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ON THE POLYSEMIC NATURE OF TRACES AND CO-OCCURRING PATTERNS IN ANTHROPIZED MATERIAL — CONTRIBUTION OF A "RETOUCHER" WITH A FLAKED BONE ASPECT FROM ROC-EN-PAIL (FRANCE)

ABSTRACT

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This article presents a new archaeological material to discuss methodological issues encountered by scientists working both on minimally-modified bones from Mousterian assemblages, to those dealing with the identification of "retouchers" having a flaked bone aspect. The technological approach integrates complementary analytical study-frames in order to assess archaeological information. On the one hand, analogies with similar experimentally produced patterns reduce the functional identification of the archaeological specimen. They do not deal with a single artefact-type in the category of "retouchers", which thus remains generic. On the other hand, the recording of the patterns in their chronological order, combined together with that of modifications relative to the diagenesis of the bone as an artefact, suggests the "retoucher" was reduced in a relatively fresh state by a carnivorous predator also. The evidence of this co-occurrence, if characterizing the successive anthropic-originated bone beds ultimately degraded by predators in situ, would suggest a relatively short period of human occupation generated by the use of the site in a singular cyclical conception "prey-hunter-predator" at regional scale.

Keywords: Mousterian, retouch, flake, puncture, percussion, pattern, temporality, bone technology
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INTRODUCTION

Identification of minimally modified bone artefacts from Palaeolithic assemblages is generally done by using large categories of archaeological material; the "tool" category takes priority over other modified bones (Child 1995; Shipman 2001). The "tool" category, as defined by using high-resolution optical observation on large bone fragments bearing flake scars and/or impact marks, mainly regroups "retouchers" (Baumann *et al.* 2020; Doyon *et al.* 2018), or retouched tools (Romagnoli *et al.* 2017; Villa *et al.* 2021) and other tools used for smoothing, scraping, battering, *etc.* (d'Errico and Henshilwood 2007; Parfitt *et al.* 2022). The other parallel category of discoveries reflects all other kinds of materials, mainly osseous items reduced by predators and/or by taphonomical factors or agents (Maté-González *et al.* 2019). As vestigial remains of consumption and/or marrow fracturing, the bone remains also display impact marks and/or flake scars (Vettese and Daujeard 2021; Schiffer 1983). In order to distinguish the artefacts in their attribution to one or another category of the archaeological materials, patterns in used bones are compared with those due to natural formation processes (Bello and Parfitt 2023). The dichotomy approach gives reliable identification of bone pieces originating from anthropogenic action in prehistoric archaeology. Meanwhile, it implies to give little interest in discussing other features such as co-occurring or co-related patterns and this may lead to possible conflicting identifications of the same type of artefacts. Occurrence of flake scars or scaling retouch are either recognized as being due to taphonomical events – effects of trampling (Dominguez-Rodrigo *et al.* 2010) or actions of predators (Villa and Bartram 1996) – or, conversely, damage or intrinsic attrition to the use of the bone as a tool or a retoucher (Bauman *et al.* 2023; Blasco *et al.* 2013; Daujeard *et al.* 2018; Mateo-Lomba *et al.* 2019). When "retouchers" display additionally point-ended morphologies, as is the case of the archaeological piece that, therefore, is used as an example in this paper (Fig. 1), the identification of such bone artefact is even more difficult; a point-broken end possibly being perceived as a pointed-shaped product which, as such, is integrated into the category of the bone industry (Iakovleva *et al.* 2018, p. 55, fig. 15). Given the dual possibility, it is necessary to present more material to discuss the relevance of documentation in similar-looking patterns (Parfitt and Bello 2024). This is conducted in detail by means of a qualitative analysis perspective at first sight, *i.e.*, prior to the quantitative analysis it enables (*e.g.*, Courtenay *et al.* 2020): flake scars or scaling retouch versus removal marks relative to knapping or the using of the bone as a tool; impact marks versus scores relative to retouching lithic. The illustrated material is highlighted using the concept of tool biography (David and Ducroq 2023) or the *chaîne opératoire* of the item (Turner *et al.* 2020), *i.e.*, the process of transformation of a bone through the diacritical reading of its surface modifications, from the anatomical matrix to the artefact as a bone material remnant of a cultural context.

RESEARCH AND METHODOLOGICAL BACKGROUND

Very early in French prehistoric research, archaeological excavations carried out on Middle Palaeolithic cave sites fuelled a debate on the polysemic nature of the traces present on some fragments of long bones (from epiphyses and diaphyses) found among the faunal remains of large mammals (Baudoin 1906; Henri-Martin 1906). Observations of flake scars on bone fragments, found as such or with additional impact marks, raised epistemic issues. The identification of this material as a peculiar category of objects became important because it was recorded from faunal bone floors of human origin (Daujeard *et al.* 2014). This brings to question as to whether these different patterns, in the form of flaked and/or impacted bones, are the result of a single technical human action? And, conversely, could diverse or distinct technical actions shape the bones the same way? By addressing these questions, the then technological approach, albeit unnamed in bone studies, began to develop through empirical research and experimentation (see Bello and Parfitt 2023, for a complete list of references).

If the aim of the (bone) technologist is to reconstruct the technical behaviour of prehistoric human groups from archaeological information, this is however achieved by applying various implicit academic prisms in reading past materiality, which makes the interpretation of bone remains among Middle Palaeolithic assemblages controversial when discussing ancient conceptions from surface modifications (d'Errico *et al.* 1998). The reconstruction of past technical actions on bones mainly depends on the ways of looking at archaeological osseous material: vestigial (Burke 2018; Farizi *et al.* 1994; Stiner 2004) or artefactual (Vincent 1988). These perspectives implicitely bring out a relationship between a feature and a corresponding agent, action or activity (Chase 1990; Holen and Holen 2011; Thiébault *et al.* 2019; Toth and Woods 1989). Despite a few experiments, targeted surface changes of the tool depending on the duration of its usage (Castel *et al.* 2003), archaeological and experimental studies in French research turned the interest in towards the identification and the reproduction of marks through the repetition of tasks (Vincent 1993; Armand and Delagnes 1998) and knapping and retouching or shaping lithic products using bones (David and Pelegrin 2009; Langlais *et al.* 2010; Mallye *et al.* 2012; Schwab and Rigaud 2009; Tartar 2012). In this sense, the necessary conditions for carrying out any replications were taken for granted (for clarification on this issue, see David *et al.* 2023-a), and the applied analytical framework relied less on how to base experimental work to promote an adequately equivalent level of understanding of the experimentally produced marks, but rather on reproducing patterns as many times as possible under varying study parameters to support interpretation based on analogy with the archaeological material. This research perspective generated a significant source of imagery for the identification expertise through the use of developed available high-quality optical resolution equipment (Abrams *et al.* 2014; Fernández-Jalvo and Andrews 2016; Hutson *et al.* 2018). The historical question posed by Henri-Martin as to the origin of the appearance of a modification on a bone was implicitly abandoned in favour of comparative studies of traces carried out term by term, in order to guarantee universality. Against this, our approach is to analyse the patterns based on a prior understanding of the nature of the minimally-modified bone material (*e.g.*, David and Valentin Eriksen 2021). In other words, to what extent does the artefact testify to an earlier being by its present appearance alone, rather than by its well-preserved traces that are otherwise similar to those found in other archaeological finds?

Because organic matter irremediably undergoes diagenetic change, all bone artefacts are not automatically comparable in terms of study. Considering experiments only as a validation of observations seems to detract from the contribution of wear and techno-functional approaches and we believe that it should be applied in conjunction with the latter two, also in the field of minimally-modified hard materials of animal origin. We subscribe that the different disciplines involved in worked bone studies – anatomy, traceology, technicity and taphonomy – are all contributing in the (technological) reading of an archaeological bone material (David 2007). This is done by taking into account the original aspect of the unmodified bone element in relation to the traces resulting from its reduction as a recovered item. Only those that appear to have been produced by the technical action of a biological agent as part of an intentional design can be identified as man-made products (*e.g.*, Diedrich 2015). This involves reading the surface of the bone to identify the raw material, characterizing its patterns and the steps by which it has been transformed in chronological order and ordering. In the field of minimally modified bone remains, the study of the impact marks prior to that of the bone artefact, as an extracted flake modified by its usage, would lead to a reduction of our understanding of the archaeological object to a mere knowledge of its sole material aspect. As the two aspects under discussion – flake scars and impact marks – may relate to distinct categories in the domain, it is important to raise the issue of a common scale of resolution for the study of slightly modified diaphyseal fragments, which are more appropriately referred to as "bone with impressions and scars" (Patou-Mathis 2002). This scale of resolution is reached via the diacritical analysis of the artefact with reference to the bone blank as a given anatomy, using five principles of reading the bone artefact – trace-recording, overlaying, over-crossing, arranging and framing (*e.g.*, David *et al.* 2023-b).

MATERIAL AND METHOD

A specimen found in a Palaeolithic site is used as a didactic example of our technological reading (Fig. 1: top right). It was found in square 10/5 from the Roc-en-Pail site, Maine-et-Loire (Soriano *et al.* 2021), where it was attributed to a unit of stratigraphy n°305 (erosion of US n°401) Mousterian horizon. The specimen is chosen for its distinctive morphology among the "retouchoirs" available from the 2017's excavations (David and Gargani 2018, Annexe I-n°152). The archaeological specimen constitutes a valuable representative for

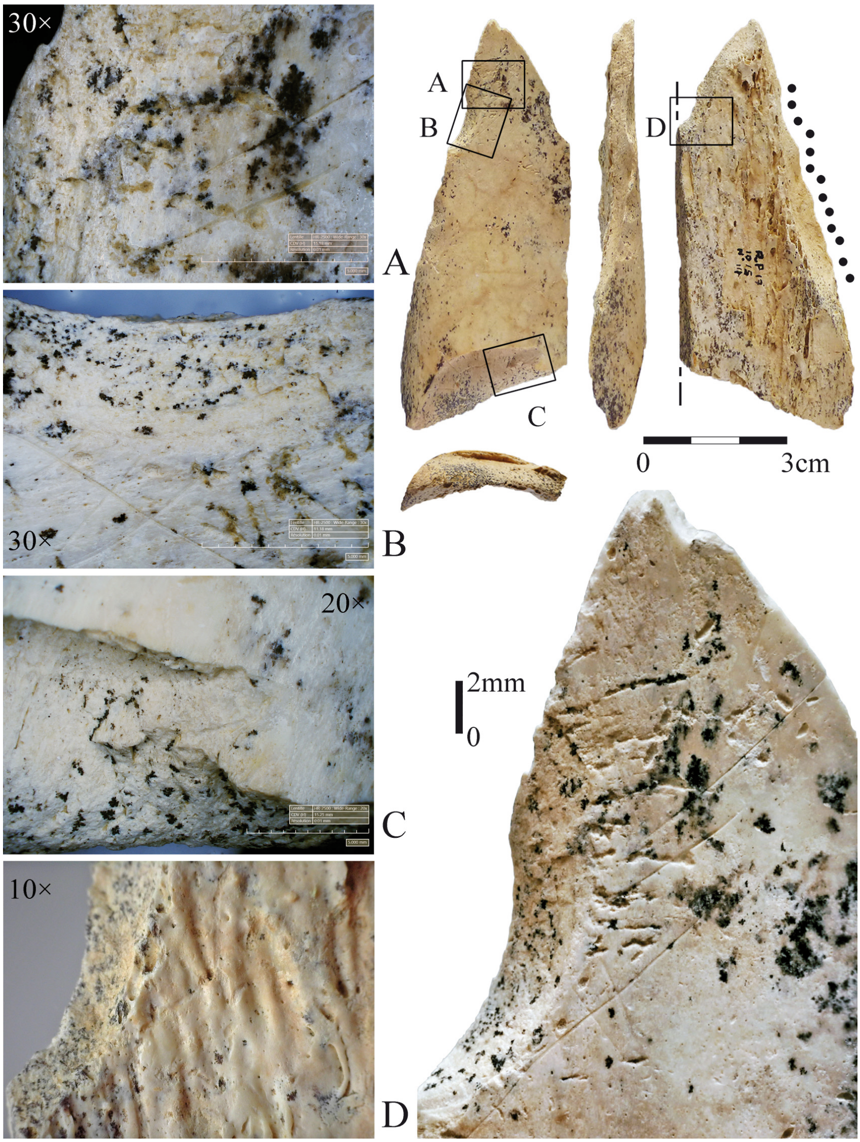

Fig. 1. A Mousterian "retoucher" with a flaked bone aspect bone from Roc-en-Pail (France). Illustrated by É. David

our purpose as a well-preserved anthropized bone piece: 88 mm long; 37.4 mm wide; 11.4 mm thick. From its morphological aspect alone and according to the classical approaches to such bone item, this specimen can be identified as a retoucher flake damaged by use, a bone flake shaped by retouching for a use as a retoucher, or even a bone point shaped out from an initially impacted bone matrix. Its observation was undertaken using a RX-100 Hirox microscope for 3D imaging under low magnifications (20× and 30×). The same equipment was used to document features from other specimens, recently-gathered bone flakes bearing similar impact marks, but from dog gnawing. The percussion marks, as visible on other used bone fragments recently obtained from an experiment involving lithic tools, on which patterns on the bones were observed using a motorized Zeiss Axio Imager Z2m microscope with an Axiocam 506 colour (10×), and assembled for this purpose (Figs 2 to 4), are shown for their value as comparative materials.

Contribution to the methodology using two experiments

A first experiment on 'bone tool-making tools' was conducted with fresh bones of large ungulates used in lithic reduction and percussion by a skilled flint knapper – Jacques Pelegrin – originally in answer to a previous Postglacial archaeological issue (David and Pelegrin 2009). The experiment was conducted to account for technical actions possibly performed during the Stone Age as regular procedures using bone-blanks on lithic material. For the purpose of this paper, the surface of each of these used bones was newly micro-photographed after being first coated with a light smoke deposit of ammonium chloride salts to give an improved optic resolution under magnification (unfortunately bone grease still remains in the form of large brown dots in Figs 3: A and 4: B). The use of a skilled knapper – *i.e.*, with more than 10 years of regular lithic practice – was required to ensure that all the marks recorded on the surface of the bone fragments would indeed result from an effective action even if the knapper sometimes might 'miss' his strike. In this way, "replications for replication of marks" as well as parasitic marks were avoided. In other words, the technical action was stopped when, for instance, the lithic edge was retouched with satisfaction – *i.e.*, the lithic tool produced with the use of the bone fragment was considered to be usable as such by the flint knapper. The obtained impact marks on the bone are all percussion marks (Vettese *et al.* 2020) corresponding to a realistic achievement of technical performance.

During this experimental test, ten bone fragments were employed as active or passive tools. When using each bone fragment such as a small hammer (active), four tasks were conducted: 1) to retouch a flint product (Fig. 3: A); 2) to detach burin spalls from a truncated flint end (Fig. 4: B); and, with the flint product used as an intermediate piece, 3) to carve a large standing piece of dry wood (Fig. 2: B, C); and 4) to split a fresh long wooden piece lengthwise (Figs 2: D and 3: B-D). Conversely, using a bone fragment as a standing anvil (passive), (two) flint edges were retouched respectively by percussion (Fig. 2: A) and by pressure (Fig. 4: A).

The results of this experimental test show that, depending on how the intermediate lithic piece was precisely held during the action, very distinct marks were obtained from performing similar tasks (see Fig. 2: B compared with C). The contrary is also true: striking

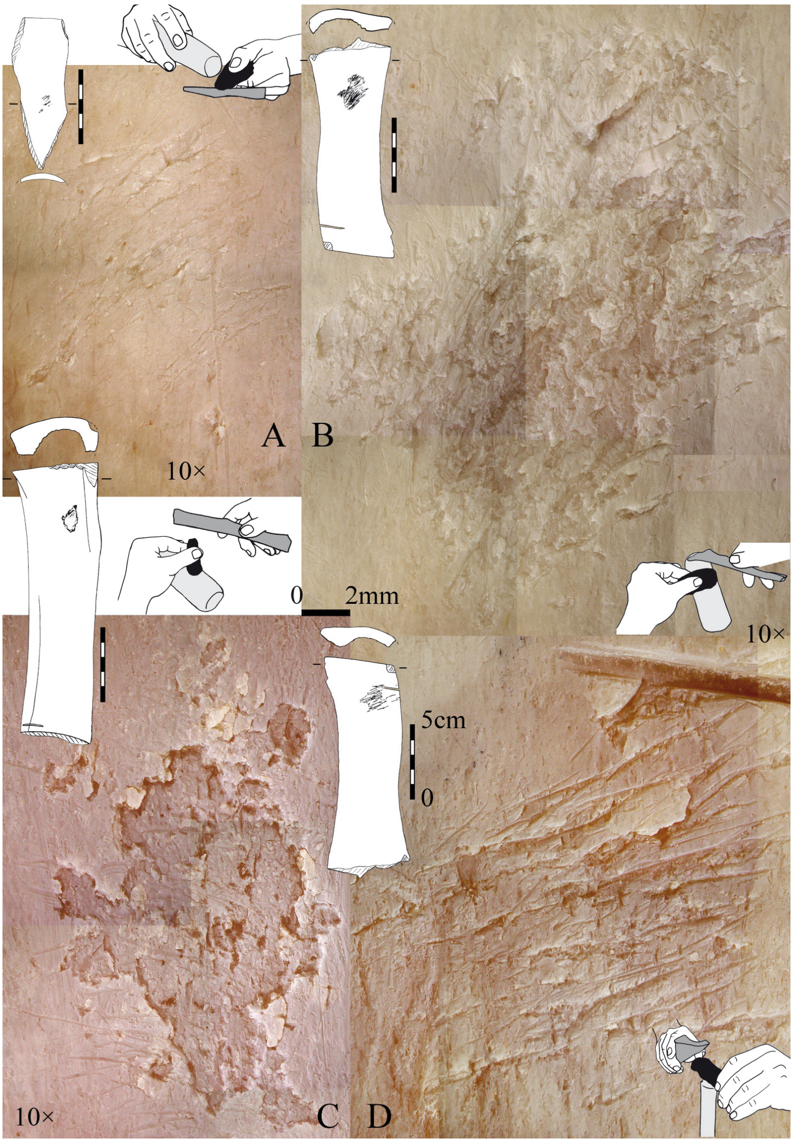

Fig. 2. Aspect of bone surfaces after having retouched a lithic edge (A), carved (B, C) and split wood (D). Illustrated by É. David and J. Orłowska

on the butt end of any lithic products yielded very close features regardless of the task (see Fig. 2: C compared with Fig. 3: C). Moreover, the type of impact marks appearing on the bone surface used as a small hammer to strike a flint edge depended actually on whether the later was previously regularized by retouch or not (see Fig. 2: D compared with Fig. 3:

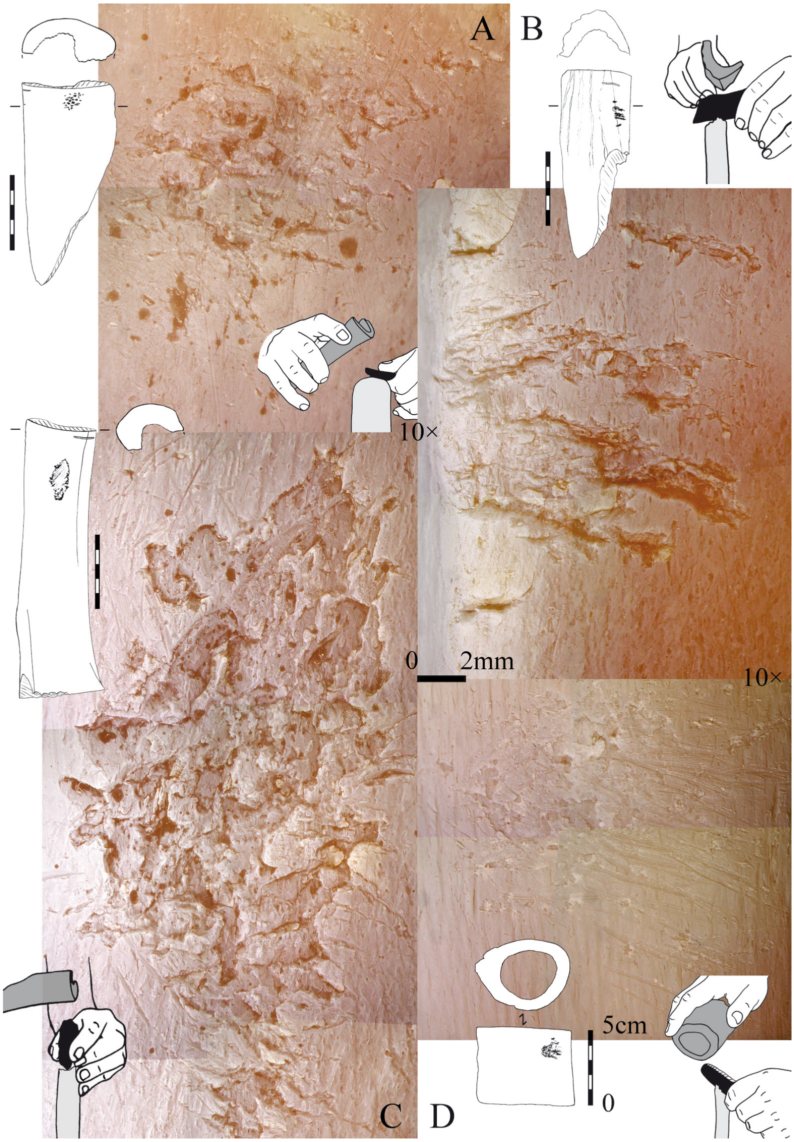

Fig. 3. Aspect of bone surfaces after having retouched a lithic edge (A) and split wood (B, C, D). Illustrated by É. David and J. Orłowska

D). Most technical actions resulted in impacting an area that is close to the upper edge of the bone tool (except Fig. 2: A) with a more or less important osseous loss sometimes associated to transversal series of marginal striations. This feature seems to reveal the motion of the gesture when using a bone fragment in percussion, leading to percussion marks that are always group concentrated where the bone is deliberately impacted. The use of the bone fragment as a retoucher in the strict sense of the term has produced results that are not particularly different from those of other types of action, if not in depth (see Fig. 3: A compared with B). The term "retoucher" should thus be placed between inverted commas. In addition, the shape of the bone fragment itself played a role in how the percussion marks distributed transversally or obliquely in the form of scores, from a concentration of isolated sharp straight marks to clustered deep zigzag lines (see Fig. 2: D compared with Fig. 3: B). Thus, it is not possible here to assess for any specified functional identification of the archaeological artefact based on the traces on the bone surface only.

A second experimental test on a 'worked bone-appearance accumulating agent' was carried out with the contribution of a trained hunting dachshund dog, a three years old male weighing 11 kg, called "Timone" (Fig. 4). The aim of this test was to refine parameters for the identification of the pointed attribute of the archaeological specimen through observations of resembling pointed morphologies of bone flakes resembling it, but gathered from the results of the dog's actions when gnawing. Although the initial quantity of carcass parts of several slaughtered white-tailed deer (mainly given to the dog) could not be sampled, 41 pieces of split bone fragments less than two centimetres-long cortical chips, 92 of long splinters from *ca* 2 to 19.2 cm long, from 0.6 to 1.9 cm wide and 0.1 to 1.2 cm in thick, and 14 half-complete diaphysis and large epiphyseal parts deposited over a period of six months (hunter's pers. comm.) were gathered from the farm where the dog was kept. These constitute a reference material that is only partly used in this paper and remain available for a more complete study.

Among the collected diaphyseal fragments, there are three large pointed pieces resembling the archaeological specimen. Their basal end appears as if intentionally broken off and a point-broken end is located at the upper extremity. The general shape suggests a bone point. This is however due to that the longest edges of the bone fragment are incidentally convergent, merging together in pseudo-symmetry on the upper face (Fig. 4, gnawed bone piece above D). These edges are not planes obtained from percussion, but planes of breakage that naturally developed in the osseous material when scars split following mainly the lamellar elongated structure of the osseous material from a more complete bone. This breakage originally developed from one or several impacts marks identified as tooth punctures, in the shape of cupule-shaped pits either aligned in a row located on the surface across the bone hard tissue (Fig. 4: C), or possibly including the adjacent plane (Fig. 4: F, arrows). These punctures with pits associated to consecutive planes of breakage located opposite to one another involved the pinch-biting of the bone (Fig. 4: E, arrows). Etching marks also drift as a result of the teeth slipping during the action of splitting the bone. Some hatched areas appeared superimposed on the edges of the breakage planes, showing a smooth aspect at prominent bone reliefs on broken parts. This smooth aspect possibly developed locally on the bone edge when in radial contact with the dog's jaw (Fig. 4: F, see abraded area between arrows). The surface also displays several parallel-aligned, large and superficial scratches (Fig. 4: D, arrows from above). These marks were

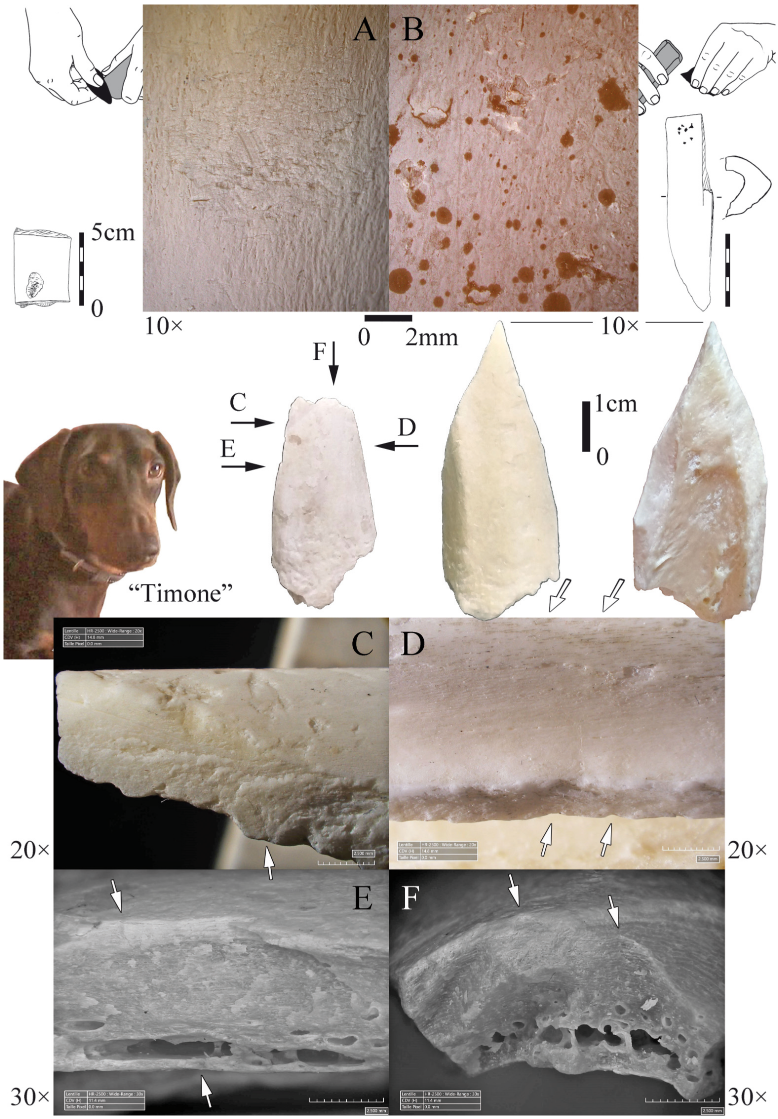

Fig. 4. Aspect of bone surfaces after having erased a lithic edge (A) and detached burin spalls (B) and results from a recent dog gnawing (C to F). Illustrated by É. David and J. Orłowska

left by the dog attempting to immobilize the bone by pressing it with its (paws and) claws. The collected diaphyseal fragments show more of these shallow grooves towards the end of the bone anatomy. The dog spent time gnawing the epiphyseal parts and the bone flake once split from the diaphysis was left by the dog and abandoned for the bony parts containing more cartilage.

The fragments collected from this observed experience on bone crushing and gnawing, where Timone was recorded in action both as a bone-modifying and as an accumulating agent, attest to a pattern containing three principal stigmata. As they usually occur together, the pattern is constituted in that they are related to each other through their systemic association on the bone piece as evidenced by:

a) cupule-shaped pits – known as punctures (Binford 1981, 51) – with various sizes and distinct morphologies, up to half a millimetre deep and sometimes in the form of an isolated elongated biting mark up to 3.5 mm of diameter; when pits are side by side, a maximal distance between the two, 5.8 mm, might indicate the effect of the cusps of a the same tooth or, more likely, the cusps of different teeth but with a same elevation on the dentition;

b) planes of breakage developed in either axial – known as butterfly-like wings or X-shaped fracture and chipped edges (Binford 1981, 51) – oblique – known as spiral-step fracture (Haynes 1983, 112) – and hinge fracture for the transverse-facial scar (Henri-Martin 1907, 301-302). These often wavy or even twisted planes of breakage are successive cracks in bone constituted of rough reliefs with flake scars deriving from the above-mentioned punctures. Where the hard tissue is impacted and cupulated, the associated planes appear in some areas relatively abrupt or perpendicular compared with the outer face of the bone (c. >106°), and;

c) etching marks – also referred to as "channelled bone" (Binford 1981, 51) – randomly distributed on the surface, but mainly coming from the opened pits, and in the form of long scratches or striations, micro-scars with sometimes (towards the upper face) smooth planed and/or shiny (hatched) areas (*e.g.*, Madgwick 2014). In addition, superficial parallel scratches (each, up to 200 μm deep and c. half a millimetre wide) with a possible additional smooth aspect can be seen on the largest bone surfaces that include epiphyseal elements, respectively at the extremities and on the broken parts.

From the two experimental tests briefly described in the frame of this paper, these slightly improved our method in that the polysemic nature of the traces guide us to a mere focus on the nature of the archaeological specimen: the artefact is a bone showing percussion marks with a pointy and flaked aspect due to gnawing. The traces on the surface are not as significant as how these relate to one another and, through time in their chronology, with the different parts of the recognized skeletal part. This is further developed with the reading of the archaeological specimen.

DIACRITICAL READING OF THE ARCHAEOLOGICAL SPECIMEN

The archaeological specimen displays a trabecular structure, axially distributed all over the inner face that anatomically corresponds to a medullar canal (Fig. 1: top right). Because of its large dimensions, the rectilinear delineation in the main profile and of the large curvature of the thick hard bone (6.9 mm) in the transversal profile, as reconstructed with its complete circumference (Fig. 5: top left, cross section), the piece is in all probability a diaphyseal part of one of the largest skeletal elements of the limbs of a large mammal (like a radius or a tibia of reindeer); the slightly thinner part of the tip-like end seems to point towards a metaphyseal part.

The artefact is mainly constituted by three convergent edges displaying planes with scars aligned along the length and even developed both on the upper and lower anatomical sides, and a large facial scar that represents the basal transverse broken end. The upper face shows a few isolated and slightly pronounced short zigzagging lines that constitute a concentration of impact marks on the tip-like end. One of the few well-preserved lines is made of three consecutive equal sharp marks, c. less than c. 2 mm long in a row. These impact marks relate to percussion due to passive or active modes on/with a lithic, such as a "retoucher". They occur sparsely with no marginal striations or extra bone loss on the surface, and have a slight transverse-oblique orientation in an area that would correspond to a flat side of the bone, anatomically (Fig. 5: top left). The area displaying these marks is damaged by a large transverse-facial scar coming from the side of the artefact; thus, a large part of the initial bone surface, bearing the anthropogenic percussion marks, is missing.

Considering that the only remaining primary edge of the artefact (Fig. 1: top right, dash lines) suggests that the bone fragment had a much longer size when initially used, it is unknown whether the concentration of percussion marks would have been close to the upper end – as required from the bone retoucher used in the above described experiment (Fig. 3: A) – or, on the bone's mid-part as a standing bone anvil to retouch a lithic edge (Fig. 2: A). By placing the location of the concentration virtually where it would remain in an initial curvature, the first hypothesis is most likely, since the percussion marks would have remained anatomically concentrated on the same and most centrally placed flattest area of the curved anatomical edge (Fig. 5: top left, between parallel lines). This being said, it is not possible to assess the possibility that the bone fragment was extracted as a bone-blank, because there is no evidence of a deliberate anthropogenic cause impact fracture. However, the very straight delineation of the remaining primary edge, where two transverse-facial scars are superimposed, which could favour of the hypothesis that the bone diaphysis was broken lengthwise prior to its use as "retoucher", as if split in a controlled manner, also recall the natural-half broken off bone which, as such, would have served in its complete osteological shape as a tool.

These flake scars derive from pits superimposed over the straight broken edge. Three oblique parallel long incisions cross over the whole impacted area on the surface and must therefore have appeared after the concentration of percussion marks. The incisions clearly end where cupule-shaped marks are superimposed on the lateral flake scar (Fig. 1: A) and extend above, and even change the surface aspect of the bone, where even flaked, which is largely transformed in pits of various depth toward the concentration of previous percussion marks. These incisions are actually made of several in a row and heterogeneously punctuated with cupule-dots just as these described for the experimental material resulting

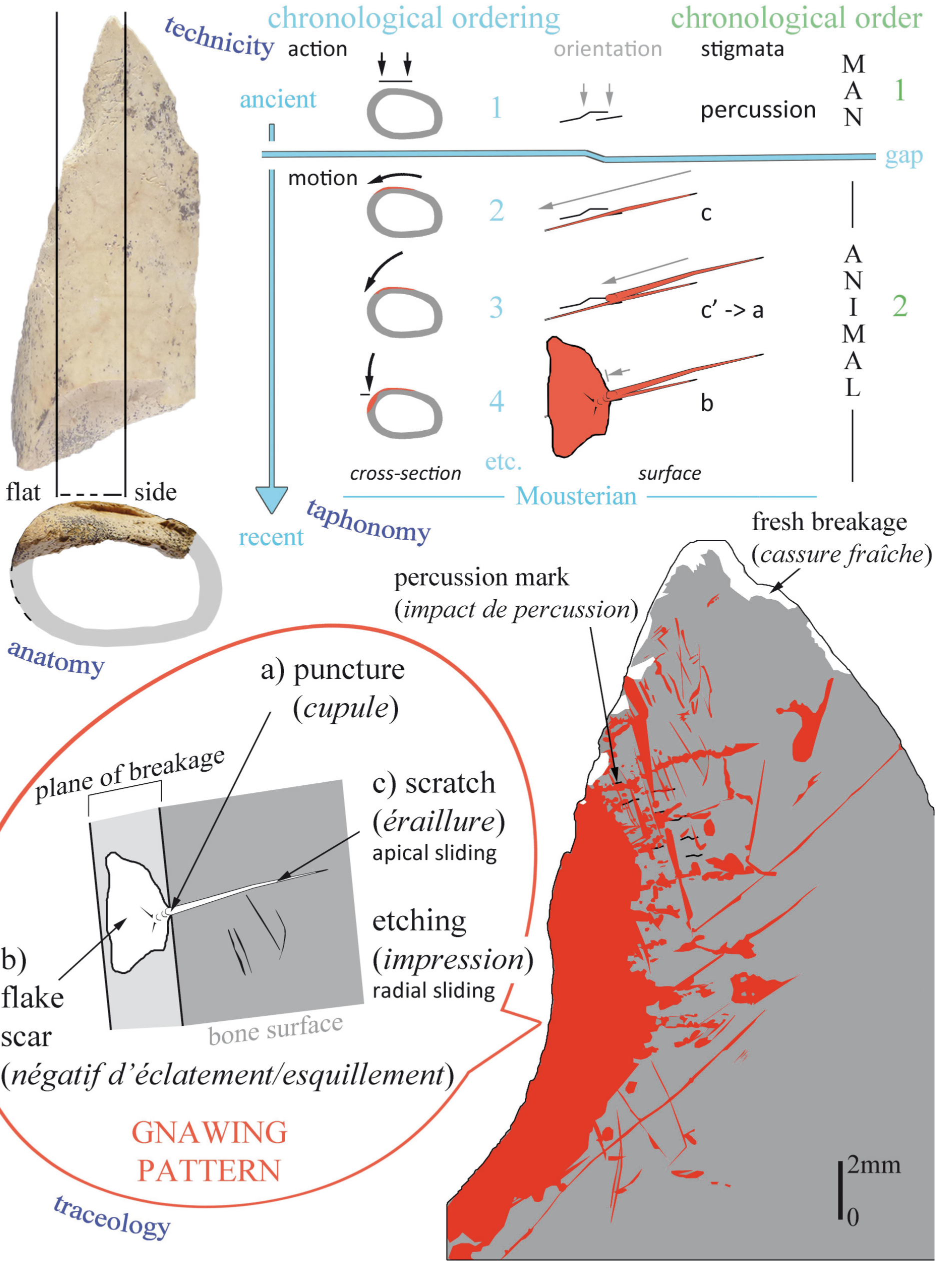

Fig. 5. Diacritic reading (synthesis) of the archaeological specimen presented in figure 1. Illustrated by É. David

from gnawing. On the other side of the artefact, the bone surface is also damaged in the same manner *i.e.*, by similar incisions cutting off the trabecular structure of the bone, albeit less easy visible due to the more developed osseous relief at that point (Fig. 1: D). The subsequent chipping of edge precisely emerges from cupule-shaped pits joining the inner trabecular tissue from above the broken edge where incisions also display. No matter which face of the artefact is considered, the planes in the shape of transverse-facial flake scars, hinge fracture and chipped edges arise from cupule-shaped pits located in surface above the broken planes. These attest to the reduction of the limb bone as with a (half) complete diaphysis in cross-section initially. Because cupules merging from incisions are rare on the medullar side, compared to the outer side of the specimen, the inner trabecular tissue must have recorded effects of the only last gnawing action, just before the bone cracked almost with its actual aspect. And, judging from the (counterclockwise) orientation and the ordering of the marks that developed with respect to the natural morphology of the bone in cross section (Fig. 5: top, chronological ordering), the bone tissue was crushed, here from left to right and from up to bottom, following a clear carnivore-gnawing pattern that gave the specimen its final pseudo-pointed morphology (Fig. 5: bottom left, gnawing pattern).

Since the lateral flake scar develops as the chipped edge, *i.e.*, into single wavy broken planes instead of step-terminating fracture (*e.g.*, Binford 1981, 51), it is most likely that the bone was still in a relatively fresh state of preservation when it was gnawed. In addition, all scars, broken base and chipping of edges have a lighter shade compared to the otherwise more brownish colour of the bone artefact that is additionally showing manganese dots. While these concretions spread all over the surface, this makes it difficult to know whether the specimen's rectilinear edge (dash lines) is the result of a deliberate fracturing of the bone in its length previous to being used as a "retoucher", or as an anatomical matrix that has naturally broken off due to that the osseous deposit eventually underwent prior to being used as a "retoucher" a kind of taphonomic pressure due to a lateral displacement of the sediment deposit locally (*e.g.*, Bertran *et al.* 2019). In some parts however the manganese dots are not present all over the flake scars. This suggests the cracks which have developed into the bone from gnawing eventually detached as complete flakes and fragments long but only after the material was buried, meaning the present aspect of the archaeological specimen as an artefact relates to its very last osseous diagenesis as a Mousterian calcified gnawed fresh bone. The archaeological specimen can be identified as genuine anciently-modified bone material by two distinct biological agents successively: human and carnivorous (Fig. 5: top, chronological order). The latter damaged the tool which served in percussion shortly after the time when the human agent accumulated and used bones. In this respect, and except some recent alterations around the tip (Fig. 5: bottom right), all the features of a lighter shade occurred soon after the bone was abandoned as a "retoucher" but quite shortly before being definitively buried.

From the diacritic reading through optic observation of the archaeological specimen, as analyzed as if out of context for our methodological purpose, the identification of the Mousterian artefact has been refined by using a dual variable – volumetric and technic. The relationship between the used anatomical matrix and the recorded patterns – percussion with gnawing stigmata – illustrates its unique morphology. With the ordering of the patterns in chronology, it was possible to distinguish the pseudo flake-retouched aspect of the bone fragment edges identified as finally deriving from gnawing, from the traces left on the original bone-blank by its use, eventually a small hammer made of a large diaphysis used in percussion.

CONCLUSION

The paper shows that percussion and gnawing patterns co-occurred and not co-related, *i.e.*, no gradient exists in the way the pseudo-retouch pattern developed through time on the bone surface during action, from zigzagging lines to flake scars. The gnawing pattern overlap the prior percussion zone, but after a while only. There is thus no strict contemporaneity between the human activity and the carnivorous degradation of the used bone piece (this would be expected in the case that the carnivorous were companions to the hunters), but a differed co-occurrence: human occupation first, the site was then occupied by predators.

This kind of co-occurrence from the study of "retouchers" might further contribute to attest to the human origin of bone floors recorded *in situ* and to the relative dating of the successive osseous deposits of the site, if containing more of such evidence, within the frame of the Mousterian to refine the absolute chronology (Richard *et al.* 2021). If the kind of Mousterian work done using bone on/with the lithic need to be specified, as well as the carnivorous species responsible for the reduction of the anthropogenic-used skeletal parts, this differed co-occurrence—in that the bone matrix was used as a practical percussive tool and, soon after, was remaining as a fresh available material to be gnawed over a relatively short time span—unearths new insights into the temporality of human occupations *in situ*. If characteristic to the bone deposits in the stratigraphy, as resulting from successive similar frequentations of the site, this temporality might have been relatively short and generated by a recurrent cyclic conception of the territorial occupation at the regional scale.

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