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Potential of a large-scale functional analysis to reconstructing past human activities at the Final Palaeolithic site of Lommel-Maatheide

Marta Arzarello  and **Alice Leplongeon**  based on peer reviews by **Gabriele Luigi Francesco Berruti** and **Ana Abrunhosa**

Sonja Tomasso, Dries Cnuts, Justin Coppe, Marijn Van Gils, Ferdi Geerts, Marc De Bie, Veerle Rots (2021) A closer look at an eroded dune landscape: first functional insights into the Federmessergruppen site of Lommel-Maatheide. Missing preprint_server, ver. Missing article_version, peer-reviewed and recommended by Peer Community in Archaeology.

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The paper “A closer look at an eroded dune landscape: first functional insights into the Federmessergruppen site of Lommel-Maatheide” [1] focuses on the final Palaeolithic (Federmesser) site of Lommel-Maatheide. Federmesser sites from northern Belgium such as Lommel-Maatheide, Meer and Rekem, show evidence for dense human occupation of specific areas located on top of Tardiglacial dunes nearby water bodies [2]. Preserved spatial distribution of finds at the sites suggest different activity areas and the presence of habitat structures [2]. However, because of the low organic preservation at the sites, functional analyses of lithic assemblages have the potential to significantly contribute to the spatial organisation of activities at these sites. This study by Tomasso et al. [1], represents an excellent example of a large-scale integrated approach to the study of lithic industries. The article undoubtedly demonstrates the potential of the proposed methodology and the reliability of the results obtained.

The article explores two different aspects (linked and excellently interconnected here): the possibility to apply use wear, residue and fracture analyses, on lithic assemblages affected by taphonomical alterations and to study lithic assemblages from dune landscapes.

The study allows to answer differentiated questions: what is the influence of taphonomical alterations on use wear analysis? How do excavation methods impact the formation of use wear and the preservation of

residues? Can we recognize distinct domestic activities? The article also provides an interesting hypothesis about hunting activities and propulsion methods.

The applied methodology is effectively interdisciplinary and innovative. It demonstrates how a truly integrated and articulated approach can represent the turning point for going beyond a mainly descriptive dimension to move towards a real understanding of the sites.

Studies dedicated to the analysis of the propulsion mode are not very frequent, but they are surely very important to better understand human behaviour [3]. Here, the methodology developed for the evaluation of the propulsion mode represent an important starting point for the definition of a new approach. Morphological and morphometrical analysis are integrated to the evaluation of the mechanical stress, to fracture delineations and to the hafting system (the latter defined on experimental basis).

This article therefore underlines the potential of combining different approaches to functional analysis associated with a 'tailored' reference collection and applying them to a high number of artefacts for reconstructing past human activities involving materials that are otherwise not preserved in these contexts.

[1] Tomasso, S., Cnuts, D., Coppe, J., Geerts, F., Gils, M.V., Bie, M.D., Rots, V. (2021). A closer look at an eroded dune landscape: first functional insights into the Federmessergruppen site of Lommel-Maatheide. <https://doi.org/10.31219/osf.io/pf3sm>, ver 3 peer-reviewed and recommended by PCI Archaeology.

[2] De Bie, M., Van Gils, M. (2006). Les habitats des groupes à Federmesser (aziliens) dans le Nord de la Belgique. *Bulletin de la Société préhistorique française*, 103, 781–790.

[3] Coppe, J., Lepers, C., Clarenne, V., Delaunois, E., Pirlot, M. and Rots V. (2019). Ballistic Study Tackles Kinetic Energy Values of Palaeolithic Weaponry. *Archaeometry*, (61)4, 933-956. <https://doi.org/10.1111/arcm.12452>

Reviews

Evaluation round #1

DOI or URL of the preprint: [10.31219/osf.io/pf3sm](https://doi.org/10.31219/osf.io/pf3sm)

Authors' reply, 19 November 2021

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Decision by [Marta Arzarello](#) and [Alice Leplongeon](#) , posted 11 November 2021

Accepted with minor revisions

Dear Sonja, dear Authors,

We have now received two reviews for your manuscript "A closer look at an eroded dune landscape: first functional insights into the Federmessergruppen site of Lommel-Maatheide".

As you can see your manuscript has been appreciated by the two reviewers, the work was considered original and interdisciplinary. Both reviewers expressed some doubts about the structure of the manuscript, which however represents at the same time one of its strong points.

Some useful integration proposals have been made and for this we ask you to take into consideration all the observations made, which will undoubtedly help to provide an even better version of the text. After revision, we will just check the new text and we do not think another revision round will be necessary.

Thank you for submitting your preprint to PCI Archaeology.

With best regards,
Marta Arzarello & Alice Leplongeon

Reviewed by [Ana Abrunhosa](#), 02 November 2021

The research on this paper is very interesting. It is guided by two main objectives: 1) to evaluate the preservation of wear traces, fractures and residues in lithic assemblages differentially impacted by taphonomy and 2) to study the Final Palaeolithic dune landscapes through a large-scale functional analysis. It is done through integrated functional research includes two methods: i) microscopic analysis of use-wear / residues/taphonomy and ii) experimentation to identify different activities. One could argue this paper could be divided into three since it covers different aspects of tool analysis and methodologies. But I think this is what makes this work interesting. This integration of methods and interpretations in one narrative helped build up a stronger interpretation of the analytical potential of these assemblages and the reconstruction of activities taking place at the site of Lommel-Maatheide.

I have only a few minor comments and suggestions that I truly hope will help you improve your work even more.

- In the introduction, sometimes there are very long sentences (e.g. see 2nd paragraph page 2) think about breaking them down to increase readability.

- The potential of functional analysis for reconstructing aspects of cultural behaviour is already established among scholars. As is my understanding of the paper, it is the potential of this study in assemblages with a higher variation of preservation conditions where the potential of analysis is being tested. The paper addresses the functional analysis through a large-scale analysis. One of its strong arguments is the comparative analysis of assemblages subjected to different post-depositional processes. I suggest this aspect be addressed and highlighted, e.g., in paragraph "in this paper, we evaluate the potential (...)" on page 3. I suggest you either rewrite it or just move the last sentence from the Discussion section (page 36) to the Introduction ("A central goal of the functional study was thus to evaluate to what extent this type of variably preserved site could still contribute to the understanding of Federmessergruppen technology and organization, with particular attention to the impact of taphonomy and excavation protocols, and an identification of domestic and hunting tasks.")

- Analytical protocol can be considered part of the Methodology. Also, in protocols, it is mentioned in more detail the materials that were analysed for this study and the criteria used for their choice. I suggest this section be included in the methods (materials and methods) section.

- Page 10: the paragraph starting with "All tools were first submitted to residue analysis." Continues with a detailed description of residue analysis observation and analysis under a microscope. This reads as the methodology of analysis therefore I suggest moving it to 3.2. – residue analysis.

- Page 11: the last sentence of the first paragraph partly repeats what is in 3.4. I suggest deleting the paragraph from this section and moving the reference to 1000 experimental pieces from experimental projectiles to be moved to section 3.4.

- Page 11: 2nd paragraph - Doesn't the expertise of the analyst also influence the degree of confidence of the data and interpretations? Even if all analysts are considered experts, I think this factor should also be mentioned as a factor in data analysis confidence.

- Results: the impact of post-depositional factors, especially chemical and mechanical weathering can also be influenced by the nature of raw materials. Are raw materials the same on all sites? Can there be different degrees of alteration related only to external factors or are there differences in raw material as well? Would this be an element to consider in this or future studies or are the materials homogeneous and not justified?

- The qualitative scale of preservation used to describe the general state of preservation in Results and Figure 3a is not very clear – what makes an artefact moderate to poorly preserved in this scale? Would like to see this more clearly explained in the text.

- Page 21: 2nd paragraph on 5.3.2. is repetitive. I suggest removing it or rewriting it.
 - In 5.4. Hunting tasks for LB25, table 7 presents the values in integers and percentages. For LB57A table 9 presents only integer values. Why? If the data presented are used for site comparisons, I suggest you homogenise your data presentation criteria across tables.
 - In table 9 the first column "number of pieces" presents a total number of pieces of 5 "(N=5)". The first line "bending breaks" has a value of 6. For my understanding, if the first column refers to the number of pieces with the occurrence of fracture categories, then 5 should be the maximum number that can be on the first column for each category. If I am not correct and 6 is not a typo, please clarify the table and data organization.
 - "Exp 112" is referred to in Figure 16 but not in the text. I suggest you mention it in the previous paragraphs to connect the figure with the text.
 - Page 35 – in "The weapon design worked perfectly" what do you mean by working perfectly? I suggest rewriting the sentence to be more objective and unambiguous. I would like to see what the criteria are for you to consider that the experience went well.
 - The experimentation was used as the basis of comparison to understand the origin of stress marks in the assemblage. I suggest you rephrase the sentence starting with "the number of fractures obtained" to clarify that it is the experimentation that allowed validation of interpretation and not the other way around – it reads as if the archaeological is validating the experimentation.
 - page 35 – results you mention a "recent ballistics investigation" – is this study published? Could you provide a reference?
 - Discussion: on page 37 there is a reference to the composition of the analysis of the residues. On page 21 the reference on residue analysis provides only information from SEM-EDS (an elemental analysis, therefore, does not provide clear evidence on the organic components of the residues). On page 25 there are images of fluorescence under a microscope. If there was no chromatography or any other kind of further analysis on the organic components that means you have no strong evidence to present on its origin/type such as terpenes, carbohydrates, fats or others. In the Discussion section, some considerations are made for the source of the organic components. Without more concrete data, I suggest this paragraph should be rephrased to clarify that the origin for the residues present is a hypothesis rather than a result or conclusion of this work (so far).
 - Conclusion section: the sentence starting with "one of the goals" leads the reader to understand there are other goals that follow. The paragraph continues without mentioning what the further objectives are. To those who are only going to read the introduction and conclusions, this can be disorienting. I suggest you rephrase to include other goals in this section or change the start of the sentence to "the main goal".
- Typos/ tables and figures edition** - citation in 3.3 (page 6) – should be "proposed in Coppe and Rots (2017)". - Figure 7 – I suggest making the arrows thicker as they are barely visible when printed. (This comment on arrows applies to all images). - Page 38 review the use of brackets on the last citation at the end of the last paragraph. - typo at the end of page 39 "on the basis of (based on) results FROM Lommel-Maatheide .." - Tables are not uniform and sometimes hard to read. E.g.: Table 2 is a little confusing because there are no lines/guides to read the corresponding values. The same comment applies to tables 5, 13 and 14. I suggest you edit those as you did for Table 8.

Reviewed by **Gabriele Luigi Francesco Berruti**, 21 October 2021

The paper entitled "A closer look at an eroded dune landscape: first functional insights into the Federmessergruppen site of Lommel-Maatheide" deals with quite debated matters in the field of the Use wear analysis: i.e. the influence of post-depositional processes on the kind of functional inferences; the identification of excavation that affect the preservation of wear traces and residues; the evaluation of what domestic tasks can be identified and to what extent preservation biases functional insights; the identification of the potential of the site for hunting activities and the propulsion mode used; the evaluation of whether a specific function can be proposed for each concentration of lithic artefacts analysed in the study.

This is a very interesting and interdisciplinary line of research, involving use wear analysis, residues analysis, experimental archaeology and obviously Upper Palaeolithic archaeology. The study proposed is very huge and interesting. In particular the comparison between the different concentrations of lithic tools, with similar chronology but selected in a big area (45 Ha) with different position in the landscape is very useful to understand if the different sites positions are linked with the different post depositional alterations recorded on the surfaces of the tools in the different sites.

The article is well done, takes into consideration many problems and manages to deal with them with competence and prescription. I found very interesting both the study on excavation damage and, although it is only a preliminary study, the experimentation on hafted curved backed points.

I have a single doubt regarding the structure of the article, the topics covered are so numerous and well treated that I feel I can suggest dividing the article into two or more works.

In any case, the theoretical framework, the methodology and the results are clear and well exposed as well as the aims of the proposed research regarding the current issues about the disciplines taken into consideration. The bibliography is complete and correct.

The results are interesting, and a wider application of this methodology is desirable, especially for what concerns the interaction between the sites position and the post depositional alterations.

I have also some suggestions to improve the article:

- In the introduction when the type and causes of post depositional alterations are briefly described, you may also consider conservation damage: the material analyzed also comes from collections made by non-professionals (167 curved backed points derive from the Caris collection, and 87 derive from the Janssens collection). How have the materials from these collections been preserved?
- In section two, you should add a general map with the location of the site (I suggest a map indicating the location of the site with respect to Europe, the country and the region). Furthermore, I would move Table 1 to this point by adding an indication of how the materials were collected: excavation or surface collection; in the case of an excavation which methods were used (metal sieve, trowel, etc.).
- In my opinion, should combine section 3 and section 4 to make a usual section of Materials and Methods. In this way it will be possible to merge the various subsections, for example 3.1 with 4.2. This will certainly make the text more readable. It should also indicate which programs have been used for image processing.
- In section 4.1 the criteria used to select the lithic to be analyzed should be better explained.
- In figure 3, first graph, the recognition letter is displaced with respect to the other graphs.
- I suggest adding a table to indicate the various types of post-depositional alteration in relation to the sites. It would allow to notice the differences with a single glance.
- In section 5.2: how the 506 lithic artefacts analyzed were selected?
- In figures 7 and 8 please make arrows and other graphic elements more visible.
- In the section 5.3.3: how the 23 lithic artefacts analyzed were selected?
- In figure 10 a photo of the artifact under analysis could be added, as was done for figures 7, 11, 12 and 13
- Tables 9 and 11 are unclear. Relate the fracture attributes with the individual elements examined.

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