

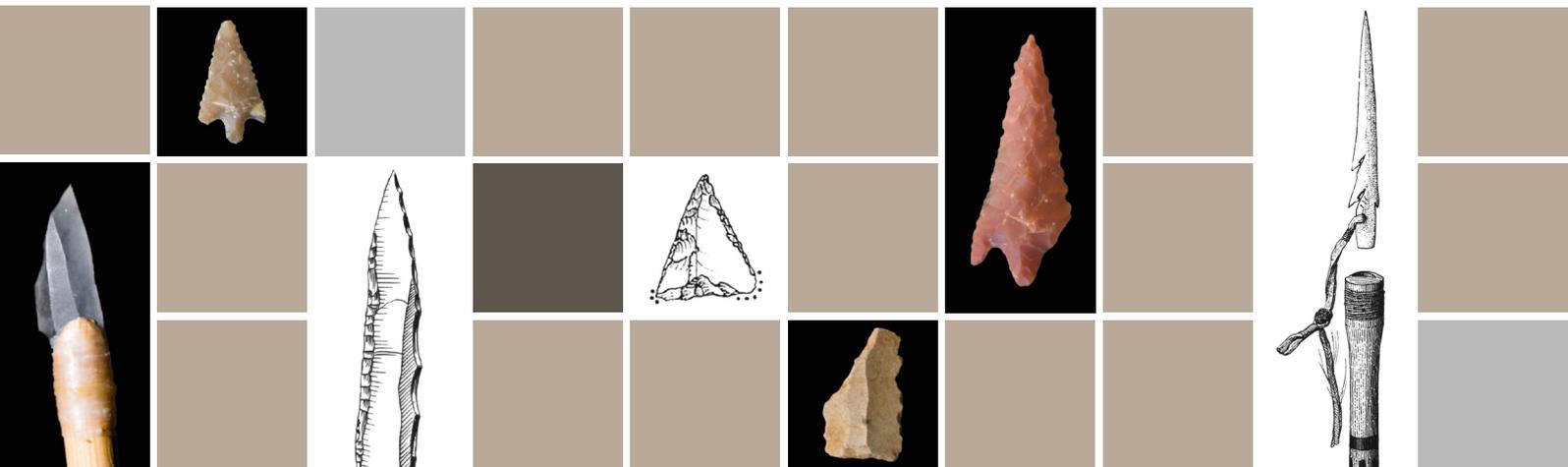
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**PROJECTILE WEAPON ELEMENTS**

**FROM THE UPPER PALAEOLITHIC TO THE NEOLITHIC**

**Proceedings of session C83**



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# FABRICATION AND USE OF HAMBURGIAN SHOULDERED POINTS : NEW DATA FROM POGGENWISCH AND TELTWISCH 1 (AHRENSBURG VALLEY, SCHLESWIG-HOLSTEIN, GERMANY)

Mara-Julia WEBER

## Abstract

The objective of this paper is to present certain characteristics of Hamburgian shouldered points that can be compared with Magdalenian lithic points. The collections studied are those of Poggenwisch and Teltwisch 1. The blanks of these points are narrow and thin blades with a relatively rectilinear profile. One question that is raised is whether they originate in part from a specific *schema opératoire* \* (operational scheme) employed with the objective of obtaining these blanks, which seem to have been detached using a soft stone hammer. Despite some common characteristics, I observed a difference in the degree of standardisation between the two collections studied. The microburin technique was used during the shaping of the blanks into points. The basal modifications are highly variable, which has not yet been explained. One of the causes could be related to the hafting method, for which I propose an alternative that takes into account the profile of the points, as well as the lack of wood in the environment.

**Key-words** : Schleswig-Holstein, Poggenwisch, Teltwisch 1, Tardiglacial (Late Glacial), Classic Hamburgian, shouldered points, technological analysis, functional analysis.

\* : Schéma opératoire : operational scheme - In technological analysis, this term designates a global and synthetic consideration of several reduction or production sequences (chaînes opératoires) that share the same technical and economic principles. It is represented by the transformation of several raw material volumes (after Averbough, 2000). It consists of a series of operations conducted in order to realize a project (after Inizan *et al.*, 1995)

## Introduction

The Hamburgian is the first archaeological culture encountered on the northern European plain after the last glaciation. Its sites are distributed between the Rhine in the Netherlands and the Oder Basin in Poland, and to the north, until the middle of the Jutland Peninsula. According to C14 dates and palynological analyses, the Hamburgian dates essentially to the GI (Greenland Interstadial) 1e and is thus associated with a tundra landscape with reindeer and horse.

Shouldered points are one of the characteristic elements of the Hamburgian lithic industry, or at least of its so called “classic” facies<sup>1</sup>. This is its principal difference with the Magdalenian, which is partly contemporaneous and probably originates from the Hamburgian: in the Magdalenian, points made from osseous materials are dominant, the efficacy of which was augmented by microlithic armatures in the form of backed bladelets, which are absent from Hamburgian assemblages. Meanwhile, varied lithic points are also found in Magdalenian contexts, raising suspicions of mixtures: in southwest France (Sonneville-Bordes, 1969b, pp. 184-186), in the Jura, in Switzerland and southwest Germany (Peters, 1930; Sonneville-Bordes, 1963, p. 224, 226-227, 232-235, 244-245, 252, 258-260, 1969a, p. 177; Thévenin, 2003, pp. 114-116), in Thuringia and in the Paris Basin (Allain, 1978, p. 474; Burdukiewicz & Schmider, 2000, p. 101; Schmider, 1971, p. 168). In this latter region in particular, lithic points dominate and backed bladelets are rare (Lang, 1998; Valentin, 1995), which results in an axial armature/lateral armature ratio comparable to that of the Hamburgian. The similarities appear to concern the laminar debitage as well. Consequently, one of the objectives of this analysis of Hamburgian shouldered points, integrated within a technological study of the lithic

industries of this culture, is to identify characteristic elements that could contribute to a comparison with Magdalenian lithic points. In addition to the details of their fabrication, it is necessary to consider the hafting techniques and mode(s) of propulsion employed, which are related to hunting strategies. These hunting strategies may be at the origin of differences in weapon armatures between the Magdalenian and Hamburgian (Pelegrin, 2000).

I present a study of the shouldered points of two Classic Hamburgian sites located near each other in the Ahrensburg Valley (fig. 2), at the limit of the maximal extension of the Weichselian ice sheet: Poggenwisch (Rust, 1958) and Teltwisch 1 (Tromnau, 1975a).

Poggenwisch is one of the sites associating a habitat zone on a sandy terrain and a kettle in which organic materials are preserved. It was discovered during the realisation of systematic test pits in 1950 and the habitat site was excavated from May 28 to July 1, 1951, under the direction of Alfred Rust (Rust, 1958, pp. 94-95) who had previously directed excavations at Meiendorf and Stellmoor (Rust, 1937 et 1943). Over a surface of 114.5 m<sup>2</sup>, a lithic assemblage of 2,864 objects<sup>2</sup> was collected and recorded by meter square unit. Inspired by his discoveries at the site of Borneck (Rust, 1958, pp. 30-44), Rust interpreted the distribution of stones on the ground and the presence of small sandy mounds as elements of a tent (Rust, 1958, pp. 97-104). From July 4 to August 27, 1951, an ancient pond located 30 metres from the habitat site was also excavated (Rust, 1958, pp. 106-113): thirty-five siliceous material artefacts were recovered, but none of them was characteristic of the Hamburgian. However, the waste products of the fabrication of tools from reindeer clearly attest to the presence of the double grooving technique, which is exclusive during the Hamburgian, but very rare during the

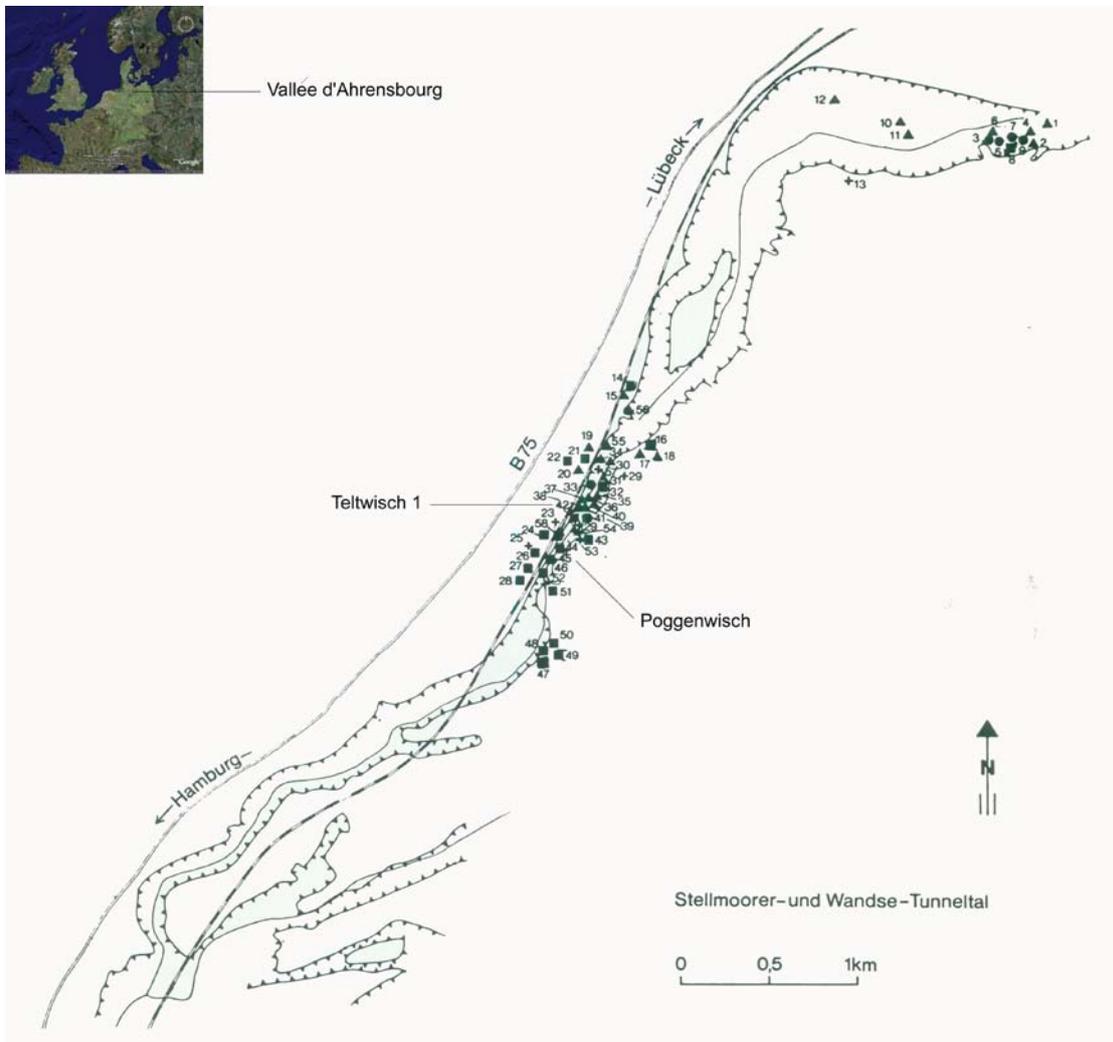
<sup>1</sup> - The only Hamburgian division that seems pertinent is that distinguishing classic groups with shouldered points and a Havelte group with tanged points (Bohmers, 1947), a division that is not discernable based on common domestic tools. The Havelte points (fig. 1) are generally more streamlined than the shouldered points, the length of the basal retouch relative to the entire length is less than that of the shouldered points, and the tang retouch is often, but not exclusively, alternate. The stratigraphy of the site of Ahrenshöft LA 73 (Clausen, 1998), as well as the distribution of C14 dates, indicate that the Havelte group is more recent than the classic group (Grimm & Weber, 2008). This could explain the absence of classic sites in Denmark, which would have been re-colonized only in a second wave.

<sup>2</sup> - Rust speaks of 2840 remains (Rust, 1958, p. 95), but the addition of numbers furnished by the different classes of artefacts gives a total of 2864 objects.





**fig. 1** : Two examples of tanged points of the Havelte type, characteristic of the late phase of the Hamburgian. Ahrenshöft LA 58 D. Unless otherwise stated, all of the photos are © Archäologisches Landesmuseum Schleswig-Holstein.



**fig. 2** : Location of the Classic Hamburgian sites of Poggenwisch and Teltwisch 1 in the Ahrensburg Valley. Rectangles: Hamburgian sites. Triangles: Ahrensburgian sites. Circles: Federmesser sites. Crosses: isolated remains. After Tromnau, 1975c, fig. 2.



Ahrensburgian<sup>3</sup>. The most important Hamburgian artistic artefact also comes from this pond: a reindeer baton decorated with a meandering motif and a human head at one extremity. The small faunal assemblage (around 800 objects, after Rust, 1958, p. 106; Bratlund, 1994) is dominated by reindeer (MNI: 15) and indicates autumn hunting. The presence of a tool made from a wing bone of a *Cygnus cygnus* can be interpreted as evidence for a bird hunting episode in summer, but which would have occurred elsewhere. Poggenwisch has the earliest C14 date of the Hamburgian (H-31-67: 13 050 ± 200 BP; Münnich, 1957), but even though there are no clear dating problems, its antiquity raises doubts concerning its validity. This is even more true since the other reliable dates range between 12 570 ± 115 BP and 12 440 ± 115 BP (Fischer & Tauber, 1986; Grimm & Weber, submitted; Lanting & van der Plicht, 1996; Tromnau, 1992), which places the Poggenwisch occupation between those of Stellmoor and Meiendorf. In order to test this hypothesis of an early age for Poggenwisch, three reindeer antlers, all attached to the cranium and two of which have traces of anthropogenic modification, are in the process of being dated by AMS at the Kiel laboratory (Grimm & Weber, 2008).

Around 250 metres north of Poggenwisch, there is a sandy threshold between two ancient ponds (Tromnau, 1975a, pp. 14-21). The site of Teltwisch 1, located on this threshold, was discovered on the surface by Rust in 1951. Excavations were undertaken in advance of road construction that would endanger the presumed sites. Seventeen Tardiglacial sites were thus discovered under the direction of Gernot Tromnau between December 1967 and August 1971. Teltwisch 1 was excavated from July 1 to August 9, 1968, over 99 m<sup>2</sup>, with plans made below the current soil level and then by 10 or 5 cm deep

levels. The artefacts were recorded by square metre. The 7,790 lithic artefacts showed a vertical distribution over around 15 cm at a depth of 40 to 55 cm below the current surface. Around the excavated surface, 30 test pits, each covering a surface of approximately 0.3 m<sup>2</sup>, yielded very few remains, leading the excavator to believe that the habitat site had been completely excavated. Three attempts to excavate an ancient pond (Tromnau, 1975a, pp. 71-72) 30 m south of the site yielded only one reindeer bone in the horizon attributed to the Dryas III. Two other ponds on the Teltwisch, however, seem to contain abundant faunal remains. Lacking organic remains, the only chronological indication at Teltwisch 1 is given by the position of artefacts below a paleosol attributed to the Allerød (Tromnau, 1975a, p. 16) and probably representing an Usselo soil, which was also identified at a site 80 km to the northwest (Kaiser & Clausen, 2005).

I will now present a critical review of the collections studied, particularly the point assemblage from Teltwisch 1. From a comparative perspective, I will then address the question of the blanks and the shaping of the points, as well as questions relative to their utilization, such as hafting and propulsion methods.

## Evaluation of the sources : the question of homogeneity

### Poggenwisch

At Poggenwisch, the Hamburgian shouldered points (fig. 3) were found exclusively in the habitat zone of the site (Rust, 1958; fig. 1). Their number is difficult to determine as the figures published by Rust are contradictory: first, the number shown between parentheses after the word

<sup>3</sup> - During excavations, a few bone remains were also found in the deepest ten centimetres of a peat, with a maximum thickness of 2.9 m, under the modern soil level (Rust, 1958, p. 105). This position corresponds to a depth of around 3.1 to 3.2 m and overlies the Hamburgian horizon in this part of the pond of approximately 2.4 to 2.3 m. At 2.75 m depth, fragments of reindeer antler appear and, according to Rust, were found in primary position. According to the palynological observations, the peat in which these remains were found is interpreted as dating to the Preboreal and, starting with a high augmentation of tree pollens, to the Boreal (Schütrumpf, 1958, p. 18). More recently, the radiocarbon dating of a reindeer scapula from this peat gave a result of 9992 ± 53 BP (KIA-11171; Benecke & Heinrich, 2003), which would confirm the attribution of the lower part of the peat to the Preboreal. However, the reindeer antler mentioned, which is under the bones in the peat, was dated to 11,250 ± 50 BP (GrN-11262; Lanting & van der Plicht, 1997, p. 116). Lanting and van der Plicht explain this date through a revision of the interpretation of Schütrumpf, meaning that they attribute the lower part of the peat to the pine phase of the Allerød (middle phase), which would be directly overlain by the Boreal, the final phase of the Allerød, the Dryas III and the Preboreal being absent in this pond. If this new interpretation is correct, KIA-11171 would have a problem and would represent an intrusion from the missing Preboreal horizon. On the contrary, if we accept the attribution of Schütrumpf, the bones would be intrusive into the peat where GrN-11262 could be polluted by older humic acids that rose with the water table.



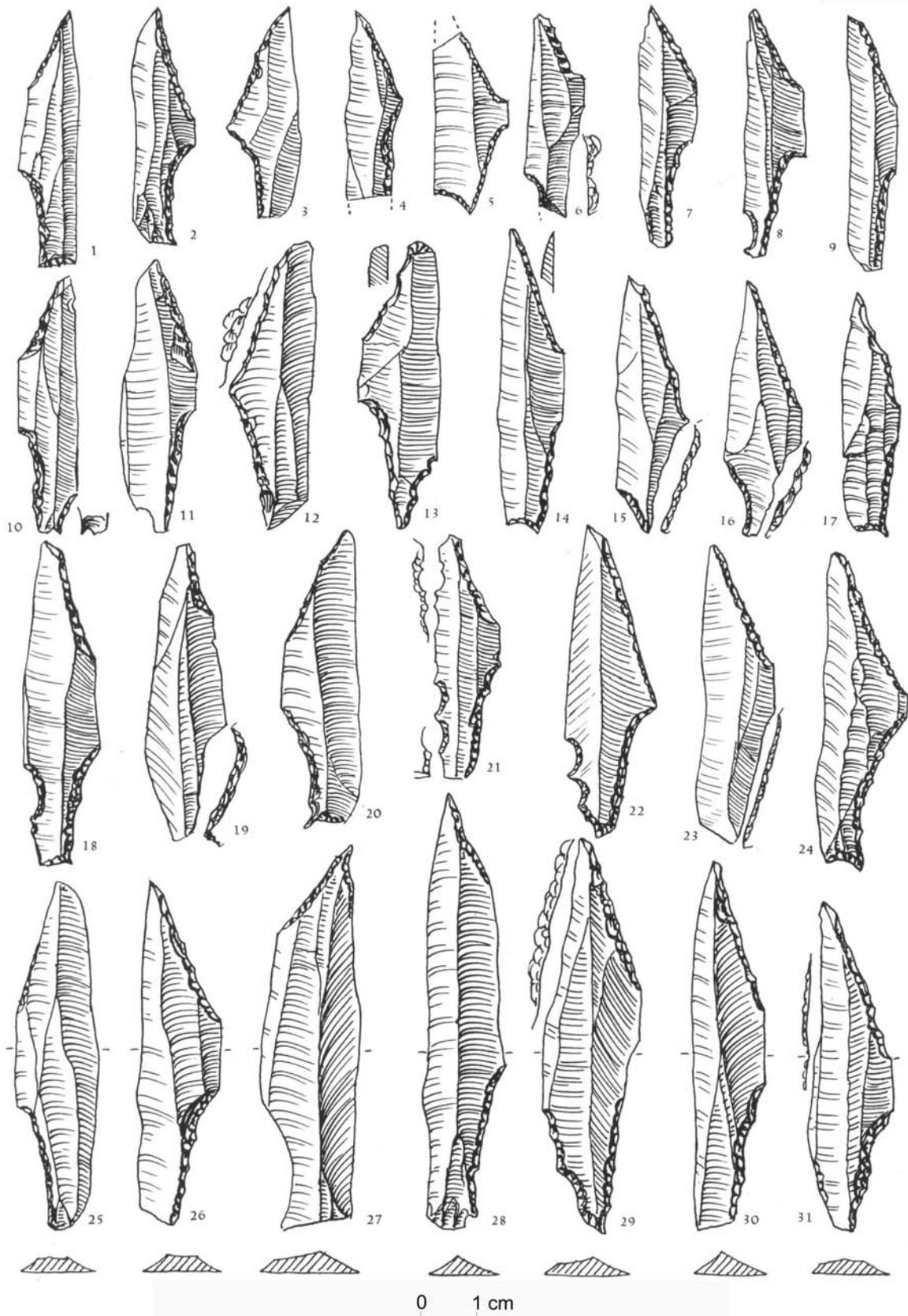


fig. 3 : Hamburgian shouldered points from Poggenwisch. After Rust, 1958, plate 44.



“Kerbspitzen”—or “shouldered points”—is 45 (Rust, 1958, p. 96); second, in the sentences that follow this number, he speaks of 35 whole or almost whole pieces, eight basal fragments and one point fragment, for a total of 44 pieces; third, in the description of pieces by basal retouch type, he mentions 39 whole points and eleven basal fragments, thus 51 pieces including the apical fragment. When the artefacts from this site arrived at Landesmuseum Schleswig in 1968, only 37 pieces were present (according to the Archäologisches Landesmuseum Schleswig-Holstein archives), and today there are only 26. I exclude three, which are, in my opinion a fine Zinken, a probable ancient point blunted at the apex and with use retouch on the adjacent unretouched edge, and a blade with lateral retouch, for which an attribution as a point cannot be totally excluded. At least the two first pieces were counted by Rust among the points since they are included with in the illustrations of points that he published (fig. 3, n° 13, 27). If we accept the description of basal retouch by Rust (Rust, 1958, p. 96) as the most reliable indication of the number of points, ten basal fragments are missing. The fragment that is still present has direct shoulder retouch associated with inverse retouch on the edge opposite the truncation. Consequently, it seems to represent one of the two fragments described by Rust as having alternate retouch, the truncation not having been observed. The nine other basal fragments consist of two fragments with only direct retouch, five fragments with direct retouch plus a truncation, one fragment with direct retouch opposite direct retouch with a notch and one fragment with only inverse retouch.

Still based on this description of bases by Rust, and considering the whole and almost whole points, eight points with only direct retouch and four with only direct retouch and a truncation would be missing. One point with only direct retouch that I classified as undetermined due to its basal fracture can nonetheless be included in the first group. The points with direct retouch on the two edges of the base, without distinction based on the presence or absence of a truncation, appear eight times according to Rust, while I counted three examples. However,

it is possible that one of the two points associating direct retouch with alternating retouch was included in this group. Rust mentions three points with direct retouch and opposed notches; I found two points of this type, one meanwhile with ventral retouch on the same edge as the dorsal notch. Only one of the two points with only inverse retouch is still present, while all of the pieces with alternate retouch appear to be accounted for.

In addition, on the plate published by Rust, ten points that are not present in the assemblage available today are represented (fig. 3, n° 1, 3, 5, 9, 15, 18, 22, 23, 25, 26). The forms, dimensions and retouch locations of these ten points are comparable with the available collection of points (see below). Even if this sample of points is insufficient for certain statistical calculations, such as parametric tests, it is thus still representative of the original assemblage.

An additional apical fragment designated as “Rust inheritance” does not have a clear discovery context and is thus not included in this study.

### *Teltwisch 1*

It is especially necessary to evaluate the sources of the assemblage of Teltwisch 1. At this site, 53 shouldered points (fig. 4) and backed points (fig. 5) were found (Tromnau, 1975a). Today, I count 43, plus four fragments that could be fragments of the bases of points. Two pieces had already disappeared before their arrival at the museum (G. Tromnau, personal communication) and the difference remaining between the counts might be partly explained by differences in the classification of some ambiguous fragments.

### *The presence of backed points*

An element inciting caution is the ten or so backed points found along with the shouldered points (fig. 5). The excavator speaks of “Gravette Points” (Tromnau, 1975a). I identified seven of them in the assemblage (fig. 6), but I question the projectile point attribution of some of them. In any case, they do not form a homogeneous group due to their morphology and the nature of their retouch.



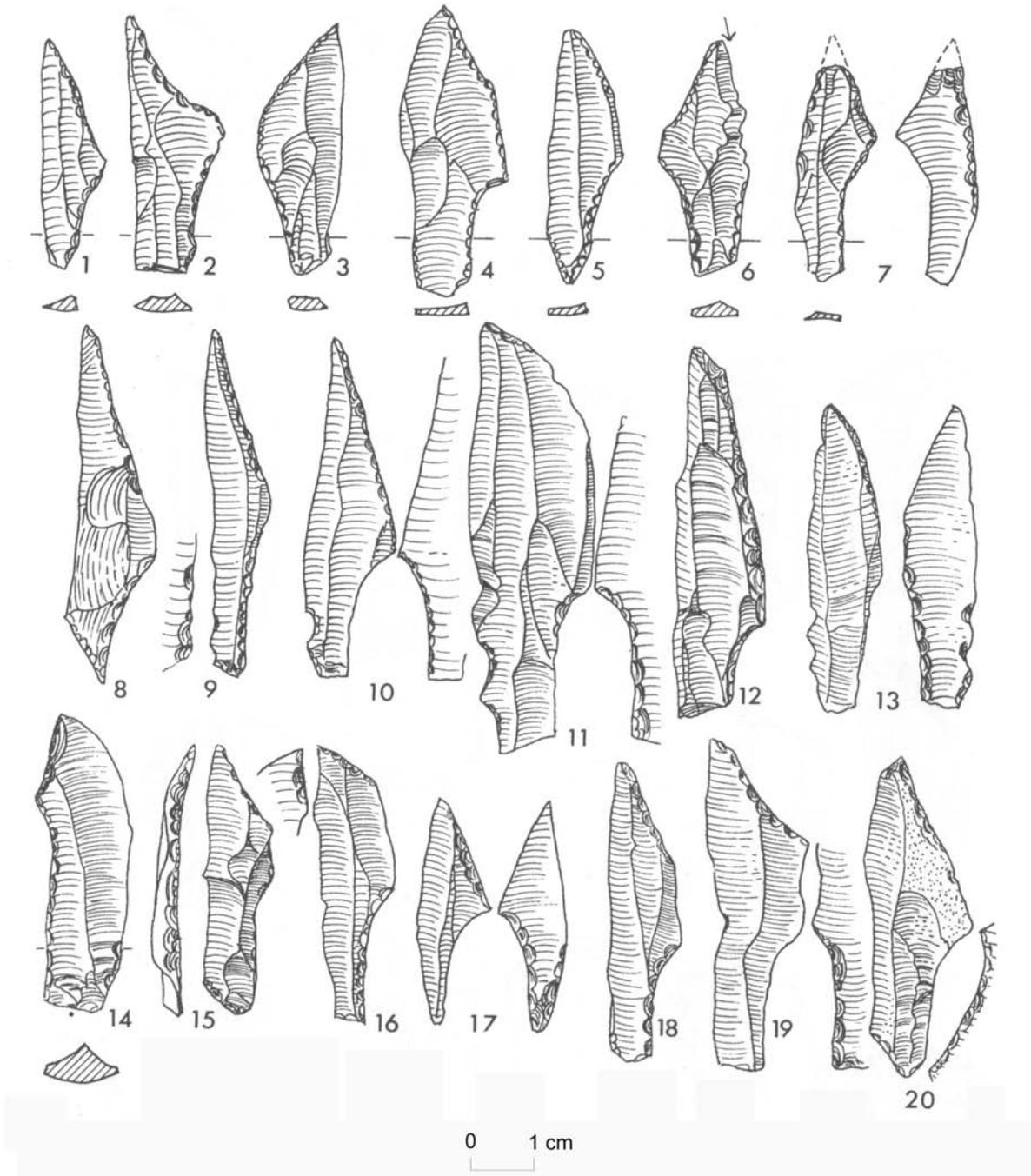


fig. 4 : Hamburgian shouldered points from Teltwisch 1. After Tromnau, 1975a, plate 1.



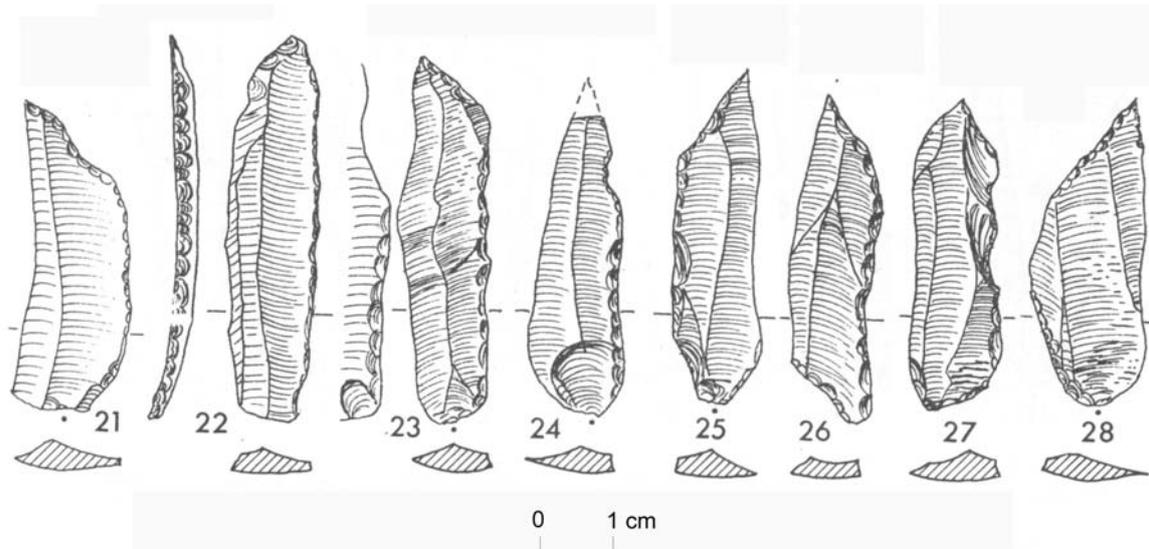


fig. 5 : Backed points from Teltwisch 1. Scale 1:1. After Tromnau, 1975a, plate 1.

- The backed point (fig. 6, n° 1), whose blank can be situated at the beginning of the full blade debitage phase due to a refit (see below), looks more like a Federmesser or arched-backed point. It is oriented with the apex on the distal part of the blank. The back retouch avoids the bulbar base, not beginning until 7 mm from the butt. This retouch is direct, continuous and slightly curved; its delineation nonetheless has an angle that allows distinction between the apical and lateral retouch. Both are abrupt, but the width and depth of the retouch scars of the lateral retouch is more variable. Moreover, it does not correct the slightly curved and twisted profile of the blank.

- One point (fig. 6, n° 2) is made on a blank that resembles an elongated flake. It has direct, non-shouldered basal retouch and alternating apical retouch, separated by an unretouched edge and organised in a way that suggests it may be a preform of an arched-backed point. The apex is again located on the distal part of the blank. The retouch is abrupt, except for the ventral part of the apical retouch, which forms an angle of 100° to 110° with the ventral face. The retouch scars of the basal and lateral retouch are narrower and have edges that are more parallel than those of the apical retouch. The inclination of the butt relative to the axis of the piece is also an indication that the blank was removed from the edge of the blade removal surface.

- The position of the blank on the core also seems to be the cause of the curved and twisted profile of one of the two pieces that I do not consider as projectile

points (fig. 6, n° 3). The transverse flake scars on one of the planes of this blank indicate that it was probably located at the junction between the blade removal surface and the side of the core. Its proximal part was removed by diagonal truncating retouch that forms a small spur with lateral concave retouch that extends along only 9.5 mm. Both of these retouches are direct and abrupt and the 3 mm wide spur has bladelet retouch. This latter retouch type, as well as the morphology of the ensemble of these retouches, leads me to consider this part of the piece to be a Zinken-type active part that was probably reworked, and not a projectile point base, even if such bases appear on Federmessers (Schwabedissen, 1954, fig. 11, j). In addition, the state of the edge of this part is reminiscent of the active parts of blade-firestones. On one of the edges there is abrupt retouch that becomes more irregular in the mesial part, which is the thickest part of the blank. On the distal part, fine retouch along 9 mm forms a point with the opposite edge. This edge also has light use retouch on the dorsal face, along 5 mm and especially in a zone where its delineation is convex. This leads me to interpret the unretouched edge as the active part and the retouched edges as the hafted edge or a blunted zone where the fingers could be placed during use of the unretouched edge.

- The same tendency can be observed on a more or less rectilinear point with a back that does not attain the apex and has no independent apical retouch.



The second piece that I do not attribute to the group of backed points (fig. 6, n° 4) is a blade or elongated flake with a right distal fracture and direct abrupt retouch on the proximal and mesial parts of one of the edges. Since the opposite edge is slightly damaged, I again propose that this piece was used as a knife rather than as a projectile point.

- One point (fig. 6, n° 5) could be classed as an atypical stemmed Federmesser. One of the edges is modified by abrupt and continuous retouch that attains the opposite edge and thus forms a point. The base, however, does not consist only of the proximal part of the retouched edge, which is straighter than the mesial and distal parts, but also of a direct truncating retouch that is oblique, slightly concave and also abrupt. An 8 mm long stem was thus created. This type of basal modification is rare among Federmessers, but does not contradict this attribution (Schwabedissen, 1954, fig. 11, g, j).

- The typological and functional determination is difficult in the case of another backed point (fig. 6, n° 6). As in the preceding cases, the base of the point is on the proximal end of the blade blank. On one edge, direct, or very direct, abrupt retouch insures the general rectitude of the edge despite its sometimes sinuous delineation. However, this retouch does not cover

the entire edge, but stops at 6 mm from a truncating distal retouch that forms the apex with the unretouched opposite edge. On the most distal part, there is a removal scar that seems to represent a trihedral point that preceded the apical abrupt retouch. The use of the microburin technique seems to have already existed during the Hamburgian (see below). The combination of a straight edge and an oblique truncation that creates an apex occupying less than one seventh of the entire length of the point is atypical and does not correspond to Federmessers or to Creswell Points, whose back angle is located in a less distal position. The attribution of this piece becomes even more difficult considering the inverse retouch present on the basal half of the edge opposite the back. This could have a function related to hafting, but not necessarily the hafting of a projectile point since the hafting of a knife is also possible.

- Finally, a last point (fig. 6, n° 7), also with a straight back, also has apical retouch on the opposite edge, which rejoins the retouched edge at an angle of 70°. The retouch of the entirely retouched edge is regular, composed of narrow removal scars and has an inclination close to 90°. This is also the most streamlined piece (L = 52,1 mm, W = 12,1 mm), made on the most regular blank in terms of the rectitude of the profile and the parallelism of the dorsal ridges relative to the debitage



fig. 6 : Backed points from Teltwisch 1 still available today.

axis. This point, which is the most carefully retouched of the backed points, has use traces that could indicate use as a projectile point: on the base, an oblique ventral chip that starts from a lipped fracture (prolongation < 2 mm) with a hinge termination, itself not diagnostic of an impact fracture (cf. Plisson & Geneste, 1989), could result from crushing in the weapon shaft during a frontal shock. Ventral chips with visible negative bulbs and step terminations along the entire unretouched edge could indicate scraping against a hard material. Meanwhile, we cannot exclude that these latter traces could be the result of a secondary utilisation as a knife, or even that the piece was oriented in the opposite direction. In this case, the atypical apex would in fact be a truncated base and the lipped fracture combined with a chip would be the result of an impact on the apex.

The homogeneity of the assemblage has been contested due to these pieces, which could represent a characteristic Federmesser group assemblage according to some authors (Bokelmann *et al.*, 1983). Moreover, such points are present at all the Danish Hamburgian sites belonging to the late phase of the Havelte (Holm, 1991; Holm & Rieck, 1992; Vang Petersen et Johansen, 1996); these sites meanwhile include domestic tools common in the Federmesser groups, leading to doubts concerning their homogeneity (Clausen, 1998). In addition, one of them, the site of Slotseng (Holm, 1991), includes two Federmesser group locales next to two Hamburgian locales. However, the late chronological position of these Havelte sites could have conferred them a transitory nature. Moreover, judging by the published illustrations, the Classic Hamburgian assemblages of Heber and Deimern in Lower Saxony also have backed points (Tromnau, 1975b).

A second element characteristic of the Wehlen group—that of the Federmesser groups that Schwabedissen declared as typologically of an early nature but not forcibly the earliest of all the groups (Schwabedissen, 1954, p. 70-71)—is a scraper with a stem retouched around its entire perimeter (Schwabedissen, 1954, pl. 57). Some Magdalenian scrapers resemble this type in their lateral retouch that is oblique relative to their longitudinal axis. In my opinion, however, the difference

resides in the blank, the Magdalenian scrapers being made on the most regular blades while the Wehlen scrapers often have surfaces other than those originating from the blade removal surface (cortex, frost-shattered surfaces, and negatives of flakes or blades removed from one or two platforms). Among the Teltwisch 1 scrapers, some have continuous retouch on the two edges, which converge slightly toward the base. Their dorsal faces, however, correspond to debitage removal surfaces and I thus do not consider them as indications of a Federmesser type occupation.

The situation is somewhat different in the Ahrenshöft LA 58 D assemblage, which belongs to the Havelte group (Clausen, 1998). It contains scrapers on very regular blades with or without retouched edges, but it also includes two scrapers with similarities to the Wehlen scrapers. The first (Clausen, 1998, fig. 19, n° 10) is made on a more or less laminar blank which has a natural surface on its dorsal face and which appears to have been detached with a soft stone hammer; the two edges are entirely retouched and slightly convergent. The retouch is inclined or even abrupt along at least 3 mm and irregular. The second is also made on a blank detached with a soft stone hammer. It has cortex, a frost-shattered surface and, on the dorsal face, negatives detached from that same platform as the blank itself. One of the slightly convergent edges has inclined retouch that is fine over most of its length and long on the distal part. The second edge has long retouch on the distal part, use retouch in the mesial part and fine retouch on the proximal part. Finally, a few other scrapers in this assemblage (e.g. Clausen, 1998, fig. 19, n° 8) are made on regular blade supports but the negative retouch scars are wider than those on Hamburgian scrapers in general. From an evolutionary perspective, we could see a development from Magdalenian and Classic Hamburgian end scrapers, to end-scrapers with “Federmesser” retouch, present at least in this Havelte-type assemblage, to Wehlen end-scrapers, whose precursors would belong to the Havelte group. We can meanwhile not exclude the possibility of a mixture with a Federmesser type assemblage at Ahrenshöft, which could be indicated by the presence of a backed



point (Clausen, 1998, fig. 19, n° 4). This piece could nonetheless be a Havelte point since it is broken at the base and the unretouched edge has a negative adjacent to the fracture, which could represent an element of the retouch forming the stem.

#### *Spatial arguments*

A few spatial arguments argue against the possibility of a mixture with a Federmesser group occupation at Teltwisch 1: the distribution of backed points concurs with that of shouldered points (Tromnau, 1975a, fig. 8); the general distribution of remains, which show a single principal concentration (Tromnau, 1975a, fig. 6 and 7) that can be seen in the spatial arrangement of refits, and; the presence of refits over long distances.

I was recently able to refit one of the backed points onto a small series of three blades detached from the same platform as the blank of the point (fig. 7). This refit shows that at least this point was manufactured in place. A transverse fracture removed the extremity of the apex, but the morphology of the fracture surface is not characteristic of an impact fracture. This fracture could even be the reason for which the point was not used (H. Paulsen, personal communication). The fact that it was

found in a meter square next to that of the last blade, in the middle of the concentration, is another argument that it was abandoned in the location of its fabrication. It also shows that blank production occurred in the same location as the transformation of blanks into points, at least in this case. Consequently, we can exclude the idea that this point originates from a simple Federmesser hunting station. On the other hand, if this was a habitat site, we would expect to find domestic tools as well, but there are none. Nonetheless, we cannot exclude that the points were found in a peripheral zone of such an occupation, and that the domestic tools are to be found beyond the excavated surface.

#### *Technological arguments: the debitage technique*

Other questions subsist since the butts of the point and the three blades show traces of percussion with a soft stone and an internal point of percussion (far from the edge of the striking platform), while the majority of Hamburgian blade blanks show traces of percussion with a soft organic or mineral hammer and a tangential point of percussion (skimming the edge of the striking platform). At least three hypotheses to explain this are possible.



fig. 7 : Refit of a backed point (marked with ochre) and three blades from Teltwisch 1.

- Given the presence of cortex zones on the distal part of the blades, and a frost-fractured surface on one of them, one hypothesis would be that these blades were produced during the preparation of the core or at the very beginning of the full blade debitage phase.

- A second hypothesis would be to consider this type of percussion as a third type used to produce blades within the Hamburgian blade debitage strategy. It is true that a small proportion of blades at Teltwisch 1 indicate this type of percussion, but until now we tended to consider them as the result of core preparation or maintenance—what we could call laminar flakes.

- Finally, a third hypothesis could go further and interpret this refit as evidence of an occupation by Federmesser groups in the same location as that of Hamburgian groups. The only differences between these occupations would be the point types and lithic production strategies. It is true that among the four backed points with the proximal end preserved, three show this internal type of percussion, which could indicate a relationship between these two elements. Unfortunately, no detailed description of the apparently variable debitage techniques of Federmesser groups in northern Germany exists. An element of information is available for the site of Alt Duvenstedt (Clausen & Hartz, 1988) where it seems that large irregular butts with visible points of impact exist along with small, thin butts; the bulbs are pronounced and the angles between the striking platform and flaking surface exceed 70°. The blades in question at Teltwisch 1 could thus correspond to those of Alt Duvenstedt.

In order to obtain more elements that would allow a choice between these three hypotheses, it may be useful to observe the butts of other tools and blades in these meter squares and to look for other pieces belonging to this same refit. For the moment, we have not found these pieces. Based on the flint type, one short scraper with a cortical zone covering more than half of its dorsal surface could come from the same raw material nodule. Unfortunately, the square meter provenience is not indicated for this object. Here again, we can ask whether this type of scraper belongs to the toolkit of the Federmesser groups or if it is one of the flake tools that

appears in the Hamburgian inventories. Again based on the raw material, the backed point with probable impact traces was made from a red, translucent flint from which two shouldered points were also made. Another element to add to the puzzle in favour of one of the three hypotheses would be the proportion of blades at Poggenwisch made with the internal impact method. Whatever the case, we prefer for the moment to exclude these seven ambiguous pieces from our study.

## Point fabrication

### *Blanks*

#### *The dimensions*

The blanks from which the shouldered points were made are short, narrow and thin blades. The lengths of the points do not exceed 78.3 mm at Poggenwisch where the average length of whole or almost whole pieces is 53.5 mm ( $n = 19$ ,  $\sigma = 10.1$ ,  $cv = 19.0\%$ ). The lengths of the missing whole points that are shown in the illustrations by Rust ( $n = 9$ ; Rust, 1958, pl. 44), range from 38 to 63 mm; if we add them to the lengths of the points present and round off to the millimetre, the average is only slightly different at 53 mm. The points at Teltwisch have an average length of 45.6 mm ( $n = 23$ ,  $\sigma = 7.8$ ,  $cv = 17.1\%$ ), rather close to the median of 46.1 mm, and their distribution presents a modal class of 46 to 48 mm (table 1), while that of the Poggenwisch points is between 42 and 44 mm. Based on the whole or almost whole pieces, the average width is 13.2 mm at Teltwisch ( $\sigma = 2.3$ ) and 13.1 at Poggenwisch ( $\sigma = 2.0$ ), with a lower coefficient of variation at Poggenwisch ( $cv = 15.0\%$ ) than at Teltwisch 1 ( $cv = 17.2\%$ ). Once again, the average is barely different at Poggenwisch ( $av = 13$  mm) if we include the measurable widths of the pieces represented by Rust. Though the distribution of widths in the Teltwisch 1 assemblage shows a modal class between 10 and 12 mm (table 2), and that of Poggenwisch between 13 and 14 mm, the distribution curve is skewed toward the upper values at Teltwisch 1 relative to Poggenwisch. Since the maximum thickness can be determined on only around ten whole points at



Poggenwisch (2.5 – 4.6 mm,  $m = 3.5$  mm,  $\sigma = 0.6$ ,  $cv = 17.3$  %) (note 4), no comparison is possible. In the Teltwisch 1 assemblage, there is a modal class in the distribution curve between 3.4 and 4.2 mm (table 3) in which the average ( $av = 3.9$  mm,  $\sigma = 0.7$ ,  $cv = 17.6$  %) is integrated, as well as the median of the same value.

An intentional standardization can be seen in the refit of two points from Poggenwisch. At 44.7 mm and 44.2 mm (incomplete due to a pseudo-burin removal) their lengths are nearly identical; their thicknesses of 2.7 mm and 3.1 mm are also rather close and only the width varies slightly at 13.3 mm and 11.0 mm respectively. Consequently, the weight differs little from one point (2.6 g) to the other (2.4 g). Considering the greater morphological and dimensional variability of the points at Teltwisch, which appears through a simple observation of the two assemblages, we would expect greater dimensional variability in this assemblage. A parameter that shows this difference is the relationship between length and width. Since these assemblages have fewer than 30 individuals, it is not possible to calculate the linear regression or coefficient of determination  $R^2$  between these two parameters (Chenorkian, 1996), but the point cloud (table 4) of the length and width shows a lower dispersion at Poggenwisch. Could this greater homogeneity of proportions be due to a greater standardisation of blades in general at Poggenwisch? An example of the relationship between the standardisation of blanks and the dimensions of points is presented by H. Plisson and J.-M Geneste (1989) who observe that the Solutrean Points at Forneau du Diable have smaller dimensions than those of other contemporary assemblages because they are “better adapted to the morphology of the debitage” (Plisson & Geneste, 1989, p. 75) due to the standardisation of the blanks. A second aspect that shows greater variability at Teltwisch 1 is the relationship between the length of the whole point and the length of the shoulder (table 5). Once again, the dispersion is greater in the Teltwisch 1 assemblage than in that of Poggenwisch. This shows that at Poggenwisch,

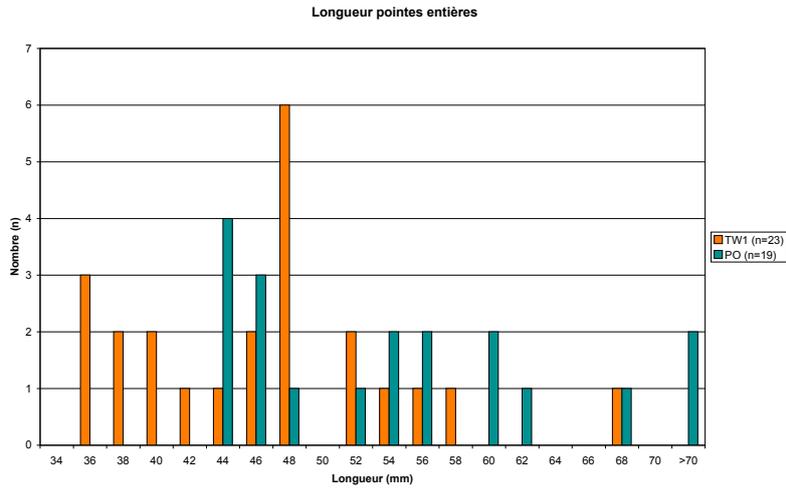
a relative standardisation existed not only in blank manufacture, but also later in the production sequence during the shaping of the blanks into points.

#### *The profile*

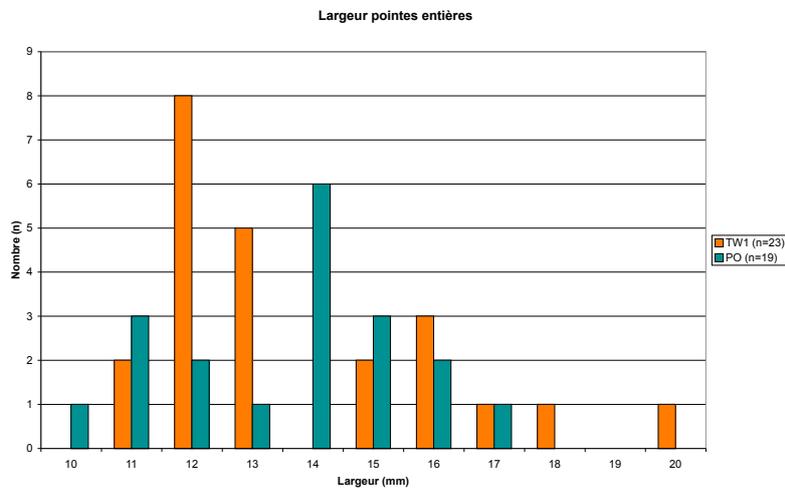
A rectilinear profile seems to be a consistently sought after feature of lithic points. This can be explained by the fact that a point with a symmetric profile will have greater resistance at impact (the force being applied along the axis of the piece) relative to a “crooked” point on which the force of impact will bear on the lower or upper face of the apical end (H. Paulsen, personal communication). Solutrean shouldered points, whose retouch serves in part to straighten the profile, are an example of this principle (Plisson & Geneste, 1989), despite the difference in rectitude between Type A and Type B points (Plisson & Geneste, 1989, p. 75). It is in fact the extremities that most often have retouch on their inferior face, corresponding to the same principle as the basal ventral retouch of Chwalibogowice points, for example. The tanged points of the Swiderian (Taute, 1968, fig. 1, n° 4) have not only abrupt lateral retouch to form the tang, but also, at the base of the tang, retouch on the ventral face that is orthogonal to the axis of the points. Hamburgian shouldered points are also made on relatively rectilinear blades, but very few are totally rectilinear (fig. 8, n° 1; Poggenwisch:  $n = 0$ ; Teltwisch 1:  $n = 3$ ). Almost all of the others have a rectilinear mesial part, along the greater part of their length, associated with at least one extremity that diverges from the axis of the piece. This is most often the basal extremity (fig. 8, n° 2; Poggenwisch:  $n = 10$ ; Teltwisch 1:  $n = 11$ ), while the apical extremity (fig. 8, n° 3; Poggenwisch:  $n = 4$ ; Teltwisch 1:  $n = 4$ ) is as often concerned as are both extremities at once (fig. 8, n° 4; Poggenwisch:  $n = 3$ ; Teltwisch 1:  $n = 4$ ). In a few rare cases, the curvature is continuous and more (fig. 8, n° 5; Poggenwisch:  $n = 1$ ; Teltwisch 1:  $n = 0$ ) or less (fig. 8, n° 6; Poggenwisch:  $n = 3$ ; Teltwisch 1:  $n = 1$ ) pronounced. Almost half of the pieces (Poggenwisch:  $n = 10$ , including 8 only slightly

<sup>4</sup> - The other pieces are now in display cases in the Archäologisches Landesmuseum Schleswig-Holstein and have glue on their lower face, making it impossible to measure their maximum thickness.

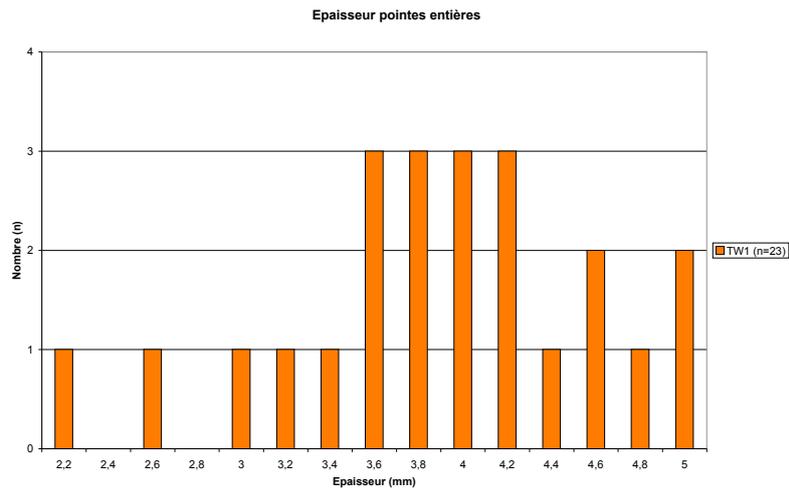




tab. 1 : Refit of a backed point (marked with ochre) and three blades from Teltwisch 1.

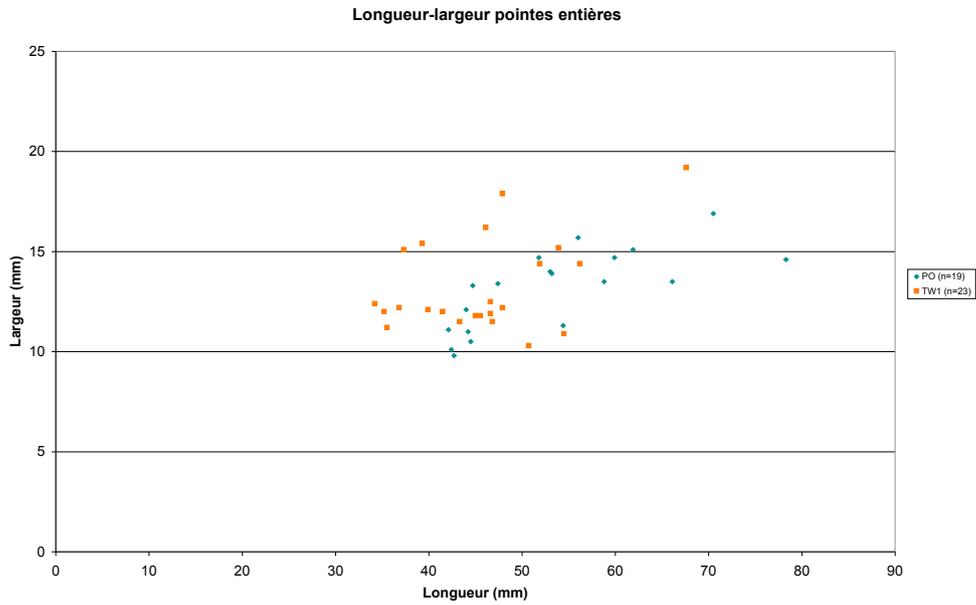


tab. 2 : Distribution of the widths of the whole or almost whole shouldered points from Poggenwisch and Teltwisch 1.

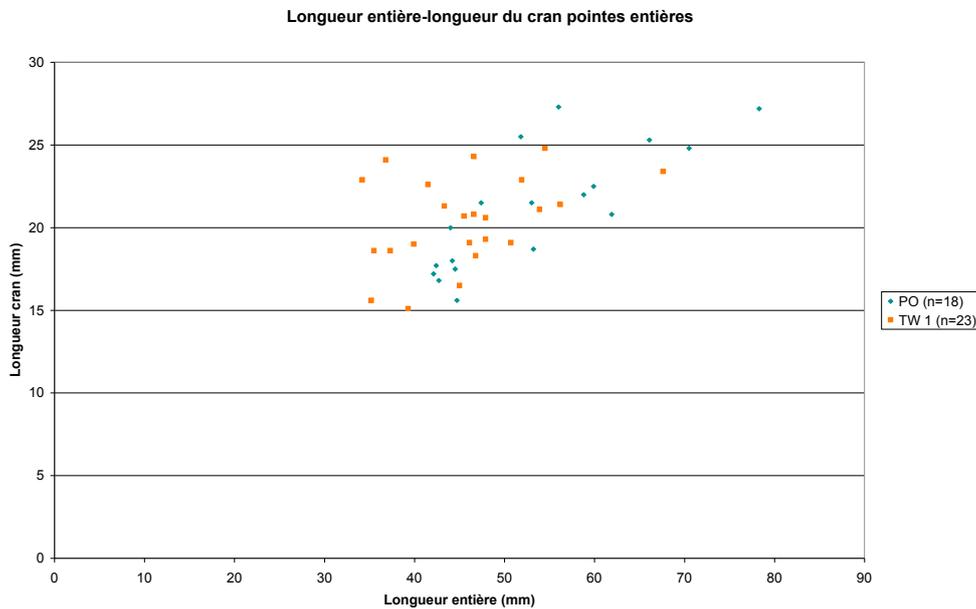


tab. 3 : Distribution of the thicknesses of the whole or almost whole shouldered points from Teltwisch 1.





**tab. 4 :** Relationship between the length and width of the whole or almost whole shouldered points from Poggenwisch and Teltwisch 1.



**tab. 5 :** Relationship between the length of the shoulder of the whole or almost whole shouldered points from Poggenwisch and Teltwisch 1. One of the points from Poggenwisch was excluded due to a measure less precise than the others.



twisted; Teltwisch 1:  $n = 10$ , including 9 only slightly twisted) are also more or less twisted (fig. 8, n° 7). Due to fractures, the profile cannot be determined on two points from Poggenwisch and 13 from Teltwisch 1. In addition, the limits between these forms are sometimes difficult to define. On the one hand, it is possible that this intentional rectitude could have influenced the choice to use a bipolar core reduction method. This utilisation is manifest in the dominance of cores with two opposed striking platforms, as well as by certain refits that indicate a rapid change of the striking platform even at the beginning of the laminar debitage phase, while most of the dorsal faces have unidirectional blade negatives. The question is thus raised as to whether bipolar core reduction was chosen for economic reasons (easier correction of the flaking surface and less costly in raw material) or because it allowed a flattening of the flaking surface and thus more rectilinear blade profiles. On the other hand, if the points were hafted in a manner that assured their base would follow the axis of the shaft, the apical would no longer be in line with it (see below), thus creating a disadvantage at the moment of impact. Moreover, among the points that have clear impact traces, we find examples with inclined and/or twisted extremities, while some of the points without macroscopic impact traces are (almost) rectilinear.

#### *The debitage technique*

The type of hammer or flaking technique used is rarely identifiable since the proximal part of the blank was usually removed during the shaping of the point. Only one shouldered point from Teltwisch 1 permits a description of the knapping stigmata. The characteristics that suggest the use of a soft stone hammer in a tangential striking direction are a butt thickness of less than 1 mm and tightly spaced undulations on the first millimetres. At Poggenwisch, four points still have their proximal end. The bulb of the longest one is splintered (fig. 9). Another one has a possibly splintered bulb, and another a cone of percussion that strongly indicates they belong to the “soft stone hammer” group. There is one more example with non diagnostic stigmata. In all of the other cases, we can reason only by analogy. Since

the blades and blanks whose stigmata indicate the use of a stone hammer often have dense and pronounced undulations over most of their length, the twenty or so pieces (including the fragmented ones) that also have these undulations seem to indicate the use of this type of hammer as well. Finally, the five proximal microburins from Teltwisch 1, as well as one of the two from Poggenwisch (see below), all have butts less than 1 mm thick, which correlates with the observations made on the points themselves. The observable stigmata thus concur to suggest that debitage with a soft stone hammer was the principal technique employed in both of the assemblages studied.

#### *The place within the core reduction sequence (chaîne opératoire)*

Most of the blades used as point blanks originate from an advanced stage of the reduction sequence of blade debitage. As we have already seen, their widths are reduced and their lengths rarely exceed 60 mm. These values correspond to the last negative blade scars on the cores, or are lower than these. The fact that only one point from Teltwisch 1 has cortex and that there are no crested blades are also indications that the point blanks were not produced at the very beginning of the full blade production phase. In addition, there is only one point with a frost-shattered surface, three points with a cleavage surface and two with an ancient surface. There is a similarly small proportion of natural surfaces at Poggenwisch where only one point (fig. 8, n° 5) has a frost-shattered surface. The presence of preparatory negatives perpendicular to the laminar negatives on the dorsal surface of only two points from Poggenwisch and two points from Teltwisch 1, as well as the rarity of natural surfaces, show that the point blanks originate from the central parts of the blade removal surfaces and that they belong to the full blade debitage phases. This observation is supported by the parallelism of the edges of the negative blade scars on most of the points. If we consider the missing points from Poggenwisch, which are illustrated on the plate published by Rust (fig. 3, n° 1, 3, 5, 9, 15, 18, 22, 23, 25, 26), we can observe that their upper faces also have mostly parallel removal





fig. 8 : Different profile types of shouldered points (n° 5 and 7 Poggenwisch, n° 1-4 and 6 Teltwisch 1).



fig. 9 : The longest point from Poggenwisch with a splintered bulb.

scars, indicating a position of the blank in the middle of the blade removal surface. Numbers 1 and 3 also have removal scars that are slightly divergent relative to the axis of the piece, which indicates a lateral position on the blade removal surface. Finally, number 22 has a natural surface next to a blade negative, which could also suggest a position at the junction between the removal surface and one of the flanks of the core.

The point blanks seem to originate from blade debitage phases during which the striking platform was only rarely changed, unless the products of the opposed striking platform were too short to be manifest on the distal part of the blanks, given that most of the points have removal scars on their upper face oriented in the same direction as the points themselves. For the points from Poggenwisch, the use of only one striking platform is nearly exclusive since all the negatives of 20 pieces are oriented in the same direction as the blanks. The three others have, respectively, four out of five, four out of six and five out of seven negatives oriented in the direction of the blank and one or two undetermined negative(s) (either very small or on the edge). This observation does not change if we include the missing pieces illustrated by Rust (fig. 3, n° 1, 3, 5, 9, 15, 18, 22, 23, 25, 26): in only one case (n° 9), the dorsal negatives are oriented in two opposed directions, while the negatives of all the others are oriented in one direction. It is of course impossible to determine the orientation of the blanks themselves and, consequently, their relation with the negative removal scars on their dorsal faces. At Teltwisch 1, the points with negatives in the direction of the blank dominate with 23 examples out of 36, while only one piece has negatives in the opposite direction only. Six other pieces have negatives in both directions, but the opposed negatives dominate in only one case. Five points have an undeterminable negative next to negatives oriented in the direction of the blank, and one last point is distinguished from this group only by a supplementary negative in the opposite direction. Moreover, most (five out of seven) of the possible backed points from Teltwisch 1 have negatives oriented only in the direction of their blanks.

Among the 68 cores from Teltwisch 1, a group of seven (fig. 10) can be distinguished by their narrowness, the presence of cortex on the flanks and/or on the back, and for some, the type of flint (e.g. fig. 10, n° 1 and 2). For seven of them, the heights of the blade removal surface or surfaces is concentrated between 64 and 74 mm, and in one case, the initial height of one of the removal surfaces can be reconstructed through a refit of 80 mm. For some of the other cores of this group, the presence of cortex or other natural surfaces suggests that the heights of the blade removal surfaces were not much greater at the beginning of their exploitation than when they were abandoned. The maximum widths of most of the visible negative blade scars ranges from 13 to 17 mm, some not exceeding 10 mm. This could indicate an independent reduction sequence with the objective of producing the short and narrow blades that correspond to the point blanks.

Even though the use of a soft stone hammer is also attested for phases other than the end of the blade production phase, the absence of stigmata indicating the use of a soft organic hammer on the points could show that the majority of blanks originate from the end of the blade debitage phase.

### *Point shaping*

#### *The microburin technique*

The microburin technique is especially well known in the Mesolithic period when it served sever blades to obtain fragments that could easily be transformed into microliths. This technique (e.g. Tixier *et al.*, 1980) consists of placing the upper face of a blade on the edge of an anvil with the axis of the blade oblique to this edge. A notch is made on the edge of the blade by striking it with a thin stone hammer. When the notch attains a dorsal ridge, the fracture is produced in the direction of the edge of the anvil, and is thus oblique relative to the axis of the blade. A fragment is thus obtained with a trihedral point (*piquant-trièdre*) that forms one of the edges of the microlith. The waste product is a microburin with a fracture surface that is complimentary to the trihedral point.



It is interesting to note that this technique was also used in the fabrication of projectile points other than microliths and in periods other than the Mesolithic. Its interest for the shaping of shouldered points lies in the removal of the proximal part of the blank, either at the apex or at the base of the point, and in the creation of the apex. Meanwhile, microburins are already known in the Upper Magdalenian (Hahn, 1993), making their presence in the Hamburgian not very surprising. Nonetheless, the use, or not, of this technique constitutes an element of comparison between Magdalenian lithic points in the Paris Basin and Hamburgian shouldered points, which can aid in the distinction between phenomena of convergence and expressions of the same tradition.

Microburins appear in almost all Hamburgian assemblages, Classic and Havelte (Burdukiewicz & Schmider, 2000; Clausen, 1998; Holm & Rieck, 1992; Kabacinski *et al.*, 2002; Madsen, 1983; Mencke, 195; Rust, 1937; Taute, 1959; Tromnau, 1975b, pl. 62; Zoller, 1963, fig. 6, n° 2), though the phenomenon of the microburin technique during the Tardiglacial has not been studied in detail. In the Teltwisch 1 assemblage, I identified five proximal microburins (fig. 11), as well as one distal example and one other one that has a microburin type fracture surface on its distal extremity and a straight fracture with a hinge terminated prolongation on its proximal extremity. All of the proximal pieces are less than 12 mm wide (in two cases, the maximum width does not correspond to the initial maximum width of the blade) and three of them are even less than 10 mm wide (including one incomplete width). The thicknesses vary between 1.9 and 3.8 mm. These values correspond to those of the narrowest and finest points, but also to the calibres outside of the inferior dimensional limits of this assemblage and which are thus not represented. Two explanations appear possible: either such points were manufactured at the site and taken away but not brought back, or the microburins were also used for the fabrication of other tool types. Due to the lack of sieved materials, it is possible that microburins are underrepresented in the inventory. This hypothesis seems even more probable at Poggenwisch where I have currently identified one

atypical proximal microburin whose fracture face continues in the direction of the retouch. Moreover, the other waste products of the fabrication of these points, such as fragments with a straight fracture or Krukowski microburins, corresponding to the types AI, BI, and II, CI and II illustrated by Madsen (1992, fig. 79), are present in both assemblages.

In a paper on microliths where he mentions that the microburin technique was used during the Hamburgian, Mencke (1951) already refers to trihedral points on some tools from Meiendorf and Hamburgian sites located near Cuxhaven. Rust, who still used the denomination “Mikro-Stichel” (Rust, 1937), the direct translation of the French term, observed possible trihedral points on six points from Poggenwisch (Rust, 1958, p. 96) (note 5). This feature was also detected by Taute on some shouldered points at Deimern 28 (Taute, 1959). Hartz spoke of trihedral points as a common element of Hamburgian shouldered points (Hartz, 1987, table 1), though he did not give numbers or relate them to the microburins. According to him, the apical edge thus created would not require further retouch (*op. cit.*, p. 9). Trihedral points are also a common element between the Classic Hamburgian and the Havelte group since Madsen found them under some apical retouch of Havelte Points from Jels (Madsen, 1996, p. 68), which correlates with the presence of microburins in the two Havelte assemblages of the site (Holm & Rieck, 1992; Madsen, 1992). On the points from Teltwisch 1, I observed four proximal trihedral points and one distal one on the apical extremities, along with four other possible ones (fig. 12). On the points from Poggenwisch, there are two proximal and three distal ones, along with two possible proximal ones and one possible distal. All of these trihedral points have retouch on the area adjacent to the edge, either over their entire length, or only on the part opposite the apex. On three of the points for which we have only the drawings (fig. 3, n° 15, 18 and 22), the apical retouch does not seem to join the unretouched edge, which could indicate the presence of trihedral points. At Teltwisch 1, three other points seem to have remains of trihedral points on their base (fig. 12). In addition, I observed apical trihedral points on





**fig. 10** : Three examples of a group of cores from Teltwisch 1 that could have been used to produce shouldered point blanks.





fig. 11 : Two proximal micro-burins from Teltwisch 1.

the points from Meiendorf, Hasewisch and Stellmoor, which are located in the same valley. On the contrary, the shouldered points and points with an angular back of the Paris Basin do not seem to have been manufactured by this technique (Burdukiewicz and Schmider, 2000). At Tureau de Gardes locus 7, Krukowski microburins have been identified (Caspar in Lang, 1998).

#### *Modification of the apex*

In general, the apex is formed by the unretouched edge and an oblique truncation, with or without a preceding trihedral point. On some points, the morphology of the apex suggests that one pointed extremity was clearly intentional. First, three points from Poggenwisch and 14 from Teltwisch 1 have an unretouched edge converging toward the truncation in a way that the angle formed between these two elements is smaller than with a straight unretouched edge. Five of the seven backed points from Teltwisch 1 also show this feature.

Second, some points have retouch on the first apical millimetres of the unretouched edge. In one case at Teltwisch 1, this retouch forms an inverse notch that creates a thorn-like apex; a second point of this assemblage has dorsal retouch along around five millimetres, creating a slight inclination of the edge and, along with the truncation, thus forms the apex. In a similar manner, on one of the backed points (see above; fig. 6, n° 7) the retouched edge meets an oblique truncation.

In contrast, one of the points from Poggenwisch, known from the illustration by Rust (fig. 3, n° 25), has only incomplete apical retouch, as if the least effort possible was made to create an apex.

#### *Retouch*

On the blanks, the apical and basal retouch is situated in such a way that the apex is located on the distal extremity 57 % of the time at Poggenwisch (n = 13/23) and 58% at Teltwisch 1 (n = 21/36). With the apex oriented at upward, the retouched edge is located on the right 86% of the time in both assemblages.

The location of the basal retouch is somewhat variable, thus resulting in a variable morphology of the point bases. At Teltwisch 1 (table 6), excluding the backed points, only 36% of the points on which we can determine the basal modification represent what we could call “the Hamburgian type point” with direct, unilateral retouch. Less than half the pieces have unilateral retouch. The proportion of exclusively direct retouch is 68%. On the contrary, at Poggenwisch, direct unilateral retouch represents 52% of the cases. Unilateral retouch is also found on more than half the points (57%), but the proportion of direct retouch (71%) is only slightly higher than at Teltwisch 1. On the missing points illustrated by Rust, direct unilateral retouch is dominant (n = 6; fig. 3, n° 1, 3, 5, 9, 25, 26) and sometimes associated with a truncation. Two pieces combine direct retouch and one or two direct notches (fig. 3, n° 18, 22), while two other points have inverse retouch (fig. 3, n° 15, 23), in one case next to a truncation (fig. 3, n° 15).

We shall now focus on this variability of the shouldered point bases. When we consider the differences between two assemblages, we can imagine chronological, geographic or functional explanations. These latter are also feasible for intra site variability. However, we cannot exclude the possibility that different individuals made the points, or even that they were made by one individual with changing behaviours. The refitting of two shouldered points at Poggenwisch (see above) is

<sup>5</sup> - It is interesting to note that in the same volume in which he presents the trihedral points of Poggenwisch, Rust declares that the microburin technique was not used for the fabrication of shouldered points (Rust, 1958, p. 33) when he speaks of the microburins of the site of Borneck.



**fig. 12** : Examples of trihedral points (piquants-trièdres) on a shouldered point from Poggenwisch (1) and a backed point from Teltwisch 1 (2). Three points from Teltwisch 1 also have remains of trihedral points on their base, including two examples shown here (3.4).

a good example of this variability existing between products presumed to be made by the same person: the first point has inverse retouch associated with direct retouch and a small direct truncation, while the second point has direct shoulder retouch and on the opposite edge, a notch that is also direct. In addition, the first base is on the proximal end of the blank, while the second is on the distal end. I favour the interpretation of an adaptation of the projectile point to the shaft. The retouch on the first point could also play a role in the correction of a slight proximal twisting. Whatever the case, this refit brings our attempts to explain the variability of shouldered points somewhat back into perspective.

Another interesting question concerns the function of inverse retouch in the modification of point bases. As I already said, on some points, this retouch seems to correct a twisted profile in order to facilitate their hafting. One point from Poggenwisch (fig. 8, n° 7) shows the consequence of direct retouch on a twisted proximal end of a blade: hafting in a lateral groove seems to be impossible. Since inverse retouch at Teltwisch 1 appears three times on the distal end of the blank and six times on the proximal end, it is possible that this type of retouch also served to thin the zones with a bulb of percussion. At Poggenwisch, however, inverse and alternating retouch are equally present on the proximal and distal ends of blanks, and at Teltwisch 1, the points with inverse retouch fall in the middle of the distribution of point thicknesses and the distribution of shoulder thicknesses. Could this thus be a choice made at the moment of the transformation of the blank, simply influenced by the ease of manipulating it? Perhaps, but the inverse retouch has an angle inferior to that of the direct retouch, which could influence hafting (see below). The function of the truncations found on half of the points also remains to be determined. In one case at Teltwisch 1, an inverse truncation removed the bulbar part of the blank, which would have created an arched profile at the base of the point. During experimental fabrication of shouldered points by H. Paulsen, we realized that intentional fracturation by percussive retouch can create short retouched zones at the base of

points, notably on the unretouched edge and the basal extremity. We must thus re-examine the archaeological points from this perspective in order to attempt to explain part of the basal retouch and, consequently, find the reason for the morphological heterogeneity of the bases. In other cases, especially that of true notches, the retouch opposite the shoulder could serve to protect the ligature, as Beckhoff (1967) has already proposed.

## Use

### *Hafting*

Two hafting methods have been proposed for Solutrean shouldered points, including one in which the point was inserted into a lateral groove (Plisson & Geneste, 1989). This principle has also been proposed for Hamburgian shouldered points (fig. 13; Beckhoff, 1967; Lund, 1993). The difference between the models of Beckhoff and Lund reside in the manner of mounting the point into the groove: for Beckhoff, the unretouched edge is inserted into the groove, while for Lund it is the shoulder that is inserted. This latter proposition seems more logical considering the presence of notches or simple retouching of the base of the unretouched edge of a few points: in Lund's proposition, these notches or retouching are located outside the shaft can and thus allow fixation of the ligature. Moreover, in Beckhoff's version, the asymmetry of shouldered points is not compensated for (see below).

One of the advantages of this type of hafting relative to a complete insertion—known for Ahrensburgian tanged points (Rust, 1943) and proposed for Hamburgian points with bilateral basal retouch (fig. 13 a; Beckhoff, 1967)—could be the ease with which the point can be detached at the moment of impact without breaking the shaft since the resistance on the side of the groove would be less than on the side with the shaft. The preservation of the shaft is important in an environmental context where wood is rare. The experimental shots made by Geneste and Plisson (1986) with replicas of Solutrean shouldered points also showed that if this type of hafting is associated with resin and no ligature, the points break at the apex or come out of the shaft without damage. In



Série	Type de retouche basale												
	Directe		Inverse		Dir. + dir.		Dir. + inv.		Dir. + alterne		Inv. + inv.		Indéterminable
	n	%	n	%	n	%	n	%	n	%	n	%	
Teltwisch 1	10	37	2	7	9	33	4	15	0	0	2	7	13
Poggenwisch	11	52	1	5	4	19	3	14	2	10	0	0	2

**tab. 6 :** Basal modifications of the shouldered points from Poggenwisch and Teltwisch 1. The percentages are calculated based on the determinable points only.

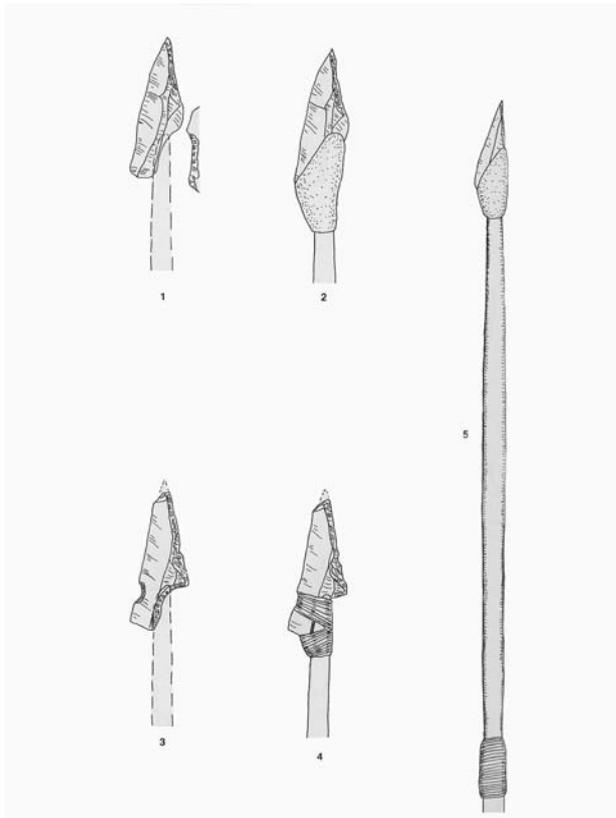
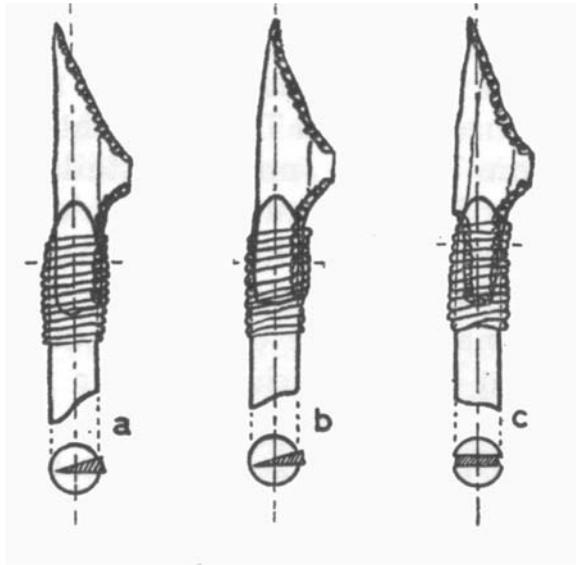
addition, positioning the point at a slight angle relative to the shaft (fig. 13 b; Lund, 1993) allows the apex to be positioned in this same axis, thus compensating for the asymmetry of shouldered points. The disadvantage of an apex positioned outside of the axis of the shaft, as seen from above, is that only the blunt apical truncation comes in contact with the target and is thus confronted with a greater resistance than that of the unretouched sharp edge (Lund, 1993). The basal part jutting out from the shaft could play the role of a barb. However, this hafting method would require a larger shaft and thus a more massive projectile in order to be effective. Such a projectile is hardly compatible with a bow, but conceivable as a spear that is launched by hand or with a spearthrower.

A disadvantage of this technique could meanwhile be that the weapon armature is positioned outside of the longitudinal axis of the projectile (see above). When the point is nearly rectilinear and the apex diverges only slightly from the axis of the shaft, this is not problematic, but if the point possesses an inclined extremity and does not remain within the limits formed by the edges of the shaft, as seen from a lateral view, the point is more vulnerable at impact. This phenomenon has been observed during experimentation (Odell & Cowan, 1986, cited by Lund, 1993). In addition, a point that extends beyond the limits of the shaft creates a circular motion around the axis of the projectile during flight and thus reduces the precision of the shot (personal communication, H. Paulsen). With a sufficiently wide groove and mastic, this difficulty can be overcome (note 6), but for the Hamburgian we have no direct evidence of the use of resins. And since birch was present only in dwarf forms (Usinger, 1998), pine is the only tree that could have furnished resin, but in small quantities. Though we cannot exclude the use of glues made from animal materials, the objective of experiments conducted with H. Paulsen was to find an alternative hafting technique

that would allow us to rectify the profile of projectiles without the use of mastic. His proposition (fig. 14) was inspired by the Neolithic points found in the Olenij Ostrov cemetery in Lake Onega (fig. 15; Gurina, 1956; Taute, 1968). These points were mounted on bevelled bone foreshafts and correspond to the principle of single-bevelled bone points: the shoulder of the point is supported by the bevelled distal extremity of the shaft. A similar hafting type is known in the Saqqaq culture of Greenland for the mounting of bifacial points onto spears and arrow foreshafts (Grønnow, 1988, fig. 8, 10). In our case, the point was mounted on the shaft with a tendon ligature that becomes very rigid when dry. As the basal part of the point, sometimes inclined, was fixed onto the oblique face of the shaft, its apex was positioned in the axis of this latter or at least remained, from a lateral view, in the zone delimited by these edges. The variation of the thickness of the points at the shoulder also presented no problem. On the contrary, for the pieces with inverse retouch, only the edge touched the lateral part of the shaft, making the fixation of the point more unstable and the junction between the point and the shaft less solid.

With H. Paulsen, we tested the efficacy of this hafting method through experimental shots. Since the method of propulsion used with Hamburgian shouldered Points is unknown (see below), we chose to use a Holmegård type bow (Becker, 1945), which is the oldest type currently known and which has an estimated draw weight of 21 to 32 kg (Junkmanns, 2001). The arrow shafts were made from pine since this tree is attested in the region at the GI-1e (Usinger, 1998) and the oldest arrows known, found at Stellmoor (see below; Rust, 1943), were made from this wood. Eleven copies of the shouldered points from Poggenwisch (table 7) were manufactured and six of them were chosen to arm the arrows. The arrows were 79 cm long and 8 to 10 mm thick. The weight of the projectiles varied between 30 and 36 g (table 8). We





**fig. 13** : Propositions for the hafting of Hamburgian shouldered points. a: after Beckhoff 1967, fig. 4; b: after Lund, 1993, fig. 3.



used the simplest type of fletching known, consisting of three half feathers attached at their extremities (fig. 15), which is the system used by American Indians on the northwest coast (Miles, 1963).

The target was a piece of pork thorax around 4 cm thick and containing the ribs. The layer most exposed to the arrows consisted of pure fat; toward the interior of the thorax, there was a layer of meat with fat, then another layer of fat and the ribs. A difference relative to a living target was that the fat was less flexible. In order to avoid damaging the arrows that traversed the meat, the target was placed in front of an empty and open cardboard box so that its depth would protect the projectile heads (fig. 15). The shooting distance was 6 metres. The points traversed the target with no difficulty. When there was contact with bone, the point broke leaving the shaft undamaged (fig. 16). We believe that the frequency of breaks almost immediately below the shoulder is related to the solid ligature, in a manner similar to the observation of Plisson and Geneste (1989) that fractures just above the shoulder were due to the ligature. On the Teltwisch 1 points, this fracture type was produced five times, while it is absent on the points from Poggenwisch (present or illustrated by Rust). We can thus wonder if these points were hafted with a ligature as solid as that used at Teltwisch. Five pseudo-burins are also present at Teltwisch 1 and four at Poggenwisch.

Following the shots, the fragments of points n° 3 and 5 were recovered from the meat. In order to collect the small fragments of point n° 5 without damaging the ribs, the meat was boiled two times for one hour, 32 and 29 hours after the shots. A second post-shot operation was to remove the points from the shafts in order to document their state after use. It was sufficient to put the projectile tips in water for a few minutes, after which the tendon became soft again and could be easily removed.

This was of course just a first stage of experimentation, but these first results already show that this hafting method can be an effective alternative that limits

damage to the shaft. A second result is that, at least with this hafting method, tendon seems to be sufficient to attach the point to the shaft during the entire use of the projectile. We also observed that the asymmetry of the Hamburgian shouldered points did not have negative consequences for the penetration of the points into the target, even if the form of the perforation reflects the cutting edge and abrupt edge. Finally, we were able to confirm that the points could easily be replaced, even without the use of fire.

#### *Method of propulsion*

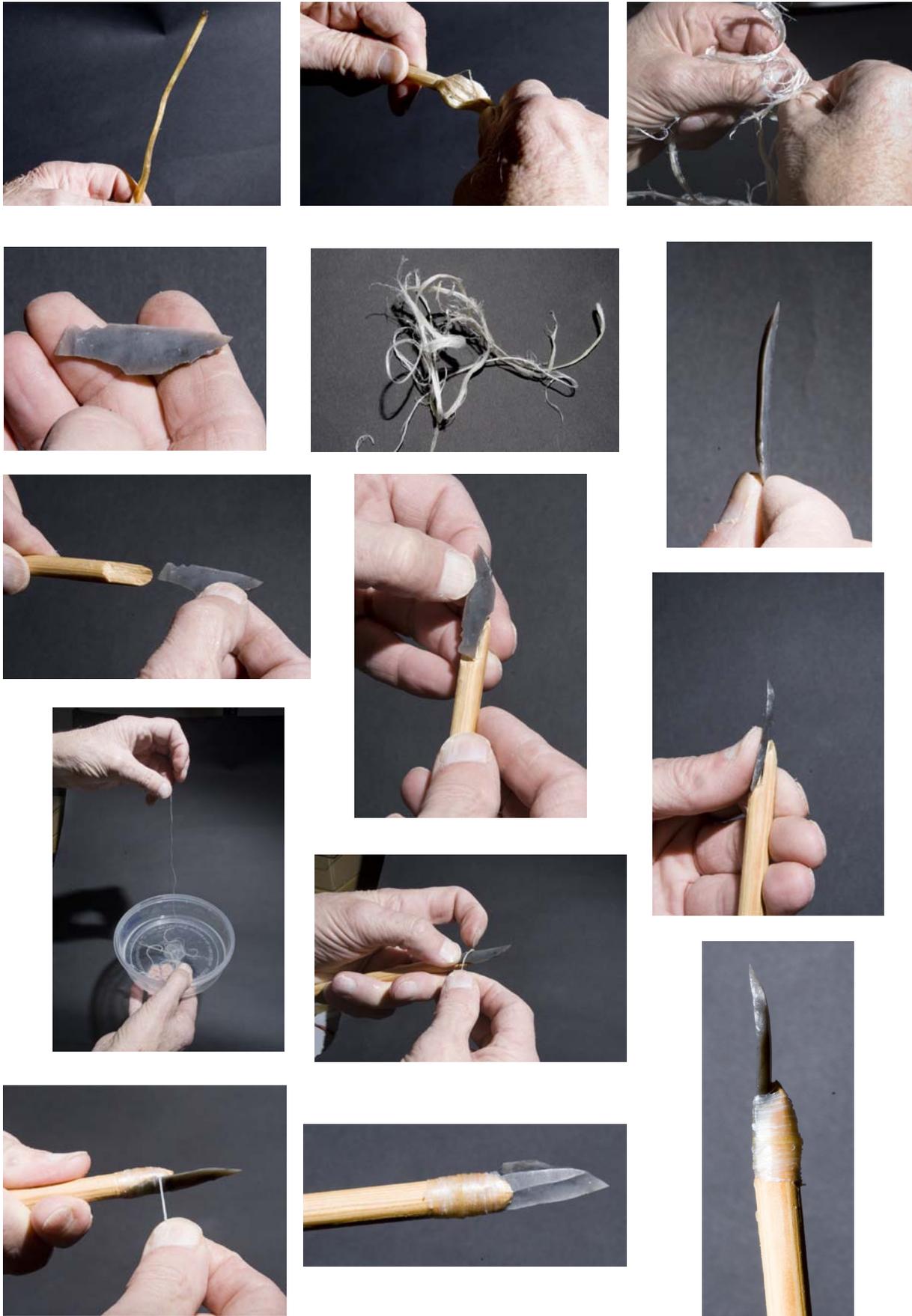
The question of the propulsion method used during the Hamburgian is related to the question of the appearance of the bow. The oldest known bows date to the Mesolithic and are classed as Holmegård types after the first discoveries in Scandinavia (Becker, 1945). The same types have also been found in northern Germany (Junkmanns, 2001; Stodiek & Paulsen, 1996) and as far as Russia (Burov, 1980: Vis I). The existence of bows starting in the Dryas III is attested by the approximately one hundred Ahrensburgian arrows discovered in the Stellmoor kettle in the Ahrensburg Valley (Rust, 1943). The fragments of pine wood found at the same site, which Rust interpreted as bow fragments, are more doubtful however, as is a fragment of pine wood found at Mannheim (D) and dated to the Magdalenian (Rosendahl *et al.*, 2006).

Unfortunately, no remains of arrow shafts, spears, bows or spearthrowers have been found in a Hamburgian context. The only evidence could be the two arrow smoothers found at the Havelte site of Luttenberg (NL; Stapert, 2005).

We must thus determine if it is possible to equip oneself with a bow in an environmental context of shrub tundra. A first solution could be to import one from the south, perhaps in the context of annual migrations. Pine was available locally, but is not well adapted to this use because it is not resistant to tractive force. A bow made from this material can be reinforced by tendons, as

<sup>6</sup> - According to Lund (1993, p. 409), even the points with a curved profile can be hafted if we first apply a little resin in the groove and then push the retouched edge into this resin.





124

fig. 14 : New proposition for the hafting of Hamburgian shouldered points.



Pointe n°	Longueur (mm)	Largeur (mm)	Epaisseur (mm)	Poids (g)	Aménagement basal	Orientation	Profil
1	82,6	20,8	5,8	9,9	retouche directe	apex distal	apex incliné, torse
2	86,7	20,3	4,4	8,8	retouche directe	apex distal	apex incliné, torse
3	60,1	14,7	4,4	3,8	retouche directe plus troncature	apex distal	apex et base inclinés
4	54,6	17	3,8	3,6	retouche directe	apex distal	rectiligne
5	42,9	12,4	3,9	1,8	retouche directe bilatérale	apex proximal	rectiligne
6	41,4	11,9	3,6	1,9	retouche directe bilatérale	apex proximal	rectiligne, légèrement torse
7	48,4	13,5	3	1,7	retouche directe	apex distal	légèrem. courbe
8	43,4	12,7	3,6	1,8	retouche directe bilatérale	apex proximal	légèrem. courbe
9	39,7	12,2	2,8	1,1	retouche directe	apex proximal	légèrem. courbe et torse
10	38,7	13,2	3,4	1,4	retouche directe	apex proximal	apex et base inclinés
11	39,8	13,3	3,7	1,6	retouche directe plus 2 coches directes	apex distal	base inclinée, torse

tab. 7 : Experimental shouldered points manufactured to imitate Hamburgian shouldered points, especially from Poggenwisch. The points marked in orange were used in the projectile experiments.

Projectile	Armé par pointe n°	Poids (g)	Nb de tirs	Cause d'abandon	Type de fracture
a	3	33	3	fracture par heurt à os	apex distal: droite au-dessous cran: à lang., term. en gond, plus pseudo-burin
b	5	30	5	fracture par heurt à os	base d'apex: pseudo-burin 3/4 d'apex: pseudo-burin 4/4 d'apex: pseudo-burin
c	7	31	1	fracture par heurt à carton	moitié cran: à lang. > 2 mm au-dessous cran: à lang., term. en gond
d	8	34	1	séparation du fût	-
e	9	35	2	fracture par heurt à carton	au-dessous cran: à lang., term. en gond, plus pseudo-burin
f	11	36	1	fracture par heurt à mur	moitié apex: à lang., term. en marche au-dessous cran: à lang. > 2mm, term. en marche

tab. 8 : Characteristics of the projectiles used in the experimental shots and their utilisation during these experiments.





**fig. 15** : Projectile experiments with shouldered points hafted as proposed in figure 14: on the left, the base of an arrow, on the right, the construction used as a target. a: photo M.J. Weber. b: photo W. Lage.

are the bows of Inuits, which were also made from bone, horn and reindeer antler (Cattelain, 1997). We thus cannot exclude the use of bows during the Hamburgian. It is also possible that spearthrowers were used, but in different hunting contexts.

If we follow Rozoy's observation (1992) that weapon armatures weighing less than 10 g were used with arrows, as well as Cattelain's (1997) observation that the dimensions of ethnographic arrow and spear armatures overlap between 5 and 15 g, the shouldered points from Teltwisch 1 would more likely be arrowheads since all except one of them weigh less than 3 g (table 9). The dozen or so measurable pieces from Poggenwisch fall within the same range. Ethnographic studies show, however, that we must be cautious since spears can also be armed with light points (Cattelain, 1997). Furthermore, various experiments (e.g. Browne, 1940) have shown that most projectile points can be used in both ways (Knecht, 1997).

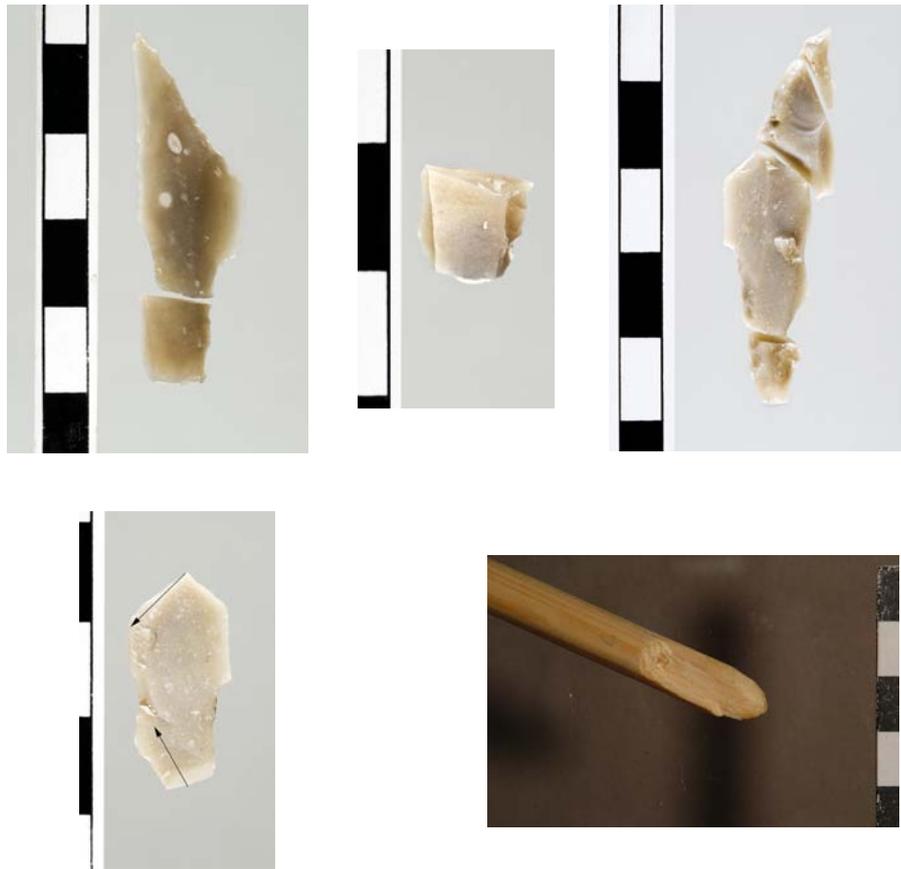
In general, hunting with a spearthrower is associated with driving (Rozoy, 1992), while bow hunting is associated with the ambushing strategy. Ethnographic examples, however, show that these associations are not valid in every case (Cattelain, 1997). One example is that of the Inuits of the Bering Strait (Cattelain, 1997) who hunt reindeer herds with a bow an arrow and only two hunters. The combination of bow hunting and an attacked herd has an archaeological correlate in the Ahrensburgian occupation of Stellmoor (Rust 1943); a mass kill

was proposed due to the large number of carcasses found in the kettle and the results of an analysis of the projection angles indicating that the hunters attacked the reindeer from all sides (Bratlund, 1994; Grønnow, 1985). On the contrary, for the Hamburgian of the same site, ambush hunting was proposed based on projection angles that came only from behind and directly on the side.

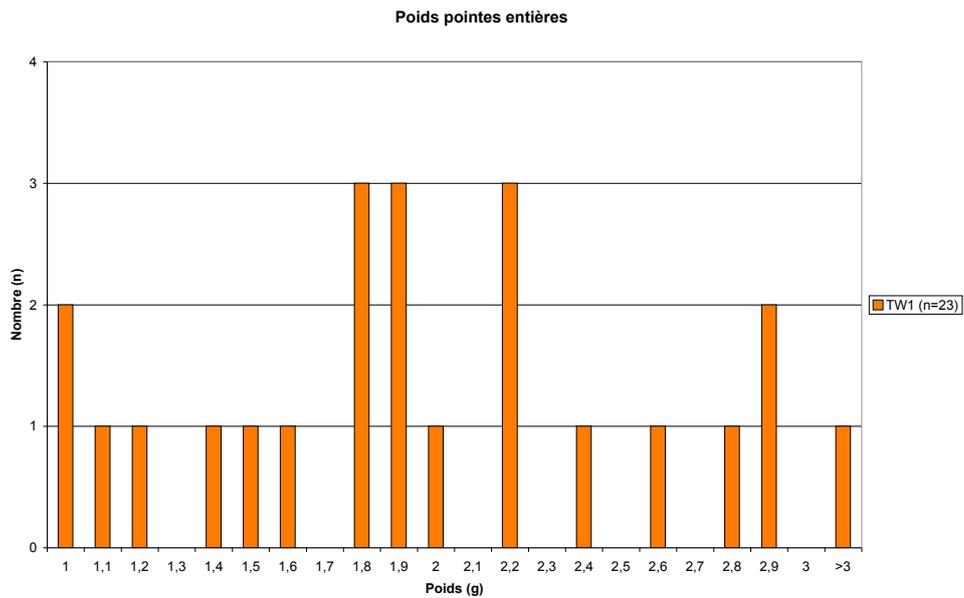
Another approach to understanding the propulsion method would be to compare Hamburgian shouldered points with Ahrensburgian points, which are indisputably arrowheads (Rust 1943).

### Comparisons with Magdalenian lithic projectile points in the Paris Basin

Burdukiewicz and Schmider (2000) have already compared Magdalenian shouldered points from the Paris Basin to Hamburgian shouldered points from the Oder Basin. The dimensions of the points from Poggenwisch and Teltwisch 1 correspond well to those of the Paris Basin; their lengths and thickness are even closer to those of the Magdalenian than they are to the Hamburgian points of Poland. However, if we include the points from Tureau des Gardes locus 7, we see that they are wider and thicker than our Hamburgian points. In terms of profile rectitude, 70% of the points from the Oder Basin are curved while most of the points from the Ahrensburg Valley have only one or two inclined extremities. Those from the Paris Basin are also mostly rectilinear in profile (Burdukiewicz & Schmider, 2000). Another similarity between the Paris Basin and northern



**fig. 16** : The two points (above: n° 3; middle: n° 5) that impacted bone during the experiments and the shaft of point n° 3 after use. Point n° 3 has a fracture with a prolongation (lip) with a hinge termination; the mesial fragment of point n° 5 has a pseudo-burin removal on its ventral face toward the apex and on its base a fracture with a prolongation >2mm long and a termination type that could not be determined. a-d: © Archäologisches Landesmuseum Schleswig-Holstein. e: photo M.J. Weber.



**tab. 9** : Distribution of the weights of the whole or almost whole shouldered points from Teltwisch.



Germany is the dominance of cores with two striking platforms from which the blade-blanks were produced. The use of a soft stone hammer is also very common in the three regions.

On the other hand, a clear difference between the fabrication of Hamburgian points and Magdalenian points of the Paris Basin lies in the use of the microburin technique in the first tradition and its absence in the latter (Burdukiewicz & Schmider, 2000). This absence might be explained by the fact that during the Magdalenian it was not necessary to remove the proximal part from the longer point blade-blanks in order to transform them into points.

### Conclusions

The shouldered points of the two Hamburgian sites in the Ahrensburg Valley presented here have many elements in common, including the profile, blank fabrication methods, retouch and use of the microburin technique. Meanwhile, the Poggenwisch assemblage, though it is smaller, appears more homogeneous in terms of the morphology and proportions of points. For the moment, we have no explanation for this difference.

Two other non resolved questions concern the hafting and propulsion methods employed. To obtain additional elements of response, it would be useful to enlarge our projectile experiments to include lateral hafting, spears, other distances, other targets, etc.

Finally, a comparison with Magdalenian points from the Paris Basin shows similarities in the fabrication of blanks and—in part a consequence—their dimensions and profile. However, it appears that the second stage of the production sequence, which is the transformation of the blank into a point, is not completely identical. An example is the use of the microburin technique, which is a common element even between Hamburgian points that are otherwise different, such as those from northern Germany and from Poland. These observations, concerning different traditions, could be explained by their occurrence within the same time span or comparable living conditions during the Tardiglacial period.

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### References

- ALLAIN J. (1978) - Circonscription du Centre. Fontenay-sur-Loing – La Maison Blanche, *Gallia Préhistoire*, t. 21, p. 472-476.
- BECKER C. J. (1945) - En 8000-årig Stenalderboplads i Holmegaards Mose. Foreløbig Meddelelse, *Fra Nationalmuseets Arbejdsmark*, 1945, p. 61-72.
- BECKHOFF K. (1967) - Zur jungpaläolithischen Kerbspitze, *Die Kunde*, N.F. t. 18, p. 8-15.



- BENECKE N., HEINRICH D. (2003) - Neue Daten zur Entwicklung der Huftierfauna im Tieflandgebiet zwischen Elbe und Oder im Spätglazial und Altholozän, *Archeozoologia*, t. 21, p. 19-36.
- BOHMERS A. (1947) - Jong-Palaeolithicum en Vroeg-Mesolithicum, in H. E. van Gelder, P. Glazema, G. A. Bontekoe, H. Halbertsma et W. Glasbergen éd., *Een Kwart Eeuw Oudheidkundig Bodemonderzoek in Nederland. Gedenkboek A. E. Van Giffen*, Meppel, J. A. Boom & Zoon Uitgevers, p. 129-201.
- BOKELMANN K., HEINRICH D., MENKE B. (1983) - Fundplätze des Spätglazials am Hainholz-Esinger Moor, Kreis Pinneberg, *Offa*, t. 40, p. 199-240.
- BRATLUND B. (1994) - A survey of the subsistence and settlement pattern of the Hamburgian Culture in Schleswig-Holstein, *Jahrbuch des Römisch-Germanischen-Zentralmuseums*, t. 41, p. 59-94.
- BROWNE J. (1940) - Projectile Points, *American Antiquity*, t. 5, p. 209-213.
- BURDUKIEWICZ J.M., SCHMIDER B. (2000) - Analyse comparative des pointes à cran hambourgiennes du Bassin de l'Oder et des pointes à cran magdaléniennes du Bassin parisien, in B. Valentin, P. Bodu et M. Christensen éd., *L'Europe centrale et septentrionale au Tardiglaciaire. Confrontation des modèles régionaux de peuplement*, Actes de la Table-ronde de Nemours, mai 1997, Nemours, Association pour la Promotion de la Recherche Archéologique en Ile-de-France (Mémoires du Musée de Préhistoire d'Ile-de-France, 7), p. 97-107.
- BUROV G. M. (1980) - Der Bogen bei den mesolithischen Stämmen Nordosteuropas, *Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam*, t. 14/15, p. 373-388.
- CATTELAINEP. (1997) - Hunting during the Upper Palaeolithic: bow, spearthrower, or both? in H. Knecht éd., *Projectile technology*, New York, Plenum Press (Interdisciplinary contributions to archaeology), p. 213-240.
- CHENORKIAN R. (1996) - *Pratique archéologique statistique et graphique*, Paris, Editions Errance (Méthodes et techniques), 162 p., graph.
- CLAUSEN I. (1998) - Neue Untersuchungen an späteiszeitlichen Fundplätzen der Hamburger Kultur bei Ahrenshöft, Kr. Nordfriesland. Ein Vorbericht, *Archäologische Nachrichten aus Schleswig-Holstein*, t. 8, p. 8-49.
- CLAUSEN I., HARTZ S. (1988) - Fundplätze des Spätglazials am Sorgetal bei Alt Duvenstedt, Kreis Rendsburg-Eckernförde, *Offa*, t. 45, p. 17-41.
- FISCHER A., TAUBER H. (1986) - New C-14 Datings of Late Palaeolithic Cultures from Northwestern Europe, *Journal of Danish Archaeology*, t. 5, p. 7-13.
- GENESTE J.-M., PLISSON H. (1986) - Le Solutréen de la grotte de Combe-Saunière I (Dordogne) : première approche palethnologique, *Gallia Préhistoire*, t. 29, p. 9-27.
- GRIMM S. B., WEBER M.-J. (2008) - The chronological framework of the Hamburgian in the light of old and new <sup>14</sup>C-dates, *Quartär*, t. 55, p. 17-40.
- GRØNNOW B. (1985) - Meiendorf and Stellmoor Revisited. An Analysis of Late Palaeolithic Reindeer Exploitation, *Acta Archaeologica*, t. 56, p. 131-166.
- GRØNNOW B. (1988) - Prehistory in Permafrost. Investigations at the Saqqaq Site, Qeqertasussuk, Disco Bay, West Greenland, *Journal of Danish Archaeology*, t. 7, p. 24-39.
- GURINAN. N. (1956) - *Oleneostrowskij mogil'nik so vstupidel'noj statej V.I. Ravdonikasa*, Moskva-Leningrad, Izdatel'stvo Akademii Nauk S.S.S.R. (Materialy i issledovaniia po arkheologii S.S.S.R., 47), 432 p., fig., 6 pl. h.t., 5 dépl. h.t.
- HAHN J. (1993) - *Erkennen und Bestimmen von Stein- und Knochenartefakten. Einführung in die Artefaktmorphologie*, Tübingen, Institut für Ur- und Frühgeschichte, Verlag Archaeologica Venatoria (Archaeologica Venatoria, 10), 396 p., 113 fig.



- HARTZ S. (1987) - Neue spätpaläolithische Fundplätze bei Ahrenshöft, Kreis Nordfriesland, *Offa*, t. 44, p. 5-52.
- HOLM J. (1991) - Settlements of the Hamburgian and Federmesser Cultures at Slotseng, South Jutland, *Journal of Danish Archaeology*, t. 10, p. 7-19.
- HOLM J., RIECK F. (1992) - *Istidsjaegere ved Jelsøerne. Hamburgkulturen i Danmark*, Haderslev, Haderslev Museum (Skrifter fra Museumsrådet for Sønderjyllands Amt, 5), 151 p., 95 fig.
- JUNKMANN J. (2001) - *Pfeil und Bogen. Herstellung und Gebrauch in der Jungsteinzeit*, Biel, Verlag Museum Schwab, 63 p., 75 fig.
- KABACÍNSKI J., SCHILD R., BRATLUND B., KUBIAC-MARTENS L., POBOLSKIK., BERG K. VANDER, PAZDUR A. (2002) - The Lateglacial sequence of the Hamburgian site at Mirkowice: stratigraphy and geochronology, in B. Valentin Eriksen, B. Bratlund éd., *Recent studies in the Final Palaeolithic of the European plain*, Proceedings of the UISPP Symposium, Stockholm, 14.-17. October 1999, Århus, Århus University Press (Jutland Archaeological Society Publications, 39), p. 109-116.
- KAISER K., CLAUSEN I. (2005) – Palaeopedology and stratigraphy of the Late Palaeolithic Alt Duvenstedt site, Schleswig-Holstein (Northwest Germany), *Archäologisches Korrespondenzblatt*, t. 35, n° 4, p. 447-466.
- KNECHT H. (1997) - The history and development of projectile technology research, in H. Knecht éd., *Projectile technology*, New York, Plenum Press (Interdisciplinary contributions to archaeology), p. 3-35.
- LANG L. (1998) - *Marolles-sur-Seine « Le Tureau des Gardes » (Seine-et-Marne). Site n° 77 279 027 AP. Vestiges d'implantations du Paléolithique supérieur. Fouilles de sauvetage urgent*. Document final de synthèse, SRA d'Ile-de-France, Bazoches-lès-Bray et Saint-Denis, AFAN et Direction des Archives et du Patrimoine de Seine-et-Marne, 115 p., 43 pl.
- LANTING J. N., PLICHT J. VAN DER (1996) - De <sup>14</sup>C-chronologie van de Nederlandse Pre- en Protohistorie, I.: Laet-Paleolithicum, *Palaeohistoria*, t. 37/38, p. 71-125.
- LUND M. (1993) - Vorschäfte für Kerbspitzen der Hamburger Kultur, *Archäologisches Korrespondenzblatt*, t. 23, p. 405-411.
- MADSEN B. (1983) - New evidence of late Paleolithic settlement in East Jutland, *Journal of Danish Archaeology*, t. 2, p. 12-31.
- MADSEN B. (1992) - Hamburgkulturens flintteknologi I Jels, in J. Holm, F. Rieck éd., *Istidsjaegere ved Jelsøerne. Hamburgkulturen i Danmark*, Haderslev, Haderslev Museum (Skrifter fra Museumsrådet for Sønderjyllands Amt, 5), p. 93-131.
- MADSEN B. (1996) - Late Palaeolithic Cultures of South Scandinavia – Tools, Traditions and Technology, in L. Larsson éd., *The Earliest Settlement of Scandinavia and its Relationship with Neighbouring Areas*, Stockholm, Almquist & Wicksell (Acta Archaeologica Lundensia, Series IN 8° 24), p. 61-73.
- MENCKE E. (1951) - Grundsätzliches zur Morphologie der Mikrolithen, *Germania*, t. 29, p. 173-181.
- MILES C. (1963) - *Indian and Eskimo Artifacts of North America*, New York, American Legacy Press, xii et 244 p., ill.
- MÜNNICH K. O. (1957) - Heidelberg Natural Radiocarbon Measurements I, *Science*, t. 126, p. 194-199.
- ODELL G. H., COWAN F. (1986) - Experiments with spears and arrows on animal targets, *Journal of Field Archaeology*, t. 13, p. 195-212.
- PELEGRIN J. (2000) - Les techniques de débitage laminaire au Tardiglaciaire : critères de diagnose et quelques réflexions, in B. Valentin, P. Bodu, M. Christensen éd., *L'Europe centrale et septentrionale au Tardiglaciaire. Confrontation des modèles régionaux de peuplement*, Actes de la Table-ronde, Nemours, mai 1997, Nemours, Association pour la Promotion de la Recherche Archéologique en Ile-de-France (Mémoires du Musée de Préhistoire d'Ile-de-France, 7), p. 73-86.



- PETERS E. (1930) - *Die altsteinzeitliche Kulturstätte Petersfels*, Augsburg, B. Filser, 75 p.
- PLISSON H., GENESTE J.-M. (1989) - Analyse technologique des pointes à cran solutréennes du Placard (Charente), du Fourneau du Diable, du Pech de la Boissière et de Combe Saunière (Dordogne), *Paléo*, t. 1, p. 65-106.
- ROSENDAHL G., BEINHAEUER K.-W., LÖSCHER M., KREIPL K., WALTER R., ROSENDAHL W. (2006) - Le plus vieil arc du monde? Une pièce intéressante en provenance de Mannheim, Allemagne, *L'Anthropologie*, t. 110, p. 371-382.
- ROZOY J.-G. (1992) - Le propulseur et l'arc chez les chasseurs préhistoriques : techniques et démographies comparées, *Paléo*, t. 4, p. 175-193.
- RUST A. (1937) - *Das altsteinzeitliche Rentierjägerlager Meindorf*, Neumünster, Karl Wachholtz, 146 p., 33 fig., 57 pl.
- RUST A. (1943) - *Die alt- und mittelsteinzeitlichen Funde von Stellmoor*, Neumünster, Karl Wachholtz, 242 p., 34 fig., 107 pl.
- RUST A. (1958) - *Die jungpaläolithischen Zeltanlagen von Ahrensburg*, Neumünster, Karl Wachholtz (Offa-Bücher, N.F. 15), 146 p., 56 fig., 72 pl.
- SCHMIDER B. (1971) - *Les industries lithiques du Paléolithique supérieur en Ile-de-France*, Paris, CNRS (Supplément à Gallia Préhistoire, 6), 219 p., 109 fig., 9 tabl.
- SCHÜTRUMPF R. (1958) - Die pollenanalytische Untersuchung an den altsteinzeitlichen Moorfundplätzen Borneck und Poggenwisch, in A. Rust éd., *Die jungpaläolithischen Zeltanlagen von Ahrensburg*, Neumünster, Karl Wachholtz (Offa-Bücher, N.F. 15), p. 11-22.
- SCHWABEDISSEN H. (1954) - *Die Federmesser-Gruppen des nordwesteuropäischen Flachlandes. Zur Ausbreitung des Spät-Magdalénien*, Neumünster, Karl Wachholtz (Offa-Bücher, N.F. 9), 104 p., 23 fig., 106 pl.
- SONNEVILLE-BORDES D. DE (1963) - Le Paléolithique supérieur en Suisse, *L'Anthropologie*, t. 67, p. 205-268.
- SONNEVILLE-BORDES D. DE (1969a) - Pointes à cran (Kerbspitzen) du Magdalénien supérieur du Petersfels, *Quartär*, t. 20, p. 175-181.
- SONNEVILLE-BORDES D. DE (1969b) - A propos des pointes pédonculées du Nord de l'Europe : pointe de Lingby et pointe de Teyjat, *Quartär*, t. 20, p. 183-188.
- STAPERT D. (2005) - Het Laat-Paleolithicum in Noord-Nederland, in J. Deeben, E. Drenth, M.-F. van Oorsouw, L. Verhart éd., *De steentijd van Nederland*, vol. 11/12, Meppel, J. A. Boom & Zoon Uitgevers, p. 143-169.
- STODIEK U., PAULSEN H. (1996) - *Mit dem Pfeil, dem Bogen... Technik der steinzeitlichen Jagd*, Oldenburg, Isensee Verlag, 69 p.
- TAUTE W. (1959) - Neu entdeckte Lagerplätze der Hamburger und Ahrensburger Kultur bei Deimern, Kr. Soltau, in der Lüneburger Heide, *Die Kunde*, N.F. t. 10, f. 3-4, p. 182-192.
- TAUTE W. (1968) - *Die Stielspitzen-Gruppen im nördlichen Mitteleuropa. Ein Beitrag zur Kenntnis der späten Altsteinzeit*, Köln, Böhlau Verlag (Fundamenta Monographien zur Urgeschichte Reihe A, 5), 326 p., 57 fig., 180 pl., 12 cartes.
- THÉVENIN A. (2003) - Les pointes à cran de la fin du Tardiglaciaire : chronologie et contexte culturel, in E. Ladier éd., *Les pointes à cran dans les industries lithiques du Paléolithique supérieur récent de l'oscillation de Lascaux à l'oscillation de Bölling*, Actes de la Table-ronde de Montauban 2002, *Préhistoire du Sud-Ouest* (Supplément, 6), p. 113-128.
- TIXIER J., INIZAN M.-L., ROCHE H. (1980) - *Préhistoire de la pierre taillée. I terminologie et technologie*, Antibes, Valbonne, CREP, Association pour la promotion et la diffusion des connaissances archéologiques, 120 p., 47 fig.
- TROMNAU G. (1975a) - *Neue Ausgrabungen im Ahrensburger Tunneltal. Ein Beitrag zur Erforschung des*



*Jungpaläolithikums im Nordwesteuropäischen Flachland*, Neumünster, Karl Wachholtz (Offa-Bücher, 33), 105 p., 49 fig., 5 tabl., 42 pl., 6 cartes.

TROMNAU G. (1975b) - *Die Fundplätze der Hamburger Kultur von Heber und Deimern, Kreis Soltau*, Hildesheim, Verlag August Lax (Materialhefte zur Ur- und Frühgeschichte Niedersachsens, 9), 46 p., 30 fig., 82 pl.

TROMNAU G. (1975c) - Die jungpaläolithischen Fundplätze im Stellmoorer Tunneltal im Überblick, *Hammaburg*, N.F. t. 2, p. 9-20.

TROMNAU G. (1992) - Anmerkungen zur Rengewei-Harpune von Meiendorf, in E. B. Krause, B. Mecke éd., *Ur-Geschichte im Ruhrgebiet. Festschrift A. Heinrich*, Gelsenkirchen, Edition Agora, p. 79-83.

USINGER H. (1998) - Pollenanalytische Datierung spätpaläolithischer Fundschichten bei Ahrenshöft, Kr. Nordfriesland, *Archäologische Nachrichten aus Schleswig-Holstein*, t. 8, p. 50-73.

VALENTIN B. (1995) - *Les groupes humains et leurs traditions au Tardiglaciaire dans le Bassin Parisien. Apports de la technologie comparée*, thèse de doctorat, université de Paris I, 834 p., 270 p. annexes, 200 fig., 61 tabl., 117 pl.

VANG PETERSEN P., JOHANSEN L. (1996) - Tracking Late Glacial reindeer hunters in eastern Denmark, in L. Larsson éd., *The Earliest Settlement of Scandinavia and its Relationship with Neighbouring Areas*, Stockholm, Almqvist & Wiksell International (Acta Archaeologica Lundensia Series IN 8°, 24), p. 75-88.

ZOLLER D. (1963) - Vorläufiger Bericht über eine Rentierstation der Hamburger Stufe bei Querenstede, Kreis Ammerland, *Die Kunde*, NF t. 14, p. 17-25.

### To quote this article

WEBER M.-J. (2008) - Fabrication and use of hamburgian shouldered points : new data from poggenwisch and Teltwisch I

(Ahrensbourg Valley, Schleswig-Holstein, Germany). In : J.-M. Pétilion, M.-H. Dias-Meirinho, P. Cattelain, M. Honegger, C. Normand, N. Valdeyron (coord.), *Projectile weapon elements from the Upper Palaeolithic to the Neolithic* (Proceedings of session C83, XVth World Congress UISPP, Lisbon, September 4-9, 2006), *Palethnologie*, 1, p. 99 - 132.

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