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Research Article

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Stylistic Study of the Late Mesolithic Industries in Western France: Combined Principal Coordinate Analysis and Use-Wear Analysis

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Abstract: The notion of style has been the subject of much research and theoretical development in prehistoric archaeology. This vast concept touches several fields, including the morphology of artefacts, technical gestures and their function. The lithic typology of arrowhead armatures was widely developed in the twentieth century for the study of the French Mesolithic and includes some of these aspects. The functional, technical, or aesthetic nature of the morphological characteristics of these artefacts has received little attention, while the mapping of types has been overvalued. This article presents a new approach combining statistical analysis with the use-wear analysis of arrowhead from several Breton sites, dated to the Late Mesolithic.

Keywords: Late Mesolithic, lithic industries, Western France, style, principal coordinate analysis, hierarchical classification, use-wear analysis

1 Introduction

The concept of style has a long history in archaeological research and as a result, several different uses. The first stylistic study aimed at a typological classification of artefacts, and their distribution in space and time led to the establishment of periods and chronological tables at the end of the nineteenth and beginning of the twentieth centuries (Bertrand, 1864). This work was echoed in research until the 1990s, when the chrono-cultural framework of the Mesolithic lithic industries was created (Rozoy, 1978; Thévenin, 1990, 1991). Indeed, a major classification of knapped tools was drawn up at that time (Barrière et al., 1969, 1972; Daniel & Rozoy, 1966; Fortea Pérez, 1973; Kozłowski, 2009; Rozoy, 1967, 1968, 1991). In France, stylistic studies are strongly associated with

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arrowhead armatures, considered to be a “factor of group identity in prehistory” (Thévenin, 1995, p. 28) due to their significant morphological variation. In this context, style is understood as a set of formal characteristics observed in the lithic industry, both in the shaping of tools and in the appearance of debitage products, as for example Coincy, Montbani, or Montclus styles defined by Rozoy. Their distribution over space and time makes it possible to define regional cultures or “cultural components” (Thévenin, 1990, p. 178).

At the same time, but in other academic circles, several researchers attempted to understand the origin of these changes. The process of making and the use of artefacts were questioned. Each object was thought to have a specific mode of action and a shape adapted to a targeted activity (Leroi-Gourhan, 1971, 1973). This refers to the “active” aspect of artefacts (Sackett, 1977) and their functioning (Sigaut, 1991). Nevertheless, the final morphology of the object is not exclusively determined by its utilitarian role, as suggested by marked variations in armatures during the Mesolithic. Other works look more precisely at the technical gestures and the operational chain implemented during the manufacture of these objects. The concept of “technical style” is thus defined by the way an artefact is shaped (Lechtman, 1977). This not only includes the *chaîne opératoire* but also the organisation of work and ritual gestures observed by ethno-archaeologists (Coupaye, 2015).

On the other hand, the functional analysis of prehistoric tools through the use-wear studies (Semenov, 1964) continues to be nowadays one of the few objectifiable methods to approach the function of prehistoric tools. Nevertheless, the morphology of objects is not merely the result of their presumed functioning (Pfafenberger, 1992), but in addition, of a much deep ideological inheritance.

The final morphology of an object is the conjunction of the techniques employed during its manufacture and the mode of use for which it is intended. The combination of different technical and functional solutions results in the creation of a range of shapes with equivalent uses (Sackett, 1982), reflecting various possibilities. Ancient populations were thus able to choose between these options, intentionally or not (Lemonnier, 1993, pp. 1–35). Style thus resides in this notion of choice, since the sum of technical and functional choices results in a “highly specific and characteristic manner of doing something and [...] this manner is always peculiar to a specific time and place” (Sackett, 1977, p. 370).

2 Expanding the Notion of Style in the Study of the Mesolithic

Theoretical work on the style of archaeological objects does not seem to have undergone many practical developments in studies conducted on the Mesolithic in France. This rapid re-contextualisation of stylistic studies shows that they are still based on the search for the geographical outline of cultures and their movements over time. This obviously overlooks the fact that the geographic distribution of these different stylistic markers is rarely superimposable (Marchand, 2014; Michel, 2011). On the other hand, morphological descriptions of knapped stone tools overlook the functional, technical, and aesthetic parameters of the examined features.

In this article, we propose a first attempt to broaden these perspectives by investigating the origin of the morphological characteristics observed on the armatures of the Late Mesolithic in Brittany. To this end, this work is built on the theoretical developments mentioned above, which highlight the notion of choice in the style of objects (Lechtman, 1977; Lemonnier, 1993; Leroi-Gourhan, 1971, 1973; Sackett, 1977, 1982). However, except for the functional studies based on the use-wear methodology (Semenov, 1964), there is little or no analytical method for this concept to objectify observations made on past productions and societies. In this work, we propose a new methodological framework to address the style of knapped objects from the Late Mesolithic, based on a statistical approach that aims to quantify the degree of stylistic similarity of archaeological collections. At the same time, the use modes of the tools are questioned, based on a classical use-wear analysis intended to identify the function and functioning of lithic armatures. The aim here is to understand to what extent the morphology of armatures is defined by the way they are used, and consequently, what is the influence that function has on the style of the object.

3 Materials and Methods

3.1 Choice of the Corpus

Several habitats occupied during the Late Mesolithic in the West of France were selected. The corpus includes settlements that underwent archaeological operations (excavations or test pits) with published radiocarbon dates (Table 1). These two conditions ensure the comparability of the collected data. The selected sites are relatively well distributed across the study area, although most of them are located on the coast (Figure 1). In fact, only Pont-Glas (Marchand, Le Goffic, & Marcoux, 2011; Marchand, Goffic, Donnart, Marcoux, & Quesnel, 2017) is located inland; Beg-an-Dorchenn (Rault, 1992), Beg-er-Vil, and La Gilardi re (Marchand, 1999) are in coastal situation.

The bibliographic data available for each site were consulted and analysed, in order to retain information relating to the archaeological intervention, raw dates, and technological data relating to the lithic industry. It was possible to consult the collections resulting from this work for Beg-er-Vil and Beg-an-Dorchenn, and observations from these sites were particularly useful for the use-wear study. The choices made in the different corpus led to a representation bias between the technological and the use-wear study (Table 2). This difference is less significant for Beg-an-Dorchenn, as the collection could be seen by all the authors (the 12 pieces missing from the typo-technological analysis correspond to armatures that were too fractured to be accurately classified).

3.2 Technological Approach

Technological choices are approached through different characteristics considered to structure the production of blanks: the percussion techniques used, when they could be estimated (Pelegrin, 2000), the original knapped block (core, debris, blade, or flake), the volumetric designs, and orientation of debitage (unipolar, bipolar, discoid, etc.). Subsequently, elements related to armature shaping are retained, such as the methods of blank truncation or the type of retouch used to regularise the edges (Inizan, Reduron, Roche, & Tixier, 1995). This information is noted on a presence/absence basis in a database (Table 3).

3.3 Typological Approach

The general morphology of the armatures was also taken into account for redefined types. Structuring attributes were selected, such as the general shape of the tip (triangular, trapezoidal, or pointed), the symmetry axis of the piece and the delineation of truncations (Inizan et al., 1995; Perrin, 2001). These characteristics have been ranked from the most general to the most specific (Figure 2). Three classes of armatures are thus considered, according to their shape. These classes are then divided into sub-classes, based on the symmetry axis of the piece. Finally, types are defined according to the delineation of each truncation. This

Table 1: Some general information about the selected sites, which include the SU, city, chronological period of occupation (dating made with OxCal 4.4) and the bibliographical references

Site	SU	Commune	Cal. dating (lower)	Cal. dating (higher)	Reference
La Gilardi�re	3 and 4	Pornic	−5666	−5218	(Marchand, 1999)
Beg-an-Dorchenn	4	Plomeur	−6460	−5305	(Kayser, 1984, 1985, 1986, 1987; Rault, 1992)
Pont-Glas	Ind.	Ploun�our-M�enez	−5476	−5227	(Marchand et al., 2011, 2017)
Beg-er-Vil	Ind.	Quiberon	−6315	−6015	(Marchand, 1999; Marchand et al., 2018)

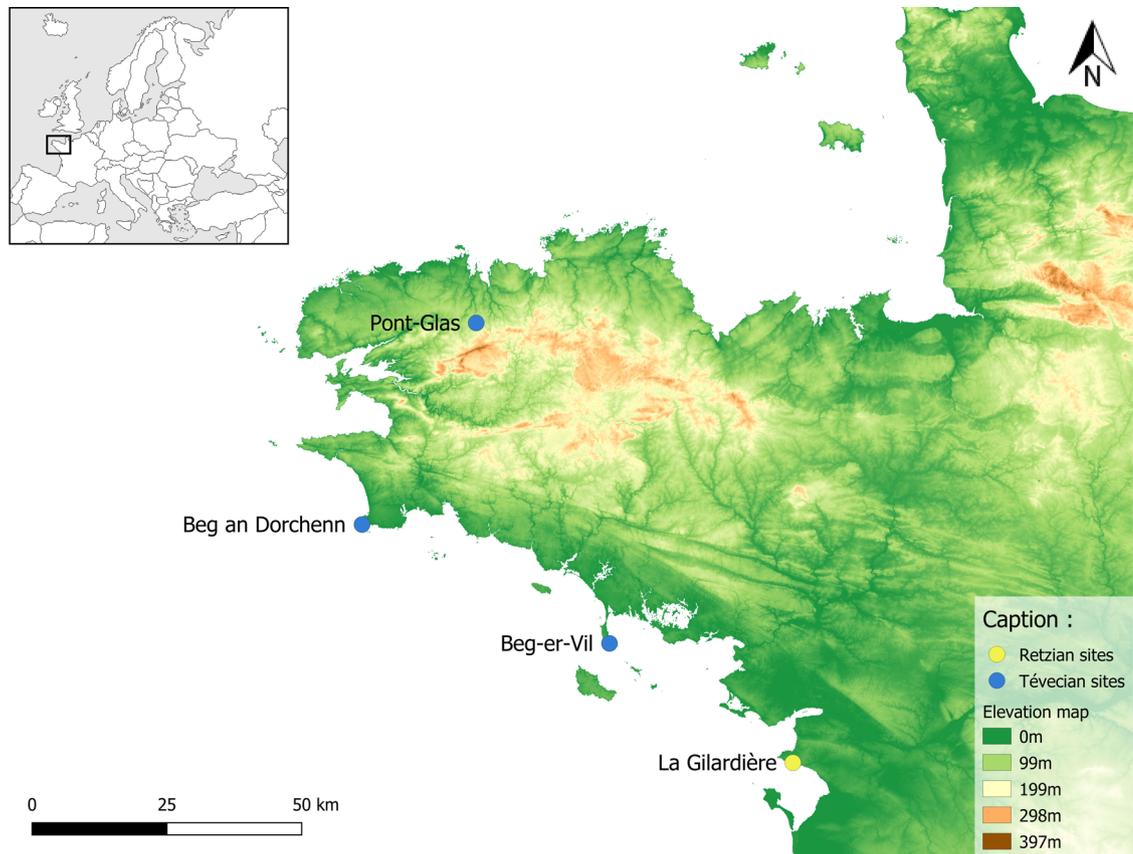


Figure 1: Location of the selected archaeological sites for the study (CAD: L. Hauguel-Bleuven).

Table 2: Count of microliths concerned for the technological study on the one hand, and for the use-wear analysis on the other hand

Site	SU	Count (technological study)	Count (use-wear analysis)
La Gilardière	3 and 4	115	0
Beg-an-Dorchenn	4	50	62
Pont-Glas	Ind.	27	0
Beg-er-Vil	Ind.	58	319

classification makes it possible to describe the pieces more accurately and creates a uniform interpretative grid for the studied sites. Morphological information is given in the form of counts (Table 4).

3.4 Statistical Approach

Statistical tools are used to compare the typo-morphological assemblages of armatures from each archaeological site, as well as the technical gestures applied to each of them. The aim here is to estimate the differences between the assemblages, in an objective way. In order to do this, a dissimilarity matrix is constructed for each dataset as a first step. Since there are two kinds of datasets, one with counts and one with presence/absence information, two dissimilarity indices are used here. The Jaccard index is used for the technological dataset, which contain qualitative information. Based on the counting of common characteristics, it is the best suited to this type of data (Hammer, 2002). The typo-morphological information is handled with the Bray–Curtis index, because the information is quantitative here. This index compares the population gap of the different

Table 3: Data base of technological gestures studied in this article

Technique (Table 1/3)	Hard direct percussion	Soft direct percussion (mineral)	Soft direct percussion (animal)	Indirect percussion	Unipolar core	Bipolar core	Second striking plan	Discoïd core	Core on blank	Sum
La Gilardière 3-4	1	0	0	1	1	1	1	0	0	5
Beg-an-Dorchenn	1	1	1	1	1	1	0	1	1	8
Pont-Glas 5.6	1	0	0	1	1	1	0	0	1	5
Beg-er-VII_2016 101 et 4	0	0	0	0	1	1	1	1	1	5
Beg-er-VII_2012 4 et 5	1	0	0	1	1	1	0	1	1	6
Beg-er-VII_2013 4 et 5	1	0	0	1	1	1	0	1	1	6
Sum	5	1	1	5	6	6	2	4	5	
Percentage of representation	7.35%	1.47%	1.47%	7.35%	8.82%	8.82%	2.94%	5.88%	7.35%	

Technique (Table 2/3)	Trihedral point	Microburin	Abrupt direct retouch	Flat direct retouch	Low direct retouch	Semi-abrupt direct retouch	Abrupt reverse retouch	Flat reverse retouch	Sum
La Gilardière 3-4	1	1	1	0	0	0	0	0	3
Beg-an-Dorchenn	0	1	1	1	1	1	1	1	7
Pont Glas 5.6	1	1	1	0	0	0	1	0	4
Beg-er-VII_2016 101 et 4	0	0	1	0	0	0	0	0	1
Beg-er-VII_2012 4 et 5	0	0	1	0	0	0	0	0	1
Beg-er-VII_2013 4 et 5	0	0	1	0	0	0	0	0	1
Sum	2	3	6	1	1	1	2	1	
Percentage of representation	2.94	4.41	8.82	1.47	1.47	1.47	2.94	1.47	

Technique (table 3/3)	Low reverse retouch	Semi-abrupt reverse retouch	Alternate abrupt retouch	Alternate semi-abrupt retouch	Alternating abrupt retouch	Cross abrupt retouch	Bifacial semi-abrupt retouch	Sum of the three tables
La Gilardière 3-4	1	1	0	0	0	1	1	4
Beg-an-Dorchenn	1	1	1	1	1	1	1	8
Pont Glas 5.6	0	0	1	0	0	0	0	2
Beg-er-VII_2016 101 et 4	0	0	0	0	0	0	0	0
Beg-er-VII_2012 4 et 5	0	0	0	0	0	1	0	1
Beg-er-VII_2013 4 et 5	0	0	0	0	0	1	0	1
Sum	2	2	2	1	2	4	2	68
Percentage of representation	2.94	2.94	2.94	1.47	2.94	5.88	2.94	

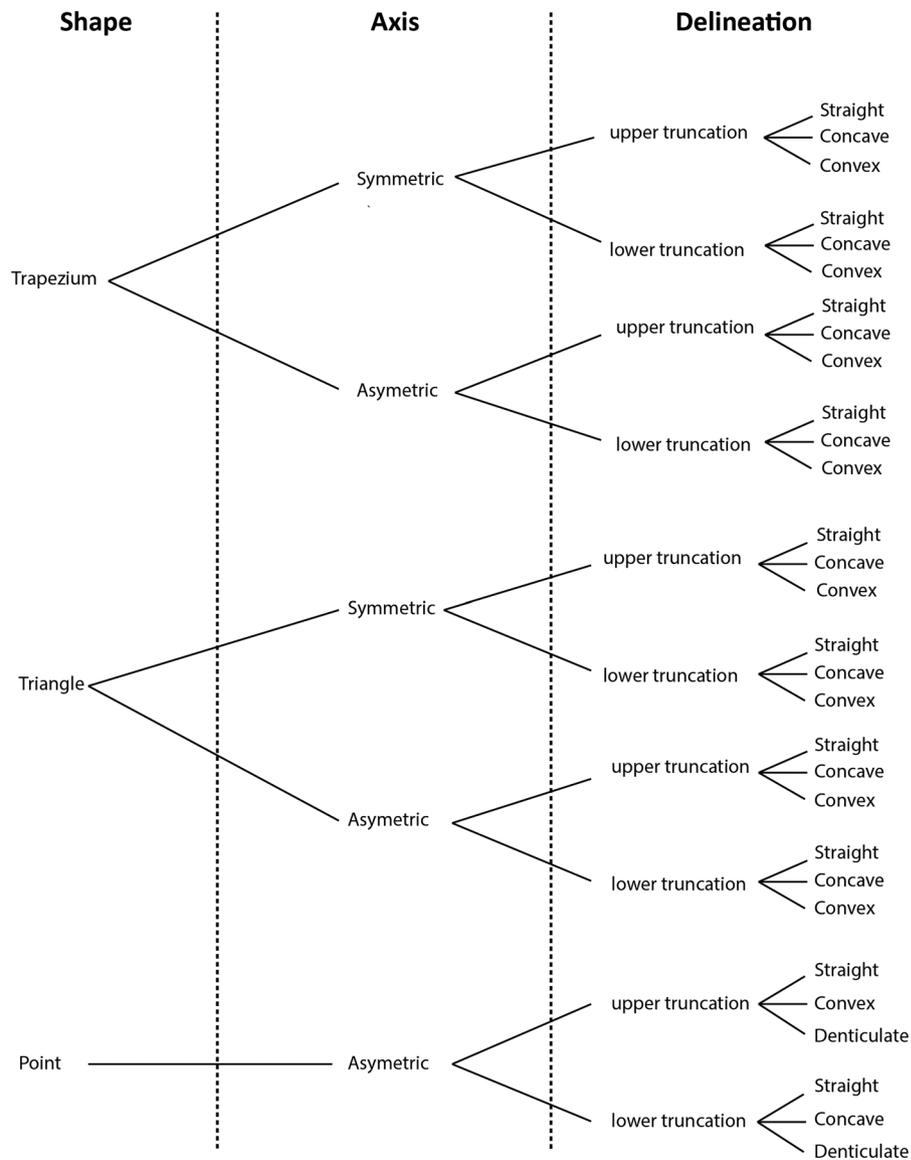


Figure 2: Hierarchisation of the visible characteristics view on microliths, with the different possibilities observed (CAD: L. Hauguel-Bleuven).

objects studied here, and divide them by the total population (Greenacre & Primicerio 2014, pp. 62–63; Hammer, 2002).

Then, these matrices are analysed by using a Principal Coordinate Analysis (PCoA), an ordination method adapted for this kind of information (Carlson, 2017, pp. 297–303; Gower, 1968; Rigaud, 2011, p. 55). PCoA is combined with ascending hierarchical classification (HC) (Shennan, 1988), in order to better visualise the clusters.

The aim of this approach is to not only assess the technical similarity of the occupations, but also the degree of resemblance of the armature's collections. These two aspects are studied separately, by calculating two PCoAs: one for each dataset. The cross-referencing of these results aims to evaluate the influence of technical gestures on the morphology of the armatures. Statistical processing is carried out in the Rstudio software, version 3.6.2.

Table 4: Database in which types of armatures studied here are gathered

Typology (Table 1/3)	Symmetrical trapeze (indefinite)	Symmetrical trapeze (straight truncations)	Symmetrical trapeze (concave truncations)	Asymmetrical trapeze (straight truncations)	Asymmetrical trapeze (concave truncations)	Sum
Beg-an-Dorchenn	0	4	3	6	12	25
Pont-Glas	0	3	8	0	0	11
La Gilardière 3-4	0	6	8	0	19	33
Beg-er-VII_2016 - 10-102-107-112	0	1	3	0	1	5
Beg-er-VII_2012 - 4 et 5	4	19	7	0	0	30
Beg-er-VII_2013 - 4 et 5	0	30	19	5	3	57
Sum	4	63	48	11	35	
Percentage of representation	1.32	20.79	15.84	3.63	11.55	

Typology (Table 2/3)	Symmetrical triangle (straight truncations)	Asymmetrical triangle (straight truncations)	Asymmetrical triangle (concave truncations)	Point (indeterminate)	Oblique truncation point	Sum
Beg-an-Dorchenn	1	9	9	0	4	23
Pont-Glas	0	7	1	0	1	9
La Gilardière 3-4	18	7	5	0	9	39
Beg-er-VII_2016 - 10-102-107-112	0	0	0	1	0	1
Beg-er-VII_2012 - 4 et 5	0	0	0	0	4	4
Beg-er-VII_2013 - 4 et 5	2	0	0	0	0	2
Sum	21	23	15	1	18	
Percentage of representation	6.93	7.59	4.95	0.33	5.94	

Typology (Table 3/3)	Point with natural base	Point with retouched base	Backed point	Pointe à épéron	Segment	Sum	Sum of the three table
Beg-an-Dorchenn	0	1	3	0	1	5	53
Pont-Glas	3	1	4	0	0	8	56
La Gilardière 3-4	0	3	0	20	0	23	95
Beg-er-VII_2016 - 10-102-107-112	0	0	0	0	0	0	6
Beg-er-VII_2012 - 4 et 5	0	0	0	0	0	0	34
Beg-er-VII_2013 - 4 et 5	0	0	0	0	0	0	59
Sum	3	5	7	20	1	303	
Percentage of representation	0.99	1.65	2.31	6.60	0.33		

3.5 Use-Wear Methodology

In order to question the function of the trapezoidal industries of the Late Mesolithic period in Brittany, a use-wear analysis was carried out. The discovery of several arrow shafts armed with trapezoidal bitruncations (Kozłowski, 2009), preserved in an archaeological context in Northern Europe, led researchers to interpret the geometric industries as projectile elements (Marchand, 1999). Nevertheless, a precise understanding of the functioning of these types of tools can only really be grasped from a use-wear approach (Semenov, 1964). The functional interpretation of arrowheads can not only involve the examination of certain types of diagnostic fractures, but also requires an integrated analysis of all the macro and microscopic attributes of the impact wears, on large samples of materials (Coppe & Rots, 2017; Rots & Plisson, 2014).

In our case, we decided to systematically study and describe all the macroscopic and microscopic attributes of the impact wears of the trapezoidal bitruncations from the sites of Beg-er-Vil (Quiberon, Morbihan) and Beg-an-Dorchenn (Plomeur, Finistère), to be able to compare the functional data with PCoA. Macroscopic attributes were observed, such as the initiation of removals (Ho Ho Committee, 1979), their shape (González Urquijo & Ibáñez Estévez, 1994), their termination (Fischer, Hansen, & Rasmussen, 1984), their length, quantity, orientation, and distribution over the active area of the tool. A total of 381 armatures were studied. Microscopic attributes have been described in terms of micro-topography, brightness, orientation, and distribution (González Urquijo & Ibáñez Estévez, 1994). Several analytical experiments with trapezoidal bitruncations allowed us to establish a use-wear reference collection to infer the function of the archaeological traces (Calvo-Gómez, 2018, 2021).

4 Main Results

As the analyses of the technical and typo-morphological data were carried out separately, the results are presented one after the other.

4.1 Technical Choices

Before the calculation of technical dissimilarity index, data selection was necessary to limit the over-representation of “zeros.” For this, the technical gestures that are absent in all sites studied here were removed from the table. The same treatment is made for techniques that are site-specific (Table 5). After the computation of the PCoA, the justified variance reaches 80.55% on the two first dimensions. In addition, the correlation between the original distance and the results of the PCoA give a good coefficient, which is equal to 0.98. To put it differently, there is a good correspondence between the results and the original values.

The projection of the two first dimension brings into opposition the Beg-er-Vil levels and the other occupations (Figure 3, left). The HC confirms this observation (Figure 3, right). The stratigraphical unit 101 and 4 of Beg-er-Vil are quite similar, with a medium-low dissimilarity index between 0.25 and 0.50 on a scale from 0 (perfect similarity) to 1 (perfect difference) (Table 5). In the same way, the Beg-an-Dorchenn and Pont-Glas sites share a good similarity, with a distance of 0.38 only (Table 5). Finally, La Gilardière getting closer to Beg-an-Dorchenn (with a distance of 0.41), but remains distant from the other sites (Table 5, Figure 3).

This bipartition seems due to the absence of microburin technique at Beg-er-Vil, but also to the retouch used in the shaping of microliths (Table 3). The microburin technique is a method of blank fragmentation: a notch on the blank is made by percussion and enlarged until this bipartition (Figure 4, 1–3). The fracture formed by this process looks like a trihedral point, sometime visible on the microlith (Figure 4, 4b). Characteristic debris are also produced, called “microburins” (Figure 4, 4a) (Albarello, 1987; Inizan *et al.*, 1995, pp. 84–86; Rozoy, 1968). This technique is identified at Beg-an-Dorchenn, Pont-Glas, and La Gilardière not only by the presence of “microburin,” but also by the conservation of the trihedral point on some arrowhead. Moreover, these sites show a greater diversification of retouch type, compared at Beg-er-Vil, on which only the

Table 5: Distance matrix of the technological data

	La Gilardière 3-4	Beg-an-Dorchenn	Pont-Glas 5.6	Beg-er-Vil_2016 101 et 4	Beg-er-Vil_2012-2013 4 et 5
La Gilardière 3-4	0	0.41	0.56	0.71	0.57
Beg-an-Dorchenn	0.41	0	0.38	0.69	0.47
Pont-Glas 5.6	0.56	0.38	0	0.69	0.54
Beg-er-Vil_2016 101 et 4	0.71	0.69	0.69	0	0.44
Beg-er-Vil_2012-2013 4 et 5	0.57	0.47	0.54	0.44	0

direct abrupt and the crossed retouched are known (Figure 5a and b). The rest of the reduction process is rather homogenous between the Mesolithic sites studied here. In fact, the direct (hard hammer) and undirect percussion (punch) are used during the exploitation of unidirectional and bidirectional cores, and core on flake. At Beg-er-Vil and Beg-an-Dorchenn, discoïd cores seem to be used for the blank production too (Table 3 and Figure 6).

4.2 Morphological Choices

As for the technical choices, a selection of the information was necessary to limit the over-representation of “zeros.” The types which are site-specific and whose representation is lower than 4% of the total population are removed before the calculation of the dissimilarity matrix. This threshold is chosen arbitrarily to reduce the number of “zeros” without depleting too much dataset. Moreover, the level 101 of Beg-er-Vil is also excluded, due to its low number of microliths (Table 4). After the computation of the PCoA, the justified variance reaches 79.93% on the two first dimensions. In addition, the correlation analysis between the original distance and the results of the PCoA show that there is a good correspondence between them (with a coefficient equal to 0.96).

The projection of the PCoA show the opposition between Beg-er-Vil and the other sites, along the first dimension (Figure 7, left part). La Gilardière seems to be isolated in the second dimension too, and is located in the superior right corner of the diagram (Figure 7, left part). Pont-Glas and Beg-an-Dorchenn share the lower dissimilarity index, with a distance of 0.52 from each-other (Table 6). In a general way, the sites are quite unsimilar with indices between 0.50 and 0.80 (on a scale from 0 to 1). The HC reflects this despite the absence of clear bipartition (Figure 7, right part).

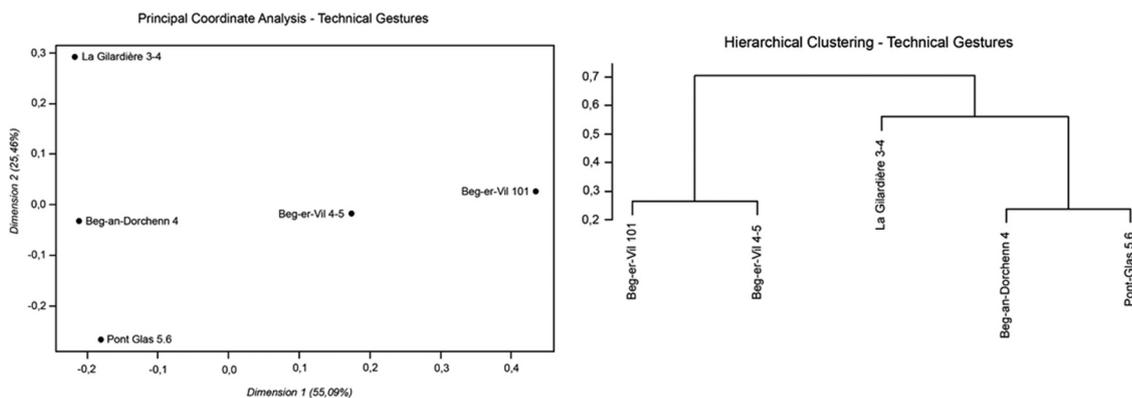


Figure 3: Graphical results of the PCoA (on the left) and its hierarchical clustering (on the right), based on the technological data (CAD: L. Hauguel-Bleuven).

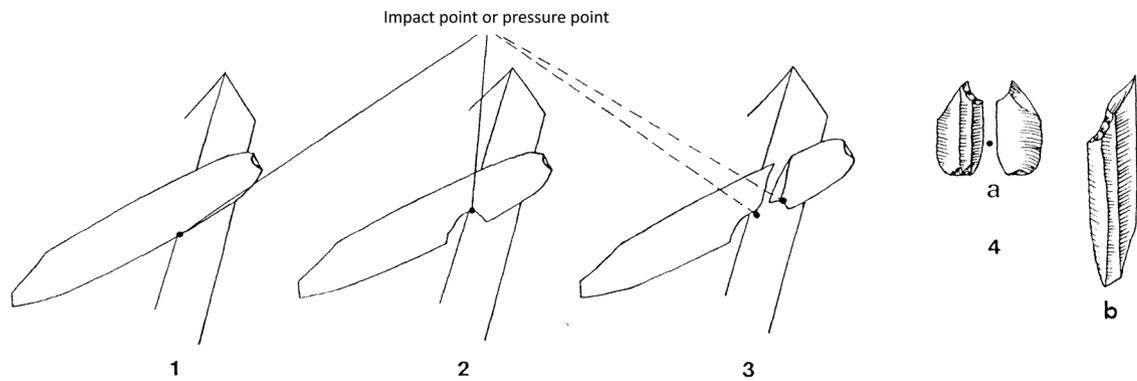


Figure 4: Explanatory diagram about the “Microburin technique” (1–3) and the reproduction of one microburin (4a) and one trihedral point (4b) (Inizan *et al.*, 1995, p. 85).

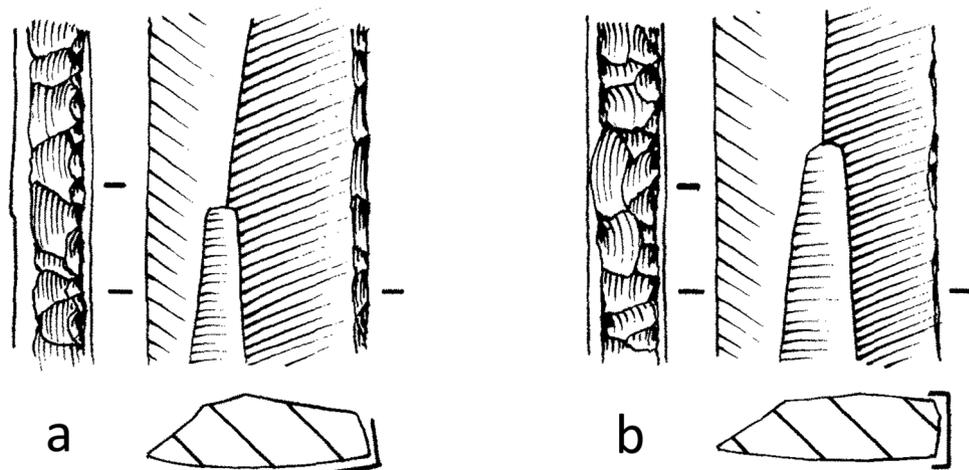


Figure 5: Explanatory diagram which shows the direct retouch (a) and the crossed retouch (b) (Inizan *et al.*, 1995, p. 148).

Beg-er-Vil shows a high number of symmetrical trapezes with straight truncations and a great number of symmetrical trapezes with concave truncations (Figure 8, numbers 1 and 4). Beg-er-Vil is also marked by the poor representation of points, more frequent at Pont-Glas and Beg-an-Dorchenn (Table 4). La Gilardière is marked by a higher quantity of asymmetrical trapezes with concave truncations as well as by the presence of symmetrical triangles with straight truncations (Table 4 and Figure 8, number 15). Moreover, this site is also characterised by the presence of some “*armatures à éperon*,” specifics at La Gilardière (Figure 8, number 19). Finally, Pont-Glas and Beg-an-Dorchenn share some microlith types, more precisely among the points: points with oblique truncation, points with retouched based, and backed points (Table 4 and Figure 8, numbers 16, 17, 18, 20, 21, and 22).

4.3 Results of the Use-Wear Study

The study of impact wears provided numerous results concerning the function and functionality of Tevician bitruncations. On one hand, 11 out of the 62 trapezoidal armatures from the Beg-an-Dorchenn site were interpreted as impacted armature elements. Generally speaking, the asymmetrical bitruncations bear impact wears parallel to the large base of the trapeze, i.e. they were impacted as piercing arrow elements (in 32.9% of cases; Figure 9a and b). On the other hand, symmetrical bitruncations often bear impact traces organised perpendicular to the large base of the trapeze, suggesting the use of transverse-edged arrows (in 18.5% of cases;

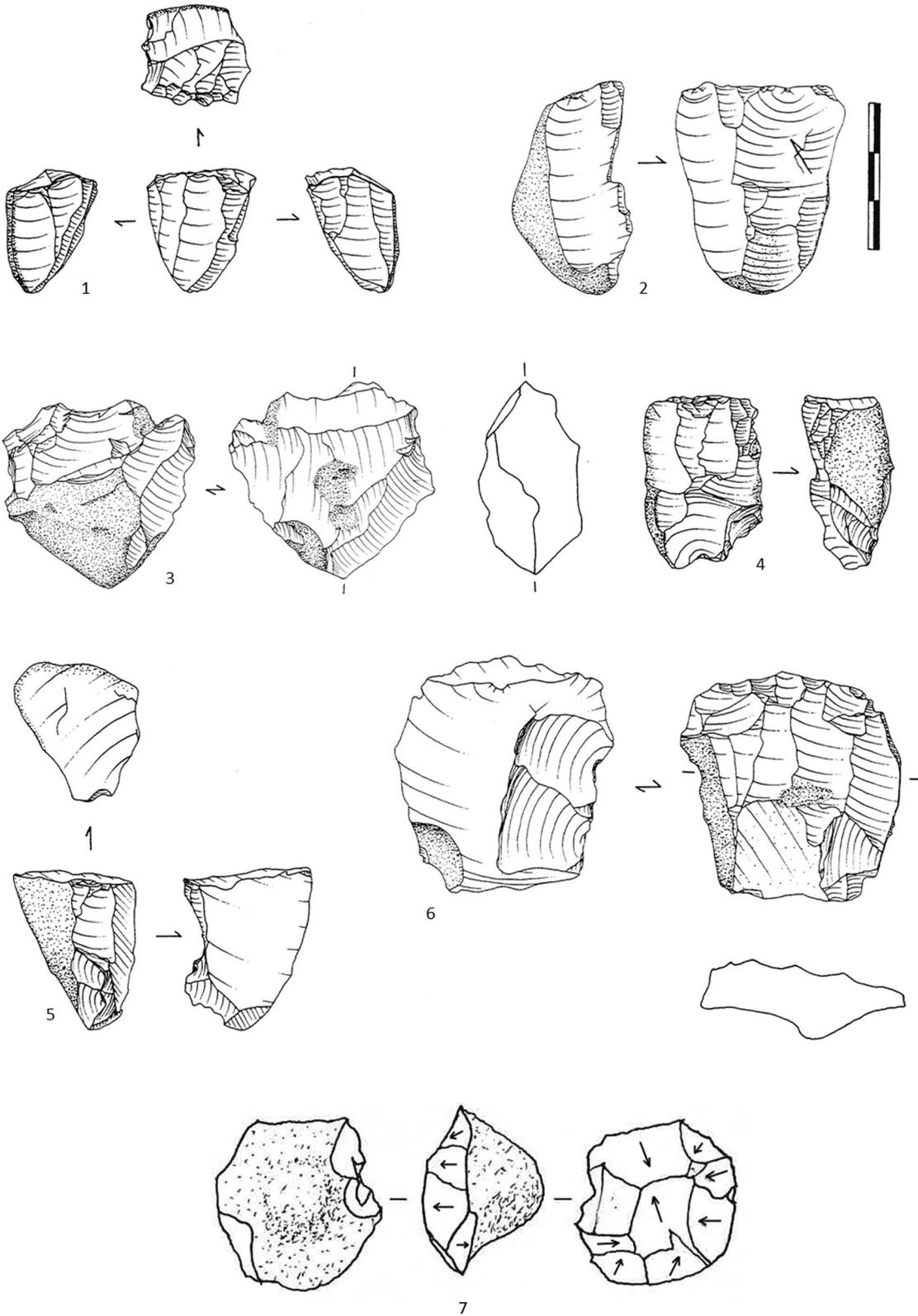


Figure 6: Core plate. Morphology: (1 and 2) unipolar core; (3) multipolar core; (4) bipolar core; (5 and 6) core on flake; (7) discoid core; Source: 1, 2, and 6, La Gilardière (Marchand, 1999, pp. 392 and 394); 3, 4, and 5, Beg-er-Vil (Marchand, 1999, pp. 419–420); 7, Beg-an-Dorchenn (Rault, 1992, p. 46).

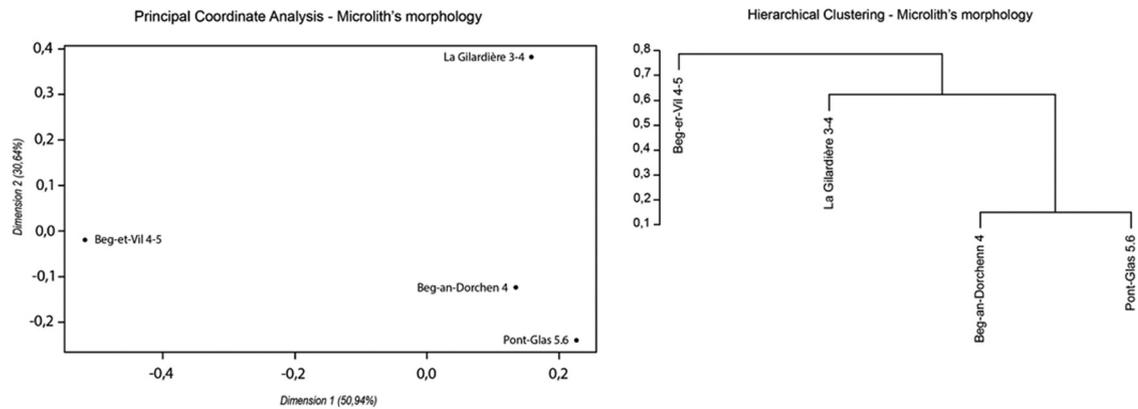


Figure 7: Graphical results of the PCoA (on the left) and its hierarchical clustering (on the right), based on the typological data (CAD: L. Hauguel-Bleuven).

Table 6: Distance matrix of the typological data

	Beg-an-Dorchenn	Pont-Glas	La Gilardière 3-4	Beg-er-Vil US4-5
Beg-an-Dorchenn	0	0.52	0.60	0.73
Pont-Glas	0.52	0	0.65	0.80
La Gilardière 3-4	0.60	0.65	0	0.79
Beg-er-Vil US4-5	0.73	0.80	0.79	0

Figure 9e). These impact wears consist of mainly fractures and scars of the active areas, especially on the large base of trapezes, as well as microscopic linear elements that follow the direction of the macroscopic removals. Most of the time, functional removals are fractures of the angles, with very different shapes. The fractures are usually caused by hard materials, that creates cone initiations, and have feather or step terminations. Finally, the rare microscopic attributes related to impacts accompany the direction of removals in the form of striations with a rough bottom.

On the other hand, the use-wear study of the 319 bitruncations from the Beg-er-Vil site allowed us to identify 49 elements with clear impact wears. Almost systematically, the symmetrical bitruncations were also interpreted as transverse arrowheads, due to the location and organisation of the macro- and microscopic attributes, which are always perpendicular to the large base of the trapeze (Figure 10). The initiation of the removals associated with a projectile impact was predominantly conical, with very pronounced and glossy striations. This suggests impacts against hard mineral materials. The predominant morphologies were elongated or pseudo-burin type removals starting from the corners of the large trapeze base. Again, in the studied Beg-er-Vil collection, removal terminations have often feather or step shapes.

5 Interpretations and Discussion

5.1 The Technical and Typological Variations in Regard of the Chrono-Cultural Framework

Several ethno-archaeological studies highlight the relationship between the morphology of the produced objects and technical choices. This is a recurrent research topic in works on traditional pottery craftsmen. It appears that certain technical aspects carry strong identity markers, transmitted through generations of

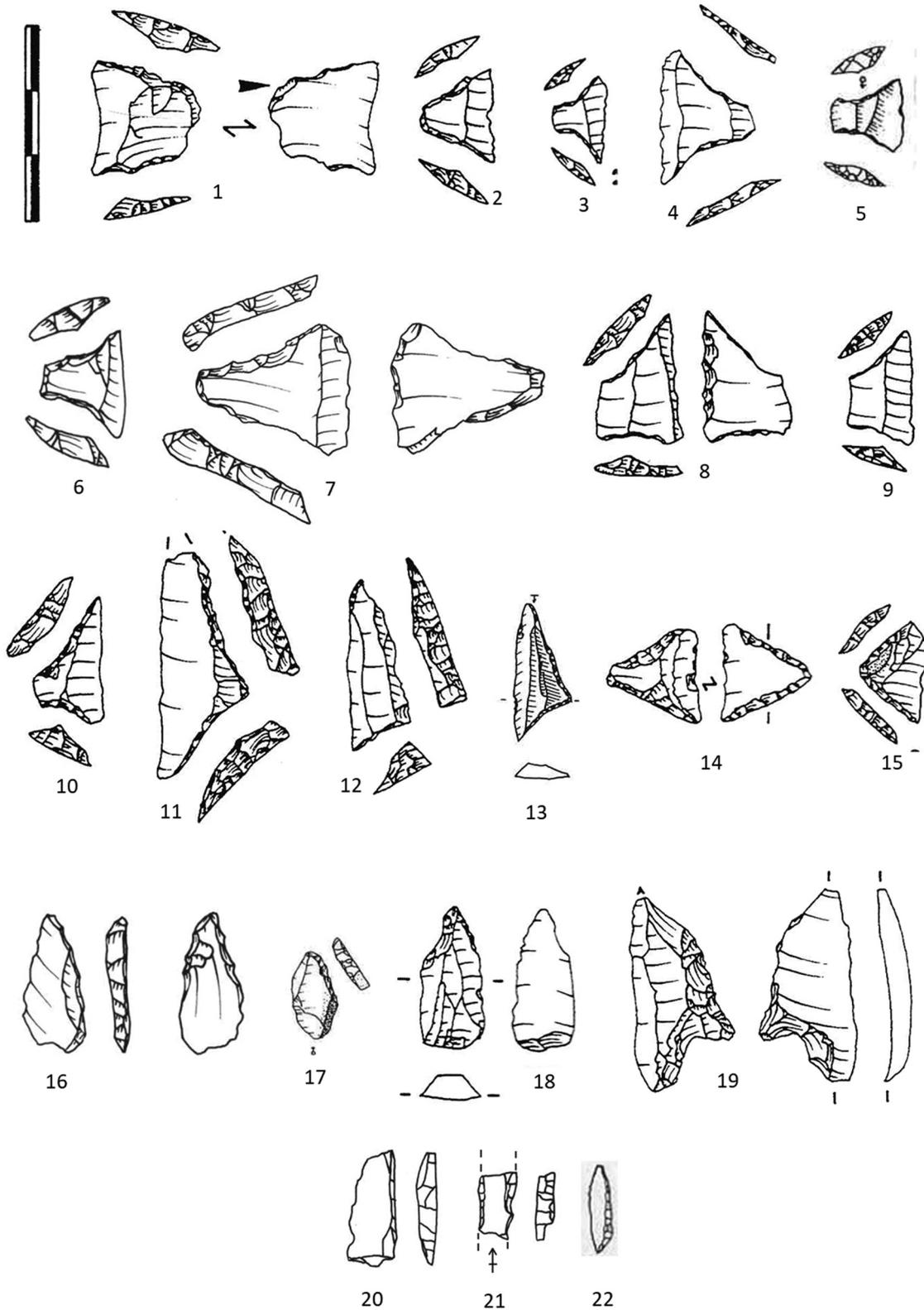


Figure 8: Selection of Microlith. Typology: (1 and 2) symmetrical trapezes with straight truncations; (3-5) symmetrical trapezes with concaves truncations; (6 and 10) asymmetrical trapezes with concave truncations; (7-9) asymmetrical trapezes with straight truncations; (11-13), asymmetrical triangle with straight truncations; (14) Chatelet point; (15) symmetrical triangle with straight truncations; (16 and 17) truncated point; (18), point with retouched base; (19) "pointe à éperon"; (20-22) backed point. Source: 1, 4, 11, Beg-er-Vil (Marchand, 1999, pp. 427); 2, 3, 6, 7, 8, 9, 10, 12, 14, 17, 18, La Gilardière (Marchand, 1999, pp. 399-400); 5, 13, 22, Beg-an-Dorchenn (Rault, 1992, pp. 73-76); 6, 7, 16, 17, 20, 21, Pont-Glas (Marchand et al., 2017, pp. 262-263).

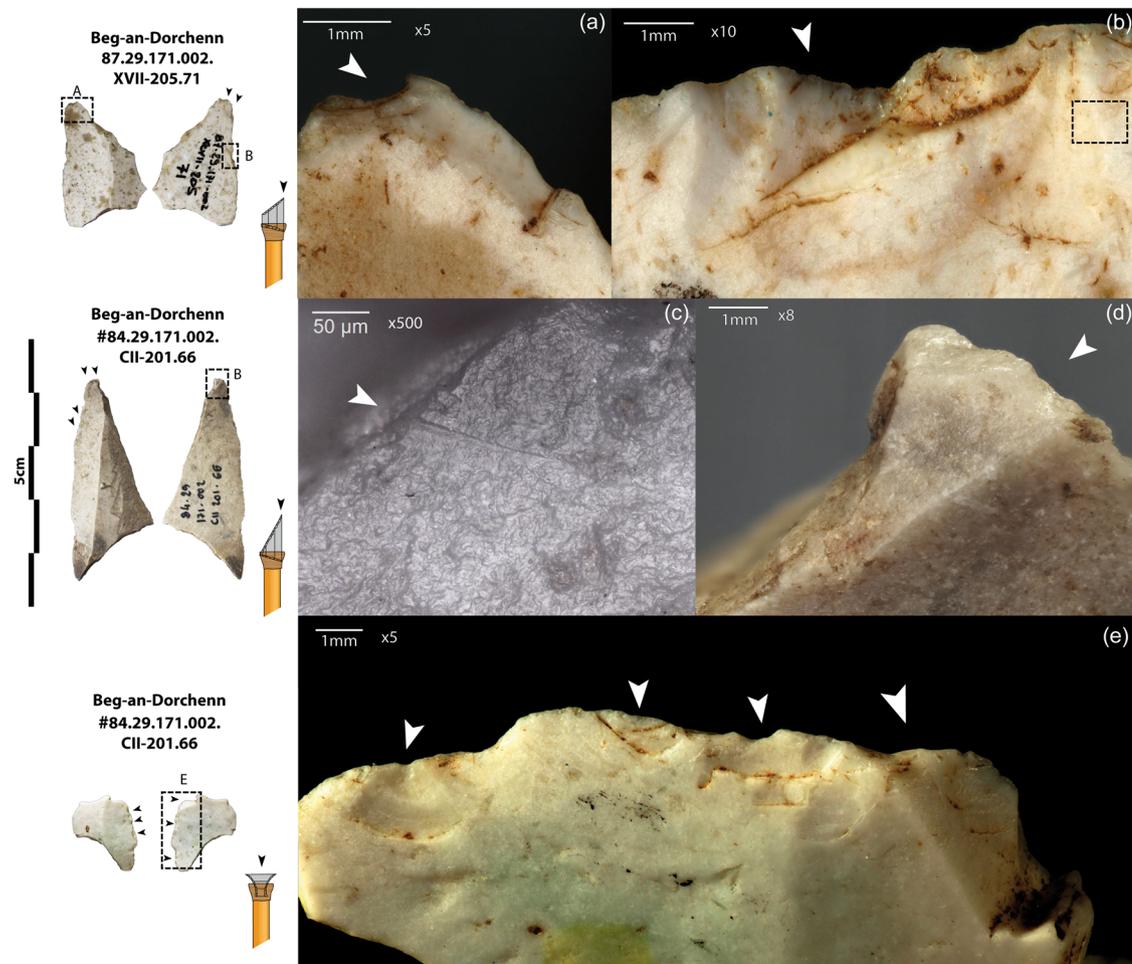


Figure 9: Impact wears of the Beg-an-Dorchenn armatures. (a) Burin-like fracture ($\times 5$). (b) Bending initiated scars ($\times 10$). (c) Isolated striation, parallel to the axis of the trapezoidal bitruncation ($\times 500$). (d) Burin-like apical fracture ($\times 8$). (e) Scars and fractures on the large base of a symmetrical bitruncation ($\times 5$).

craftsmen, while others attest to direct contacts (at markets or during visits) or indirect contacts (through the diffusion of finished products) between potter communities (Gosselain, 1992, 1995, 2017; Roux *et al.*, 2017). These works highlight the social and significant character of technical choices for the populations that implement them. In our study, recurrent technical gestures could point to a common basis for knapping and shaping lithic tools. This is the case for percussion techniques (direct and/or indirect) and the volumetric organisation of cores (mainly unipolar frontal debitage with one or two successive debitage planes), identified in all the examined occupations. On the other hand, other technical elements, such as microburin technique or retouch types, are more likely to be local choices (Beaune de, 2008; Leroi-Gourhan, 1973; Roux, 2015). This mixture of technical, aesthetic, and social characteristics makes it possible to define “communities of practices.” This expression refers to the behaviours shared on a daily basis by a human community. The term “practice” refers to the gestures and techniques used as well as to the objects used and the relationships between the actors (Wenger, 2000). Keeping this in mind, the PCoA of technical information would therefore indicate the coexistence of three communities of practices in Western France during the Late Mesolithic (Figure 3).

These three communities of practices echo the chrono-cultural framework known in this region. The Late Mesolithic of Western France is characterised by the opposition between Tevecian and Retzian, defined by Rozoy (1978, pp. 747–748). A bipartition of Tevecian group has been proposed by Marchand, who identifies two successive phases, the Beg-er-Vil facies and the Hoedic facies (Marchand, 2014). Furthermore, the spatial distribution of symmetrical trapezium subtypes in Brittany points to three different regions in the sixth

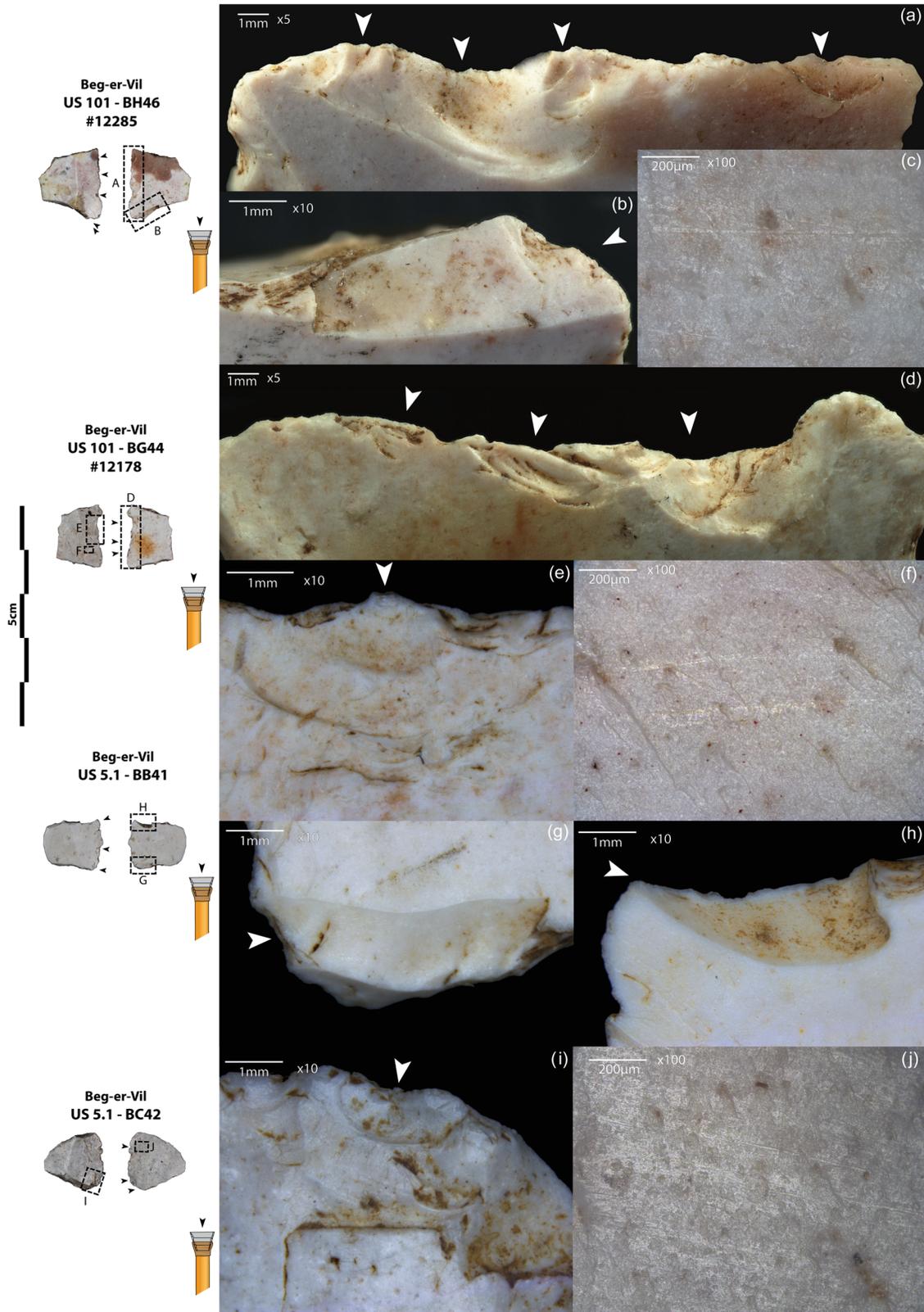


Figure 10: Impact wears of the Beg-er-Vil armatures. (a) Several scars and fractures on the large base of a symmetrical trapeze, with marked cone initiations ($\times 5$). (b) Burin-like fracture ($\times 10$). (c) Microscopic striations, perpendicular to the large base of the symmetrical trapeze ($\times 100$). (d) Several impact scars on the edge of a symmetrical trapeze ($\times 5$). (e) Cone-initiated scar, with a semi-circular shape and feather-like termination ($\times 10$). (f) Bright microscopical striations, running perpendicular to the large base of the trapeze ($\times 100$). (g) Burin-like fracture ($\times 10$). (h) Burin-like fracture ($\times 10$). (i) Scars and fractures with cone initiations ($\times 10$). (j) Microscopic linear traces, running perpendicular to the large base of the trapeze ($\times 100$).

millennium cal BC. (Marchand, 2000, 2005). The definition of these groups is made on the basis of the microliths typology. Tevecian sites are marked by high proportions of trapezoidal bitruncations (symmetrical or not) and asymmetrical triangles (Figure 8, numbers 1–13), while the Retzian group is defined by a more diversified quiver and the presence of “*pointes à éperon*” or Chaville points (Figure 8, numbers 14 and 19) (Marchand, 2000, 2005; 2014, pp. 234–239; Rozoy, 1978, pp. 747–748). Nevertheless, the distinction between Tevecian and Retzian sites is not as clear as we thought. In fact, La Gilardière get close to Pont-Glas and Beg-an-Dorchenn on the basis of their dissimilarity index (Table 5). From a technical point of view, Tevecian and Retzian debitage are quite similar with the exploitation of unipolar core by indirect or direct percussion (Marchand, 2014, pp. 234–239). The absence of microburin technique is specific to the Tevecian. But this observation can be restricted to the “oriental Tevecian,” since only Beg-er-Vil stand out by this aspect.

5.2 The Function of Microliths

Although the statistical results show that there is no strict correspondence between technical gestures and the final shape of the armatures, their functioning distinctly relies on their morphology. Use-wear analyses provide useful hints to objectify the functioning of the Mesolithic arrowheads. Even though there are always some exceptions to the rule, impact wears show clear tendencies on the fitting of the arrowheads, depending on their geometrical shape. Symmetrical trapezes almost always have impact wears running perpendicular to the large base of the trapeze, meaning their use as transversal arrowheads. On the other hand, asymmetrical trapezes and triangles deliver frequently impact wears on the apical angles, parallel to the axis of the armature, which indicates their use as piercing arrowheads.

Thus, we consider that the statement that the morphology is not essentially linked to their use (Pfaffenberger, 1992) must be, at the very least, relativised. It is clear that the function of the archaeological tools cannot be exclusively inferred by their shape alone. Since their very beginning (Keeley, 1980; Plisson, 1985; Semenov, 1964), use-wear analyses have repeatedly demonstrated the spectrum of potential technical choices while the object implemented are much wider than their morphology would initially suggest. However, in our opinion, while these observations are objectifiable, they also imply the meaninglessness of the shape of an object. Since the shape of an object is an independent character of their function and their social meaning, the shaping of an object is meaningless.

We consider on the opposite that the morphology could be understood as an actant role on the potentialities of the object. In our case, the strict correlation between the use of symmetrical trapezes as transversal arrowheads is a good example. Their shape seems to be a defining character of their use. The same statement is valid for the asymmetrical bitruncations. While the human techniques can make several technical procedures with a similar tool, the tool itself is an actant. Social meaning of the objects is not determined by their morphology, but by their use. The social meaning of the symmetrical bitruncations is totally meaningless without their use. The social meaning of the hunting activities and their techniques themselves is, in our opinion, what fulfils the identarian role of these objects.

5.3 What About the Concavity of Some Truncation?

By studying the technical and functional aspect of microliths, one last thing can be highlighted here: the variation in the delineation of the retouched line used to shape the armatures. If a straight line of retouch is enough to determine triangle from trapezoidal bitruncations or to differentiate the symmetrical and asymmetrical one, some truncations are marked by a deeply concave retouch. This fact is all the more striking because it is less visible, or not at all visible on the object once hafted. Moreover, the delineation does not seem to have a function: this characteristic can help to join the microlith and the shaft on the microliths, but it is not mandatory. In fact, symmetrical trapezes with straight truncations are hafted in the same way that similar

pieces with concave truncations. Furthermore, this characteristic seems to be specific to some places. For example, the assemblage of Beg-an-Dorchenn is known for the important presence of trapezes with concave truncations, while Beg-er-Vil is marked by the predominance of straight bitruncations. The delineation of the truncation can be another characteristic of style, like the retouch type (Lenoir, 1975). But the discretion of this feature puts it closer to the notion of “adjunct form,” an element not necessary for the use of the tool but present for other reasons, aesthetical or identical ones (Sackett, 1982, p. 71).

5.4 Limitations of This Study

Through this study, the difference between Beg-er-Vil and the rest of the corpus has been highlighted, on a technical and typological point of view. This observation can be due to a real distinction, or to the constitution of the corpus itself. In fact, only four archaeological sites have been chosen here, corresponding to occupations which have been studied and properly dated with radiocarbon. But this selection limits the number of comparisons possible. Moreover, the technological and typological information are uneven between different sites. Actually, the data come from former and published studies for Pont-Glas and La Gilardi re. More recent publications have been consulted for Beg-an-Dorchenn and Beg-er-Vil, and the re-examination of the lithic assemblage has been possible too. In consequence, Beg-er-Vil has more complete information about its assemblage, which is probably reflected in the statistical analysis presented here.

This fact constitutes the most important limit of this study. A small corpus makes the difference between the number of sites and characteristics more important, which can affect the results of the analysis and his reliability. About this point, it seems that the PCoA presented here are quite reliable, with great goodness-of-fit. Second, this lack of information makes impossible the use of PCoA, or other statistical analysis, to compare the functional information between sites. Effectively, this kind of data concern only two sites, which make useless this method.

6 Conclusion

The results obtained here shed further light on the morphological diversity of arrowheads from the Late Mesolithic in Brittany. If two communities of technical practice are defined on the basis of the blank fragmentation and the shaping of microliths, a three-way split is observable from the arrowhead’s types. This distribution echoes with the chrono-cultural framework known in this region, with the differentiation of Retzian sites (like La Gilardi re) and Tevecian occupation (like Beg-er-Vil, Beg-an-Dorchenn, and Pont-Glas). This last entity can be subdivided in two sub-group, depending of the presence of microburin and of the proportion of symmetrical or asymmetrical trapezes (Marchand, 2014, p. 237). This observation suggests the existence of a common basis of technical know-how, based on blank debitage on the one hand, and on the other hand, on tool shaping methods with a more local connotation, which can be imitated and/or borrowed. Nevertheless, this assertion must be taken with care since the dissimilarity index between sites is quite high, on the typological data. In consequence, this three-way split is visible only on the PCoA diagram, not on the hierarchical clustering (which cannot properly classify the sites).

On the other side, the use-wear study identified a correlation between the symmetrical aspect of microliths and the way in which they are hafted. Symmetrical pieces were generally used as cutting arrows, while asymmetrical elements were mainly piercing arrows. This observation questions the assumption in which the shape of an artefact is not linked to his function (Pfaffenberger, 1992). In this study, the function clearly determines one aspect of microliths. Furthermore, the use of microlith is an important key to understand the role of this kind of tool, and its meaning in a social point of view.

Finally, technical and functional considerations about microlith lead to question other little variations in their shapes. It is the case of the concave truncations observed on some pieces. This characteristic may come as

a surprise, as it remains very discreet when the microlith is hafted. Moreover, the concavity of truncations seems specific to some places in Bretagne. It leads to place this feature as an “adjunct form,” something that is not necessary for the use of microliths, but added for other purpose (aesthetic, identity, or symbolic one?) (Sackett, 1982, p. 71).

The conclusions of this work are not definitive and must be completed in order to better understand the settlement dynamics during the Mesolithic. In fact, this approach can lead to interesting conclusions or to a different view of lithic industry, but is limited here by the choices operated in the *corpus* constitution. Only four sites are selected, which is quite few for the statistical analysis. Moreover, the functional analysis of microliths has been led on two sites only, which makes the statistical analysis on this information impossible, or unreliable. By consequence, the interpretation given here must be put into perspective. To overcome these biases, it would be necessary to include more Mesolithic sites in order to have more comparisons possible. Moreover, use-wear analysis must be generalised in this region, to have more precise details about the function of object. Furthermore, this type of study should integrate common everyday tools. Indeed, projectile armatures only concern one of the activities of past populations, linked to hunting or war. Style can also be gleaned from domestic tools, associated with technological choices and functional considerations. Finally, style also has a social connotation through the relationship between craftsmen and the people who use these objects. Although it seems impossible to identify individual craftsmen in occupations using the methods chosen here, it is still possible to study the relationships described by technological, morphological, and functional choices. For this, the use of another analytical tool is required: social network analysis.

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