to the foot. The



Fig. 214. Vedrette di Ries, South Tyrol in Italy: Iron Age leg warmers 'under-leggings', 8th–6th century BC.

⁸¹⁵ Cf. Barth 1992. – Stöllner 2002.

⁸¹⁶ Bazzanella *et al.* 2005; 2012.

over-leggings are 55 cm long and 16 cm wide, and consist of dense, thick, woollen material in herring-bone twill. A carefully stitched patch of thin woollen cloth was found at the height of the knee on the left legging. The under-leggings are 62 cm long and 16 cm wide, with a slight conical shape, and are made in tabby weave. The right under-legging has a simple side seam, while the left one incorporates a 1.5 cm wide ribbon in diagonal plaited braid consisting of two parts of different colour sewn together; the lower part is grey, the upper part brown. The obliquely elastic construction of this band lends elasticity to the narrow leg tube made in tabby weave. A good fit is thus just as ensured as an easy slip through.

The socks ('inner shoes') (Fig. 215) were made from twill fabric of beige brown to grey wool; the fabric is felted on the inside and outside. The weave is somewhat finer than that of the over-leggings. On a very well preserved sock it can be recognized that it was composed of ten different parts, including the sole. The sole is reinforced by additional pieces of fabric sewn onto the inside; on the outside, patches of dark brown woollen twill are fixed to the toe and heel area. Where the foot slips in, the sock can be closed by a lateral flap to which a band is sewn; the flap and band can be wound around the ankle joint.

A number of Iron Age cloaks and capes of different forms are known from the pre-Etruscan Villanovan Culture (c. 1000–700 BC), in particular from Verucchio, Italy, dating to c. 700 BC⁸¹⁷.

The ceremonial garments from Tombs 85, 89 and *tomba del trono* include two large, semi-circular cloaks with a size of about 260 by 80 cm. They are twill woven with spin patterning and carry broad, decorative tablet woven borders, which were added to the garment after the completion of the ground weave. Due to their semi-circu-

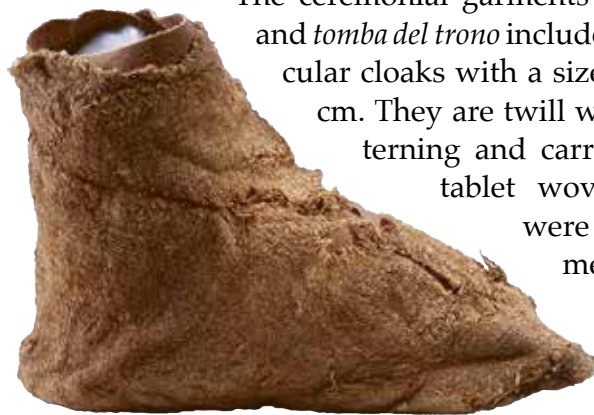


Fig. 215. Vedrette di Ries, South Tyrol in Italy: Socks sewn from wool fabric, 8th–6th century BC.

⁸¹⁷ Stauffer 2002, cloak 1: fig. 64–65, cloak 2: fig. 72–73, cape: fig. 77–78. – Stauffer 2012, discussion about the term *tebenna*: 251.

lar shape, these *tebennae* are considered to be the prototype of the Roman toga. Some further more or less complete garments were found as well. Garment 3 is woven with four curved edges and a neck opening in the central part and a size of 103 by 105 cm; it might have been worn like a long shirt or a tunic with short woven-to-shape sleeves.

Design of Early Iron Age textiles

We are generally very well informed about the appearance of textiles during the Hallstatt period in Central Europe, which constitute the material basis of clothing. Numerous textiles have been recovered from graves. The princely tomb of Hochdorf, Germany⁸¹⁸, plays an important role for textile research. An analysis has revealed various splendid textiles, which were prepared especially as grave goods for the Celtic prince. These are mainly in red and blue; imported dyes, such as the red of the scale insects (*Kermes vermilio*) have also been used. The resourceful textile craftspeople not only used sheep's wool or flax, but also badger hair and hemp bast. The materials from the royal grave are characterised by their high quality and decoration of various checked patterns, weave types such as diamond twills and tablet woven bands. The gorgeous patterns including swastika or meander motifs suggest connections to the Mediterranean civilisations south of the Alps, although the production was probably carried out locally.

The salt-preserved textile finds from Hallstatt, Austria⁸¹⁹, were left behind in the mountain after having been used in a number of different functions (see chapter D). Twill weaves were particularly popular, along with tabby and basket weaves, which were dyed and decorated. Stripes and checks are indeed characteristics of this period, although they are not found on every textile. Far more common are spin patterns that form a very exquisite type of tone-on-tone décor effect. Colourful tablet woven bands and repp borders are further characteristics of the Hallstatt period. It should be emphasised that strong, dark co-

⁸¹⁸ Banck-Burgess 1999.

⁸¹⁹ Grömer *et al.* 2013. – Hundt 1987. – von Kurzynski 1996.

lours like shades of blue and black were preferred and achieved through dying. The bronze jewellery, bright and shiny when polished, must have created a nice colour contrast. It is also interesting that there is much evidence for tailoring, particularly in Hallstatt (see chapter B). Panels of fabric were cut and then sewn together. The careful trimming of the edges was especially emphasised, not least for practical reasons in order to increase the durability and wear-resistance of the garments.

Grave finds

As is the case for the Central European Bronze Age, the graves of the Iron Age offer an important source of information when it comes to interpreting the clothing that was worn on the last journey of the deceased. For this purpose, only costume items and accessories in their original context are used. The funerary rites of the Hallstatt period include both cremation and inhumation. Frequently, as in the cemetery of Hallstatt, the richer graves (*e.g.* those equipped with bronze vessels) are cremations⁸²⁰.

Particularly impressive are the finds in the elite burial mound X of Mitterkirchen in Upper Austria⁸²¹, one of the earliest graves from the eastern edge of the western Hallstatt Culture to contain a ceremonial wagon. Two grave chambers and a pit burial dating to the 7th century BC (Ha C) were discovered in this imposing burial mound. Chamber 1 contained vessels of the drinking and feasting set, such as cups, bowls, plates and large storage vessels in addition to an ornate ceremonial wagon, on which a woman's body was laid. This kind of burial with wagon was reserved for the elite of the Hallstatt period. The double burial of a 30-year-old woman and an 18-year-old man was discovered in Chamber 2. Here, the excavators found a striking context (Fig. 216): the woman's skeleton, clearly the more important person in the grave after her equipment, was covered with thousands of little bronze buttons in the upper body and leg regions. Between the knees and toes they were lined with a double zigzag row of tiny bronze rings. Among these metal

⁸²⁰ Cf. Kern *et al.* 2009a, 130–133. – Kromer 1959.

⁸²¹ Pertlwieser 1987, 55–70.

trimmings, remnants of leather and animal hair were preserved through oxide penetration, which suggest a flamboyant cloak made of leather, and perhaps in part made of fur. In addition, this rich woman wore a spiral headed pin, five pairs of bronze rings above the ankles, amber necklaces with multiple rows of bronze and amber beads, which may have once belonged to a magnificent bonnet.

Leaving the level of the richest burials, one is faced with a large number of graves quite handsomely equipped with jewellery⁸²². Although there are numerous variants and combinations of decorative and costume elements in Hallstatt period graves, some general patterns can be discerned: men are frequently equipped

Fig. 216. Grave X, Burial Chamber 2 from Mitterkirchen in Austria, Early Iron Age. Context drawing and reconstruction of the cloak.



⁸²² Rebay 2007, 134–156.

with a long pin on the chest or shoulder and an element of a belt (belt hook, belt plate or sheet bronze belt), which characterises the 'civilian' costume⁸²³. They also appear together with spear-heads and swords or daggers in warrior graves. Some protective gear such as helmets may also complete the set.

The most important metal item used in the Iron Age as a clothes fastener is the fibula⁸²⁴. In principle, it functions like a safety pin. In addition to their practical purpose as fasteners they were flashy jewellery and subject to fads of fashions, more or less like the design of pins changed during the Bronze Age. The shape and ornamentation of fibulae can be studied to reveal cultural connections and chronological trends. The spatial and temporal distribution of the fibulae will not be discussed in detail in this book; here, we are interested in the positioning on the body in which these clothes fasteners appear in the graves.

Female graves are often difficult to compare with each other because of their extraordinary wealth and variety. Except for the abundance of grave goods, there are few general patterns or common denominators. In Hallstatt period women's graves paired fibulae or pins are commonly encountered in the upper body / shoulder region. Most clothes fasteners are symmetrically arranged left and right of the shoulders. Sometimes the two fibulae are also arranged in parallel on the right shoulder. Further jewellery such as bracelets or anklets, hairpins and various necklaces completed the ensemble. Belts in the form of belt fasteners or belt plates⁸²⁵ emphasised the waist.

The shape of the fibulae is subject to regional variation. The cemetery of Hallstatt⁸²⁶ (Fig. 217) contained numerous fibulae with double bronze spirals as the main body and sheet metal rattling pendants, combined with sheet bronze belts in rich graves. Many finds from the rich burials give us an impression of splendour,

⁸²³ *E.g.* Hodson 1990. – Kromer 1959.

⁸²⁴ For an overview on types and stylistic development of fibulae in different times and cultures, see Müller *et al.* 1994, 411–607.

⁸²⁵ Pabst-Dörrer 2000, pl. 3, 4. – Hallstatt: Kromer 1959, plates.

⁸²⁶ Kromer 1959. – Hodson 1990. – Kern, Lammerhuber and Schwab 2010.

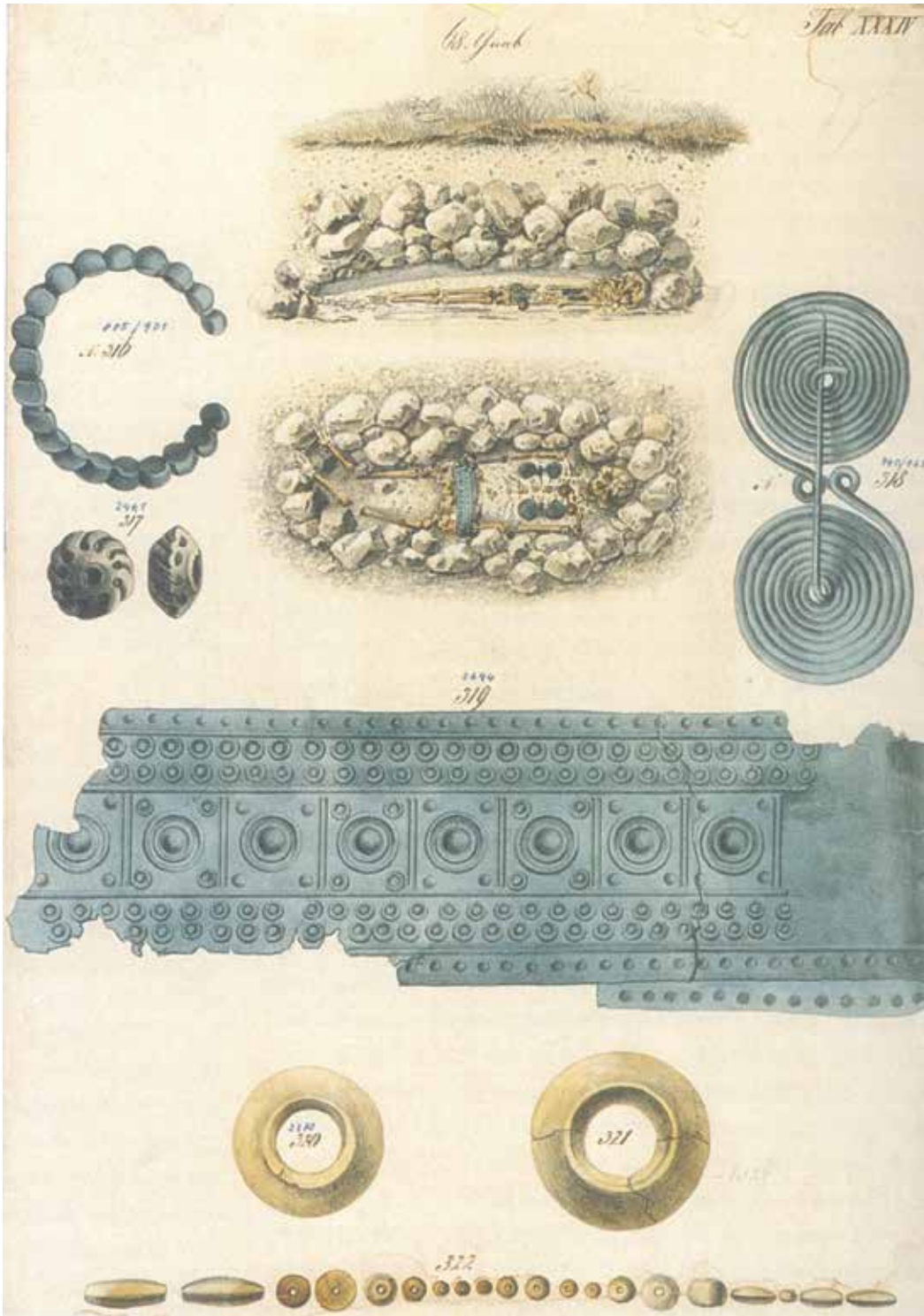


Fig. 217. Woman's grave from Hallstatt with belt plate and spectacle fibulae, Early Iron Age. Watercolour painting from Johann Georg Ramsauer's documentation of the cemetery excavations in 1846.

as do the 19th century watercolour paintings, which illustrate the positions and contexts in which the items were found.

When several fibulae were present in one grave, they could have in principle also belonged to several garments. The shapes and sizes of the fibulae found within a grave may vary, which possibly indicates under and over garments of different cloth qualities (coarse and fine ones). In the late Hallstatt period in Northern Württemberg⁸²⁷ the woman's costume consisted of up to three fibulae; in addition to the symmetrical pair at the shoulders, a smaller third fibula is found in the centre of the chest. This most likely reflects the custom of wearing an under and over garment, fastened at the neck.

Overall, it can be noticed that there is a tendency towards increasingly smaller forms of fibulae as the Iron Age proceeds, in tandem with finer and finer textile qualities. The spectacle fibula of the early Hallstatt period are still very coarse and have very thick pins (which are better suited to fasten coarse fabric materials); in the late Hallstatt and especially in the La Tène period there are very lightweight and delicately designed small fibulae with tiny catch plates. These are ideal for fine fabrics, since thicker pins would damage the textiles (see Fig. 207).

In addition to fibulae and belts, there are also other clothing fasteners. We know some examples of buttons made of ceramic or deer antlers from the Hallstatt period. These are usually serrated or star-shaped and occur mainly in southern Moravia, Lower Austria and Slovakia. Austrian sites in which such buttons have been found include Leopoldsberg near Vienna and Unterparischenbrunn⁸²⁸ (Fig. 218). Compared to fibulae, buttons are very sparse. The button as a primary means of fastening clothes apparently did not become popular until the Middle Ages, although it appeared again and again from the Stone Age onward. Because no buttons have been found in grave contexts, it is unclear what exactly had been fastened with them. The buttons all stem from archaeological excavations in settlements, where they were lost by the people who wore them.

⁸²⁷ Müller *et al.* 1994, 441.

⁸²⁸ Griebel 1996, 95–114. With further examples from Slovakia.

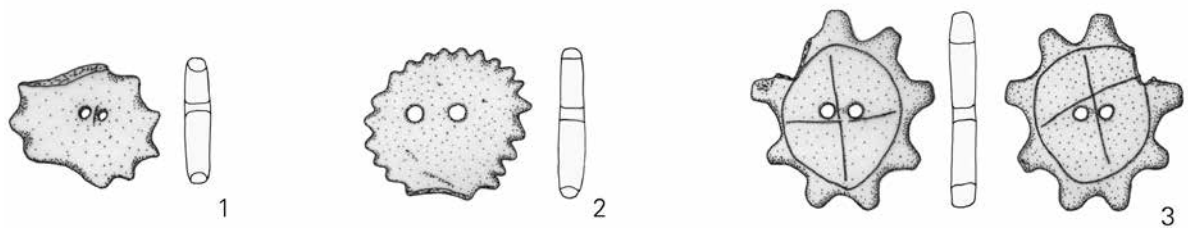


Fig. 218. Early Iron Age ceramic and antler buttons from Austrian sites: Leopoldsberg/Vienna (1), Unterparschenbrunn (2), Horn (3).

The clothing fastened by fibulae as we know it from graves cannot be directly related to contemporaneous illustrations, as unfortunately no pictures of garments with fibulae can be identified from the Early Iron Age in Central Europe. Even buttons in the correct position to fasten a garment are never shown on images. What the garments might have looked like, which were represented by the clothing components in the graves in situ, will be discussed below.

Pictorial sources for clothing

Figurative art⁸²⁹ of the Hallstatt Culture is generally not very naturalistic. From the western Hallstatt area representations of clothed people are rare, while several images are known from the eastern Hallstatt area. Sets of small ceramic figurines were found, for example, in Gemeinlebarn or Langenlebarn in Lower Austria. They were most likely arranged in scenes on small ceremonial wagons or conical necked vessels (Fig. 219). The various human and animal figurines told a story inaccessible to us today. The human figurines are flat like a wooden board. Women are represented with breasts and dresses with wide swinging skirts, the hem reaching only up to the knees. Most figurines from Central Europe, however, represent people without clothes.

More human representations have been found in the area of the Kalenderberg Group at the north-eastern edge of the Alps (in Lower Austria, Burgenland, western Hungary, Slovakia), which belonged to the eastern Hallstatt Culture. In the 7th century BC, it was customary to decorate pottery with elaborate geometric patterns as well as with representations of people⁸³⁰ (Fig. 220).

⁸²⁹ Huth 2003. – Rebay-Salisbury 2014. – Reichenberger 2000.

⁸³⁰ Dobiak 1982. – Reichenberger 2000.



Fig. 219. Early Iron Age figurine from Gemeinlebarn in Austria and reconstruction of the conical necked vessel.

In these images, the people are abstracted and drawn very schematically. The representation was reduced to the mere signaling of what was represented; a simple triangle with a dot as a head, and perhaps strokes as arms and legs was enough to represent a human being. Scenes including wagon rides, music and dancing and hunting are also shown. The clothing remains mostly reduced to differently designed and decorated triangles. The images are far from accurate representations of clothing, but they reveal several interesting details (Fig. 221). There are 'women' who were obviously dressed in a skirt and top, while the garment of others represented with a continuous triangle from the head to the legs could rather be interpreted as a dress. The skirt fitted to the waist comes in different shapes, but is usually depicted as a triangle. The skirt depicted on a vessel from Sopron-Várhely (Hungary), Tumulus 28⁸³¹ (after Eibner 1980), is even a bell-shaped skirt that in its dimensions evokes associations with the crinoline skirts popular in the 18th and 19th centuries AD. In this case, however, it is more likely that the particular shape indicates a rotating movement – a dance⁸³².



⁸³¹ After Eibner 1980.

⁸³² Eibner 1997, 129–145.



'Men' are usually drawn as stick figures (Fig. 221.9), but there are also unique representations of trousers. People with narrow triangles as dresses are also often interpreted as male. In the famous weaving scene on the conical necked vessel from Sopron, Tumulus 27, the thin triangular person with lyre is interpreted as a man (Fig. 221.6), whereas the people spinning, weaving and dancing are represented with wide triangles and interpreted as women.

Fig. 220. Conical necked vessel with incised decoration featuring human figures from Sopron-Várhely in Hungary, Early Iron Age.



There are a few monumental statues⁸³³ dating to the late Hallstatt and early La Tène periods, for instance the warrior of Hirschlanden in Germany. The stone statues are confined to the western Hallstatt area and can be traced back to Mediterranean models. In their symbolism they are strongly linked to the representation of rulership. Amongst the usually naked representations (with only a pointed hat and a torque) the Glauberg statue stands out with his ornate composite armour decorated by a meander motif (Fig. 231). Again, the head is an important zone of ornamentation; this time, a leaf crown is represented. Interestingly, the wire frame of such an unusual headdress has indeed been detected in a burial mound on the Glauberg⁸³⁴; the representation can thus be classified as quite realistic. Otherwise, the monu-

⁸³³ Frey 2000.

⁸³⁴ Bagley 2014, 415, Kat. Nr. 118.

mental statues of the Celtic Iron Age do not add much to the question of clothing.

5.3 Representations of clothing on situlae

The most detailed representations of clothing can be recognised in the late Hallstatt/early La Tène period situla art⁸³⁵. The works of situla art were produced between the 6th and the 4th centuries BC in the alpine and south-eastern Alpine region between the Danube and Po rivers, the areas of the eastern Hallstatt as well as the Este Cultures. The images on the early La Tène scabbard from Hallstatt, grave 994⁸³⁶ are designed in a different technique. They also show stylistically similar imagery, especially in the way people and their clothing are represented, which is why this particular find is also treated here in this context. As with the illustrations on ceramics, which are largely derived from rich graves, situla art is clearly linked to the lives of the elite, who presented themselves in this medium.

Although both style and content of these early images show southern influences, it is certain that the artists adhered to local models in terms of the details of weaponry and tools: the objects represented have good parallels in graves of the same area. It is thus assumed that the items made of organic materials, such as the clothes, equally correspond to the circumstances of time and place. The clothes represented in situla art also might be partly inspired by Etruscan templates⁸³⁷, just like other parts of the image content (*e.g.* animal representations, various forms of helmets). As mentioned in the introduction to this chapter, situla art probably shows symbolic themes as well as the ideas, lifestyle and festivities of the elites.

The **women** in these pictures (Fig. 221) usually wear long dresses reaching to the calves with elbow-length sleeves. These garments may have a straight or uneven hem and are partially decorated with borders. The dress may be gathered with a belt

⁸³⁵ Frey 2005. – Lucke and Frey 1962. – Rebay-Salisbury 2014. – Turk 2005.

⁸³⁶ Barth und Urban 2007. – Egg *et al.* 2006.

⁸³⁷ Bonfante 2003, *e.g.* fig. 2–18, 72–75.

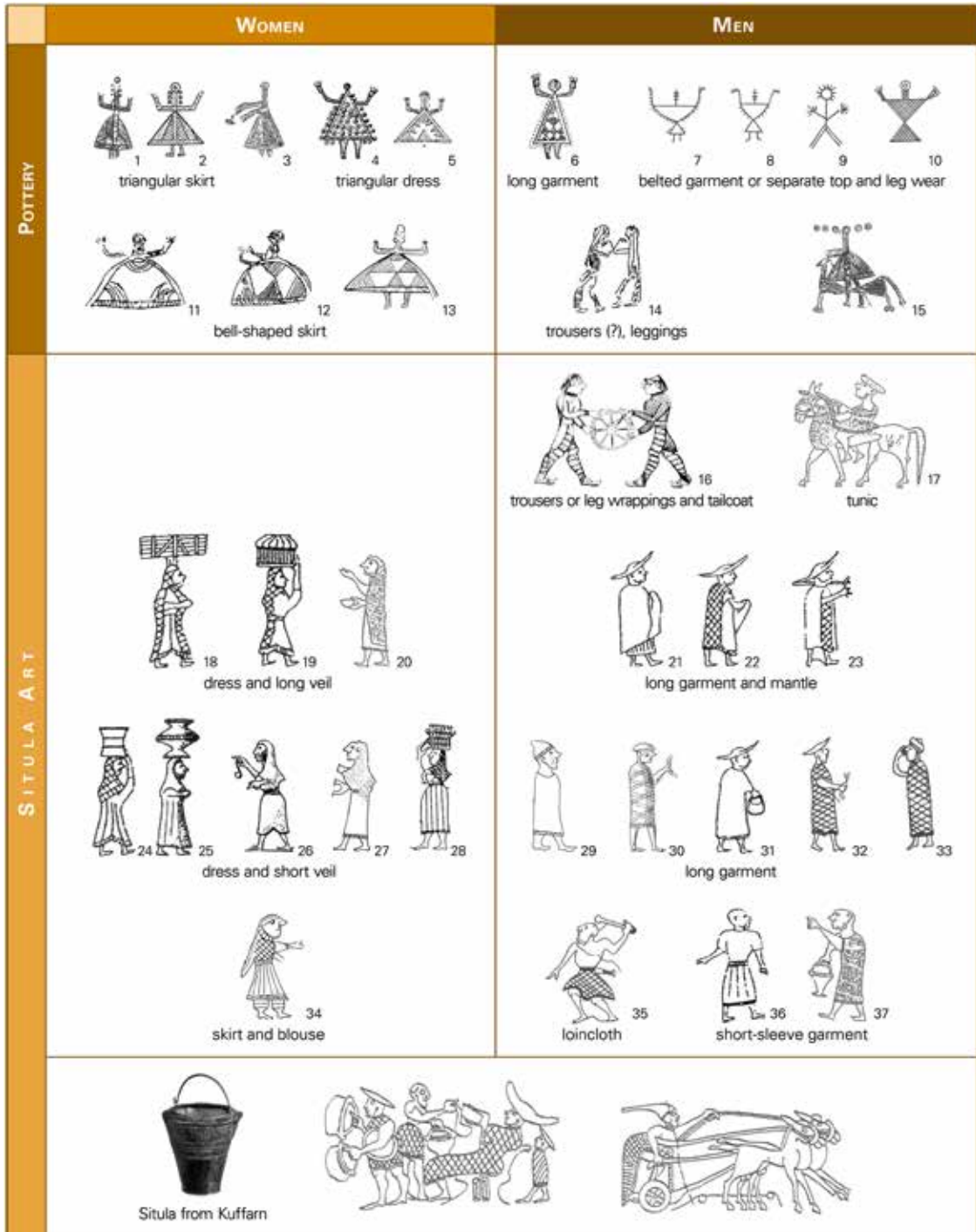


Fig. 221. Human representations on Early Iron Age pottery and situlae. Sites with pottery: Sopron (1–6, 11–15), Nové Košariská (7–8), Klein Klein (9), Dietldorf (10). Sites with situla art: Hallstatt (16), Vače (17, 20, 37), Certosa (18–19, 21–25, 31), unknown find spot, situla stored at Providence, USA (26), Welzelach (28, 32–33, 35), Magdalenska Gora (27, 29), Moritzing (30), Carceri near Este (34).

around the waist. A veil or a headscarf of different lengths is always combined with the dress. Sometimes the veil is longer and extends approximately to the knees or calf. These long veils are also sometimes slashed, so that one part covers the front of the chest, whilst the other covers the back and the arms can move freely (Fig. 221.18). The extra-long veils could perhaps also be cloaks drawn over the head.



Particularly interesting is the representation of a woman on the belt buckle of Carceri near Este in Italy (Fig. 221.34). In this scene, a man reclines on a couch and a woman serves him; she hands him a double-handled cup whilst holding a beaked flagon in the other hand. The woman does not wear the long dress like other women on objects of situla art, but is dressed in a combination of skirt and blouse. The short sleeved top is checked, while the skirt is held by a belt and decorated by radial strips as well as a border at the hem. It is not necessarily possible to clarify whether the strips are supposed to represent a hint of ornament or drapery. A veil extending as far as the buttocks completes the ensemble as in the usual manner. In addition, however, something unusual is represented: a thickening on the legs indicates the lady was wearing leggings or trousers.



Men's clothing in situla imagery (Fig. 221) largely consists of a tunic or shirt-like garment, either sleeveless or with elbow-length sleeves. The garment is not belted and falls smoothly down from the neck, extending to the calf or to the ankle. The garment is on occasion depicted as checked or striped; the hem is often decorated with a border. The garment covers the body so completely that any underwear is not detectable. Sometimes a cloak is worn over it.



Warriors (both infantry and mounted soldiers), such as the ones depicted on the scabbard of Hallstatt (Fig. 222), wear variously designed helmets and long-sleeved, shorter garments; they sometimes also wear sleeveless armour, which is decorated with stripes or checks. Quite likely, this represents composite armour made of leather or linen, similar to the one shown on the monumental statue from Glauberg. Men engaged in physical activity, such as the 'waiter' on the Situla from Kuffarn (Fig. 176), who serves the enthroned person wine, have clothing reaching only





Fig. 222. Sword scabbard from Hallstatt, Grave 994, early La Tène period. With water coloured drawing of the grave.

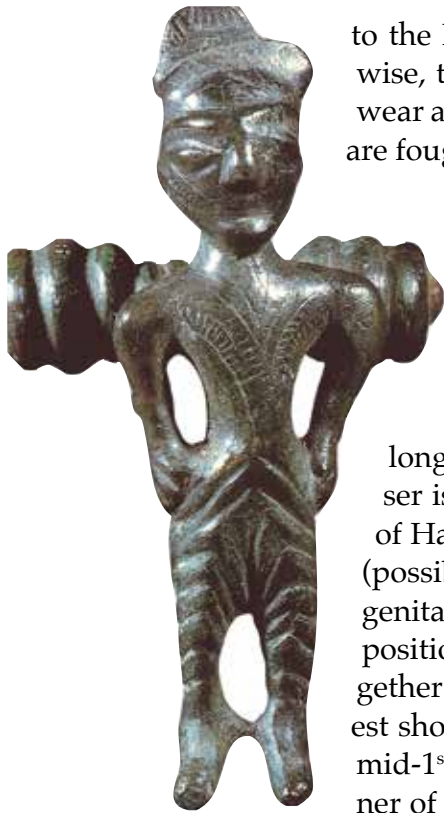


Fig. 223. Dürrnberg-Eisfeld in Austria, Grave 135. Fibula in human shape, Late Iron Age.

to the knees – if they are not only wearing a loincloth. Likewise, the ‘hunters’ on the Situla from Welzelach (Fig. 221.35) wear a loincloth and are otherwise shirtless. Sportive fist fights are fought completely naked.

Representations of legwear, probably trousers, can be found on the early La Tène scabbard from Hallstatt and on the belt plate of Molník in Slovenia⁸³⁸, dating to the 6th or beginning of the 5th centuries BC. In this image, the striking ‘archer’ wears wide trousers with a barely visible, incised fabric pattern, plus a long-sleeved shirt and a pointed cap. Another type of trouser is depicted on the ‘wheel bearers’ on the scabbard from of Hallstatt. There are tight-fitting trousers with rich pattern (possibly with laces and wraps), reaching to the hip. Since no genitals are shown, which should actually be visible in this position, it can be assumed that the trousers were sewn together at the crotch. These representations are among the oldest showing trousers in Central Europe; they are dated to the mid-1st millennium BC. Nowadays this garment and its manner of construction are so common that it is rather difficult to imagine how humanity could ever have lived without it.

On the scabbard from Hallstatt, the fitted, patterned trousers are combined with a dress coat with folded-back tails. Thus, the outer garment has an extended back, while the front legs remain uncovered to the hips. This strange attire can be found on other representations of the early La Tène period as well. The chariot drivers on the Situla from Kuffarn (Fig. 221), for example, or the figurine on the early La Tène fibula from Dürrnberg-Eisfeld, grave 135⁸³⁹ (Fig. 223), in which this ‘tail suit’ is combined with wide, heavily pleated trousers.

The famous scene of four men with trousers on the scabbard from Hallstatt has inspired different interpretations. It was first interpreted in terms of the local salt mining industry. The wheel, which two of them hold, was declared a windlass used for heavy lifting in the mines. Accordingly, the people in the im-

⁸³⁸ Turk 2005, fig. 87.

⁸³⁹ Zeller 1980, 126, fig. 17.

age were interpreted as miners and the unusual tails on the upper garment would have represented 'Arschleder'⁸⁴⁰ ('arse leathers') designed to protect the trousers of the miner from fraying. According to a recent reinterpretation by the Hallstatt specialists Fritz-Eckart Barth and Otto H. Urban⁸⁴¹, however, the scene does not depict mining history, but illustrates the three types of armed forces important to the early Celts: cavalry, infantry and chariots with drivers. The men holding a wheel between them thus symbolise the chariots (on the situla from Kuffarn, however, they are depicted at full speed). According to this interpretation, the garment with tails is the protective gear of a chariot driver. If one pictures such a fight scene, the purpose of this clothing becomes clear. According to Barth and Urban, the back of the chariot driver was defenceless after breaking through the battle line, particularly to every type of thrown weapon. Without infringing on the legroom – vitally important for chariot drivers – the extended back cover could have ensured effective protection, even if it consisted only of relatively thin material.

5.4 Evidence for Late Iron Age clothing in Central Europe

No uniform costume existed for all Celts. The various Celtic tribes lived in widely dispersed areas throughout Europe and had different points of contact with other cultures. Therefore, it is likely that they adopted different clothing habits. The archaeological source material is scattered over Europe, similarly to that of the Hallstatt period. The written sources are a novelty, which, for the first time, provide concrete names and concepts for the archaeological data.

Design of La Tène period textiles

Archaeological discoveries inform us well about the appearance of textiles in the La Tène period. Over 600 textile remnants from

⁸⁴⁰ E.g. Egg *et al.* 2006, 194.

⁸⁴¹ Barth and Urban 2007.

the salt mines of Dürrnberg near Hallein⁸⁴² in Austria offer a colourful picture of what was common in the textile sector during the early La Tène period. As before, fine fabrics are present, but now tabby weave is predominant and twill is found in simple versions. Both wool and linen were detected as raw materials during analyses; both materials were dyed as already known from the Hallstatt period. Stripes were preferred, but checks and spin direction patterns that characterize the textile work in the Hallstatt period are rare. Exceptional individual pieces were produced applying checkerboard, diamond and meander motifs in different techniques with floating thread systems and in tablet weaving.

A large number of simple tabby weave textiles have also been obtained from La Tène period graves in Austria, the Czech Republic and Slovakia⁸⁴³. The magnificently embroidered fabric from Nové Zámky stands out particularly. It should be noted however, that the textiles from La Tène graves in Central Europe often do not have a direct contextual relationship to the clothes, but fulfilled other functions. For example, there are many fabric scraps in secondary use, such as a filling for hollow arm rings (see Fig. 167) or as wraps of objects. In any case, however, the textiles reflect the types of fabric quality that were in use at the time.

Antoinette Rast-Eicher⁸⁴⁴ ascertained on the basis of textiles from La Tène period graves in Switzerland that women in the early and middle La Tène period wore a belted linen garment (dress), whereas in the late La Tène period a coarse to medium cloth, held together by a pair of fibulae at the shoulders, was popular; the garment probably looked similar to the dress of Menimane, shown on the famous grave stone from Mainz-Weisenau in Germany, dating to the 1st century AD⁸⁴⁵.

⁸⁴² Grömer and Stöllner 2011. – Stöllner 2005. – von Kurzynski 1996.

⁸⁴³ Belanová 2005; 2012, pl. 15.2–15.4. – Grömer 2012, 46–47, pl. 1.1.

⁸⁴⁴ Rast-Eicher 2008, 177–188, 191; 2012.

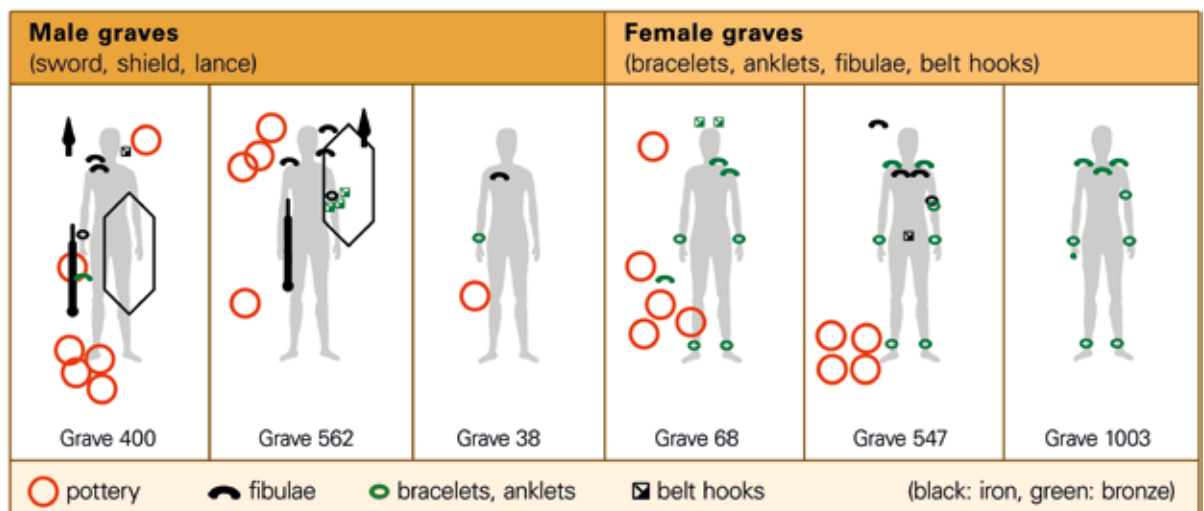
⁸⁴⁵ Cf. Böhme-Schönberger 1997, fig. 18.

Grave finds

One most directly encounters the clothing of the people of the La Tène period in their graves. Especially the fibulae are important metal dress accessories that fasten the clothes worn on the body; they are found in graves of the early to middle La Tène period from the 5th to the mid 2nd centuries BC. The style and décor of fibulae as well as the way they were worn differs from region to region⁸⁴⁶. In Baden-Württemberg, for example, male graves tend to contain an almost 6 cm long iron fibula worn at the left shoulder. Women are usually found with two fibulae, one placed symmetrically on each shoulder. In southern Bavaria and Switzerland, fibulae are so popular that men are usually buried with two fibulae and women with up to seven, although two or three pieces are most common. In excavations these are usually recovered in the shoulder or chest area, distributed either on both shoulders, or all on the right shoulder. A single fibula is 5 cm long or larger. If several fibulae are discovered in one grave, they are often a combination of one large and several small fibulae.

La Tène woman from Austria⁸⁴⁷ wore a similar combination of fibulae (Fig. 224). In addition to the pairs of fibulae worn on the

Fig. 224. Graves with fibulae from the Late Iron Age cemetery at Pottenbrunn in Austria.



⁸⁴⁶ Lorenz 1978. – Maute 1994, 458–467.

⁸⁴⁷ E.g. Ramsel 2002; 2011; 2014b, fig. 15.



Fig. 225. Late Iron Age belt chains worn on the body, reconstruction. Model: Gloria Lekaj.

shoulders, there are also cases in which two fibulae were found close together on one shoulder. Men typically have only one fibula in the grave, usually worn on the right shoulder. In the Czech Republic and Slovakia men usually wear a 6 cm long fibula on the right shoulder, the women normally only one or two in the shoulder or chest area, rarely more. Two fibulae are predominantly found close together on a shoulder.

Additional clothing accessories found in graves show that the garments were also belted⁸⁴⁸. Early La Tène male and female graves contain elaborately designed belt hooks, which probably fastened a leather belt. Belt chains became popular in the middle La Tène period for women, and were wrapped around the body in a decorative way. The chains were longer than the waist circumference of women in general, so their length was adjusted by hooking a hook end into a chain link (Fig. 225). In the middle La Tène period, men preferred sword chains in addition to the simple leather belts with metal hooks.

The belt had several functions. On the one hand it gathered the material of the garments at the waist, but on the other hand, it was useful for carrying various items on the belt. Typical for the women's costume was a bag worn on the right side. Its metallic components are sometimes discovered as characteristic accumulation in the graves.

The Celt's preference for jewellery is well known. Even the ancient authors report about it in detail and further enlightening evidence comes from graves. The torque became almost a symbol of Celtic identity (Fig. 226); it is a neck ring open at the front, with often elaborately decorated ends of various shapes. Virtually no representation of Celts from antiquity⁸⁴⁹ lacks a torque. It

⁸⁴⁸ Müller 1999, 159–166.

⁸⁴⁹ Thiel 2000, 73–76.



was mostly worn by warriors, but the torque also appears especially in middle La Tène period women's burials⁸⁵⁰.

Occasional pins in the chest or head area of women's graves can be linked to the fixing of a head covering such as a veil (Fig. 227). In addition, a variety of decorative elements, especially necklaces made of glass beads, finger rings, arm, foot and neck rings⁸⁵¹ may be found in the graves. The composition of the ring jewellery in women's graves follows certain regular patterns, in terms of where on the body specific varying numbers of rings occurred. The ring jewellery patterns differ from region to region, but they may also include statements about the social position of the wearer – just like today a ring on the finger may signal an engagement or has importance as a wedding ring. Herbert Lorenz has suggested that the sets of rings incorporated in the costume may mark certain stages in women's lives, such as married women, those who had children or maybe those who were widowed. In the late Hallstatt and early La Tène periods,

Fig. 226. Golden torc from Oploty, Czech Republic (reconstruction) and bracelets, Late Iron Age.

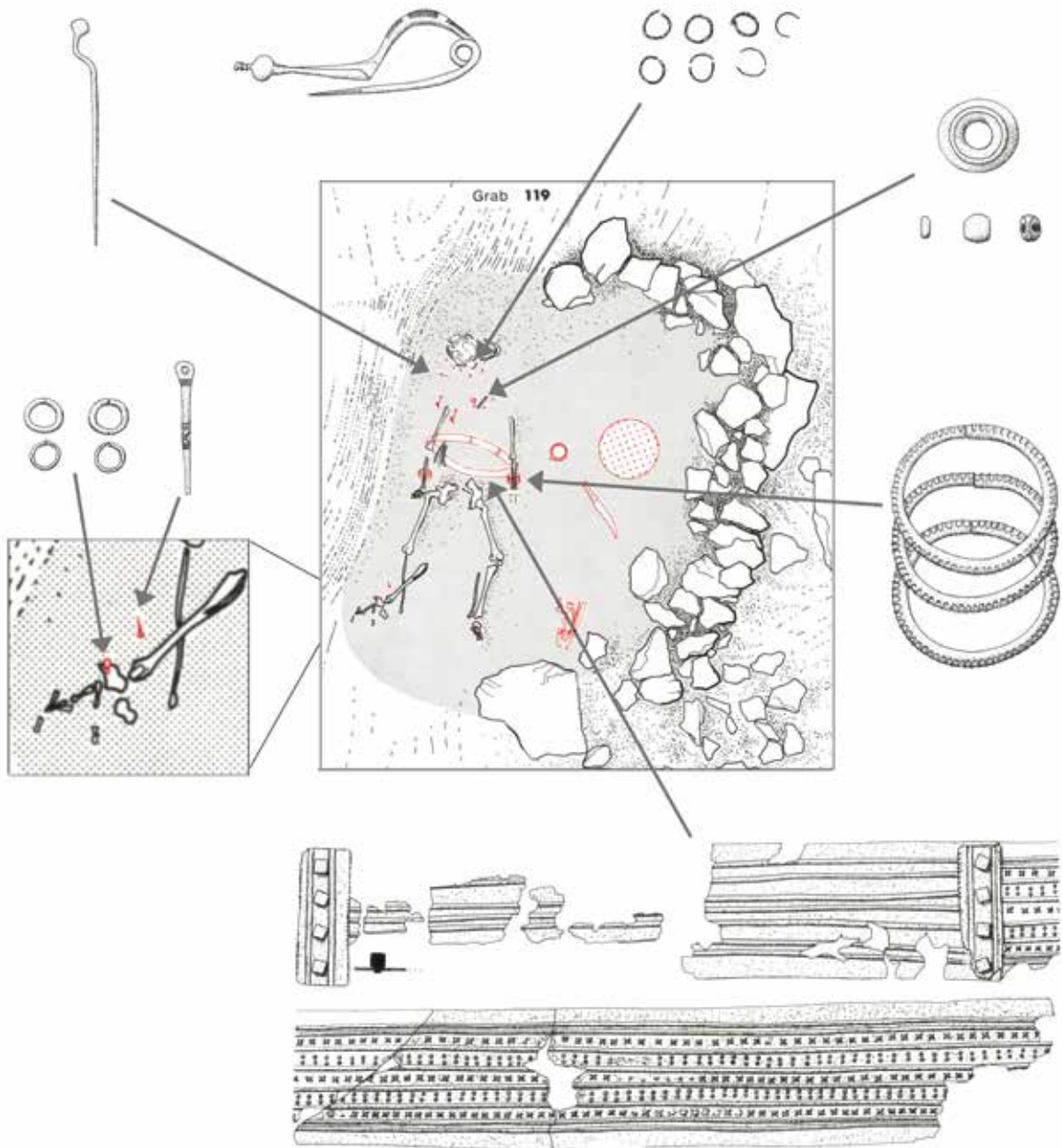
⁸⁵⁰ Bujna 2005, e.g. fig. 3, German summary 173–194.

⁸⁵¹ Lorenz 1978.

Fig. 227. Grave 119 from Dürrenberg-Eisfeld, Austria: Late Early Iron Age woman's grave with costume components (selection).

small buttons or club-shaped pendants with eyelets are occasionally found in the foot area of men's and women's graves⁸⁵². They may be associated with shoes (Fig. 227).

That a high value was placed on personal hygiene and a neat appearance is attested by various toiletry articles. In the graves



⁸⁵² Schönfelder 1999, 537–552.

of the Dürrenberg, for example, tweezers, scrapers, razors, grinding stones for sharpening the razors, and various tools for the care of fingernails are repeatedly found in male graves. Grave 44, for example, contained a two-piece toiletry set made of bronze, consisting of tweezers and a scraper, which is decorated with the head of a bearded man only a few millimetres high⁸⁵³. Evidence for late La Tène costume is sparse, because cremation prevailed at the time.

The observations presented here on La Tène grave inventories summarise basic tendencies that can be broken down in many ways – regionally, chronologically and in terms of different social levels. This, however, is the subject of many archaeological treatises⁸⁵⁴ and would go beyond the framework of this book.

Pictorial sources for clothing

Late Hallstatt and early La Tène images of women's and men's clothing are mainly found on the numerous works of situla art mentioned above. A scene echoing the situla style that was incised on a scabbard from grave 994 in Hallstatt also was discussed before. In this section we will focus on other Iron Age human representations of the 5th–1st centuries BC.

Small bronze figurines⁸⁵⁵ such as those found in Idrija pri Bači, Slovenia (Fig. 228) or on the Partinspitze near Imst in Tyrol (Fig. 229.1) complement the picture. Both examples date to the 5th century BC and show men dressed in late Hallstatt style short-sleeved, knee-length tunics. Early La Tène figurative depictions⁸⁵⁶ are otherwise found almost exclusively on objects of arts and crafts, as ornamentation of vessels or integrated into bracelets, belt hooks or fibulae. Most of them only show the human head; the previously described early La Tène fibula from Dürrenberg is particularly rich in detail. The gold neck rings from



Fig. 228. Statuette of Idrija pri Bači in Slovenia. A man wearing a tunic, 5th century AD.



⁸⁵³ Penninger 1972, 78, pl. 42 A/3.

⁸⁵⁴ *E.g.* Bujna 2005. – Maute 1994. – Müller *et al.* 1994. – Ramsel 2002; 2011.

⁸⁵⁵ Idrija pri Bači: Gustin 1980. – Imst: Exhibition Catalogue 1997. Cover photo.

⁸⁵⁶ For general points on La Tène figurative representations, see Bagley 2014, 277–282. – Frey 1993, 153–168.

the treasure of Erstfeld in Switzerland⁸⁵⁷ depict human figures alongside human-animal hybrids. As far as clothing can be discerned, they wear patterned trousers.

Early La Tène representations appear extraordinarily varied. No piece is like the other, as these are usually individual creations cast in the lost-wax technique. Celtic craftspeople modelled the objects in wax first, then covered them with clay and fired the mould. Upon firing, the liquid wax vanished and left a cavity, which was then filled with molten metal. Once the metal cooled and hardened, the mould was broken to remove the object.

At the end of the early La Tène period Celtic craftspeople discovered new forms of expression by fusing faces and ornaments into expressive symbols. These are usually very abstract and therefore not readily usable as sources for the reconstruction of La Tène garments.

The middle La Tène period representation of a man from Leipzig-Connewitz⁸⁵⁸ appears on a belt hook; it shows a man standing with legs apart and leg wraps. The intersecting lines on the legs to the thighs indicate the way the binding was wrapped. Although the image was found in Germanic territory, its style reflects Celtic influences.

Numerous figurative works of bronze were found in the middle to late La Tène period *oppida*, town-like settlements north of the Alps. The pommels of sword handles are frequently designed in human form; linchpins on chariots and wagons are sometimes adorned with human heads.

The images of gods on the famous Gundestrup cauldron found in Denmark⁸⁵⁹ occupy a special place amongst Iron Age representations. The cauldron was most likely manufactured in the centuries around the birth of Christ, but its origin is still unclear. The combination of Celtic and Thracian image elements possibly points to the Lower Danube region (present-day Bulgaria

⁸⁵⁷ Wyss 1975.

⁸⁵⁸ Frey 1993.

⁸⁵⁹ Nielsen 2005. – Taylor 1992.



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Fig. 229. Selection of human images from the 5th century BC to the 1st century AD: votive figure from Imst, Austria, 5th century BC (1), Early La Tène fibula from Dürrenberg/Hallein, Austria (2), Gallo-Roman votive offering from the sources of the Seine, Saint-Germain-Source-Seine, France, 1st century BC (3), Late Iron Age horseman from Magdalensberg, Austria (4), girl in Noric costume, tomb stone from Klagenfurt, Austria, 1st century AD (5). Different scales.

and Romania). The most striking garments represented are tight trousers; binding methods such as pointed twill are probably shown by the patterns.

Images of trousers⁸⁶⁰ are known from a bronze figurine from Neuvy-en-Sullias in France, showing a dancer with checked trousers, and the representation of a horseman from the Magdalensberg in Austria (Fig. 229.4). This Celt with sword and shield is shown with naked torso, wearing wide trousers and a torque.



⁸⁶⁰ Cunliffe 1979, 26–27, 100–101.



Both depictions date to the beginning of the Common Era, the end of the La Tène period and the beginning of Roman times.

During this time, large statues of wood and stone were created, which can be interpreted as gods. Examples include the stone reliefs from Entremont, France, the stone relief showing the goddess Epona from the Rhineland and wooden Gallo-Roman votive offerings, especially from France. These representations were, however, already created under Roman influence. A hooded cloak can be seen on a wooden figure from the headwaters of the Seine River in France (Fig. 229.3).



Even Roman period grave monuments from the provinces along the Danube and Rhine rivers sometimes provide insights into the forms of clothing that clearly have their roots in the Iron Age. First and second century AD tombstones show old, pre-Roman elements, particularly the custom of wearing a pair of fibulae on the shoulders⁸⁶¹. Examples include the grave stones of Blussus and Menimane from Mainz, Germany, and the 'Norican girl' on the famous grave stone from Klagenfurt, Austria (Fig. 229.5).

Written sources

From the 2nd century BC onwards written sources contribute to our knowledge of Celtic clothing. This 'outsider's' view on the clothing of the Celtic and Germanic tribes (the terms are sometimes equated or used interchangeably), given by Greek as well as Roman authors⁸⁶², are valuable sources, even if they sometimes just repeat platitudes or deliver ideologically biased statements. As to the appearance, body size and the light skin and fair hair are often emphasised, for example by the Roman historian Tacitus (Tac., *Germ.* 4), who writes: '*...hence their body features are all alike... reddish hair eyes cruel and blue, large strong bodies good only to strike...*'. The ferocity of the Celts is also expressed

⁸⁶¹ Böhme-Schönberger 1997, Blussus and Menimane, fig. 18. – Noric-Pannonian costume: Garbsch 1965. – Rothe 2012. – Rhine-Mosel area: Rothe 2009.

⁸⁶² Translations after <http://penelope.uchicago.edu> and <http://www.crtpesaro.it> (last accessed 30th Nov. 2014).

in the description of Celts as barely clothed. Sallust, the Roman historian and contemporary of Caesar, thus writes (Sall., *Hist.* 3, 104-105): ‘... *the Germans [= Celts] cover their unclothed bodies with skins.*’

Diodorus Siculus, a Greek historian of the 1st century BC, wrote a universal history in 40 books from various viewpoints, in which he wanted to both teach and entertain. He also mentioned the wild nakedness of the Celts, particularly during fighting (Diod., *Hist.* 5, 29.2): ‘*Certain of them despise death to such a degree that they enter the perils of battle without protective armour and with no more than a girdle about their loins.*’ Polybius, however, writes in his 2nd century BC *Histories* (2, 28.7-8): ‘*The Insubres and Boii wore their trousers and light cloaks, but the Gaesatae had discarded these garments owing to their proud confidence in themselves, and stood naked...*’ The Celtic tribes of the Insubres and Boii settled in the eastern Alps, and from the 2nd century BC onwards also in northern Italy.

Diodorus Siculus also delivered more precise descriptions of typical tribal clothes. About the Celts (Gauls), he writes the following (Diod., *Hist.* 5, 30.1): ‘*The clothing they wear is striking – shirts which have been dyed and embroidered in varied colours, and trousers, which they call in their tongue bracaе [βράκαι]; and they wear striped cloaks [σάγος, sagum], fastened by a brooch on the shoulder, heavy for winter wear and light for summer, in which are set checks, close together and of varied hues...some of them gather up their shirts with belts plated with gold or silver.*’

The historian and geographer Strabo, who worked around the beginning of the Common Era, in a time of intense contacts between the Romans, Celtic and Germanic tribes, reports similarly on the Belgae – the bravest among the Celts, as he emphasises (Strab., *Geog.* 4, 4.3): ‘*The Gallic people wear cloaks [i.e. the sagum], let their hair grow long and wear tight trousers; instead of tunics they wear slit shirts that have sleeves and reach as far as their private parts and the buttocks. The wool of their sheep, from which they weave the coarse cloaks they call laenae is not only rough, but also flocky on the surface.*’ On the elite we read later on (Strab., *Geog.* 4, 4.5): ‘*In addition to their trait of simplicity and high-spiritedness, that of witlessness and boastfulness is much in evidence, and also that of fondness*

for ornaments; for they not only wear golden ornaments – both chains round their necks and bracelets round their arms and wrists – but their dignitaries wear garments that are dyed in colours and sprinkled with gold.'

This small selection of ancient texts show a clear picture: they describe, for the most part, elements of clothing that emphasise the 'otherness' of northern barbarians in contrast to the civilized (= Roman) world. The most prominent garments for which the name is thus known are the trousers called '*bracae*' and the cloak held by a fibula called a '*sagum*'. Both were later incorporated into the attire of Romans, especially in the military, as the expansion of the Roman Empire to the north demanded suitable clothing for the local climate⁸⁶³.

5.5 Iron Age head coverings and shoes

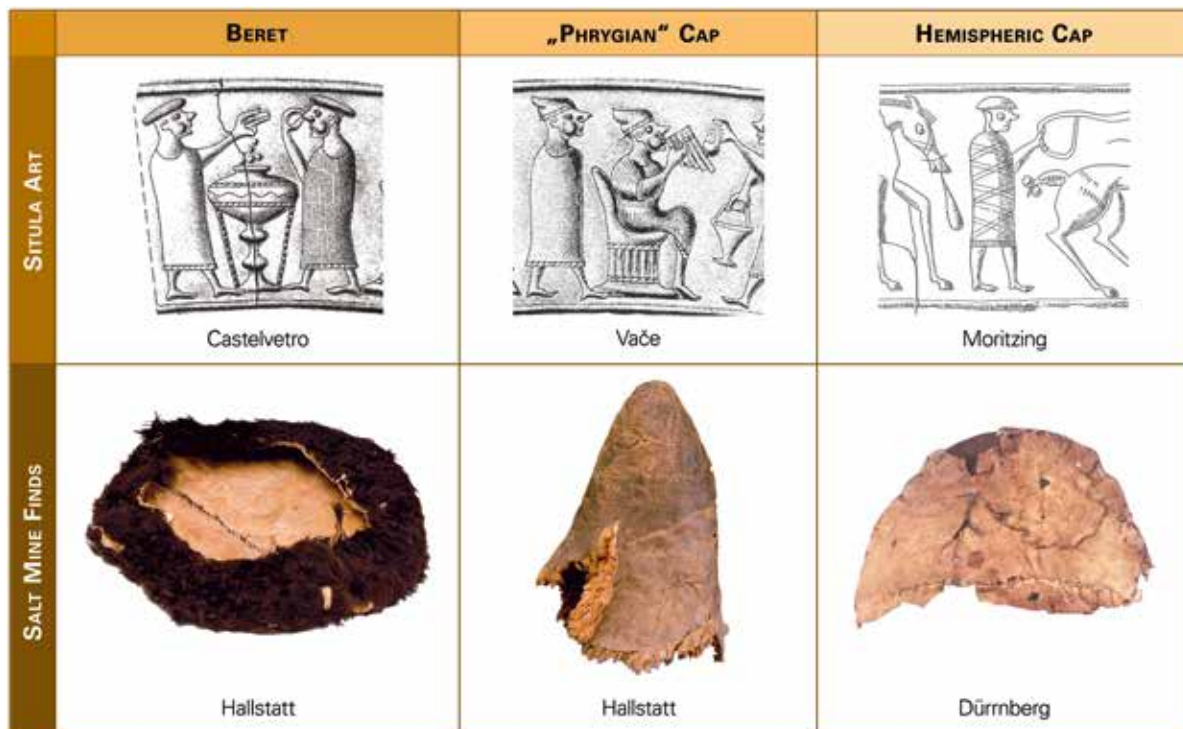
Head coverings

Anthropomorphic figures on pottery do not add a lot to our knowledge about head coverings, because they are very schematic. Especially differentiated is the headgear as shown on the works of situla art⁸⁶⁴ (Fig. 221 and 230), if people are not shown bare-headed and/or bald. Women are usually depicted with veils of different lengths. Warriors – men armed with swords and shields wear helmets of types known from contemporary finds in the same area. *E.g.* it is possible to compare helmets from Magdalenska Gora or Brezje in Slovenia (type '*Doppelkammhelm*' and Negau, 6th century BC) with depictions on the belt sheet from Vače⁸⁶⁵. Non-armed persons usually have hats of various kinds. The situla from Kuffarn shows a flat, wide-brimmed hat for a socially high-ranking person. The majority of the men on the situla art, however, are depicted with a hemispheric cap or a beret. Phrygian caps, soft conical caps with the top pulled forward, are also common in the eastern Alpine region.

⁸⁶³ For men's clothing, see Croom 2002, 31–59; – Speidel 2012.

⁸⁶⁴ Lucke and Frey 1962. – Turk 2005.

⁸⁶⁵ Kern *et al.* 2009b, 13 and 21.



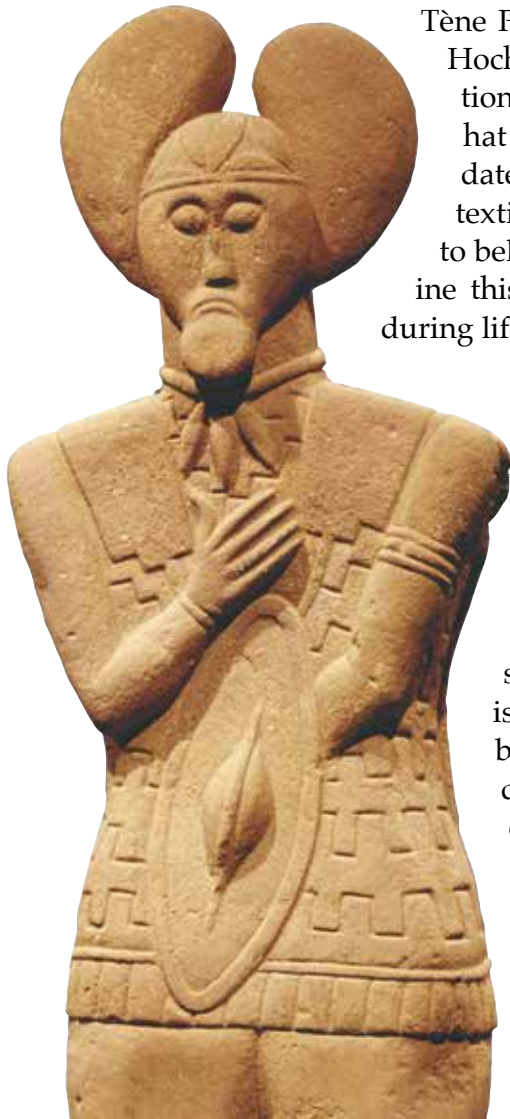
It is very interesting that we have contemporary finds from the salt mines in Austria (Fig. 230), especially of the headgear, which are all made of leather or fur⁸⁶⁶. So far, the flat cap, the beret and the Phrygian cap have been found in Hallstatt, the hemispherical (globular) cap in Dürrenberg. The Phrygian cap made of fur was worn with the hair side inwards. The beret-like caps were made of sheepskin, by gathering a circular piece with a leather strap. In this case, the hair side was worn towards the outside. All of those items belonged to the workwear of the miners from the salt mines as functional and protective head coverings. As we can compare them with the contemporary depictions, they were worn by men. There is one example among the berets found in Hallstatt that belonged to a small child – as can be seen in the size of the item⁸⁶⁷. Scarce depictions of children (situla of Kuffarn) also point to the beret type of head gear for them.

Grave finds of headgear of high-ranked male persons are known in the princely tombs of the late Hallstatt and early La

Fig. 230. Headgear from the Iron Age salt mines of Hallstatt and Dürrenberg in comparison with depictions on situlae, Iron Age.

⁸⁶⁶ Popa 2009, 105. – Stöllner 2002, colour pl. 10.

⁸⁶⁷ Pany-Kucera *et al.* 2010, fig. 8.



Tène Period in Southern Germany⁸⁶⁸. From Eberdingen-Hochdorf a pointed birch hat was found. More attention has to be drawn to the big leaf-shaped crown or hat (Fig. 231) depicted on the statue from Glauberg, dated around 400 BC. Metal wires, wood, leather and textile remains found in grave 1 could be reconstructed to belong to such a leaf-shaped crown. So we can imagine this depiction to have had a real counterpart worn during lifetime as well.

Hallstatt period inhumation graves contain a lot of bodily adornment. Typical metal objects around the head of female individuals are bronze rings and bronze pins⁸⁶⁹, e.g. at Hallstatt or Gießübel, Tum. 18, grave 6. The position of the bronze pins suggests their use as hair-pins, or as part of some otherwise perishable head-gear such as a veil or bonnet. Grave 464 from Hallstatt is remarkable because there are hundreds of amber beads around the head (Fig. 232), which may have decorated a bonnet. The Early La Tène period cemetery of Dürrenberg is representative concerning inhumation graves in this region. Metal objects as remains of headgear are very scarce, sometimes in women's graves pins and bronze rings appear (Fig. 227). In one case a very rich adorned woman wore a bronze ring around her head, together with a torques around her neck, beads of a necklace, fibulae and rings around her arms and ankles⁸⁷⁰.

Fig. 231. Glauberg, Germany, statue with leaf-shaped crown, c. 400 BC.

Like other elements of dress – the most famous being the use of paired fibulae on the shoulders and belts with metal fittings – the use of different hats, caps, veils and bonnets were developed

⁸⁶⁸ Glauberg: Bagley 2014, 415, Kat. Nr. 118. – Bartel 2002, 163–167. – Frölich 2006. – Hochdorf: Biel 1985.

⁸⁶⁹ Gießübel: Banck-Burgess 2012b, 41. – Hallstatt: Grömer and Kania 2006; – Kromer 1959.

⁸⁷⁰ Moosleitner *et al.* 1974, pl. 189.

as a habit of the local people of the Alpine region until the Roman period (province Noricum and Pannonia)⁸⁷¹.

Shoes

Shoes complete the attire. Many different shapes of shoes are known from the Central European Iron Age. In the framework of this book, a detailed overview of Iron Age shoes⁸⁷² cannot be provided, so only the most important observations are included here.

In addition to the well-known finds of shoes from the bogs of northern Europe, various shoes have also been obtained from the salt mines of Hallstatt and Dürrnberg⁸⁷³. Fritz-Eckart Barth was able to distinguish three different types (Fig. 233). The shoes are normally a type of one-piece shoe where the sole and upper leather are made from a single piece of leather, one of open-work type. Those shoes are made of raw leather, barely tanned or not at all, with cut out opening and perforated edge. The shoes have a seam on the heel and the shape of the shoe is effected by binding straps or cords. This very basic type of shoe was named *carbatina*⁸⁷⁴ by the Romans. In addition, a different type of shoe with a folded leather tongue was found in the Hallstatt Kilbwerk mine (9th to 4th centuries BC). These shoes are only sewn on the heel and otherwise consist of flaps, which are just folded over.

The leather shoe with a seam around the sole from the Pletznerwerk in Hallstatt⁸⁷⁵ (Fig. 233 right), a salt mine complex dating to around the beginning of the Common Era, is a singular find. It is the front part of a right shoe made of cattle leather, the upper

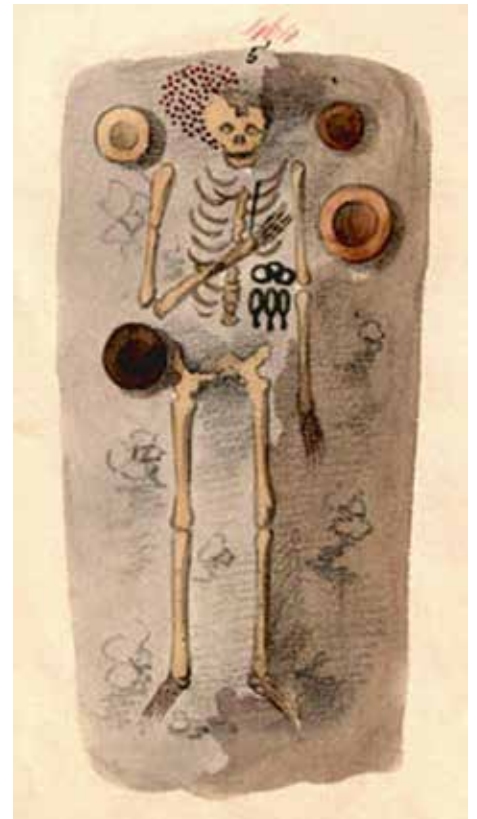


Fig. 232. Hallstatt, Grave 464. Watercolour painting from Johann Georg Ramsauer's documentation of the cemetery excavations, detail.

⁸⁷¹ Garbsch 1965. – Rothe 2012.

⁸⁷² For a general overview, see Groenman-van Waateringe 1974, 111–120.

⁸⁷³ Barth 1992.

⁸⁷⁴ Cf. Knötzele 2007, 61–64, fig. 58–59.

⁸⁷⁵ Barth 1992.

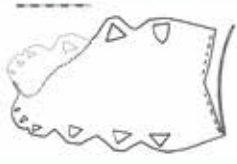





| | one-piece shoe open-work type | one-piece shoe with folded leather tongue | leather shoe with seam around the sole |
|---------------|---|---|--|
| CUT PATTERN |  |  |  |
| ORIGINAL FIND |  Dürnberg (La Tène Period) |  Hallstatt-Kilbwerk (Hallstatt Period) |  Hallstatt-Plentznerwerk (Late La Tène Period) |

Fig. 233. Finds of Iron Age shoes from Austrian salt mines.

part and sole are interconnected by a seam that can be turned. Both the cut and the use of the closed seam with grain stitching characterise this shoe as a product of a professional shoemaker.

These three shoe types were found in the salt mines, so we may interpret them as common types of working shoes for the everyday Iron Age life. Interestingly, some very small shoes have been found in the salt mines, with today's European shoe sizes 31 to 35 (UK children's size 12 to women's size 2 ½, US children's size 13 to women's size 4 ½), which likely belonged to children and women.

Another type of shoe is represented by shoe-shaped pottery. This is probably a local shoe shape with sloping instep and flat tapered point. According to research by Ludwig Pauli⁸⁷⁶, this type of shoe, a pointed shoe (*Schnabelschuh*) was especially fashionable in the early La Tène Culture, as evidenced by representations on shoe fibulae (Fig. 234) or ceramic pots in shoe shape. In the images of situla art we encounter *Schnabelschuhe* on the feet

⁸⁷⁶ Pauli 1978, shoes: 217, fig. 11. Representations of shoes: list 3, 630–631, fig. 52.

of a socially superior group of people. The golden shoe fittings from the princely grave at Hochdorf also indicate this shape of shoe, just as the various shoe fibulae, of which famous examples were found at the Dürrenberg and Vienna-Leopoldau. The 'shoe vessel' from grave 4 from Mannersdorf⁸⁷⁷ in Lower Austria (Fig. 235), the grave of a child, shows the *Schnabelschuh* of a child with laces at the instep.

Pointed shoes are generally considered a product of Etruscan influence, which was absorbed during the late Hallstatt period in the entire area of the Hallstatt and La Tène Cultures. The fact that local leather craftspeople possessed the skill to produce *Schnabelschuhe* is evidenced by the finds of craft tools. Ceramic shoe lasts, for example, have been found in Sommerein in Lower Austria⁸⁷⁸ (Fig. 236). They roughly correspond to today's European shoe size 37 (UK size 5, US women's size 7).



Fig. 234. Shoe fibula from Leopoldau, Austria, Late Iron Age.

Iron Age graves sometimes also include metal components from footwear: metal rivets or small rings in the area of foot bones⁸⁷⁹. Grave 119 from Dürrenberg-Eisfeld⁸⁸⁰ (Fig. 227), for example, is the burial of a rich woman of the late Hallstatt period, who died at the age of c. 60 years. A rod-shaped pendant was found close to her lower right leg; at each foot, one larger and one smaller ring were found. The exact appearance of the

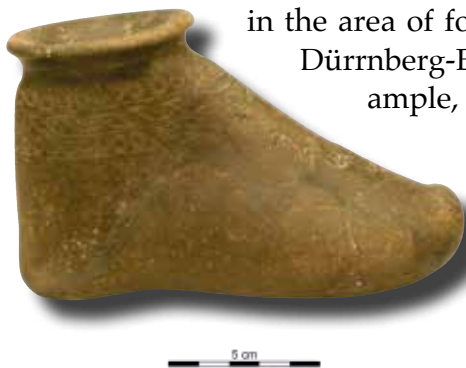


Fig. 235. Shoe vessel from Mannersdorf, Austria, Late Iron Age.

⁸⁷⁷ Ramsel 2011.

⁸⁷⁸ Neugebauer 1980.

⁸⁷⁹ Schönfelder 1999, with finds catalogue.

⁸⁸⁰ Pauli 1978, 532–533.



Fig. 236. Late Iron Age shoe lasts from Sommerein in the Museum Mannersdorf, Austria.

shoes cannot be reconstructed with certainty. It can be said, however, that rivets and little rings near the feet area of the skeleton were part of shoes that were closed (buttoned) over the instep. Especially on shoe fibulae, such as the one from Vienna-Leopoldau (Fig. 234), decorative and functional elements in round shape are shown.

5.6 Interpretation of Iron Age sources in terms of costume history

The image we create of costume during the Iron Age, based on an overview of grave finds, representations, written sources and original finds, clearly does not fully mirror the abundance and complexity of Iron Age clothing in Central Europe. In general, the clothes were very colourful, as evidenced on the one hand by original finds and on the other hand by ancient historians.

Men's costume

The images of men's clothing dating to the late Hallstatt and La Tène periods are sometimes very detailed and can be compared with original finds of garments. The upper body was covered by a long or short-sleeved shirt or tunic. These garments sometimes reached the knees and were occasionally belted, as on the figurines from Idrija pri Bači or Imst and based on finds of belts in graves. The belts are important accessory items, since their use optically divides the body clearly into an upper and lower body and thus strongly influences the silhouette of the person.

Jacket-like garments, *i.e.* open in front, are worn on early La Tène representations such as the scabbard of Hallstatt and the fibula from Dürrenberg. Men with long garments, without belts, can be found on the works of situla art. Different forms of cloaks worn over other garments were very popular. The written tradition

names these garments *saga*. Roman representations and original finds from the bogs of northern Europe indicate they were rectangular pieces of cloth held together on the shoulders by fibulae. In men's graves, a single larger fibula on the right shoulder suggests that it probably served to hold together a coarse mantle (maybe a *sagum*). The *sagum* was later adopted as a military cloak by the Romans. Hooded capes (e.g. the *cucullus* or the *caracalla*⁸⁸¹), closed at the front, were also in use; one of them is represented on the late La Tène wooden figure from the headwaters of the Seine. These hooded capes were worn well into Roman times and displayed as native costume on grave stones, for instance on the famous relief of the ship's captain (*nauta*) Blussus and his wife Menimane from Mainz-Weisenau in Germany⁸⁸², the man is wearing a *caracalla*.

The earliest evidence of trousers (or leggings) in Central Europe comes from the early Hallstatt period belt plate of Molník in Slovenia and the conical necked vessel from Sopron-Várhely, Tumulus 127 (Fig. 221). Narrow, long and patterned trousers are shown on the 'wheel-bearers' on the scabbard of Hallstatt, whereas the hunter on the belt plate of Molník wears baggy trousers. The leg wear of the figure on the Dürrenberg fibula has generous creases, just like the trousers of the mounted Celt from Magdalensberg – a much later image around the beginning of Common Era.

The representations also show that the trousers were often attached to the lower legs with bindings. Bronze pendants as we know them from the leg area in early La Tène burials may have hung on these bands. Tight Hallstatt leggings were found together with socks on the Vedrette di Ries glacier in South Tyrol. Original finds of trousers and leg wraps come from the Nordic bogs (Thorsberg, Damendorf, Søgårds Mose). They are usually dated to the Roman Iron Age, *i.e.* after the birth of Christ.

⁸⁸¹ The *cucullus* is a hood with only a short extension covering just the shoulders; the *caracalla* is the long version of the same hooded cape. Friendly comment by John-Peter Wild, Manchester, Jan. 2015. See also Cleland, Davies and Llewellyn-Jones 2007, 30, 44.

⁸⁸² Böhme-Schönberger 1997, fig. 18.

The name of certain types of garments is known through written sources: to Diodorus Siculus we owe the name *bracae*. The trousers are so clearly recognized as foreign in the Greek and Roman written sources that they almost became a symbol of barbaric northern peoples.

Nevertheless, the origin of this garment is not yet fully understood. Trousers, composed of two leg warmers stitched together in the middle, were probably developed at several different locations at the same time⁸⁸³. The earliest trousers known so far, radiocarbon dated between the 13th and 10th century BC, have been found in Turfan in China. Their age corresponds to the spread of mobile pastoralism in eastern Central Asia and predates the widely known Scythian finds. The trousers were made of three independently woven pieces of fabric, they were shaped in the correct size to fit a specific person and then sewn together⁸⁸⁴. Ancient horsemen, especially the Cimmerians and Scythians, already had trousers, as evidenced by trimmings of precious metals found in kurgans of the 4th century BC. This garment provides ideal protection of the inside and outside of the legs, particularly when riding, and can be considered as a well thought-out functional gear. Herodotus mentions in the 5th century that Medes, Persians, Scythians and Saci all had trousers (Hdt. 7, 61–64). In Greek art, trousers appear primarily to identify Scythians⁸⁸⁵.

In Roman pictorial sources such as on Marcus Aurelius' or Trajan's Column, barbarians are repeatedly shown in trousers. The toga-wearing Roman *gens togata* was thus visually distinguished from the trouser-wearing *gens bracata*. Although Romans considered trousers the essence barbarity, they were eventually adopted as a practical piece of clothing in the military. Leather knee-length trousers (*feminalia*) can be, for example, found in the Roman cavalry from the late 1st century AD⁸⁸⁶.

⁸⁸³ Von Kurzynski 1996, 131–139, with further sources and references.

⁸⁸⁴ Beck *et al.* 2014, fig. 2 and 5.

⁸⁸⁵ Gleba 2008b, 13–28.

⁸⁸⁶ Böhme-Schönberger 1997, 26. – Croom 2002, 55–57. – Speidel 2012.

Women's costume

The costume of Iron Age women is more elusive on the situla art, women are always depicted with a long robe, combined with a veil and sometimes worn belted. The body silhouette of women is not revealing; straight, austere shapes of the robed figures emphasise the vertical. It is definitely not close to the images of the draped wealth of folds, as they are known from *peplos*-wearing women on Greek representations. Representing body shapes and movement was obviously not a concern with the female characters of situla art – the figures appear static, despite scenes with motion sequences. Apart from the images on situlae, there are very few La Tène period representations of women, except for the late La Tène representations of the goddess Epona, who mostly wears a knee-length robe.

We encounter the Iron Age woman in graves as follows: Smaller fibulae in the chest area probably served to fasten the neck opening of an (under?) garment. The fibulae placed symmetrically on both shoulders are usually associated with a specific overdress, the *peplos* (see below). The fibulae may, however, just as well fasten a cloak, similar to the fibulae found individually or closely adjacent on one shoulder (see Fig. 237).

The custom of wearing upper arm rings is interesting in terms of costume history, as it may indicate that short-sleeved dresses were worn and the upper arms were bare. Conversely, they may also indicate tight, long sleeves over which the rings could have been worn. The leg rings worn over ankles may also suggest that clothing was not floor length, so that the jewellery pieces could be seen.

Skirts, shoulder capes made of fur and various sprang nets for the hair are known from the Iron Age of northern Europe. Particularly well known is a tubular garment found from the bog of Huldremose, which has been interpreted as a *peplos* by the Danish textile researcher Margarethe Hald based on the Greek garment of that name⁸⁸⁷. This *peplos* and the way it was worn will be discussed below, as it has always been considered as a

⁸⁸⁷ Hald 1980, 358–365.

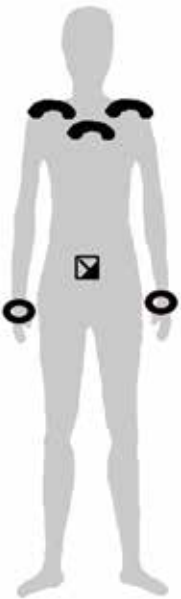
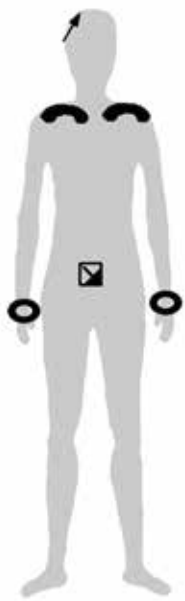


Fig. 237. Variants of costumes with fibulae and garments of the Iron Age: Free reconstructions from Grave 119 from Dürrnberg (above) and Grave 1003 from Pottenbrunn (below). Tube dress *peplos* made of checked wool fabric, green cloak with decorative stitching and tablet woven belt: fabrics and patterns according to finds from Hallstatt. Simple linen dress with embroidery from the finds from Nové Zamky. Model: Anna Palme.

characteristic Iron Age woman's garment in the relevant research and popular literature. It is a piece of clothing made of textile which was either woven tubular or square, with the cloth sewn together. It is draped around the body and folded horizontally, so that a folded flap appears. At this line, the garment is fastened with a fibula or pin at each shoulder (Fig. 238). A belt, which may, depending on the length of the flap, be placed above or below, gives the *peplos* additional support. In Greek clothing⁸⁸⁸ different variants of the *peplos* are distinguished, for instance depending on whether the side is sewn up (Doric *peplos*) or open (Ionic or Laconian *peplos*).

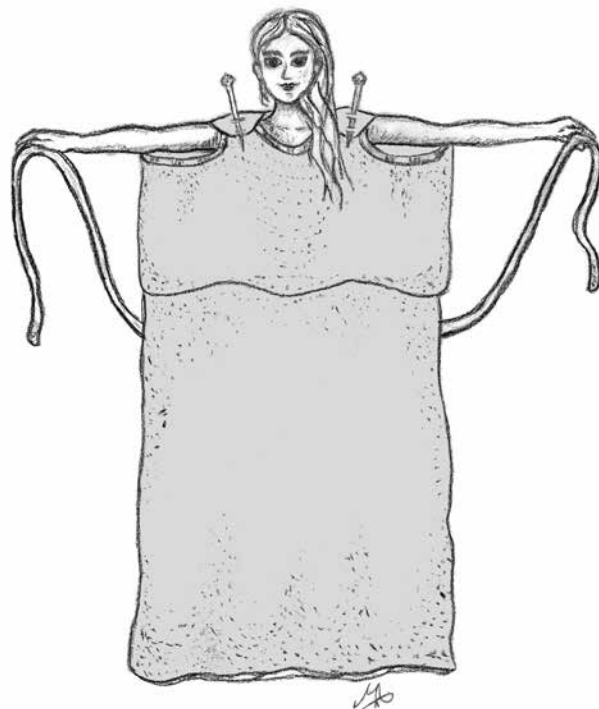


Fig. 238. Draping a Doric *peplos*.

The textile researcher Inga Hägg has dealt intensively with the question of where the *peplos* comes from and where it spread⁸⁸⁹. According to ancient tradition, the custom of the *peplos* was introduced into Greece with the arrival of the Dorians around 1,200–1,000 BC from the north. Immigration is indeed traceable through the dissemination of the Doric language groups. The *peplos* is first tangible in the archaeological record from the late Helladic III B–C (c. 1,200 BC) by large-sized pairs of pins found paired on the shoulders of the dead for the first time. It can later be seen on Greek works of art.

In Central Europe, women's costume with paired metal fasteners at the shoulders appears again and again from the Early Bronze Age (from c. 2,200 BC) to the Hallstatt and La Tène periods. Merely the types and shapes of the fasteners change, from variously designed pins in the Bronze Age to various forms of fibulae in the Iron Age. Metal belt elements are also frequently present, whether as a belt plates, belt hooks or belt chains. Thus we can ask whether it is possible that the *peplos* originated in

⁸⁸⁸ Pekridou-Gorecki 1989, 77–82.

⁸⁸⁹ Hägg 1996, 136–142.

Central Europe and spread to Greece in the 2nd millennium BC and reached northern Europe in the Iron Age.

This question provokes another one: is this garment known from the graves in Central Europe, closed at the shoulders and belted, really a long *peplos* folded at the upper side and pinned with fibulae through the fold⁸⁹⁰, or may other forms of clothing result in the same archaeological pattern⁸⁹¹ (Fig. 237)? Interestingly, neither the few Bronze Age nor the slightly more numerous Iron Age representations of female figures show a folded *peplos*. This type of garment with its characteristic fold and fastening at the shoulders would result in a rather unique silhouette. In the works of situla art, for example, rather plain dresses, with or without belt and combined with long and short veils and cloaks are shown. The draped fabric of a *peplos* is nowhere to be seen.

Only the representations of ancient Germans, such as the ones from Trajan's or Marcus Aurelius' Column in Rome dating to the 2nd century represent Germanic women in a creased, *peplos*-like garment⁸⁹², but without a fold. The same can be said for tombstones from the Danubian *limes*, the Roman provinces of Noricum and Pannonia. There the tube-dress without fold is combined with local forms of large, winged fibulae at the shoulders, various hats and veils. In particular, the paired fibulae on the shoulders are unusual for the Romans and indicate a pre-Roman tradition in this costume.

The question of when and where the rectangular pieces of fabric or fabric tubes were turned into garments such as the *peplos* is also a matter of textile technology. In Northern Europe the situation is quite clear due to the good preservation of complete

⁸⁹⁰ Antoinette Rast-Eicher's (2008) latest research doubts that the folded *Doric peplos* with flap was used in the Swiss textile material of the Iron Age. She rejects the idea based on the detection of weaving edges at the shoulder fibulae. E.g. Bern-Enge, Grave 15 and 39; fig. 41. – A tube-dress which was pinned directly at the borders to create the neck and arm opening was found in a woman's grave at Hamerum, Denmark, 1st century AD. This dress was 95 cm long and 146 cm in circumference and may have reached the knees of the woman. Mannering and Ræder Knudsen 2013.

⁸⁹¹ For different forms of clothing resulting in the same archaeological pattern see also Grömer, Rösel-Mautendorfer and Bender Jørgensen 2013.

⁸⁹² Böhme-Schönberger 1997, 45. – Garbsch 1965. – Rothe 2012.

garments⁸⁹³. Garments of the Bronze Age include blouses and skirts for women and men's wrap-arounds, all of which are characterised by the fact that they were tailored. This means that the woven fabrics were cut and hemmed to prevent fraying of the edges with many different types of stitch and finally sewn into the desired garment. This approach is clearly derived from the technique of sewing leather especially for blouses, as Margarethe Hald has impressively demonstrated. The Iron Age garments of Northern Europe, in contrast, follow different design principles. The rectangular cloth derived from weaving on the warp-weighted loom is now incorporated. This was done mostly without further cuts; cuts across the fabric surfaces in particular are now avoided. These rectangles could be seamlessly wrapped as square upper garments, scarves, veils, headscarves or leg wraps, solely secured by the drapery or with accessories such as belts, pins or fibulae. Sewn together, the rectangular cloth elements result in different coats, tunics or the sewn *peplos*. All of these forms are also typical of Greek and Roman clothing. Only the design of trousers required a more complicated cutting and tailoring technique.

Comparing the textiles from Central Europe of the Bronze and Iron Age with these findings, no such clear picture emerges. Both on the Bronze and Iron Age textile remnants from Hallstatt many tailored elements⁸⁹⁴ can be found. Curvy edges were often cut and seamed with buttonhole stitches; fabrics were cut transversely into trapezoidal shapes and assembled into a garment. The leggings and socks from the Vedrette di Ries glacier⁸⁹⁵ were stitched together from several cut pieces, building the socks in a three-dimensional structure. There is clear evidence for sophisticated tailoring techniques, which are in the Nordic area interpreted as reminiscence of older furriery techniques which are superseded by the use of rectangular panels in the Iron Age.

In the Iron Age in Central Europe, we are clearly dealing with a variety of different shapes and designs for clothing, with different technological approaches.

⁸⁹³ Hald 1980. – Mannering *et al.* 2012.

⁸⁹⁴ Rösel-Mautendorfer 2013.

⁸⁹⁵ Bazzanella *et al.* 2005, fig. 9–12.

6 The meaning of clothes and jewellery

Some general thoughts on clothing will first be presented here, since clothes serve and served different purposes during history (Fig. 239)⁸⁹⁶. One basic function is certainly the protection against environmental elements such as rain, cold or heat. Utility, however, is not the only purpose for clothing. Decoration for the wearer and the representation of status are also significant aspects of clothing. Climate, level of craftsmanship, custom and tradition resulted in different forms of dress. Clothing is also an important means of communicating statements about identity, age, gender, group membership (including ethnicity, religion), and social status (*e.g.* work clothing, clothing with regard to marital status)⁸⁹⁷. The garments including dress accessories and jewellery further create identity for the individual, but also the community. Through clothing materialise aspects of a person, whether these are aesthetic, economic, and moral values or aspects such as charisma and power. Costume also sheds light on how much public and private space existed in a community and how gender relations were organised. Visually identical garments for men and women, for instance, express different social relations than do a strong emphasis on gender differences enhanced by various items of clothing.

Clothing may also be used to alter the body and its silhouette as well as reshape its surface. Likewise, garments influence body language and options of movement⁸⁹⁸. To put it boldly: the Roman toga allows for more thoughtful and slow movements because of its wealth of fabric and draping, giving the wearer a different body feeling to wearing than the late La Tène Celt's combination of trousers and cloak, which allowed considerably more freedom of movement.

⁸⁹⁶ Cf. Bender Jørgensen 2007. – Eicher and Evenson 2015. – Lurie 1981. – Schierer 1996, 10–29, 42. – Schneider and Weiner 1989. – Wincott Heckett 2007.

⁸⁹⁷ The research project 'DressID – Clothing and Identity' under the direction of the Curt-Engelhorn Foundation Mannheim 2007–2012 had examined the function of clothing in terms of creating identity. Cultural identities and their reflection in textiles and costumes were explored starting from the Roman Empire with its archaeological, art and literary sources. <http://www.dressid.com>, last accessed 30th Sept. 2014. – See also Calefato 2004. – Roach-Higgins and Eicher 1995. – Sommer 2010; 2012.

⁸⁹⁸ Cf. Grömer, Rösel-Mautendorfer and Mückler 2012, 152–153. – See also Koda 2001.

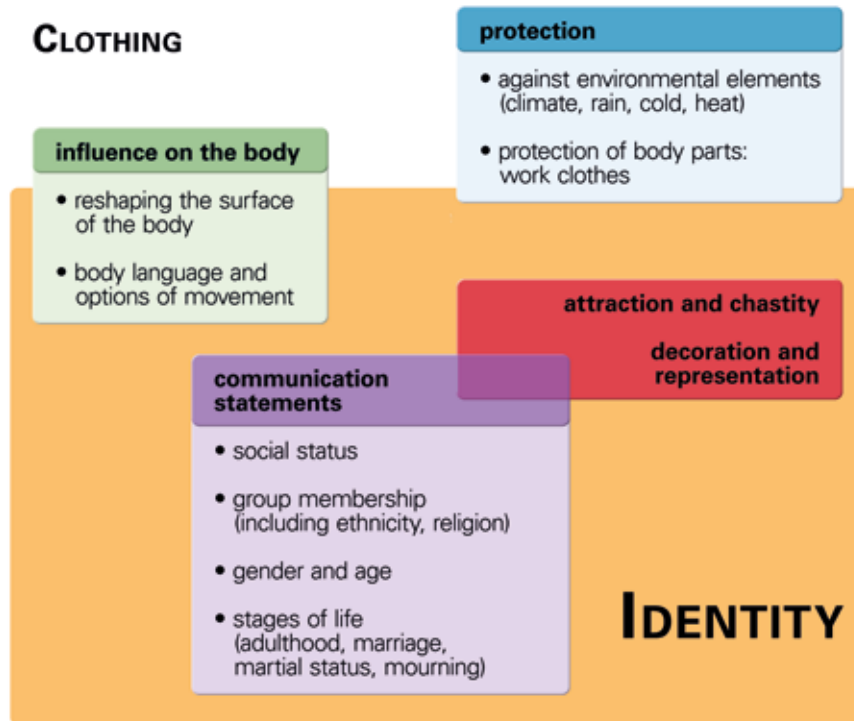


Fig. 239. Function of clothes.

6.1 Attraction and chastity

Early on, people started to ponder about the reasons for dressing. According to early moralists, clothing was invented to cover intimate parts of the body. The Bible's Old Testament story of the Original Sin (Genesis 3.7) will be familiar to many: *'Then the eyes of both of them were opened and they perceived that they were naked; and they sewed together fig leaves and made themselves loincloths.'* The texts of the Book of Moses were recorded from different traditions around c. 1,000 BC and give us an insight into the perception of morality in the Near East at that time. Nevertheless, these moral values shaped the Christian West until well into the 20th century.

The sense of shame, chastity and modesty⁸⁹⁹, particularly as represented by moralists of the 19th and early 20th century, advocates that clothing developed because people were ashamed of their nakedness. This applies, however, only to those human communities for which clothing is common. If nudity is commonplace,

⁸⁹⁹ Hirning 1973. – Schierer 1996, 10–29.

shame is expressed in a different way. Drawing on colonial ideas of dress, undress, and nakedness, Adeline Masquelier⁹⁰⁰ discusses the cultural specificity of appropriate body covering and its interpretation as moral or immoral. In the eyes of colonialists and ethnographers of the early 20th century, bodies without sufficient clothing were considered naked, hence immoral and primitive. These Westerners failed to recognise that small items of clothing such as a waist cord were sufficient dress to those who knew how to read them.

Chastity, modesty and shame are thus cultural products and depend on relative standards. Which parts of the body may be visible and which should be covered is constantly changing and not least inspired by erotic imagination. It is thus clear that during the course of human evolution, clothing was not invented out of a feeling of chastity. Chastity and its reversal – erotic appeal – are, however, essential factors in the expression of certain clothing customs. Research on this topic is particularly insightful for the Roman period, as it can include the rich written tradition⁹⁰¹. Moralizing words about how to dress can be read in treatise on dress codes and satires.

Little is deducible on the question of shame and attraction for prehistory, even when written sources are available at the end of the Iron Age. Julius Caesar writes in his commentaries on the Gallic Wars about the Suevi (Caesar, *B.G.* 4, 1.10):⁹⁰² *'And to such a habit have they brought themselves, that even in the coldest parts they wear no clothing whatever except skins, by reason of the scantiness of which, a great portion of their body is bare, and besides they bathe in open rivers.'* Describing people like that was intended to mark them as primitive. It does not say anything about what the Suevi might have felt about nakedness and modesty.

Only few examples from modern research on prehistoric clothing may be considered to elucidate the oppositional pair of chastity and attraction. The function of the famous string skirt of the Bronze Age 'Egtved Girl', for example, is interpreted by

⁹⁰⁰ Masquelier 2005, 7–10.

⁹⁰¹ *E.g.* Métraux 2008, 271–293.

⁹⁰² <http://classics.mit.edu/Caesar/gallic.4.4.html>.

Elizabeth Wayland Barber⁹⁰³ in terms of symbolising eroticism. To argue for this interpretation, she draws on a text from ancient Greece, a passage from the 14th book of Homer's *Iliad*, in which Aphrodite receives 'a girdle crafted with a hundred tassels' (Homer, *Il.* 14.181) from Hera to seduce Zeus. '... and there in it have been crafted all bewitchments – love, and sexual desire, and intimate persuasion, which has stolen away the mind of even those who think carefully.' (Homer, *Il.* 14.214–217). According to Barber the decorative apron of Homer's time (8th century BC) represents an artefact from the 'legendary Bronze Age' with symbolic and ritual, but also erotic significance. An erotic component is inherent when the conspicuously veiled and wrapped references the hidden and invisible and thus creates a stimulating effect.

6.2 Protection of the body

In his theory of climate the Greek writer Plutarch emphasises the importance of clothing as protection of the body: '*The same garment warms in the winter cold, but cools in the sun... Germanic peoples thus use clothing only as protection against the cold, the Ethiopians [i.e. Africans] as protection from the heat, but we use it as protection against both.*' (Plut., *Mor.* 691d). In this context, mentioning clothing serves to legitimise the claim to power of the Romans because they live in the most balanced part of the world.

The function of clothing as a protective **cover against the weather** is still a topic of concern⁹⁰⁴, whether one protects the body against heat loss in colder regions or from overheating in extremely hot regions. There are, however, extreme cases where people only wear little clothing despite inhospitable climate. The well-known British naturalist Charles Darwin, the founder of evolutionary theory, for instance reports that the residents of the southern tip of South America wear only body paint and a few scraps of fur in the tundra-steppe of the southern Polar Regions⁹⁰⁵. Humans can become acclimatized to cold, but only down to a critical level,

⁹⁰³ Barber 1991, 256–257.

⁹⁰⁴ Compare Eicher and Evenson 2015, 158–162. – Gilligan 2007. – Parsons 2003.

⁹⁰⁵ Darwin 1839.

below which hypothermia begins within hours and can lead rapidly to death, literally overnight.

Clothing is essential as thermal insulation by trapping air close to the skin surface, reducing the thermal gradient between the body and external environment. After Ian Gilligan⁹⁰⁶, two aspects largely determine the thermal effectiveness of clothing: first, whether a garment is properly fitted, *i.e.* shaped to fit closely to the body, including the limbs, as opposed to being loosely draped over the body. The second aspect is the number of layers, with multiple layers requiring that at least the inner layer(s) are fitted. Draped, single-layer clothing can provide only limited thermal protection, whereas fitted, multi-layered clothing assemblages are even sufficient in very cold environments. Also specific properties of raw material can be exploited for that reason. Wool, for example, when spun into loose yarns and woven into thick weave structures, can keep the body warmer than can flax fibres, because wool fibres are scaled and somewhat curly and can be made into a cloth that holds insulating pockets of air around the body. In contrast, flax will absorb body moisture and then release it at the touch of a breeze, so it can be woven into thin, light fabrics that cool the body.

In Central Europe, the change of seasons exposes the body to rapid temperature changes, which could be compensated for with appropriate clothing in prehistoric times⁹⁰⁷. It is, however, difficult to pinpoint specific summer and winter clothes in the archaeological record. Particularly striking examples are the Iron Age leggings from the Vedrette di Ries glacier, but especially the Stone Age 'alpine mountaineering equipment' of the Iceman, a fitted, multi-layered clothing assemblage as described above. These may well be interpreted as warm functional clothing. An ancient text of the late Iron Age by Diodorus refers to the fact that the Gauls used seasonally different garments: '*... they wear striped heavy cloaks, fastened with a brooch at the shoulder, heavy for winter wear and light for summer ...*' (Diod., *Hist.* 5.30.1).

⁹⁰⁶ Gilligan 2007, 501–503.

⁹⁰⁷ Cf. Harris 2012, 82–84. – Winingar 1995, 121–131.

Another aspect of clothing components is their function to protect certain body parts during manual activities – **work clothes** in the broadest sense. These would include, for instance, aprons worn by a blacksmith (*faber ferrarius*) as shown in Roman representations⁹⁰⁸.

Head coverings and shoes discovered in the Iron Age salt mines of Hallstatt and Dürrnberg in Austria clearly belong to the work clothes of underground miners due to the context of their discovery. Did these items differ from everyday garments at all? Was there a distinction between everyday and specialized work clothes in the Iron Age? We just do not know. It seems plausible that there was a special festive costume, particularly for the wealthy strata of the population. Studies conducted by the physical anthropologist Doris Pany⁹⁰⁹ on skeletal remains from the cemetery of Hallstatt revealed interesting details: The buried community in the salt valley appears very rich, as they are equipped with numerous bronze vessels, exotic imports and a wealth of jewellery. The general population spent their life there and worked in the mines; the skeletons of the dead show that even this wealth was earned by hard physical labour. The Iron Age people of Hallstatt were generally built very strong, and traces of heavy workload can be seen on the bones. Muscle marks suggest that children, young people, women and men were all involved in the salt mining process. A specific division of labour could even be determined, which could be demonstrated by the fact that men and women primarily used different muscle groups. Men were responsible for the salt mining (striking movement with bronze picks), women for transport (lifting, pulling and carrying movements). Even people buried with very rich grave goods have such changes in the skeleton.

Back to the clothes: It seems unlikely that the pins, spectacle fibulae, sheet bronze rattling pendants and sheet metal belts found in the graves were worn while working in the mine. This is underlined by the fact that (except one pin) no such items were found in the salt mines themselves. They would not only be a hindrance, but could also be easily soiled or be damaged. Was

⁹⁰⁸ Zimmer 1982, *e.g.* no. 117, grave monument from Ostia, blacksmith with tunic and apron.

⁹⁰⁹ Pany 2009, 136–141.

there a difference between functional, hard-wearing clothing for work in the mountain (possibly with a different cut?) and clothes from fine fabrics complimented by rich jewellery? Or was the jewellery simply attached to the (cleaned) everyday clothes on festive days? In the absence of appropriate pictorial and written sources, these questions must remain open.

6.3 Psychological effects of clothing

Every object that human beings produce or select for their personal sphere can be considered as objectification and expression of their identity. Joanna Sofaer⁹¹⁰ writes: '*... as archaeologists we are familiar with the idea that objects are created by people.... we are perhaps less routinely aware of the ways that people are literally created by objects and the material world, although the implications of this are profound.*' Clothing takes on special significance, since of all personal items it is literally and figuratively the thing closest to us. After the mother's skin, fabric is the first substance a person comes into contact with after birth. The first sensory experiences take place and the senses awaken. Among all materials, textiles are obviously those with which people have the most intensive direct contact and which are most intensively used⁹¹¹. They are the ones in which we immerse ourselves at night and in which we walk around during the day; we will be even buried in textiles. Textiles are so elementary, because they are the first and last material with which one comes in contact. Clothing can be understood as a second skin and as kind of personal space⁹¹². With dress we transform our biological body into a socially meaningful manifestation. People are three-dimensional beings, all of whose utterances – the acoustic, tactile, olfactory and even optical – are spatially defined; clothing provides a protective shell and supports the personal space. The shell of the clothing, however, does not create the space alone – without the person, the shell collapses, it is hollow. People and clothing together are a system of mutual interdependence.

⁹¹⁰ Sofaer 2006b, 84.

⁹¹¹ See also Bender Jørgensen 2007. – Sommer 2012, 257.

⁹¹² Antons 1999, 74–78. – Lurie 1981.

Clothing is an important means of body production and personal expression. Key priorities are the structural properties such as texture, colour and other material properties (e.g. transparent, rough, smooth, soft, hard, shiny, dull), but also the weight distribution on the body as well as the division of individual clothing items and clothing accessories (straight, round, square, closed, symmetric, etc.). Through these properties, the expressivity of clothing is defined, which is encoded in the value and symbolic system of a particular society (e.g. as solemnly, friendly, proud, dark, peaceful, hostile)⁹¹³.

The expressivity inherent in the clothing was most likely also perceived by prehistoric people and attached with values. As Susanna Harris⁹¹⁴ emphasised by taking the 14th century BC Bronze Age as a case study, different parts of Europe had different prehistoric 'cloth cultures', which probably also influenced the self-understanding of human psychology. According to Harris, all societies use cloth-type materials, i.e. flexible, thin sheets of skin, various types of plant fibres, bark or textiles that can be wrapped, folded, shaped and used for clothing and other purposes. For the Bronze Age, Harris distinguishes between cloth cultures of Scandinavia, Central Europe, the Aegean and Pharaonic Egypt. Materials are specific to each culture and thus contribute to express cultural identity.

6.4 Gendered design

Well into the 20th century in Europe it was considered as 'self-evident' that men and women could be identified on the basis of their different clothing⁹¹⁵. The style of clothes alone determined gender so much that women dressed as men could live as men unrecognised for many years. In the 18th century, for example, it is reported about a woman in South Holland: '*... on February 23, 1769, the court of Gouda sentenced a woman because of "very gross and serious misconduct" and "ridiculing divine and human laws"*.

⁹¹³ Antons 1999, 78–79. – Eicher and Evenson 2015.

⁹¹⁴ Harris 2012.

⁹¹⁵ Cf. Barnes and Eicher 1991. – Calefato 2004. – Lurie 1981. – Reich 2005, 42–43. – Roach-Higgins and Eicher 1995, 7–18.

*The crime had occurred eight years earlier, when she started to wear men's clothes, accepted a man's name and became a soldier ...*⁹¹⁶

The theme of changing gender to the opposite sex by dressing in men's and women's clothes is taken up again and again in fiction and film. The film *Yentl* with Barbra Streisand, for example, tells the story of a Jewish girl in 1904, who only succeeds in studying at a yeshiva in an Eastern European village by dressing as a man⁹¹⁷. Since the Second World War, in Europe the strict visual gender assignment by clothing has been softened more and more in the Western world⁹¹⁸. Nevertheless, even enlightened people of the 21st century stereotypically assign attributes like skirts and dresses to women and suits and ties to man.

Did a system like this also apply to prehistoric times? Was gender visible and articulated through clothes in the times of the early farmers or the pre-Roman Celts? For the Neolithic, the sources are few and far between. The complete garments of the Nordic Bronze Age clearly have different shapes, designs and cuts for men and women⁹¹⁹. The silhouettes of men differ from those of women. The legs of men wearing wrap-arounds and loincloth are visible, whilst women normally wear long skirts. Their upper bodies and waists are accentuated with close fitting blouses and girdles, while on the other hand the cloak worn by men covers the upper body, making it shapeless and more massive.

Even in the Bronze Age in Central Europe, jewellery and clothing accessories for men and women are usually different in form and shape or in their number and the way they are placed in the

⁹¹⁶ After Dekker and van de Pol 1990, 11. '... am 23. Februar 1769 verurteilte das Gericht von Gouda eine Frau wegen „sehr grober und schwerwiegender Verfehlungen“ und „Verspottens der göttlichen und menschlichen Gesetze“. Ihr Verbrechen bestand darin, dass sie acht Jahre zuvor Männerkleidung angezogen hatte, einen Männernamen angenommen hatte und Soldat geworden war ...'

⁹¹⁷ *Yentl*, movie USA 1983. Directed and produced by Barbra Streisand.

⁹¹⁸ In America, this process began in the 1930s, when women at universities such as Vassar, Bryn Mawr, Barnard and other 'preppy' schools began wearing the same clothes as young men were wearing at Harvard, Yale and Princeton. Rebecca C. Tuite 2014, *Seven Sisters Style*.

⁹¹⁹ Bergerbrant 2007, 50–59. – Broholm and Hald 1940, 146–156.

graves. Most likely, these metal objects in the graves point to different forms of garments.

Images of narrative scenes on works of Iron Age situla art can be best used to contrast the differences in the representation of women's and men's clothes, as both genders are shown together on one medium and very clearly. Primarily people shown in these images are of the elite classes, engaged in festive and possibly ritual or symbolic activities. At first glance the two genders are quite similar in the silhouette and basic form of the garments, except perhaps for the warriors. The most common piece of clothing is the long tunic or dress, worn with or without a belt. A cloak is often combined with this garment. The most obvious difference between man and woman is articulated through the headdress and not – as might be expected – through an emphasis on secondary sexual characteristics such as women's breasts or men's beards.

Women cover their heads with a headscarf or veil, which can extend over the shoulders and buttocks to the ankles. Men are always beardless and wear various shapes of hats – if they are not represented totally bald. Some carry different helmets, (leather?) armour and weapons, which characterise the warrior. In addition to the garments of civilians that conceal the body shape, there are also those that remodel the body. If men wear the combination of trousers and tunic, *e.g.* on the Hallstatt scabbard or the Dürrnberg fibula, then the body is clearly divided into head, upper and lower body. This creates a completely different body silhouette than the one we encounter with the long, flowing robes shown on situla art.

Garments for women and men are also distinguishable in the finds from Iron Age bogs of northern Europe, although they were not always found with a body: there are trousers, tunics and cloaks for men; skirts, capes or *peploi* for women. The difference between men and women can clearly be recognized – the visibility of legs versus their almost complete concealment. It cannot be determined whether this has something to do with enabling and restricting movement, or with a taboo associated with certain body regions for women.

It can be generally assumed that different clothing for men and women existed in prehistoric times, in particular in the Bronze and Iron Ages. Did these gendered ways of dressing and their visual effect define gender roles so much that they created a boundary that could not be transgressed? For times without written history, this can ultimately not be decided. Dress codes were in use in the Roman period, as appropriate clothing was seen as an important key to social order⁹²⁰. For example, wearing a toga, the sign of citizenship and honour, was unthinkable for a respectable woman. She wears a *stola* in public, without which she did not leave the house.

6.5 Social function – vestimentary codes

Social categories such as ethnicity, religion, gender, character need to be manifested in visible expressions. Dress as identity medium plays an important role here. Costume helps people to express and represent themselves; it shows a person's dignity to others. This is necessary to orient and position themselves in the social world. Costume history is thus always a reflection of social history⁹²¹. From the Roman period at the latest, even more so in the Middle Ages and in modern times, the social status and rank of the wearers can be read with reference to the cut, material, embellishment and colour of their clothing. Together with language, gestures and facial expressions, clothing is a powerful means of identity formation and self-expression. In Roman times and the Middle Ages, the social order is also reflected by clothes. Not least this is reflected by the various dress codes and laws⁹²².

Until the 19th century, public communication was choreographed and determined by information from clothes. Garments protected wearers from inappropriate communication through its function as marker of social class. The visual appearance of the textiles is most obvious to the human eye – their patterns, colouring, texture and draping – and acted as a medium

⁹²⁰ Cf. Böhme-Schönberger 1997. – Edmontson 2008.

⁹²¹ Entwistle 2000. – Roach-Higgins and Eicher 1995. – Sørensen 1997; 2010.

⁹²² Middle Ages: Reich 2005. – Late Antiquity to early Middle Ages: Schierer 1996.

of communication⁹²³. There are vestimentary codes⁹²⁴, which are regularly used and interpreted in a largely consensual way. The signal range of this code is comprised of variations of material, colour (hue, intensity, and value), and cut. The respective meanings of such combinations are the result of a socio-cultural agreement. Due to a lack of literary sources in European pre-history, we do not have direct access to the symbolic meaning of jewellery, individual garments, materials, colours, *etc.* A look into history, for instance in the Middle Ages⁹²⁵, tells us that certain colours were reserved for certain sectors of society. Expensive colours, such as purple red, for example, was the colour of aristocratic people.

Models from ethnology⁹²⁶ are also helpful. An important indicator for the differentiation of social ranks can be different fabric types and qualities as well as the amount of material used, even if the cut of the garments within a culture remains the same in broad terms. In India for instance, only the high castes and the nobles were allowed silk fabrics, whilst the lower classes were only allowed cotton and wool. Even the colour of clothing is usually not random in pre-industrial societies, but can be used to distinguish between age groups, genders, social status or professions. Similarly, emotions and feelings – for example, mourning or joy – are expressed by the colour of clothing and certain accessories and thus communicated. In ethnology, jewellery is integral to the clothing and used as a sign of group membership, status and prestige. Jewellery also serves as a sign of political and economic relations. The different stages of life (birth, adulthood, marriage, marital status, mourning *etc.*) are accompanied by special clothes and special jewellery that thus acquires a high degree of magical and symbolic meaning. In addition to the norms of a society, clothing and jewellery is always also an expression of individual preferences and creativity.

⁹²³ See Sommer 2012, 257–259.

⁹²⁴ Eicher and Evenson 2015, 270–286.

⁹²⁵ See Reich 2005.

⁹²⁶ Cf. Cordwell and Schwartz 1979. – Feest and Janata 1989, 161–163, 225–226. – See also Leventon 2008, 184–223; 256–275.

Can we – with due caution – apply such considerations on costumes from historic periods and ethnology to prehistoric times? To what extent did garments refer to the social position of a person in prehistoric times?

Using the ethnological analogies above, we can assume that elaborate textiles were reserved for the richer sectors of society in the Iron Age. In addition to dyed textiles, these are labour intensive and time consuming textiles with high thread counts and complex weaves with special decorative patterns. Textiles made with ‘expensive’ materials such as imported dyes or gold threads in particular are probably attributable to the elite. Examples were found in the Iron Age princely tombs of Hochdorf and Hohmichele⁹²⁷.

Assigning certain colour shades to social functions is more than difficult for prehistory. Most Iron Age illustrations do not contain any colour information. Even if textiles are available from graves, they are only preserved by metal mineralization and usually do not retain the original colour. In rare cases such as the elite graves from Hochdorf and Verucchio it could be ascertained that the textiles used as grave goods were primarily dyed in blue and red. Especially the red dye is very expensive in some cases, particularly if it is derived from insect dyes and had to be obtained through expensive imports. It does, however, fit the luxury good atmosphere of elite funerals. Was the use of this red colour or its imitation with the more easily available native plants such as madder a prerogative of the upper classes or available to the general population? Without written sources such as legal texts or decrees these questions ultimately cannot be answered. Information of this kind is only available from the Roman period, when purple is clearly reserved for the rulers⁹²⁸.

Jewellery and dress accessories were used to visualise wealth and prosperity from the beginning of the Bronze Age at the latest. The archaeological investigation of grave good patterns in cemeteries using inhumation or cremation is one of the basic and frequently applied methods to gain insights into the hierar-

⁹²⁷ Banck-Burgess 1999, with reference to further finds. – Hundt 1962.

⁹²⁸ Edmontson 2008, 26–29, 32–36.

chy and structure of prehistoric societies. Dress accessories and jewellery not only communicate information about the financial situation and the social position of the owner by their number, but also by their material value (bronze, iron, silver or gold)⁹²⁹.

Wearing jewellery, the shine of metal contrasting with the naturally coloured or dyed fabrics, is a matter of social representation and self-representation. Even the sounds that people make when moving and the way clothing feels varies according to the number of metal elements used⁹³⁰, *e.g.* when the soft, warm, resilient wool fabric is contrasted with hard, shiny, cold metal. In the Bronze and Iron Ages in Central Europe, women generally have more metal objects (jewellery and clothing accessories) in their graves than do men, and wealthier people have more than poor people. The individual wealth thus has direct repercussions for the physical experience of touch – at least when one appears in full costume like in the graves.

Sounds also play a role in encounters between people, and the effect is partly dependent on the metal objects a person carries. A particularly striking example is the fibula with sheet metal rattling pendants (Fig. 240) found in rich women's graves of the Hallstatt period. Examples include the two crescent bronze fibulae with ornate rattling plates and representations of animals from Grave 551⁹³¹ from the cemetery of Hallstatt in Upper Austria. It is certain that the appearance of the person should be striking not only visually, but also acoustically.

Behind some artefacts lies another interesting message, which was understood within the community jointly with the body language. Rich women of the Austrian and Bavarian Middle Bronze Age⁹³² for example sometimes have very long pins and spiked disk pendants placed on their chest (Fig. 241), whereas 'poorer' women only adorn their upper bodies with shorter pins and simple bronze spirals. Wearing spiked disk pendants does not only symbolise prosperity due to the ornamentation and

⁹²⁹ Sørensen 2010, 54–58.

⁹³⁰ Bergerbrant 2007, 62–65, 139–140.

⁹³¹ Kromer 1959, 124, pl. 105/5. – Kern, Lammerhuber and Schwab 2010.

⁹³² Grömer, Rösel-Mautendorfer and Bender Jørgensen 2013. – Wels-Weyrauch 1978.



Fig. 240. Sheet metal rattling pendants on an Early Iron Age fibula from the cemetery of Hallstatt in Austria, Grave 551. Model: Angelika Rudelics.

amount of metal used, but can clearly be understood as an obstacle to physical contact – a demarcation to a member of the elite.

In how far the garments themselves indicated membership in a particular social group in addition to the tangible evidence of jewellery and dress accessories from graves is not easily ascertained due to the low numbers of available textile material. In the Early and Middle Bronze Age⁹³³, for example, people were regularly buried with dress pins. If we assume that at least the wealthy women, those who were buried with a garment that was fastened with two pins in the shoulder region, had at least one set of clothing, what did the women wear that were not buried with metal items? Were the metal clothing accessories merely replaced by organic materials such as two wooden thorns or by cords which could fasten the clothes in a similar fashion? Or was the clothing of the 'poorer' sectors of society cut differently, for example as a simple dress, which required no further fixing by the help of metal accessories?

⁹³³ E.g. Wiegel 1994, 173–177. – Sørensen 1997, 95–102; 2010.

Only from the Iron Age onwards we find more answers to these specific questions about memberships to particular social groups. In the works of situla art it can be noted that different groups of males wear different clothes. The warriors on the situla from Certosa in Italy, for example, or on the scabbard of Hallstatt all wear short tunics, the 'civilians' on the situla from Certosa, however, wear a long garment reaching the calves concealing the body silhouette. People engaged in 'serving' activities, such as the 'waiter' on the situla from Kuffarn in Austria, are dressed in shorter tunics or just wear a loincloth. Even the hunter on the situla from Welzelach in Austria is dressed in such a way. One can therefore see a social differentiation in the clothing. Fist fighters only wear a narrow belt, but even this may be missing – they fight naked. On the situla housed in the Museum of Art in Providence, Rhode Island, USA, the folded clothes can be seen placed next to the naked fighters⁹³⁴. It is unclear, however, whether the stories shown in the pictures reflect the reality of the general population in the Hallstatt period (in the Eastern Alps).



Fig. 241. Middle Bronze Age Grave 2 from the cemetery of Pitten in Austria: spiked disks positioned on the chest and two long pins on the arms.

6.6 The value of clothing

Colour, texture, pattern, decoration and qualities such as fineness and coarseness demonstrate the visual judgements and cultural choices inherent in technological styles⁹³⁵. The manufac-

⁹³⁴ Rebay-Salisbury 2012a, 189–201.

⁹³⁵ See Harris 2012, 84–86.

ture of textiles is very labour intensive and time consuming⁹³⁶. The more complex the textile and the technique used, and the finer the quality of the fabric, the more time that is needed for its production. The question of the value of the clothes brings us to consider the value of work hours and human labour – dependent on the people who actually manufactured the textiles. For the Iron Age it is likely that mostly women were engaged in household production or responsible for spinning and weaving as specialists or in workshop production (see pages 247–261). Without written sources, the value of their work is simply not obtainable. From the Roman period, however, prices and wages become available through price edicts, ordinances or labels such as lead tags⁹³⁷. For the Central European Iron Age it can only be noted that some very valuable materials were used, be it imported dyes (Hallstatt, Hochdorf) or even gold threads (Hohmichele).

Furthermore it can be emphasised that garments, and textiles in general, were handled with care. We know of fabrics from the salt mines of Hallstatt that were carefully darned and mended with patches⁹³⁸. In addition, clothing was reworked and used for secondary purposes, for instance ripped into strips as binding material. All this proves that the ‘resource textile’, which necessitated so much labour and time, was valuable.

The value of clothing is well known from the ancient cultures of Greece and Rome, which have left many written sources⁹³⁹. In the Homeric epics, the *Iliad* and *Odyssey*, textiles represent a significant part of the total household assets. Gowns for wedding and death, family clothes and linen were part of the domestic wealth that women had to manage. Garments served both for representation in the wealthy households and as valuable gifts or votive offerings to the gods. The possession of clothes is – like jewellery – an investment, not an expendable item that was replaced after a short time. In Roman period, clothing forms an

⁹³⁶ Andersson Strand 2010a and b.

⁹³⁷ Lead tags: Martijnse 1993. Radman-Livaja 2013. – Papyri: Droß-Krüpe 2011. – Diocletian’s Edict on Maximum Prices: Lauffer 1971.

⁹³⁸ Rösel-Mautendorfer 2013, 113–115. – Grömer, Rösel-Mautendorfer and Reschreiter 2013, 130–134.

⁹³⁹ Droß-Krüpe and Wager 2014. – Wagner-Hasel 2000; 2006. – Yiftach-Firanko 2003.

important part of dowries. Even in the Middle Ages⁹⁴⁰ garments are mentioned in wills and inventories as durable valuables, which were often handed down through generations.

Is there any evidence how many pieces of clothing people would have possessed in prehistoric times? Answering this question is difficult, because we do not even know if there were special summer or winter clothes⁹⁴¹, although this is likely. Likewise, the question arises of in how far garments could be selected at will. Indirect evidence for the number of garments owned by an individual person comes again from graves, especially of the rich strata of the population. Women's graves of the Iron Age, particularly from the La Tène period, often contain very large numbers of fibulae. Many more pieces than would be necessary for fastening under and over garments in the shoulder and chest area were placed in the grave. Some burials were found with ten to sixteen fibulae in the chest area⁹⁴². In some cases, they are placed so close to one another that a deposition in a pouch or purse seems likely.

The 'record holder' for most fibulae in one burial is a woman from the cemetery of Münsingen in Switzerland, who had 26 fibulae in her grave (Fig. 242), along with a bronze belt chain and gold and silver finger rings. Whether one can deduce from the number of fibulae how many pieces of clothing the woman 'owned' is questionable but not impossible. Assuming that two fibulae are needed to close a garment like a *peplos*, the woman in grave 184 from Münsingen might have possessed at least 13 *peploi*. Such a wealth of clothes was certainly dedicated to her representational function.

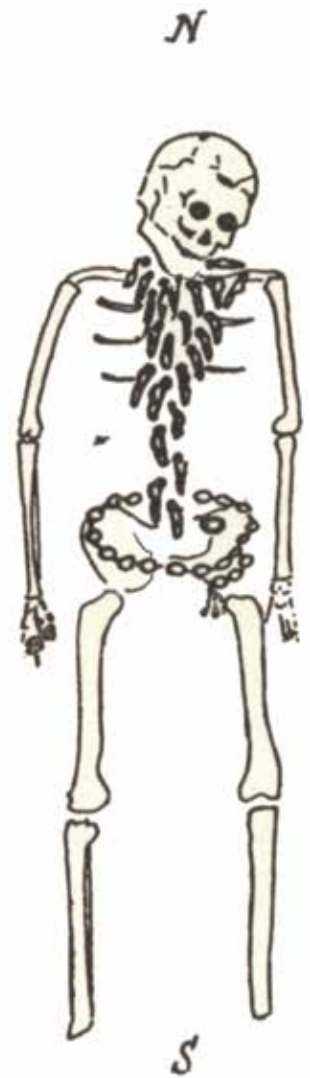


Fig. 242. Late Iron Age woman's Grave 184 from Münsingen in Switzerland with 26 fibulae.

7 Pre-Roman clothing history: conclusions

Wild, shaggy hair, primitive garments of coarsely materials, a fur coat slung over the shoulder – these are often the first im-

⁹⁴⁰ Reich 2005, 51–55, 182.

⁹⁴¹ For general thoughts on Bronze Age cloth cultures see Harris 2012, 82–84.

⁹⁴² Müller and Lüscher 2004, 108–109. – Münsingen: Wiedmer-Stern 1908 and Hodson 1968, 63.

ages that come to mind when one raises the question of how prehistoric people were clothed. This contrasts with the image of the noble, white-robed figures of Greek and Roman antiquity, wrapped in finely draped garments. The clothing of European prehistory, however, was colourful and varied, which this book aimed to demonstrate. A large number of different items of clothing can be identified. Some of these differences are due to the climates in which they have been used and found millennia later by archaeologists. Other changes in clothing are tied to the technical possibilities of the individual prehistoric periods. Particularly striking are the jewellery and the (metal) clothing accessories, which testify various fashions and fads. Clothing and costume are further the material expression of the social status of a person and their place in society.

It should be noted that there is not a continuous development from simple to complicate in the over 5,500 years spanning Central European clothing history from the Neolithic to the end of the Iron Age. It can be expected that clothing in prehistory was adapted to the situation – for summer and winter as well as for different climatic environments. A variety of materials played a role in the clothing of the people – leather, fur, various plant materials and finally woven textiles. Josef Winiinger correctly states that *'textile garments could only replace those made of animal skins due to a more efficient textile production and such could only be achieved mechanically through the invention of weaving on a loom during the Neolithic.'*⁹⁴³

Developments in the textile crafts play a major role for woven clothes in particular. Changes, influences and innovations such as weaving and patterning technologies directly influence the design of clothing and are easy to trace and observe from the Neolithic to the Roman period. Furriery techniques, however, remain significant for the design of textile clothing to at least the Bronze Age, as evidenced by the cuts of Bronze Age blouses. Tailored garments also seemed to have been popular in the Central European Iron Age, as many scraps of sewn fabrics from Hallstatt demonstrate. In contemporary artistic representations, such as the ones on situlae, no draped garments like those worn

⁹⁴³ Winiinger 1995, 121.

in contemporaneous ancient Greece can be found. Clothes tailored and fitted to the body shape protected better from the cold than the draped and wrapped robes of the Mediterranean south. Cutting and sewing played an important role in Central and Northern Europe. The colder climate also makes a greater number and variety of clothing necessary.

Nevertheless, beside fitted garments like trousers, more and more the principles of clothing design based on the rectangular panel seem to prevail from the Iron Age onwards. This shapes the way they were put on and worn and has repercussions for the appearance and shape of individual pieces of clothing as well as the overall appearance of the person, including the body silhouette. Cloaks, scarves, throws or leg wraps consisted only of rectangular pieces of fabric, taken directly from the loom without further cutting or sewing.

Clothing draped around the body was taken to the extreme by the people of Mediterranean civilizations. The most striking example is the toga (Fig. 243), the robe of state and honour of the Roman citizen. In his book *De Pallio*, Tertullian describes the toga and its drapery around 200 AD:

'First, as to the simple putting on of the pallium, it is absolutely not bothersome. Indeed, there is no need of a specialist, who, the day before use, forms the plies at the beginning and leads them in pleats, assigning the whole formation of the contracted umbo to the custody of the pincers; who, at daybreak, having first shortened the tunic (which had better been woven at a moderate length!) with a belt, checks the umbo again and if anything has gone out of line, rearranges it, lets a part of the garment hang down on the left, draws back from the shoulders the surrounding part (from which stem the folds), with its folds now ending, and leaving free the right shoulder piles it on the left shoulder yet again, with another mass of folds destined for the back, thereby imposing a burden upon the man. Now I will interrogate

Fig. 243. Figurine of a *togatus* from Carnuntum in Austria, Roman period.



your conscience: how do you feel in a toga: dressed or oppressed? Is it like wearing clothes or bearing them? If you deny, I will follow you home, and I will see what you hasten to do right after the threshold. No other garment is taken off with such relief as the toga!' (Tert. De Pallio 5.1.3, 5.2.1).

F Summary

The roots of our history, as well as the history of the textile craft, reach back to the 'dark ages', the millennia before the Ancient Civilisations and before writing. Textiles, textile production and clothing were essentials of living in prehistory, locked into the system of society at every level – social, economic and even religious.



The cultural and historical importance of textile technology, especially of spinning and weaving, can hardly be overstated. Textile crafts not only produced essential goods for everyday use, most notably clothing, but also utilitarian objects as well as representative and luxury items.

This book is dedicated to historians, costume designers, archaeologists and anyone interested in handcraft and artisanship. The temporal and geographical scope of this investigation is the pre-history of Central Europe, the period before the introduction of writing, which coincides with the Roman occupation in Central Europe. Austrian finds and sites as well as those of neighbouring countries are the primary focus.

The essential textile craft techniques that we still largely employ today date back to inventions in the Stone and Bronze Ages. A major concern of this book is to draw a differentiated picture of prehistoric textile crafts. The numerous individual production steps – not just spinning and weaving – are presented here in their entirety. The historical depth is illustrated by a variety of archaeological sources – from tools and textile finds to written sources of the Late Iron Age. From the first early agricultural societies of the Neolithic period, people developed many ingenious weaving and sewing techniques, as well as types of bindings and patterns that accompany us for the most part until today. From the Bronze Age in the 2nd millennium BC, a ‘wave of innovation’ can be noted in which the first twill weaves, dyes, colour patterns and spin patterns emerge.

The refinement of textile technologies achieved a first climax in the Hallstatt period, visible in the finer and more diverse wool fabrics of the Iron Age in comparison to the Bronze Age. The Hallstatt fabrics are of high quality, and very decoratively designed by weave structures, colours, patterns and elaborately made borders. This development was perhaps fostered by the emergence of differentiated social structures at the beginning of the Iron Age. The title of the book – ‘The Art of Prehistoric Textile Making’ – reflects the diversity of decorative techniques of textiles, since it challenges the common perception of primitive simplicity in prehistoric textile technologies.

The weave types constitute an essential design element. By their textured appearance, complex twill variants stand out against simpler plain weaves from the Bronze Age and earlier periods. Using different colours for warp and weft, the patterned effect of twill weaves is even more remarkable with its typical ridges.

In the prehistory of Central Europe, most patterns were designed to emerge during weaving. The design of the pattern goes hand in hand with their production technology. The system of warp and weft threads emphasises the vertical and horizontal directions. Stripes and checks of various kinds arise organically by using different colours for the warp threads and repeating colourful weft threads. Spin patterns are also created during the weaving process, which were very popular in the Central European Iron Age.

Creating curvy, non-linear shapes required resorting to other techniques. To achieve those, various pattern-forming entries in the weft as well as floating elements on a base fabric could be applied. The incorporation of different elements provided a wide sphere of activity for creative prehistoric people. Embroidery, sewing technology's little sister, has so far only rarely been detected in Central Europe, and yet it can be traced through the ages from the Bronze Age onwards. Tablet weaving is a special weaving technique utilising four-holed tablets that allow complicated and figurative designs. Tablet weaving had its heyday in the Central European Iron Age, and provided a rich field for creative work in pattern design: there is almost no limit for this technique, as archaeological and historical textile finds impressively testify.

In this book, every effort is made to correct the common misconceptions of prehistoric textile crafts being primitive. Questions of the organisation of production, labour division and the people involved in textile production are considered. Textiles and textile tools can give us a first indication of the level of production – starting from the level of household production in the Stone and Bronze Ages and culminating in more industrial level workshop production in Roman times. The evidence for Central Europe, albeit scanty, suggests that most textiles were produced in the domestic sphere during the Neolithic, but that specialist

weavers and mass production emerge during the Iron Age. It is also a delightful challenge, to create a hypothesis about 'the people behind', about textile producers and consumers. We can find traces in every settlement of where they lived and worked. Spindle whorls, loom-weights and needles in graves may indicate that their owners were textile workers, but also may demonstrate their special status.

Textiles were not only produced for clothing. Like today, they fulfilled a number of different functions in everyday life. We have presented evidence of wall hangings, pillows and mattresses dating back to prehistoric times. Textiles were used as transport bags in salt mines and as padding for scabbards. Even after wear and tear, the 'resource textile' – produced with so much time and effort – was handled thoughtfully. More than once, veritable 'recycling' has been observed. Discarded materials were used as makeshift binding material, as packaging material and even for dressing wounds.

The book concludes with a comprehensive chapter about clothing in prehistory. Different archaeological sources such as textile objects, rare finds of complete garments, jewellery in graves and iconographic evidence were compiled; Greek and Roman written sources enlighten some aspects of textile art at the end of prehistory. Neolithic depictions of clothed people on figurines, stelae and carvings show some representations of clothing which can be technically interpreted. But were the loincloths and aprons shown on the (cult) statuettes of the Early and Middle Neolithic reserved for ritual purposes, or were they also used in everyday life? Whether the garment of the Neolithic period may be reduced to a simple belted dress silhouette is questionable. An upper garment, open at the front, is definitely part of the repertoire; it is a basic type that is also known from the clothes of the Iceman. The way the garment was built can clearly be traced to working leather. Various hats and forms of shoes made of plant materials as well as all the equipment of the Iceman with his leggings, loincloth, bearskin hat and multi-component shoes show us the diversity of clothing in the Neolithic period. A certain optimisation and tweaking of the clothes for particular purposes may already be seen at this time.

In the Bronze Age, the lack of human representations in Central Europe drastically affects our knowledge about the forms of clothing. From Northern Europe, however, complete garments are known: women wear a combination of blouse and skirt or string skirt; men a loincloth or wrap-around and an oval cloak. The Central European dress elements recovered from graves, such as pins and metal trimmings, do not exist in this form in Northern Europe. We thus do not know with certainty which kinds of clothing they belonged to and how the garments were designed.

The Iron Age, however, delights us with numerous sources. Both the archaeological finds, the finds from graves, as well as pictorial representations in Central Europe indicate a variety of different garments. All this is complemented by original finds of garments from the centuries around the beginning of Common Era from Northern Europe: tunics, rectangular cloaks, skirts and dresses. For the first time in the history of Europe, trousers emerged – a form of garment that, like the shirt-like tunic, remained essential to the development of European fashion ever since⁹⁴⁴. Particularly interesting are the written sources by ancient authors, to whom we owe descriptions and even the names of various pieces of clothing for the first time in Central European clothing history: *bracae* for trousers and *sagum* for the rectangular cloak held together by fibulae.

Iron Age women's clothing in Central Europe certainly consisted of shirt-like (sewn) dresses, veils and cloaks; combinations of skirts and tops are also possible. The *peplos* with flap, however, is not attested in pre-Roman times. The location of paired fibulae at the shoulders, which are frequently seen as evidence of the *peplos*, can also be interpreted in various other ways. The multiple colours of Iron Age garments are noteworthy, as demonstrated both in the written sources and by the Central European textile finds – especially those from the Austrian salt mines. Various forms of headgear and footwear complete our picture of Iron Age clothing. Not all questions have been answered and we are far from being able to paint a full picture of the clothing for the whole population of each prehistoric period. First indica-

⁹⁴⁴ Cf. Bönsch 2001.

tions of individual garment shapes, footwear and headgear are, however, already possible. In the spirit of the research project '*DressID – Clothing and Identities. New Perspectives on Textiles in the Roman Empire* (2007–2012)', the book is further concerned with illuminating the importance of clothing and jewellery in the prehistoric period. Clothing not only protects against wet, heat and cold; the psychological effects of clothing as well as the social meaning, as an important medium to communicate identity and as indicator of power and status, cannot be underestimated. Like today, clothing was an important non-verbal means of communication, expressing details about its wearer such their social status, age, gender and group membership.

Today, as then, clothes had a role in identity creation for the individual and for the group. Textiles and the skill of craftsmanship with which they were created contribute much to this visual effect. This monograph interweaves the topics of prehistoric textile art, the history of the textile craft and the history of clothing.

G Appendix

Glossary
Sources
Literature
Register



Glossary of archaeological and textile terms

- Back-strap loom:** Weaving device, in which the warp is held in tension between round wooden bars. The device is fastened to a post or similar at one end, whilst the other end is attached to the body of the weaver (*e.g.* using a strap across the weaver's back).
- Band loom:** Device for the production of narrow bands, on which the → sheds are opened by means of heddle rods or a rigid heddle. The warp threads are held in tension between wooden bars.
- Basket weave:** A binding system similar to → tabby, but in which threads interlace two at a time in each direction for a cube-like effect.
- Brocade:** Pattern with extra ornamental weft, which occupies some or all of the width of the pattern.
- Bronze Age:** Prehistoric period, named after the prevalent production and use of bronze; in Central Europe *c.* 2300–800 BC
- Chevron twill with point repeat:** Variant of → twill, in which the direction of the weave changes at intervals to form zigzag lines. Adjacent zigzag stripes start and end on the same thread ('point').
- Cloth:** Cloth may be used synonymously with 'textile', but sometimes refers to a finished piece of fabric used for a specific purpose (*e.g.* table cloth).
- Clothing:** A garment constructed from cloth.
- Comb beater:** A toothed device to beat in (compress) the weft.
- Combed (worsted) yarn:** Yarn made from combed wool.
- Copper Age:** Prehistoric period, late phase of the Neolithic; exact definition and dating varies according to regional research traditions.
- Costume:** Costume includes clothing together with dress fittings (*e.g.* belts, pins or fibulae), footwear and headgear.
- Dendrochronology:** Dating method for wood based on the measurement and analysis of annual tree rings, which vary in thickness according to season, climate and year.
- Dividing rod (shed rod):** A stick used in tabby weaving on the lower part of a → warp-weighted loom to divide the front and back warp threads.

| | |
|---|---|
| Dyer's woad (<i>Isatis tinctoria</i>): | An important indigo plant for dyeing textiles. It contains precursors of the blue pigment indigotin in its green parts. |
| Dyes: | Soluble and insoluble colouring agents used in dyeing especially in textile dyeing. Few dyes are direct dyes that bind directly to the fibres. Most of the red and yellow dyes are mordant dyes such as alizarin from madder (<i>Rubia tinctorum</i>) or luteolin and apigenin from weld (<i>Reseda luteola</i>), which have to be fixed to the fibres by mordants. Insoluble organic pigments (vat dyes) like indigotin from woad demand a special dyeing method (vat dyeing). |
| Dyestuff (dyeing material): | In this book the term 'dyestuffs' means dyeing material such as madder, woad or weld. |
| Fabric: | Fabric is a generic term, referring to any material made by weaving, netting, matting, plying, twining <i>etc.</i> |
| Fleece: | The woollen coat of a sheep without the skin after plucking or shearing and before processing. |
| Floating threads: | Lengths of warp-threads or weft-threads that pass over (or under) several threads without being held down at binding points. Used to produce patterned effects. |
| Fulling: | Deliberate scouring, shrinking and felting of woven wool fabrics. The surface scales of fibres catch each other under the influence of heat, moisture, mechanical strain and milling agents. |
| Hallstatt period: | Early phase of the → Iron Age; in Central Europe c. 800–450 BC; named after the famous finds from the cemetery of Hallstatt, Austria. |
| Heddle rod (= shaft): | In → warp-weighted looms the heddle rod is the rod to which the warp-threads are attached by auxiliary loops of thread (leashes). A → tabby weave requires one heddle rod, a → twill weave at least three. On treadle looms linked shafts are used for raising and lowering warp-threads in order to create a (mechanical) → shed opening. |
| Heidengebirge: | Traces of prehistoric mining in Austrian salt mining terminology; literally 'heathen rocks'. |
| Iron Age: | Prehistoric period, named after the prevalent production and use of the metal iron; in Central Europe c. 800–15 BC. |
| La Tène period: | Later phase of the → Iron Age; in Central Europe c. 450–15 BC (Roman conquest); named after the famous finds from La Tène on Lake Neuchâtel in Switzerland. |

- Loom weights:** Clay or rarely stone weights used to hold the warp threads in tension; used on → warp-weighted looms.
- Lozenge twill:** Weave, variant of → twill, in which the oblique direction of the weave changes in both warp and weft direction, giving rows of lozenge-shaped patterns.
- Mordant dyeing:** Soluble dyes are chemically bound to the textile fibres using herbal mordants (tannins) or aluminium, iron or copper containing mordants. The polyvalent metal ions of these mordants bind both to the dye and fibre molecules forming insoluble dye lakes that are very stable and have a very good wash fastness.
- Peplos:*** Greek women's garment made of a tubular cloth, with the top folded down half way and held in place at the shoulders with brooches or dress pins.
- Plait:** A minimum of three threads are crossed over each other diagonally to form a fabric.
- Plied yarn:** Two or more yarns twisted together in S- or Z-direction
- Prehistory:** Period before recorded history or the invention of writing systems; in Europe roughly divided into Stone, Bronze and Iron Ages, ending with the Roman conquest.
- Radiocarbon dating (¹⁴C dating):** Scientific method for dating organic materials containing carbon, based on the rate of decay of carbon-14 isotopes over time.
- Repeat:** A basic pattern unit which is repeated (sometimes in mirror image) on a loom equipped for mechanical pattern-making (*e.g.* damask).
- Repp:** Weave, variant of → tabby, in which in one thread system contains at least twice as many threads per cm as are used in the other. The fabric appears ribbed. Repp is often made on band looms and used for → starting borders.
- Rigid heddle:** Hand-held device to open a → shed; can also be used to weave ribbons.
- Sectional warping:** A specific number of warp threads are prepared with a specific width and thread count.
- Selvedge:** Side border of a woven item.
- Shed, weaving:** The space between the warp threads into which the weft threads are inserted. Various devices are used to separate and lift a proportion of the threads.
- Situla art:** Figurative representations on sheet bronze dating between *c.* 600 and 300 BC; produced by repoussé and chasing (hammering from the reverse side to create a design in low relief, refining the motif from the front by punching with fine chisels).

| | |
|-------------------------------|--|
| Spindle: | Device for producing threads, consisting of a stick (spindle shaft) with a spindle whorl mounted on it. |
| Spin pattern: | Pattern created by alternating use of differently twisted (s, z) → yarns. |
| Starting border: | Start of a woven work on a → warp-weighted loom. The border is made using a band weaving technique or tablet weaving, with the weft loops pulled out much further on one side. These then become the warp threads of the main weave. |
| Sword beater: | Wooden, bone or iron blade-shaped implement to beat in the weft. |
| Tabby weave: | The simplest binding system or weave in which threads cross over each other in an unchanging rhythm. Each warp thread passes over and under one weft thread. |
| Tablet weaving: | A weaving technique that uses (mostly square) tablets with holes at each corner through which the warp ends are threaded. Rotating the tablets creates the → sheds. A characteristic of this method is that weft threads are only visible at the edges and at the 'reverse points'. Tablet weaving is used to produce ribbons and starting and selvedge borders. |
| Textile: | In a broad sense, textile is a collective term for material made of interconnecting basic components; in a narrow sense, textile refers to woven fabrics. |
| Thread count (weave density): | The number of threads per centimetre in a weave. Both thread systems are counted (warp and weft). |
| Twill: | The binding system of a weave in which the number of threads in one system is passed over and under two or more threads of the other, and the successive passages of the threads are staggered to left or right. Twills are produced on a → warp-weighted loom with several → heddle rods. Prehistoric variations of twill include warp- and weft-chevron twill and diamond (lozenge) twill. |
| Twist angle: | Indicates how tight or loose a thread is twisted. |
| Twist direction: | For both → yarns and → plied yarns the direction of the twist is described by the letters 'S' and 'Z', indicating the direction of the fibres when held vertically according to the diagonal bar of the letter 'S' or 'Z'. To better differentiate single yarns from plied yarns, the former are described by lower case letters, the latter by capital letters. |
| Vat dyeing: | Dyeing technique developed for insoluble organic pigments (vat dyes) from indigo plants (blue indigotin) and from purple (dibromoindigo and related compounds). In the indigo vat, the insoluble pigment indigotin is reduced to the soluble greenish yellow leuco-indigotin. The fabric is dipped into the vat for a cer- |

tain time and then taken out. The oxygen in the air oxidises the leuco-indigotin to the blue pigment indigotin, which is then fixed to the fibres.

- Warp:** The set of threads (warp threads) that run longitudinally through the weave. In a → warp-weighted loom, the warp threads are attached to the → warp beam and held in tension by the loom weights.
- Warp beam (beam):** The top beam of a vertical → warp-weighted loom. The beam may also be movable to allow cloth to be rolled up as the work proceeds.
- Warping device:** Device for counting, measuring and arranging the warp threads before they are attached to the loom.
- Warp-weighted loom:** A vertical device for weaving large textiles, in which the warp threads are held in tension by weights. The loom may have one shaft or several shafts, depending on the desired type of weave (→ tabby or → twill). In a single-shafted loom for tabby weaving, all even numbered threads run over a dividing rod (shed rod) and all uneven-numbered threads are tied to a heddle rod. In the natural → shed the warp threads are held in a specific position by gravity when the loom is at rest; the counter shed is created by pulling the heddle rod to lift the attached threads forwards.
- Weave:** Textile produced by interlacing at least two thread systems (→ warp and → weft) at right angles to one another.
- Weave type:** The specific structural system by which weft and warp threads are interlinked. The principal prehistoric binding systems are → tabby, → basket weave and → twill, plus their variations.
- Weaving:** Interlacing two → thread systems at right angles to produce a textile. Characteristic for a developed weaving process is the mechanical creation of a → shed using → heddle rods (shafts). Also refers to woven cloth, specifically the binding system.
- Weaving draft:** Technical diagram for the production of a weave (pattern).
- Weft:** The transverse threads of a textile that are passed through the → sheds from one selvedge to the other.
- Weft wraps ('flying shuttle' technique):** Type of pattern with threads inserted into the cloth surface during weaving.
- Wool (fibre) fineness measurements:** The diameters of 100 fibres in a yarn are measured to characterise the wool used for its spinning.
- Yarn:** Fibres that have been spun. Two twist directions, s-twist and z-twist are possible.

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Sources for dyestuff analyses (Explanations to Fig. 84)

Performance of dye analysis

- A: HPLC-PDA analysis by Maarten R. van Bommel, Cultural Heritage Agency of the Netherlands (RCE), Amsterdam, The Netherlands.
- B: TLC analysis by Penelope Walton Rogers, The Anglo-Saxon Laboratory, York, England. – HPLC-PDA analysis by Maarten R. van Bommel, RCE, Amsterdam, The Netherlands.
- C: HPLC-PDA analysis by Jan Wouters and Ina Vanden Berghe, KIK/IRPA, Brussels, Belgium.
- D: HPLC-PDA analysis by Ina Vanden Berghe, KIK/IRPA, Brussels, Belgium.
- E: TLC analysis by Penelope Walton Rogers, The Anglo-Saxon Laboratory, York, England.
- F: HPLC-PDA analysis by Jan Wouters, KIK/IRPA, Brussels, Belgium.
- G: HPLC analysis by Witold Nowik, Laboratoire de Recherche des Monuments Historiques, Champs-sur-Marne, France.
- H: TLC analysis by Penelope Walton Rogers, The Anglo-Saxon Laboratory, York, England. – HPLC-PDA analysis by Ina VandenBerghe, KIK/IRPA, Brussels, Belgium.

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Traditional textile crafts, such as spinning, weaving, and sewing, have accompanied humanity since the Stone Age. Until a few hundred years ago, textile crafts occupied a huge portion of the daily workload in addition to the acquisition of food.

Textile crafts, and weaving in particular, have contributed much to the overall development of technology. Looms were invented in the Neolithic and represent the first 'machines' of human history; even the first automated machine with punch cards was designed for weaving. Essential goods for daily use, especially clothing, as well as utilitarian textiles, ostentatious objects for display, and luxury items were produced with this craft.

Textiles were valuable, as can be inferred from the recycling of fabrics. Worn-out garments were used as binders, packaging and even as a dressing material in prehistoric times.

Clothing, however, not only offered protection against the elements. Even in prehistoric times textiles and jewellery were more than just simply means to dress – they are an essential feature of every culture.

In the past as well as today, clothing represents an important non-verbal means of communication and conveys aspects of identity about the wearer such as age, gender, social status, and group memberships.

