

# Testing the effectiveness of horse teeth as retouchers: a preliminary characterisation of the use wear traces

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## 1. Introduction

The aim of this work is to test the effectiveness of horse teeth as retouchers and their impact on the manufacture of lithic tools. For that, an experiment was conducted in which 41 horse teeth were used to retouch flakes on several raw materials. Understanding how these tools were used will complement the more traditional approaches for interpreting stone tool technologies, and it will also provide a new perspective for discussions about the technical abilities of neanderthal and early modern human populations. Use wear traces have been characterised in order to better understand its formation and development on materials with different physical features. The scope of this paper leads to consider teeth retouchers as important elements of the *chaîne opératoire* for lithic industry

## 2. Experimental framework

Five experienced experimental stone knappers performed the activity of retouching tools with upper (n=23) and lower (n=15) premolars/molars and incisors (n=3) of horse.

Four types of raw material were used: 1) **Flint from Norfolk (FN)** (United Kingdom); 2) **Flint from Ebro Valley (FEV)** (Zaragoza, Spain); 3) **Quartzite from Olmos de Atapuerca** (Burgos, Spain), and 4) **Quartz from Moia** (Barcelona, Spain).

High resolution moulds of the tooth surfaces were made to record the initial conditions and the development of user wear traces during the experiment.

The transparent casts were examined with a stereomicroscope (Zeiss Stemi 2000-C). All tooth surfaces used in the experiment were examined under transmitted light. Different magnifications were used depending on the size of the use wear traces, from x6.5 to x 50. Microphotographs were taken using this same equipment. The alterations were analysed both quantitatively and qualitatively.

We followed the nomenclature established by **Mallye et al. (2012)** to characterise the use wear traces.

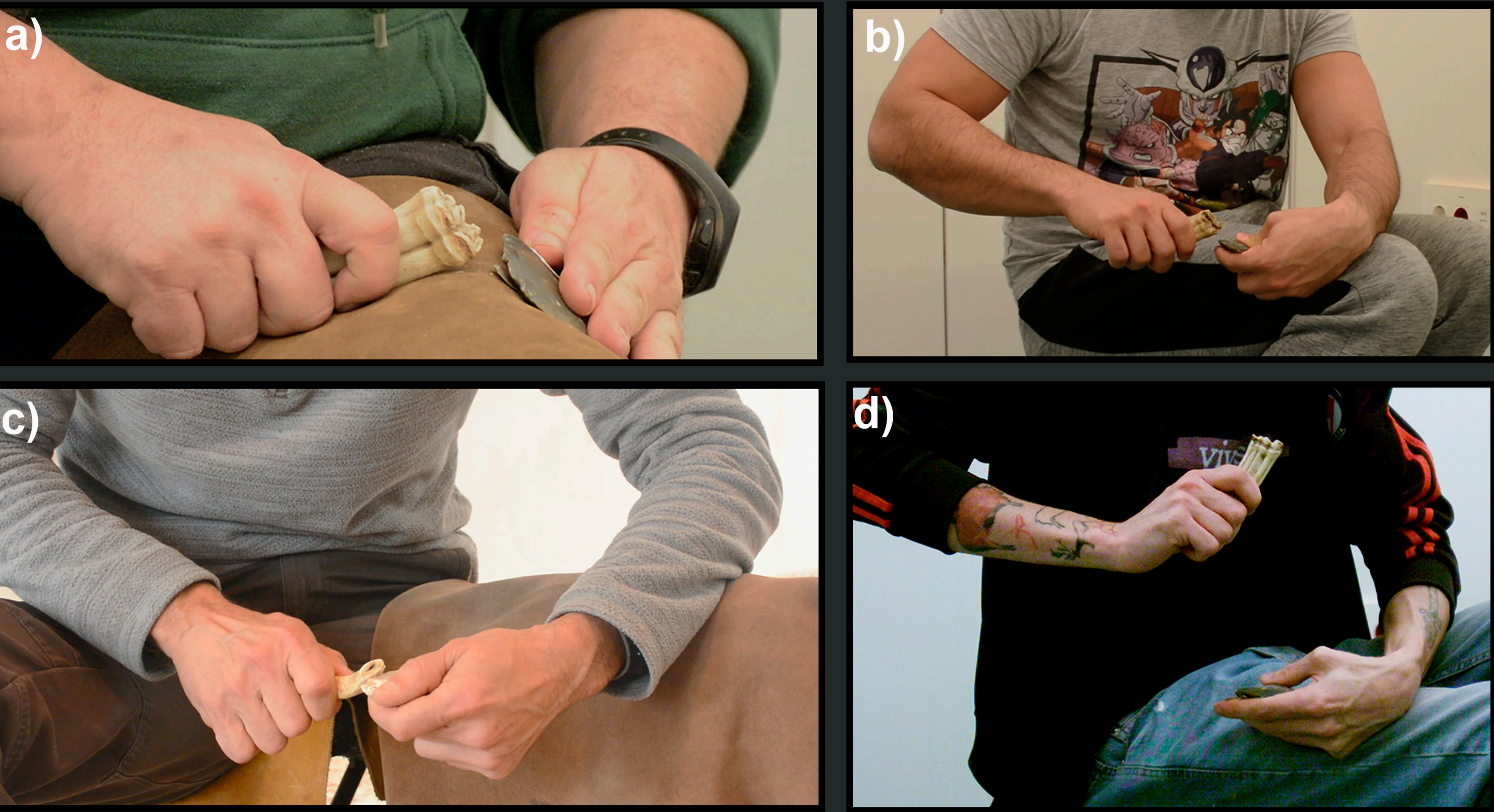


Figure 1. a) knapping a Solutrean point; b-d) knapping scrapers.

## 4. Discussion and conclusions

- Features of horse teeth provide a great flexibility to retouch tools. They allow the use of a wide range of techniques, being possible the manufacture of typical tools from both Middle and Upper Paleolithic.
- In some cases, use wear traces only can be identified using high-resolution methods. Thus, teeth should be observed carefully in the archaeological record.
- Techniques used can be inferred through the analysis of the morphology of the use wear traces.
- The different chemical composition of bones and teeth should be considered. Teeth are denser and heavier than bone blanks and, consequently, their technological features are not homologous. This could lead to differences regarding the features of the retouch. Therefore, more comparatives studies should be carried out.

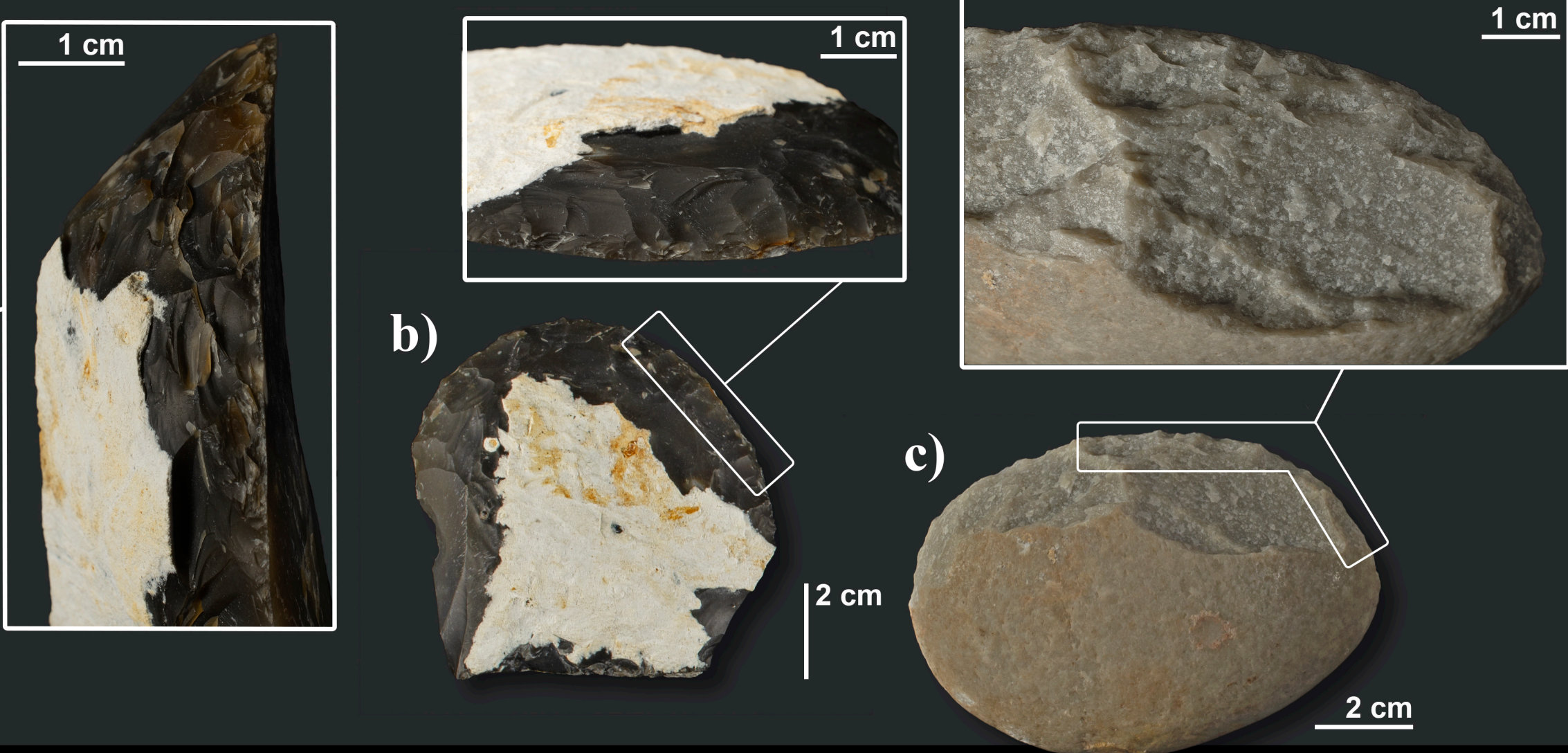


Figure 2. a) Quina type retouch in FN; b) typical scraper knapped in the experiment, showing a retouch with direct orientation, continuous distribution, convex delineation, long extent of the removals, low angle of removals and a subparallel morphology of removals. c) demi-Quina scraper in quartzite. Photos taken by M. D. Guillén (IPHES) and modified by C. Micó.

## 3. Results: type of tools and mode of retouch

In total 143 tools were knapped, including: 5 pointed scrapers, 27 scrapers, 24 demi-Quina scrapers, 16 Quina scrapers, 5 denticulates, 51 bladelets, 1 solutrean point, 10 backed points and 4 backed blades.

The high quality of the FN allowed a broad variety of retouching types. 92 tools were obtained. Scrapers tend to show same features (**Figure 2b**).

With quartzite only were made scrapers and demi-Quina and Quina scrapers as consequence of the raw material characteristics. 28 pieces were retouched. However, teeth also allowed a long and invasive extent of the removals as well as a long angle retouch and demi-Quina and Quina retouch (**Figure 2c**).

Quartz only allowed knapping small-sized tools due to internal fissures of the pebbles. Knapped pieces (n:10) include demi-Quina and Quina scrapers.

13 tools were knapped employing FEV. Contrary to FN, the pieces manufactured with FEV show different features, most probably due to the hardness of this raw material. The extent of the removals is short, and angles of removals tend to be abrupt or semi-abrupt.

## 3. Results: Morphological description of the resulting use wear traces

Hatched areas are the most common used areas. They have been identified in 51 (78.45%) of the 65 moulds analysed (including all the processes recorded). Scaled areas appear in 35 (53.85%) of the total and pitted areas in 24 (36.92%) of the total.

Compared to bones, scaled areas are relatively frequent (**Mallye et al. 2012**). This may occur due to: 1) the higher the frequency of use is, the more probable that scaled areas can be formed, and; 2) the tooth structure comprised by layers (in horse teeth, cementum is the most superficial layer, followed by the enamel, dentine, and enamel again).

Hatched areas are correlated with the retouching of flint flakes (chi-square cal 14.367;  $P < 0.05$ ).

Teeth used to retouch quartzite flakes are correlated with pitted areas (chi-square cal: 8.6911;  $P < 0.05$ ).

Morphology of the use wear traces varies according to the technique used by each knapper, being clearly distinguishable (**Figure 3**).

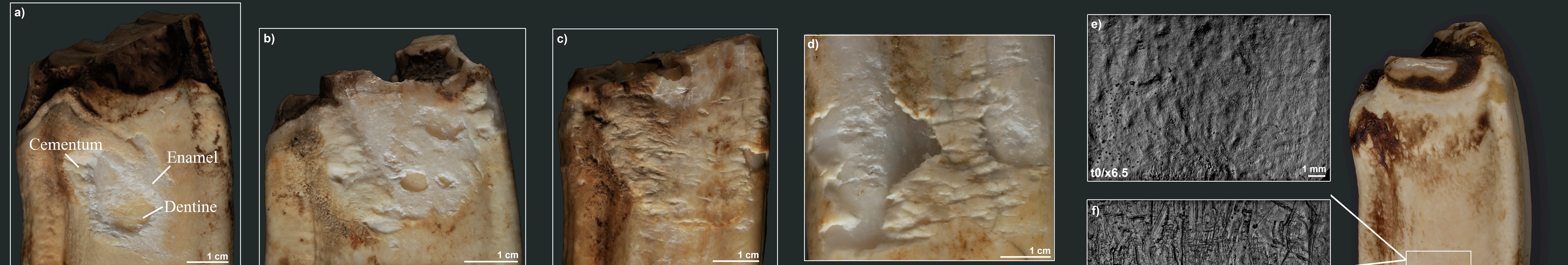


Figure 3. a) Scaled area. The upper molar was used to knap a Quina scraper on quartzite; b) Scaled area. The upper molar was used to knap a scraper on FN; c) Hatched area. The upper molar was used to knap two pointed scrapers on FEV; d) Hatched area. The incisor was used to knap a scraper on FEV; e) Microphotograph before the tooth was used to retouch bladelets; f) Microphotograph of the same area after the tooth was used to retouch bladelets to make backed points (n=10) on FN. This upper molar was used as pressure flaker, gripping the tool between the palm and fingers and levering it against the lithic tool-edge. Use wear traces are characterised by slightly pitted and hatched areas associated to microstriated areas. Photos taken by (a-d) M. D. Guillén (IPHES) and modified by C. Micó.

References:  
Mallye, J.-B., Thiébaud, C., Mourre, V., Costamagno, S., Claud, É., Weisbecker, P., 2012. The Mousterian bone retouchers of Noisetier Cave: experimentation and identification of marks. J. Archaeol. Sci. 39(4), 1131–1142. <https://doi.org/10.1016/j.jas.2011.12.018>

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