

## Cloth cultures in prehistoric Europe: the Bronze Age evidence from Hallstatt

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*Cloth Cultures in Prehistoric Europe is a Postdoctoral Fellowship project awarded to Susanna Harris by the British Academy. Its aim is to bring together and examine evidence for textiles and animal skins in prehistoric Europe from the Neolithic and Bronze Age. Several case studies are being examined as part of this project, including the Bronze Age Hallstatt salt mines. Here researchers working on the materials from Hallstatt look at some of the similarities and differences between the techniques applied to textiles and animal skins in their production and use in the mines.*

The term “cloth cultures” is used in this project to include the range of cloth-type materials a society uses. Cloth is defined as flexible, thin sheets that can be employed to wrap, shape and fold.<sup>4</sup> This includes woven textiles, twining, looping, netting and animal skins, whether depilated or furry. These cloth-type materials are often studied separately on the basis of their raw materials or the technology used to make them. Yet, as materials they share properties and can be used in similar ways as clothing, containers, covers for dwellings, furnishings, wrappings for objects and bodies as well as components of all kinds of equipment. The purpose of considering cloth cultures, rather than individual technologies or techniques is the potential to understand the roles and relationships between these materials in past societies. This is important in the European Neolithic to Bronze Age where these relationships are poorly understood. The Cloth Cultures project aims to shed light on the relationships between these materials in prehistoric Europe by comparing textiles and skins in contexts where evidence for these materials survives together. The unusual preservation conditions of the Hallstatt salt mines in Austria offer an excellent example (Fig. 1).

### Hallstatt: the Bronze Age salt mines

Salt mining in Hallstatt is dated from the 15<sup>th</sup> century BC onwards. Current research indicates that three huge shafts, up to 170m deep operated in parallel (Fig. 2).<sup>5</sup> Within this shaft system salt was broken in huge galleries. A shaft connected a few of these galleries lying one above another. One of these galleries, the Christian von Tuschwerk site, has been excavated since 1991 by the Prehistoric Department of the National History Museum, Vienna. From the excavations, the size of this gallery can be estimated to have been between 20 and more than 40 metres long and more than 8 metres high. Dendrochronology dating of all the wood samples that could be analysed from this mining gallery fixes the period of use to 1458–1245 BC.<sup>6</sup> Shortly

after 1245 BC the entire mining area was filled up with material from the surface.

When the galleries were mined in the Bronze Age everything that was not used any longer was just thrown away inside the mine. The accumulated debris includes piles of hundreds of burnt down wooden

mines of Hallstatt show a great degree of standardization and are highly specialized, such as the salt collecting tools and salt carrying sacks. However, it is hard to decide whether these were typical tools of the time or only provide an insight into a specialized mining technique.<sup>7</sup>

### The evidence for animal skins

Objects of fur had an important function within the working process. The examinations suggest they came from a variety of species and were probably not tanned in the modern sense of the word and in some cases were simply used as raw hide.<sup>8</sup> Because of this they should not strictly be considered leather (a term which should be used for tanned skins only) and they are referred to here as skin products or animal skins, including both depilated and hairy or furry skins. The use of a number of these artefacts has

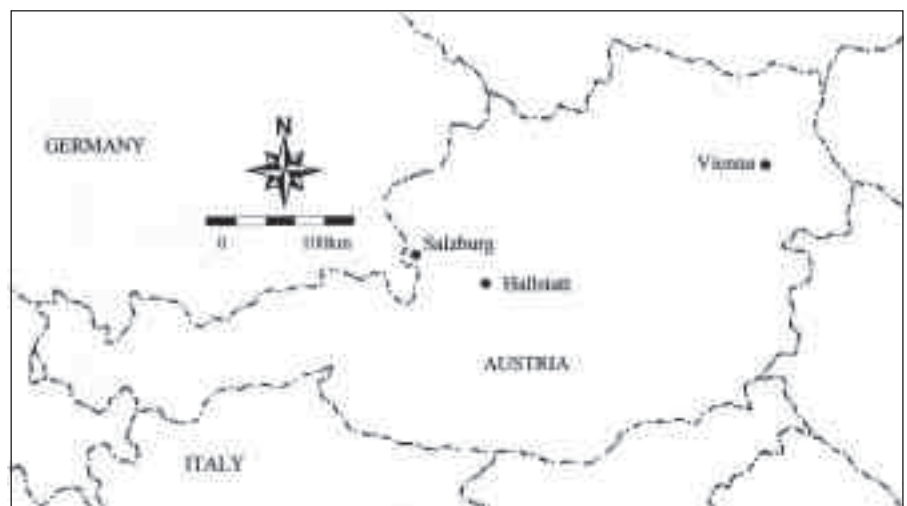


Figure 1 Location map showing the position of Hallstatt

spills of fir that were used as torches, along with broken tools, parts of the clothing, mining timbers and even complete tools. Lying on the ground of the galleries, this waste is mixed with salt, clay and gypsum, which preserves undamaged all the organic material left in the prehistoric mines (mine timber, wooden tools, strings of grass and tree bast, skin products including hide and furs, textiles, human excrement etc.). This waste – also called heathen rock – was left in the mines and has been compressed to solid rock through the pressure of the mountain. The enormous number of archaeological finds allows a reconstruction of the working process in the mining galleries, spanning the breaking of the salt to transporting the salt through the shaft up to the surface (Fig. 3).

It is estimated that the salt mining was organized in an efficient and near industrial manner with strongly optimized working and producing processes. Many of the tools used in the Bronze Age

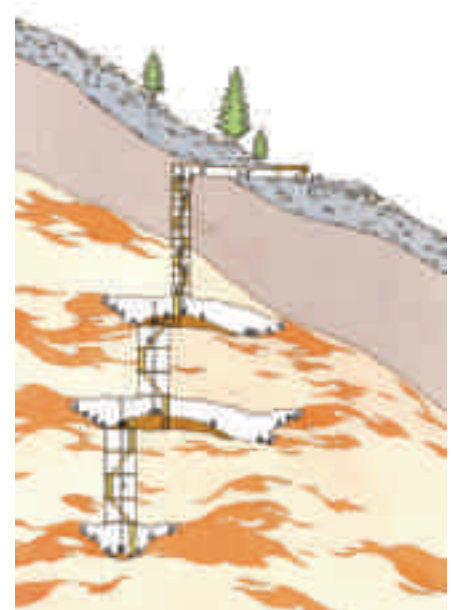


Figure 2 Section through the Christian von Tuschwerk site showing galleries and shafts, based on discoveries from current excavations and historical records



**Figure 3** Visual representation of the Bronze Age salt mining in Hallstatt based on research carried out by the Vienna Natural History Museum

been identified in association with the mining context. A sample of the animal skins from the Bronze Age Christian von Tuschwerk site was examined by Susanna Harris for dimensions, thickness, stitching and seams. They will be discussed here along with other published finds from the Appoldwerk and Grünerwerk Bronze Age areas of the mines.

#### Use of the animal skins

A number of the animal skin artefacts were recovered in their complete state, making it easy to identify their use. Carrying sacks made from cow skin were used to carry the salt from the place where it was broken to the shaft (Figs 4 and 5). There the salt was transported with thick ropes, which were handled with hand leathers – these are pads of leather strapped over the palm of the hands to protect them when handling rough surfaces, such as rope (Fig. 6). A conical hat with tassel was recovered from one of the Bronze Age galleries (Fig. 7) and skins were frequently used for straps and bindings and also used as thongs to join wooden objects. The use of other items, although recovered whole, is less clear. Of these, several examples are described as wrist straps and others as finger bandages due to the shape, size and context in the mine. The presence of whole artefacts is not only useful for diagnosis of their use: it is also evidence of how they were left or abandoned in the mine. Some were worn-

out rags, others appear to have been left in good working order; all were discarded along with piles of burnt lighting rods and other debris. Most of the skins and furs are torn and fragmentary pieces that cannot be identified to any category of



**Figure 4** Cow skin carry sack from the Bronze Age salt mines



**Figure 5** Reconstruction showing how the carry sack may have been used in the mines



**Figure 6** Hand leathers from the Christian von Tuschwerk site



**Figure 7** Fur hat (fur facing inwards) with tassel from the Grünerwerk site

object: pieces of strap, flat pieces of fur without cut edges or diagnostic features and scraps with the remains of a seam or series of cut holes.

The size of some of the items is remarkable, both because they are so well preserved and because they were left as refuse and not reused further. The carry sacks are around 80cm tall and with a top opening diameter of 35–40cm. They were cut from cow skins and would have been carried over the right shoulder on the back with a special release mechanism on the left for the salt to be poured out (see Fig. 4). Single skins were sewn together to form larger sheets, which in one case measures 1.5m wide. The thickness of the skins varies, from 2mm to less than 1mm thick, although skins were also stitched to form double layers, thereby making them thicker. These dimensions may be expected of skins from different animals or even different areas of the same skin.

### The textiles

More than one hundred fragments of Bronze Age textiles were examined by Karina Grömer in her doctoral thesis.<sup>9</sup> The stitching on the textiles is currently being examined by Helga Rösler-Mautendorfer as part of her Masters' thesis at the Institut für Keltologie at the University of Vienna. The textiles come from the Christian von Tuschwerk site as well as from the Grünerwerk and Appoldwerk. Most of them are highly fragmented – we do not have a complete piece. Surprisingly most of the pieces are wool; there are just two pieces of linen. No plied yarns (two threads spun together) were used for weaving during the Bronze Age in the material from the Hallstatt salt mines, only single yarns, although plied yarn was used as sewing thread or for the reinforcement of starting borders. The yarns are usually very coarse (1.2–2mm thick) but surprisingly very fine qualities are found too, where the diameter of wool threads are as little as 0.3mm. The main type of woven cloth



**Figure 8** Bronze Age textiles showing the range of weave types

is made in a weave structure called plain weave (also known as tabby). This is a simple alternating weave structure of one over, one under, followed in the next row by one under, one over. Beside the plain weave, warp or weft faced weaves (also called repp) are known in Hallstatt, both for starting borders and ordinary weaving (Fig. 8).

A new technical detail in weaving can be recognized in the Middle Bronze Age in Central Europe. It is the invention of the loom with more than one heddle rod, which is necessary for weaving twill. In twill weave the warp or weft may pass over or under more than one thread at a time. Worked in regular sequences through a textile this can be used to create diagonal, diamond or zigzag effects. This is achieved by changing the order of the yarns when setting up the loom or when the weft is inserted. The twill-variants from Bronze Age Hallstatt are unique but very important finds. Two of them, found in the Grünerwerk are made with flax (linen). More complicated twills such as woollen zigzag twill are known from the Christian von Tuschwerk site. The qualities of the woven fabrics fit very well into the picture that we have from Nordic Bronze Age oak coffin finds that date to the same period.

### Use of the textiles

The textiles found in the Bronze Age find spots of the salt mine Hallstatt had many different purposes.<sup>10</sup> The textiles are mostly in a very fragmentary state; some pieces were found torn into strips. Most were brought as rags into the mine, and might have been used as makeshift bonding or strips, carrier slings, handle reinforcements or to fix tools, for cleaning, or maybe as sanitary items. Some of the finer fabrics could have been part of clothes, but there are no complete garments in the prehistoric salt mines. The role of other textiles is understood through their context. As already described, the archaeological evidence indicates that the Christian von Tuschwerk was a filling station. Here, after the salt was laboriously broken up with picks, it was brought to the shaft that leads to the surface. The technological evidence and location at the filling station suggests some of the Bronze Age textiles can be interpreted as hauling bags (Fig. 9). These thick natural white-brown colour textiles have very strong edging that is sometimes reinforced with stitching, cords or a hem. The surface of the fragments often appears strongly felted. Maybe this surface resulted from the use in the mine or alternatively the textiles were fulled or milled before use in order to strengthen the texture or to make it wind- and waterproof. It is the



**Figure 9** Textile remains interpreted as hauling sacks

same process that is carried out today to make the famous *Lodenmantel* which is part of the national costume of the Salzkammergut region of Austria where Hallstatt is situated.

### Colour and pattern

In the Bronze Age salt mines at Hallstatt, the use of colour for patterning and dyeing textiles is more common than usually known for Central European Bronze Age textiles. Eight fabrics from the Christian von Tuschwerk and Grünerwerk have been analysed so far at the Instituut Collectie Nederland by Maarten van Bommel, Ineke Joosten and Regina Hofmann-de Keijzer and four were found to be dyed.<sup>11</sup> On one dark textile they detected more than five dyestuff components, such as indigotin for blue and luteolin or apigenin for yellow; these could be the dyestuffs woad and weld. Some red dyes from another sample are probably wild madder. The zigzag twill textile from Hallstatt-Tuschwerk was dyed after being woven, because at the point where the structure of the fabric disintegrated one can see that the colour did not fully penetrate the textile. This is significant evidence, as there are not many examples of dyed textiles in Bronze Age Europe. By contrast, there is no visible trace of dye or paint on the animal skin artefacts. Where the hair or fur remains attached, the texture and colour naturally distinguish items and the colour ranges from white to dark brown.

### In the detail

The animal skin artefacts provide evidence for a range of specialist and more general uses in the mine and the textiles provide evidence for the technology of weaving, but how else can we understand the role of textiles and skins during the Middle to Late Bronze Age from this evidence? Among the details that provide evidence for the varied role of textile and skins are the techniques used for stitching and seams.

In the application of stitching and seams on the animal skin items we see the techniques and energy put into shaping, joining and finishing the artefacts. All the stitching examined was carried out with skin thong, not sinew. There are a very limited range of stitches – just running stitch and over stitch – although they were used to different effect depending on their application for hems, joining seams or layering. The size of the stitches and width of the thong varies substantially. On the one hand, there are small stitches in fine sewing thread made of very narrow strips of animal thong. By contrast, there are coarse stitches made with wide strips of thong. These coarse stitches would be quick to sew in a crude but effective way and it is probably no surprise that they were used to stitch the specialist mining equipment. Fine stitches were used on the conical hat and one of the so-called finger bandages, but often items with finer stitches are just scraps. It is possible they originally belonged to clothing where the appearance of the seams was important, then reused as scraps in the mine.

The textile samples also document the way they were stitched, hemmed and sewn (Fig. 10). Four different kinds of stitches were found on the textiles from the Christian von Tuschwerk and Grünerwerk sites. Most common was over stitch (also called top stitch) and blanket stitch (also called buttonhole stitch) but running stitch and stem stitch were also used.<sup>12</sup> Nearly all textiles have just one type of stitch; a few have a combination of over stitch and blanket stitch. There are fewer seams than hems on the Bronze Age textiles and they are worked in various ways. Some hems are turned and sewn, while others are finished along the length of the edge with blanket stitches or over sewing. They are mostly sewn with plied yarn that has the same or a very similar colour to the fabric. The edge of one textile has been repaired with two different sewing threads, which do not match the

colour of the fabric. Another find displays dark brown sewing threads, which might have been chosen for a decorative effect, and an additional light brown sewing thread which resembles the colour of the fabric.

### Cloth cultures seen in a working environment

As the majority of preserved textile and skin products in the Bronze Age come from burial environments, the Hallstatt salt mines provide a rare example of organic materials preserved in a working environment. In this context, the evidence is uniquely able to show the relationship of textiles and animal skins as aspects of cloth cultures in a working environment. It is revealing that most of the skins were used with the hair or fur left on, rather than depilated. Both textiles and skins were used for rags, binding and strapping. If we compare the deposition of textiles and skins in the mines, we see a contrast. The animal skins were left in the mine in much larger pieces than textiles, and sometimes as complete artefacts. The textiles remain only as rags with no complete garments or containers yet recovered. One explanation is that the materials were valued differently; with skins of less value and therefore less worth recycling than the textiles. But the contrast of coarse and fine stitching on the skins suggests that the skins could be used at different levels, with a rough distinction between the items made with large stitching used for mining equipment and the fine stitches used on the hat and on other items and rags. The technical similarities between the stitching on the skins and textiles are noticeable. At one level, the stitching techniques of skin working and textile working are closely related: the same stitches are used on both. The textile techniques are more varied, however, with the addition of stem stitch and blanket stitch, which is suited to hemming edges that may fray,



**Figure 10** Stitching types from the Bronze Age mines

such as occur on textiles. The application of colour only to textiles contrasts to the skins, where the texture and colour are provided only by the natural animal hair.

#### Future research directions

The annual excavation programme by the Vienna Natural History Museum continues to excavate in the Bronze and Iron Age areas of the salt mine. No doubt, new discoveries and research programmes will add to the growing knowledge surrounding the materials from this unusual preservation context. This is just one of the case studies for the comparative Cloth Cultures project. Other studies currently under way include those of cloth preserved in the oak coffin burials of the Nordic Bronze Age and of wall paintings depicting cloth in the Minoan and Mycenaean worlds.

#### Notes

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