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Narrow bands and a looped-pile tablet-woven band from an Early Modern industrial context in Austria

Katrin Kania and Beatrix Nutz

Abstract

The excavation of the miner's house at the copper mining site “Im Blindis” (East Tyrol, Austria), in operation from 1531 (first written source) until 1715, at an altitude of 2300 metres above sea level, unearthed numerous textile fragments. Among those finds were two narrow bands and a broad tablet-woven band with pile on one side. The narrow bands both have knots indicating that they were used to tie something, maybe hauling bags. The broad band might have served as a carrying strap with the pile as padding.

Most published tablet-woven bands are made from precious materials, often with complex patterning or brocading. The technique also lends itself to making simple and very sturdy bands that can still be decorative as well. The Blindis find with the looped pile is among the rare examples of these more mundane tablet-woven items, which were probably much more common than the number of archaeological finds suggests. The two narrow bands are included as well, as examples of simple, mundane bands for practical use.

Keywords: narrow wares, weaving, tablet weaving, reconstruction

11.1. Archaeological context

The archaeological investigation of the mining area and of the miner's house "Im Blindis", East Tyrol, Austria, took place in 1991 as part of the creation of the "Hohe Tauern" National Park. The site lies at an altitude of 2300 m above sea level, above St. Jakob in Defereggen. In 2016, a re-evaluation of the textile finds was carried out, sponsored by the National Park.

The mining of copper ores in the mining area "Im Blindis" probably started in the Early Modern Period. The first written record of the area dates to 1531, mentioning "Am Plintis" in the mining books of the mining judge of Matrei in East Tyrol. The site was in operation from the 16th to the 18th centuries; the end of the mining activities can be dated to 1715 (Ladstätter 1972; 1977)

The excavation of the miner´s house at the site unearthed 1560 textile fragments. Most of these textiles were knitted, plain woven, or twill woven fabrics belonging to miner´s apparel, bags, or blankets. Textiles like these can also be found at contemporary mining sites in Austria (Nutz 2015;

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2016; Bachnetzer et al. 2017). Some narrow bands of undetermined use were found, as well as a broad tablet-woven band which does not have a comparison to date.

Our aim was to look at these bands to find out how they were produced. The band with looped pile is certainly an unusual item and deserves attention, while the narrow bands are examples of simple, practical bands without decoration or special features. This "normal" and mundane type of textile is exactly the kind of textile usually not examined in detail, even though it may yield valuable information about the yarns and techniques used for simple textile items or simple clothing in daily life. As these simple everyday pieces made up the bulk of items used in the past, and fragments of them are also the most common finds, they do deserve our attention as researchers.

11.2. Band B 1 with loop pile

Band B 1 is a rather unusual item. It is clearly tablet-woven, showing the telltale cords formed by turning weaving tablets. This results in the formation of a cord for each tablet; these cords are held together by the weft thread.

B 1 is a wide, thick piece that has a rather uneven pile made up of threads on one surface. The band might have been used as a carrying strap, with the pile serving as padding for the strap – though other uses (as a belt, for instance) are of course possible.

Figure 1. Band B 1. (Photograph: authors)

Band B 1 (Figure 1) is preserved in a length of ca. 56 cm and a width of ca. 7 cm. The width is made up by eleven surviving warp cords, with small remainders of a twelfth cord in some places. However, the band was probably wider originally. The weft thread sticking out of the side of the band at least hints at this, as it is considerably longer in places than would be needed for just twelve tablets in width. Judging from the remaining length of the wefts, there might have been up to nine more tablet cords in the band which are now gone. One end of the band is frayed, as the weft thread is completely missing there.

The band consists of threads that today range from light to dark brown and almost black colours, with a strong to very strong z-twist. The yarn thickness is about 1 mm in diameter. The weft thread, which can be seen in some places on the back of the fabric as well as on the sides, is a single yarn ranging from medium to light brown in colour, also z-spun. The weft, however, shows a very low twist. All of the surviving band shows the cords formed by the tablets twisting in a z-direction.

The band with pile on one side was not created using the method described by Peter Collingwood for working a band with pile, where two packs of tablets are used, one forming the main warp and one forming the pile (Collingwood 1982: 356–357). Instead, examination of the band revealed that there is only one warp, and the pile is formed from this main warp.

The band structure is made using only two elements per tablet. Sometimes both elements in one tablet are the same colour, sometimes each element is coloured differently. They all consist of several individual threads, in this case six single z-spun yarns per hole, for a total of twelve yarns per tablet. In some places, one of the two elements making up a tablet cord is now missing.

The pile might have originally been formed by twisting threads together as they are in the warp, forming a multi-element ply. In a few places in the band, this formation is still visible close to the band surface. In most places, however, the individual threads from the tablet weave element have split up and are now a slightly matted, unordered mass of threads. They usually have a length of somewhere between 3 and 5 cm.

The thread bundles forming the pile seemingly come out from between the cords making up the band, and they have similar colours to the ground weave. The damaged parts of the band, where the weft thread is missing, show that the pile is formed by the main warp itself, as there are broken-off tufts coming out of the unconnected cords (Figure 2).

The pile is formed during weaving by pulling up the bottom element of the weave, twisting it, and going through the loop with the weft thread to fix the twist in place. To keep the pile loop open and the desired size, a rod or stick is inserted. The tablets are then turned 180° before the next weft is inserted. After a few more wefts, the stick holding the loop open can be removed (Figure 3).

Pulling the loops up causes irregular tension in the individual elements, which can be seen as irregularities in the twisting of the two elements around each other. Similar distortions appeared on the back of the test weave (Figures 4 and 5).

The band can be woven with different tablet setups, which are always all threaded in the same direction. It is possible to use six-hole tablets, with two threads running through each of the holes. Also, it is possible to use four-hole tablets, with three threads running through each of the holes, or

Figure 2. Two tufts of warp threads coming out of a loose cord. The tufts are the remains of the pile loop formed by one element of the cord. (Photograph: authors)

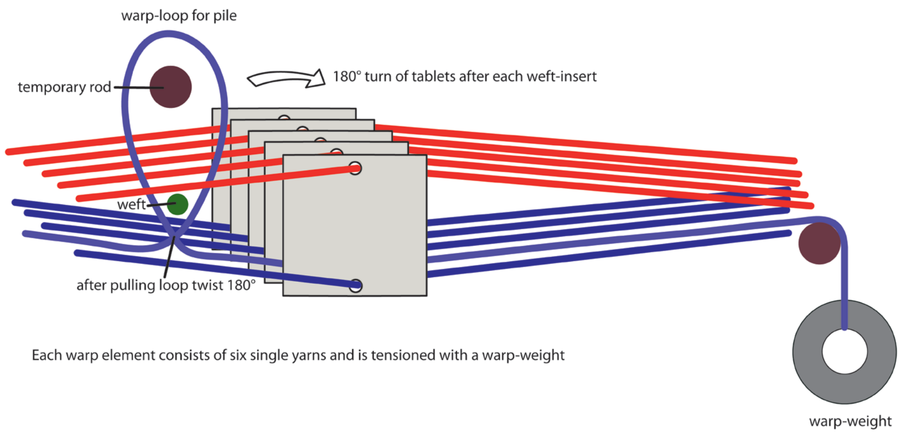

Figure 3: Schematic of weaving B 1. (Image: authors)

tablets threaded in only two holes with all six of the threads for each element running through one hole. In the weaving tests, it was easiest to turn the tablets when all elements were running through a single hole, though, especially if the holes were in the middle of two sides on square tablets.

Judging from the preserved length of the pile threads, which are mostly between 3 and 5 cm, an original loop length of about 5–6 cm seems to be a reasonable assumption. This would mean about 12 cm of warp element taken up by each loop that is formed. As the pile loops thus take up quite a lot of yarn, it proved to be easiest to weave if each of the elements was tensioned by an individual weight instead of tensioning both elements of one tablet with a weight.

If the loops were not cut after weaving, uneven wearing through of the pile loops could have occurred, so that a slightly shorter loop length might also have been woven originally.

The loss of some parts of individual elements, clearly visible on the back, must have occurred when some of the pile was forcefully pulled out of the band, taking the part of the element anchored in the band with it. This either happened when the band was already so worn that the uncut loops had all worn through, or the pile loops were cut open after weaving the band.

There was no clear pattern of the pile looping discernible in our first examination of the band. With the matted and disordered state of the pile threads, making out where exactly the loops were pulled is very hard, and the distortions on the back of the band are not clear enough to tell from the back alone. In addition, the missing elements obscure the number of loops that were pulled from the corresponding tablet.

Figure 4. Closeup of B 1, showing pile threads and distortions on the back of the band. (Photograph: authors)

Figure 5. Test weave, showing looped pile on the front (A) and distortions of the cords on the back face (B). (Photograph: authors)

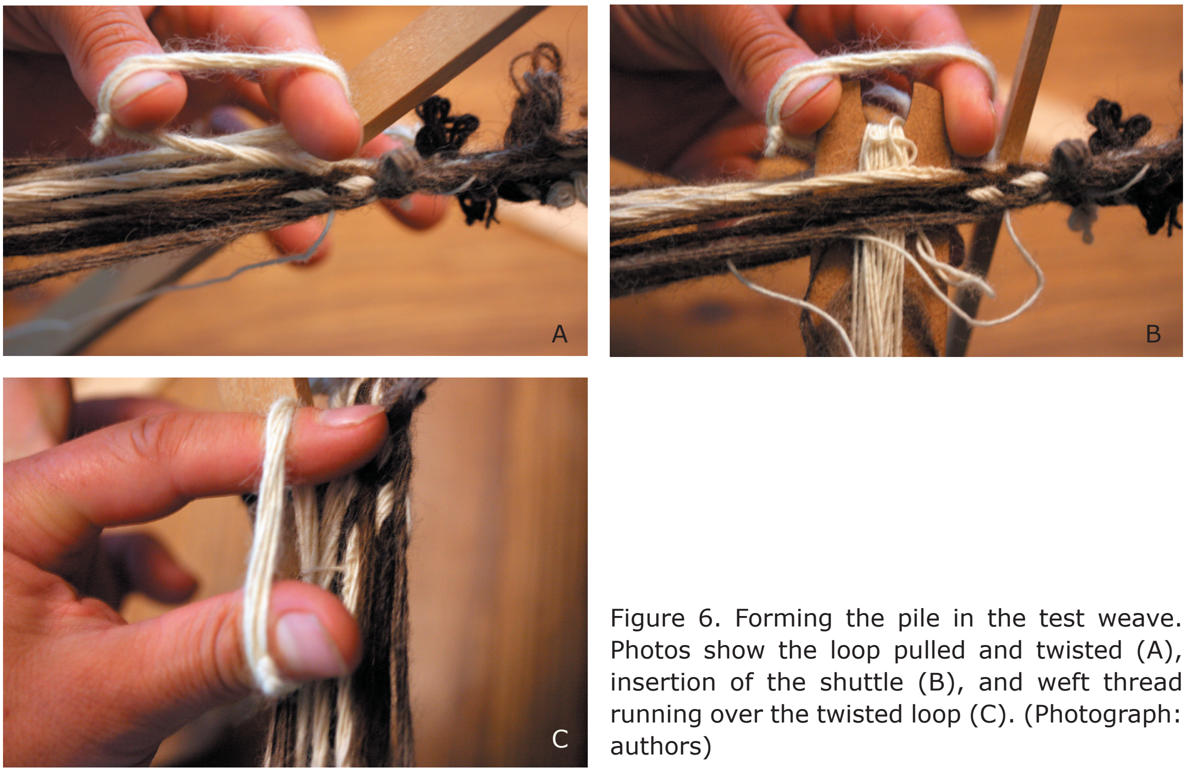

Figure 6. Forming the pile in the test weave. Photos show the loop pulled and twisted (A), insertion of the shuttle (B), and weft thread running over the twisted loop (C). (Photograph: authors)

Making this type of band in our test runs proved to be simple, especially with tablets threaded through their sides instead of through the corners. Making the pile loops and anchoring them with the weft thread was a little fiddly in the test weave. However, the loop size used in the tests was only ca. 2–3 cm in length, compared with the at least 4 cm of the original, and thus considerably smaller. Larger loops may improve how easily they can be formed. Making several loops in the same weft pass also increased the difficulty; considering this, it would be very interesting to look at the band again and try to discern whether only one or several loops were pulled in a single weft pass.

It was important to leave the rod in the loops long enough to prevent its shrinking as weaving continued. Even with the small loop size used, the uptake of warp was considerable as the pile was formed (Figure 6).

11.3. Narrow Bands B 967 and B 1396

Two other bands found at Blindis, Inv. No. B 1396 (Figure 7) and B 967 (Figure 8), are both narrow and unpatterned. Their surface structure is similar.

B 1396 has a surviving length of 21.0 cm and a width of about 0.9 cm. B 967 is even narrower, with a width of only 0.5 cm. It has a surviving length of 16.0 cm. Both appear to be an overall brown colour today.

The threads used for B 1396 and B 967 are smooth, tightly twisted z-spun single yarns. They are made from a mixture of lighter and darker fibres. No fibre analysis was completed, but from their general appearance, they are probably wool fibres. The single threads are about 0.5 to 0.7 mm thick. In B 1396, the warp threads lie in pairs; they run more or less parallel to each other and do not form a plied thread.

The same or a very similar material was used as weft thread, again with the threads taken double or possibly plied together. As the weft is only clearly visible at the turning points on the sides of the band, it is not possible to determine with confidence if there is consistent ply twisting throughout, or if the threads lie parallel to each other. The weft thread was not always beaten in firmly enough to lie perpendicular to the length of the band, forming a slight zig-zag curve instead.

B 967 appears to be made in a similar style and from a similar material as B 1396, although it is narrower in width. The warp threads in this band are not paired, but single, with only six warp elements altogether. Both bands do not have the typical look of a tablet weave, but they also look quite different compared to a plain woven band B 1168, found at the same site (Figure 9). This band consists of similar materials, being 19.5 cm long and 0.9 cm wide.

The use of these bands is unclear. They do both have knots, which indicates that they were used for tying something. Whether this was tying closed hauling bags for ore, tying things together, or for a similar use in the mines or to tie items of clothing or other pieces cannot be seen from the knots alone. One of the bands was found on the mining waste tip, indicating that it may have been used to tie bags.

Both bands show distinct ridges on their surface, an effect created by the relatively thick weft thread that was used. The weft seems to be thicker in comparison to the warp in band B 1396, although less than in B 967, making the ridged effect in B 1396 more pronounced. The width of band B 1396 is irregular in some places. Both the irregular width and the fact that the weft was not beaten in to lie parallel in all places might all indicate that B 1396 was woven quickly and without much care.

Figure 7. Blindis Inv. No. B 1396. Bottom: Microscope images (magnification 30x, Dino-Lite-Microscope. (Images: authors)

Figure 8. Blindis Inv. No. B 967. Bottom: Microscope image, magnification 30x, Dino-Lite-Microscope. (Images: authors)

11.4. Tablet weaving or heddle weaving?

The visual appearance of both bands, but especially B 1396, gives an impression of a diagonal slanting of the threads on the surface in some places, while in other areas the threads lie completely parallel. Additionally, it appears that the threads sometimes overlap more than would be expected for a repp band.

Slanted and parallel threads in a band is an effect that is typical for tablet-woven structures and occurs when the direction of twist is reversed. When the tablets are turned in one direction, the threads from each tablet form a cord, with the individual threads of the cord running over its surface in a diagonal line. The weft thread locks this twist, and with it the slant of the threads, in place. When the twist direction is reversed, the threads lie parallel over one weft thread, while slanting in opposing directions to the left and right side of this reversal point.

The visual slant of the threads led us to assume that the bands were tablet-woven as well, like the band with a looped pile. To explore this, tests for replicating the bands with tablets were made at the European Textile Forum (Kania and Ringenberg 2013) in Lorsch, Germany, 2019. For the reconstruction attempts, the bands were accessible for checking and cross-referencing results with the original; this is usually considered the best case for technical analysis and reconstruction.

As the threads in the band appear to run in pairs, for the reconstruction attempt with tablet weaving as a technique, all tablets were warped in the same direction and threaded with four threads, but only in two corners, diagonally opposite of each other, instead of in four corners. Weaving was tried both with double holes in the tablets, with one thread in each hole, as well as with running two threads through one hole. Examples for tablets with double holes at the corner can be found among the wooden tablets recovered in the Oseberg burial. The Oseberg textile finds also include band 34D which, according to reconstructions made by Bente Skogsaas (2019), was partly woven in plain weave using tablets threaded in two holes. This is possible by turning the tablets 180° forwards once, then 180° backwards for the next pick. Structurally, this gives the same result as using heddles – the threads do not form cords in this case due to the reversing direction of twist.

The differences between threading through a single hole and through double holes were subtle, but using the double hole variation seemed to come a little closer to the look of the original. The method used was the following: all tablets were aligned so that the filled and empty holes alternated. All tablets were then turned 180° in the same direction before the weft thread was inserted. We focused on B 1396, and our test weaves were made with five tablets.

Figure 9. Blindis Inv. No. B 1168. Bottom: Microscope image, magnification 30x, Dino-Lite-Microscope. (Images: authors)

As the threads used for the test weave were not as smooth as the threads of the original, the band did look a little different. We ended up with a proposed technique that used tablets turning in a single direction, turned 180° after each weft, with the tablets aligned so that an empty hole in one tablet sat next to a threaded hole in the next tablet. The result of the test weave is shown in Figure 10.

The result seemed convincing enough to the authors and other people present at the conference. But sometimes a fresh eye is needed; after presenting the bands and the reconstructed weaving method at NESAT, a colleague pointed out that the threads in the original do not form the cord typical for tablet weaving, but instead remain parallel as in a heddle-woven band.

This became clear and easy to see by colouring in the threads in a photograph of the band (Figure 11). The different colours of the fibres used for spinning the threads, the slightly uneven weaving, and the band surface with some stray fibres sticking out make the actual structure hard to read, as the eye is easily distracted trying to follow the threads. In B 1396, the weft thread forming a slight zig-zag also adds to the visual impression of slanting threads.

In this case, using a photograph as the basis for analysis of the weave structure instead of looking only at the original band proved to be a better way. Colouring the single elements eliminates the distracting effect of the diagonal pattern made by the zig-zagging weft thread, the lighter and darker fibres in the individual threads, and the irregular crossings of the two threads forming each warp element.

Structurally, band B 1396 is thus a plain weave band, using five paired threads per shed. On the image of the band that was used for the re-evaluation, however, there is a thread standing out, looking a bit like it might be a weaving fault. It is also visible on Figure 11, the second thread from the left in the lower blue pick on the right-hand image. Here, it looks like one of the warp threads crosses over the "dent" between weft threads, disappearing into the band on or after the next weft.

If this were the case, this thread would form a very curious weaving fault. Not catching a warp thread in the correct shed is something that can occur when weaving; the missed thread then floats on top of the weave until the next regular change to the bottom of the shed. When weaving with heddles, this means the thread will float over three wefts. If the weaver catches the mistake and opts

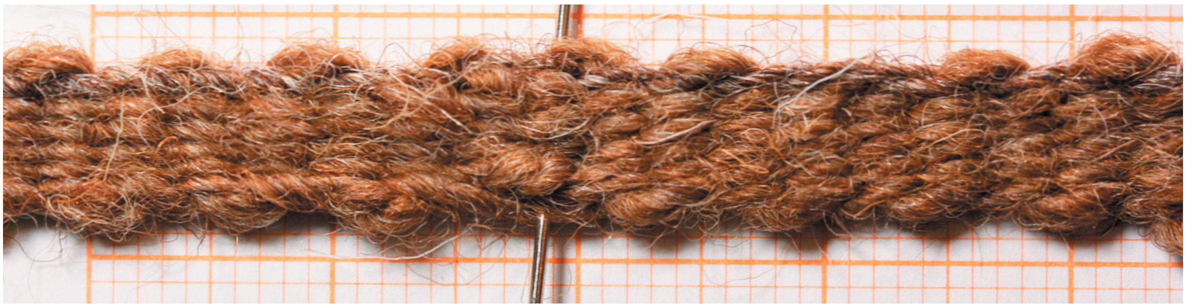

Figure 10. Test weave done with staggered tablets and 180° turns in both directions. Left half turn direction towards the band, right half turn direction away from the band. The pin in the middle marks the reverse of the turn direction. (Photograph: authors)

Figure 11. Part of B 1396, with added colours. Weft thread coloured green, warp threads coloured red and blue. (Image: authors)

to push the thread down after the second weft to avoid the long float, the thread will then float over two threads on the other side of the band before returning to the regular pattern. A single float over two weft threads is thus not possible to weave using heddles.

If using tablets to weave a plain weave structure, turning them 180° forwards and backwards alternatingly, a missed tablet which is not turned with the others will result in a slightly different weaving fault. The missed threads will both float over two weft threads, then return to the regular pattern. The float will occur simultaneously on the front and the back of the band.

A single thread on one side of a band only, and floating over only two threads, is technically possible when weaving with tablets, but its occurrence is very unlikely, as it involves a sequence of specific individual mistakes and chance happenings.

To resolve this weird and apparent weaving fault, another image was taken of the same area, this time with a Dinolite digital microscope with 30x magnification (Figure 12) – and here the thread in question does quite clearly move underneath the next weft thread. In this case, the photograph of the original was misleading, as a combination of view angle and lighting combined to let the thread in question appear to stand out more than it actually does.

There is thus no indication that the narrow bands were tablet-woven at all. They have a plain weave structure throughout, and the visual effect of diagonal lines in the band must be a combination of the different elements described above. The result of a weaving test made with a string heddle setup in hand-spun wool with a mix of darker and lighter grey fibres can be seen in Figure 13. Like in the original, the threads were spun with relatively high, but not consistent twist throughout. Threads were taken double but not plied for each warp element, and for the weft thread, the same material was plied and then taken double to get a thicker weft in comparison to the warp.

11.5. Conclusion

Most archaeological textiles that are published in detail, including narrow wares and especially tablet-woven bands, are made from precious materials or show complex patterning. The more mundane finds are frequently not analysed in as much detail or given as much attention, even though they make up the bulk of the archaeological material and would have been the cornerstone of textiles used in daily life by most people.

While the spectacular-looking, precious, patterned textiles do require a high amount of skill to make, the simple, more mundane cloth and its requirements on the workers' skills should not be

Figure 12. Microscope image of B 1396 showing the thread that appeared to stand out, indicated with a red arrow. (Image: authors)

underestimated. They are, therefore, also worth examining more closely. In recent years, there has also been a rising interest in museums and exhibitions to provide visitors with a hands-on experience. To be able to reconstruct "commonplace" medieval and early modern textiles for these purposes, it is necessary to start researching these simpler finds in detail, too.

The bands from Blindis are a fine example of mundane, functional textiles used in an everyday context. They have no discernible pattern and may have been woven without too much regard to their appearance, as utility textiles.

Nevertheless, all three bands presented in this article are interesting pieces: B 1 due to its unusual pile, and B 1396 and B 967 due to the optical illusion of diagonal slants in the threads even though they were woven in simple plain weave. For making these bands, either a rigid heddle or a string heddle setup are most probable; while it is technically possible, as mentioned above, to weave a plain weave structure with tablets, this is more cumbersome than using a heddle setup.

Our attempts in re-weaving B 1396, which initially went astray, do show that there is sometimes more to reconstructing or – indeed – just re-creating a historical textile. While having access to the original item for analysis and a reconstruction attempt is certainly the best-case scenario, using photographs in addition to looking directly at the textile can in some cases be extremely helpful. Photographs and macro-photographs make it possible to mark or colourize parts of the textile, to avoid optical effects distracting the eye and enable better following of the course of individual threads. Our trials also highlight how important it can be to use materials that correspond to the original materials in all aspects. Replicating even a simple textile such as B 1396 and its visual effects is not trivial, as the attempt with similar – but not exactly corresponding – fibres in Figure 13 shows. This means that in some cases, where matching the original materials is not possible for various reasons, it may be impossible to arrive at results that are close to the original item.


Figure 13. Band woven with heddles, using handspun sheep wool in mixed grey colours. (Photograph: authors)

In the case of B 1, tablets with at least two holes were used, with an ingenious method to form the pile through very simple means. The band could have been woven using square tablets with holes in the sides instead of in the corners, as they use only two elements per tablet. Using tablets with holes in the middle of the sides instead of in the corners eliminates the tendency for tablets to shift during weaving, due to the uneven distribution of tension when the threads only run through two corners of the tablets. Bone tablets with extra holes in the middle of two sides are already known from Roman times (Collingwood 1982: 12). Just as it is not possible to say if a band woven in plain weave was made using a rigid heddle or a string heddle setup, it is impossible to tell if corner holes or side holes of tablets were threaded up for a band using only two holes per tablet, as the results will be the same.

The pile band, due to its irregular and strong uptake of individual elements when forming the pile, must be tensioned with weights to allow for the changing length of the elements. It was easiest to work with each element tensioned separately. As they are rather easy to weave and form sturdy, strong bands, they may well have been made in the same local workshop for use in the mines.

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Katrin Kania wrote her PhD dissertation about construction and sewing techniques in secular medieval garments. She focuses on textile crafts processes and their practical use, including reconstruction of possible working methods. She now works as a freelance textile archaeologist, which includes teaching textile crafts and reconstructing textile items.

Beatrix Nutz studied English, History, and Archaeology at the University of Innsbruck, Tyrol. In 2009 she decided to specialise in archaeological textiles and started to work on 15th century textiles from Lengberg Castle. More research projects dealing with textiles followed, including the textiles of the Modern Age gold mines of Carinthia and the 17th to 20th century textiles from the Stams Cache in North Tyrol. Beatrix Nutz is currently employed at a private archaeological excavation company as well as working as a freelance textile archaeologist.

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