

Hunting with trapezes at Bazel-Sluis: the results of a functional analysis

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1. Introduction

The site of Bazel-Sluis (municipality of Kruibeke, Prov. of East Flanders, Belgium) is situated in a broad part of the alluvial plain of the current Scheldt river. It consists of a multi period palimpsest, ranging from the middle Mesolithic to the middle Neolithic period. Important occupation phases are to be situated in the 5th millennium cal BC, during the final Mesolithic (Perdaen *et al.*, 2011; Crombé *et al.*, 2015a; Meylemans *et al.*, in prep.). In this period it is considered to be either a base camp (Crombé *et al.*, 2015b), or a logistical campsite with an important focus on hunting activities (Meylemans *et al.*, in prep.). At the moment ca 1/3th of the artefacts from the site have been studied, totalling a number of 23373 lithic finds described in the database. In the northern excavation area of the site, these lithics show a clearly clustered pattern with fairly homogenous compositions of a late/final Mesolithic character (Meylemans *et al.*, in prep.) (Fig. 1). A large number of microliths, predominantly trapezes, were concentrated in these clusters, while others were mostly found in the eastern part of the excavation area, situated at the edge of a fossil channel of the Scheldt river.

2. Methodology

Tools were first examined with a Zeiss stereomicroscope Discovery.V12 (magnifications up to 120 x) and a Zeiss Macro-Zoom microscope V.16 (magnifications up to 160 x), to record the preservation state and to identify the presence of possible alterations.

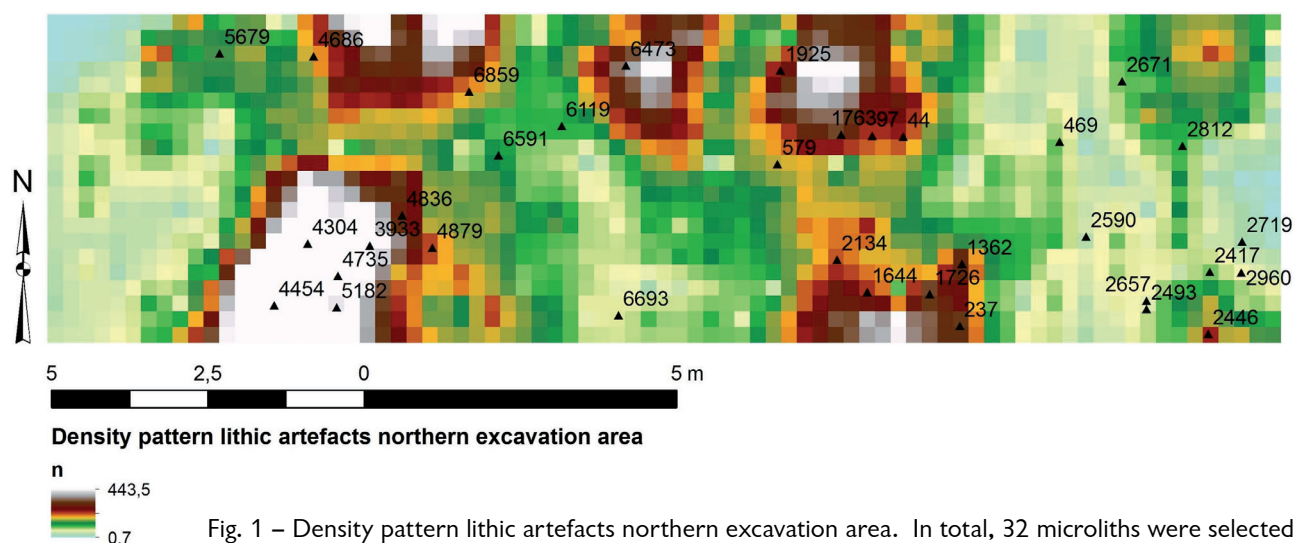


Fig. 1 – Density pattern lithic artefacts northern excavation area. In total, 32 microliths were selected for a functional study, trapezes mainly, but also some crescents and triangular points. The artefacts were manufactured out of flint except a minor portion made out of Wommersom quartzite.

Subsequently, edge modifications and use-wear traces were detected with a Zeiss metallurgical reflected-light microscope Axiolmager, equipped with polarizing filters and differential interference contrast (DIC) (magnifications 50-500 x). Next to wear traces, attention was also devoted to the presence of residues, in spite of the fact that the tools of Bazel-Sluis were not ideally handled to permit such an analysis. Indeed, a reliable identification of residues necessitates specific precautions during excavation in terms of handling to avoid contamination and ideally, no sieving. Tools should also not be cleaned, and they should only be handled minimally. Nevertheless, some strongly adhering residues were still observed and could be extracted for closer examination.

The functional interpretations of the archaeological trapezes from Bazel-Sluis were based on comparisons with the extensive experimental reference collection available at TraceoLab (University of Liège) that currently contains about 2500 experimental pieces. This reference collection includes a variety of projectile morphologies (about 400 pieces), shot with different projecting modes into artificial targets and animal carcasses. The variety in fracture types and micro-wear patterns of this experimental dataset is representative and comparable to what has been proposed elsewhere based on other projectile experiments (Fischer *et al.*, 1984; Odell & Cowan, 1986; Pargeter, 2011; Caspar & De Bie, 1996; Crombé *et al.*, 2001). In addition to the existing reference collection, a small-scale projectile experiment was designed with microliths having identical morphologies to the archaeological trapezes from Bazel-Sluis. Such a procedure is important for the reliability of the projectile identifications, which are always based on a combination of various wear traces (see Rots & Plisson, 2014, for a discussion).

3. Experimentation

After a first examination of the material, a small experiment was set up in order to obtain reliable referential data. Impact traces are a factor of the morphologies of the points and therefore, the trapezes were duplicated by Christian Lepers, an experienced knapper. Four experimental trapezes were mounted with resin (30 % beeswax and 70 % Picea



Fig. 2 – a) experimental transverse arrowhead, hafted with resin on a pine shaft; b) experimental trapezes are shot into the artificial target composed of ribs encased in a block of ballistic gel, covered with deer hide; c) the experimental arrow after it hits the target.

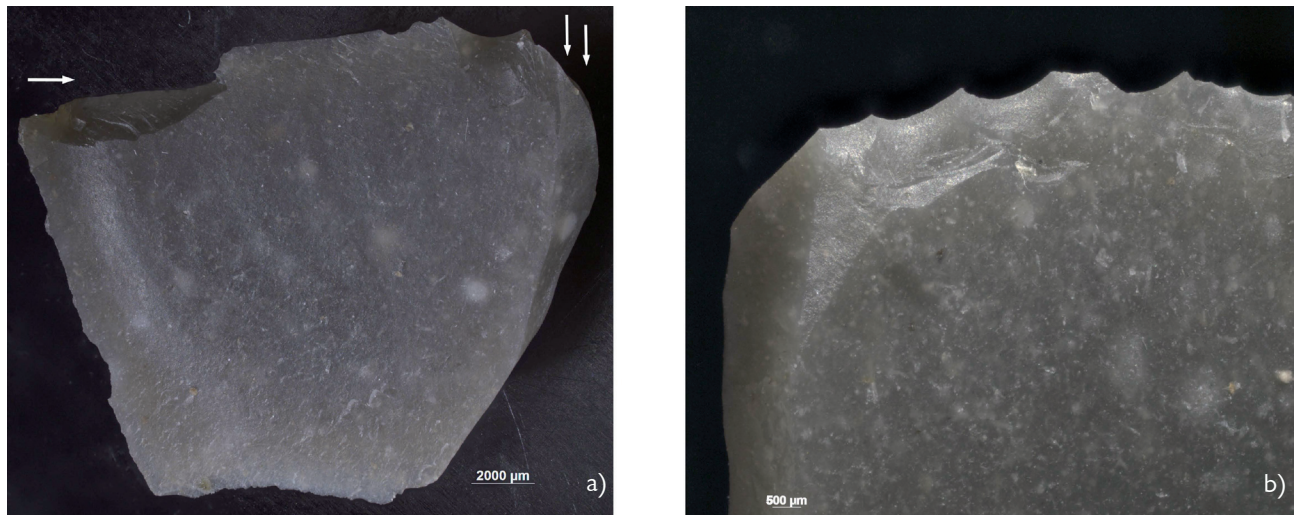


Fig. 3 – a) experimental trapeze with lateral and longitudinal damage (10 x); b) detail of the distal edge damage: a feather-step terminating scar and a longitudinal posterior scarring (16 x).

abies resin) as transverse arrowheads on pine shafts (Fig. 2). They were shot with a 39 pound bow at a distance of 10 m into an artificial target. The target was composed of ribs encased in a block of ballistic gel, the totality being covered by a stretched deer hide. Each arrow was shot until it hit the target successfully. The wear patterns on the experimental pieces proved explicit. Multiple impact scars and / or burinations were associated with MLIT's. The organisation and orientation of macro- and microscopic wear traces corresponded to the position and orientation of the tool in the shaft (Fig. 3).

4. Residue analysis

Even though the tools from Bazel-Sluis were handled intensively without taking precautions for residue analysis, some residues were preserved and analysed in combination with the use-wear traces in order to evaluate whether these were potentially use-related. After all, residues may also be incidental or the result of various other processes (Rots *et al.*, submitted).

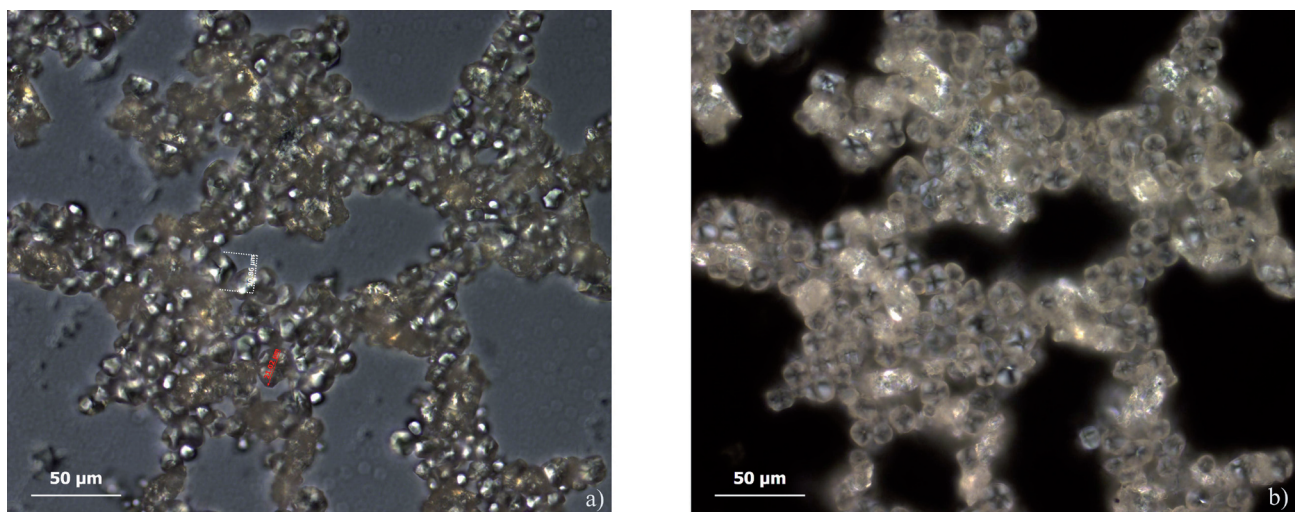


Fig. 4 – Starch residue extracted from the ventral distal part of piece BASL7808: photographed under a) transmitted-light with DIC, b) transmitted-light with cross-polarising filters (400 x).

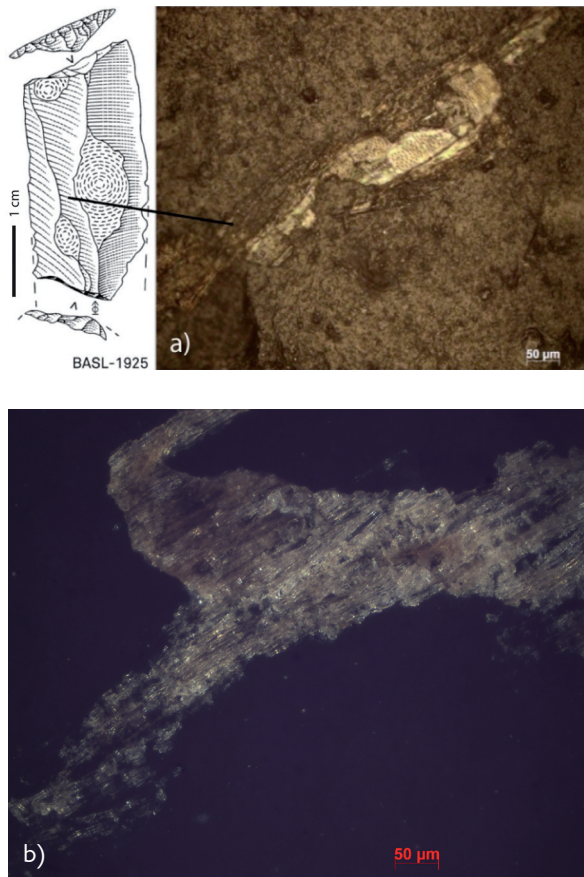


Fig. 5 – a) Plant tissues preserved on the piece BASL1925 (200 x); b) plant tissue extracted from the dorsal face of BASL-8393 and photographed under transmitted-light with cross-polarising filters (200 x).

In spite of these taphonomic problems, two potential use-related residues were observed: resinous residues and blood spots. The blood cells were identified based on their specific structure and the size of the cells, which corresponded to the characteristic size of 7-8 µm (Loy, 1983, 1993; Fig. 6a). The resinous residue was located on the dorsal face of piece BASL-1726 and could be identified based on the typical smooth droplets with charcoal inclusions (Fig. 6b).

5. Wear traces analysis

The entire sample of 32 microliths was examined for wear traces and the majority proved to have been used. Different associated wear patterns

On several tools, residues seem of taphonomic origin: they did not cover a specific part of the tool and no relation with hafting or use could be suggested.

The most explicit taphonomic residues were starch grains which were identified on several tools ($n = 6$). Their abundance, their unorganised distribution over the whole tool surface, their good preservation and the site's depositional context contradict a potential use origin (Fig. 4). It is more likely that these starch grains are the result of their depositional history in a peat environment.

Also plant tissues were identified on the microliths (Fig. 5) but again, these had no specific location and it is therefore questionable that they would be related to use or hafting. The particular depositional context of the tools suggests that a post-depositional/ taphonomic origin is most likely.

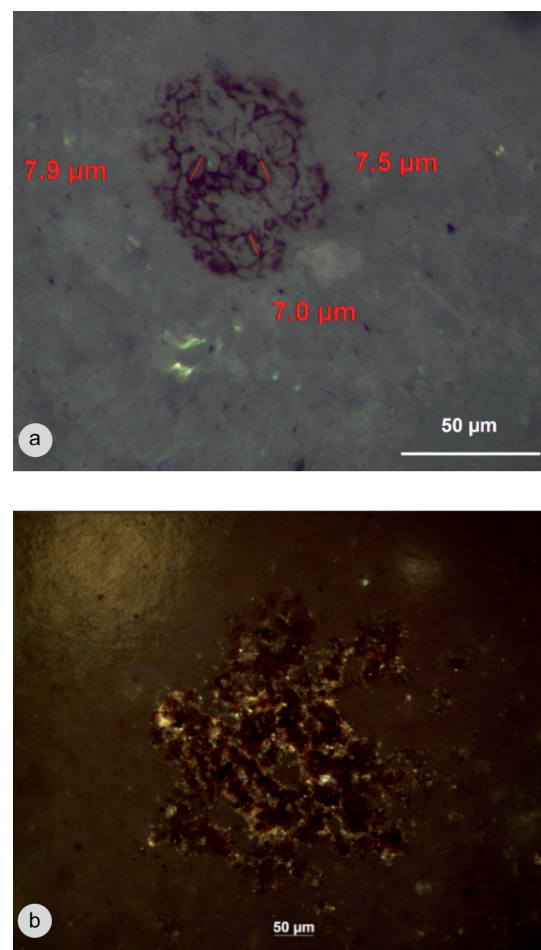


Fig. 6 – a) Blood residue on the truncated left edge of BASL 4879, photographed under DIC (500 x); b) resinous residue on the dorsal proximal right face of the tool BASL 1726, photographed under reflected light with DIC (200 x).

proved to be organised in a meaningful pattern, which was considered to be sufficiently diagnostic to reliably interpret most of the microliths as elements in projectile arrangements. Based on these wear patterns and their comparison with the experimental data-sets, the orientation and/or position in the arrow shaft could be identified. This allowed the identification of 17 tips – both transverse arrowheads and pointed tips – and 5 barbs. For 5 pieces, the traces were insufficiently developed to propose a specific orientation; while wear features were either absent or insufficiently diagnostic on 5 other pieces (Tab. 1). Aside from the general characteristics of the wear patterns per projectile type, a few representative pieces are described in more detail.

ID	Projectile			Uncertain function	Unused/uncertain
	Transverse arrowhead	Barb	Tip		
8393		X (CL2)			
8391				X (CL1: barb or transverse arrowhead)	
8389	X (CL4)				
44		X (CL2)			
1763	X (CL2)				
7626		X (CL3)			
8218					X
97	X (CL2)				
2671	X (CL4)				
2812	X (CL4)				
2657				X (CL1: cutting motion?)	
2719		X (CL3)			
2417	X (CL3)				
469	X (CL4)				
3933				X (CL1: butchering or barb?)	
6859			X (CL2)		
4304	X (CL4)				
4836					X
4879	X (CL2)				
4735	X (CL4)				
2134	X (CL4)				
237	X (CL2)				
1362					X
1726	X (CL4)				
7808			X (CL4)		
2446				X (CL1: tip or barb?)	
1925	X (CL2)				
2493					X
7740				X (CL1: transverse arrowhead or barb?)	
2590		X (CL2)			
8111					X
6119	X (CL2)				

Tab. 1 – Summary of the functional interpretation of the microliths including the confidence level (CL) of each interpretation, scored on a scale of 1 (poor confidence) to 4 (high confidence).

It has to be mentioned that the confidence levels of the individual interpretations may vary. The confidence level (CL) of each interpretation has been scored on a scale of 1 (poor confidence) to 4 (high confidence). The results – including these confidence levels – are summarised in Tab. 1.

5.1. Transverse arrowheads

Fifteen microliths were classified as transversal arrowheads. These pieces showed important edge damage on the cutting edge consisting of bifacial scarring, multiple burinations with step terminations, and obliquely or elongated oriented bending initiated scars with snap feather or step terminations. Under high magnification, the macroscopic damage was frequently associated with microscopic linear impact traces (MLIT; Moss, 1983), oriented perpendicular to the cutting edge, and caused by the friction with a detached flint particle following the impact into the target. In addition, basal damage was observed that is caused by the counter-pressure against the arrow shaft upon impact. Indeed, bright spots, striations and scarring interpreted as specific hafting wear (Rots, 2010) were observed on several tools.

Wear patterns on some representative examples:

A first trapeze (BASL-469) showed important edge damage consisting of multiple burinations with step terminations on the ventral face (Fig. 7), and an obliquely oriented scar negative initiated from the lateral retouched edge (see Fig. 7, on drawing). Microscopic linear impact traces were observed on the same distal surface. These are caused by a detached flint particle scratching against the surface upon impact into the animal. A friction polish was also recorded on the dorsal mesial ridge. In the proximal part (Fig. 7: location c, on drawing), a bending initiated fracture with hinge termination is associated with a fissure (indicating the longitudinal movement of the impact) and small cone-initiated feather-terminating scars were detached by the counter-pressure upon impact.

The wear patterns on a second trapeze (BASL-4304) are also indicative for a use as transverse arrowhead (Fig. 8). Important edge damage was recorded on the cutting edge with a concentration of bifacial scarring (location a) and transversal and longitudinal scars (loca-

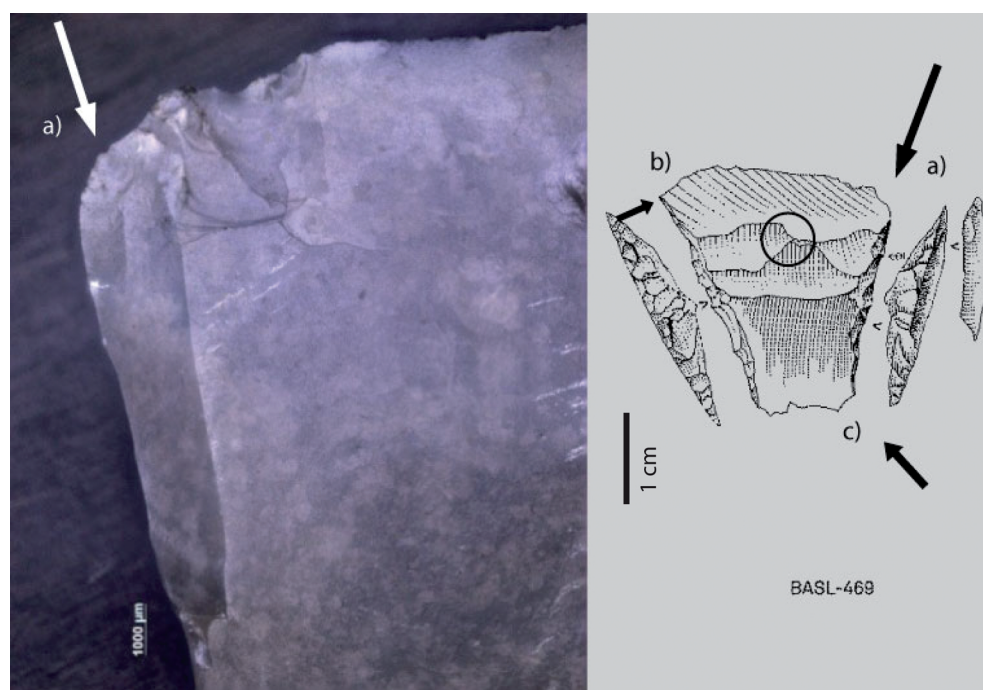


Fig. 7 – Low magnification picture (16 x): in the distal part of the tool the edge damage consist of multiple burinations with step terminations.

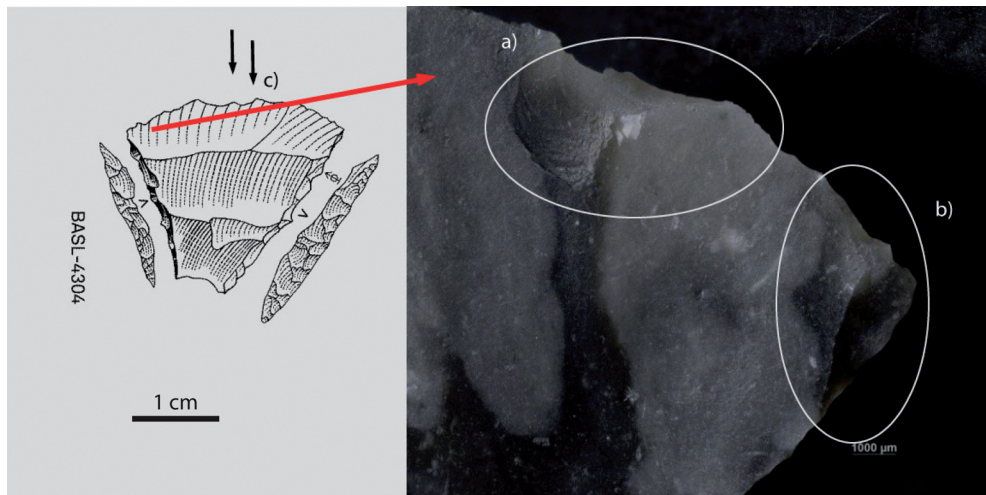


Fig. 8 – Low magnification picture of the distal part of the tool, impact damage visible on the ventral face (16 x).

tion b). This intense impact damage is associated with microscopic linear impact traces, oriented perpendicular to the cutting edge (Fig. 8: location c, on drawing).

A third trapeze (BASL-2134) shows similar macro- and micro wear patterns corresponding with use as a projectile. The orientation and position of the fractures and MLIT's suggest that it was hafted as a transverse arrowhead. Unfortunately, this piece was altered by a high number of metal deposits due to the sieving (see Fig. 9a). The distal edge damage consists of scarring with snap, feather or step termination (see a, on drawing) in combination with microscopic linear impact traces (see Fig. 9b). On the opposite edge, crushing has been recorded (see b, on drawing) and seems to have originated from the friction against the haft. The extremities of the dorsal ridge are intensively rounded (see Fig. 9c). It probably concerns an intentional abrasion during production or retouch (e.g., on an anvil).

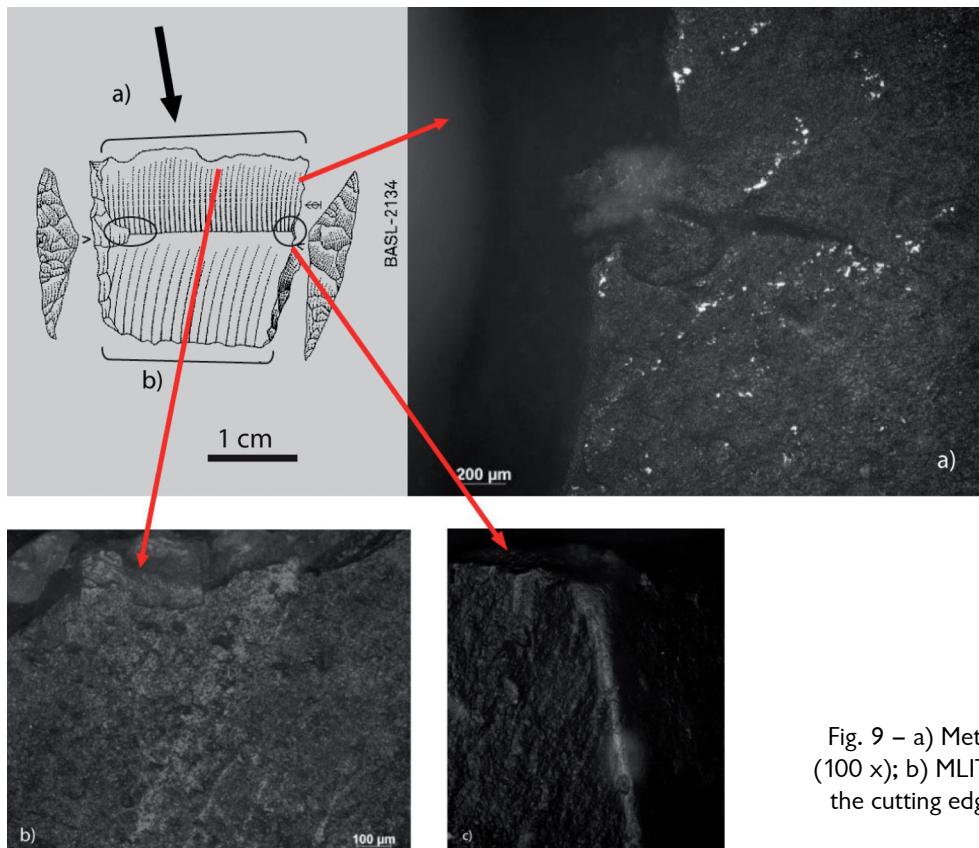
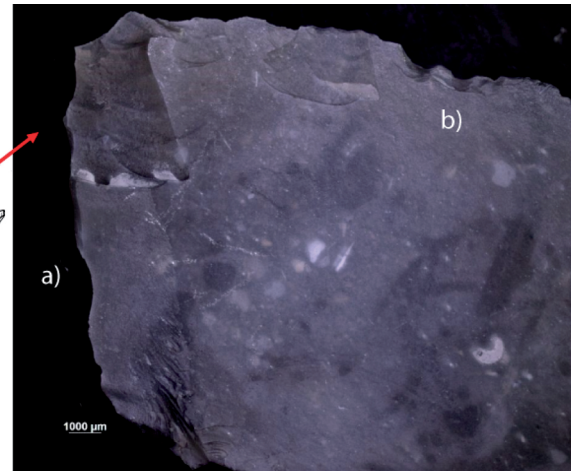
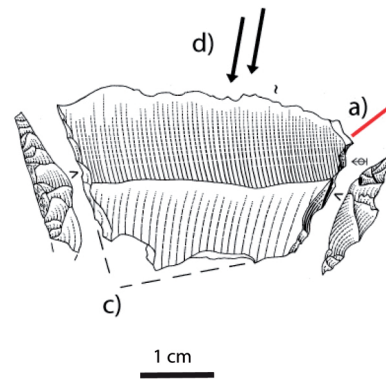


Fig. 9 – a) Metal deposits on the ventral face (100 x); b) MLIT's oriented slightly oblique to the cutting edge (100 x); c) rounding on the ridge, dorsal surface (200 x).

Fig. 10 – Low magnification picture (12.5 x), bifacial scarring with multiple burinations on the ventral face, distal part of the tool.



The combination of traces on a fourth trapeze (BASL-1726) was also considered to be diagnostic of impact. In particular the cutting edge shows important damage (Fig. 10): in location a, the edge damage consists of bifacial scarring with multiple burinations; in location b, the damage consists of a concentration of scars with step termination. Crushing (location c on drawing) is present on the opposite edge, in the proximal part, where it is most likely caused by the intense friction against the haft. This intense damage may have caused the detachment of the piece from its haft. Under high magnification, microscopic linear impact traces were visible in location d, on the ventral face, perpendicular to the cutting edge and parallel to the retouched edge.

5.2. Barbs

Five microliths were classified as barbs. In general, these pieces were less heavily damaged than the transverse arrowheads. The concentration of scarring is mostly present in the distal part, the unretouched cutting edges showing small obliquely oriented isolated scars, in combination with microscopic linear impact traces that are also oriented slightly oblique to the cutting edge.

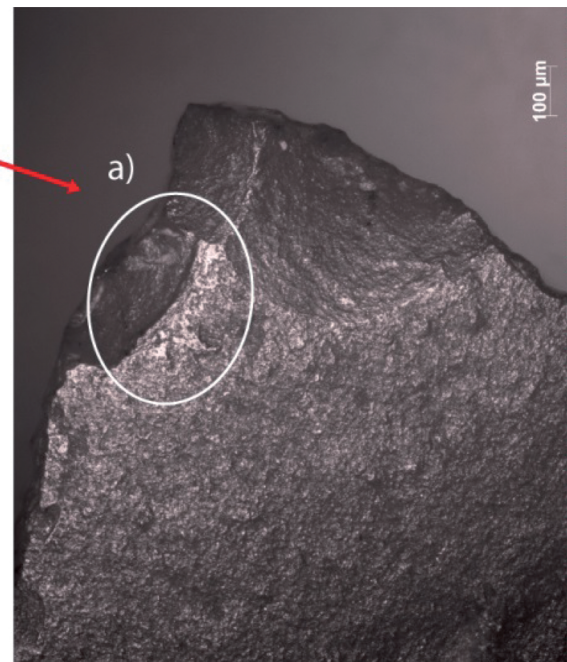
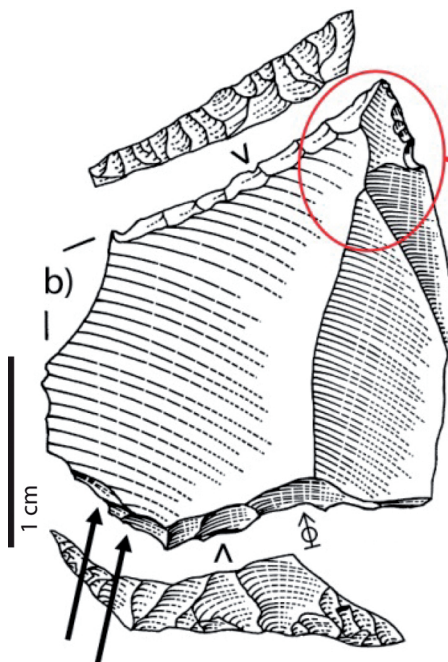


Fig. 11 – High magnification picture (100 x), bright spots in the distal part of the tool, ventral surface.

Wear patterns on two representative examples:

Scarring, microscopic linear impact traces and bright spots (Fig. 11: a) were observed in the distal part of one microlith (BASL-8393). These bright spots were probably formed during impact, following a friction with a flint particle (Rots, 2002). On the opposite edge, damage is visible that is caused by the pressure against the arrow shaft (see b, on drawing). The orientation of the traces, the position of the MLIT's and the macroscopic edge damage indicate that this microlith was probably hafted as a barb.

Another trapeze (BASL-2719) showed rather limited edge damage, but the combination of wear features could nevertheless be attributed to a use as barb. A scar concentration was visible on the corner of the truncated edge and the long unretouched edge (see location a). Under high magnification, slightly oblique oriented striations were observed on the ventral face of the unretouched edge (see arrows, Fig. 12).

5.3. Tips

The organization, orientation and intensity of the edge damage on 2 tools could be attributed to their use as projectile tips. One of the pieces (BASL-7808) shows intense damage on the tip, with multiple burinations (Fig. 13: a, on drawing). On the unretouched edge, bifacial scarring and dorsal bending scars were observed (see indication b, on drawing), while an oblique scar (c) with ventral initiation on the right edge with hinge termination at the left edge is visible on the proximal tool part of the tool. Starch residues were observed inside the impact fracture (see indications on the picture); they are considered to be taphonomic in origin.

5.4. Projectile, but uncertain position and orientation

For some pieces ($n = 3$), sufficient damage was visible to interpret the microliths as having been used as a projectile, but traces were too minimal to infer their position and orientation. The triangular point (BASL-9315) for instance, shows very limited scarring on the unretouched edge: in location a), minor edge damage was observed with a small burination near the corner of the straight truncation. The truncation is posterior to a small fracture (Fig. 14: location b). On the opposite part of straight truncation, removals are cutting through the intentional retouch (indication c), possibly due to an impact, but an unintentional detachment during retouch cannot be excluded. The damage pattern is suggestive for a use as projectile, but the damage pattern remains limited and associated microscopic

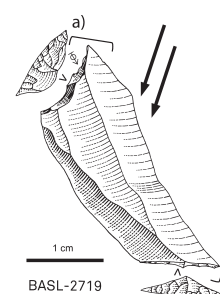


Fig. 12 – Drawing of the microlith (BASL-2719), MLIT's oriented slightly oblique to the cutting edge and limited scarring on the corners of the edge.

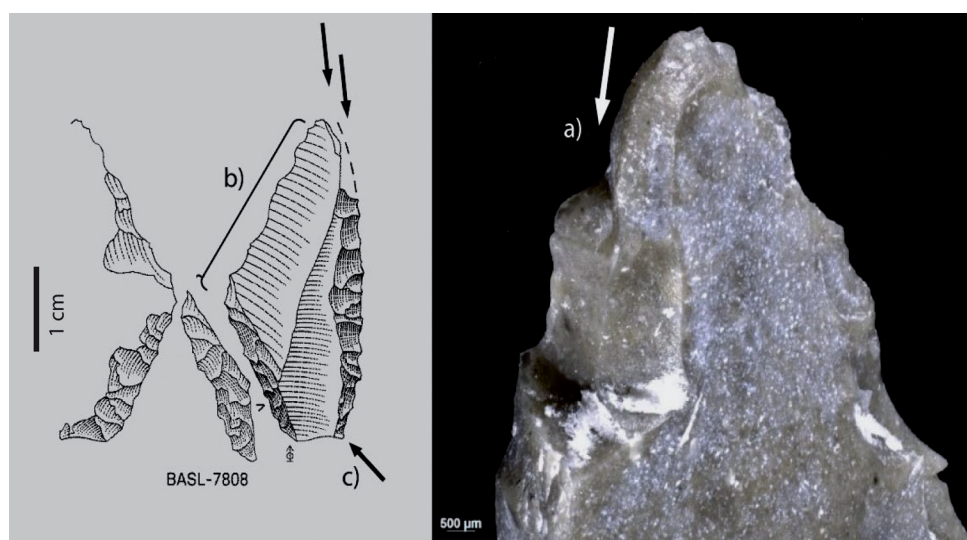


Fig. 13 – BASL-7808: low magnification picture (12.5 x) showing the impact fracture consisting of multiple burinations with step terminations on the ventral face, the residue and its distribution is visible in the inside of the impact fracture, on the ventral distal part of the piece.

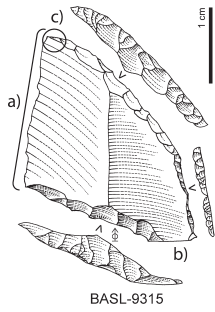


Fig. 14 – Drawing of the microlith (BASL-9315), probably used as a projectile.

wear is absent. The wear traces as a whole are too restricted to allow a confident interpretation of the position and orientation of the piece.

5.5. Other than projectile use

On a number of pieces ($n = 6$), no projectile evidence was observed. Macroscopic edge scarring is, for instance, very limited on one of the trapezes (BASL-2657). A few isolated scars are visible on the unretouched edges, with different terminations, alternating between the dorsal and the ventral face. The proximal retouched edge of the piece shows evidence of an earlier transversal break on which the retouch was subsequently applied. On the unretouched right edge, an invasive use polish with linear features parallel to the edge was observed. This polish is best visible on the dorsal face where it is even visible under low magnification with a stereomicroscope. On the long unretouched left edge, a vegetal polish was found. It is best developed on the distal part of the edge. Linear features within the polish indicate a transverse/oblique use motion. As the morphological appearance of the traces and the use direction differ between both edges, it can be concluded that they were not produced simultaneously. Instead, this piece seems to bear evidence of two separate use episodes. The sequence of these episodes can be reconstructed: the proximal retouch (and the earlier break) cut through the longitudinal polish on the right edge, whereas the use-wear on the left edge continues around the proximal and distal corners. The right edge was therefore used first, the tool was subsequently reworked (after breakage), and the left edge was used on plant material in a transverse/longitudinal motion, which corresponds to the last use episode (Fig. 15).

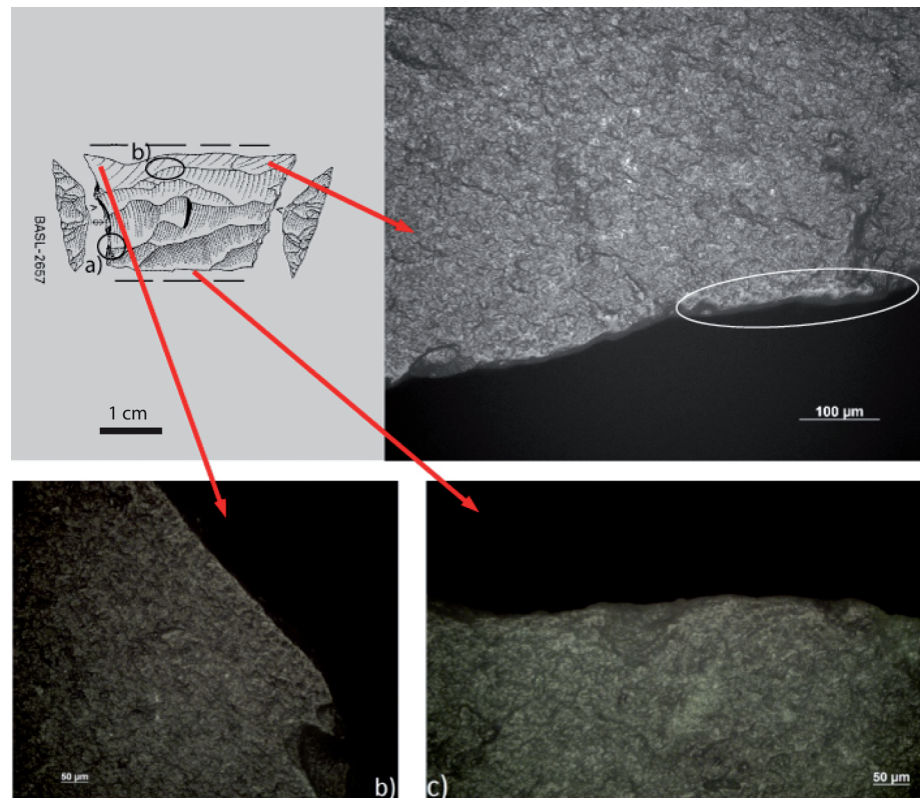


Fig. 15 – a) High magnification picture showing vegetal polish (200 x) on the ventral surface of cutting edge; b) same vegetal polish on the corner (cutting edge/truncated edge) (200 x); c) light polish on the short unretouched edge (dorsal face) (200 x).

6. Conclusions

Based on a detailed microscopic examination of the wear traces and residues on the microliths from the site of Bazel-Sluis, it can be argued that the majority of these microliths were used as a projectile element in hunting weapons. The specific organisation and orientation of the impact damage, in association with microscopic linear impact traces, allowed proposing a position and orientation in the shaft. The majority of the microliths proved to have been used as transverse arrowheads, but also some tips could be identified. In addition, one or both of these types of arrowheads were combined with barbs. For some microliths, no particular orientation on the shaft could be identified even though the wear pattern was sufficiently diagnostic to infer projectile use.

These functional results on the stone tools corroborate the faunal evidence. Big game hunting seems to have been a primary activity at the Bazel-Sluis site in the course of the 5th millennium cal BC, which is also suggested by the presence of antler and bone remains of red deer, wild boar and auroch (Meylemans *et al.*, in prep).

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Abstract

In the presented study, the results are discussed of a use wear analysis on 32 microliths of the site Bazel-Sluis. The site was occupied during the final Mesolithic and the series of examined microliths consists predominantly of trapezes. Based on an existing experimental reference and a small site-specific projectile experiment, the majority of these microliths could be interpreted as having been elements in hunting weapons. Trapezes were mounted mainly as transverse arrowhead, but also barbs were identified. These results confirm the hypothesis based on faunal studies that the site had an important focus on hunting activities.

Keywords: Use-wear analysis, microliths, hunting weapons, experimentation, Bazel-Sluis, Municipality of Kruibeke, Prov. of East Flanders (BE).

Résumé

Cette étude présente les résultats d'une analyse fonctionnelle réalisée sur 32 microlithes du site Bazel-Sluis. Le matériel lithique est attribué à des phases d'occupation datant de la fin de l'époque mésolithique. Les microlithes analysés sont principalement des trapèzes. L'interprétation fonctionnelle se base sur une collection de référence existante et une expérimentation de tirs de projectiles spécifiques au site. Les microlithes ont principalement pu être interprétés comme des éléments d'armes de chasse. Dans la majorité des cas, les trapèzes ont été montés comme pointes de flèches à tranchant transversal, mais des montages en barbelures ont également été identifiés. Les résultats obtenus confirment les hypothèses des études sur la faune, indiquant que le statut du site était principalement orienté sur les activités de chasse.

Mots-clés : Tracéologie, microlithes, arme de chasse, expérimentation, Bazel-Sluis, Commune de Kruibeke, Prov. de Flandre orientale (BE).

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