Microscopic Differences

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A micro-wear approach for the extraction of behavioural information from lithic artefacts from the Upper Palaeolithic Aurignacian occupation of Les Cottés, France

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Acknowledgements

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1. Introduction

The arrival of anatomically modern humans (AMH) in Western Europe, and its implications for the Neanderthal population inhabiting the region at the time, is one of the most debated topics in prehistoric archaeology. To date, relatively little is known about human behaviour during the Middle to Upper Palaeolithic transition, and what factors led to the demise of the Neanderthals. One suggested implication is that the Neanderthal population became vastly outnumbered by the arriving AMH, and that this factor played a critical part in their replacement (Mellars and French 2011, 627). Some scholars suggest that the Neanderthals were eradicated by the AMH in the same way that species of the megafauna, such as the woolly mammoth and the giant deer, were (Hortolà and Martínez-Navarro 2013, 69; Koch and Barnosky 2006, 216). Others follow the lines of acculturation of the Neanderthals into the AMH population (d'Errico *et al*. 1998, 2) or interbreeding between the two populations, with a swamping of the Neanderthal genome into that of the AMH as a result (Villa and Roebroeks 2014, 7). Additionally, it is argued by some scholars that the Neanderthals were inferior to the AMH in terms of both their ability to adapt to changing environments (Froehle and Churchill 2009, 97; Pääbo 2015, 313), and in their capacity to exploit a nutritiously satisfactory and varied diet (Hockett and Haws 2005, 27, 31). However, recent research show little support of these arguments (Henry *et al*. 2011, 486; Roebroeks and Soressi 2016, 6374), suggesting that the Neanderthals had equally developed cognitive abilities as the arriving AMH. However, the apparent similarities between the species have rendered their disappearance even more curious (Villa and Roebroeks 2014, 6). As no differences of such significance that they might potentially explain the ruin of the Neanderthals have been demonstrated, a study of the behavioural differences between the two populations might offer valuable insight into the success of the AMH and the demise of the Neanderthals. One step towards an understanding of these behavioural differences is mapping and comparing site functions for each population. Stone tools constitute the majority of finds from this period. As such, they are of significant value for the studies of large-scale questions such as site functions over time, and comparative studies of a vast number of sites through time and space.

Different methodological approaches have been applied to analyses of lithic assemblages. For instance, Bordes (1961) established a typological system where a tool's morphology is used to classify it within a group type. The frequency of types within an assemblage was then applied to place it within a specific culture. In recent years, techno-functional analysis of stone tools focusing on the relationship between active and non-active parts, such as prehensile areas, has allowed for suggestions as to their probable functional aims (Abruzzese *et al.* 2016, 161). Moreover, the application of lithic assemblages as proxies for specific *Homo* species is ongoing (Hublin 2015). Functional analysis (primarily micro-wear analysis) is becoming more common within the archaeological society, providing us with data directly related to the function of the analysed tool. For instance, at the late Upper Palaeolithic site of La Fosse, France, micro-wear analysis combined with a spatial analysis was used to investigate possible site functions (Naudinot and Jacquier 2014) (see Tomasso *et al*. 2015 for an additional example). The reliability of micro-wear analysis is still being questioned in terms of the sometimes subjective nature of the interpretations, but throughout the past decades, partly because of blind-tests performed in order to assess the ability of the individual analysist as well as the efficiency of the method itself, its credence has increased (Evans 2013; Rots *et al*. 2006).

By examining lithic artefacts through micro-wear analysis, a direct and more objective interpretation of a specific tool's function may be established (van Gijn 1989, 3). This can in turn yield information about a site's function, preferably in correlation with the analysis of, for instance, faunal remains from the same archaeological context. Through the understanding of site functions, a deeper knowledge of behavioural differences between populations can be achieved.

For this thesis research, I have therefore selected the site of Les Cottés as a case study for micro-wear analysis, with the aim to understand the different tasks carried out at the site during the AMH occupation of layer US 02.

1.1. Les Cottés

The French site of Les Cottés (fig. 1**)** is situated in an area well-known for its many Palaeolithic sites. This cave site developed in a Jurassic limestone cliff, and consists of two consecutive chambers (Soressi 2009a, 19-21). The site was chosen because of its well-defined stratigraphical record, stretching from late Mousterian to the Evolved Chatelperronian, and from there to the Protoaurignacian and finally to the Early Aurignacian (Soressi 2015a, 22; https://www.universiteitleiden.nl). The sequence have produced dates from approximately 40.000 B.P. to 29.000 B.P., and contains continuous archaeological sequences affiliated with both Neanderthals and the arriving AMH. As such, the stratigraphical sequence of Les Cottés is suitable for comparisons of site function and behaviour, both through time and between Neanderthal and AMH populations. Future researchers have the opportunity to examine the hominin activities of adjacent layers, ultimately providing us with the ability to discern potential behavioural differences between the two different *Homo* populations within the same site and context.

Figure 1. Map of France. Les Cottés is marked with a black rectangle (after https://www.google.nl/maps).

The site of Les Cottés was discovered in 1878 by A. Jamin and was first excavated in 1880 by count de Rochebrune (Primault 2003, 137; Soressi 2006a, 11; https://www.universiteitleiden.nl). In 1958, Dr. L. Pradel conducted the noteworthy excavations which put Les Cottés on the scientific map, and paved the way for further investigations (Soressi 2009b, 33-34). He discovered a layer which he assigned to Périgordian II, to which he introduced the Cottés point (fig. 2) as lead artefact.

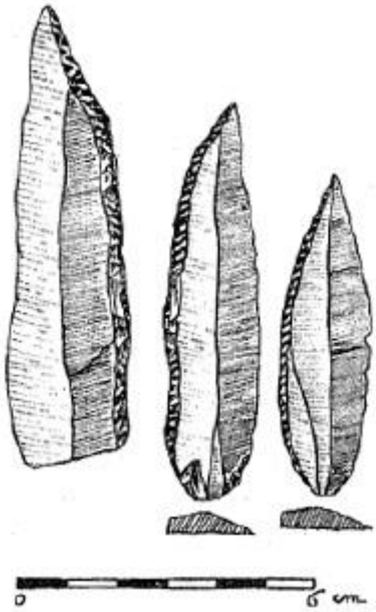

Figure 2. Les Cottés points (after Soressi 2009, 25).

From 2006 up until this year (2016), Dr. M. Soressi has been in charge of the excavations carried out at Les Cottés. Under her lead, a detailed picture of the stratigraphy of the site has been produced (fig. 3). As the inside of the cave had already been excavated, it is the area immediately in front of the cave entrance that has been investigated by Soressi (fig. 4) (Soressi, personal comment 7/7-2016). The area in question measures roughly 63 square metres (Soressi 2015b, 37) and is recorded using a 1 square metre grid (A-Z, 1-10) (fig. 5). The depth ranges from 1, 8 metres in the east to 5 metres in the south (Soressi 2015a, 22).

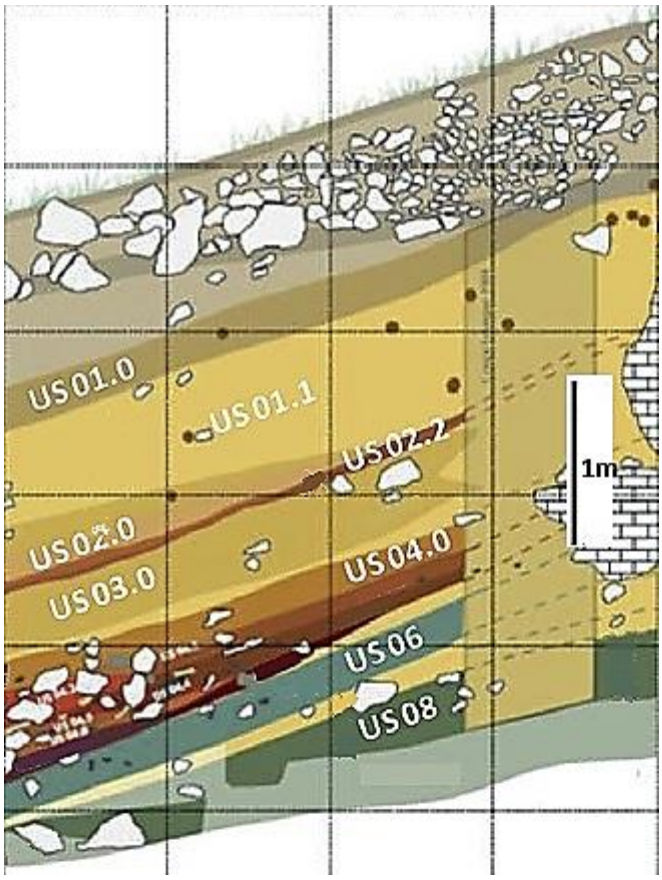

Figure 3. Detailed picture of a section of the stratigraphical sequence (southern wall) (after Soressi 2015c, 60).

Figure 4. The excavated area in front of the cave entrance. Viewed from the South East (after Soressi 2015b, 38).

Figure 5. The grid of Les Cottés. The cross in the middle was added to facilitate the visualization of the grid (after Soressi 2015d, 12).

The stratigraphical unit chosen for this research is, as mentioned above, layer US 02. This layer has been ascribed to the final stage of the Early Aurignacian and dates from around 35, 150 B.P. to approximately 31, 750 B.P. (Soressi 2014, 22; Talamo *et al*. 2012, 179) (see chapters 3.2.1. and 3.2.2. for the evidence supporting the cultural affiliation of the layer). It contained (amongst other lithic artefacts) the three, to date, morphologically unique flint implements that will be the main focus of my research. The tools are made from large blades and constitutes a combination of one or two burin facets with scraper-like retouches on the remaining edges. Henceforward they will be referred to as the burin/scrapers (see chapter 3.1. for more information about the tools).

The lithic industry of the Early Aurignacian is the first European Upper Palaeolithic industry associated with AMH. It is dated from around 40 Ka to 29 Ka (Delson *et al*. 2000, 222). The Early Aurignacian is characterized by the prevalence of bone and antler tools, in particular the *pointe d'Aurignac*. This split base bone point is considered one of the diagnostic artefacts of the technocomplex, along with rather thick carinates, truncate pieces, burins as well as Aurignacian blades (fig. 6) (Mellars 2006, 168). Technological emphasis on blade production is also assigned to Aurignacian assemblages (Delson *et al*. 2000, 222), together with an increase in the variety of tool types in comparison with the preceding technocomplexes (Rendu 2009, 193).

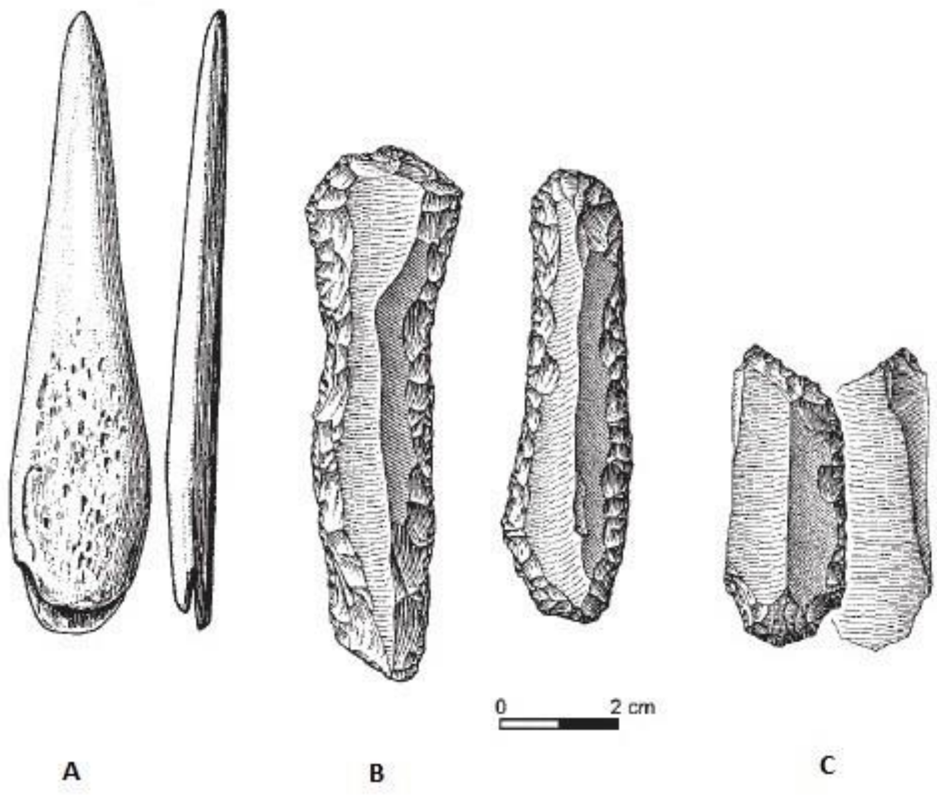

Figure 6. A) Pointe d'Aurignac B) Edge-retouched Aurignacian blades C) Combined truncation burin and endscraper (after Mellars 2006, 168).

The Aurignacian has been divided into a number of different stages which have sometimes been given different names, depending on the background of the

scholar (Bordes 1984, 219-220, 249, 253; Kozlowski and Otte 2000, 515; Mellars 2006, 169), making it challenging to obtain a good overview. Recently, two new subdivisions of the Aurignacian technocomplex have been presented; Proto- and Pre-Aurignacian. These groups are believed to stem from different regions outside of Western Europe, entering the region from the Mediterranean area and Eastern Europe respectively (fig. 7) (Kozlowski and Otte 2000, 515).
However, the Proto-Aurignacian industry with its predominately larger, retouched Dufour and Font Yves bladelets, together with a distinctive bladelet-core form (Mellars 2006, 170) differ quite heavily from the classic Aurignacian assemblages distinguished by the above mentioned artefacts. This has made some scholars argue that it is not entirely correct to include this industry in the Aurignacian family (Mellars 2006, 170), or to refer to it as a predecessor of the classical Aurignacian (Kozlowski and Otte 2000, 514).

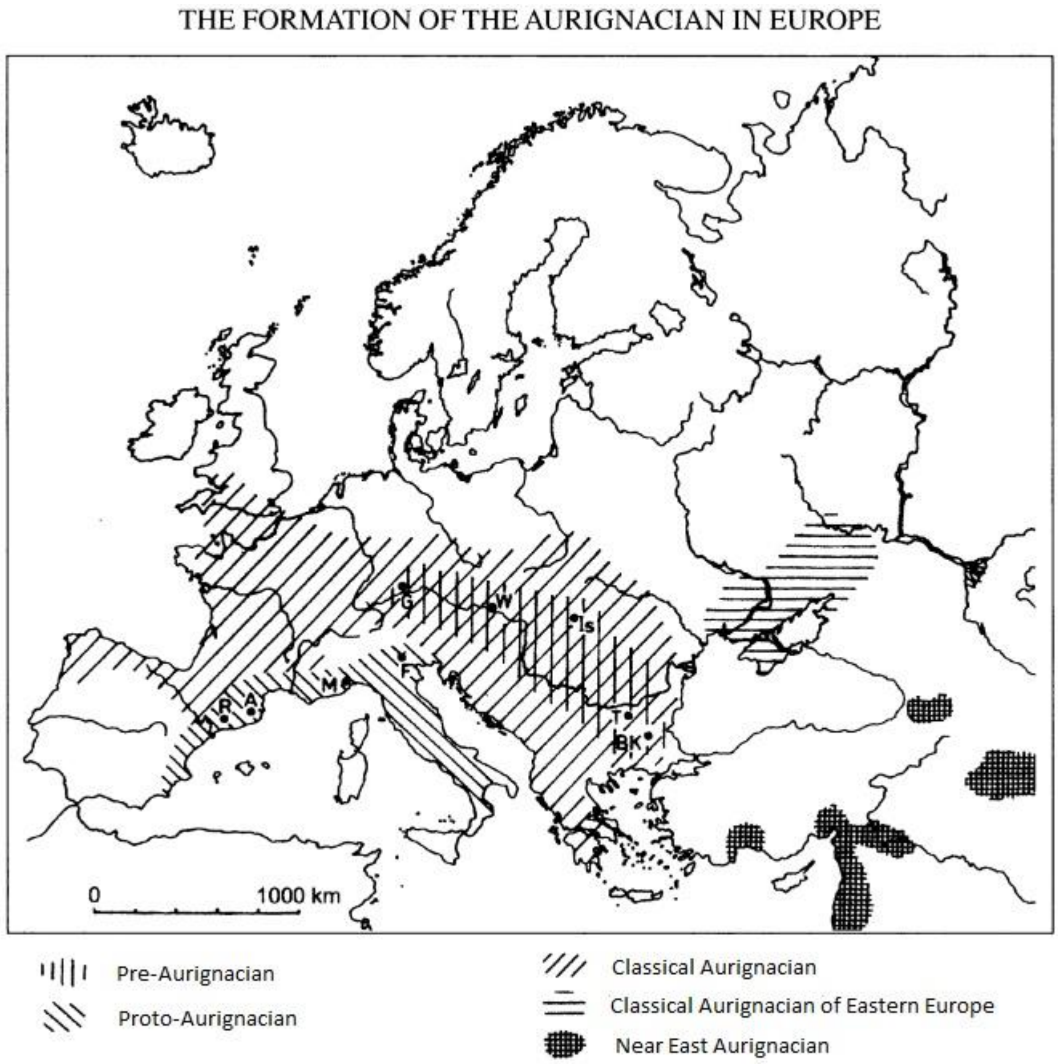

Figure 7. The geographical distribution of the different Aurignacian types (after Kozlowski and Otte 2000, 515).

Luckily, scholars agree on one point regarding the Aurignacian technocomplex; namely that it was the arriving AMH that brought it to Europe. The presence of Aurignacian assemblages can therefore be used as markers for the presence of AMH populations (Bailey and Hublin 2005, 119; Bailey *et al*. 2009, 11; Mellars 2006, 173).

1.2. Research questions

The main goal of this thesis research is to, through a combination of micro-wear analysis and interpretations of the layer yielded from other methods, understand the function, or at least some of the tasks performed during the AMH Early Aurignacian occupation of Les Cottés.

Seeing to the divergent morphology of the burin/scrapers and their apparent affiliation to AMH, they can be used as representatives of, for instance, an adaption to changing needs, morphological adaptions to a specific function, the whims of a knapper or a combination of all, or some of these suggestions. Regardless of the reason behind their distinctive morphology, our understanding of their function, in combination with interpretations of, among other things, the faunal remains, may shed some light upon the tasks performed at the site during this specific occupation. Furthermore, the results of this research will contribute to the understanding of early AMH behaviour in Western Europe, and can be used as a comparative instrument for behavioural studies of AMH and Neanderthals. Likewise, this research will provide a small step towards the understanding of the continuous function of a site exploited by two different *Homo* populations. With these aims in mind, the following research questions were established:

1. What was the function of the three burin/scrapers according to the micro-wear analysis, and what tasks can be inferred based on the results?

2. Based on micro-wear and technological analysis, can the reason behind the unique morphology of the burin/scrapers be explained? If so, what are the implications of these discoveries for the understanding of certain behavioural aspects of the early AMH of Western Europe?

3. Does the inferred tasks correspond with other interpretations of the occupation of layer US 02, based on the faunal and lithic assemblages?

4. Can the results of my thesis research be of help to the archaeological community, in terms of trying to understand the behavioural differences between the Neanderthals and the AMH?

2. Methods

In this chapter, a detailed account of the methods used to retrieve the data will be provided. The methods consist both of a functional analysis of the burin/scrapers (micro-wear analysis), and a comparison of micro-wear results with those obtained from earlier investigations of the lithic and faunal assemblages (see chapters 3.2.1. and 3.2.2. for a detailed summary of the faunal and lithic assemblages). Further, a review of the visibility and detection criteria of the hafting of lithic implements will be presented, as this was one of the initially proposed explanations for the morphology of the burin/scrapers. Consequently, special attention was given to areas and/or micro-wear that could be indicative of this feature.

For the micro-wear analysis of my research, two approaches were used, supplementing each other: Low and high power microscopy (generally between 10-160x and 50-1000x magnification respectively). The low power analysis was performed using a stereoscopic Nikon SMZ800 with two objectives with a range of magnification from 0, 75 - 6, 3x. The high power analysis made use of a metallographic Leica DM1750 with three objectives (1. Hi plan5x, 2. N plan EPI 10x/ 0, 25 and 3. Hi plan 20x) and a HC plan s 10x/22m eyepiece. While with low power microscopy it is often more difficult to discern polishes and post depositional surface modifications such as sheen (see chapter 2.3. for more information about this phenomenon), it is easier to confirm edge-damages such as edge-removals and edge-rounding, and give a general statement about the wear-traces. With metallographic, high power microscopes, potential striations and polishes are more easily discernible. Moreover, high power microscopes can be used to confirm the results from a low power analysis. Since both low and high power microscopy have been used by prominent scholars within the field (Semenov (1964) and Keeley (1974) respectively), and the two approaches complement each other (van Gijn 2014, 167; Keeley and Newcomer 1977, 35), both approaches were used for the micro-wear analysis in this thesis.

The camera used to take the photographs was a Leica MC120HD, and they were processed using the software Leica application suite, v.4.8.

2.1. Micro-wear analysis – a historical overview

It was not until the late 1950's and early 1960's, when the work of the Russian archaeologist Sergei Semenov became publically available that micro-wear analysis was introduced into the archaeological arena. Semenov began studying micro-wear traces on lithic and bone implements using a binocular microscope, offering a method capable of determining what actions had caused the wear found on the artefacts (Murray 2007, 453). Some ten years later, Tringham continued to develop the method of micro-wear analysis by focusing on edge-damage on lithics, using a low-power stereo-microscope (maximum 100x magnification) (Tringham *et al*. 1974). In the 1980's, Keeley advocated the use of a high-power approach, where magnifications ranged between 100x-400x. On this level of magnification, otherwise invisible use-related wear such as polish and small striations (see below for an explanation of the different phenomena) is more clearly discernible, and may be used to determine both *what* function the tool might have had, *how* it was used (which motions have been applied), and also what the *contact material* was (van Gijn 1989, 3**;** Keeley 1980, 54, 102). Today, scholars such as Rots keep evolving the method, expanding its applications by conducting blind-tests and by looking for previously ignored traces of use from activities such as hafting (Rots 2008; 2011; 2015; Rots *et al*. 2006).

2.2. Different types of micro-wear and their formation

When a tool is used, four main types of modifications may occur, namely edge-removals, edge-rounding, polish and striations (van Gijn 1989, 3). Residues are another use-related phenomenon that may be observed on a tool, but while some forms of residue are more impervious than others, they are generally not well preserved. Organic residue such as blood and plant material are short-lived and rarely preserved, while silica particles such as phytoliths and starch grains stand a better chance of surviving (van Gijn 1989, 8) (see Henry *et al*. 2014 for a case study of phytoliths and starch grains from Neanderthal contexts).

Regarding the formation of micro-wear traces, there are a few factors worth mentioning. Firstly, the characteristics of the raw material used for the tool are decisive when it comes to the formation of micro-wear. A coarse grained flint will take longer to develop micro-wear than a fine-grained flint, and its edges are more likely to get crumpled when used (van Gijn 1989, 8). Secondly, the attributes of the contact material also play a major part. There are four hardness classifications used to categorize contact material. *Soft materials* (soft plants, meat and hide), *soft medium* (soft woods), *hard medium* (fresh bone, soaked antler and hard woods) and *hard materials* (antler, ivory and bone). The hardness of the contact material generates different kinds of micro-wear (van Gijn 1989, 4), and different contact materials develop micro-wear traces faster than others (van Gijn 1989, 8). Additionally, the motion, as well as the level of expertise of the user, is quite decisive for the amount, and type, of micro-wear. Scraping will create less damage to the edge than sawing, for example (van Gijn 1989, 9), and a beginner will dull the working edge faster than someone with more experience.

2.2.1. Edge-removals

Edge-removals can certainly be indicative of use (fig. 8), but it is important to be aware that other factors are capable of producing the same type of micro-wear. For instance, the retouching of a scraper-edge can cause micro-scarring on the edges of the implement, virtually impossible to differentiate from traces of use. Likewise, excavation and post-excavational handling can also cause damage to the edges. It has been suggested that edge-removals caused by use are formed in a more regular pattern, but practical experiments have refuted this claim. Lastly, experiments have showed that not all types of use causes edge-damage to the tool, meaning that the presence of edge-removals or micro-scarring alone cannot be considered as a definitive indication of use. It can, however, provide an indication of use when put in relation to other types of micro-wear (van Gijn 1989, 4).

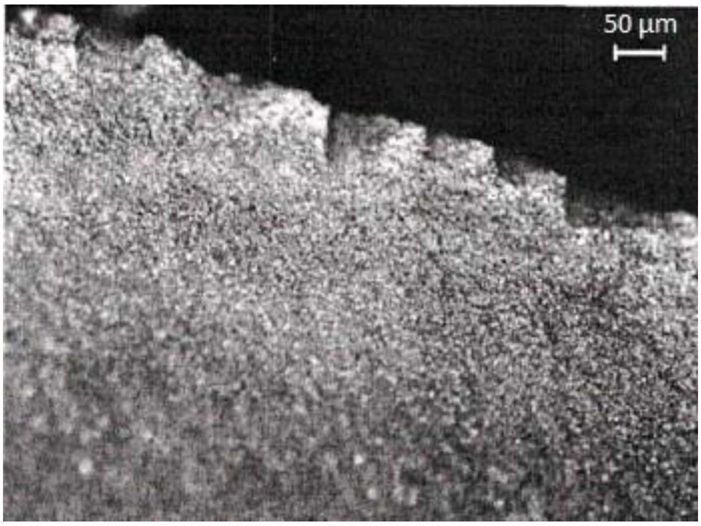

Figure 8. Edge-damage on an experimental tool caused by cutting sturgeon-skin (after van Gijn 1989, 42).

2.2.2. Edge-rounding

All kinds of use will cause edge-rounding, however the degree and the rate of its development varies significantly (fig. 9). To a certain extent, the type of contact material may be deducted from the amount of edge-rounding on an edge or a ridge. If the edge is heavily rounded, the contact material was most likely soft, for instance hide, while a less obvious rounding tends to be the result of a harder contact material such as bone. Experiments have evinced that there does not seem to be a correlation between the development of polish and the inferred use-motion. Lastly, as is the case with edge-removals, edge-rounding alone should not be considered key for inferences of use. The depositional environment of the tool may affect the edges in such a way that rounding occurs post-depositionally (see chapter 2.3. for more information about depositional environments and their effect on micro-wear) (van Gijn 1989, 8).

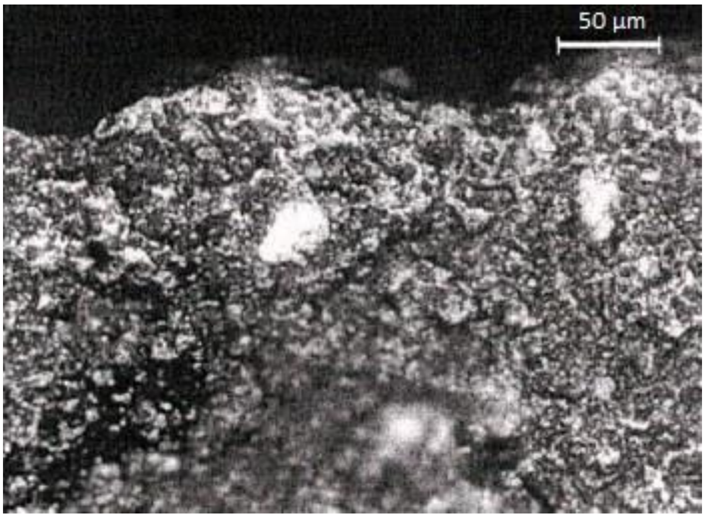

Figure 9. An experimental tool showing edge-rounding and polish as a result of working putrefied flax (van Gijn 1989, 39).

2.2.3. Polish

The formation of polishes is not yet fully understood. Whether a chemical or a mechanical phenomenon, it is most often the result of use. A polish is described and defined by its spread on the tool, brightness, certain topographical features, as well as its location on the tool (van Gijn 1989, 4). Further, depending on the contact material, these different features will develop differently, thus allowing us a chance to identify the contact material that the tool was used on (fig. 10) (van Gijn 1989, 28, 31-32, 40, 43).

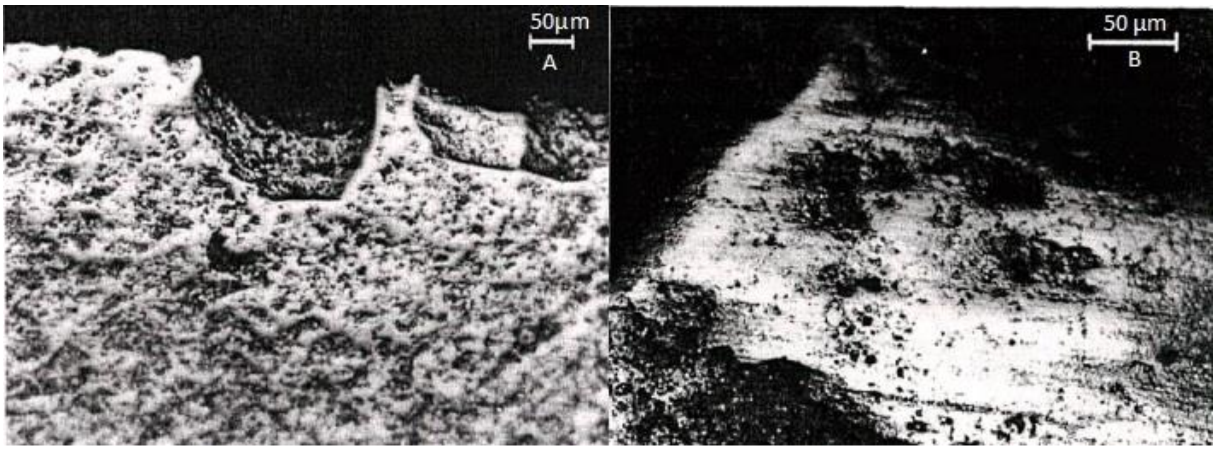

Figure 10. Examples of different polishes on experimental flint tools. A) Polish originating from reed-cutting. B) A rough and flat polish developed from sawing bone (after van Gijn 1989, 34, 39).

2.2.4. Striations

The most common explanation for the origin of striations, is the occurrence of abrasive particles between the tool and the worked material. The prevalence of striations is nowadays used to infer directionality of the use-motion, despite the original intention of using them as an indicator of what material had been worked (fig. 11**)** (Simpson 2015, 71). However, some scholars claims that striations are more a chemical feature than a mechanical one, especially seeing as they only occur in polished areas. Though this is true, it has also been established that striations occur more frequently when experiments are carried out in dusty environments than in cleaner ones. This fact indicates that the contact material is less important than the cleanliness of the surrounding environment when it comes to striation formation (van Gijn 1989, 7).

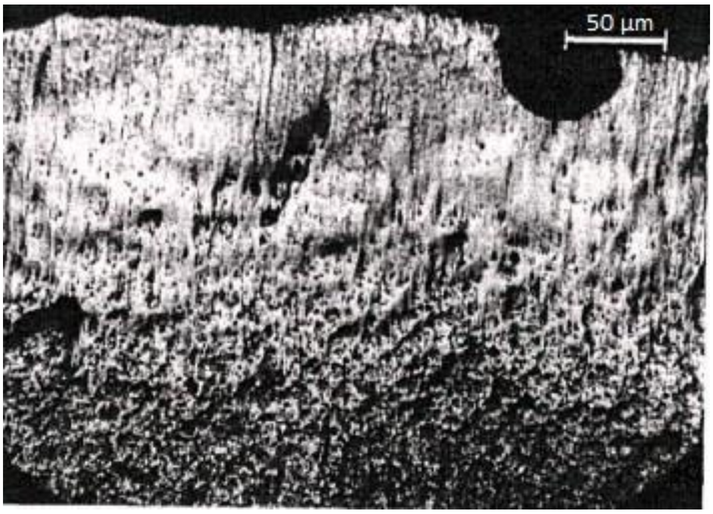

Figure 11. Clear striations on an experimental tool. Caused by scraping dry clay (van Gijn 1989, 46).

2.3. Micro-wear analysis - a word of caution

With each type of modification found on a tool, be it micro-wear or residue, a certain amount of attention regarding its origin is needed. The issue of post-depositional surface modifications (henceforth referred to as PDSM) (see chapter 3.1.1. for an overview of the impact of PDSM on the burin/scrapers) may truly hamper a micro-wear analysis, as its effect on an assemblage may either obscure, or completely obliterate the micro-wear traces. Traces derived from a soft contact material are especially prone to disappear due to PDSM (van Gijn 1989, 26). Therefore, it is vital to assess the development and rate of PDSM of an assemblage before starting a micro-wear analysis (van Gijn 1989, 9). Other natural modifications, such as mineral concretions on the surface of the tool, may also obstruct a micro-wear analysis.

Soil-compaction and trampling are but two examples of PDSM that may cause, for example, edge-removals. The matrix in which the artefacts have been deposited in also has to be taken into consideration. A sandy matrix may, among other things, cause rounding of the edges and ridges of the artefacts. This rounding is virtually impossible to separate from use-related rounding (van Gijn 1989, 8). Other examples of PDSM are patination, gloss and sheen. A relationship between environments with a high acidity or alkalinity and the development of these types of PDSM has been observed (van Gijn 1989, 51, 53; Pasquini 2009, 182). These features all either obscure the polishes, or look very similar to "the real thing", which may potentially lead to misinterpretation.

Additionally, polishes may occasionally be confused with certain residues, as they sometimes reflect light in the same fashion. Lastly, if chemically cleaned (see chapter 2.3.1. for more information about chemical cleaning of lithic artefacts), certain polishes may be altered, somewhat depending on the type of polish and the concentration of the chemicals used (van Gijn 1989, 5).

A final observation, sometimes overseen by archaeologists, is post-excavational damage and excavational trauma. For instance, the transport of artefacts, refitting attempts as well as sieving – particularly on metal screens - may create "false" micro-wear that alters and/or erases "real" micro-wear (van Gijn 1989, 54; Simpson 2015, 83-84). Excavational trauma includes, among other things, contact with metal tools, sometimes causing both micro- and macroscopic damage to the artefact (Simpson 2015, 81). Luckily, post-excavational damage of lithics is rarely very pronounced (Simpson 2015, 84) and are more likely to affect "fresh" or unused edges, rather than edges already eroded by use (Gero 1978, 34). Fortunately, many of the post-excavational damage pitfalls can be avoided simply by raising awareness of them among archaeologists.

2.3.1. Chemical cleaning - an overview

In some cases, lithic implements have been affected by PDSM and/or post-excavational handling to such an extent that any micro-wear is either completely obscured or very indistinct. In those cases, for a micro-wear analysis to be fruitful, the implements must undergo some kind of cleaning. There are several types of cleaning procedures, with the most commonly applied being washing with soap and water, cleaning with alcohol and lastly, the more aggressive chemical treatment (MacDonald and Evans 2014, 22). The first two options are considered less invasive, while chemical cleaning (most often using both acid and alkali chemicals) is considered more invasive, and potentially directly harmful to the surface of the lithic. It will also remove any organic residues, making it very important to assess the likelihood of finding some before commencing the chemical treatment (van Gijn 1989, 11). Due to the risk of doing unrepairable damage to the lithic implement (for example dehydrating the surface, or causing it to develop a green/blue sheen), this kind of heavy cleaning is generally avoided unless the piece is heavily covered in, for instance, mineral concretions. In some cases, however, chemical cleaning is the only known method for potentially identifying any use-related polishes (van Gijn 1989, 11), and recent experiments have shown that a chemical treatment of lithic implements is not necessarily as damaging as it was once thought (fig. 12) (MacDonald and Evans 2014). Rather, in order to remove contaminations such as **well-established** dirt and unwanted materials such as mineral concretions, chemical cleaning, using both an acid and an alkali, is sometimes advisable (Macdonald and Evans 2014, 25. It should be noted, that for the experiment in this article, a confocal microscope is used as opposed to the stereographic and metallographic microscope used for my research. However, when discussing the effect of the chemicals upon the surfaces of the artefacts, this matter is of no relevance).

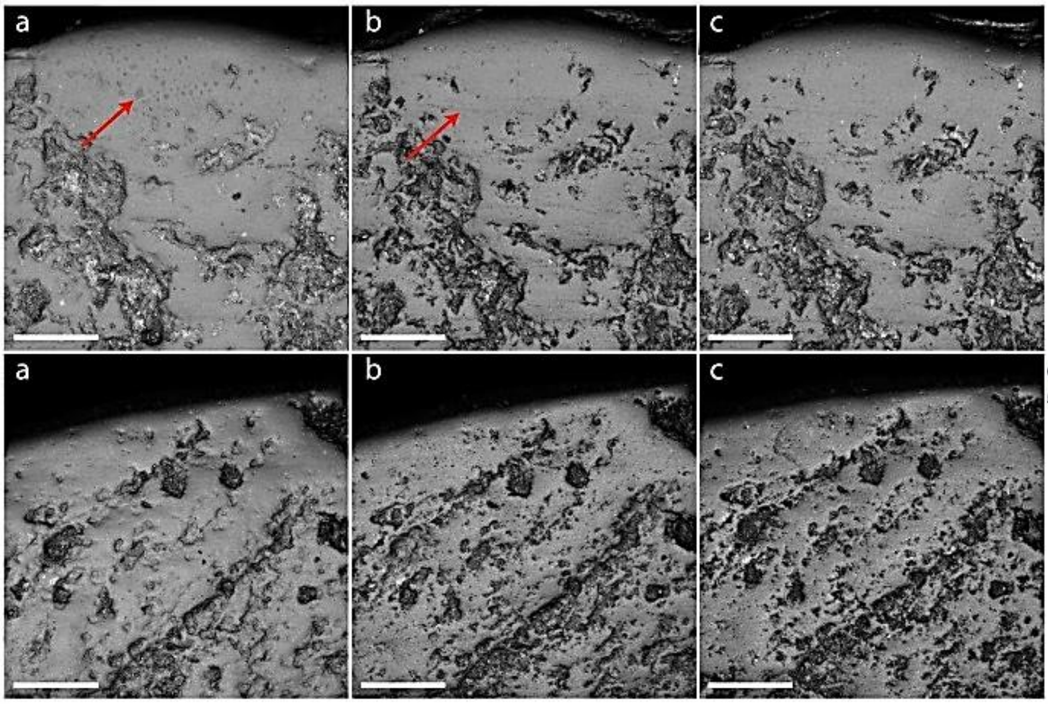

Figure 12. Upper row, experimental tool 1, Negev chert, scale 40 µm a) After cleaning with alcohol. The arrow indicates a grease spot. b) After cleaning with soap and water. The arrow indicates a striation previously obscured. c) After chemical treatment with HCl (10 %) and KOH (10 %. Lower row, experimental tool 2, Negev chert, scale 100 µm. a) After cleaning with alcohol. b) After cleaning with soap and water. c) After cleaning with HCl (10 %) and KOH (10 %) (after Macdonald and Evans 2014, 25).

2.4. Hafting

Since the burin/scrapers were found, various attempts to explain their morphology have been made. In some ways, their morphological attributes correspond to those seen on hafted implements. The thinning of the proximal end of the tool, as well as a retouched area creating a larger surface, potentially for an adhesive, are but two examples of modifications made to facilitate hafting (Rots 2011, 283). As both of these features are present on the burin/scrapers, the possibility of them having been used as hafted implements was discussed from the very onset of this research.

However, there is an ongoing debate on whether or not hafting is actually distinguishable in a micro-wear analysis (Keeley 1982; Rots 2005, 61). A large part of the scepticism concerns the organic, and thus impermanent, nature of the haft itself (Rots 2008, 43), as well as the potential haft glue. However in the last years, using the same principles of formation as for any micro-wear (van Gijn 1989, 3), it has been proved that hafting can indeed be identified (Keeley 1982, 798; Rots 2008, 43). Besides, certain categories of tools, such as projectile points, simply could not function as handheld implements. They require a haft in order to fulfil their intended function (Rots *et al*. 2001, 129). Additionally, a haft may allow for a greater utilization of power, which might be desirable for activities such as scraping (Rots 2009, 54). Lastly, and more relevant for the burin/scrapers, hafts facilitate the combination of different working edges on the same tool, creating composite tools that can be used for a number of different tasks (Rots 2015, 384).

In order to enable the identification and interpretation of potential haft traces, a number of criteria have been developed. Firstly, a clear border of differing wear-traces should be discernible on the active versus non-active parts of the tool. The active parts are the working edges, while the non-active parts are the portion of the tool that was once inside of the haft. The border should be marked either by a sudden increase in scarring, a polish differing from that of the active part, striations (often perpendicular to the edge) or bright spots (highly reflective spots of polish caused by friction (Rots 2002, 61)). It should also be noted, that micro-wear related to use is concentrated along the active edge of the tool, while micro-wear caused by hafting can develop across the entire surface of the hafted portion of the tool. A combination of all, or some, of these features is of course also a possibility (Rots *et al*. 2001, 130). Since differing polishes develop when the worked material differs from that of the haft (Rots *et al*. 2001, 130), one has to be aware of the practice of using leather wrappings for hafting (fig. 13) (see fig. 14 for the most common hafting arrangements). If this form of hafting has been used, the polish developed on the non-active portion of the tool could look very similar to that of an active part that was used for hide working (Rots 2008, 57). Additionally, soft plant fibres may also be used as wrappings, possibly diminishing the chances of recognizing a haft limit if the worked material was also plant-derived (Rots 2008, 49). However, in experiments where wrappings alone were used as hafts, polishes are poorly developed in the wrapped areas, meaning that a potential haft limit may still be discernible (Rots 2008, 57). A slight smoothing of scars, as well as a minor increase in rounding is another effect of wrapping (Rots 2008, 60), yet it should not be considered as characteristic (Rots *et al*. 2001, 130). Moreover, wrappings may be used as a complement to a haft. As such, it can act as a stabilizing agent for the lithic inside the haft, as well as removing some of the strain from it, thus extending its life-cycle. By using wrapping as a supplement to a haft, an extension of the size-range of lithics that can be used for the same haft is made. Implements that are in themselves too small to be compatible with a specific haft, may, when wrapped, be used just the same. Additionally, when a tool is wrapped before being hafted, the micro-wear formation changes quite a lot. The amount of micro-wear becomes smaller because of the lesser amount of friction inside the haft, and a mixed polish may develop as a result of contact between the lithic and the wrapping material and the haft respectively (Rots 2008, 59).

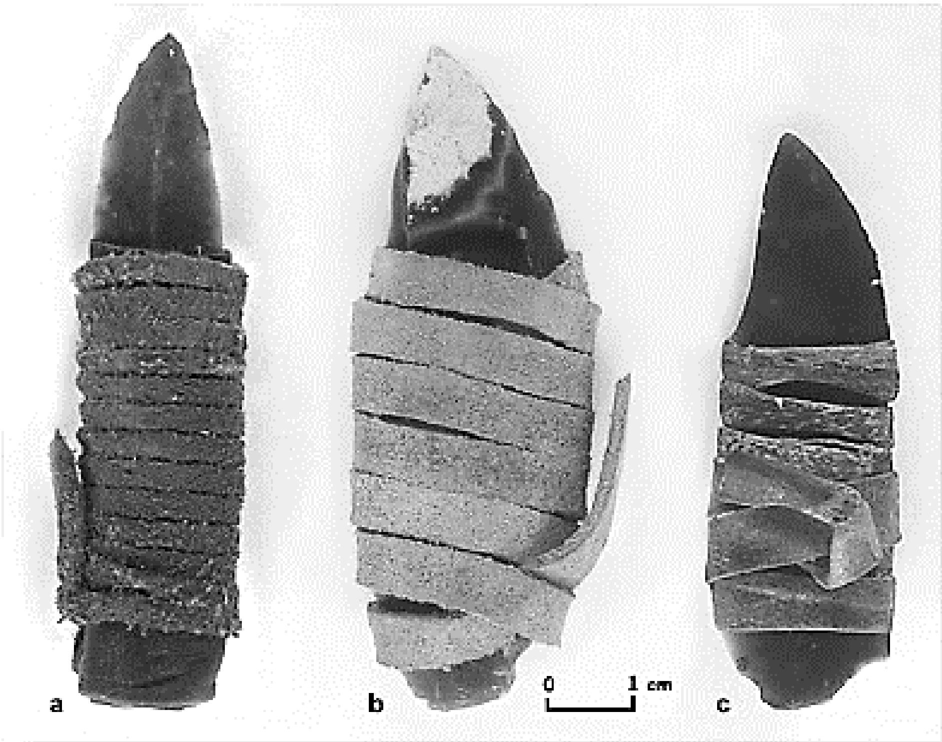

Figure 13. Experimental leather wrappings (after Rots 2008, 57).

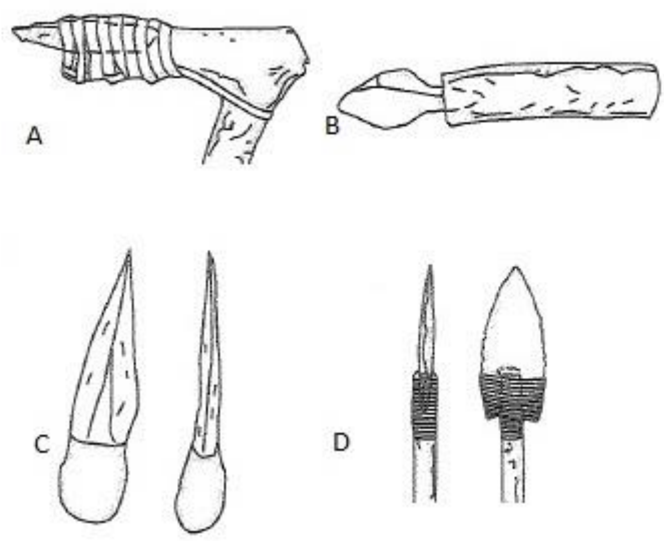

Figure 14. The most common hafting arrangements. A) Juxtaposed hafting B) Inclusion: the lithic implement is inserted into a hole in the haft C) Applied: resin or a plant/animal binding is used to create a protection for the hand D) Cleft (after Barham 2013, 183, 192).

Micro-wear analysis of the active parts (the working edges) of tools have shown that it is difficult to distinguish between micro-wear caused by use and micro-wear caused by hafting. Therefore, in order to strengthen claims of hafting, it is recommended to include the non-active (inner surfaces) parts of the tools in the analysis, since traces indicative of hafting, such as bright spots and striations, are sometimes visible there (fig. 15) (Rots *et al*. 2001, 129-130).

Figure 15. Bright spot and striation on a lithic implement as an effect of it having been hafted (after Rots et al. 2001, 131).

Furthermore, as previously mentioned, morphological features such as tangs, notching and proximal thinning may also be indicative of hafting (fig. 16). However, the link between these features and actual hafting is to date too unreliable for them to be considered as anything more than an indication (Rots 2011, 283; Rots 2015, 384).

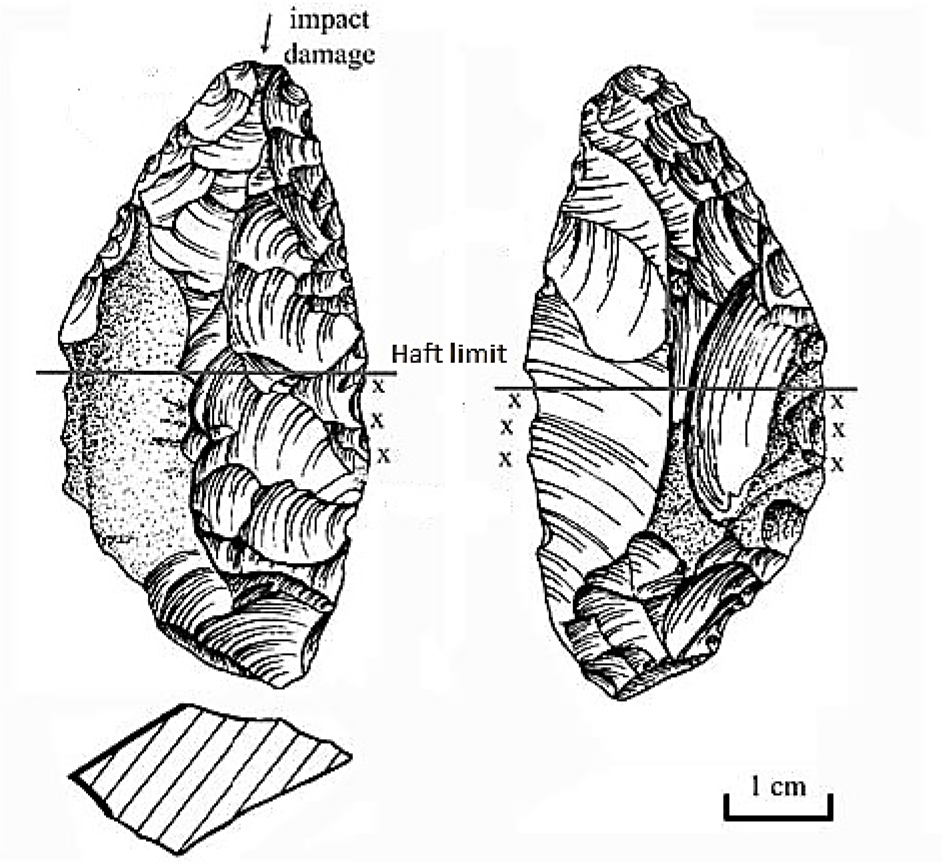

Figure 16. Example of a projectile point with a thinned based (the part below the haft limit). The "x" marks scarring derived from hafting. From Sesselfelsgrotte (Middle Palaeolithic) (after Rots 2015, 399).

Lastly, it is advisable to highlight the importance of understanding the mechanics affecting a hafted implement when it is being used. Each *mode d'emploi* (fig. 17) will create a distinctive micro-wear pattern, for example impact-scarring (fig. 18) which, if understood, can significantly help us to understand the remaining micro-wear found on the tool, and consequently aid us in making a reliable interpretation of its function (Barham 2013, 180).

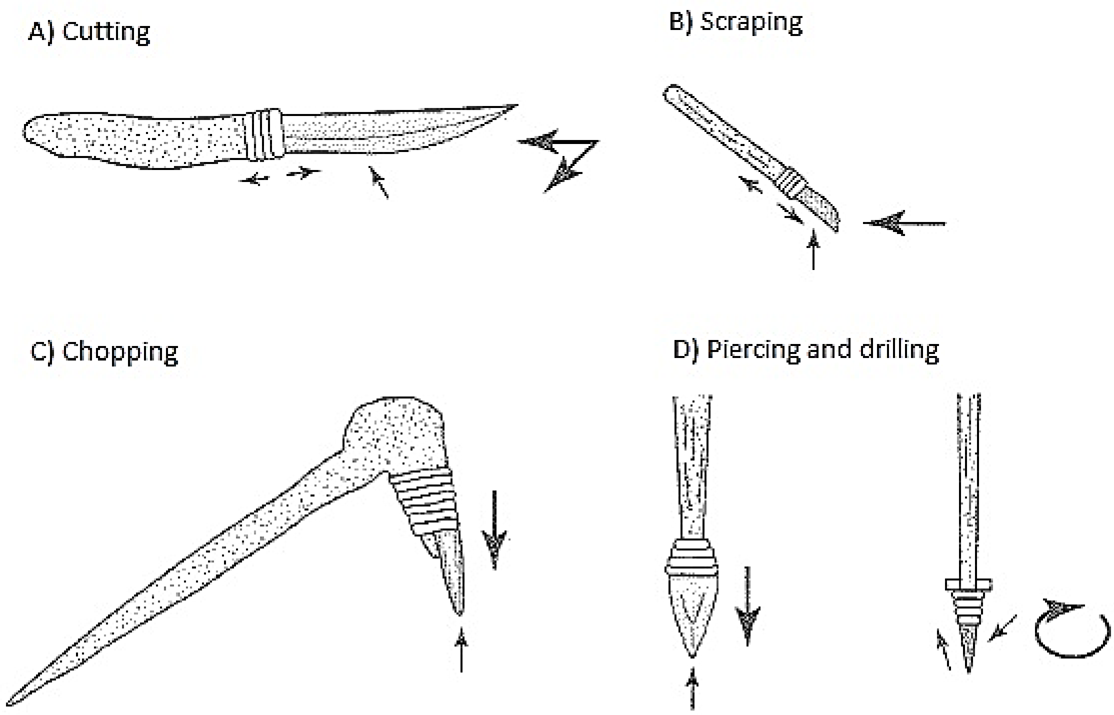

Figure 17. Various modes d'emploi of hafted tools. The larger arrows indicate the direction of use, and the smaller ones the resulting force affecting the tool (after Barham 2013, 181).

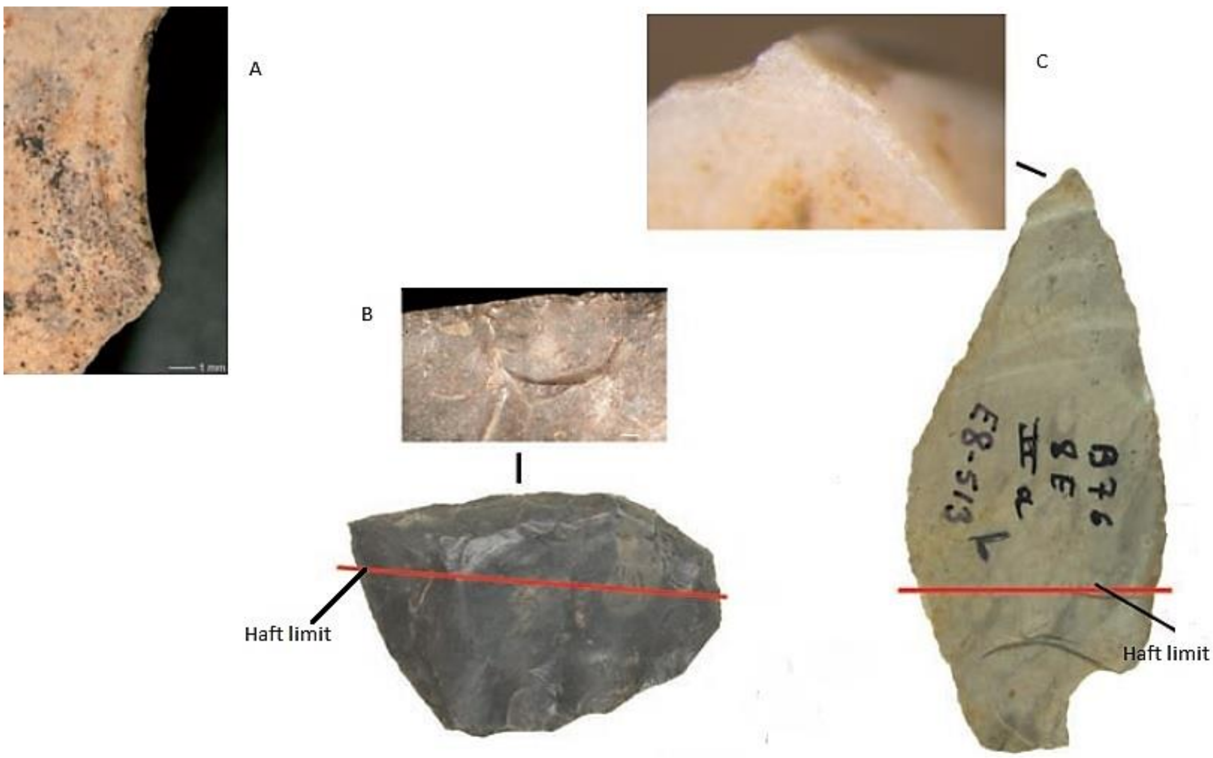

Figure 18. Examples of different fractures resulting from use. A) Sliced scar derived from a twisting motion (projectile point) B) Micro-wear from wood-working (transverse scraper) C) Step-terminating scar from impact (projectile point) (after Rots 2015, 391, 394-395).

3. Material

The three burin/scrapers constituting the main focus of this thesis research, were manufactured during a time of great change in the area of lithic technologies. Notably, the production and usage of combination tools increases immensely during the Middle to Upper Palaeolithic transition. The fact that only one example of a combination tool, a burin combined with an endscraper from the Middle Palaeolithic site of Pech de l'Aze II, is mentioned in Bordes' work (1984, 154), serves to illustrate the differences in production when compared with the 41 combination tools (burins combined with either endscrapers or borers) listed from the Upper Palaeolithic (Bordes 1984, 244, 248, 250-251, 281-282, 284, 289, 291, 305, 313-314, 325, 327, 338, 343, 353, 356, 361, 369, 375, 378, 380-381, 402, 406, 412). Of course, examples not listed in Bordes' work exist, but the difference in numbers in his work (1984) serves to illustrate the shift in manufacturing strategy that took place during the Upper Palaeolithic. Apart from the apparent changes in manufacturing techniques and morphology, we basically know nothing about the functional aspects of tool kits from this period of time (Pasquini 2009, 189).

When deciding which tools to analyse, I took the above mentioned facts, as well as the arguments put forward in the introduction into consideration and made my selection. The three combined burin/scrapers represent a type of tool not restricted to, but very characteristic of stages following the Middle Palaeolithic in Europe. It is thus a category of tools common among AMH and rarer among Neanderthals. By understanding their function, certain conclusions as to which tasks were performed at the site, as well as aspects of behaviour of the AMH can be deduced (Dobres 1999, 124).

The main focus of my research is based on the results of the micro-wear analysis performed on three tools, and could consequently be called into question with regard to the quantity of the analysed material. As a consequent, the validity of the following argumentation might be challenged. However, as the number of lithic artefacts differ from assemblage to assemblage, and factors such as time and artefact types vary between each individual case, there is no minimum number of pieces required for an analysis to be undertaken. An appropriate sampling-method in relation to the research question at hand can be argued to be more important than the quantity of analysed pieces. There are a number of sampling-methods that can be applied. A random sample including retouched artefacts only, or a weighted sample including both retouched and unretouched tools, with a higher percentage of the former, are two examples of sampling-methods. A third option is to focus on artefacts found within a specific feature, such as a hearth, and lastly, the fourth option which emphasizes a specific tool category (van Gijn 1989, 9). Seeing to the type of data I aim to obtain from the micro-wear analysis (information about form and function), the fourth method was chosen as sampling method. Moreover, I include the results of previous analyses of the layer in the discussion, solidifying the foundation for the development of my argument. A similar analysis has been done on parts of a lithic assemblage from Abu Hureyra in Syria, where a comparison between the burins and the points of the assemblage was made (Moss 1983). The study showed that the contact material of the secondary use of the points, corresponded with that of the burins, and could then be used for intra-site comparisons (van Gijn 1989, 9-10), which is one of the aims of my own research.

In the following chapters, I will present the three burin/scrapers, and provide an overview of the geological formation processes that have shaped US 02. In this overview, I also assess the effect of PDSM on the assemblage, as this is an important aspect to consider for micro-wear analysis. Lastly, a summary of the faunal and lithic assemblages will be presented, complete with the resulting interpretations of the layer.

3.1. Presentation of the burin/scrapers

Three morphologically similar, and to date unique, combination tools (Roussel, personal comment 26/5-2016) have been found in US 02 as of 2014 (fig. 19) (Roussel and Soressi 2014b, 105).

Combined burins and scrapers have in fact been found on other Upper Palaeolithic sites, but rarely from so early a period (Bordes 1984). Additionally, the morphology of the tools stand out in the way that the burin facet(s) are parallel to the scraper edges, and do not overlap with either the ventral or the dorsal side of the pieces, as is often the case with these types of tools. Moreover, since the distal edges are retouched, the commonly present pointed conjunction between the burin facet and the retouched edge do not exist (fig. 20) (Roussel, personal comment 27/11-2016).

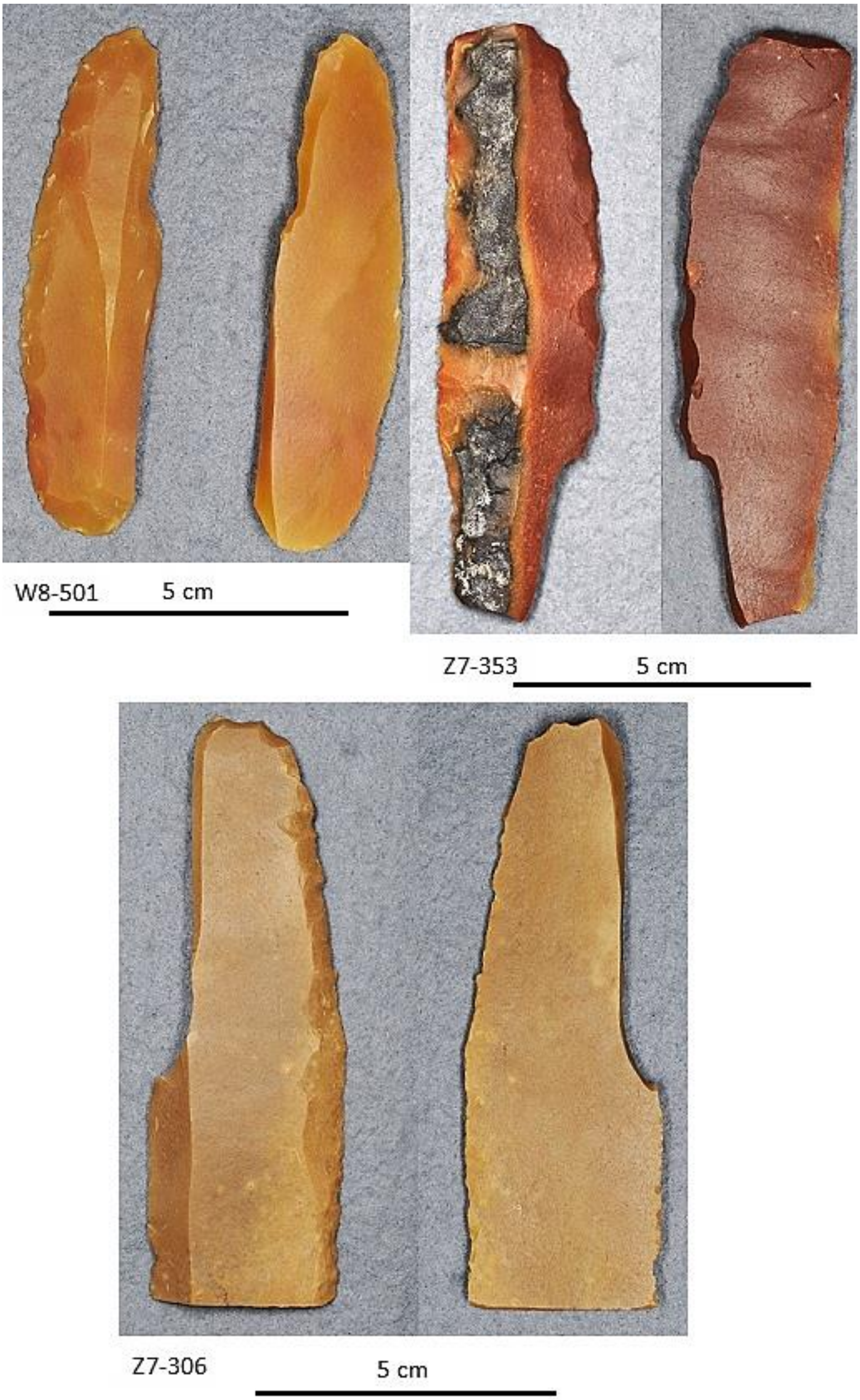

Figure 19. Photographs of the three burin/scrapers, showing both their dorsal and ventral surfaces (photographs taken by the author 2016).

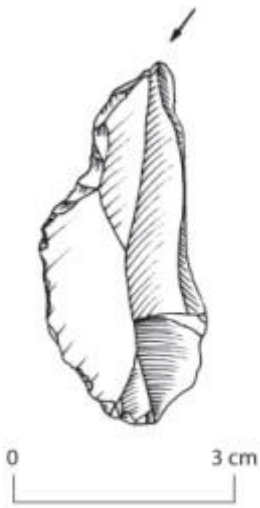

Figure 20. Example of a typical Aurignacian burin with retouches on one edge. Note the pointed angle indicated by the arrow (after Toussaint 2006, 120).

3.1.1. Geological formation of US 02 and effects of PDSM on the burin/scrapers

In order to make a reliable interpretation of micro-wear traces found on archaeological material, it is important to understand the geological processes that affected the matrix in which they were found (van Gijn 1989, 51). By providing information about the geological context of layer US 02, I aim to clarify which factors may have played a role in the formation of the current surfaces of the tools, including lateral movement before burial of the objects, sedimentation processes during burial as well as post-depositional processes affecting the matrix as well as the artefacts during and after excavation.

Four major phases of deposition formed the litho-stratigraphical (henceforth abbreviated to UL from the French *Unité Lithostratigraphique*) units that together make up the different layers of Les Cottés. US 02 belongs to UL III, and was formed during the third depositional phase (fig. 21). The different ULs are distinguished from one another through sedimental differences observable in the stratigraphy due to erosion (Liard 2010, 71).

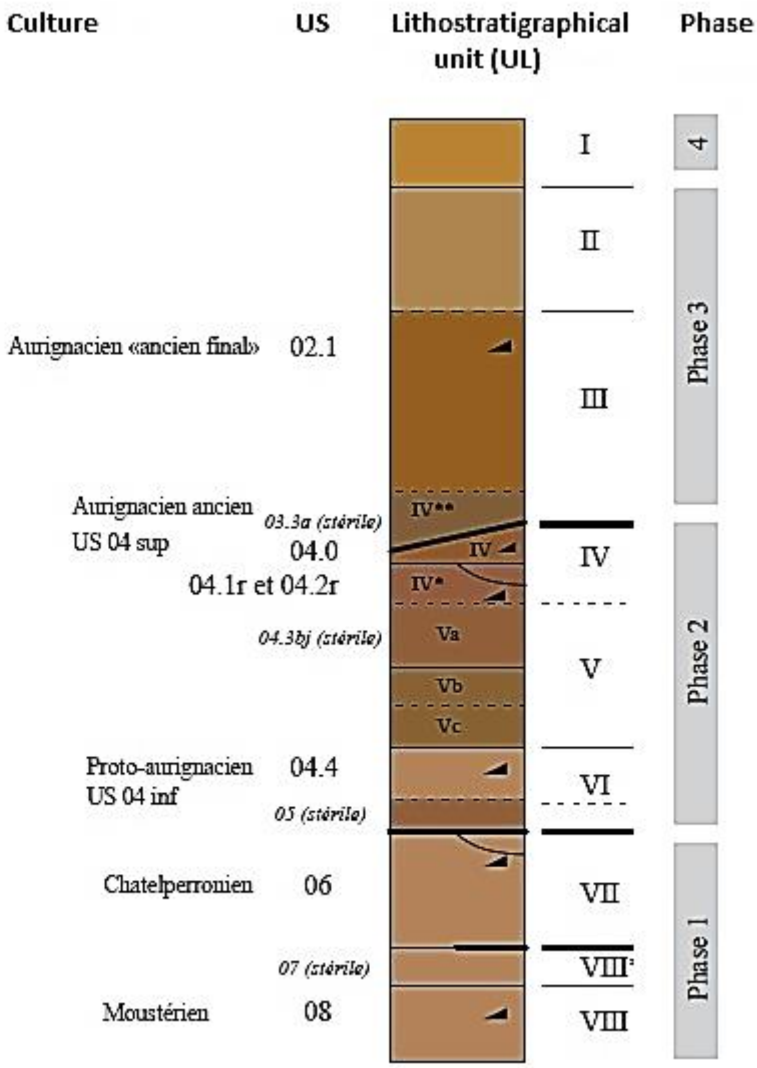

Figure 21. The different UL's and the depositional phases (after Liard 2014, 66).

Through macroscopic analysis it has been possible to distinguish runoff channels that may be the originators of UL III. Moreover, through fabric tests (the fabric of a rock describes the geometric and spatial arrangement of its constituting elements (Hobbs *et al*. 1976, 73)) performed on the upper part of UL III, a mudflow has been recognized. This mudflow has probably caused an over-representation of fine sediment in the southern area, and might also have displaced artefacts within the layer, precluding any spatial analysis. However, micro-morphological analysis of the layer will hopefully be able to determine the origin of this influx, and tell us whether it is an isolated mudflow event or if the entire layer has simply slipped down the slope (Liard 2010, 71).

From the top of UL IV**, it is possible to distinguish the gradual transition between phase 2 and 3. The sediment deposited during phase 2 was heterogeneous and contained a lot of gravel (particles ranging in size from 2-63 mm (ISO 2013) and micro-fragments of bone (Liard 2010, 59). Come phase 3, the sediment changes into the homogenous brown/yellow, silty clay constituting US 02 (Liard 2010, 71). The structure of the sediment is prismatic, meaning that each individual prism (in this case, the prisms are ~1cm) is bound to the neighbouring prism through a slightly rounded or flat surface. Moreover, elements such as fine sand (particles ranging in size from 0, 063-0, 2 mm (ISO 2013)), are evenly distributed throughout the matrix of US 02 (Liard 2010, 55).

All through the layer, limestones of varying sizes are found, as well as some patches of an ashy, black sediment of a few millimetres depth each. Concentrations of charcoal and burnt bone were also encountered (Soressi 2015b, 45) along with spherulites which in this case further indicates combustion (Liard 2010, 59). Unburnt fragments of bone and flint, as well as lithoclasts (fragments of what was once limestone (https://wwwf.imperial.ac.uk) are scattered throughout the layer, and the sediment proved to be rich in phosphates, a circumstance that might be the result of an integration of coprolites, animal waste and/or owl pellets into the sediment (Liard 2010, 59).

In terms of the conservation of the archaeological material, the geoarchaeological study has shown that the lithic material is well-preserved enough for a micro-wear analysis to be meaningful (Liard 2010, 74; Pasquini 2010, 117). The flint has no patina (Roussel *et al*. 2013, 73) and only a few artefacts exhibit any natural modifications (millimetre sized concretions) (Soressi and Roussel 2014a, 72). However, it should be noted that previous micro-wear analysis (in total 44 pieces from layers US 06-US 02) of parts of the lithic assemblage of US 02 showed the presence of PDSM in the shape of a glossy sheen covering the surfaces, as well as a pseudo-polish very similar to use-induced polish (fig**.** 22) (Pasquini 2009, 182). Furthermore, after several hours of analysis of the burin/scrapers performed by Drs. Verbaas, it has become clear that even if the state of preservation of the material is good, it has still been rather heavily affected by PDSM (Verbaas, personal comment 24/11-2016). As a result, almost no unequivocal interpretations of contact materials has been possible.

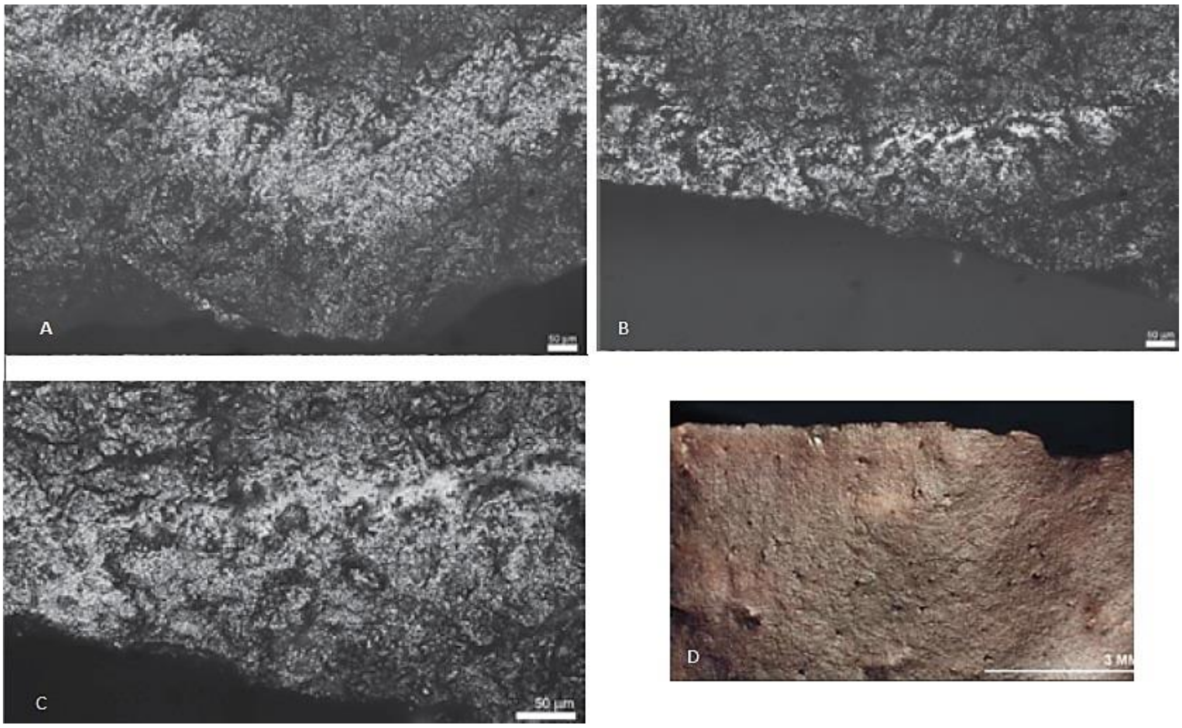

Figure 22. Various PDSM found through micro-wear analysis done lithic artefacts of US 02. A-C) Pseudo-polish D) Glossy sheen (after Pasquini 2009, 181).

3.1.2. Chemical cleaning of the burin/scrapers

As mentioned in chapter 2.3.1., chemical cleaning of flint artefacts have in some cases had harmful effects on the surfaces of the implements. Since the three burin/scrapers had to undergo this cleaning procedure to be suitable for micro-wear analysis, there is a risk that their surfaces have been affected by more than just PDSM. In the following section, an account of the cleaning procedure and the motivation behind it is provided.

An initial analysis of the burin/scrapers was performed by Drs. Verbaas to establish their suitability for micro-wear analysis. This analysis showed that all three tools were too dirty from handling (i.e. covered in finger grease) to be suitable for a proper micro-wear analysis. Thus, under the supervision of Drs. Verbaas, all the tools were submitted to a chemical cleaning in an ultra-sonic tank (model Branson 8510). With consideration of the above mentioned dangers associated with submitting lithics to chemical treatment, this method of cleaning was used as a last resort.

Before commencing, photographs were taken of a fixed point of two of the tools (Z7-306 and W8-501) for comparative purposes in between each step of the cleaning process. Further, in order to be able to assess potential damage to the tools, caused by the chemicals, a second series of photographs were taken about one month later. When comparing the photographs, no visible damage can be seen on either surface (see appendix I for the photographs). The camera used was a Leica DFC 450, assembled with a Leica DM 6000 M microscope. The software employed for viewing the photographs was Leica application suite (v.4.8).

The first step in the cleaning procedure, after an initial wipe-down with alcohol (96 %) on a cotton pad, was to clean the artefacts under running water using regular soap. As this showed only a small improvement, it was decided to put the artefacts in an ultra-sonic tank. Still only using soap and water, they were submerged in separate plastic beakers for an initial 25 minutes. After a comparison with the first photographs, it was decided to leave them in this solution for another 55 minutes. Following this total of 80 minutes, and a second comparison with the photographs, it could be established that the finger grease was gone from the surfaces of all of the tools. However, there was some remaining sheen that needed to be treated with chemicals in order for it to be removed. To make sure that the artefacts would run as little risk as possible of being damaged by the chemicals, they were soaked in water for 23 hours. As rocks are slightly porous, soaking the artefacts will fill the pores with water, thus preventing the chemicals from penetrating too deep into the rock. The chemical treatment began with a 10 % HCl solution, in which the artefacts were again immersed in separate plastic beakers and put in the ultra-sonic tank for 15 minutes. Thereafter, following a quick rinse in running water, they were put in a 10 % KOH solution for an additional 15 minutes. After a third comparison with the original photograph, the artefacts were deemed clean, and sufficiently preserved for a micro-wear analysis. They were then put in regular water, and left to soak for 24 hours to make sure that any potential chemical remains were gone. It should be noted that all three artefacts are rather heavily affected by a PDSM-related sheen covering their surfaces, making it relatively difficult to obtain any reliable results using high-power microscopy only. However, by supplementing with low-power analysis, features such as edge-rounding, striation and edge-damage can be combined with polishes to form a relatively firm basis for interpretations (Verbaas, personal comment 5/7-2016).

3.2. Overview of faunal and lithic assemblages and their interpretations

As previously mentioned, the results of the micro-wear analysis will be compared with those obtained by earlier performed analyses of the faunal remains, as well as with the results from earlier analyses of the lithic assemblage. With the exception of a few artefacts (see chapter 3.2.2. for details), most of the analysis of the lithic assemblage of US 02 has been based on technological aspects rather than use-related traces, and may thus be an adequate supplement to the results from the micro-wear analysis. In the ensuing chapters, the data obtained from the analysis of the faunal and lithic assemblages will be presented, as well as the interpretations of the layer.

3.2.1. Faunal assemblage

A total of 1065 bones have been recorded from US 02 since 2006, out of which 32 (3 %) are teeth (Renou and Rendu 2015, 104). Despite the fact that a large part of the faunal assemblage has been heavily affected by manganese oxide (613 of 794 analysed remains), creating a crust-like deposit covering parts of the bones (fig. 23), 394 of the 1065 remains have been taxonomically determined (Rendu and Renou 2014, 134).

Figure 23. Bones affected by manganese oxide. Found in layer US 04.inf, les Cottés (after Renou and Rendu 2015, 108).

The dominating taxa, composing 95 % of the identified faunal remains, is reindeer (*Rangifer tarandus)* (NMI=4) (Rendu 2009, 194), accompanied by chamois (NMI=1) (*Rupicapra rupicapra)* as well as bison (NMI=1) (fig. 24), and horse (NMI=1) (Rendu 2009, 203, 211; Soulier 2015, 114). The evident over-representation of reindeer in the assemblage is considered to denote a monospecific hunting strategy (Mellars 1998, 500; Soressi 2015a, 23).

Figure 24. A) Reindeer B) Chamois C) Bison (after https://upload.wikimedia.org/wikipedia/commons).

From the 1065 bones, 765 were analysed for traces of weathering. Out of these, 543 (71 %) showed signs of cracking, disintegration as well as exfoliation (Renou and Rendu 2015, 107). Additionally, the same amount of bones were analysed in search of anthropogenically originated modifications, resulting in 401 remains showing signs of various human related modifications (tab. 1). Other analyses have shown that some of the remains have striations that might be indicative of deliberate disarticulation, sinew extraction (Soulier 2015, 139-140) as well as marrow extraction (Rendu 2008, 182). So far, no traces of carnivore activity (such as gnaw marks) have been found on the bones, but one carnivore long bone from an unidentified species has been found in the layer (Renou and Rendu 2015, 130).

Table 1. An overview of the anthropogenically affected faunal remains from US 02 (after Renou and Rendu 2015, 112).

	Analysed remains	Affected remains
	765	
Anthropogenic (undefined)		191
Striations		99
Signs of scraping		16
Use as retouching tool		6
Notches		44
Splinters		8
Burnt bone		37
Total		401

A rather interesting feature of the faunal assemblage, is the inter-relationship of the skeletal remains of reindeer. Compared to cranial fragments, there is a clear abundance of antler. Furthermore, apart from hind limb bones, post-cranial elements are largely under-represented (fig. 25) (Rendu 2009, 212).

Figure 25. Representation of skeletal remains from reindeer. Darker shades indicate a higher prevalence (after Renou and Rendu 2015, 115).

This representation might be the product of varying conservation properties between the different elements (Rendu 2009, 212), but in view of the over-representation of antler, and the bone and antler industry associated with the Aurignacian technocomplex, it could suggest that antlers were specifically sought after by the people dwelling at the site (Rendu 2007, 234). This argument goes in line with the interpretation made by Dr. W. Rendu. According to him, based on the specific skeletal parts found, and the scarcity of man-made traces related to meat exploitation, the reason behind hunting the animals was to acquire hide and bone or antler for tool production (Rendu, personal comment 14/4-2016). However, other analyses have shown that certain striations present on at least one reindeer humerus are suggestive of meat exploitation (fig. 26) (Soulier 2015, 137).

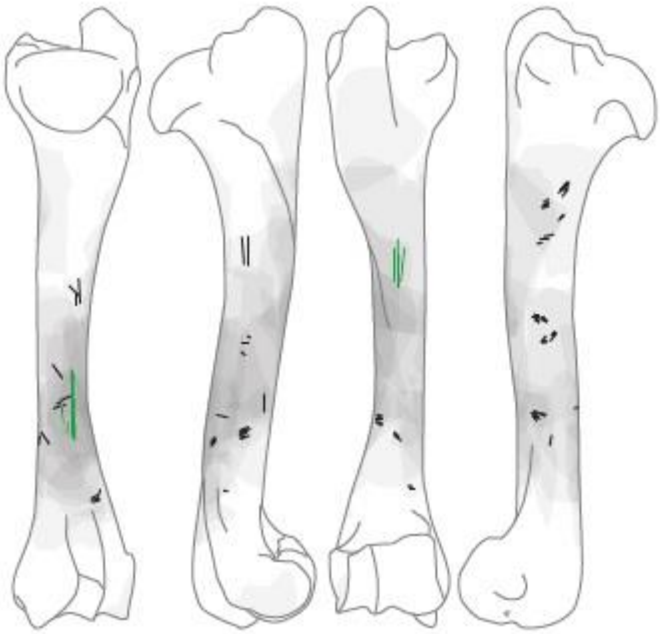

Figure 26. Reindeer humerus found in US 02 with striations associated with explicit meat removal. Black lines are marks derived from cutting and green lines are from scraping. No scale bar was available on the original figure (after Soulier 2015, 137).

From earlier excavations, bone and antler tools diagnostic for the Aurignacian technocomplex, such as the previously mentioned split base points, have been found, along with piercing tools (fig. 27), and other antler and bone remains carrying signs of human manipulation (fig. 28) (Tartar 2014, 170).

Figure 27. Typical Aurignacian bone/antler tools found at Les Cottés. A) Split base points excavated in the early 1880's and B) Piercing tools excavated in the 1950's (after Soressi 2010, 34; Tartar 2014, 170).

Figure 28. Reindeer antler with manufacturing marks found in US 02.1 (after Tartar 2014, 169).

Unfortunately, due to poor documentation of the earlier excavations, none of the bone and antler tools excavated before Soressi can be assigned specifically to either of the two stratigraphical units attributed to the Aurignacian (US 02, final stage of Early Aurignacian and US 04, Proto-Aurignacian and Early Aurignacian). Therefore, I have chosen to exclude them from this thesis research. However, it should be noted that both split base points (out of which some where made from ivory), lissoirs, piercing tools as well as pierced teeth were recorded in the 1906 excavation by H. Breuil, and assigned to layers E' and E (Aurignacian I *évolué* and Aurignacian I respectively) (Soressi 2006b, 20). This goes well in line with the usual abundance of bone and antler tools found in Aurignacian assemblages (Mellars 2006, 168; Tartar 2014, 170).

To summarize, it can be noted that the majority (401 of 765) of the analysed faunal remains from US 02 show signs of human manipulation. It is clear that bone and antler have been exploited at the site, most likely to be used for tool production. Meat acquisition has also been proven, together with signs of hide procurement and marrow and sinew extraction. Judging by the analysis of archaeozoological factors such as bones having been used as fuel, the specific fracturing patterns of the bones as well as the differing representation of anatomical elements, it is suggested that the site changed from being a dwelling site during the Proto-Aurignacian (US 04inf) to being a specialized site during US

02 (Soressi 2015a, 21). Several Upper Palaeolithic sites in southwest France ascribed to the Aurignacian, such as Roc de Combe and La Gravette (Mellars 1989, 357) have the same monospecific faunal pattern as Les Cottés. Although disputed (see Grayson and Delpech 2002 for the counterarguments), it has been suggested that this phenomenon is due to a specific use-pattern of sites, following the yearly migration cycle of the reindeer (Mellars 1989, 357). Lastly, the finding of an un-used premolar from a reindeer signals that the killing of the animal took place either during the summer or fall. However, it has been deemed too early to infer seasonal exploitation patterns of the site based on this tooth alone (Renou and Rendu 2015, 114).

3.2.2. Lithic assemblage

The following chapter describes the composition and the main characteristics of the lithic assemblage of US 02, and provides a preliminary interpretation of the layer based on, for instance, the analysis of the distribution of various types of flakes, either for reduction purposes or for core shaping (Liard 2014, 73; Roussel and Soressi 2014b, 106).

The raw material from this layer is consistently of top quality (Soressi 2015a, 22). Five different types of flint have been recognized: *Turonien supérieur* (Upper Cretaceous), *Les Cottés flint*, *Meulière blanche oolithique* (Tertiary) and *jaspoïde flint*. Disregarding the fact that the Turonian flint is found farther away from the site than the other four, it is the most preponderant in the layer (Primault 2006, 74-75). In total, 77 % of the lithics are made from this material (Roussel and Soressi 2014b, 106), most of it recovered in the valley of La Creuse, 10-15 kilometres north of the site (Primault 2007, 121). It is interesting to consider this specific choice of raw material, especially since the preferred raw material of the preceding Aurignacians of layer US 04 was locally collected flint (tab. 2.) (Roussel and Soressi 2008, 93).

Table 2. Relationship between raw materials found in US 02 (after Soressi and Roussel 2010, 94).

US 02	Blade/bladelet	Retouched tools	Core	Flakes from reduction	Flake	Total
Local flint	52	1	2	3	78	136
Neighbouring flint (5-20 kms away from the site)	368	29	4	20	590	1011

In total, 2570 lithic artefacts have been recorded since 2006, out of which 117 are tools (tab. 3.) (Roussel and Soressi 2014b, 103**;** Roussel 2015, 71). Flakes are in clear majority over blades in this assemblage, and as of 2014, there are three times as many flakes as blades.

Table 3. Table showing the distribution of registered lithic artefacts from 2006-2015 (after Roussel and Soressi 2014b, 103; Roussel 2015, 71).

Flake / block	Reduction flakes	Blade /lets	Core	Tool	Hammer-stone	Geofact	Undefined
1065	80	713	12	117	5	14	4

The artefacts used to assign the layer to its specific technocomplex (final stage of the Early Aurignacian) are, among others, thick-nosed endscrapers (n=11), fragments of blades with Aurignacian retouch (n=3) and carenated scrapers (n=2) (tab. 4.) (fig. 29) (Roussel and Soressi 2014b, 105, 115; Soressi *et al.* 2013, 80). It has been discussed whether the thick-nosed endscrapers were used as bladelet cores, but since no retouched bladelets have been found, this hypothesis has not yet been proven (Soressi *et al*. 2013, 81).

Table 4. Table showing which artefacts were used to affiliate the technocomplex to its culture (after Roussel and Soressi 2014, 115).

Diagnosed technocomplex	Other tools	Debitage	Cores	Majority of retouched tools

Final stage of the Early Aurignacian	Blades with Aurignacian retouch. Absence of retouched bladelets.	Many large blades and several bladelets with a slightly curved profile.	Blade cores: rare and heavily reduced. Bladelet cores: nosed/carinated with a slim front, along with preforms.	Flat and thick-nosed endscrapers

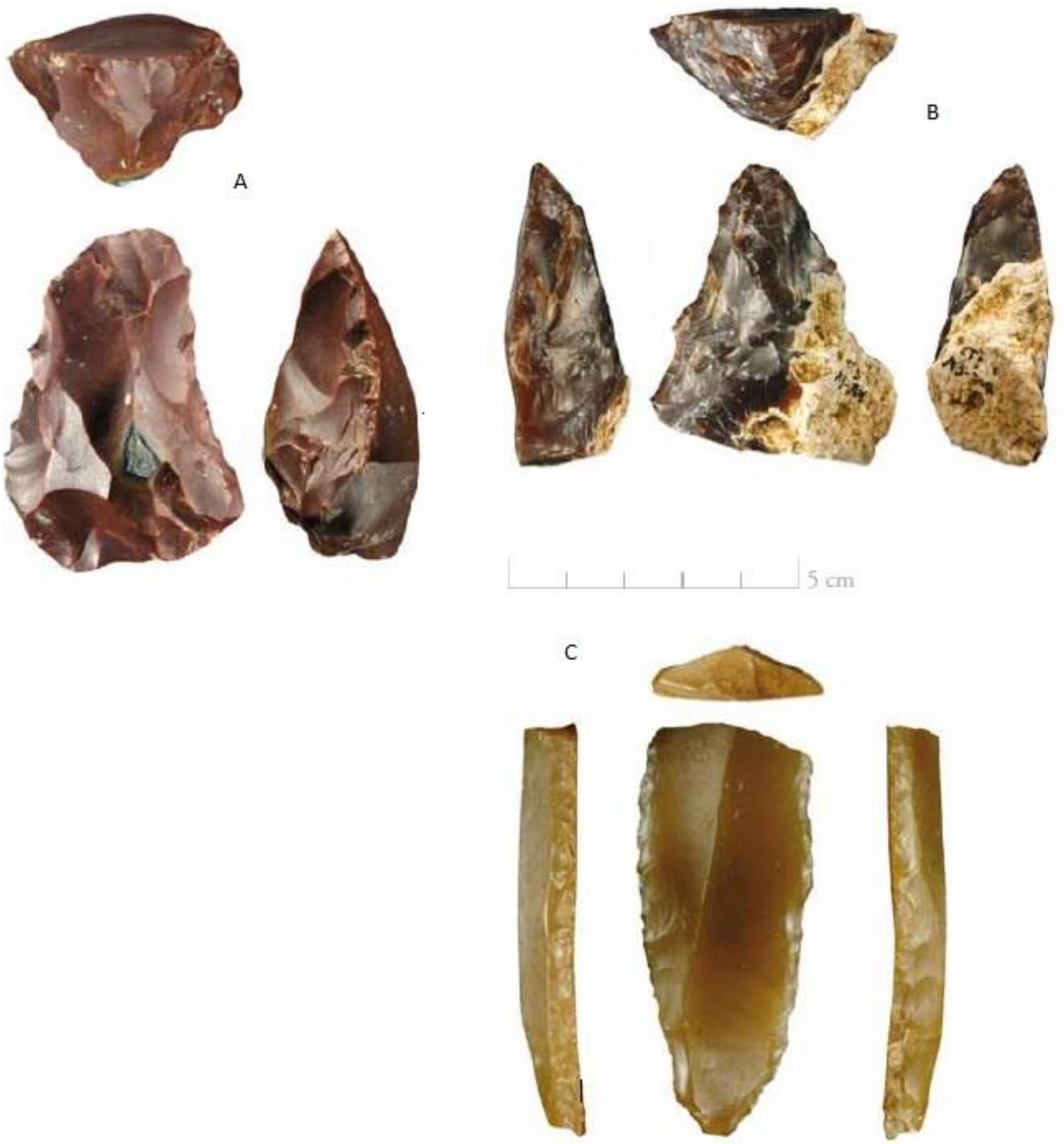

Figure 29. Tools used to determine the affiliation of US 02 to the final stage of the Early Aurignacian. A) Carinated scraper (Z4-498) B) Thick-nosed endscraper (A3-306) C) Fragment of blade with Aurignacian retouch (Y5-57) (after Roussel and Soressi 2007, 133, 143, 167).

Additionally, the assemblage has yielded some interesting features such as what have been deemed as three intentionally broken blades (two medial parts and one proximal). They have no retouch, but nevertheless show signs of use

(Soressi *et al*. 2013, 80). Moreover, since 2006, efforts have been made to establish refits. So far, three sets of refits have been made; a small flake from the lateral part of an endscraper, two flakes from a cortex removal (fig. 30) (Roussel 2008, 147) and six pieces successfully refitted into three, with two additional flakes having been recognized as belonging to the same removal sequence (Soressi *et al.* 2013, 79).

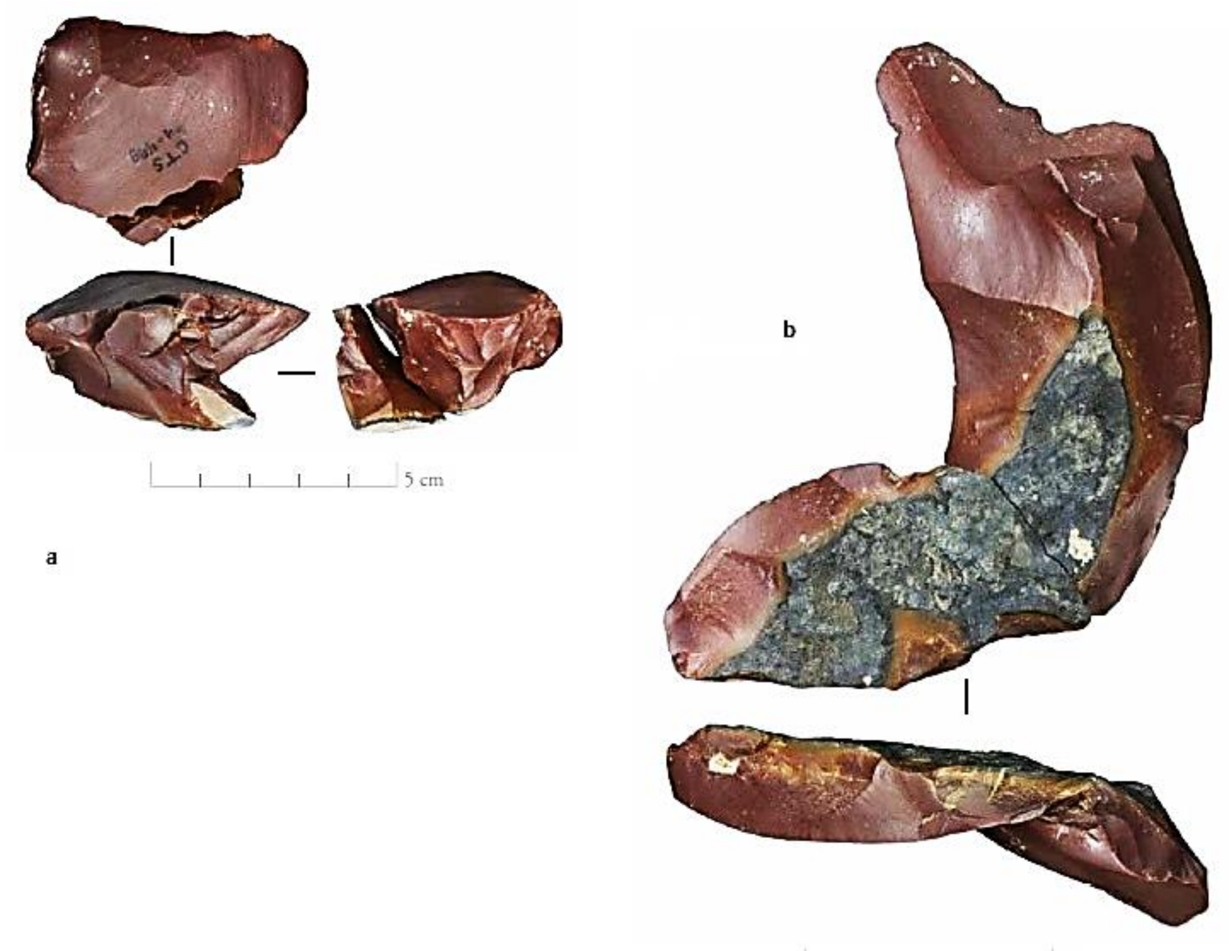

Figure 30. Successful refits from the US 02 lithic assemblage a) flake from endscraper b) flakes from cortex removal (after Roussel 2008, 151-152).

The interpretation of the main focus of the lithic production in this layer is, so far, that of blade manufacture. This implication is supported by the presence of, among other things, core-tablets and flakes removed for core maintenance purposes. This, along with only a small proportion of cortical elements, suggests that the cores were prepared elsewhere and brought to the site as finished products (Roussel and Soressi 2014b, 106). Moreover, in view of the recovery of five burin spalls, it can also be considered fairly certain that production as well as re-sharpening of tools was taking place; especially when taking into account that one of the five burin spalls bears traces of a preceding spall (Roussel and Soressi 2014a, 73). Additionally, the results of a previous micro-wear analysis of three tools has yielded some information about the activities carried out at the site. A burin (W7-11) has been used for grooving in a hard material, a large blade (Z5-118) has a polish that can be related to a cutting motion and an endscraper (S6-536) shows signs of use on at least one part of its front (fig. 31). Unfortunately, because of time constraints, a more precise definition of the worked materials was not achieved for any of the three objects (Pasquini 2009, 185).

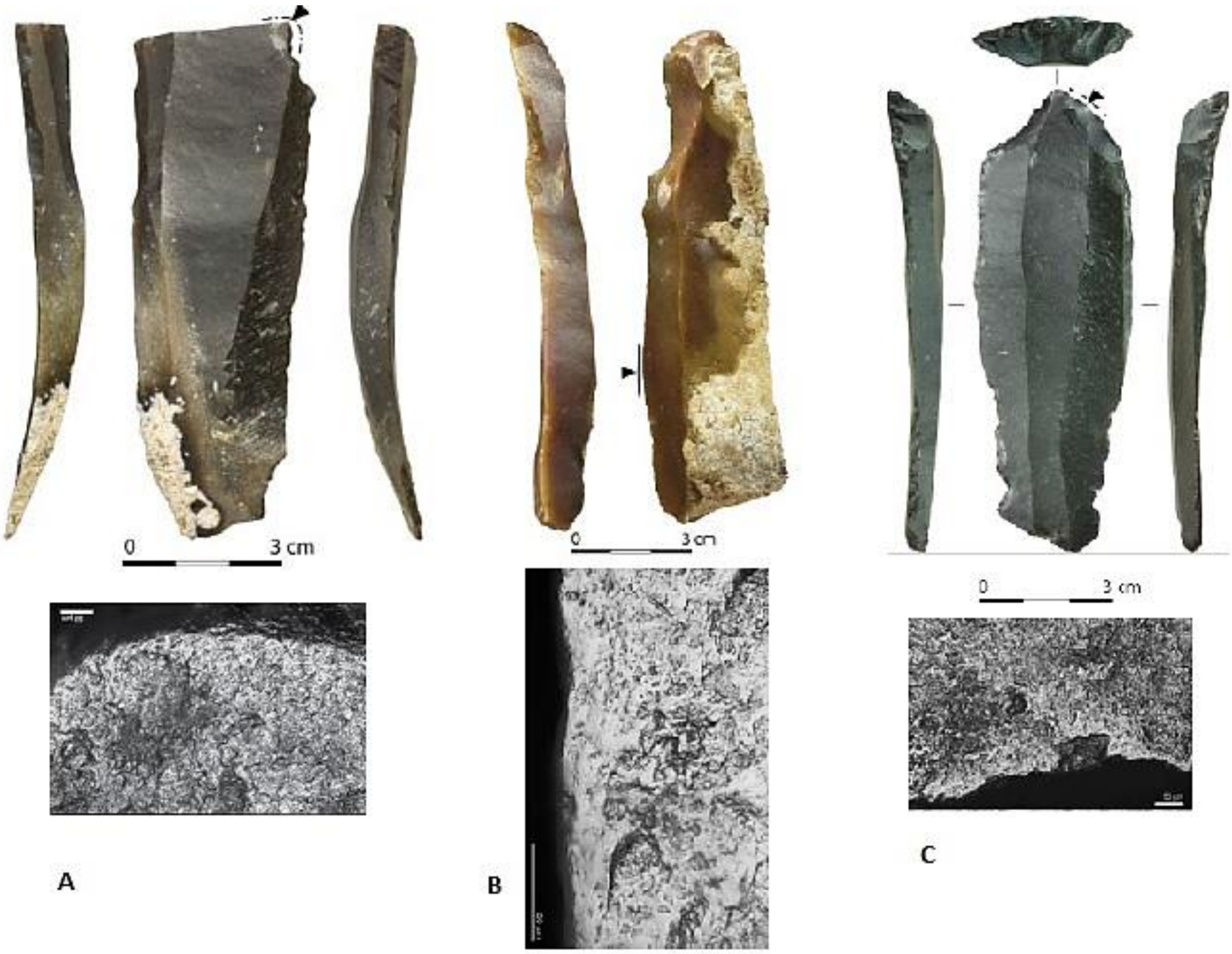

Figure 31. A) The extremity of the burin (W7-11) with wear-traces indicative of a hard material. B) Working edge of blade Z5-118 with indications of a cutting motion C) Endscraper (S6-536) with evidence of use (after Pasquini 2009, 186-187).

It has proven quite difficult to affiliate the assemblage with a specific category of the Aurignacian, as it contains elements suggesting a chronological range from a middle stage of the Aurignacian to the final stage of the Early Aurignacian (Roussel and Soressi 2014b, 108; Soressi and Roussel 2010, 111). However, considering the Upper Palaeolithic nature of the assemblage, with specific attention given to the cores and other retouched artefacts, US 02 has been assigned to the final stage of the Early Aurignacian (Soressi 2015a, 21).

4. Results

The following section treats the results of the micro-wear analysis performed on the three burin/scrapers (tab.5). Within each summary, a figure with some of the mentioned micro-wear will be provided, as well as schematic lithic drawings containing a detailed technological description of each tool (appendices III, V and VII, courtesy of Dr. Roussel 2016). The section will end with a summary of the results, as well as a review of features shared between the three tools. If needed, please refer to (fig. 32) for simple drawings, illustrating the different directions of the tools. Likewise, a compilation of the most common micro-wear traces for each worked material can be found in appendix II. The results of the analysis and indications of worked material, have been made with this compilation in mind under the supervision of Drs. Verbaas, as well as through discussions with Prof. Dr. van Gijn and PhD candidate Garcia Diaz, all three from Leiden University.

As a common rule, because of the rather heavy PDSMs of all three implements, only areas with more than one type of micro-wear (polish, rounding, edge-damage or striations), or areas with a clear intensification of a specific micro-wear have been considered as active parts suitable for inferences of performed tasks and/or contact materials. It should also be noted that the original use of the burin/scrapers is not determinable because of the second series of retouches, effectively removing the traces of the initial use of the re-sharpened edges. Yet, the results from the micro-wear analysis can at least provide us with information about their final use.

Table 5. Table showing the detected micro-wear of each of the three implements as well as suggested contact materials (compiled by the author 2016).

Type of micro-wear	Z7-353	Z7-306	W8-501
Striations	Yes	Yes	Yes
Polish	Yes	Yes	Yes
Edge-rounding	Yes	Yes	Yes
Edge-damage	Yes	Yes	Yes

Suggested contact material/s	Soft/medium	Bone, hard plant, inner bark and soft/medium	Soft/medium

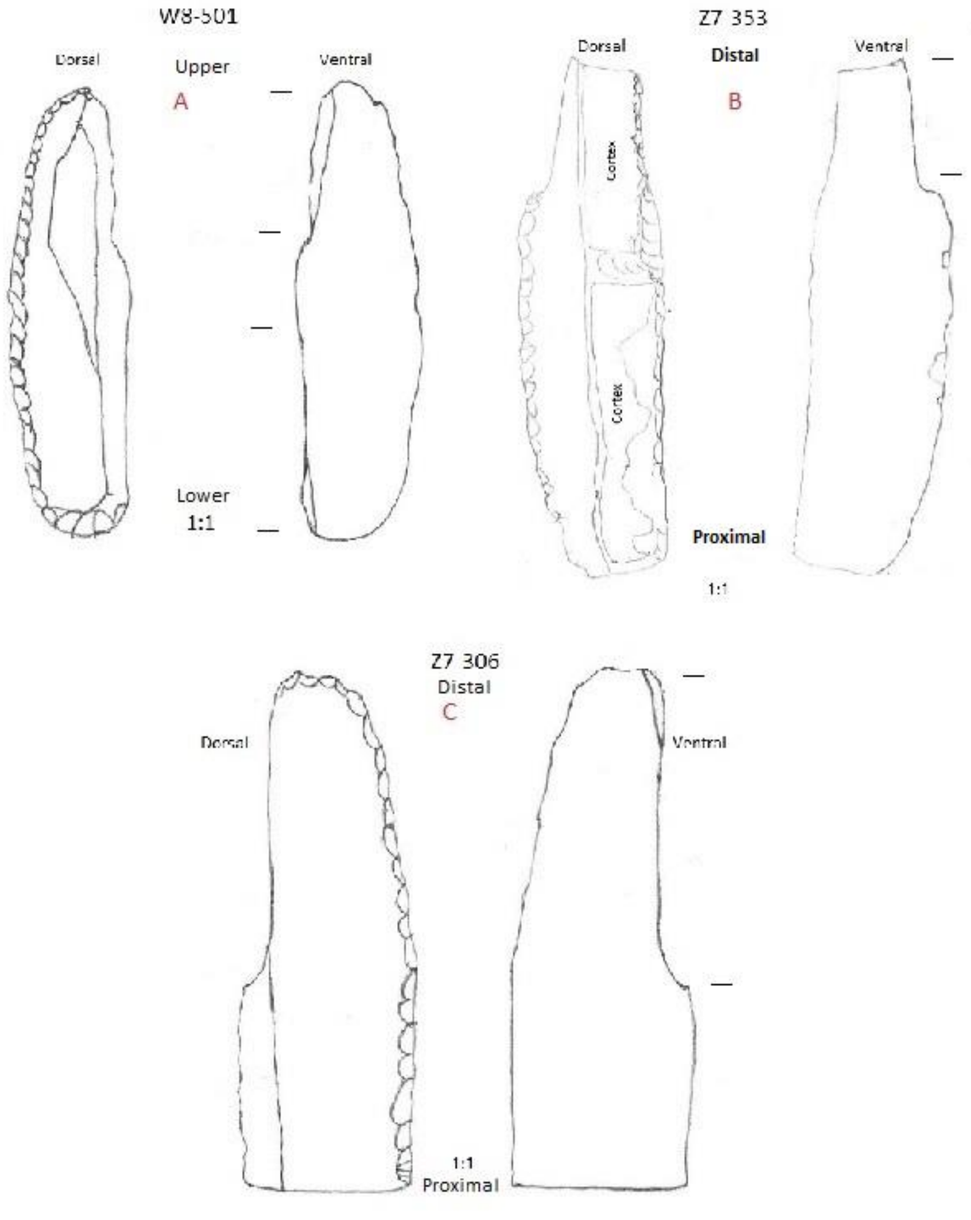

Figure 32. Simple drawings of the three burin/scrapers. Note the retouch on the lateral edges, and the placement of the burin facet/s marked by horizontal lines (drawn by the author 2016).

4.1. Z7-353

4.1.1. Schematic drawing and technological description

Z7-353 is made from a blade of red Confluent flint with a black cortex and a yellow sub-cortex. On the right, lateral edge of the dorsal surface, a strip of cortex remains with a gap on its lower proximal part. The edge has been retouched without affecting the original angle of the edge, creating a retouch with a slightly scaly nature. The butt is well preserved, and has a pronounced lip. The left edge has two burin facets, struck from the same direction, succeeding the retouches along the edge (fig. 33).

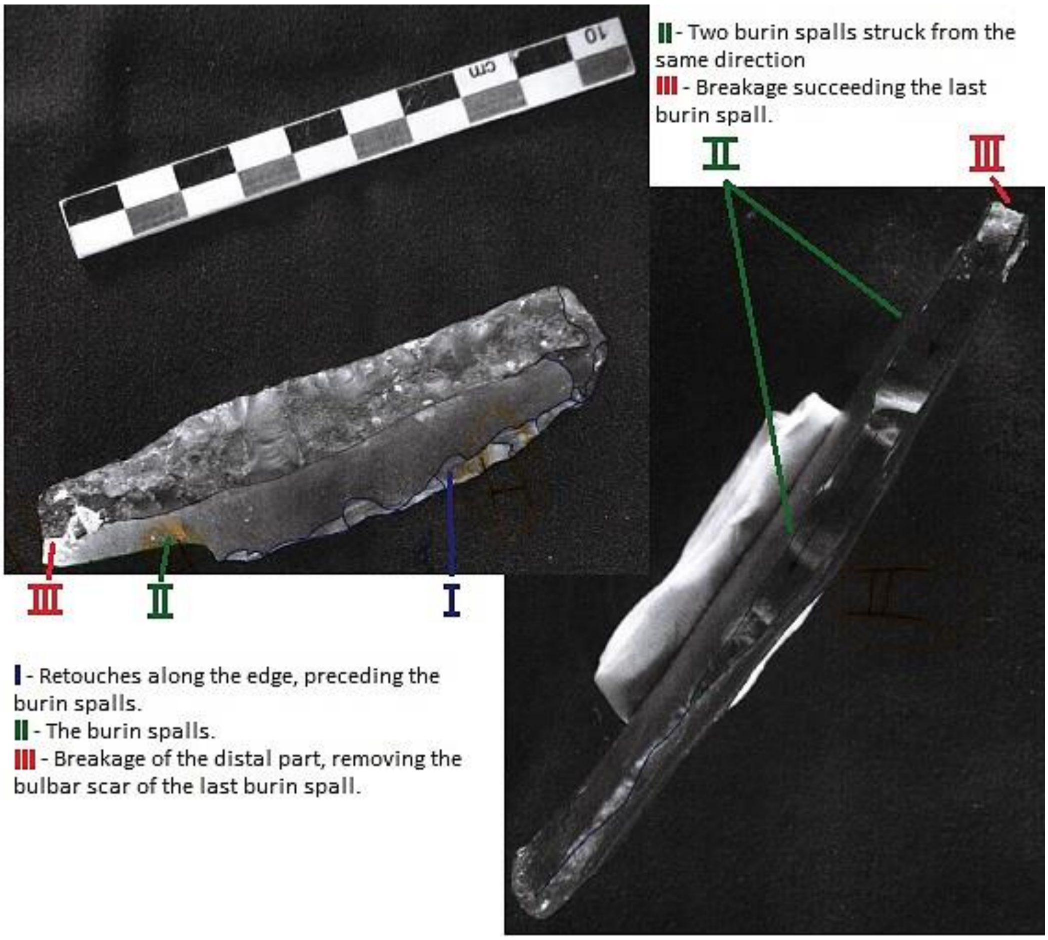

Figure 33. The roman numbers indicate the order in which the different alterations were made. Both lateral edges are retouched. The left lateral edge has two burin facets (appendix III).

4.1.2. Results from the micro-wear analysis

In general, the entirety of the tool is rounded and jagged, retouched as well as un-retouched edges and dorsal ridges. In some areas these wear-traces are more heavily developed than in others, but seeing to their relatively even spread, a post-depositional origin cannot be excluded for most of them. However, some areas have a combination of rounding and other micro-wear, such as polish from soft material and/or more intense scarring, suggesting that at least some of the micro-wear on the edges is use-related.

On the majority of the right ventral edge a combination of edge rounding, transversal striations and a polish derived from a soft contact material is visible. On the distal portion of the opposing edge, the same kind of polish and rounding is visible. Striations are less distinct on this edge, but still definable. Further, especially along the right, lateral edge, use-related retouches, visible on the ventral side are common. The direction of these retouches suggests a transverse motion, rather than a longitudinal one. Very smooth patches of an undefined polish are visible along both edges, especially on the dorsal side.

The entire dorsal ridge is heavily rounded with an adjacent polish on the left side of it, developed from contact with a soft material. On the portion of the ridge next to the gap in the cortex, the polish is visible on the right side of the ridge instead. Moreover, the ridge has striations perpendicular to its direction, spread quite evenly along its entire length. In the area around the distal and medial portion of the dorsal ridge, patches of a very smooth, unidentified polish are present, complete with striations of varying directionality (fig. 34).

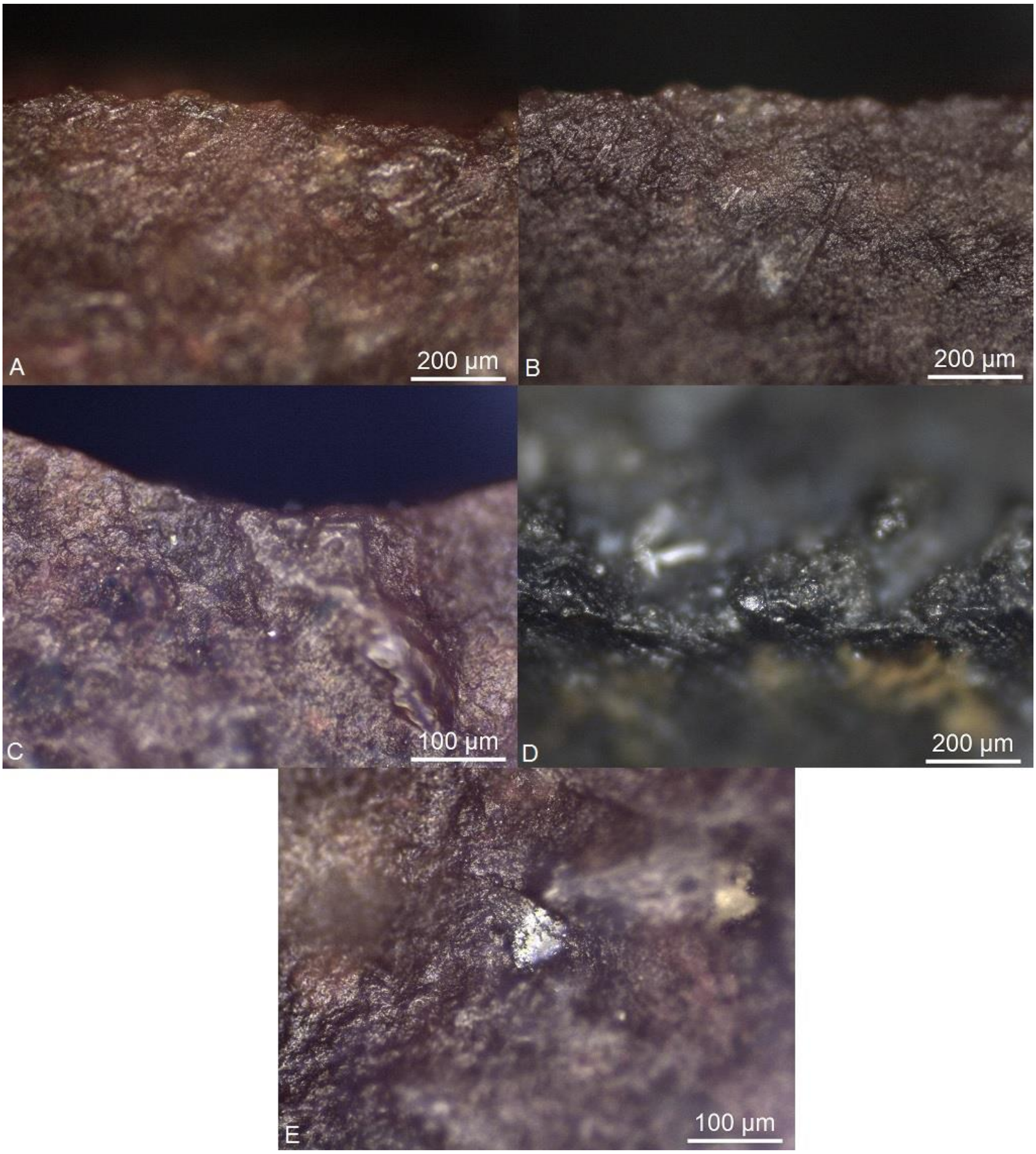

Figure 34. Examples of micro-wear found on Z7-353. See Appendix IV for photograph locations. A) General nature of the edges of the piece: Slightly rounded edges with a jagged appearance (loc. 2). B) The right ventral edge: Transversal striations combined with a slightly rounded edge (loc. 1). C) The left ventral edge: Transversal striations combined with a slightly rounded edge and an unidentified polish (loc. 3.). D) A portion of the dorsal ridge with clear rounding (loc. 6). E) A small patch of an unidentified polish, found on the left dorsal, medial part of the tool (loc. 9) (photographs taken by the author 2016).

The cortex is both rounded and polished from the distal end, up to half the length of the proximal part of the tool. After a small gap where the cortex has been removed, it continues through to the tip of the tool. Some areas also have striations indicative of a transverse motion.

On the proximal burin facet, no particular intensification of micro-wear can be noted. The distal burin facet, however, has an area of increased use-retouch on its ventral side, close to the bend of the facet, with a band of possible polish. On the tip of this burin, as well as along the proximal, ventral side of its edge, an increase in edge rounding can be noted, as well as longitudinal striations. Additionally, spots of a smooth and domed polish are visible on the tip, which together with the other micro-wear traces on this burin, may be considered to be related to bone-working activities (van Gijn 1989, 32).

A patch of polish with clear longitudinal striations reminiscent of MLIT's (Microscopic Linear Impact Traces, often found on projectile points and associated with scarring caused by the impact. As a result, abrasive particles scrape the surface of the flint, creating striations (Fischer *et al.* 1984, 28)) were found on the left, dorsal lateral surface. However, since there are no other traces suggesting that the implement has been used as a projectile (for example feather or hinge terminating fractures of the tips (Fischer *et al*. 1984, 22, 26)), and seeing to the fact that this feature is unique in its appearance, it has been determined to be a PDSM-phenomenon (fig. 35).

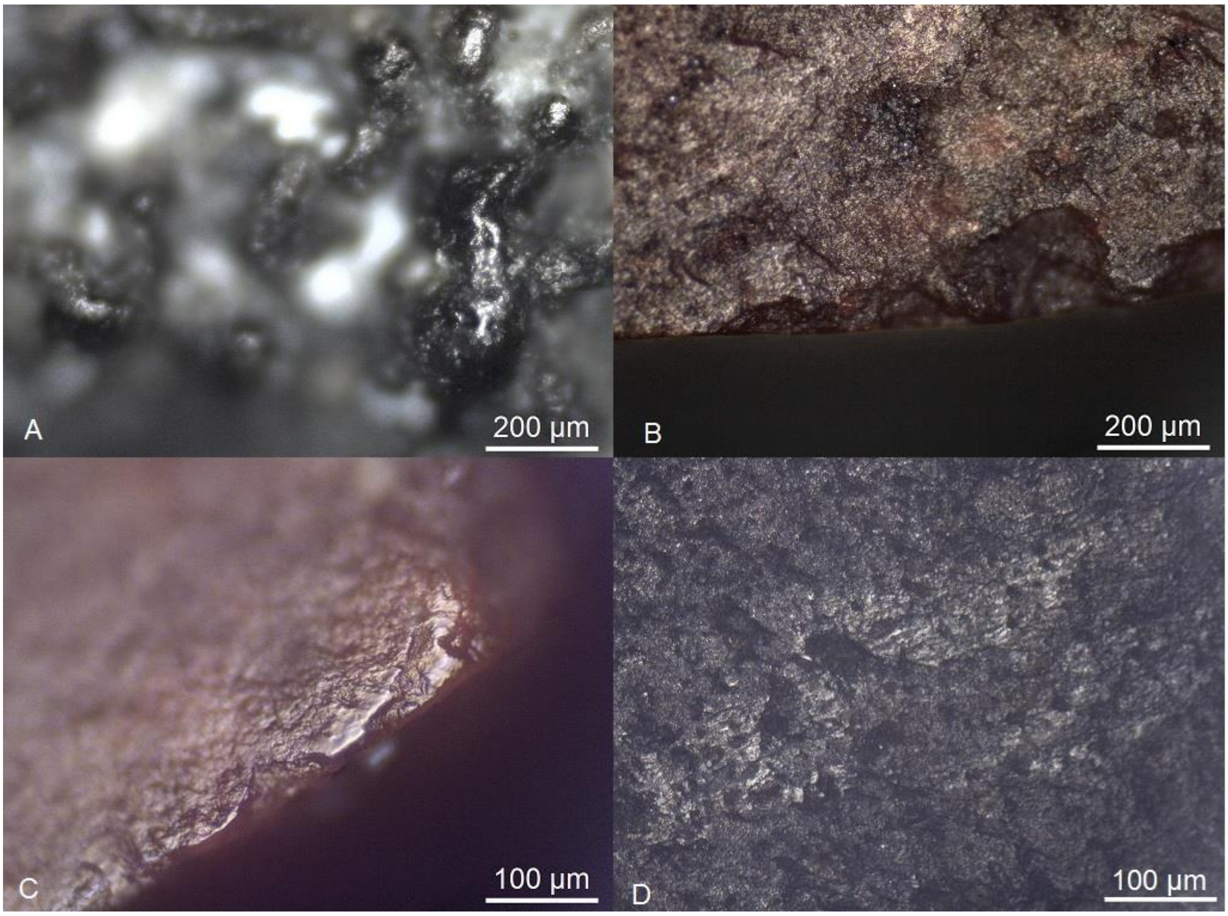

Figure 35. Examples of micro-wear found on Z7-353. See appendix IV for photograph locations. A) Heavily rounded cortex (loc. 7). B) Increased edge-damage close to the bend on the proximal burin facet. The edge is more even on the left side, with a rather abrupt increase of edge damage further to the right (loc. 5). C) Well-developed polish and increased rounding on the tip of the proximal burin facet (loc. 4). D) Patch of polish with clear, longitudinal striations, reminiscent of an MLIT (loc. 8) (photographs taken by the author 2016).

4.2. Z7-306

4.2.1. Schematic drawing and technological description

This piece is made out of a blade of *Turonien moyen* (Upper Cretaceous) flint. The artefact is broken in two, leaving us with the mesio-distal part and no butt. The right side has a low-angled, slightly scaled retouch creating a possible cutting edge. A burin spall was removed from the distal end, most likely from an oblique truncation. There are minor abrasions on the medial part of the left edge, possibly from to the preparation of the burin spall (fig. 36).

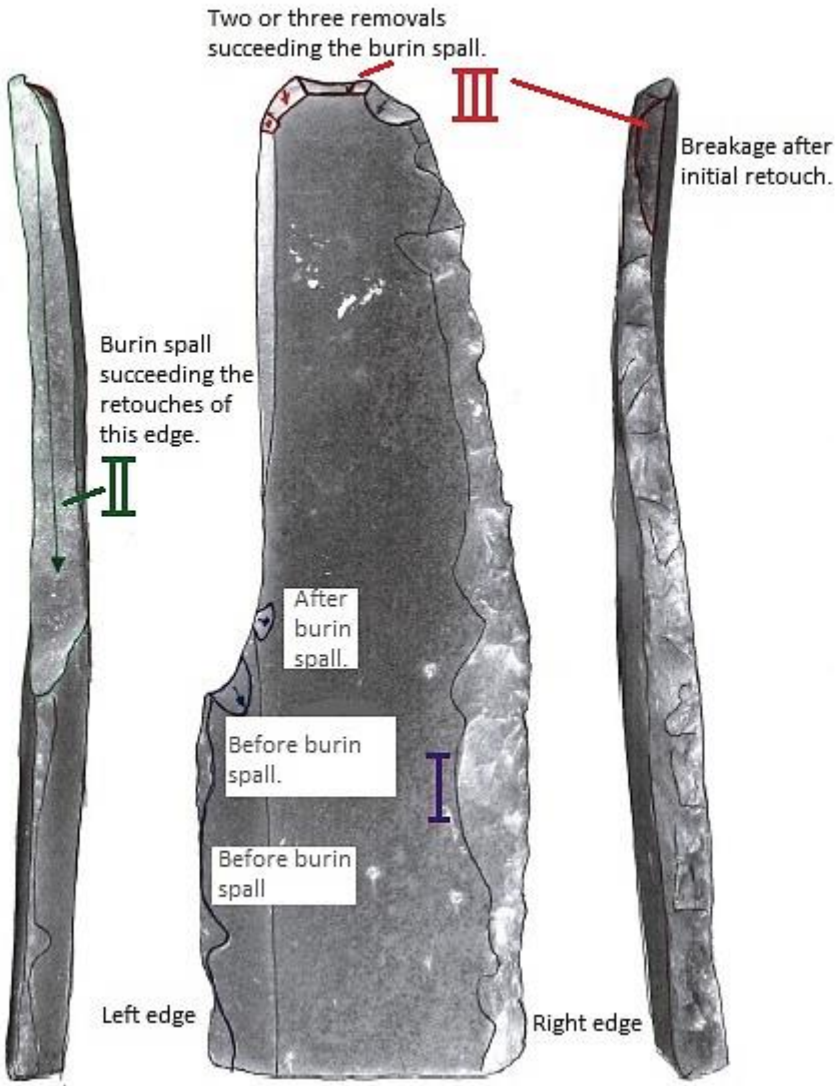

Figure 36. The roman numbers indicate the order in which the different alterations were made. The removals marked in phase III destroyed the platform as well as the bulbar scar of the burin spall (appendix V).

4.2.2. Results from the micro-wear analysis

As an overall rule, the edges and ridges of this piece are more or less evenly rounded and dented, with certain areas more heavily subjected to development of these features than others. Because of the uniform distribution of these micro-wear traces, a post-depositional origin cannot be excluded.

Most of the dorsal ridge of this piece was removed with the removal of the burin spall. What is left of it is consistently rounded and jagged, with an even distribution of striations perpendicular to the edge, as well as some longitudinal examples. The right, lateral edge (following the line of the retouches) on the dorsal side has striations as well, seemingly decreasing the further up on the edge you look. Additionally, on each lower part of the lateral, ventral edges, a polish stemming from a soft contact material is discernible, as well as more developed rounding. However, the dorsal ridge has some spots with very well-developed polish that differs from that found on the ventral, left retouched edge. The polish is indicative of hide as contact material.

Close to the upper part of the tool, on the dorsal side, two patches of an extremely smooth, unidentified polish with longitudinal striations can be seen. Similar patches of polish can be found scattered on the entire inner surfaces of the dorsal as well as the ventral sides, somewhat more concentrated towards the lateral edges (fig. 37).

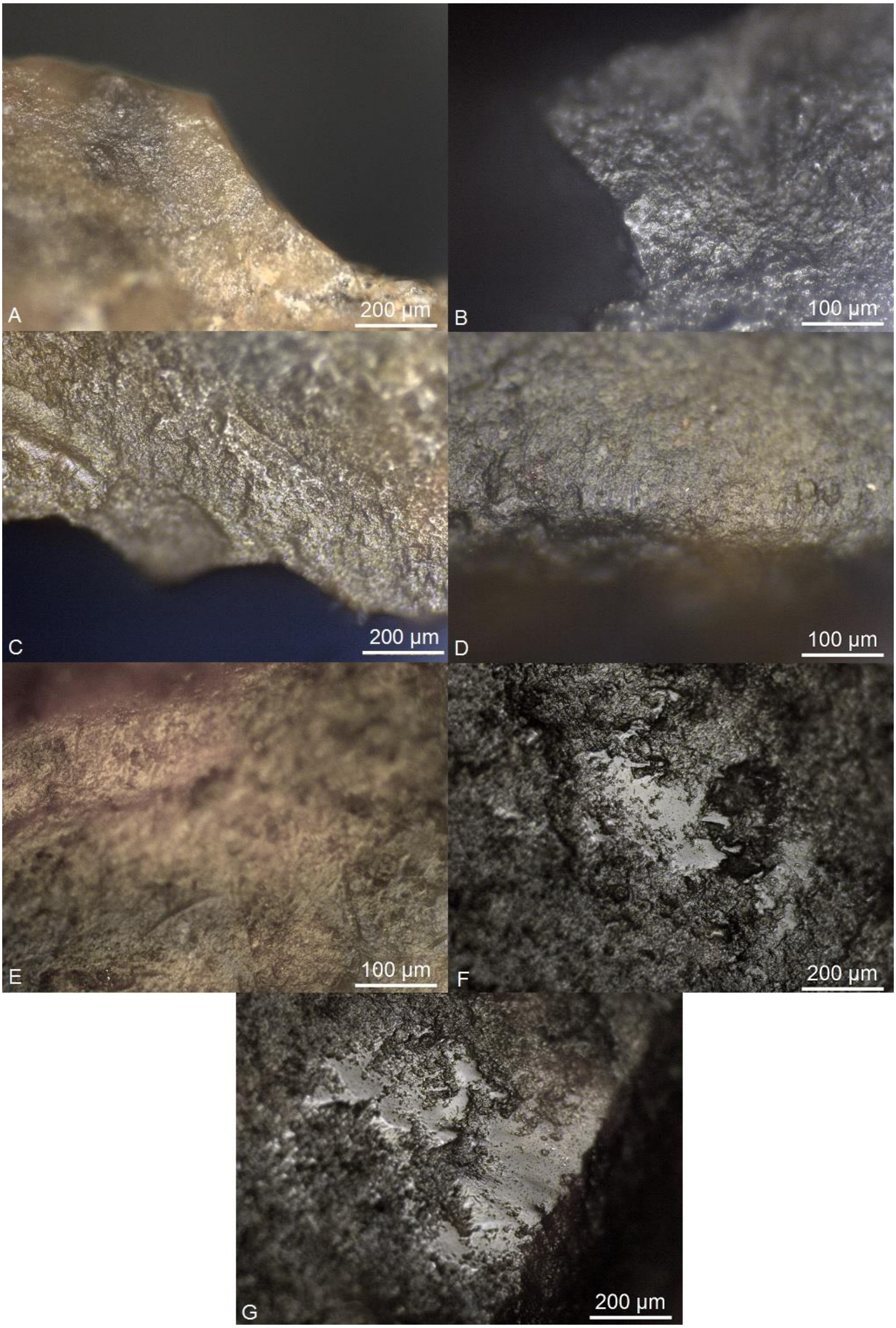
A
200 µm
B
100 µm
C
200 µm
D
100 µm
E
100 µm
F
200 µm
G
200 µm

Figure 37. Examples of micro-wear found on Z7-306. See appendix VI for photograph locations. A) General nature of edges of this piece. Slightly rounded edges with a jagged appearance (loc. 1). B) Left lateral, ventral edge with a polish stemming from a soft contact material (loc. 2). C) Right lateral, ventral edge showing a polish derived from a soft contact material (loc. 3). D) A rounded portion of the dorsal ridge with clear transverse striations (loc. 9). E) Area bordering the retouches of the right lateral edge, with striations (mostly) perpendicular to the edge (loc. 12). F-G) Patches of extremely smooth and unidentified polish. Found on the upper dorsal part of the tool, close to the retouched edge (loc. 13 and 14) (photographs taken by the author 2016).

On the left, dorsal, lateral edge, the burin cuts through the polish, and on the ventral side, the burin facet has a band of greasy looking polish along its edge, differing from that of the retouched portion of the edge. Moreover, transverse striations are clearly visible along the facet, as well as an intensification of edge removals close to the bend of the burin. On the dorsal side of the burin facet, however, the polish differ slightly from that of the ventral side. Here, the band of polish along the edge is thinner, and it has a flaming, slightly pitted appearance that fades into the background, towards the inner surface of the tool. Because of the angle of the edge of the facet, it is rather unfit for most type of woodworking (personal comment Verbaas, 24/11-2016), despite having a polish seemingly indicative of that. A slightly softer contact material, such as hide, inner bark or a medium hard plant material seems more likely in this case (Keeley 1980, 61). A third type of polish is found on the pointy tip of the burin facet. A local distribution along the edge and on elevated features, extensive pitting resulting in a rough appearance in high magnifications and a pronounced amount of rounding and scarring is highly expressive of bone-working (Keeley 1980, 43). The directionality of the breakage in the scarred area indicates a scratching motion, which is further strengthened by the spread of the polish and the very local and intense rounding of the tip (fig. 38).

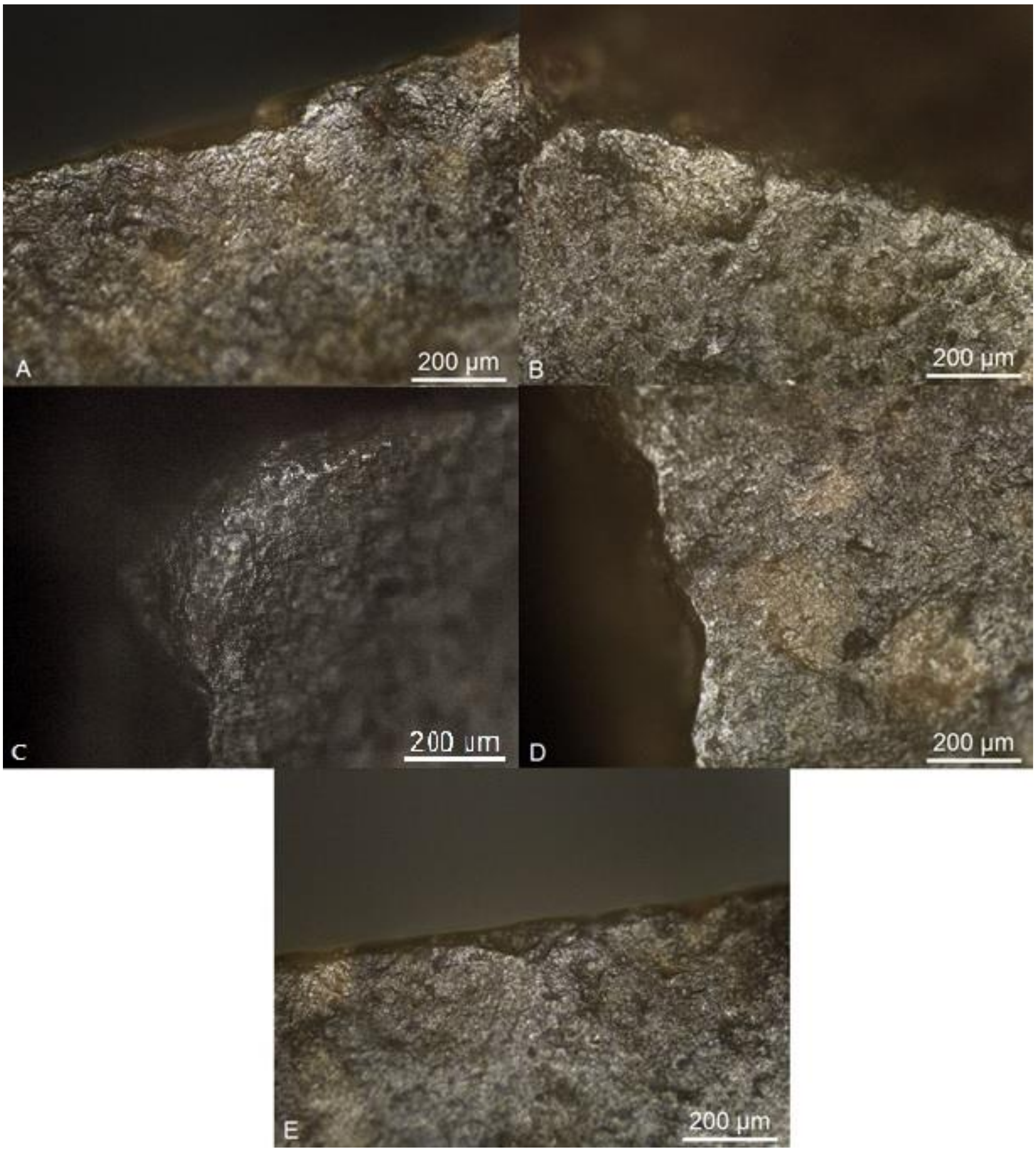

Figure 38. Micro-wear found on the burin of Z7-306. See appendix VI for photograph locations. A) A band of "greasy"-looking polish on the ventral side of the burin facet (loc. 10). B) Polish on the dorsal side of the burin facet. Slightly more pitted and "flaming" than that of the ventral side, indicating different contact materials (loc. 8). C) The tip of the burin, with distinct rounding and adherent polish (loc. 15). D) Very well-developed polish connected with the rounded tip of the burin (loc. 6). E) An increase in edge removals close to the bend of the burin facet. The left portion of the edge is more uniform, while the right side is more uneven (loc. 11) (photographs taken by the author 2016).

4.3. W8-501

4.3.1. Schematic drawing and technological description

W8-501 is made from a blade of *Bathonien* (Middle Jurassic) flint from the Benaize valley. The implement has two visible series of retouch on the edges, one of which removed the butt. Furthermore, the upper burin facet possibly has a negative of a preceding spall, while negatives of removals preceding both burin spalls suggest that the edge now comprising the burin facets, was initially retouched (fig. 39).

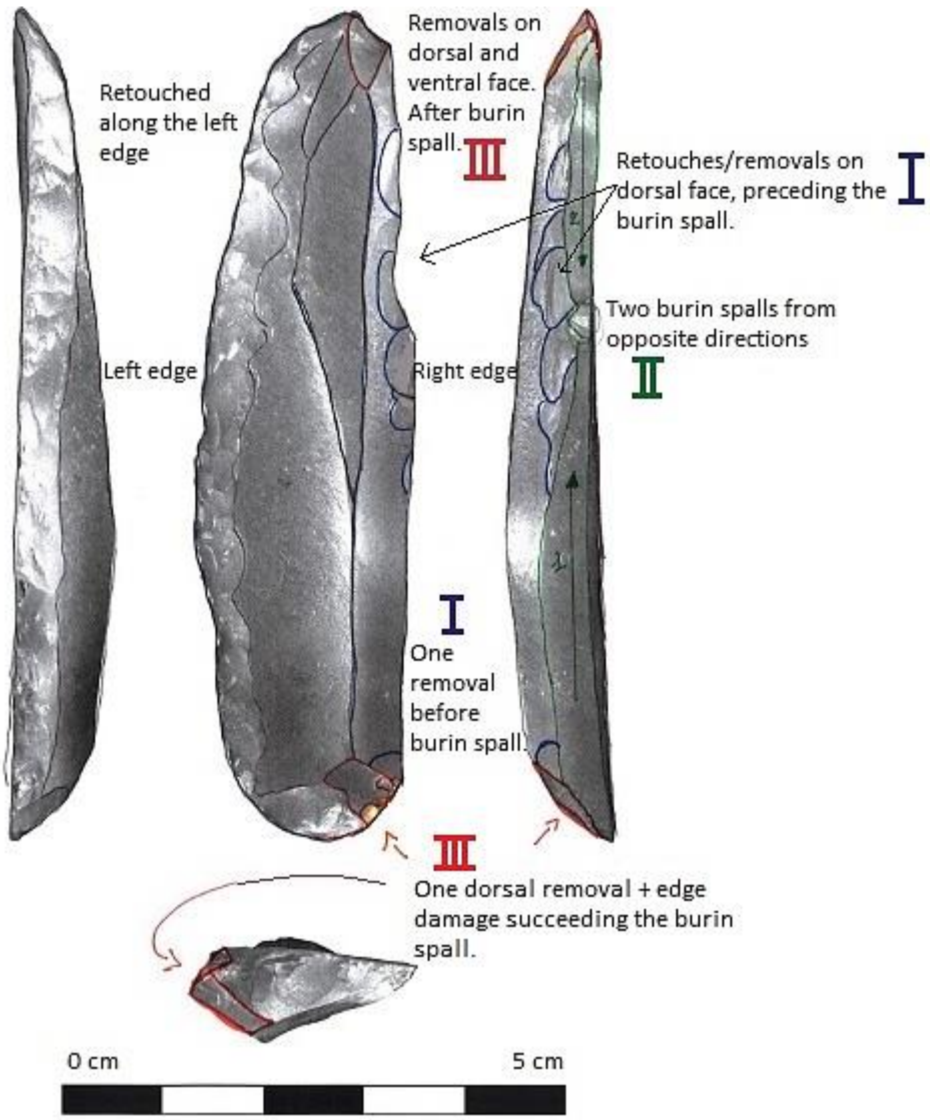

Figure 39. The roman numbers indicate the order in which the different alterations were made. There are no bulbar scar on any of the burin facets. It has not been possible to determine whether the retouch on the left (cutting) edge was made before or after the addition of the burin (appendix VII).

4.3.2. Results from the micro-wear analysis

The surface of this implement is heavily affected by PDSM, resulting in a greasy looking polish covering the entire surface, as well as an even distribution of edge damage and edge/ridge rounding. Due to the amount of PDSM, this piece has been deemed too badly preserved to be able to produce any reliable interpretations from a micro-wear analysis. However, since there are traces of use visible on the tool, they will be presented below, but because of the PDSM, only very general conclusions concerning the micro-wear will be made.

The edges are in general evenly rounded and have a uniform distribution of edge damage, with some areas showing more intense developments. For instance, the lower distal edge has been subjected to heavy rounding that slightly continues onto the lower burin facet of the right, lateral edge. Additionally, minor transverse directionality is visible close to the facet, and an intensification of the jagged appearance of the edge is visible adjacent to the bend of the uppermost burin facet, as well as a slightly more developed rounding of the tip.

The inner surfaces of both the dorsal and ventral sides, as well as the right portion of the dorsal ridge have scattered patches of a well-developed, unidentifiable polish. The right, dorsal ridge, as well as the patches of polish found on it, have an even distribution of striations perpendicular to the ridge (fig. 40).

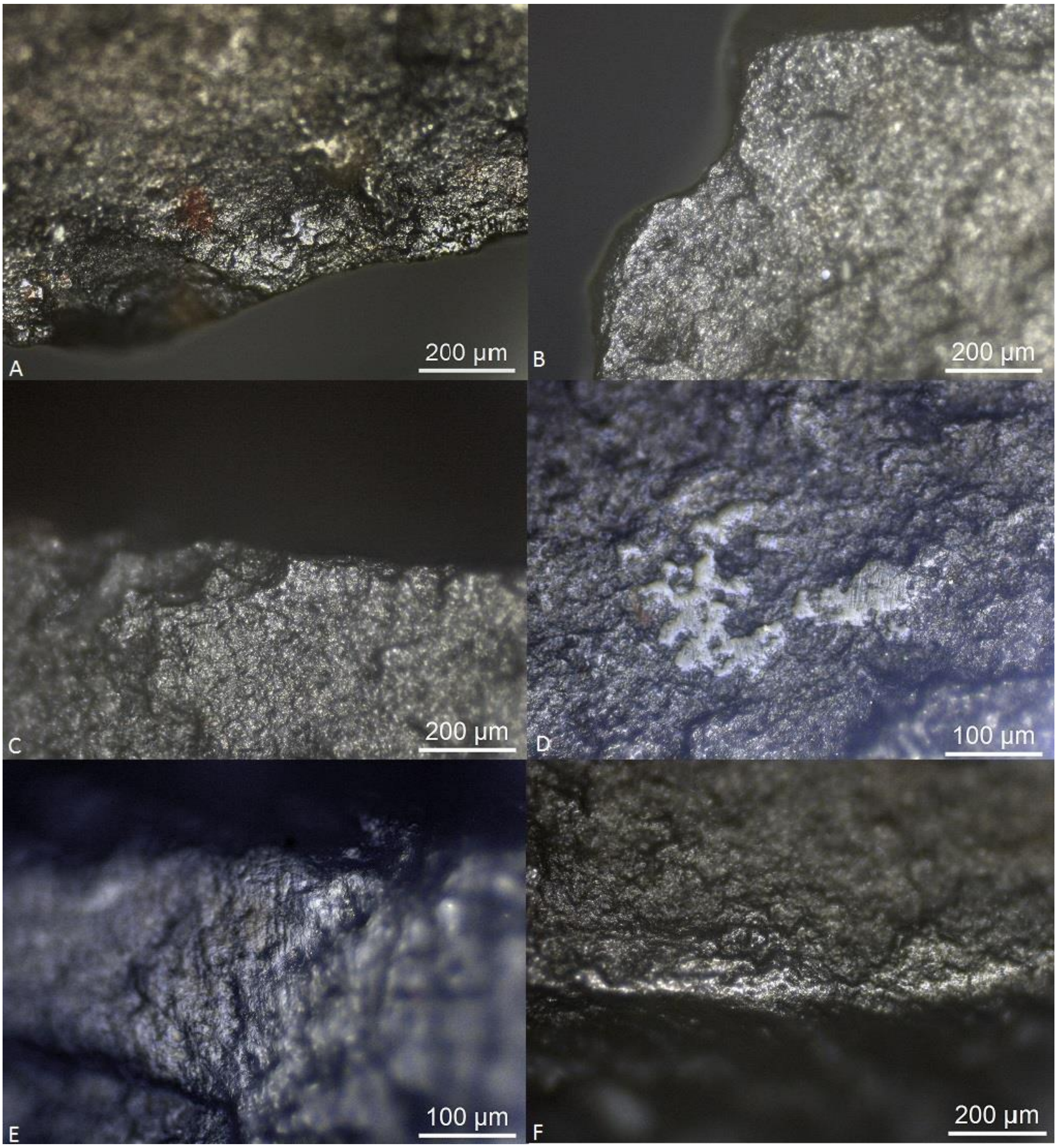

Figure 40. Examples of micro-wear found on W8-501. See appendix VIII for photograph locations. A) An area with heavily developed PDSM: Greasy polish covering the surface. Edge damage and slight edge rounding (loc. 2). See fig. 22 B for a comparison. B) Edge rounding on the lower, distal edge. Probably from use (loc. 5). C) Increased edge-damage close to the bend on the burin facet. The edge is more even on the right side, with a rather abrupt increase of edge damage further to the left (loc. 4). D) One of the patches of unidentified polish found on the inner dorsal surface. Note the striations (loc. 3). E) Striations on the dorsal ridge, perpendicular to its direction. F) Polished area on the dorsal ridge (loc. 1) (photographs taken by the author 2016).

4.4. Shared features

Apart from the previously mentioned indications of hafting or wrapping, certain features have been noted on all three of the tools. For example, there is an area of increased edge-damage close to the bend of the burin facet on all three tools, and the burin spalls seem to have been removed after the initial retouch of the lateral edges. In an attempt to find an explanation for the increased edge-damage close to the bend in the burin facet, a rather cursory search through relevant literature was undertaken. However, no similar examples were found. In thinking that the scarring in the burin bends could be linked to the manufacturing process, three replicas of the burin/scrapers (courtesy of Dr. Roussel) were examined for comparative reasons. Two of the experimental pieces had been used to carve and scrape bone and wood respectively, for 20 minutes each, while the third one was unused. Neither of the three experimental tools showed any increased scarring near the bend. Since all three of the burin/scrapers display this phenomena, it is tempting to attribute it to some kind of use. However, until further analysis has been made, this feature will have to remain unexplained.

The retouches along the edges of the tools are low angled and scaly and never affects the angle of the edge, nor the delineation. The burin facets are always opposing one of the lateral edges, rather than joining it in a pointed angle on one of the peripheral edges (see fig. 20 for a more typical example of a combined burin and scraper), and the negatives of the bulb from the burin spall(s) are consistently missing.

Apart from the evidence of bone-working on the tip of the burin on Z7-306, the contact materials with which the tools have been used seem to have been rather similar, with soft to medium hard materials such as hide, soft wood and hard plants as the most plausible ones.

On both the ventral and dorsal surfaces of each tool, randomly scattered patches of polish in varying sizes can be seen. It has not been possible to assign the polish to a specific contact material, or to determine for certain whether or not it is the same type of polish.

Lastly, W8-501 and Z7-353 exclusively share two features. Firstly, both implements have negatives of edge-removals that precede the removal of the burin spalls, indicating at least two series of retouch. Secondly, the fact that they both have two burin spalls can be indicative of a desire to create one, continuous, burin facet. After removing the first burin spall, without reaching the desired length, a second spall was removed in order to elongate the facet.

4.5. Evidence of hafting

As it was initially suggested that the distinct morphology of the burin/scrapers might have been the result of morphological changes to facilitate hafting, micro-wear suggestive of hafting was specifically sought after. Features such as a clear border of differing wear-traces, areas of increased scarring (fig. fig. 35 B), differing polishes and striations (often perpendicular to the edge) (see fig. 37 D) were all found in the micro-wear analysis. Potential bright spots (fig. 41) have also been located (tab. 6**)**. Lastly, retouched areas to create a larger surface for a potential adhesive, as well as proximal (or distal) thinning of the implements were both established through an ocular inspection.

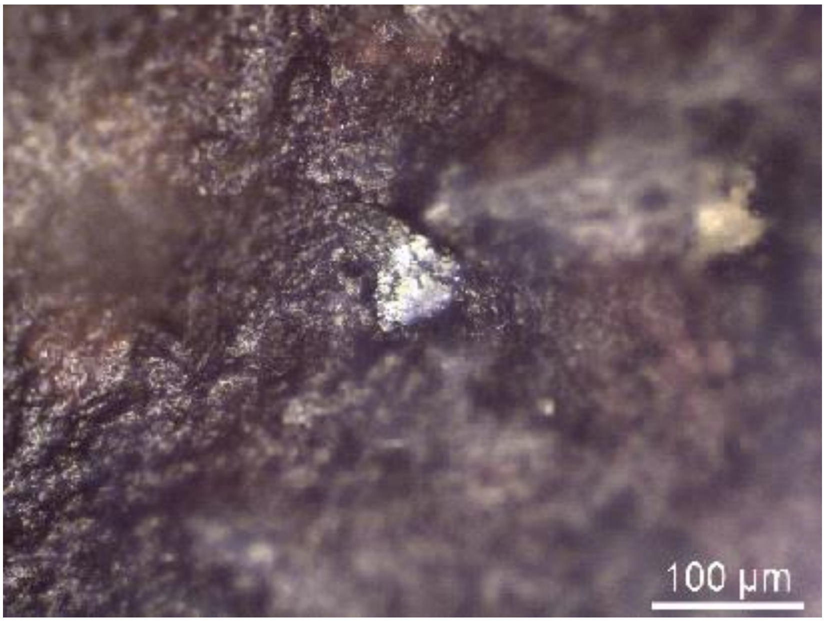

Figure 41. An unidentified patch of polish, possibly a bright spot. Located on the medial dorsal surface of Z7-353 (loc. 9. in appendix IV) (photograph taken by the author 2016).

Table 6. The most commonly used micro-wear traces for identification of hafting on lithic implements, here applied to the burin/scrapers. In this case, the features are referring only to

hafting; the same tool can, of course, have different polishes without it having been hafted (compiled by the author 2016).

Hafting	Striations on ridges	Striations on other surfaces, perpendicular to the edge	Increased scarring in a specific area	Bright spots	Distinct micro-wear changes along the edges	Differing polishes
Z7-353	Yes	Yes	Yes	?	?	?
Z7-306	Yes	Yes	Yes	?	Yes	Yes
W8-501	Yes	?	Yes	?	?	?

The micro-wear analysis showed that all three of the burin/scrapers carry traces that can be related to some kind of haft or wrapping, noting that for W8-501, due to the PDSM, it is not possible to determine this with as much certitude as is possible for Z7-353 and Z7-306. A more reflective discussion of the possibility of hafting and/or wrapping can be found in chapter 5.4.

5. Discussion

The aim of this thesis research is to, through micro-wear analysis of the burin/scrapers, extract information about the site function and/or tasks performed at Les Cottés. As a consequence, behavioural traits of the manufacturers of the three burin/scrapers may be indicated, which can later be used for comparisons between AMH and Neanderthal behaviours.

In the following chapter, the results of the micro-wear analysis will be discussed, together with the results of analyses from the faunal as well as the lithic assemblages. Following an initial discussion concerning the limitations of micro-wear analysis, thoughts concerning the detected micro-wear will be discussed in separate units. First, possible explanations applicable to all of the tools regarding their morphology will be discussed, followed by an individual assessment of the micro-wear of each piece. On the basis of the interpretations of the micro-wear traces and the results from analyses of the faunal and lithic assemblages, I will discuss possible site functions, and/or tasks performed at the site.

In similarity with the results of the micro-wear analysis, many of the interpretations presented in this chapter are the results of consultation with the compilation in appendix II as well as discussions involving Drs. Verbaas, Prof. Dr. van Gijn and PhD candidate Garcia Diaz.

5.1. Limitations of micro-wear analysis

After the initial mapping of micro-wear, the following step in micro-wear analysis is to connect the dots, and try to infer a possible use and/or contact material for the implement in question. For this particular thesis research, it became evident rather quickly that this was easier said than done. The large variety of different micro-wear and their placement, as well as differing polishes and certain deviant features made it clear that there were no easy answers to what the function of the three burin/scrapers was. This realization sparked a discussion about the limitations of micro-wear analysis as a method, and how these limitations become evident when the method is employed on complex artefacts such as the burin/scrapers. Since the results of my research rely on micro-wear analysis, I consider it necessary to address the limitations of the method, especially since they became rather evident along the way.

One of the cruxes of micro-wear analysis, is that the final result derives from a series of subjective interpretations made by the analysist (van Gijn 2014, 168). In order to remove some of the subjectivity from the interpretations, attempts to quantify and standardize micro-wear traces have been made, as well as efforts to incorporate new technology such as laser scanning confocal microscopy (van Gijn 2014, 166). However, it is vital to acknowledge that the connection between people and artefacts is too complex to be interpreted by hard science alone. A certain degree of interpretation is necessary in order to account for engagements such as the re-use and transportation of a tool, and the resulting micro-wear (van Gijn 2014, 167).

Moving beyond subjective interpretation for a moment, there is also a need to discuss the technological issues of the method. The use of a metallographic microscope with incident light, is standard when performing micro-wear analysis. The high magnifications often available (up to 1000x depending on the microscope) allows for a very detailed picture of the analysed artefact. However, in order for all traces to be visible, and the visual scope to be clear, the surface that is investigated must be angled at a 90° angle to the source of light. If this requirement is not met, the analyst runs the risk of missing micro-wear traces, and consequently deriving erroneous results (van Gijn 2014, 167).

When trying to connect the dots of micro-wear found on the burin/scrapers, the above mentioned issues were all encountered. The amount and nature of the micro-wear found, bears witness of a very long use-life, as well as multiple areas of use. This makes it difficult to define which micro-wear traces belong together and can be connected to the same task. In some cases, an analysis of the micro-stratigraphy of the micro-wear can produce a chronology that might help answering such questions. Unfortunately, due to time constraints, that kind of analysis was not possible for this thesis research. Moreover, during the mapping of the micro-wear of the burin/scrapers, "new" traces sometimes appeared on areas that had already been analysed. Most likely, this resulted from placing the pieces in different positions, thereby changing the angle of the tool against the source of light. These changes rendered it possible to detect additional micro-wear traces which would otherwise have remained unnoticed. Further, it also highlights the issue that an analysis might overlook crucial micro-wear that could affect the interpretation of the tool. In light of these facts, it can be discussed how much time should be spent on each tool in order to ensure thorough analysis of much micro-wear traces, and if it is possible to know when an artefact has been sufficiently analysed. Obviously, this is a matter of how much time is available to do the analysis, the sample size and the complexity of the tools, but also about the amount of experience of the analyst. For an inexperienced analyst, the process takes more time and the results cannot be expected to be as accurate as those of an experienced analyst.

However, irrespective of the level of experience of the analyst, micro-wear analysis cannot always provide a definitive answer regarding the function of a tool, despite reasonable time-frames. A case in point is a perforated and delicately decorated antler object, found on the Iron Age site of Wateringse Veld in the Netherlands. Its function is still unknown, despite it having undergone several kinds of analyses, one of which was micro-wear analysis (Rijkelijkhuizen *et al*. 2015). Through the micro-wear analysis, it was possible to define certain manufacture-related features. For instance, a deviance in the furrows constituting the patterns is visible on a microscopic level. This is explained by a dent in the tool used to produce the furrows (Rijkelijkhuizen *et al*. 2015, 64). It could also be established that the object was strung through the perforations by some kind of soft-material band, probably leather or hide, and that it was not very tightly tied, but had space to move around (Rijkelijkhuizen *et al*. 2015, 66). Despite this detailed information, clearly showing that a thorough analysis has been performed, it was not possible to determine the function of the antler object. It was, however, possible to rule out some previously suggested functions (Rijkelijkhuizen *et al*. 2015, 68).

During the interpretational process of the micro-wear traces of the burin/scrapers, it became obvious that the same micro-wear trace could be used to argue for several different contact materials and actions. For instance, a polished area on the dorsal ridge of W8-501 (fig. 40 F) was discussed as being the result of friction and abrasion caused by transportation (chapter 5.3.), while it was later used to argue for evidence of prehension traces (chapter 5.4.). These conflicting interpretations are yet another good example of the limitations of micro-wear analysis; a number of micro-wear traces are present which can be combined in a variety of ways, resulting in very different interpretations of the function(s) of a tool and consequently also the origin of the traces. Evidently, it is not always possible to directly decide what types of micro-wear can be related to the same function. In those cases, inferential leaps will have to be taken based on the likelihood of micro-wear being related, which might be more indicative of one activity than another (van Gijn 2014, 168). However, in cases where there is a large amount of insecurity when it comes to the interpretation of the micro-wear (because of poor preservation or PDSM, for example), it is advisable to refrain from too large leaps of logic, and settle a simple interpretation of whether it was ”used” or “non-used”.

The mentioned antler object as well as the three burin/scrapers, are very good cases documenting the limits, as well as possibilities, of micro-wear analysis. A detailed picture of *how* an object has been used can be painted, but *on what material* and for *what purpose* may not always be as easily defined.

5.2. Recycling of lithic implements

When analysing a lithic assemblage, artefacts are sometimes encountered that do not fit into any of the conventional typological boxes (*sensu* Bordes). This is the case with the three burin/scrapers from Les Cottés. The reasons that the tools might deviate in this manner could be many: Personal preference, experimentation by the knapper, natural causes such as trampling (Andrefsky Jr 2005, 83), morphological adaptions in order to suit a specific purpose (such as proximal thinning to simplify hafting), and so on (Rots 2011, 283). However, recent research has shown that recycling of lithic implements was an integrated part of the societies of both AMH and Neanderthals, which tells us something about their behavioural tendencies, and provides us with a more elaborate understanding of lithic assemblages (Barkai *et al*. 2015, 1). The possibility of recycling as an explanation for the morphology of the burin/scrapers will be discussed in chapter 5.2.3., following an introduction to lithic recycling and maintenance, as well as an account of the evidence for these activities in other Aurignacian assemblages.

The phenomenon of recycling is often being discussed in terms of how firmly incorporated it was in the lithic production-cycle. Some researchers assert that recycling was intended from the very onset of the tool production, on account of the scarcity of raw-material (Bamforth 1986, 48-49). Others regard recycling as a practice only employed if there is an urgent need for it (Barkai *et al*. 2015, 2). However, numerous studies suggest that recycling activities were widespread, both geographically and temporally. After all, it has been documented in all from Lower Palaeolithic (Qesem cave, Israel), Middle Palaeolithic (Fonseigner and Saint-Amand-les-Eaux, France) and Upper Palaeolithic (Roc-aux-Sorciers and Champrevert, France) assemblages (Barkai *et al*. 2015, 2-3; Belfer-Cohen and Bar-Yosef 2015; Cuartero *et al*. 2015).

A few criteria have been established to facilitate the detection of recycling in lithic assemblages. Unfortunately, there does not seem to be a consensus regarding terminology, so that the same features discussed in different articles might be termed differently (Barkai *et al*. 2015; Belfer-Cohen and Bar-Yosef 2015; Cuartero *et al*. 2015). One of them, and indeed the most manifest evidence for recycling, is the occurrence of two, or more, different patinas on the same artefact (Barkai *et al*. 2015, 1; Belfer-Cohen and Bar-Yosef 2015, 256; Cuartero *et al.* 2015, 113). Differing patinas suggest that enough time has passed between the completion of the original tool and the retouching of it into a new one for a patination to have developed on the previous shape. As patination develops at different rates depending on the depositional environment, this feature may also indicate that considerable time had passed between the deposition of the original tool and the recycling process. Naturally, a tool may be recycled before it has the possibility of developing a patina. Therefore, double patination should not be considered crucial for assessing whether an artefact was recycled or not (Belfer-Cohen and Bar-Yosef 2015, 256).

Excavation notes from both Middle and Upper Palaeolithic sites in the Levant (Erq el Ahmar and Sefunim cave, for instance) excavated in the 1950's, mention tools, mainly endscrapers and burins, with double patination (Belfer-Cohen and Bar-Yosef 2015, 258). At the time, these tools were interpreted as having been discarded during manufacture, and the possibility of them having been recycled was not considered (Belfer-Cohen and Bar-Yosef 2015, 259). The facts suggest that recycling was, in all likelihood, a regular practice on many Palaeolithic sites and that a re-examination of relevant assemblages might help our understanding of the phenomenon.

A second feature, generally construed as recycling is when it can be determined that the initial morphology of a tool has been changed to suit a different purpose, as is the case for some of the tools in the Aurignacian layers of the Hayonim and Kebara caves in Israel (Belfer-Cohen and Bar-Yosef 2015, 256). At these sites, Upper Palaeolithic tools were sometimes made on either tools or blanks from the preceding Mousterian, Middle Palaeolithic, assemblages (fig. 42) (Belfer-Cohen and Bar-Yosef 2015, 258).

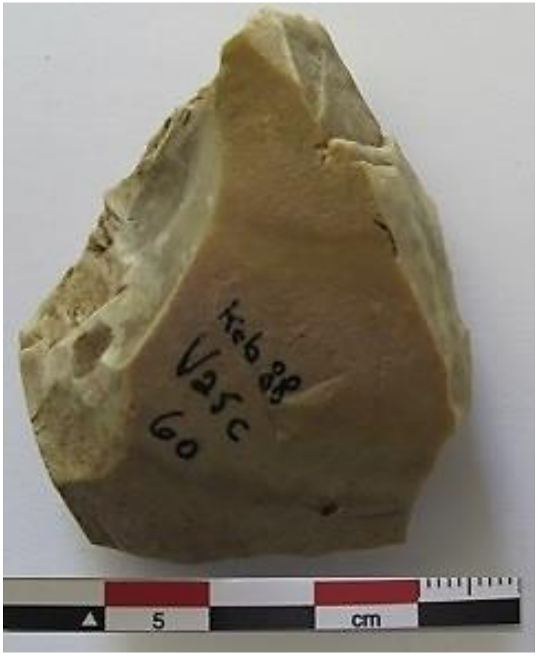

Figure 42. An Aurignacian nosed end-scraper made through recycling of a Mousterian artefact. The double patination is visible along both lateral edges. From Kebara cave, Israel (after Belfer-Cohen and Bar-Yosef 2015, 257).

The presence of composite tools in an assemblage, seen from a recycling perspective, is rather challenging. The multi-functionality of a tool may well be the result of recycling (Bamforth 1986; Barkai *et al*. 2015, 1), but the amount of time that has passed between morphological changes must be definable. Otherwise this characteristic alone is not enough to claim that recycling is the reason for the tool's multi-functionality (Vaquero 2011, 116). In some of these cases, micro-stratigraphic analysis can be of service, as it is occasionally possible to determine the sequential order of the various retouches (Cuartero *et al.* 2015, 113). It can also be discussed whether the addition of a burin spall to a retouched blade *changes* the function of the tool, or simply *adds* a new function, thus creating a multi-functional tool. If the original morphology is still clearly visible and functional, it means that the function of the tool has not completely changed, but has rather been modified to suit a broader range of uses. However, if it can be determined that the burin spall succeeds the retouched edge, some amount of time must have passed between the different changes. It might not be possible to determine whether it is a matter of seconds or years, but if the order of succession is determinable, it could, according Cuartero *et al*. (2015, 113), be possible to argue that the tool has indeed been recycled.

5.2.1. Maintenance

An activity that may obscure the recognition of recycling in a lithic assemblage, is that of maintenance (for example the re-sharpening of a working edge). From a behavioural perspective, these activities are profoundly different. The purpose of maintaining a tool is to extend its life-time, while the purpose of recycling is to alter the function of the tool. In the archaeological record, it may be difficult to distinguish between these two activities (Barkai *et al.* 2015, 1), which is why it is important to be aware of it as a source of error when making arguments in favour of recycling.

To further complicate the matter of separating recycling from maintenance activities, one should be aware that maintenance of a tool may actually change its original function, thus causing it to become recycled. Through repeated maintenance activities, such as the re-sharpening of a cutting edge, the tool will eventually become exhausted and not able to serve its original purpose. However, it may be given a new function through a modification such as the addition of a burin spall. By means of this modification, originally intended as maintenance, the function of the tool has changed, and consequently, it can be considered recycled (Schiffer 1972, 158).

5.2.2. Recycling in Aurignacian assemblages

As mentioned before, evidence of recycling has been found in the Aurignacian layers of the Kebara and Hayonim caves in Israel. The knappers appear to have been using Mousterian artefacts as "cores" for the manufacture of new tools (Belfer-Cohen and Bar-Yosef 2015, 256). A total of 740 tools from the Hayonim cave were analysed in search of traces of recycling. Out of these, 137 (16, 2%) were interpreted as recycled and had double patination. The tool categories most frequently observed among the recycled items were burins and endscrapers. As for the Kebara cave, 23 out of 221 tools (7, 5%) from the Aurignacian levels (I-II) were deemed recycled, all of them having two different patinas. Just as in the Hayonim cave, burins and endscrapers are the two tool categories most numerous among the recycled pieces (Belfer-Cohen and Bar-Yosef 2015, 258).

Further, studies from the Aurignacian levels of the French site Le Flageolet I, suggest that a majority of the burins and scrapers recovered from these layers, were in fact originally used as cores for the production of Dufour bladelets. It was not until their function as cores was exhausted that they were changed into the burins and scrapers found in the excavations (Hays and Lucas 2000, 463).

5.2.3. Recycling and maintenance applied to the burin/scrapers

As shown in the previous section, there are examples of recycling throughout the whole Palaeolithic era, from the Lower Palaeolithic and onwards. There is also evidence of this activity specifically for Aurignacian assemblages spanning over a large geographical area. Recycling has been identified in Aurignacian assemblages from at least three sites (Kebara and Hayonim caves, Israel and Le Flageolet I, France), calling attention to the value of considering recycling as a possible explanation for the morphology of the burin/scrapers found in les Cottés. Moreover, as maintenance activities may easily be confused with recycling (Barkai *et al.* 2015, 1), this possibility will also be addressed in the following discussion.

Neither of the three burin/scrapers have a double patination, which eliminates the most unambiguous line of evidence for recycling. However, a change of function may be argued for. Seeing to the fact that the burin spalls of all three artefacts are succeeding the retouches along the edges, and that Z7-353 and W8-501 have at least two series of retouches, it can be argued that the tools were initially used as retouched blades, but upon exhaustion after a minimum of one series of retouches, the burin spalls were added to make use of the remaining raw material. Exhaustion is, of course, not the only reason behind the addition of a burin spall. For instance, there could also have been an immediate need for a burin, and the (original) retouched blades were considered appropriate blanks.

This type of life-cycle for a tool can be referred to as *Lateral cycling* (Schiffer 1972, 159), meaning that the tool ends its use-life for one type of activity, but resumes another one, following, for example, maintenance activities (fig. 43). From this line of thought, at least Z7-353 and W8-501 were first re-sharpened (the second series of retouches), meaning they were first maintained, and later recycled following the addition of the burin spalls. Furthermore, seeing to the possibility of burin spalls preceding the current ones of W8-501, this specimen can be considered to have been more heavily maintained than Z7-353. In the case of Z7-306, it cannot be argued that it has been subjected to maintenance activities, since only one series of retouches is detectable. It can, however, be considered recycled because of the added burin spall.

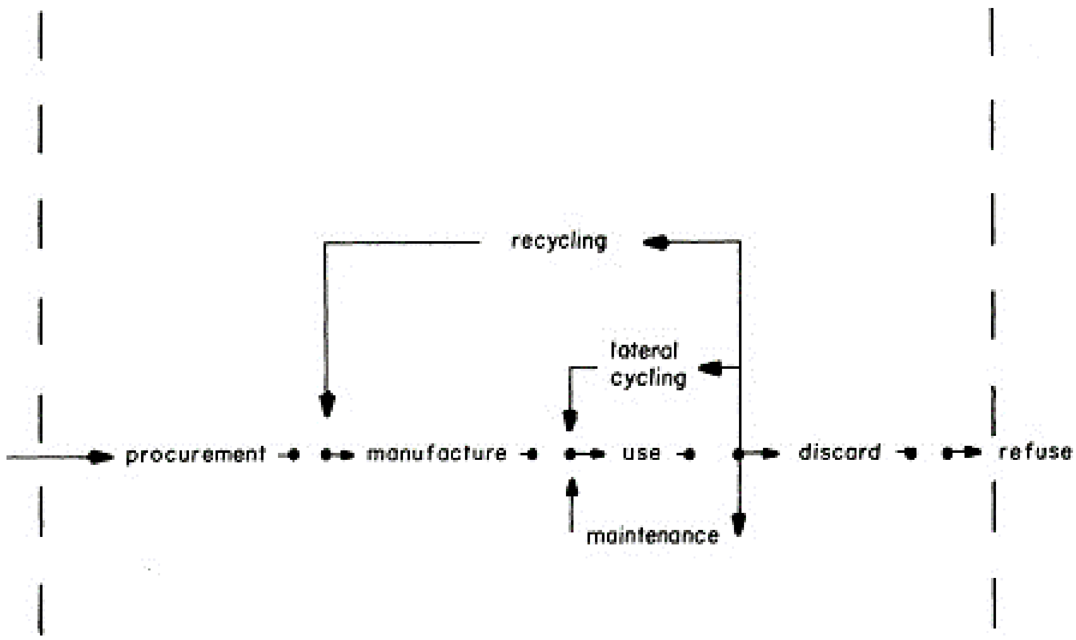

Figure 43. Possible life-cycles of a tool, including both recycling as well as maintenance activities (after Schiffer 1972, 158).

As shown in the analysis of the lithic assemblage (findings of core rejuvenation tablets and burin spalls), it is obvious that maintenance of tools was taking place, indicating a possibility that the burin/scrapers went through at least one maintenance cycle.

In order to better evaluate this claim, an option could be to examine the retouch intensity of each tool (Blades 2002, 97). Based on the fact that the burin spalls all succeed the retouching of the edges of the burin/scrapers, and to technological limitations in terms of shape-altering, the original shape of the tools, excluding its first state as an un-retouched blank, was probably a retouched blade (fig. 44) (Roussel, personal comment 13/12-2016). It was consequently discussed whether a comparison of the lengths and widths of the burin/scrapers and a sample of retouched blades, should be able to tell us something about whether the addition of the burin spall was done because of exhaustion of the original tool, or because of, for example, an urgent need for a burin. If the three burin/scrapers were of roughly the same width as the retouched blades, it could suggest that exhaustion was not the reason behind the burin spall modification. Instead, alternatives such as an acute need for a burin, or an explicit wish to create a tool with this specific morphology could be explored.

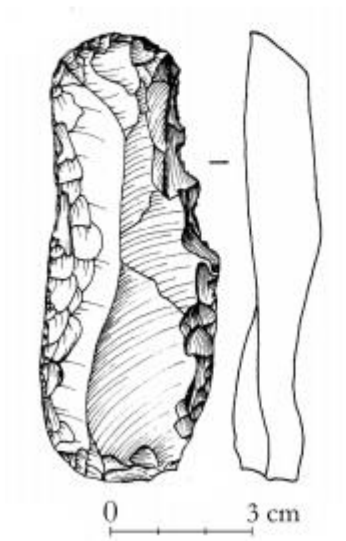

Figure 44. A retouched blade from an Aurignacian assemblage, the suggested original morphology of the burin/scrapers (after Bar-Yosef and Belfer-Cohen 2010, 152).

However, in order for this comparison to be meaningful and reliable, a large sample of retouched blades would need to be measured in order to account for as many size-variations as possible. Preferably, the retouched blades would come from the same layer as the burin/scrapers, since site-variability of the preferred dimensions of tools, as well as blanks, is a factor that would need to be considered (Blades 2002, 128). It would also have to be assumed that not all of the measured retouched blades were found in an exhausted state. Furthermore, seeing to unusual morphological features of the burin/scrapers such as the length of the burin spall, and to the abundance of raw material in the surrounding area, the probability of the burin/scrapers to be the result of an acute need for a burin can be considered as low (Roussel, personal comment 13/12-2016). In light of these facts, as well as time-constraints, this approach to explain the morphology of the burin/scrapers was abandoned.

Whether or not the addition of the burin spalls, after the initial retouching of the edges of the burin/scrapers, is to be considered recycling or simply the inclusion of an additional function to create a multi-functional tool, features decisive for both recycling and maintenance are definable on the three tools (tab. 7). Changing functions following a morphological change of the original shape, and successive series of retouches all suggest that both maintenance and recycling activities have been carried out on the burin/scrapers, though not necessarily because of exhaustion of the original tool. Lastly, due to the apparent extent of these undertakings, maintenance and recycling could be argued to be the reason behind the peculiar morphology of the burin/scrapers.

Table 7. Features indicative of recycling and maintenance applied to the burin/scrapers. The maintenance section refers to the detection of re-sharpening of edges (compiled by the author 2016).

Recycling	Double patination	Changing function	Maintenance
Z7-353	-	Yes	Yes
Z7-306	-	Yes	-
W8-501	-	Yes	Yes

5.3. Curation

The debate about recycling and maintenance further leads to the discussion of curation. Firstly, there seems to be a need to define the concept, since a slight confusion as to what exactly the term signifies is quite evident in the literature. One of the earliest definitions of the concept stems from Binford in the 1970's (Binford 1979 in Bamforth 1986, 39). He suggests that curation is a form of technology which encompasses production of tools before explicit need of use, transportation of tools between locations, tools designed for multiple uses, recycling and maintenance. Likewise, he emphasizes the aspect of efficiency (here defined as the relationship between the amounts of energy put into the production of the tool, versus its utility (Bamforth 1986, 39). Yet another interpretation of the concept concerns the relationship between the potential utility and the actual usage of a tool. For lithic implements, this relationship has been explored through the assessment of the amount of retouch that the implement has undergone (Wilson and Andrefsky Jr. 2008, 86). Judging from this rather broad range of definitions, it is quite obvious that curation is to be considered a complex behaviour that cannot be explained by one factor alone (Odell 1996, 54). However, since Binford's definition seems to incorporate the broadest range of factors, his definition of the concept will be used when discussing the burin/scrapers. Only addressing the potential utility, versus actual utilization ratio of a tool, could be considered too narrow to fully encompass the concept of curation, even if the assessment of the amount of retouch is included. However, the retouch intensity is indeed a factor to be considered, but by applying the principles for discerning maintenance and/or recycling activities in an assemblage (see chapter 5.2.), this particular factor is already addressed through Binford's five criteria.

Regarding the behavioural and cognitive aspects of curation, a few things require mention. The reasons behind spending energy to maintain and recycle a flint tool, creating a curated assemblage, instead of implementing an expedient strategy, where tools are manufactured when the need arises, and discarded directly after the task is performed (Bamforth 1986, 38), can be many. Curation can be viewed as a means of adaption to changing needs through, for example, the re-sharpening of a cutting edge during the butchering of an animal. Curation can also be related to raw material economics. During a shortage in raw material, it could be argued that the rate of curation would increase (Bamforth 1986, 39). Moreover, settlement patterns may be disadvantageous when it comes to the acquisition of raw material if a camp is set up in an area with limited access to raw material sources (Bamforth 1986, 40). Additionally, specific subsistence patterns among foraging and collecting societies and their dependence on food amassment, can be related to a greater dependence on tools in order to complete associated tasks (Odell 1996, 53). Lastly, it has been suggested that the reason behind curation is that of preparation for future use, in order to avoid situations where there is an immediate need for a tool, but no time to make one (Bamforth 1986, 39). Using these hypotheses as a point of departure, a number of related inferences regarding the behaviours of the groups in question can be made through analyses of lithic assemblages. By acknowledging factors such as curation in technological behaviour and connecting them to other aspects of culture, behavioural patterns regarding the perception, distribution and recycling of lithic material can be discerned (Bamforth 1986, 49).

As recycling and maintenance have already been discussed for the three burin/scrapers, and the design of the tools for multiple uses is visible through ocular inspection, I will discuss the evidence for transportation found in the micro-wear analysis. The analysis yielded a number of unidentified polish patches of varying sizes, randomly distributed on the dorsal as well as on the ventral sides of all of the three tools. Further, rounding of the edges and dorsal ridges, occasionally with an adherent polish developed from contact with a soft material, was also identified (Juel Jensen 1988, 56). These features can all be related to transportation of the tools in, among other things, a leather pouch. When carried around in this manner, the tools will collide with other objects within the pouch, creating very local specks of polish or bright spots upon impact (fig. 45) (Rots 2002, 68).

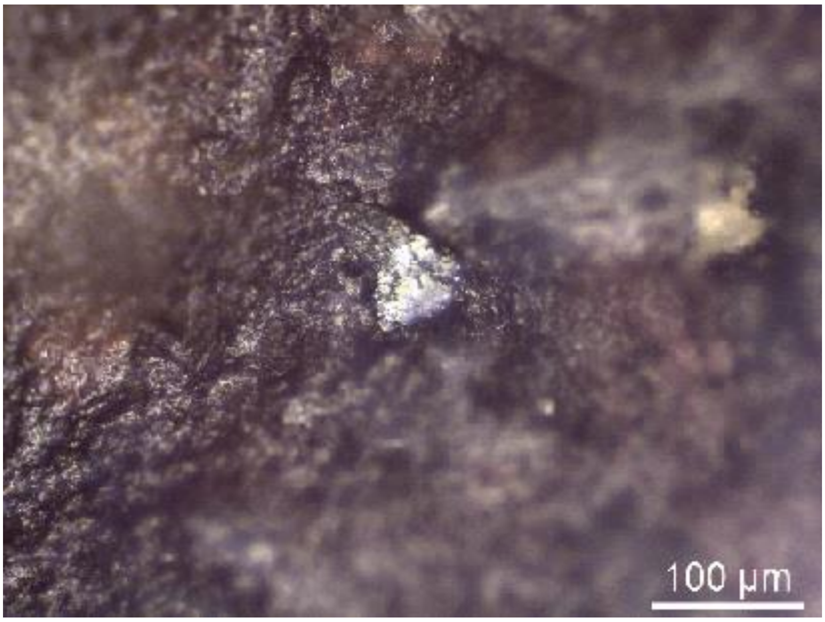

Figure 45. An example of one of the unidentified, randomly scattered patches of polish found on the three tools. Possibly, the spot is the result of collision between this and another artefact during transportation in, for example, a leather bag. This example is from the medial, dorsal surface of Z7-353 (loc. 9. in appendix III) (photograph taken by the author 2016).

Furthermore, if the pouch was made from a soft material, such as hide/leather or plant fibres, the protruding ridges, as well as the edges can develop a rounding due to the friction between the two materials (Adams *et al. 2009, 53;* Pyzewicz and Gruzdz 2012, 484-485). In fact, according to several experiments (Rots *et al*. 2001), there is a strong correlation between the overall rounding of an implement, specifically of the dorsal ridges, and transportation. This feature is often closely associated with both polish and bright spots. After prolonged transportation (in this particular experiment, this amounts to a maximum of 88 days), a clear rounding, as well as a macroscopically visible line of polish on the ridges is evident (fig. 46**)** (Rots *et al*. 2001, 134).

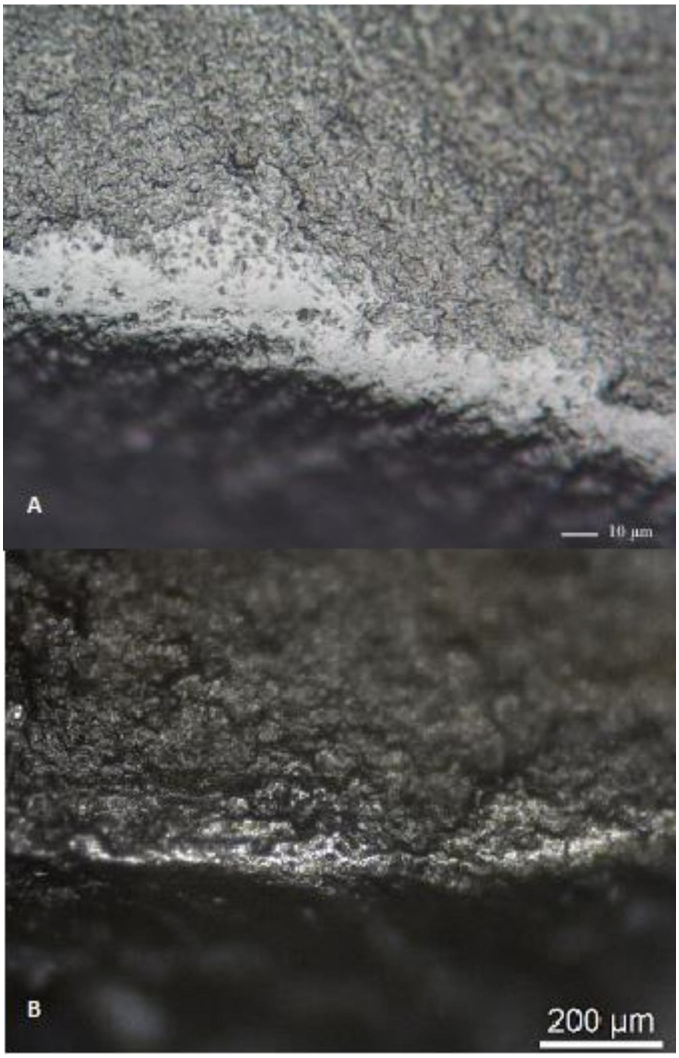

Figure 46. A comparison between an experimental flint piece that has been transported in a loosely hanging leather bag, and burin/scraper W8-501. A) Rounding and polish with an integrated bright spot, on the dorsal ridge of an experimental tool after 18 days of transportation. B) Micro-wear traces from the dorsal ridge of W8-501 (loc. 6. See appendix VII for exact location). Note the line of polish following the ridge. (A, after Rots et al. 2001, 133; B, photograph taken by the author 2016).

In order for a significant extent of rounding to develop through use, a considerable amount of time of contact and friction is needed (Pyzewicz and Gruzdz 2012, 483). Depending on the location of the rounding, for instance the edge or dorsal ridge, the likelihood of such long contact varies. A scraper or a cutting edge is, due to their function as active areas, more likely to develop a heavy rounding and polish than what a, predominantly less active, dorsal ridge is. Granted, hafting, wrapping or a combination of both may slightly increase the amount of rounding on protruding areas like dorsal ridges, but it is generally considered as less characteristic for these activities (Rots 2008, 59; Rots ***et** al*. 2001, 130, 134). Considering the extensive overall rounding of the protruding features of the burin/scrapers, the randomly distributed polish spots and the polish line connected to the dorsal ridges of at least W8-501 and Z7-353, transportation of the tools seems likely to have taken place.

Taking into account the above mentioned micro-wear, as well as the previously established evidence for both recycling and maintenance (chapter 5.2.3.) and comparing it with the distinctions of curation made by Binford (tab**. 8)**, it seems plausible that the burin/scrapers were indeed curated, and kept for quite a long time. However in this particular case, PDSM has to be taken into consideration as one of the factors behind the extensive rounding of the artefacts. Had it not been for the other types of micro-wear found in relation to the rounding, the aspect of transportation would have been more difficult to argue.

Table 8. Table showing the defining elements of curation, according to Binford, and their presence on the burin/scrapers.

	Tool designed for multiple uses	Tool transported between locations	Tool produced before anticipated use	Recycling of tool	Maintenance of tool
Z7-353	Yes	Yes	N/A	Yes	Yes
Z7-306	Yes	Yes	N/A	Yes	No
W8-501	Yes	Yes	N/A	Yes	Yes

5.4. Hafting, wrapping or prehension?

As mentioned before, all three of the burin/scrapers have wear-traces suggestive of hafting, or more likely, wrapping (chapter 4.5.). This is indicated by the scattered distribution, and prevalence of, striations along certain portions of the edges, ridges and on the cortex, most of them perpendicular to the edges, as well as the rounding of edges and ridges, and polishes related to all of these features (see chapter 2.4. for more details on hafting and wrapping). On Z7-353 and Z7-306 it has been possible to discern a concentration of these wear traces to the portion of the tools that is below the burin spalls, while on W8-501, these concentrations are not as localized. However, since no definite haft limit is discernible on any of the tools and the micro-wear traces are rather randomly scattered, wrapping is a more likely hafting method. This will be further argued for in the following text.

When wrapping is used as a hafting method, the possibility of determining a clear haft-limit diminishes, as the worked material might be the same as the material used as a wrap (for instance hide, leather or plant fibres) (Rots 2008, 59), which may well be the case for the burin/scrapers. Moreover, the polish found in relation to the striations on the dorsal ridges and to the more heavily rounded portions of the edges and dorsal ridges, is suggestive of a soft material (Juel Jensen 1988, 56), further strengthening the possibility of the tools having been wrapped rather than hafted, or perhaps wrapped prior to having been put in a haft. The occurrence of bright spots on a tool, is considered more indicative of hafting than of wrapping. This phenomenon is barely mentioned in association with wrapping, even in thorough studies of haft/wrap-related micro-wear (see for example Rots 2002, 68; Rots 2008, 57-59). As patches of polish similar to bright spots are indeed found on the burin/scrapers (fig. 47), it could be suggested that they are related to hafting. However, seeing to the fact that the remaining micro-wear points towards wrapping, it is more likely that these potential bright spots are the results of other factors such as PDSM or transportation. Besides, bright spots are most often associated with macro or micro scars, which is not the case with the polish patches or potential bright spots on the burin/scrapers (Rots 2002, 64).

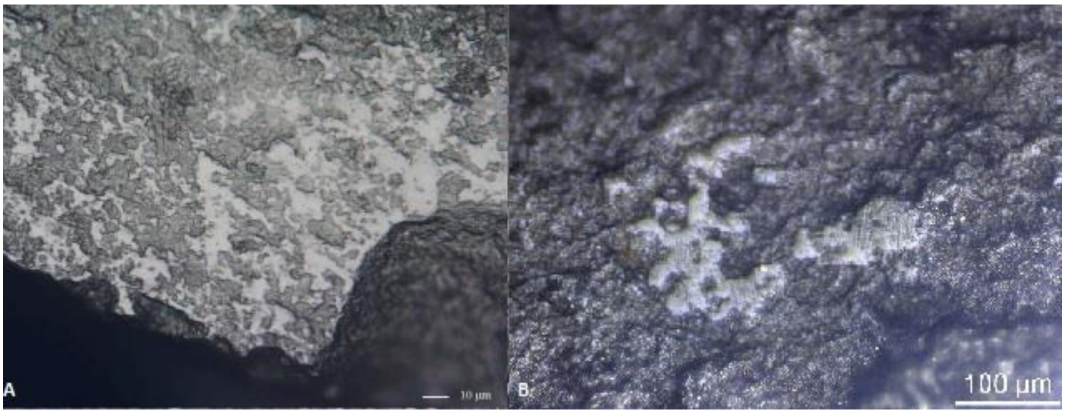

Figure 17. A comparison between bright spots from an experimentally hafted tool and a possible bright spot on burin/scraper W8-501. Both polishes have a rather thick and smooth appearance and share a similar covering pattern. A) Bright spot on ventral medial edge caused by hafting. Experimental tool. B) Possible bright spot with striations found on dorsal medial surface of W8-501 (loc. 3. See appendix VII for exact location) (after A) Rots 2002, 63, B) photograph taken by the author 2016).

Moreover, wear-traces from wrapping are more sensitive to the prehension of the tool, meaning that their development will be somewhat dependent on the way the tool was held during use, creating a rather irregular pattern of wear-traces. Tools hafted in, for instance, an inclusion haft (see fig. 14 B), will on the other hand have a more regular wear pattern. Since the wear-traces on the burin/scrapers are to be considered unevenly distributed and developed, rather than regularly, wrapping again seems like the more plausible option for these tools. Additionally, the scars derived from wrappings are often smaller than those created by hafting, and any potential polish is rather poorly developed (Rots 2008, 57), which is the case for the burin/scrapers. The heavily polished areas on the dorsal ridge of W8-501 could possibly be related to prehension, if they are at all related to tasks such as prehension, hafting or wrapping.

Prehension is yet another way of handling a tool that can be seen through micro-wear analysis. It can be distinguished from both hafting and wrapping by the relative absence of both striations and scarring in the area where the tool was held (Rots 2002, 69). Prehension refers to the usage of a tool without any type of haft or wrap. The resulting micro-wear is thus the result of direct contact between hand and tool. The development of prehension traces is heavily dependent on the tasks performed, and on the amount of dirt and dust produced during the activity. Actions such as schist working will cover the hand in dust in a short period of time, creating particles that becomes determinant in the production of micro-wear traces on the tool. Consequently, prehension polish is somewhat consistent with the contact material. Micro-wear from prehension spreads across the implement in an irregular manner, depending on the grip. Larger polish-spots, similar to bright spots, may develop adjacent to the other prehension polish (fig. 48) (Rots *et al*. 2001, 136). Seeing to the fact that all of the burin/scrapers have striations as well as a certain degree of scarring, wrapping can still be argued for. However, this does not mean that the tools were never used without a haft or a wrapping, but because of the large amount of pressure needed for prehension wear to develop, evidence of this phenomenon is seldom found (Rots 2002, 68).

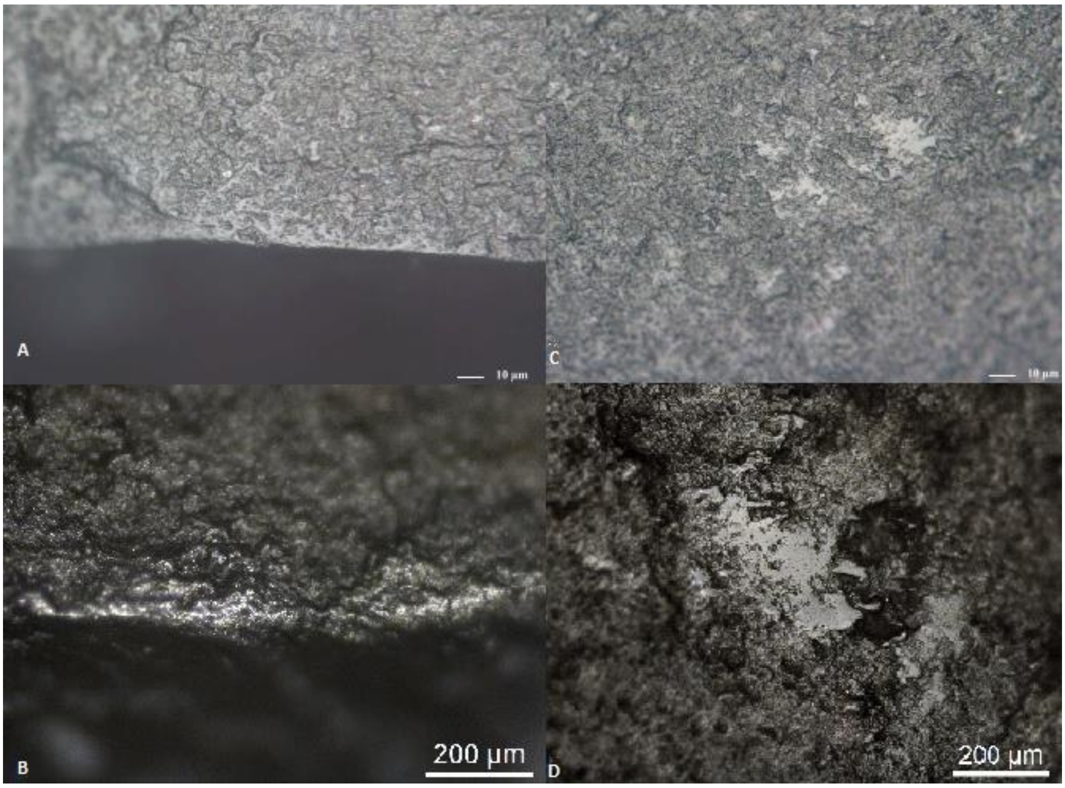

Figure 48. Comparison between two types of prehension polish from experimental tools, with micro-wear from two archaeological artefacts. A) Prehension polish developed on the dorsal ridge of an experimental tool after scraping schist, and B) Possible prehension polish on the dorsal ridge of W8-501(loc. 1, appendix VII). The polish on both tools is concentrated to the ridge, and fades outwards. C) Prehension-induced bright spot from grooving schist with an experimental tool, and D) Potential prehension bright-spot on the dorsal surface of burin/scraper Z7-306 (loc. 13, appendix III) (after A) Rots et al. *2001, 135 and C) Rots 2002, 69. B and D) photographs taken by the author 2016).*

To summarize the above mentioned micro-wear and the discussion regarding their interpretation, it suggests that the burin/scrapers were wrapped in either hide or leather, or in some kind of soft plant material, during at least one stage in their use-life. At one point, it is possible that at least W8-501 was used without any type of haft, creating a prehension polish due to direct contact between the hand and the tool. However, taking into account the striations on the dorsal ridge, perpendicular to its direction, it is more likely that the tool was used with a wrapping, since striations rarely occur through prehension alone (Rots 2002, 69). On Z7-306, the burin spall cuts through the polish of the retouched edge, suggesting that the possible wrapping was done prior to the burin modification. However, since the wrapping might have continued after the addition of the burin spall, it is very difficult to pin-point exactly when, if ever, the tool was wrapped.

Lastly, it is still important to remember that the PDSM of the tools renders it difficult to interpret the micro-wear with absolute certitude. For example, the evenly distributed edge-rounding can either be considered a result of wrapping of the tools in a soft material or as a later addition (PDSM), obscuring "real" micro-wear. Moreover, seeing to the dispersal of various micro-wear traces across the entire surfaces of the tools, it is rather difficult to definitely localize any concentrations of them, or to connect any two or more traces to the same task. However, some consistent and relatively evenly distributed micro-wear traces, such as the large number of perpendicular striations found on dorsal ridges and edges, are difficult to explain solely as effects of PDSM. Despite the ambiguity with regard to micro-wear indications for wrapping, the traces are so consistent that wrapping should be considered as a possible interpretation.

5.5. Discussion and interpretation of Z7-353

As already discussed in previous sections (5.2., 5.3. and 5.4.), the micro-wear traces of this implement (see chapter 4.1.2. for pictures) suggest that it has undergone maintenance activities such as re-sharpening, been recycled, transported and quite heavily curated. Additionally, it can be suggested that the tool has also been used while being wrapped in a soft material such as hide, leather or plant fibres.

Judging from the amounts of striation visible on the lateral edges, mostly on the ventral side, perpendicular to the direction of the edges, a scraping motion can be construed (fig. 34 B and C). Along almost the entire left lateral edge, a clear rounding sometimes accompanied by striations, is visible. The same combination occurs on the right lateral distal edge, with the addition of a polish derived from a soft contact material. The striations are not as perpendicular on this edge as on the opposing one, but a scraping motion is still the most likely one. Due to PDSM, the exact contact material cannot be established, but seeing to the morphology of the polish and the intensification of edge-rounding, a soft contact material is likely (Adams *et al*. 2009, 53). On the dorsal side, adjoining the gap in the cortex, patches of a smooth polish developed mainly on the topographically higher parts of the surface, is found. The polish is reminiscent of that developed from contact with plants (Gijn 1989, 40-41), but this has not been possible to verify because of its poor preservation.

As the heavily developed rounding together with transversal striations and polish are also found on the dorsal ridge, the possibility of the ridge being an active area was discussed. However, again owing to the effect of the PDSM, this possibility cannot be proven, despite the striations and polish. Moreover, patches of a very smooth polish with striations of varying directionality are found along the ridge, further underlining the heavy effect of PDSM on the tool. Striations in polish are indicative of the directionality of the applied motion of a tool (van Gijn 2012, 277) and while most use-related motions create quite regular striation patterns, PDSM or post-excavation activities such as rubbing off soil from the artefacts and sieving on metal screens, may harm polishes (van Gijn 1989, 54). Considering these facts, together with the similar wear-traces found on the cortex, it is more likely that the micro-wear traces found on the dorsal ridge of this implement, are the results of wrapping rather than it having been used as an active edge.

Regarding the micro-wear of the two burin facets, a few things require discussion. On the proximal burin facet, no particular intensification of micro-wear can be noted. This is possibly because of the undulating surface of the spall, making it unfit for use. On the distal burin, however, an intensification of use-related edge-retouches is visible in and near the bend of the facet (fig. 35 B). A band of possible polish is visible on the ventral side of the facet, but it is too unclear to suggest any type of contact material, especially in the absence of any other micro-wear. Therefore, it can only be established that the facet has been used. The tip of the distal burin, however, has more distinct micro-wear traces. Spots of a smooth and domed polish, as well as a heavier rounding, suggests bone as the worked material. Additionally, longitudinal striations related to the polish were located. As striations in polish can be indicative of the applied motion (van Gijn 2012, 277), the longitudinal striations of the burin tip may be related to motions associated with scratching or slicing activities (Keeley and Toth 1981, 465).

To conclude, the lateral edges of Z7-353 seem to have been used to scrape a soft contact material. The distal burin facet has clearly been used, but through micro-wear analysis it has not been possible to determine the contact material or the applied motion. Its tip, however, has been used to scratch and/or carve in bone, or a material of similar hardness.

5.6. Discussion and interpretation of Z7-306

Although quite similar, there are a few differences between this implement and the other two. It exhibits the same traces of transport, curation, wrapping and recycling, but no unambiguous evidence of maintenance has been identified (see chapter 4.2.2. for pictures).

On both proximal lateral edges, somewhat concentrated below the burin facet on both sides, a very well developed rounding and polish, both indicative of a soft contact material are visible (Adams *et al*. 2009, 53). The polish on especially the right, lateral edge consists of a smooth, thin band that is seemingly hugging the edge. These wear-traces decrease toward the distal end. Interestingly, the polish found on the dorsal ridge seemingly indicates hide as contact material (Plisson 1985, 52), but it differs from the polish on the lateral edges (**f**ig. 49).

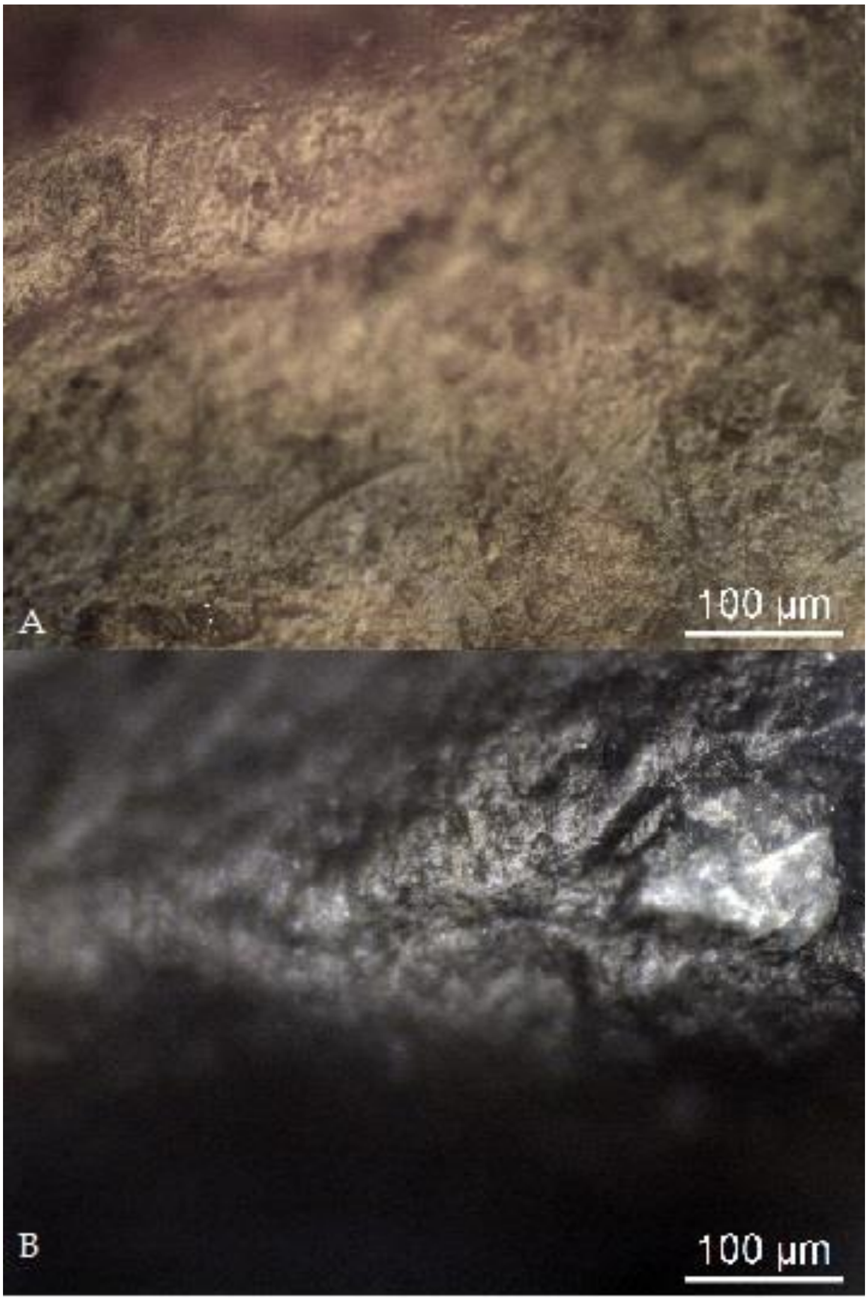

Figure 49. A comparison between the polishes from A) the right, lateral edge and (loc. 15) B) from the dorsal ridge (loc. 16) of Z7-306. See appendix V for exact locations of the photographs (photographs taken by the author 2016).

The dorsal ridge shows both transverse and longitudinal striations, while the striations on the lateral edges are consistently transverse, consequently indicating a scraping motion. The phenomenon of differing polishes on these, to some degree, connected areas could be explained by an initial use of the tool as a wrapped implement, perhaps using leather or hide wrappings, followed by a secondary manner of use where the wrapping was no longer desired. If this was the case, the micro-wear on the dorsal ridge would have had the possibility to develop through contact with the wrapping, while during the second use-phase, a material differing from that of the wrapping was worked using the lateral edges, removing or obscuring the former wrap-induced micro-wear, yet leaving the dorsal ridge unaffected. This cycle of uses could also explain the varying directionality of the striations connected to the ridge.

The burin facet of this implement, has been used quite intensely (fig. 38). Along the facet, edge-damage, edge-rounding, transverse striations and two different polishes can be found. As is the case with Z7-353, there is a slight increase of use-related retouches on the facet, close to where it bends. On the ventral side of the facet, a greasy type of polish stretches like a band along the edge. This polish has been interpreted as resulting from either something similar to bast, or slightly dried out hide. Wood was initially suggested as a possible contact material, but the angle of this facet-edge is not very favourable for wood-working activities (personal comment Verbaas, 24/11-2016). On the dorsal part of the facet, the polish constitutes a thin band with a flaming morphology that fades into the background. The same polish is also visible on the small remnant of the dorsal ridge that is next to the facet. It has not been possible to identify a contact material that corresponds with the polish, but it is clear that it is not bone. This becomes evident when investigating the very tip of the burin. This area exhibits extensive rounding and has a very well developed bone polish (Juel Jensen 1988, 56) with adherent striations. The directionality of the striations is varying, indicating tasks such as carving. Moreover, the polish detected on the ventral burin facet is also visible on the burin tip, probably preceding the bone working. It could be suggested, that the differing polishes on the burin tip are related to the relationship between the different polishes on the dorsal ridge and lateral edges. Unfortunately, due to time-constraints and the PDSM, this relationship has not been possible to evaluate.

Evidently, this burin has been used on multiple materials, for multiple tasks. When it comes to the transverse striations found along the facet-edge of the burin, some kind of scraping motion similar to that of the lateral edges can be inferred for this area as well. The micro-wear is slightly more intense in the medial part of the ventral facet-edge, suggesting that this particular area was slightly more used than the adjacent parts. However, as PDSM has affected the piece, such detailed accounts should only be considered as possibilities.

Despite the differing polishes on the burin facets, pointing towards different contact materials, the same kind of motion seems to have been applied. This can be argued as being indicative of a mentality towards tools where the worked material is subordinate to the function of the tool. For example, a functioning scraping edge will be used to scrape the material at hand, and not be restricted to working one material alone.

To summarize, Z7-306 has been used to work a variety of materials such as bone, possibly bast or some similar plant material, and perhaps hide. It has been suggested that the implement was initially used wrapped in a material similar to leather, but was later used without it, on a material differing from that of the wrapping. This other material consequently removed or obscured the wrapping polish from the lateral edges, and left it only on the dorsal ridge. Both the lateral edges, as well as the burin facets, seem to have been used in scraping motions. The lateral edges are rather rounded, which further substantiates the plausibility of scraping (Keeley and Toth 1981, 465). Lastly, the burin tip has been used to work the same material that was found on the dorsal burin facet, as well as bone. Judging from the directionality of the striations on the tip, the motion was most likely a carving one.

5.7. Discussion and interpretation of W8-501

Out of the three burin/scrapers, this specimen is the one most heavily affected by PDSM. Yet, micro-wear traces and technological analysis suggest that the piece has been maintained, recycled, transported as well as wrapped. Parts of the inner surfaces and edges exhibit very well developed polish, including highly reflective, scattered patches on both ventral and dorsal surfaces (fig. 40 D). The transverse striations visible on the right portion of the dorsal ridge are possibly hafting-related (fig. 40 E), and a polish patch resting on the same ridge is morphologically slightly reminiscent of antler polish. However, because of the PDSM and the fact that micro-wear traces related to antler working are easily confused with those from working bone and wood (van Gijn 1989, 33), this polish patch will be considered unidentified. Furthermore, this particular patch does not have any striations to indicate any kind of use, which leaves collision with another item during transportation as a more probable origin.

The area surrounding the tip of the lowermost burin facet constitutes the only area with micro-wear consistent enough to be able to produce any tangible results. This area is heavily rounded (fig. 40 B), and has transverse striations, indicating scraping as a possible motion. The rounding continues slightly onto the burin facet, and it is clear that it developed after the burination. The remaining part of this peripheral edge is less rounded, which suggests that the area around the tip of the burin was indeed used. Moreover, edge-damage succeeding the rounding on this edge was detected, suggesting that this damage was inflicted upon the tool post-use, possibly during excavation or by post-excavational handling. On the uppermost burin facet, close to the bend, a slight increase in edge-damage is visible, as is the case with the other three implements. Unfortunately, no more details related to contact material or type of tasks performed can be inferred from this micro-wear analysis. The tool is too heavily affected by PDSM, creating an even distribution of edge-damage, edge-rounding as well as surface rounding across the entire implement. Additionally, there is a gloss, possibly derived from friction, covering the surfaces and most potential polishes.

To summarize, implement W8-501 has wear-traces that can be related to previously stated activities (recycling, maintenance, transportation, curation and wrapping), as well as certain traces indicative of scraping specifically on the lowermost edge. Further, seeing to the similar morphology, and the find-context, it could be argued that this tool has been used for the same activities as the other two. Nevertheless, due to the heavy PDSM, no detailed interpretation of the various micro-wear traces is possible within the scope of this thesis research. Therefore, the tool will be considered as used, and owing to the technological description of it, it can be established that it has also been maintained and recycled, and most likely transported and curated.

5.8. Probable tasks performed at the site

Through the micro-wear analysis of the burin/scrapers, it has been possible to establish that they have been used to scrape several different soft to medium hard materials, as well as carving, scratching or perhaps incising bone. Possible tasks related to these actions are hide-scraping, plant processing and bone tool production, just to mention a few. According to previous micro-wear analyses of a number of pieces (see chapter 3.2.2. and fig. 31), grooving in bone and cutting also took place on the site. However since three tools are not nearly a large enough sample to safely determine any specific site functions and tasks, I will relate them with the analyses of the remaining lithic and faunal assemblages, and use this to substantiate my claims of which tasks have been carried out. Also, since it cannot be proven that the tools have even been used on the site, and not only discarded there, the need for a larger sample or a correlation with other analyses becomes even more evident when discussing questions such as possible performed tasks.

According to the analyses of the lithic assemblage (see chapter 3.2.2.), the emphasis in terms of lithic production of layer US 02, was that of blade manufacture. Most likely, already prepared cores were brought from elsewhere and used to extract blades on the site. Evidence of core-maintenance, such as core-tablets, have been found, as well as five burin spalls. Seemingly, both maintenance and possible recycling of lithic implements have been taking place during this occupation. These interpretations corresponds well with the characteristics of the burin/scrapers. As it has been suggested that all three of them were recycled, and two of them also maintained, the evidence for recycling and maintenance of a number of different lithic implements strengthens this hypothesis. Seemingly, these kinds of undertakings appears to have been an integrated part of the behaviour of these people. As mentioned before (chapter 5.2.), the practices of maintenance and recycling of lithic implements have formed a part of the behavioural spectra of both Neanderthals and AMH since the Lower Palaeolithic and up through the Upper Palaeolithic, contradicting the assertion made by some, that physical and cognitive changes through time are bound to affect performed activities as well as social organization (Barton 1988, 101). As such, these activities cannot be argued to have been one of the cognitive differences between the AMH and the Neanderthals, which led to the latter’s disappearance.

According to the results of analyses of the faunal assemblage, bone and antler have been worked at the site. This corresponds well with the fact that bone tools, specifically *pointes d'Aurignac* (fig. 6 A), are considered diagnostic of Aurignacian assemblages (Mellars 2006, 168), and has in fact been found in Aurignacian layers of les Cottés, although the exact layer has not been possible to determine. Moreover, the majority of the analysed faunal remains (401 of 765) bears witness of anthropogenic manipulations from, among other things, sinew extraction, burning and hide procurement. There is also a clear abundance of antler in relation to the amount of cranial remains. The faunal remains suggest that reindeer was heavily exploited, in all likelihood in order to procure antlers for tools or other kind of antler object production. When relating this information to the results from the micro-wear analysis of the burin/scrapers, a clear correlation is visible as the burin/scrapers presents all the micro-wear needed in order to argue for hide, bone/antler and meat working (see chapter 5.5., 5.6. and 5.7. respectively).

5.9. Implications for behavioural aspects

Formerly, lithic assemblages were interpreted almost as separate entities from the system which they derived from (Odell 1996, 52). In our time, however, most scholars acknowledge that each individual object forms a part of a greater network of actions, which is important to address in order to fully understand past societies and behaviours (Tsoraki 2011, 13-14). To exemplify, let us consider the transportation of the burin/scrapers.

According to the micro-wear analysis, some of the polish patches found could be the result of contact with antler, and the edges and dorsal ridges shows traces of having been in contact with a soft material, such as hide or leather, suggesting that the means of transport could have been through carrying around in a leather pouch. The potential wider implications of these results are illustrated below (fig. 50).

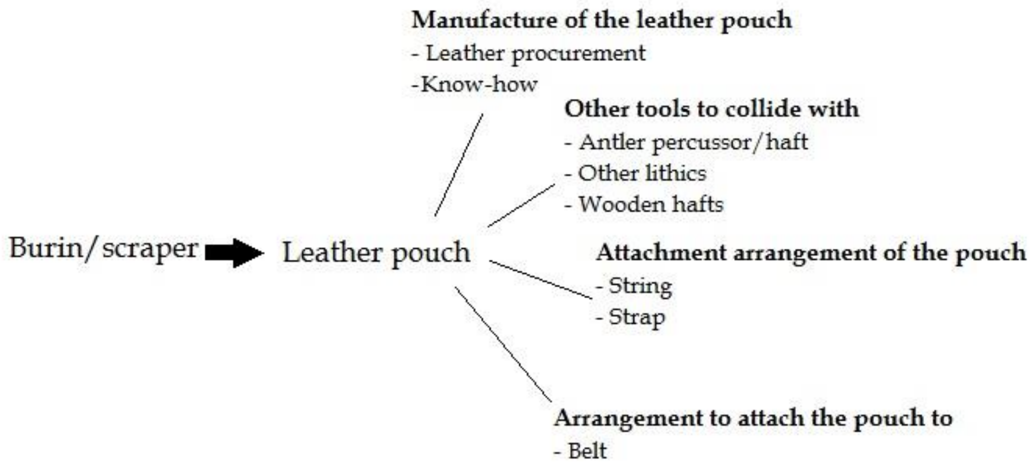

Figure 50. A much simplified illustration of connected innovations and know-how. A combination of micro-wear analysis and an integration of artefacts into larger systems can potentially illuminate certain behaviours and abilities. This figure is merely an illustration of interpretative possibilities open to us when combining these methods. The possible variations are of course much greater (figure made by the author 2016).

As illustrated above (fig. 50), a large network of connected activities and inventions can be argued to form an integral part of the behaviours and societies of the AMH that produced the burin/scrapers (see Barham 2013, 196 for a similar illustration regarding hafting). Unfortunately, the vast majority of the artefacts presented above (fig. 50) are made from organic material most of the time lost to us. Additionally, the limitations inherent to micro-wear analysis, and the inferential leaps we are sometimes forced to take, should act as a warning to us, not to make grand claims about immaterial aspects such as social organization or specific behaviours of past peoples. Lastly, not all activities leave any traces for us to find. For instance, if a string made out of plant fibres was used to attach the leather pouch to a belt, we would probably not find any evidence of the production of the string in the archaeological record, let alone the string itself. Micro-wear analysis could suggest that a specific tool had been used to work plant material, but since there is no need for any tools in order to produce reliable string from, for instance nettle fibres, this task would in all likelihood never be detected in the archaeological record. It should however be noted, that in this particular case study, evidence of sinew extraction has been recognized in the faunal assemblage (chapter 3.2.1.). Considering that sinews can act as a raw material for string production (Hardy *et al*. 2013, 33-34), the discovery of their extraction in faunal assemblages could provide archaeologists with one set of arguments in support of string production. In turn, a network surrounding the string can be created that could be argued to include the use of the string as a means of a carrying arrangement. This way of analysing the burin/scrapers did indeed yield new information as well as implications for certain behaviours and cognitive abilities of the people manufacturing them. However, a deeper analysis of the tools, as well as more information about leather pouch production during the Upper Palaeolithic is needed before fully integrating this idea into the behavioural spectra of the AMH occupying US 02.

In the case of the burin/scrapers, the micro-wear analysis has clearly shown the multi-functionality of the tools, both in terms of executed tasks, as well as worked contact materials. The apparent curation of the tools, as well as the choice to sometimes use them wrapped, and sometimes handle them through prehension, can be argued to show a set of very versatile behaviours natural to the people using the tools. They were constantly adapting to changing needs and the task at hand. Furthermore, through the maintenance, recycling and the above mentioned behaviours, anticipating of possible future needs can be seen through the burin/scrapers (Bamforth 1986, 38).

6. Conclusion

The results from my research have showed that the burin/scrapers were used for scraping of soft materials, possibly hide, leather or plants. Furthermore, two of them, Z7-353 and Z7-306, have wear-traces probably induced by scratching or carving in bone. These data are corroborated by results derived from analyses of the faunal and lithic assemblages from the same context. Analysis of the faunal assemblage indicates that the main reason for the occupation of the site was the acquisition of hide, as well as bone and antler for tool production. Additional activities such as sinew extraction and meat procurement have also been suggested. The lithic assemblage clearly indicates both maintenance and recycling of different types of tool categories. As it has been indicated that all three pieces have been both curated and recycled, the results from the different analyses continues to coalesce. Two of the tools, Z7-353 and W8-501, have also been maintained through re-sharpening of the retouched lateral edges. Additionally, a negative of a preceding burin spall is visible on the upper burin facet of W8-501, suggesting even heavier maintenance of this piece. These activities can be argued to constitute at least part of the explanation behind the deviant morphology of the tools.

Owing to the results of the performed micro-wear analysis, a number of indications regarding behaviour inherent to, and technical innovations available to the AMH can be deducted, as exemplified through fig. 50. By being able to hint towards the possibility of the tools having been transported in a leather pouch, an entire range of tasks, know-how and raw-materials crucial for the realization of the transportation becomes uncovered. These aspects may not be visible in the archaeological material because of their organic, thus perishable, nature or to them constituting immaterial knowledge. However, by inserting individual artefacts into larger systems, those aspects have a chance to become unveiled. By including the burin/scrapers into a larger network, a series of activities, inventions and behaviours that could not have been implied by only performing a strict functional analysis, was extracted.

If this method, in collaboration with micro-wear analysis, was continuously applied to archaeological assemblages, it would soon be possible to compare large sets of data of behavioural traits between different *Homo* species.

Eventually, possible differences would be conceivable to highlight. Through continuous analyses of established differences, in this case the multi-functional burin/scrapers, between AMH and Neanderthals and comparisons of the results, I believe that it is possible for us to eventually come to an understanding of which behavioural traits, if any, became decisive for the success of our species.

From the outset of this thesis research, the goal was to unlock information about behavioural aspects of the AMH arriving on the European continent in the beginning of the Upper Palaeolithic. The micro-wear analysis in correlation with remaining lithics and fauna has produced information about different behaviours and tasks performed during the occupation of US 02. It has also given us a number of possible explanations of the function as well as to the morphology of the burin/scrapers. Consequently, the results of this thesis research have added to our knowledge about early AMH behaviour in Western Europe. Although further investigation of certain aspects is needed, the obtained data may hopefully be of use for the archaeological community as a means of comparison of behaviours between, for instance, early AMH and our close relatives, the Neanderthals.

6.1. Suggestions for further research

Throughout the progression of this study, the amount of questions raised often seemed to outdo the questions answered. A list of suggestions for further research was consequently made, however modified along the way. A selection of those suggestions is presented below.

- ➔ Micro-wear analysis is in itself a difficult trade to learn, let alone conveying comprehensible results to novices. In my opinion, a good way of developing a method is to make it more available to a bigger public. By improving the technology used for micro-wear studies, especially the quality of the photographs used to illustrate the wear-traces, the results will become clearer and consequently more interesting to a broader audience. Furthermore, techniques developed to penetrate deeper into the surface of the analysed artefact could enable us to make use of material that is too poorly preserved for the available technology.

- In later years, experiments aiming to produce reference collections of micro-wear traces have become more common. However, seeing to the variability of tasks, motions and contact materials that can have affected a tool during its use-life, the production of reference material should be further encouraged. Especially considering the ambiguity that still surrounds certain wear-traces more than others.
- A re-examination of relevant assemblages in search of evidence for, among other things, recycling, maintenance and curation, could be argued for since it has been shown that these activities can have wider implications regarding, for instance, behavioural patterns of prehistoric *Homo* populations.

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https://wwwf.imperial.ac.uk/earthscienceandengineering/rocklibrary/viewglossrecord.php?gID=00000000258, accessed on 26 October 2016.

Personal comments

Rendu, W., 14/4-16. Conversation via e-mail with regards to the analyses and interpretations of the faunal assemblage of US 02.

Roussel, M. 26/5-2016. Discussion regarding the burin/scrapers.

Roussel, M., 27/11-2016. Discussion regarding the burin/scrapers.

Roussel, M., 13/12-2016. Discussion regarding the burin/scrapers.

Soressi, M., 7/7-2016. Presentation of Les Cottés held at the site.

Verbaas, A., 5/7-16. Conversation about the state of preservation of the burin/scrapers.

Verbaas, A., 24/11-16. Discussion concerning the wear traces found form the micro-wear analysis.

List of figures

by the author 2016)

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Appendices

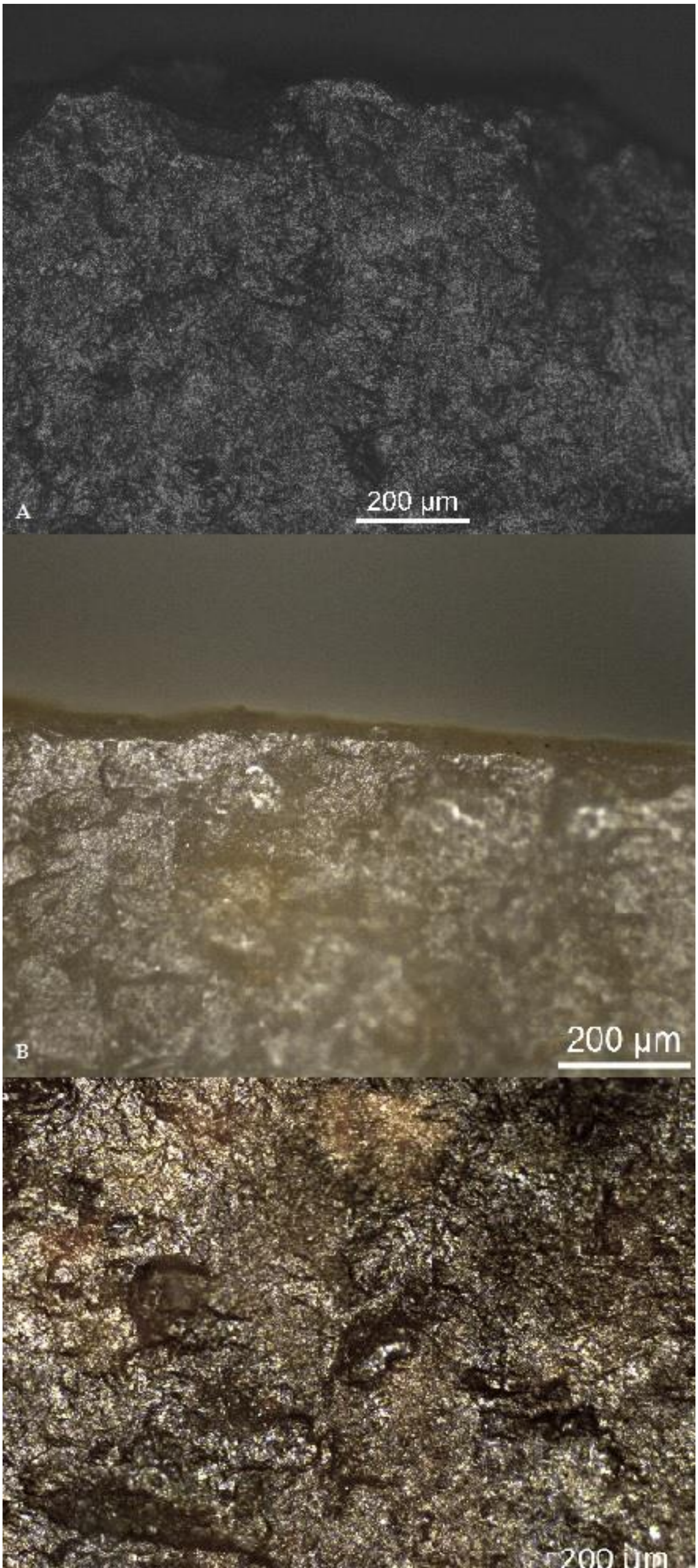
Appendix I

Photographs of Z7-306 taken by the author 2016.

A) Before chemical cleaning.

B) After chemical cleaning. A more defined concentration of polish has become visible along the edge.

C) Seemingly unaffected surface one month after cleaning.

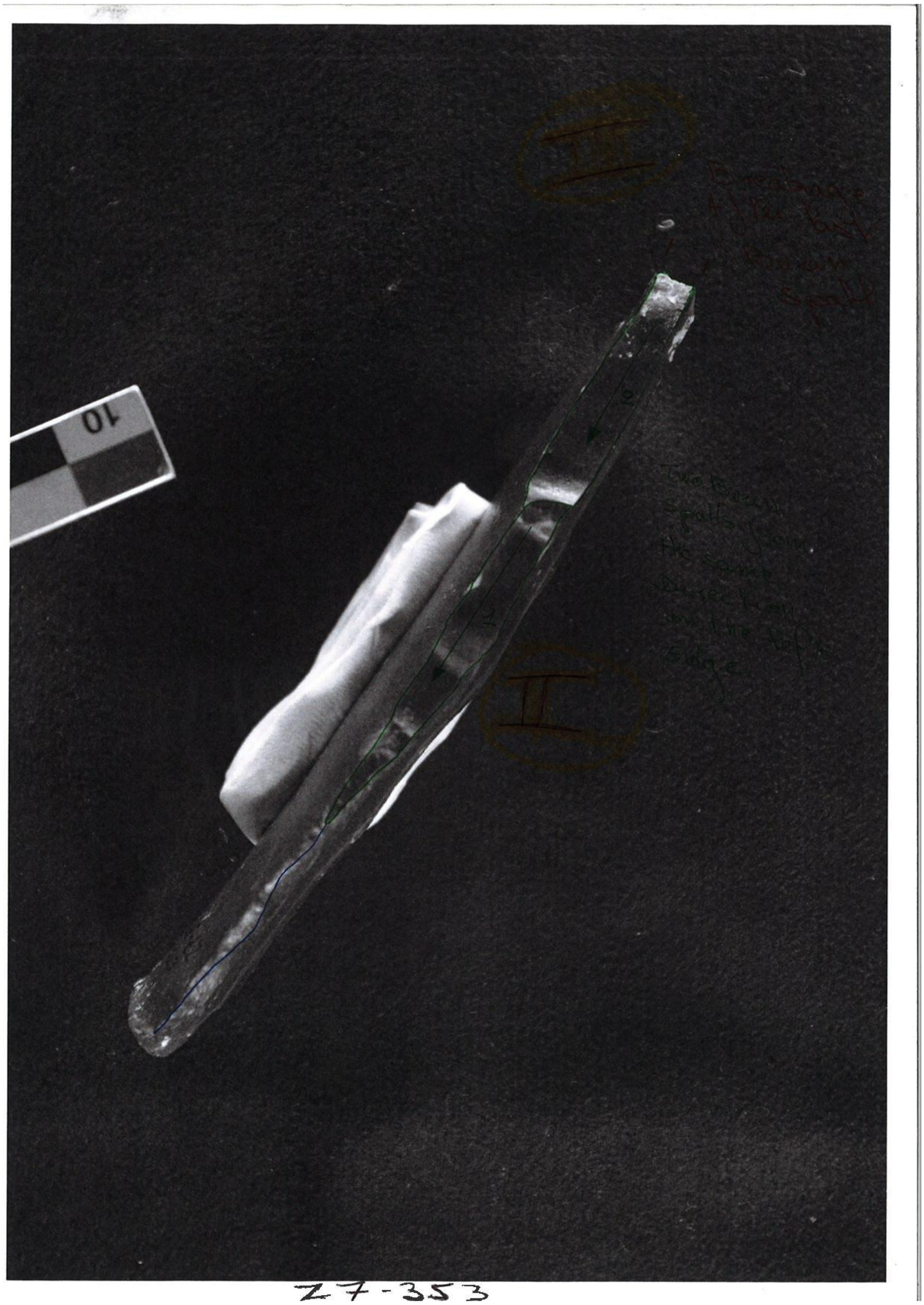

A
200 µm
B
200 µm
C
200 µm

Appendix II

Compiled after Gijn, A.L. van 1989, 28, 30, 32-33, 35, 40.

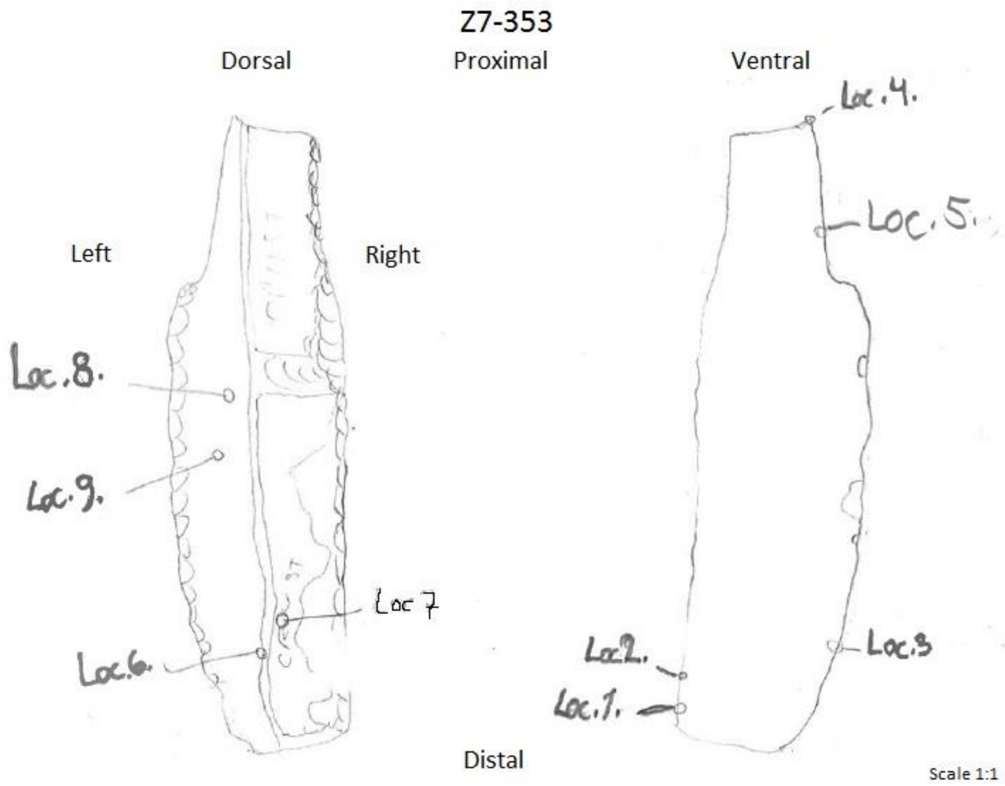
Worked material	Edge-removals	Edge-rounding	Polish	Striations
Hide	Rare	Depending on motion. Scraping produces heavily to moderate edge-rounding, while cutting and boring produces less.	Develops as a band along edge. Either rough or matt or rough and greasy. Brightness varies. Sometimes has deep "craters".	Very rare
Bone	Rare	Slight	Longitudinal motions creates a rough polish, transverse motions creates a smooth polish. Highly reflective and pitted. Local distribution. Polish-bevels are distinctive.	N/A
Antler	Mainly after longitudinal motions.	Minor	Usually a flat topography. Quite easily confused with bone or wood.	Extremely rare
Silicious wild plants	Depending on toughness of the stem.	Slight	Highly reflective, fluid-like band. Sometimes has directionality.	Extremely rare

Cereals	Rare	Dependent on the amount of use.	Highly reflective and matt. Topographical variations from flat to domed, depending on amount of use.	Rare
Wood	Common for scraping implement. Fresh wood causes less damage than dry.	N/A	Isolated, highly reflective spots or a band along the edge. Texture is smooth and matt, and almost always domed.	Rare


10
Z7-353

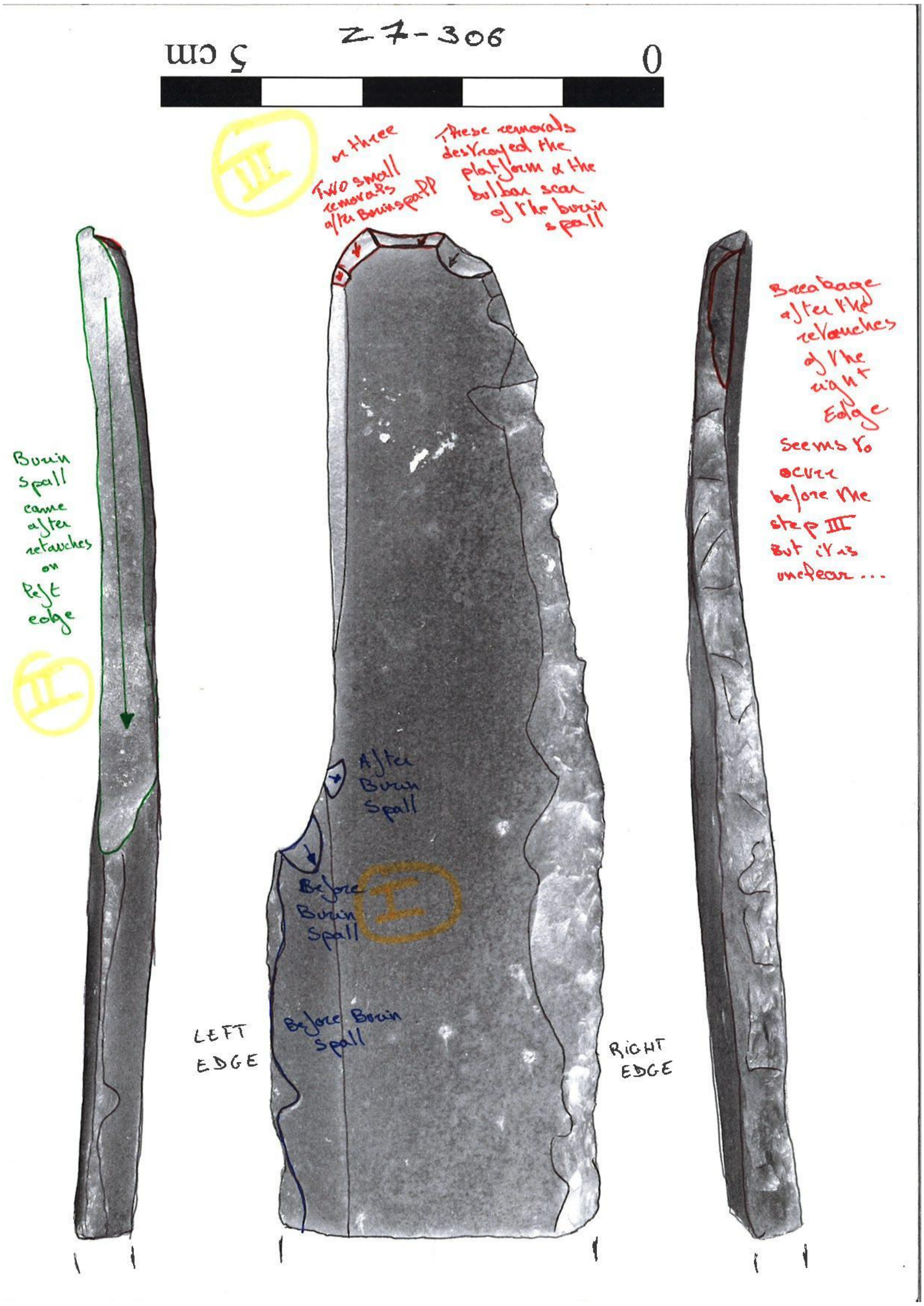
Courtesy of Dr. Roussel 2016.

Appendix IV



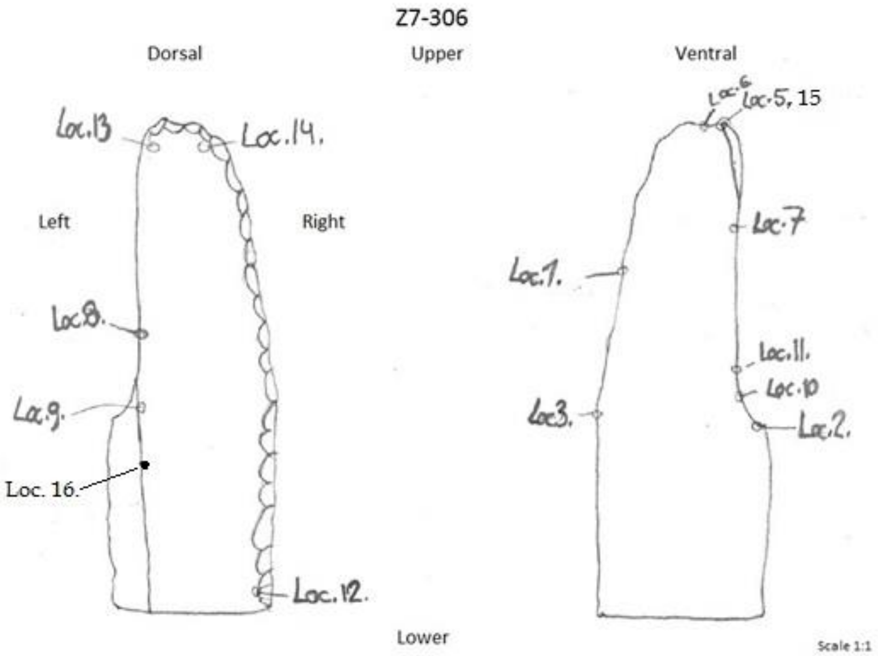
Location #	Picture in figure
Location 1	B, fig. 34
Location 2	A, fig. 34
Location 3	C, fig. 34
Location 4	C, fig. 35
Location 5	B, fig. 35
Location 6	D, fig. 34
Location 7	A, fig. 35
Location 8	D, fig. 35
Location 9	E, fig. 34

Appendix V



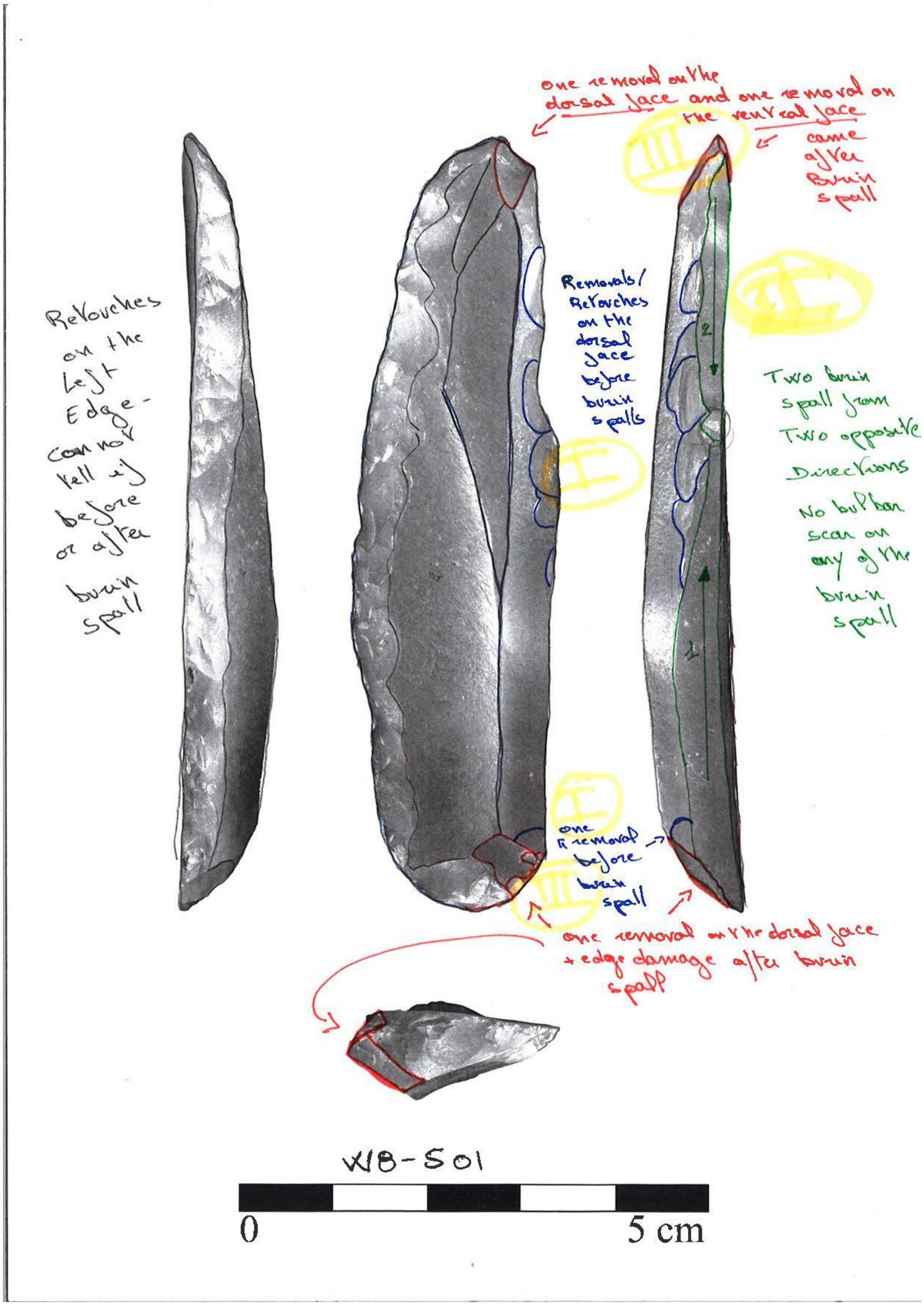
Courtesy of Dr. Roussel 2016.

Appendix VI



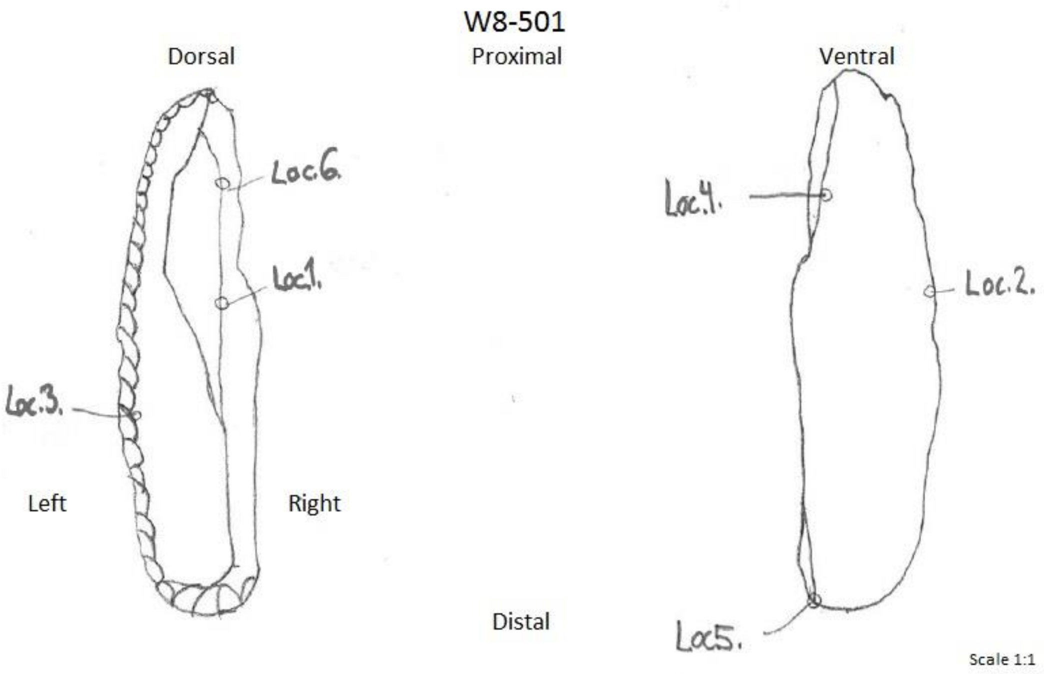
Location #	Picture in figure
Location 1	A, fig. 37
Location 2	B, fig. 37
Location 3	C, fig. 37
Location 4	Erased
Location 5	Not used
Location 6	D, fig. 38
Location 7	Not used
Location 8	B, fig. 38
Location 9	D, fig. 37
Location 10	A, fig. 38
Location 11	E, fig. 38
Location 12	E, fig. 37
Location 13	F, fig. 37
Location 14	G, fig. 38
Location 15	C, fig. 38 and
Location 16	B, fig.

Appendix VII



Courtesy of Dr. Roussel 2016.

Appendix VIII



Location #	Picture in figure
Location 1	E, fig. 40
Location 2	A, fig. 40
Location 3	D, fig. 40
Location 4	C, fig. 40
Location 5	B, fig. 40
Location 6	F, fig. 40

Abstract

The consequences for the Neanderthal population in Western Europe upon the arrival of anatomically modern humans in the Upper Palaeolithic, is a matter of intense debate within the field of prehistoric archaeology. The fact that our species is the only one to survive, has traditionally been explained by a supposed cognitive superiority inherent to anatomically modern humans. However, recent studies have refuted most of the proclaimed differences between the species, leaving the reason behind the Neanderthal disappearance even more peculiar.

One way to address this issue, is through the study of behavioural differences between the species. By mapping differences and compare the results, we may potentially discern behavioural patterns or cognitive abilities indicating a difference great enough to explain the notable success of our species.

In this study, a micro-wear analysis of three multi-functional flint tools, distinct for Upper Palaeolithic assemblages (hence anatomically modern humans) was performed. The tools originate from the final stage of the Early Aurignacian occupation of Les Cottés, France, a site that has been occupied by both Neanderthals and anatomically modern humans. The continuous stratigraphical sequence of the site makes it suitable for behavioural comparisons between the two populations within the same context. By understanding the function/s of the tools, tasks performed at the site can be inferred. As a consequence, information about behavioural and cognitive aspects of the manufacturers of the artefacts can be indicated. The results can later be used for behavioural comparisons between anatomically modern humans and Neanderthals, in an attempt to define eventual cognitive or behavioural differences.

In order to strengthen any claims of performed tasks, the results from the micro-wear analysis were compared with results derived from the faunal and lithic assemblages of the same context. The results corroborated each other, consequently contributing to our knowledge about certain behavioural aspects of anatomically modern humans from this period.