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## Lower Palaeolithic stone tools. A techno-functional study of the Soucy 3P assemblage (France)

Juliette Guibert-Cardin, Félicien Capellari, Vincent Lhomme, Nelly Connet, Elisa Nicoud, Sylvie Beyries

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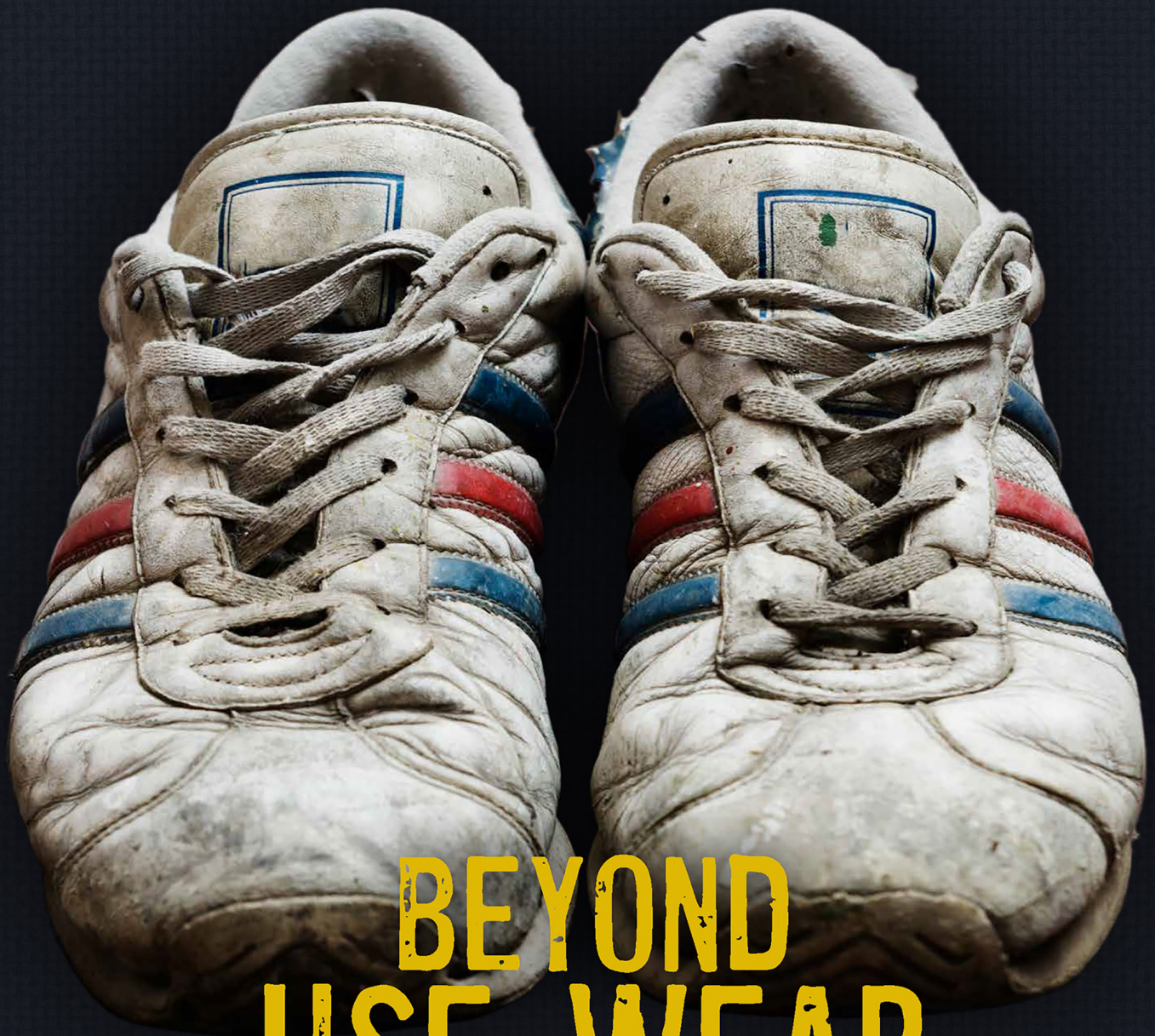
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# BEYOND USE-WEAR TRACES

GOING FROM TOOLS TO PEOPLE BY MEANS OF  
ARCHAEOLOGICAL WEAR AND RESIDUE ANALYSES

SYLVIE BEYRIES, CAROLINE HAMON  
& YOLAINE MAIGROT (EDS)



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### **AWRANA IN PICTURES**





# Lower Palaeolithic stone tools

## A techno-functional study of the Soucy 3P assemblage (France)

Juliette Guibert-Cardin, Félicien Capellari, Vincent Lhomme,  
Nelly Connet, Elisa Nicoud and Sylvie Beyries

### Abstract

Historically, European Lower Palaeolithic cultures have been differentiated according to the presence or absence of bifacial tools. In order to go beyond this typological classification of *Homo heidelbergensis* groups, we approach the study of their techno-economic behaviours based on functional and technical analyses. This involves the study of the *chaîne opératoire*, that is, the entire lithic production process from raw material gathering and tool making to the use, abandonment and/or export out of the site of any artefact. These new data are examined in the light of pluridisciplinary (archaeozoology and palaeoenvironmental) studies. Functional studies on Lower Palaeolithic tools are rare because of the difficulties of working on such ancient materials.

Here we present a techno-morphological and functional approach to the analysis of tools and other products of the *chaîne opératoire* of biface production at Soucy 3P (Yonne, France). The well-preserved archaeological layer at this site is contained in a fluvial sequence within the MIS 9 layer. It has provided faunal remains, as well as a higher quantity of bifaces (n = 276) than usually observed in the Lower Palaeolithic complex of Europe. Despite a quantitatively reduced sample of bifaces and flakes available for use-wear analysis, we have already obtained useful results on lithic technology and tool function.

From a technical point of view, the numerous bifaces are bifaces-as-a-tool (*pièce bifaciale-outil*) according to Boëda (1997). They are very rarely resharpened. When they are, the reduction does not modify their morphological characteristics. Traces resulting from post-depositional phenomena are visible on the artefacts but some use-wear traces can still be seen. The tools show use-wear traces in usually only one active area. Several modes of use have been identified. Although the bifaces may all look the same, their uses varied. Also, the bifaces and flakes may have shared the same modes of use.

*Keywords: Middle Pleistocene, bifacial tools, use-wear analysis, techno-morpho-functional study, Soucy*

## Introduction

The Western European Lower Palaeolithic Complex groups together a wide range of human settlements and various lithic productions with or without bifaces. The sites are scarce and were heterogeneous over hundreds of thousands of years. They mostly date to interglacial periods (Bosinski 1996; Tuffreau 2004; Nicoud 2013). Many studies seek to emphasize technical developments in order to trace intercontinental migration patterns over a very long time period. But this objective tends to simplify the data, as it often confronts a more complex archaeological reality (Chevrier 2012; Nicoud 2015). Indeed, a tool is defined by its structure, its function and the way it was used (Sigaut 2012), but until now we have known very little concerning the last two aspects. Thus, before observing at the scale of the entire Lower Palaeolithic, we will seek to better understand techno-economic and functional behaviours within the archaeological site.

To do so, the entire *chaîne opératoire* of the production and use of the stone tools will be described according to a techno-morpho-functional approach in association with functional analysis. Use-wear traces are often no longer present for this very early period, making it difficult to carry out this analysis (Beyries 1990). Thus, in this paper we focus on the well-preserved MIS 9 archaeological layer of Soucy 3P near Paris that has yielded the highest number of bifaces for Europe (n = 276).

## Material and method

### *Soucy sites and the Soucy 3P layer (Yonne, France)*

The Soucy quarry is located in the south-eastern part of the Paris Basin. The Palaeolithic sites are situated within a fossil section of the Yonne river valley. Rescue operations conducted between 1994 and 1997 revealed a total of nine archaeological layers at six different sites (fig. 1a and b). Pluridisciplinary studies defined their chronostratigraphic framework. Preserved in the Lower Yonne valley is a staged system of 12 alluvial terraces covering the last 400 000 years. The Soucy sites are included in the MIS 10 and 9 alluvial deposits (Chaussé 2003; Chaussé *et al.* 2000; 2004). Direct dating by ESR (on quartz) and by U-Th confirms the chronological attribution of the human settlements to MIS 9 (340-300 ka, Voinchet 2002). They are preserved within the sandy-silty alluvial sediments of the upper part of the Soucy terrace.

The Soucy sites provide evidence for various lithic industries: some layers contain only products from biface production while some present only products of *débitage chaîne opératoire*; others have both. This typotechnological variability echoes that of the entire European Lower Palaeolithic Complex. Recently excavated, well-dated, well-preserved and subjected to multidisciplinary

studies, Soucy provides an ideal archive for analysis of the variability of techno-economic behaviours of human groups during the Lower Palaeolithic. Some archaeological layers attest only to the use of bifaces (Soucy 5I), others attest only to the production of bifaces (Soucy 5II), and finally certain sites provide evidence for both the production and the use of bifacial tools, such as Soucy 3P and Soucy 1 (Lhomme 2007).

We focus here on the main archaeological level (P) of the Soucy 3 site because of its very good state of preservation, the presence of numerous faunal remains and its singular lithic industry, based exclusively on biface production. Soucy 3 was discovered in 1995. Level P was excavated over a large area of 700 m<sup>2</sup> (Lhomme *et al.* 1996). More than 10 000 faunal remains and more than 6 000 lithic remains were found (not counting very small items less than 3 cm long, N = 6 539, tab. 1). No major post-depositional event affected the layer although a slight bioturbation was perceived during the excavation. The faunal remains are in good condition and were sometimes still anatomically connected. This occupation took place on a sandy-gravelly mound with probable plant cover, bordered by the river (Chaussé 2003). The climate was temperate with a continental influence and the surrounding environment was forested, with scattered meadows. The palaeoclimatic and palaeoecological data are corroborated by malacological studies that identify numerous terrestrial and freshwater species as well as microfaunal remains (Lhomme *et al.* 2004; Limondin-Lozouet 2001; Bémilli 2004; Escudé *et al.* 2013).

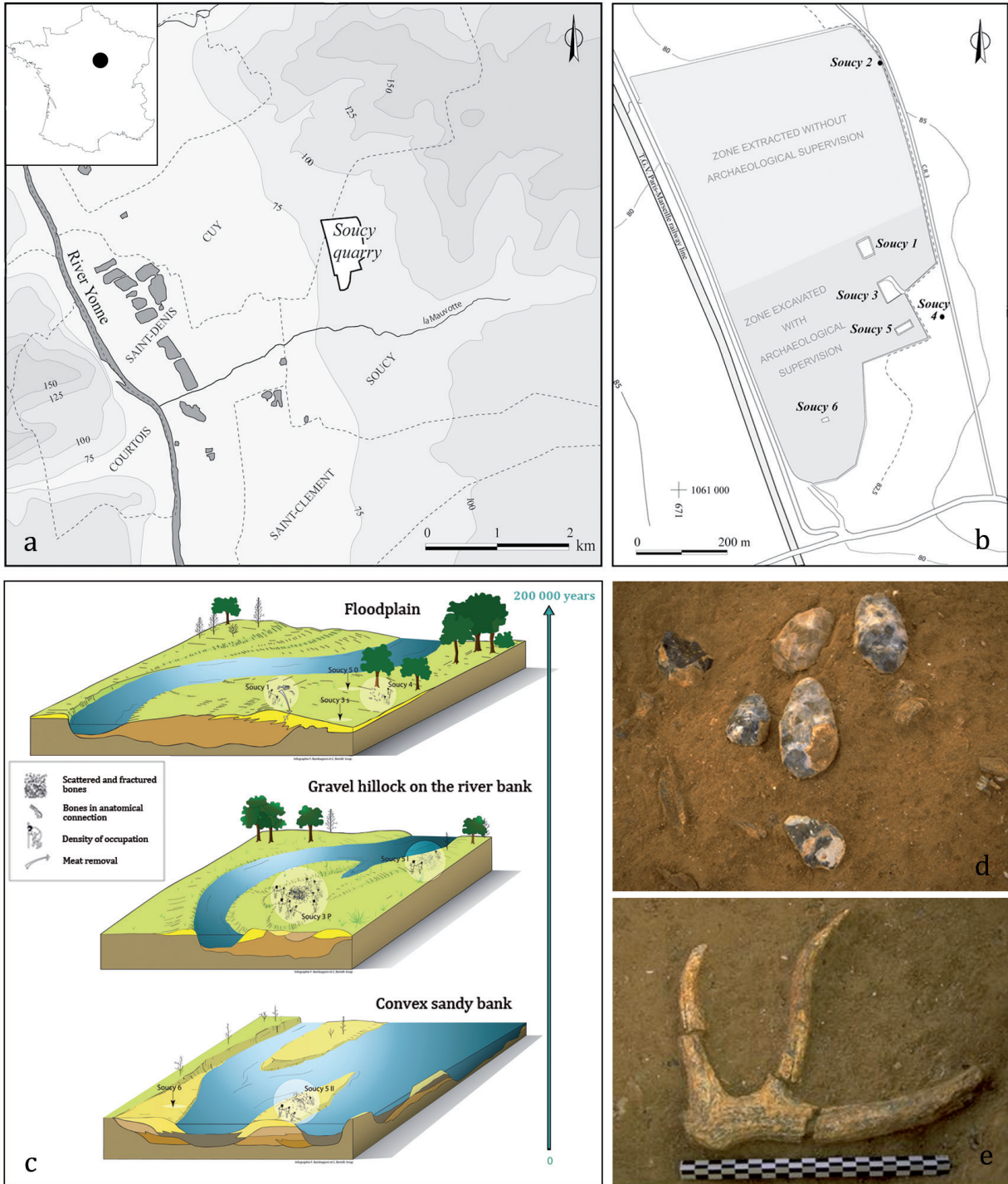
The faunal spectrum includes, in order of the highest numbers of individuals: horse, ox, deer, *Megaceros*, roe deer, Merck's rhinoceros and elephant (*E. antiquus*). The archeozoological and taphonomic analyses easily attribute a human origin to the presence of ungulates on the site. Cut marks on bones are evidence for skinning, disarticulation and transport of carcasses. The age of the animals indicates that human groups visited the site throughout the year. Forty antlers from deer and fallow deer are also recorded (fig. 1e). Indeed, activities on the site indicate acquisition and exploitation of animals or parts of animals (Bémilli 2004). Preliminary functional analysis of 20 bifaces in the 1990s showed characteristic stigmas of butchering activities (Beyries *in* Lhomme *et al.* 2004).

The lithic industry consists mainly of good quality Upper Cretaceous Senonian flint, easy to obtain as pebbles in coarse local alluvial deposits. Tertiary flint was also used and was available near the site (Lhomme *et al.* 2004). Debitage is occasional (tab. 1) within the series. Instead we find all the products of a *chaîne opératoire* associated with biface production. Present are 10 000 flakes resulting from biface production which are associated with 276 bifaces. Many of them (n=800) are retouched. The production of

flakes used as blanks for tools may be anticipated and integrated within the biface production. This is a very original series within the European Lower Palaeolithic, as flakes from biface production are very rarely retouched (Nicoud 2011). Typologically, tools made on flakes are

scrapers, notched pieces, denticulated pieces and *pièces esquillées* (Lhomme *et al.* 2004).

Except for a few bifacial pieces made from small pebbles gathered in the nearby alluvial context, most of the bifaces were originally brought to the site either as



**Figure 1:** a and b- Location of Soucy sites, c- Palaeotopographic reconstruction of human settlements at Soucy (drawing by F. Bambagioni and C. Bémilli), d and e- Bifaces and deer antlers discovered during the excavation (picture by V. Lhomme).

pre-formed blanks, tested blocks and pebbles. Sometimes they were already finished. It is clear that flat blocks and pebbles whose shape and volume were close to the finished biface desired were selected. Bifaces can have a cortical base. At Soucy 3P, the biface structure corresponds to the biface-as-a-tool concept (Lhomme *et al.* 2004; Nicoud 2013). This concept refers to a method of biface production in which both the general volume of the piece, its cutting edge and its prehensile part are created preliminarily (Boëda *et al.* 1990). All Soucy 3P bifaces share an essential morphological feature: the tip is very thin (from 15° to 30°). Thus, to resharpen this kind of tool while preserving its morphology, it is necessary to reduce the volume of the piece, in order to recreate a thin tip.

We already know much about the technical behaviours at Soucy 3P, but we would like to point out here different aspects of tool making and use before discussing site function and territorial strategies practised by the human groups. For example, something we still do not know, and not only in relation to Soucy 3P, is the intended function of the bifaces. Was what we first considered to be waste from the biface production desired by the knapper? How long were the lithic tools used? Were the used bifaces then resharpened and reused? If so, did this resharpening lead to changes in the morphology and function of the tools?

What are the functional characteristics of the flakes resulting from the biface production? Which materials were worked and what activities took place on the site? Are bifaces and flake tools functionally and morphologically redundant or complementary?

### *The techno-morpho-functional method*

We use the techno-morpho-functional approach, theorized by M. Lepot (1993) and E. Boëda (1997; 2001; 2013). This method, sometimes combined with true functional analysis, has been implemented in various research projects to better characterize lithic industries from the Lower and the Middle Palaeolithic which are often poorly standardised (Claud 2008; Soriano 2000; Bonilauri 2010; Nicoud 2013; Rocca 2013). We seek in particular to establish the relationships that may exist between the production of tool blanks, their morphology, their volume and their retouch.

A fine diacritical analysis of the chronology of each removal or group of removals involved in the creation of the tool enables definition of the different parts that make up the tool: the presumed active part (often a cutting edge), the part reserved for grasping and the intermediate part which transmits energy. The cutting edge that is naturally present or retouched is described (sections, angles, delineation...). The characteristics of the techno-morphological units of the tool then indicate intentions of use. Finally, the study of use-wear traces completes this

approach by specifying the active parts and modes of use of the tool.

The functional observations were made at low and high magnifications (up to x200) using a binocular microscope and a microscope (Guibert-Cardin 2017). Use-wear traces were compared to traces that occurred in experiments, available at the CEPAM laboratory (Nice, France).

### *Corpus*

To describe the entire *chaîne opératoire* of production our study took into account all the lithic series (here, bifaces and flakes). Their general features have already been described (Lhomme *et al.* 2004; Lhomme 2007; Nicoud 2013), but we focus in this paper on an unpublished study of small and very fragmented flakes. Usually just considered to be waste products, these numerous small pieces may provide us with new unexpected details on how tools were made at Soucy 3P (Capellari 2016). Studies on resharpening and reduction processes of Lower Palaeolithic tools are rare (Mc Pherron 1994; 1995; Emery 2010). They are more numerous for Middle Palaeolithic industries (Blaser 1996; Bourguignon 1997; Lhomme 2000; Park 2007; Faivre 2011). Small flakes are of less than 3 cm long. They are often neglected in technological studies because their analysis is long and tedious; this series is rich at Soucy 3P. 6 539 small flakes were observed and 1041 of them were studied in detail and placed in a database (entire flakes with butt, tab. 1). To identify, describe and study them, we relied on criteria commonly used to characterize products from the last shaping stage (Newcomer 1971; Tixier *et al.* 1980; Bradley and Sampson 1986; Bergman and Roberts 1988; Wenban-Smith 1996; Rees 2000; Goren-Inbar and Sharon 2006). We measured their dimensions, described their shape and their edges (angles, length, etc.) and compared them physically to the negatives visible on the bifaces and flake tools. On 129 flakes having a large enough butt, we also measured the anterior and posterior angles. They indicate the angles of the edge before and after the removal of the flake. We crossed parameters to find some recurrent features. A large quantity of the material consists of non-diagnostic flakes, but many (n = 3485) present interpretable knapping stigmas.

To evaluate the functional potential of the whole series, we studied every technological category of artefact (bifaces, large flakes that are retouched or not, small flakes, tranchet flakes, broken tips, etc.) representing different stages of the *chaîne opératoire*. They present a wide variety in size and in edge morphology. So, a sample group was selected according to macroscopic aspect in order to perform preliminary functional analysis. For this first work, 45 lithic artefacts were selected and thoroughly described (tab. 1). We examined them for use-wear traces without presumption of their use.

**Table 1:** Typo-technical counting of the Soucy 3P lithic series; technological and functional samples; number of artefacts with use-wear traces.

Soucy 3P Lithic serie	Artefacts number	Use-wear analysis sample	Number of artefacts with use-wear traces
Tested block or pebble	29		
Core	3		
Bifaces and fragments	276	20	5
Retouched flake	887	15	4
Unmodified flake	11382	10	2
Big flakes	4843	4	2
Small flakes	6539	6	0
Non-diagnostic material	3054		
Diagnostic material	3485		
Entire flakes with butt	1041		
Entire flakes without butt	383		
Fragments (proximal/mesial/distal)	2061		
Resharpener flakes	432		
Entire flakes with butt	217		
Entire flakes without butt	35		
Proximal fragments	180		
<b>TOTAL</b>	<b>12577</b>	<b>45</b>	<b>11</b>

## Results

### Technological study

The small waste flakes may represent previous steps of tool making and use. First, we observed a morpho-technical diversity among them. For example, some are thin and elongated, other are thick and short. At Soucy 3P, classic retouch removals on flakes do not exceed 5 mm in length, whereas the flakes of our corpus are between 6 and 51 mm long (on average 17.5mm ± 6.4). This means they cannot result from the retouch of flakes. In contrast, the last removals observed in the creation of bifaces correspond well to the corpus of flakes.

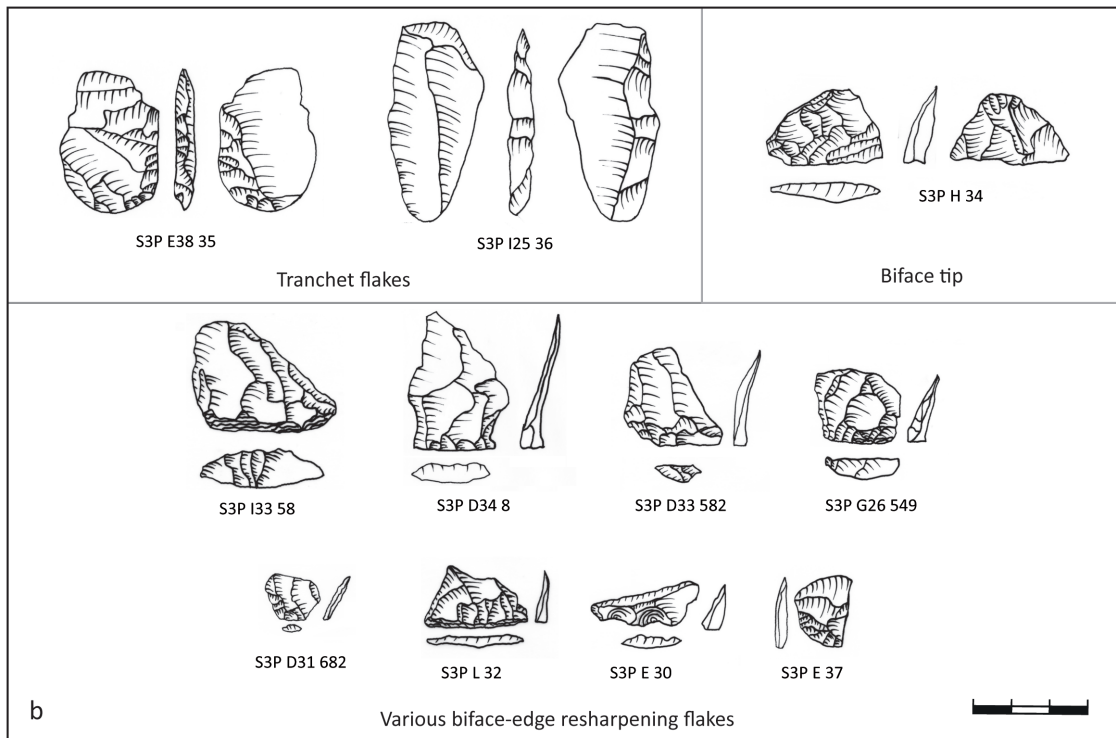
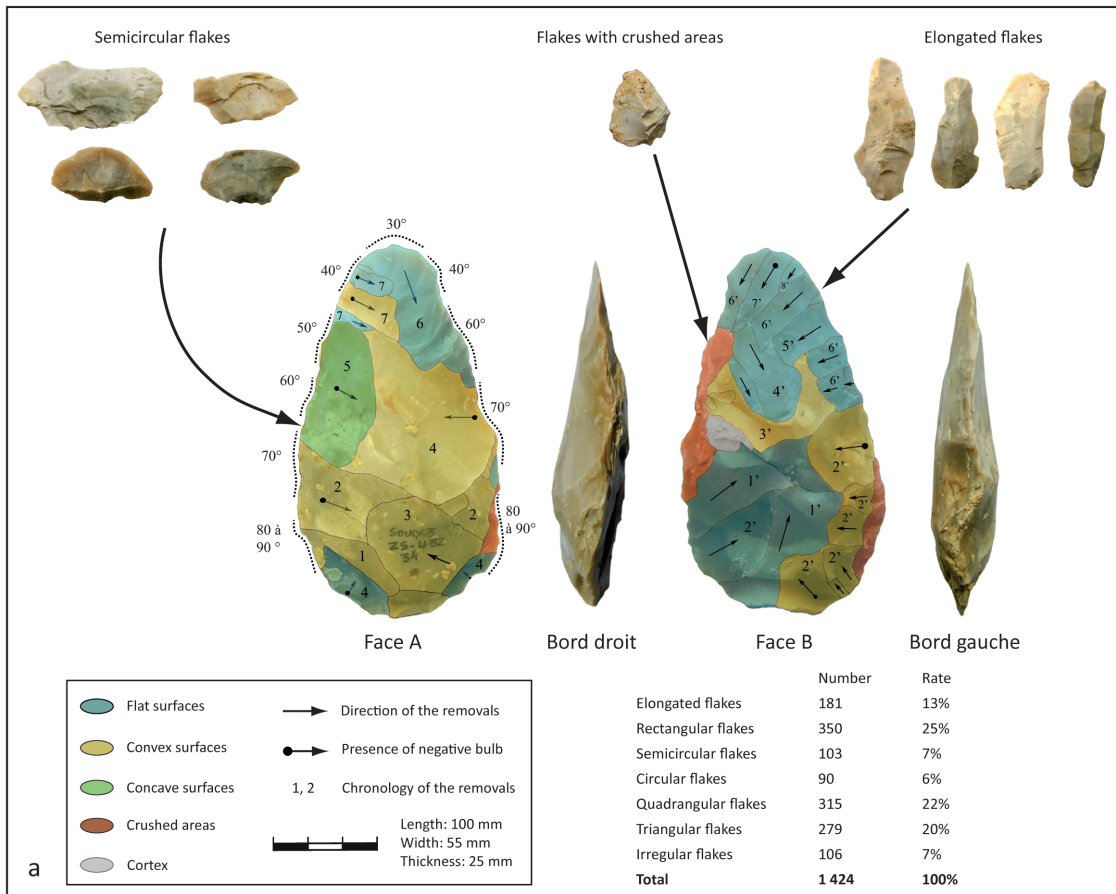
These small flakes correspond to descriptions often found in other studies in reference to biface shaping removals and soft hammer percussion (*cf.* 2.3.). Their characteristics are: small size, thinness, very flat cross section, diffuse bulb of percussion (sometimes no bulb), short and thin linear butt (mostly between 1 and 10 mm wide and around 2 mm thick) plain (60%) or punctiform (14%) and often canted. Sometimes they present a lip between the striking platform and the ventral surface. They are often broken, and present little or no cortex. They have scars from previous removals on the dorsal surface that are unidirectional (24%), opposed/orthogonal (55%) or multidirectional (11%). Their profile is flat or convex, they have feathered edges, an acute flaking angle and an “*angle de chasse*”. Thus, we can say that the flakes we studied

(N = 1041, tab. 1) only come from biface production stages, primarily the final one. Although they are fragmented, we presume the same source for the other elements (N = 2061, tab. 1) because of their dimensions.

Some of these small flakes can be refitted (mentally) on different parts of a biface, such as the tip or the median side edges (fig. 2a). They correspond to different final shaping stages. Their morphology reflects the morpho-technical characteristics of the biface, the thin tip and the concavity that cuts the regularity of the edge – from the base to the tip – in the middle part of the biface. Also, these flakes appear to come from each part of the bifaces as shown by their morphologies and dimensions as well as by the measurements of anterior angles, “*angle de chasse*” and the morphological categories that we can retrieve on bifacial tools by mental refitting. These groups are quantitatively homogeneous in the corpus of flakes.

Thanks to their dimensions and to mental refitting, the small flakes obtained during the last steps of shaping (N=825) can be distinguished from the very small flakes with a low angle resulting from the final stage of biface retouching (N=216). All these flakes correspond mainly to the finishing phase, when the blank becomes a functional tool. So we can deduce that the final step of biface making was carried out on the site, for many of the bifaces.

Also, flakes from resharpening are present at Soucy 3P and confirm that some bifaces were reduced (fig. 2b, flakes from resharpening of biface edges). 432 small flakes (7% of the total corpus) appear to be flakes from



**Figure 2:** Small flakes, a- Estimated origin of different kinds of small flakes produced at the end of the *chaîne opératoire* of bifacial tool production at Soucy 3P, b- Various morphologies of flakes from biface resharpening, depending on their original location on bifaces (drawings by F. Capellari).

resharpening (tab. 1). They are rare, considering the total number of bifaces from the site (ratio of 1.56 flakes per biface), confirming that few bifaces were reduced on the site. However, we must consider this number to probably be a minimum, because some flakes from resharpening may not have been identified and may be among the non-determined in the corpus of flakes. The rareness of reduction is also illustrated by a techno-morphological description of the bifaces: scars of previous removals located in the middle of the biface confirm that few of them were reduced (Nicoud 2013). This rare reduction is coherent with the technical limits imposed by the biface-as-a-tool concept.

As they come from different parts of the biface, these small flakes confirm that the reduction/resharpening concerns all the volume of the biface, as expected for a biface-as-a-tool concept. This overall resharpening implies a reduction of the size of the biface and for some of them, a disappearance of any residual cortex. These flakes also confirm that the morphology of the biface is preserved during this reduction even if the size is decreased. Indeed, measurements of anterior and posterior angles provide results showing that the edge morphology is preserved while the volume of the biface is reduced.

Ninety-four tranchet flakes were identified. They are 25 to 75 mm in length. Only a dozen bifaces present evidence for this method. There are two possible explanations. Either bifaces that produced tranchet flakes were taken out of the site, or the tranchet flake represents just one of the many ways to thin the distal part of the biface and was included within the final reduction steps and so has been erased from the biface by successive non-tranchet removals.

Also, we found many broken tips (n = 30), whereas broken basal parts are rare (n = 2). It is thus possible that the latter were reduced.

### *Results of functional analysis*

Twelve active parts were identified for a total of 11 artifacts with use-wear traces among the 45 selected (tab.1). Post-depositional surface modifications are numerous (soil sheen, white patina, trampling...) and microscopic use-wear traces are very often missing or highly altered. Thus, we based our interpretations on scars and rounding.

Seven large flakes, both unretouched and retouched, present use-wear traces (fig. 3).

Two raw flakes have small scars that are numerous, bifacial, trapezoidal or quadrangular, oblique, with step, hinge or feathered termination and cone and bending initiation. This indicates a bidirectional longitudinal motion on a semi-hard material (fig. 3a).

Two retouched flakes present semi-circular or quadrangular scars, more numerous on one face than the other, continuous, with feathered termination and bending

initiation and oriented obliquely or perpendicularly to the cutting edge. So, a soft material must have been worked with an undetermined gesture (fig. 3b).

One flake was used in a unidirectional transverse motion on an undetermined material as indicated by the asymmetrical and perpendicular small scars (fig. 3d).

Finally, a large flake and a tranchet flake show crushing, as well as a flat and unifacial rounding associated with an altered polish and striations perpendicular to the edge, indicating a unidirectional transverse motion on a hard material (fig. 3c). The use-wear traces are posterior to the debitage of the tranchet flake, so it was used as a tool.

Four bifacial pieces present traces linked to use on their apical part (fig.4). The first piece presents the same crushes, unifacial and flat rounding as well as the striations perpendicular to the cutting edge as do the tranchet flake and the large flake mentioned above (fig. 4a). Thus it was used on a hard material in a unidirectional transverse motion.

A second biface presents some bifacial, trapezoidal, triangular and quadrangular scars, aligned or isolated, with a step, feathered or snap termination and flexion and cone initiation (fig. 4b). They are oblique in relation to the cutting edge. They show a longitudinal unidirectional motion. The scars have the same characteristics as those formed when a hard material is worked except that they are less numerous and rarely superimposed. We assume that these scars are the result of occasional contact with a hard material. Our butchering experiments using biface reproductions present similar traces. The scars are rare, small, angular and located on the tip. In the absence of polish, we can only deduce that these scars are the result of contact with a hard material.

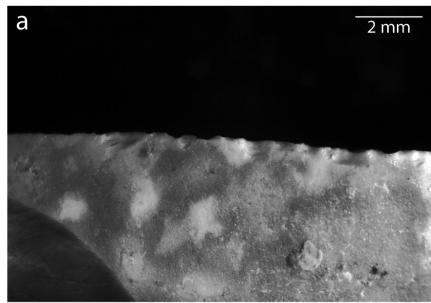
The third biface could have been used on a semi-hard material because the scars overlap, having small to medium dimensions, with step, feathered and hinge termination and with bending initiation (fig. 4c). The motion is indeterminate.

Finally, the last biface with use-wear traces presents numerous small bifacial, overlapping, irregular, trapezoidal and quadrangular scars, with feathered, hinge or step termination (fig. 4d). They are perpendicular to the cutting edge. The task and the material worked are undetermined.

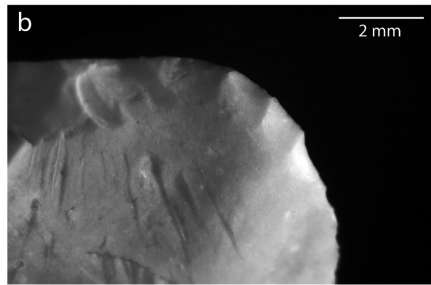
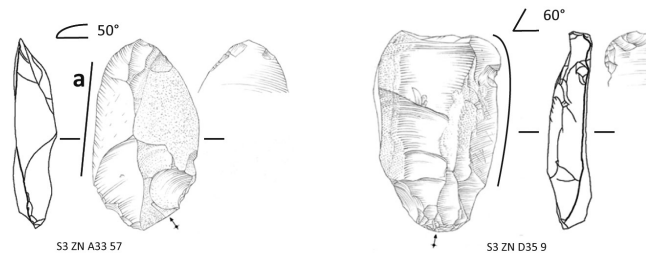
Three main modes of use have been identified: 1) a bidirectional longitudinal motion on a semi-hard material indicated on two large and unretouched flakes, 2) a unidirectional transverse motion on a hard material indicated on a biface, a tranchet flake and a retouched flake and 3) an undetermined motion on a possibly soft material indicated on two retouched flakes. The other four artefacts have various use-wear traces.

Also, artefacts without traces cannot be interpreted. Indeed, the absence of use-wear traces on a tool can be

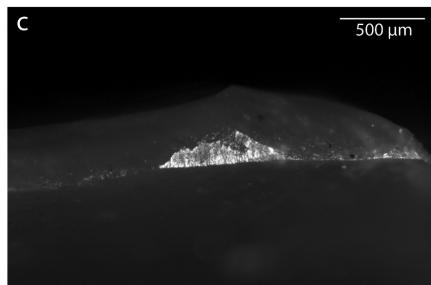
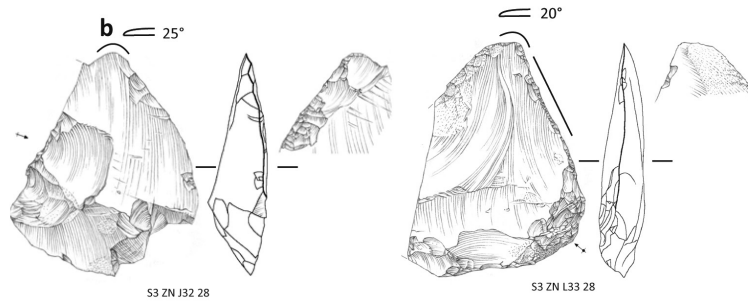




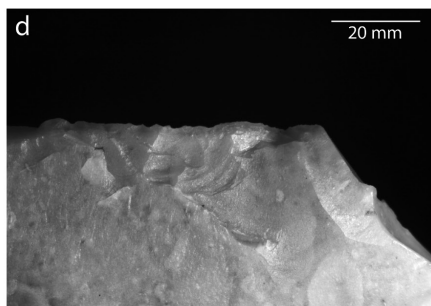
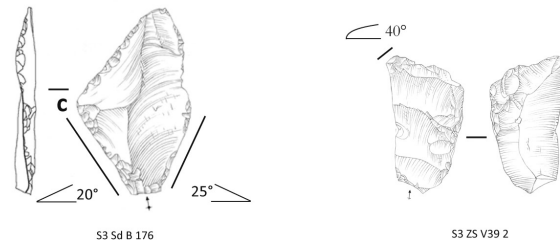
Semi-hard material  
Longitudinal bidirectional motion



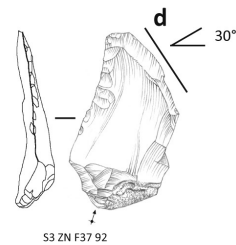
Soft material ?  
Unknown motion



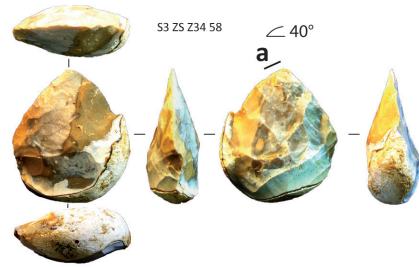
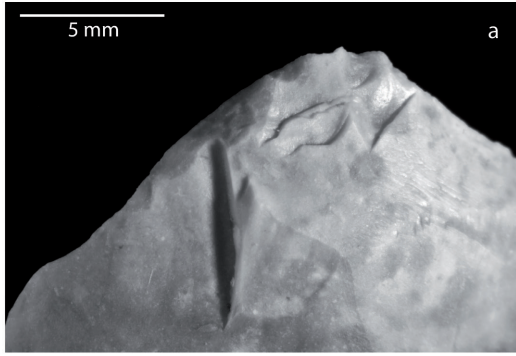
Hard material  
Transversal unidirectional motion



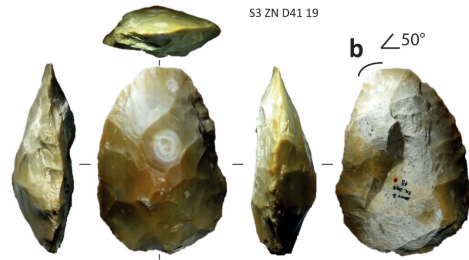
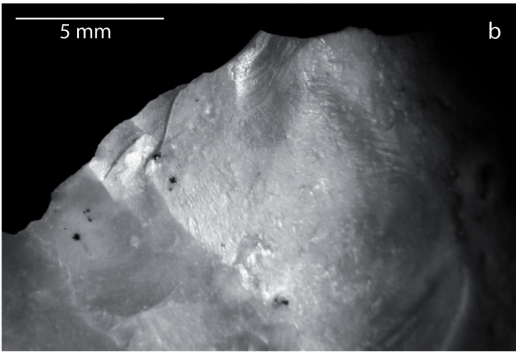
Unknown material  
Transversal unidirectional motion



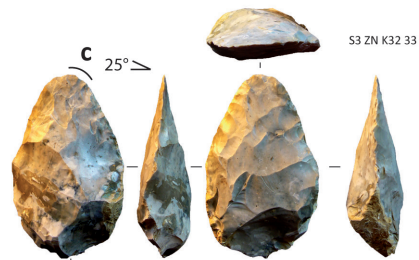
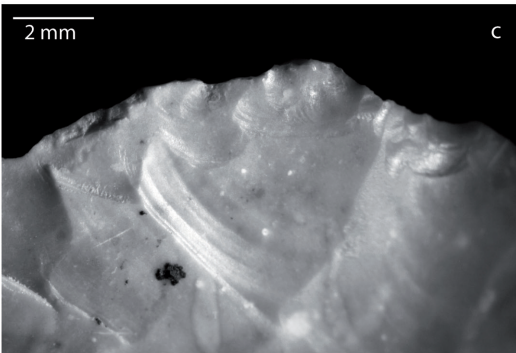
**Figure 3:** Use-wear traces on flakes from biface production, a- Unretouched flakes, b- Retouched flakes, c- Large flake and tranchet flake and d. retouched flake (drawings by M. Grenet).



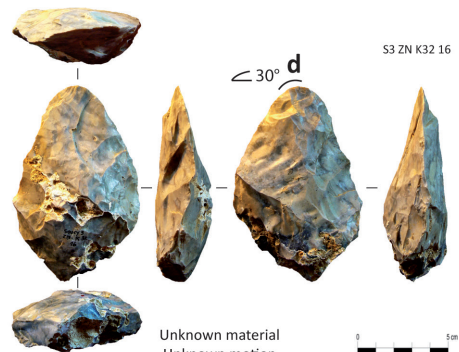
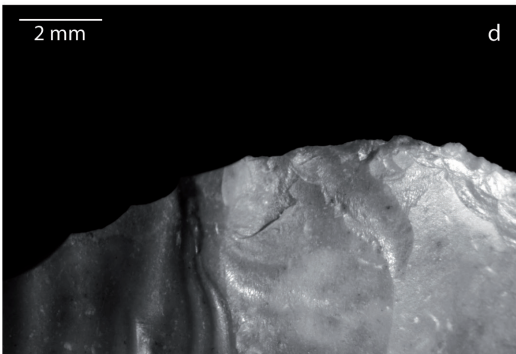
Hard material  
Transversal unidirectional motion



Hard material  
Longitudinal unidirectional motion



Semi-hard material ?  
Unknown motion



Unknown material  
Unknown motion

**Figure 4:** Use-wear traces on bifaces.

linked either to its non-use or to a lack of development of use-wear traces (brief use or soft material) or to the disappearance of the use-wear traces (Beyries 1990).

Crushes, flat rounding and striations perpendicular to the edge present on a biface, a flake and a tranchet flake may suggest voluntary abrasion of the edges. Abrasions on the cutting edges have been identified for the Middle Palaeolithic at Saint-Amand-Les-Eaux, for example (Claud 2015). They are opposed to an active edge and could therefore constitute a prehensive area. This hypothesis does not appear to apply to our use-wear traces in view of their location (in two cases on a tip), their low degree of development and that they are not opposed to an active edge. In addition, the traces on the tranchet flake occurred after the debitage, which supports the idea of a functional origin for these traces.

The presence of scars on only a small portion of the biface tips raises questions. Our butchering experiments with reproductions of bifaces have shown that in this activity, macroscopic use-wear traces develop mainly on the tip of the bifaces. The traces develop mainly at the end of the gesture, being the tip, even if the active part is longer. Thus, even if the use-wear traces are located on a small part of the cutting edge, the active part may be longer. In the absence of microscopic use-wear traces, this hypothesis cannot be confirmed.

Finally, two flakes are morphologically similar to the bifaces in length and thickness (S3 ZN L33 28 and S3 ZN J32 28; fig. 3b). They also have both a thin tip created by short retouch removals and on the opposite edge, a back (this could be the large butt of the flake or it could have been created by fracture). Only the width is different. When use-wear traces are identified, usually on the tip, they indicate the processing of soft material.

## Discussion

From a methodological point of view, we defend here the necessity to study the whole lithic series, small flakes included, from raw material gathering to use, reuse, export or abandonment. These small flakes can be very helpful in analysis of technical behaviours, in particular when bifaces are absent from the site. Also, the small and very small flakes, especially those removed during the resharpening phases, provide much information about the tool's life that we cannot perceive only on the biface. At Soucy 3P, they represent the last step of the *chaîne opératoire* of biface production.

Although until now only 45 pieces have been examined for functional analysis, the results are so diverse that we are able to renew our knowledge of techno-economic behaviours and activities carried out on the site (fig. 5). A few bifaces were produced from nodules gathered in the local alluvial gravel but most of them are made of tertiary flint and slightly rounded pebbles of secondary flint,

available outside the site. The first removals in the making of bifaces were carried out outside of the site for the most part, whereas the last tool-manufacturing phases are well represented on the site. Some bifaces were brought to the site already finished, others were made on the spot, then removed from the site. A few bifaces were resharpened or more appropriately, remade, without any technomorphological transformation; only the size decreased.

Although not systematic, this implies use of the biface during a relatively longer time than the other tools, for which we have no evidence of resharpening. We can also hypothesize that these bifaces could have been resharpened elsewhere, considering that these tools can be easily carried (Lhomme 2007). Also, many bifaces were abandoned when still large in size. We are not able to explain the dimensional variability of the bifaces. This is not only related to reduction phases because some bifaces were already small to begin with.

The four bifaces with use-wear traces have a single active-edge area located on the thin tip, which is a characteristic feature of Soucy 3P bifaces. Use-wear traces are restricted to the tip of the bifaces, whereas the used edges are more extended on flakes. This may be due to a more intense retouch of the edges of the bifaces on both sides of the tip, which strengthens them. However, the sample needs to be extended and more comparative experiments carried out on bifaces. This work is in progress.

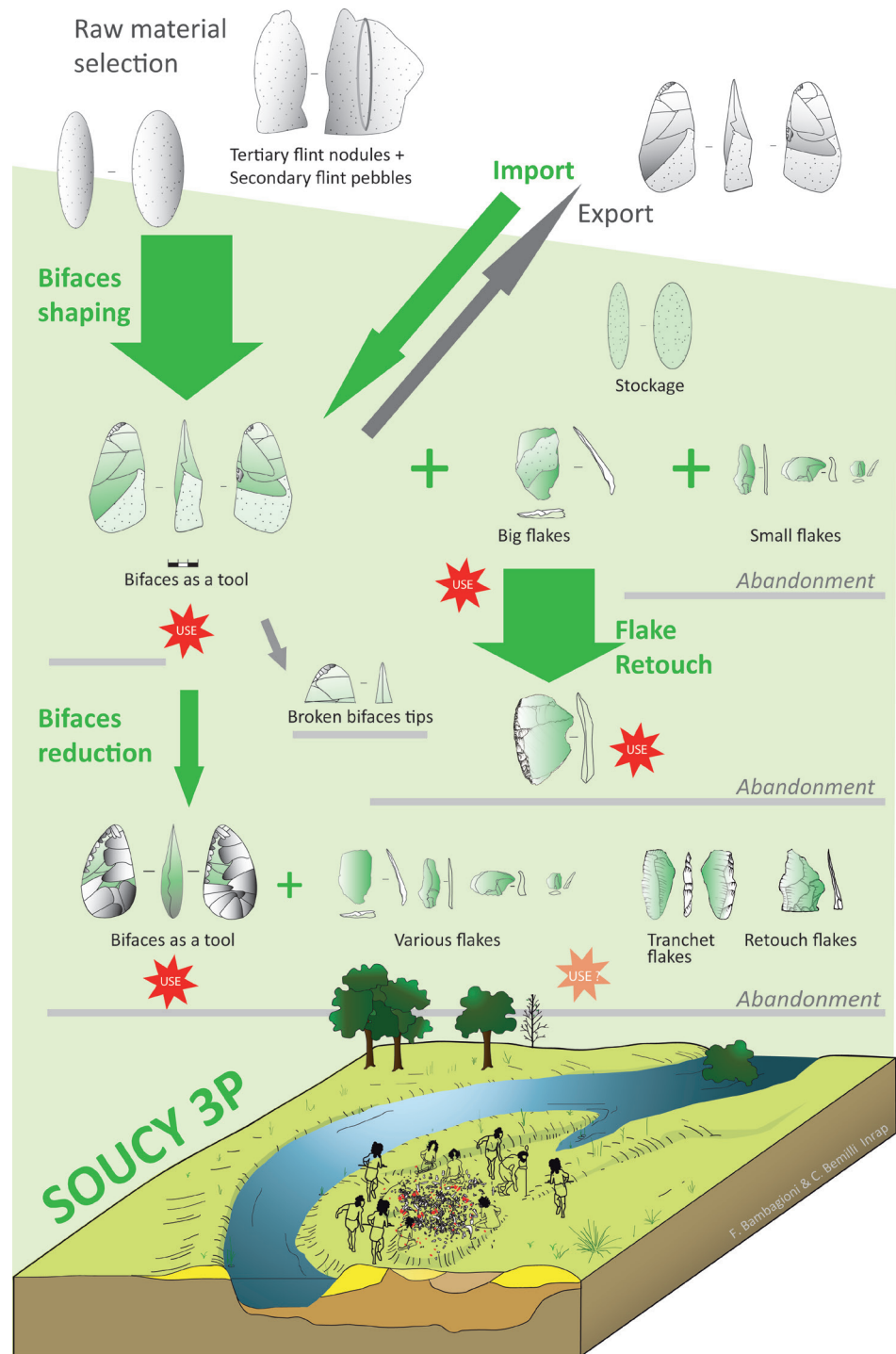
Unmodified flakes and retouched flakes were used, and some of them present the same use-wear traces as the bifaces. We still need to understand whether their efficiency is the same when their sizes, weights or grasping modes are different. However, this shows that bifaces and flakes were integrated within a unique and efficient production system. This study provides data on a specific use of flakes from biface shaping that were transformed into blanks for making tools. This technical behaviour is still not well known for the Lower Palaeolithic (Piperno and Biddittu 1978; Nicoud 2011; Claud *in* Hérissou *et al.* 2015), being more frequent in Middle Palaeolithic industries (Geneste 1985; Boëda 2001; 1997; Soressi 2002; Claud 2008; Cliquet *et al.* 2009; Faivre 2003; 2011).

The fact that all skeletal parts of the main animal species, as well as cut marks and long bone fractures, are present, indicates that human groups killed and butchered animals on the site, along the edge of the river. The first functional analysis of several bifacial pieces confirms this interpretation (Beyries *in* Lhomme *et al.* 2004). The new functional study shows that they probably also worked other materials, not determinable precisely because of the absence of microscopic traces.

Are we able to imagine several people routinely butchering a deer on the site, each with a biface and few flakes, in an environment of deciduous forest and

grassland? We easily get these impressive numbers: 276 bifaces, 887 retouched tools, 4843 large unretouched flakes, more than 70 processed animals. The good preservation of the site, the spatial distribution of the remains and the very consistent technology lead us to surmise that the settlement of Soucy 3P was inhabited during a relatively short period, not for millennia. The

site would have been highly attractive, with a temperate climate and its advantageous topographical position by the river. The recurrent occupation of the site at different periods of the year (not necessarily continuous) suggests that the human groups moved only short distances, staying in the vicinity of the site, within the forested Yonne river valley.



**Figure 5:** Synthesising schema of lithic chaîne opératoire at Soucy 3P.

## Conclusion

Every step of the *chaîne opératoire* of biface production at Soucy 3P appears to be now understood. At the site, the production of bifaces was exclusive and enabled the systematic production of flakes used as blanks for tool making. In this paper, we show that examination of the small flakes can be very useful in order to understand the last stages of tool making and the kind of biface edges produced, especially when the bifaces themselves are absent. This is often the case, because these tools would have frequently travelled with their owners (e.g. Roe 1981; Soriano 2000; Boëda *et al.* 2004; Lhomme *et al.* 2004). Also, we show that although the post-depositional surface modifications can erase some use-wear traces, especially at a microscopic scale, they do not modify the macro-traces. So even a small sample may give us much information concerning the purpose of the lithic production. Of course, there is still much to understand, but we have been able to assess that the bifaces are items within a larger toolkit. Although the scarcity of resharpening activities on bifaces would appear to indicate brief use over time, we note that these represent the only blanks for tool making that were reduced. This could indicate a potentially longer life than for the flake tools. We must also remember that the origin and morphology of the tool blanks, the cutting edges, the use-wear traces and the materials worked can vary among the series. This major idea helps us to revise a static and simple vision of Lower Palaeolithic industries and to go beyond the dichotomy of flakes vs. bifaces. The preliminary but promising results from this combined techno-functional approach to the lithic series will be continued. Soucy 3P is a particularly good site to attempt this approach because of its very good preservation and the accumulation of knowledge already available thanks to the pluridisciplinary research team. Thus, the best concluding statement for this paper is that if we want to discuss sociocultural trends and not just techno-typological features, we first need sites of good quality.

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## Notes on contributors

Juliette Guibert-Cardin  
 Université Côte-d'Azur, CEPAM, UMR 7264,  
 Pôle universitaire St-Jean d'Angély, 24 avenue des Diables  
 Bleus, 06300 Nice, France  
 juliette.guibert-cardin@cepam.cnrs.fr

She is PhD student in prehistory, use-wear analysis.

### Félicien Capellari

Université de Perpignan Via Domitia, HNHP, Disco, CERP,  
 UMR 7194,  
 Centre Européen de Recherches Préhistoriques, avenue  
 Léon-Jean Grégory, 66720 Tautavel, France  
 felicien.capellari@cerptautavel.com

He is PhD student in prehistory, lithic technology.

### Vincent Lhomme

Institut National de Recherches Archéologiques  
 Préventives,  
 Centre de recherches archéologiques, 122 rue de la  
 Bugellerie, 86000 Poitiers, France  
 vincent.lhomme@inrap.fr

He is Prehistorian, lithic technologist and director of Soucy excavations.

### Nelly Connet

Institut National de Recherches Archéologiques  
 Préventives,  
 Centre de recherches archéologiques, 122 rue de la  
 Bugellerie, 86000 Poitiers, France  
 nelly.connet@inrap.fr

She is prehistorian, lithic technologist and director of excavations.

**Sylvie Beyries**

CEPAM, STEP, UMR 7264,

Pôle Universitaire St-Jean d'Angély, 24 avenue des Diables

Bleus, 06300 Nice, France

sylvie.beyries@cepam.cnrs.fr

She is prehistorian, use-wear analyst and emeritus researcher at CNRS.

**Elisa Nicoud**

CEPAM, STEP, UMR 7264,

Pôle Universitaire St-Jean d'Angély, 24 avenue des Diables

Bleus, 06300 Nice, France

elisa.nicoud@cepam.cnrs.fr

She is Prehistorian, lithic technologist and researcher at CNRS.



