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# Tracing the skills and identifying masterpieces in Celtic glass-making: specialization through Haevernick group 15 glass bracelets

Joëlle Rolland

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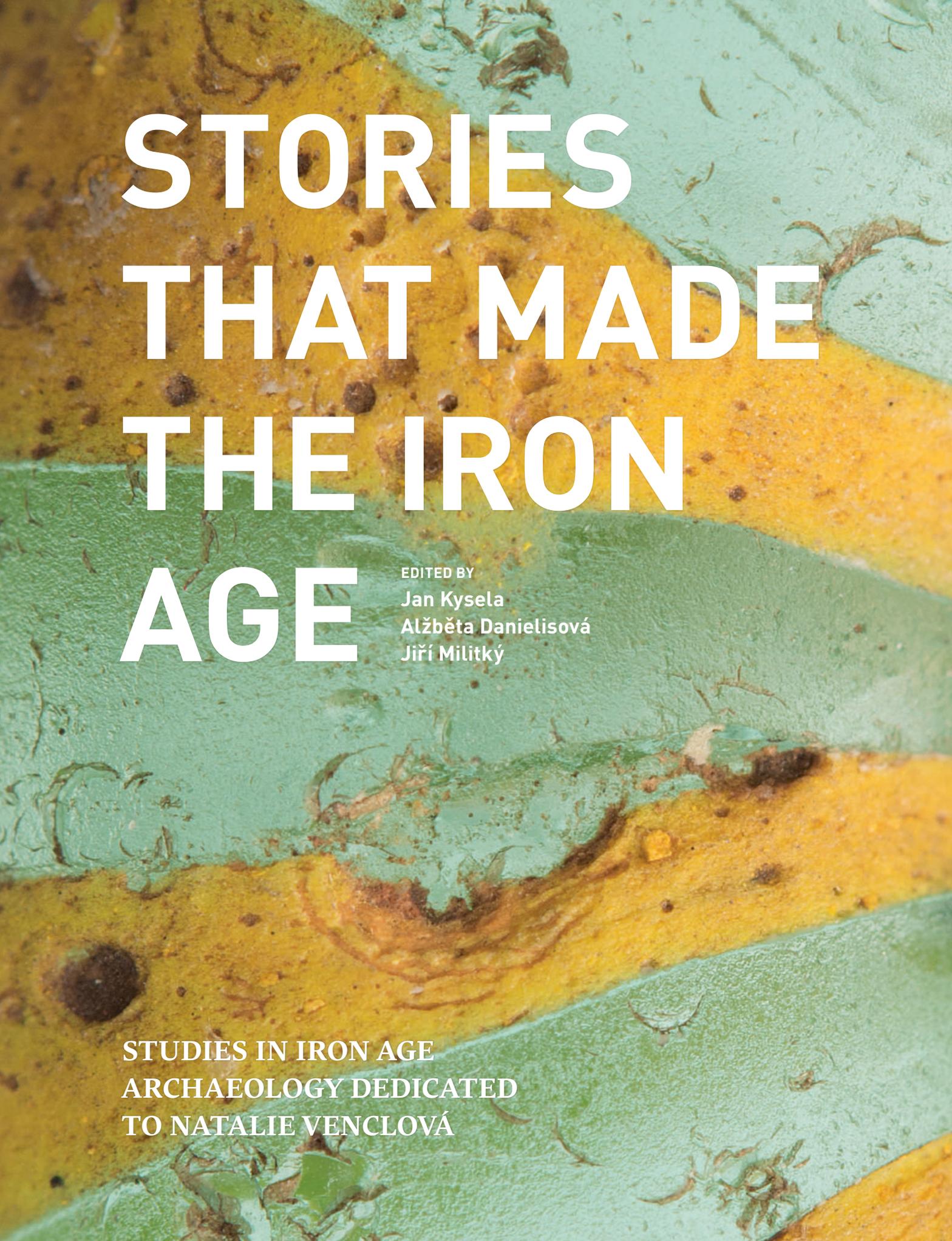
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# STORIES THAT MADE THE IRON AGE

EDITED BY  
Jan Kysela  
Alžběta Danielisová  
Jiří Militký

STUDIES IN IRON AGE  
ARCHAEOLOGY DEDICATED  
TO NATALIE VENCLOVÁ

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## STORIES THAT MADE THE IRON AGE

Studies in Iron Age Archaeology dedicated  
to Natalie Venclová

Reviewers: doc. PhDr. Peter Pavúk, PhD., PhDr. Karol Pieta, DrSc.

Proofreaders: J. V. S. Megaw, Katja Winger, Gilles Pierrevelcin, Judd Burden

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*Cover image: Late La Tène ring-bead, Stradonice oppidum (Národní muzeum, Praha, inv. no. H1-80727).*

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# TRACING THE SKILLS AND IDENTIFYING MASTERPIECES OF CELTIC GLASS-MAKING SPECIALIZATION THROUGH AN ANALYSIS OF HAEVERNICK GROUP 15 GLASS BRACELETS

Joëlle Rolland

*The glass bracelets of Haevernick's group 15 are characteristic of the beginnings of the Middle La Tène Period in the eastern Middle Danube Region. Approaching it from a technical point of view provides us with an opportunity to apprehend this typological group in an innovative way. The design is guided by the technique mastered by the craftsmen and the glass bracelets can be classified into categories according to the knowledge required. The manufacturing in small quantities of Haevernick group 15 can be explained by the complexity of some techniques used in its production. Glass bracelets of Haevernick group 15 are not only a regional specificity, it is also a technical master-piece in the La Tène glass-making.*

La Tène Glass — glass bracelet — experimental archaeology — Haevernick group 15

In La Tène Europe, evidence of a remarkable economic change was reflected by the concentration of specialized activities in central places. The intensive production of salt, widespread production of iron and rationalization of agriculture testify to the dynamics of import and export and to the increasing evolution of the economic system. With massive production of commodities, the production of durable manufactured prestige items was also specialized. Glass production is one of the leading product lines to benefit from this period of economic change.

The glass bracelet – the trade mark of La Tène glass-making – appeared at the end of the 5<sup>th</sup> century BC, but its production reached its peak in the 3<sup>rd</sup> and 2<sup>nd</sup> century BC. The glass bracelet is not only a genuine innovation in the later Iron Age, but also one of its main landmarks. Due to their exclusive spatial and temporal distribution, even more than beads, bracelets appear as cultural and temporal landmarks of Celtic civilization. The raw glass used to manufacture Celtic jewellery was imported and a substantial long-distance trade was organised at that time for handcrafted glass-making purposes. Chemical analyses of trace elements in glass and three Mediterranean shipwrecks containing cargos of glass provide evidence of these exports (Sayre – Smith 1961; Karwowski 2006; Henderson 1985; 2013; Cibecchini et al. 2012; Březinová et al. 2013; Rehren – Freestone 2015). Once imported, glass was recast to create typical Celtic prestige-goods.

On the basis of form and sorted according to colours twenty main types of bracelets have been established – blue, purple, brown, and translucent yellow, the majority being decorated with ribs and wavy line patterns (Haevernick 1960; Gebhard 1989). An important standardization in the production of glass bracelets has been observed: the same type of bracelet can be found in France as well as in the Czech Republic. On the other hand, some types appear to be much rarer and were probably the result of regional production.

Thus, the Haevernick type 4 shape 9, with lines and wavy deformations, is mainly present in France but is also represented by two exceptional fragments in Manching in southern Germany (Gebhard 1989, object n°593 and 594; Feugère 1992). The Haevernick type 15, also known as the 'Érsekújvár' type, decorated with bosses, wavy-lines and spirals (FIG. 1), has always been used to illustrate regional distribution within the Middle Danube region, where this type is restricted to the eastern zone (Moravia, Lower Austria and Upper Silesia – FIG. 2; Tankó 2007; Karwowski – Prohászka 2014; Venclová – Militký 2014).

The established typology of these glass bracelets result in this Celtic ornament being a useful chronological marker. To learn about the work of Celtic glass-makers, it seems essential to rethink this typology based on a few major criteria. We propose to reconstruct the different manufacturing processes of the glass bracelets in order to



**Fig. 1.** La Tène Haevernick type 15 glass bracelet. Coll. Corning Museum of Glass, Corning, NY. <http://www.cmog.org/artwork/bracelet-or-arm-ring>.

distinguish glass industries in terms of their technological characteristics. Each type of bracelet is the product of a '*chaîne-opératoire*' partitioned in gestures. The achievement of these gestures and of the entire procedures depends on the glassmaker's knowledge; motoric and cognitive skills are involved in the production. Identifying these gestures and classifying objects according to the knowledge required to the manufacturing process make it possible to apprehend the typological groups in a different way. Different bracelets are related to the same gestures and knowledge that can be shared or be restricted to a group of artisans. The study of the *chaîne-opératoire* and the skills involved in the fabrication of Haevernick type 15 armrings or bracelets should allow us to isolate this rare form and to explain its limited diffusion in Eastern Europe (Fig. 2).

Reconstructing the *chaîne-opératoire* it becomes possible to rediscover the different gestures and knowledge of the glass-makers but also the kinds of tools and furnaces glass-makers could have used. In order to understand which material and human resources were involved in the production of La Tène glass jewellery, an experimental project started in 2009 bringing together glass-makers and

archaeologists (Rolland – Clesse 2014; Rolland 2017). This programme has offered an opportunity to consider the levels of specialization of La Tène glass-makers. Coming face to face with the difficulties experienced by the craftsmen and the level of specialization required for the manufacture of armrings, we are able to highlight the social value of the production and the social place of the artisans.

The first difficulty modern glass-makers Joël Clesse and Stephan Rivoal have faced, is to create a glass ring with no visible soldered joint. The previous experimental techniques suggest that a glass bracelet can be made by winding a ribbon of glass around a support whose diameter was that of the bracelet (Venclová 2000; Karwowski 2012), but, for the time being, testing this technique systematically lead us to the production of ring with a visible soldered join. The works of Palestinian, Nigerian, Indian and Nepalese craftsmen provide an other realistic technical production hypotheses to reproduce seamless Celtic bracelets (Gardi – Schweizer 1963; Gardi 1970; Gaborieau 1989; Foy 2003; Dang 2010). It appears that the process required to produce seamless glass bracelets consists in creating a bead, and then enlarging it progressively, using either two solid metal rods called

ferrets (as the Nepalese do), or a cone (as is the process followed by Indians) (Fig 3:1 and 3:3).

The other difficulties encountered were linked to the recovering of the procedures used to create the different types of bracelets: we had to find the necessary resources and tools for manufacturing these sets. It appears that decorations depend on accurate gestures, abilities and skills which complete the operational sequence at different times according to the desired type of decoration. Skills come into play but also capacities of the glassmakers to anticipate the reactions and deformations of the glass and all the progress of the work. Within the framework of our experiment we began to work on decoration some six years ago. This work has not been continuous, but probably more than one thousand bracelets have been produced.

Recently, thanks to our training in the production of bracelets with ribs and wavy lines, we began the production of Haevernick type 15 bracelets. The Haevernick type 15, the 'Érsekújvár' form, is one of the most elaborate types of glass bracelet. In fact, the realization of this type appears to be a complex combination of three different techniques of decoration.

Manufacturing the Haevernick type 15 bracelet the first step is to create the spaces and boundaries in which the wavy lines and spirals will be placed. These spaces are delimited by incisions in the glass. Incisions create the parallel 'ribs' in the Haevernick groups 6 to 17, and the

different diagonally or perpendicularly incised variants in the groups 8–11, 13 and 15.

It appears that the ribbed patterns could be realized with the use of a simple knife as it has been observed for the 'melons' bead (Venclová 1990, type 306–310; Gam 1993). On the bracelets, parallel incisions are better controlled if they are realized before the extension of the bead (Fig. 3:2). The incisions can be refreshed during and after the extension (Fig. 3:4). The diagonal or perpendicular incisions which divide the central rib of the glass bracelet in lozenges, squares or triangles should be made after the first enlargement. If not, incisions will lengthen, without good control of the decor. The spacing and the number of incisions added have to be properly thought out for a good balance of the decoration. When the diagonal incisions are all made in the same direction work proceeds easily, but if they are not, as for example when square or lozenges are required as with group Haevernick 15 bracelets, matters become complicated. With this form, the craftsman also has to change the orientation of his blade.

The artisan also had to use the optimum temperature of the glass in order to make as many incisions as he could before the glass cooled. Each incision corresponds to one gesture. Haevernick type 15 bracelets comprise three or five parallel ribs (or two or four parallel incisions) and at least twenty-four incisions are applied to model the central ribs; there are twenty-four incisions in the Komjat

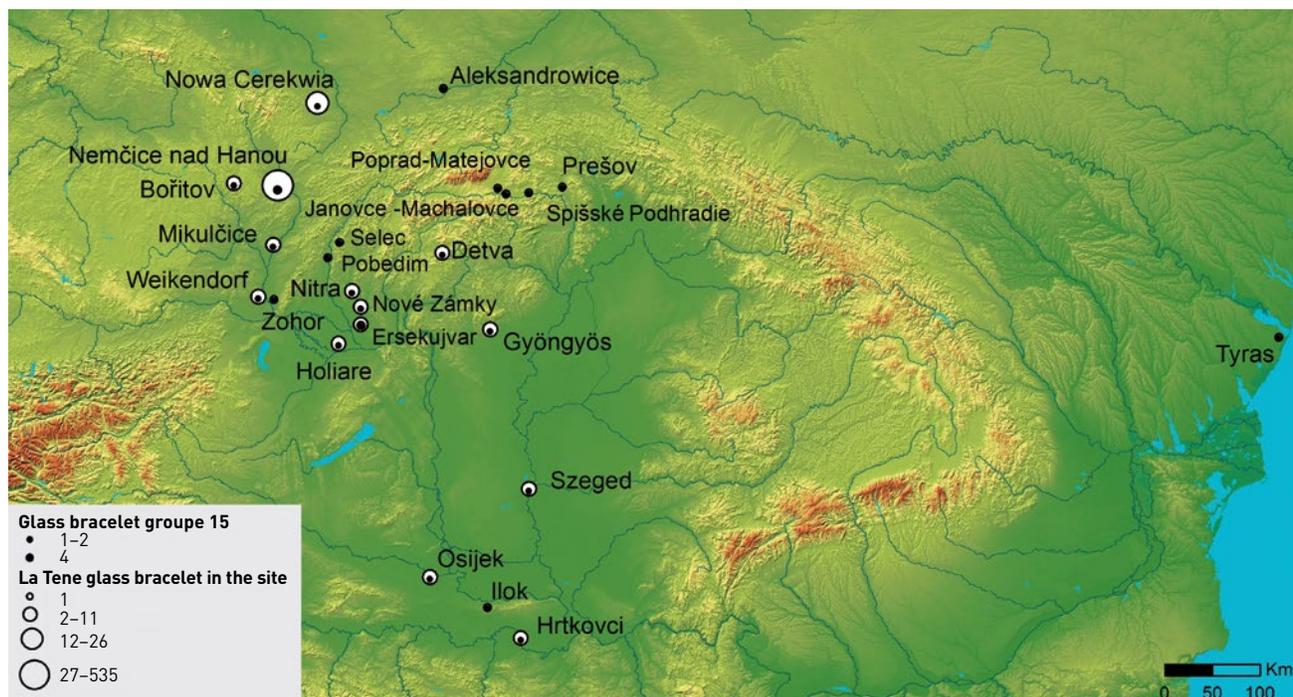


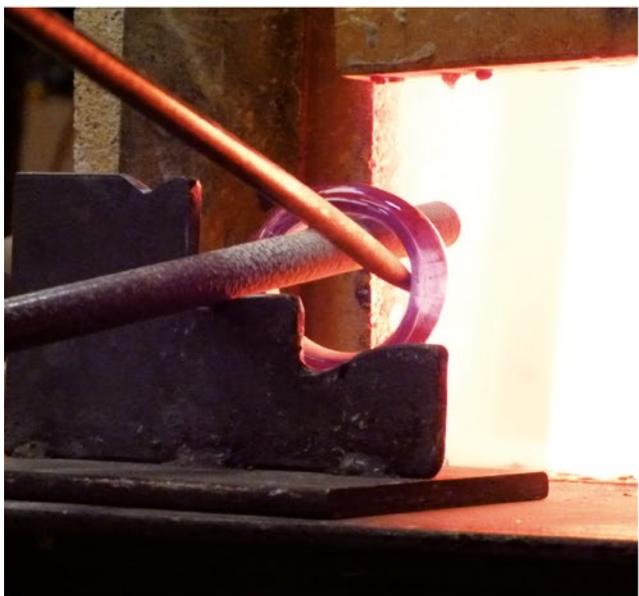
Fig. 2. Distribution of Haevernick 15 glass bracelets. Map by J. Rolland after Venclová – Miltký 2014 and Karwowski 2014.



1. The core of the bracelet a bead is created by winding glass around a ferret.



2. Parallel incision are printed in the bead to create the ribs.



3. The bead is progressively being enlarged with the use of a second ferret inserted in the ring. It allows to stretch the glass.



4. The ring is again incised on the sides and on the central ribs to create the losenge decoration.

**Fig. 3.** Hypothetical manufacturing technique followed in the making of a Haevernick type 15 glass bracelet (Photos J. Rolland).

examples (Karwowski – Prohászka 2014, Abb. 3) and probably even more in the larger example sold in 1999 by the Dorotheum auction house of Vienna and today kept in the Corning Museum of Glass (FIG. 1) (Karwowski – Prohászka 2014, 240; Karwowski 2005, Abb. 3).

Once this first step done, the glass-maker can add the wavy line and spiral decoration. Observation of the piece allows us to propose that the spiral decoration was applied before the wavy lines. Spirals are quite rare in bracelet decoration and more frequent on beads as for



5. The ring is regularly heated. Glass is picked by the tip of a second ferret to create the decoration by spirals and wavy-lines.



6. A protrusion of blue glass is added to create spiral.



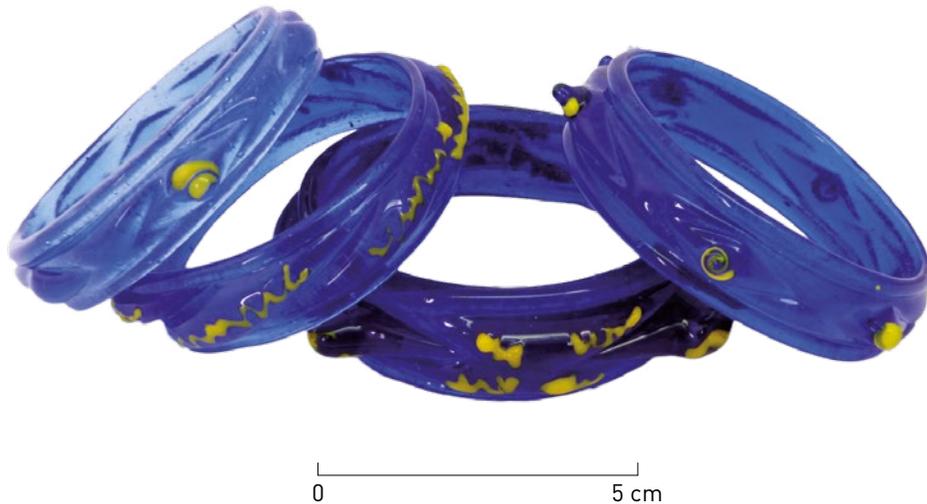
7. Yellow glass line is coiled around the protrusion. By warming up the bead protrusion shrinks.



8. The wavy lines can be drawn with a cord of yellow glass.

example in Class 6, Groups 2 and 3 'bobbin-bead' (Guido 1978) which also has a characteristic distribution restricted to the Middle Danube region (Karwowski 2005; Venclová – Militký 2014). To apply spiral decorations with precision, a modern blow torch worker produces two rods one superposed over the other; the two strands are twisted, the cross section design being a spiral. The rod can be cut, and pieces of the rod made into beads. This

requires a blow torch and produces identical spirals. Two other possible techniques have been previously discussed in relation to the production of spiral decorated Iron Age Scottish glass beads. The first process involves the practice of *cire-perdue* and *pâte de verre* as Julian Henderson has suggested following the discovery of a glass bead in a mould in Meare Village West, Somerset. These techniques are extremely complicated in the manufacture



**Fig. 4.** Glass bracelets of Haevernick type 15 and Haevernick type 8b manufactured by the glass-maker Joël Clesse during experimentation in applying wavy lines and spiral decorations (Photo J. Rolland).

of small objects such as beads, and are considered inefficient in the production of spiral decorated beads (Lierke et al. 1995; Bertini et al. 2011). A second technique has been suggested by Rosemarie Lierke and was also proposed by Joël Clesse as the method used to produce the spiral on the 'Érsekújvár' bracelet. According to Rosemarie Lierke an easier way to apply a spiral pattern would be to coil it onto a protrusion on the body of the bead (Lierke et al. 1995; Lierke 2010; Bertini et al. 2014). By warming up the bead, the protrusion shrinks; it also can be pressed on a plane surface before being reduced.

Observation of the 'Érsekújvár' type suggests that this latter technique was used; the protrusion has not been completely reduced and forms part of the decoration. One can also note the ends of the spiral lines at the base of the bosses (FIG. 1). Thus, the glass-maker had to work in two stages: first, he took some blue glass on the tip of a solid metal rod (a ferret) and added some glass on the bracelet between the incisions (FIG. 3:6). Secondly, he used another ferret with yellow glass on the tip to stick some yellow glass on the base of the protrusion. The applied glass must not exceed the width of one millimetre. The glass can be stretched from this attachment point into a thread and coiled around the bosses (FIG. 3:7). With applied heat, the protrusion will reduce a little to form the bosses and the spiral will tighten. In this 'Érsekújvár' type of bracelet the number of spirals is impressive averaging twenty. To lay down a spiral is a work of precision and requires a mastery of the decoration with glass threads.

With the 'Érsekújvár' bracelet, it is obvious that the wavy line decoration has been completely mastered by the Celtic glass-maker who made it. To realize these lines, the same method used to make spirals allows the creation of zig-zags on the glass – the wavy-line may be drawn

from an attachment point (FIG. 3:8). The free space available to decorate the 'Érsekújvár' bracelet is small, especially the external ribs. Once again, one is impressed by the number of wavy lines visible on this type – between 35 and 60 according to different bracelets and the number of external ribs (Karwowski – Prohászka 2014, Abb. 3). The precision of these wavy lines impresses too, they are closely spaced and firmly executed.

The realization of this type requires a set of well-known techniques but also abilities. This is also the case of numerous LT C2 glass bracelets, but none of them has such a combination of motoric skills. Usually performed on a restricted number of glass beads, the significant number of successful spirals is a proof of the audacity and the dexterity of the glass-makers. Choosing a complex decoration of incisions and numerous wavy lines, their finished products show that glass-makers could master the lengthy production processes. Many procedures imply a control of the cooling and heating phases of the molten glass which required the avoidance of the decorative features previously executed on the ring.

During our experiments to reproduce of Haevernick type 15 'Érsekújvár' bracelets, the glass-maker Joël Clesse has, for the time being, not completed the reproduction process (FIG. 4). The difficulties in the realisation of numerous spirals and wavy lines limits for the moment the number of decorations we are able to apply before the ring loses its shape. With six spirals and very few wavy lines, the production of one bangle takes us more than thirty minutes.

Glass bracelets of Haevernick 15 type were not only a specific glass product of the eastern zone of the Middle Danube region, but also one of the most remarkable La Tène glass products – indeed one may say masterpieces. The short production periods in LT C1-C2a in this specific

area marks not only a common cultural identity, but also the presence of master glass-makers. The small numbers of Haevernick type 15 bracelets probably indicate the production of a few expert craftsmen able to realize these pieces of extreme intricacy. Four fragments of glass bracelets of Haevernick type 15 have been recovered from the site of Nĕmčice nad Hanou in Moravia with more than five hundred other glass bracelets and numerous beads; evidence for their local manufacture has been found (Venclová 2006; Venclová et al. 2009). The settlement complex of Nĕmčice nad Hanou clearly allowed the development of specialized workshops and the flowering of expert craftsmen.

Understanding the procedures and the technical implications behind the different types of glass bracelets made it possible to demonstrate the high levels of specialization required to produce glass jewellery in the later Iron Age. As for the Haevernick type 15 glass bracelet, the study of the spatial distribution of knowledge behind the types could provide us with new elements on their traffic networks and the localization of the workshops. This technical approach also lets us highlight an evolution in production – LT C1–C2 is a time of development of complexity and research in glass-making marked by bracelets of Haevernick type 14 or 15. Glass bracelets of Haevernick 15 are works of art that only few expert craftsmen with high levels of specialization were able to create. The complexity and the scarcity of the Haevernick 15 bracelet probably added to its value making it a prestige object. In the first century BC, the manufacturing process was simplified in favour of plain glass rings. This process allowed a marked increase in their production. With their production, the value and greater accessibility of glass jewellery also evolved.

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**Joëlle Rolland**

Université de Paris 1 Panthéon-Sorbonne,  
UMR 8215, Trajectoires  
UMR 5060 Institut de Recherche sur les  
Archéo-MATériaux – Centre Ernest-Babelon  
joelle.rolland@mae.univ-paris1.fr