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Discovery of a new tablet weaving technique from the Iron Age

Introduction

A new find from the salt-mine at Dürrnberg near Hallein in Austria (Grömer and Stöllner 2009 (2011) 105-109) supplements our knowledge about early tablet weaving techniques. The find is a separately woven woolen band, attached to a sleeve fragment (Fig. 1 and 2). It was found in 2009 in excavations by Dr. Thomas Stöllner of the Deutsches Bergbau-Museum Bochum, while exploring the Georgenberg site. Dendrochronology of wooden items from the findspot covers a time-span between the 5th and 3rd centuries BC. From the Dürrnberg saltmine more than 600 textiles are known (Stöllner 2005, Kurzynski 2002), most of them belonging to La Tène Period. Beside tabbies, 2:1 twills, and basket woven items, we know of eight examples of tablet weaving (Dürrnberg Textiles no. 554-1; 1180-1; 1303; 1888; 2041-1; 2196-1; 2575-2; 2577. Grömer and Stöllner 2009 (2011), 129-134). All of them are monochrome and woven with square tablets. They are made as narrow borders in simple warp twining and woven as an integrated part of larger weaves.

The new find from Dürrnberg No. 4470, is a special kind. The band was woven separately using tablets with four holes, threaded and turned in a specific way. The weaving created yellow Greek key or meandering motifs on a background of greenish, blue and dark brown. Typological analysis of the pattern suggests a date at the end of the early La Tène period (i.e., the first half of the 3rd century BC)(Grömer and Stöllner 2009 (2011) 109-111). The band was made with woolen warp threads of different shades (Table 1). SEM-analysis shows that paired horse hairs were used as weft (Fig. 3). The technique using hard plied fine woolen threads as warp and stiff horse hair as weft is known from tablet-woven bands of the Hallstatt saltmine (Grömer 2005, 81) as well.

The weaving method of the Dürrnberg band

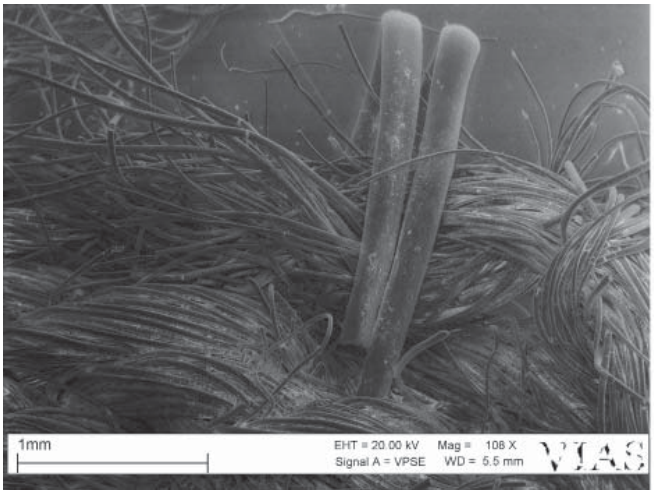
The weaving technique of the Dürrnberg band seems rather simple at first glance. The band is divided into two different pattern-woven sections with a warp-twined blue middle section of 4 tablets. The edges of the band are different from one another. One edge is a single warp-twined blue cord made with one tablet; on the other side the pattern weave ends with no solid edging. This edge is placed at the outer edge of the sleeve but it is uneven and seems not well suited for the extra wear the sleeve edge will be exposed to.

The salt in the mine has preserved the band incredibly well, but as the warp threads are very densely set, it is difficult to establish the amount of tablets used to produce it. Furthermore, the warps are made of plied yarns, making it more difficult to follow than single yarns. Unravelling the weaving was not allowed, so the only way to establish the original weaving method was trial and error..

A thorough microscopic study of the band was undertaken and macro photos were made. Then drawings of the thread course and hypotheses were made about the weaving method followed by practical attempts to make a reconstruction. Extensive experience and a thorough understanding of possible thread courses in tablet weaving are essential for this work (Ræder Knudsen and Mannering 2007, 120-122; Ræder Knudsen 2012, 254 ff). The thread course of the Dürrnberg band defined standard tablet weaving methods. The problem is that there are three colours in each tablet in the pattern, but only two colours are in use in each square of the pattern. The wavy line is light coloured, and in one square the background is blue, while the background colour of the following square is brown. A colour change of this kind is not normally possible, because the undesired colour will come to the surface, when the tablets are twisted at

Fig. 1. Dürrnberg, sleeve with attached tablet woven border, No. 4470. The dating of the border is probably first half of the third century AD (Photo: A. Schumacher, © Deutsches Bergbau-Museum Bochum).

Fig. 2. Backside of the band with irregularities (Photo: A. Schumacher, © Deutsches Bergbau-Museum Bochum).



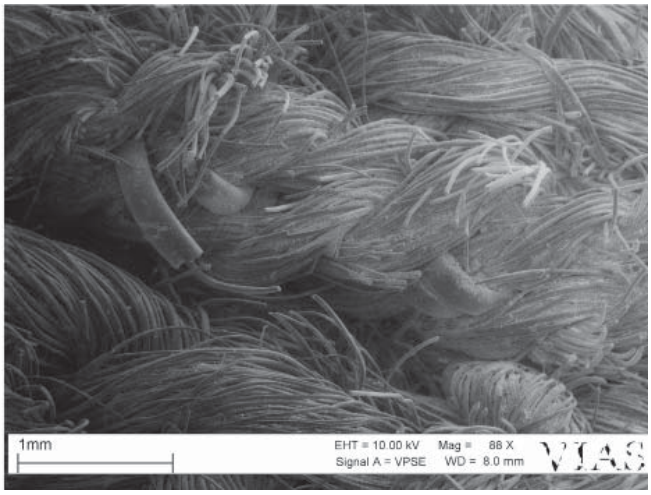


Fig. 3. SEM-photo of the horse hair weft interacting with twined woolen warp threads (Photo: M. Mehofer, VIAS Vienna).

	warp					weft
	yellow (narrow)	yellow (wide)	dark blue	dark brown	greenish blue	
fibre	wool	wool	wool	wool	wool	horse hair
thread	plied yarn	plied yarn	plied yarn	plied yarn	plied yarn	paired
direction	S	Z	S	Z	S	not twisted
twist angle	30-40°	30°	30°	30-40°	30-40°	not twisted
thread thickness	0,2 mm	0,2-0,3 mm	0,2 mm	0,2 mm	0,2 mm	
thread count	92 threads with 1,8 cm (about 50 threads/cm)					8-10 weft/cm

Table. 1. Technical data of the tablet woven band (Table: Karina Grömer ©).

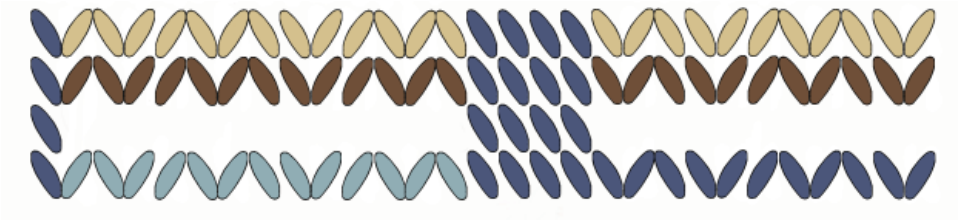


Fig. 4. Threadning of tablets of the Dürrnberg band. Each column of elongated dots represents the colours threaded in one tablet, while the slope of the dot indicates the direction of the warp thread in each tablet. (Drawing: Lise Ræder Knudsen ©).

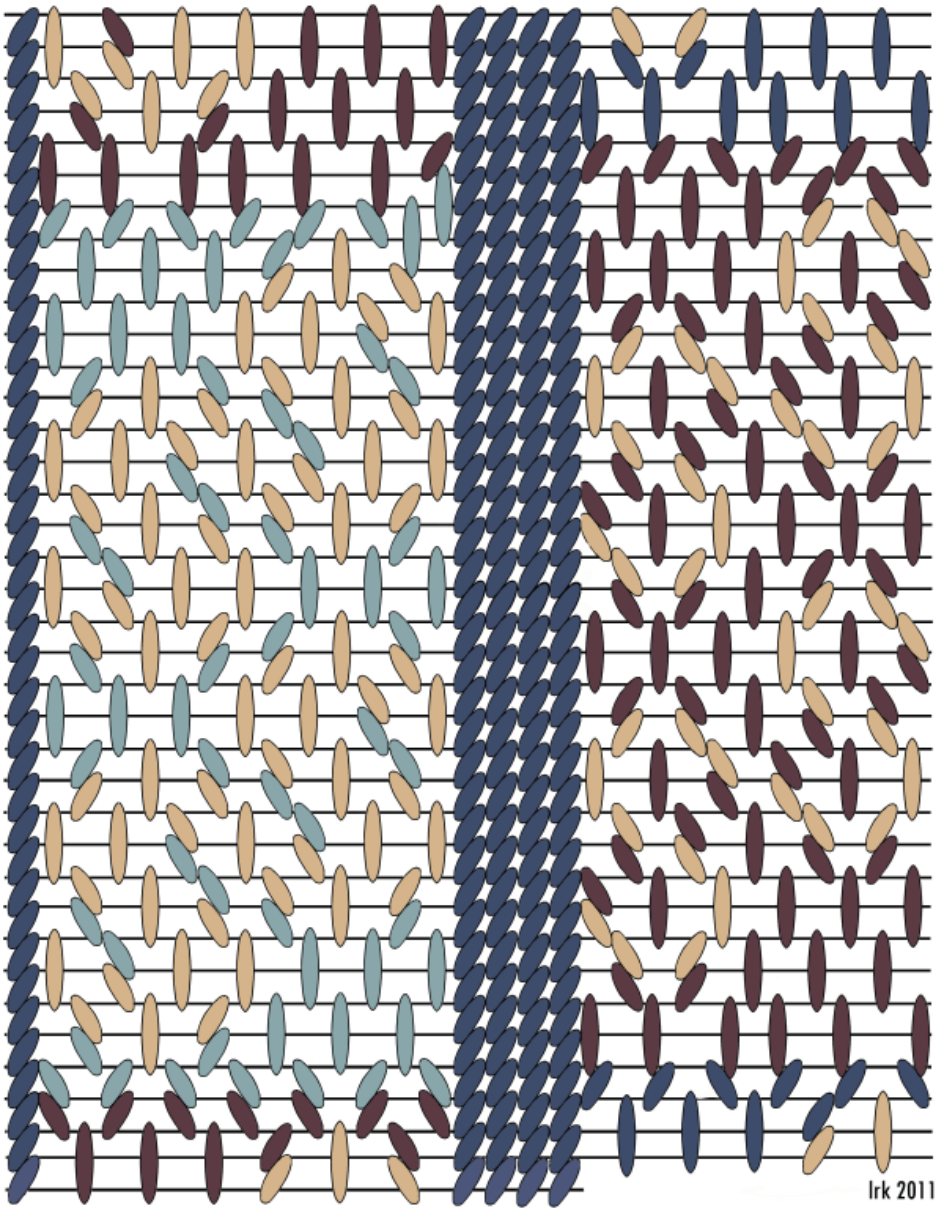


Fig. 5. Drawing of the pattern of the Dürrnberg band with focus on the threads course of each tablet. The black cross lines represent the weft while the elongated dots represent the points where the warp come to the surface of the band (Drawing: Lise Ræder Knudsen ©).

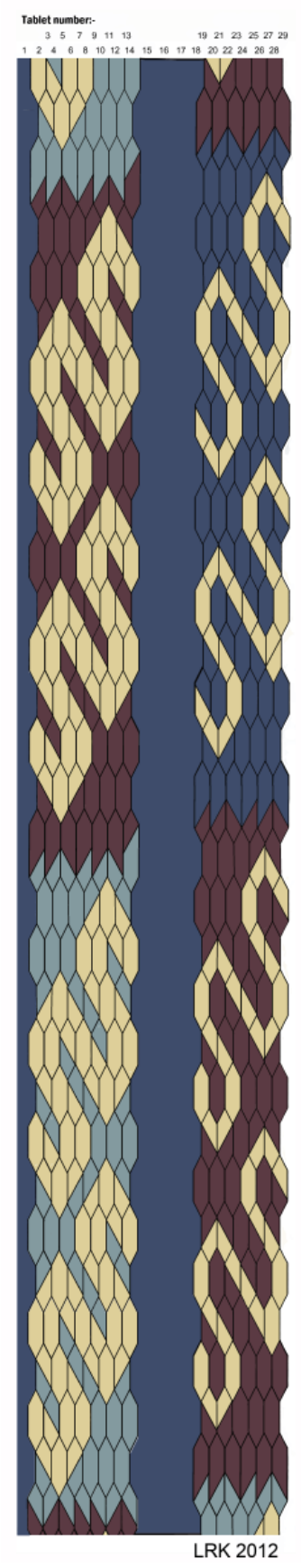


Fig. 6. Drawing of the pattern of the Dürrnberg band with focus on pattern (Drawing: Lise Ræder Knudsen ©).

certain times, no matter if the tablets are triangular, square or another shape. But using experimental archaeology provided a new idea: what if the weaver had overruled the "laws" of tablet weaving and just avoided the undesired colour by pressing the threads of this colour below the weft with the shuttle? The practical weaving process showed that this was exactly the method used and furthermore, that it was very easy using this method (Fig. 4, 5 and 6).

Yet another problem arose when the background colour change was woven. As each tablet has three colours and an empty hole, it is not possible to change the background colour without changing the turning direction of the tablets. That is, when the colours follow each other in the tablet in this sequence : empty, brown, white, blue, and you want blue to take the place of brown in the turning sequence, this can only be obtained by changing the turning direction. When the turning direction is changed, the diagonal line which makes the wavy light pattern nice and equal will change also, and the wavy pattern will become uneven and scattered. But this is not the case with the Dürrnberg band.

It was determined that a way to obtain the same pattern as in the original was to change the order that the single tablets followed each other in the bundle. As the tablets are not threaded from the same direction, the order that the colours come up, and the direction of the diagonal line of the light pattern of single tablets, are not the same. Thus it was possible to pick a tablet out of the bundle and place it differently. For instance, tablet number two and three could change place in the bundle. In this way, which is easier to show than to describe, it was possible to obtain a background colour change, as on the original border.

A reconstruction of the border was woven and the tiny errors of the original weaving and the reconstruction were compared (Fig.7). In addition, pictures of the back sides were compared and the reconstruction and the original bands appeared very much alike. There might be other weaving methods which will produce a band like this as tablet weaving has an incredible amount of variations – but the technique found in this experiment produces a band with great resemblance to the original.

Technical details

The width of the band differs from 1,6 to 2,0 cm and the length is 25,5 cm

The band was made using 29 four-hole tablets. At the edge towards the sleeve and in the middle section there are 1 and 4 tablets, respectively, each holding 4 blue threads. At the outer edge the band does not have edge tablets. In the two pattern sections there are 13

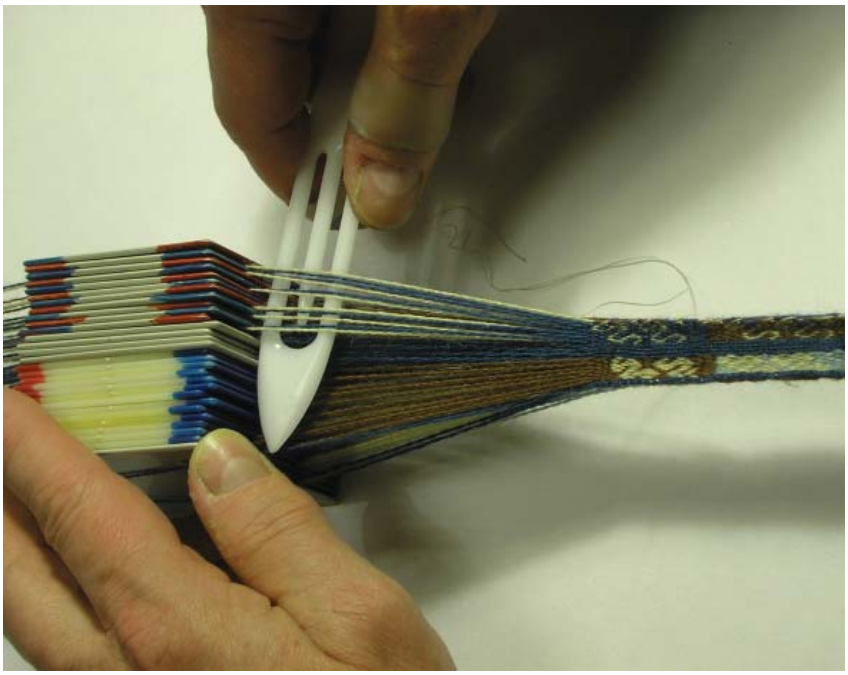


Fig. 7. Working on a reconstruction of the tablet woven band from Dürrnberg (Photo: Lise Ræder Knudsen ©).

and 11 tablets. The pattern of the 13-tablet section is a wavy line two tablets thick. The 11-tablet section has exactly the same pattern but with a thickness of only one tablet.

The tablet creating the single blue edge, and the four tablets forming the blue warp twined section in the middle are threaded from the same side, and the weaving method is straight forward quarter turns.

The two pattern sections are woven with individual turnings of groups of tablets and of single tablets. The turning sequence of the tablets is not very complicated and neither is the placing of the weft thread and avoiding the colour not in use. But threading the tablets and getting them in the right position for weaving is rather complicated. Furthermore, it is rather complicated to change the sequence of the tablets when a colour change is made.

This means that the weaver had many variables in focus and gave them equal attention to produce the pattern in this way. The pattern, especially in the background colour transition, has many small errors which are hardly visible to the naked eye. These errors are different at different places where the same pattern is repeated. This means that the weaver had a thorough understanding of the weaving system but had not memorized it or used a written pattern.

The pattern seems to continue right to the point where it was cut. This makes it likely that this sleeve border was part of a longer band.

Summary

The tablet woven band described was found in the Dürrnberg salt mine and belongs to the early group of patterned tablet borders from the Central European Iron Age. The band is sewn to the worn outer edge of a sleeve. As such, it was important that the band was stiff, and the use of horsehair as weft was a clever way to do this. The band was woven in a previously unknown technique, producing colour changes in the background. Beyond the simple dynamics of tablet turning we are witness to extensive creativity and skill of the weaver in developing this clever method.

The development of this technique and the production of the band must have taken much time and effort. All in all, it points to the fact that the band must have been produced in a society, which had an excess of food and a general cultural surplus that encompassed the ability to appreciate the skills of the weaver and the results of her/his effort.

Furthermore, the band was probably sewn onto a mine worker's sleeve edge at a later stage as reuse, which suggests that the border at the time of its disposal was not a highly important or valuable object.

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