



Peer Community In Archaeology

Mobility in pigs: A microanatomical perspective

Nimrod Marom  based on peer reviews by **Ignacio A. Lazagabaster** and **Max Price**

Romain Cottureau, Katia Ortiz, Yann Locatelli, Alexandra Houssaye*, Thomas Cucchi* (2022) Can growth in captivity alter the calcaneal microanatomy of a wild ungulate? BioRxiv, ver. 5, peer-reviewed and recommended by Peer Community in Archaeology.

<https://doi.org/10.1101/2022.08.22.504790>

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Pig domestication and husbandry involved complex processes of introduction, introgression, and feralization that challenge our understanding of human/suid interactions in ancient times. This challenge is a constant stimulus for the development of novel methods and techniques to illuminate aspects of early pig husbandry, such as human-induced changes in mobility. Using geometric morphometrics, Harbers *et al.* (2020) have shown that the calcaneus records a plastic response to reduced mobility and hence to human management. In the present study, Cottureau *et al.* (2022) explore the possibility that a similar plastic response to different mobility regimes can be observed in the microanatomy of the calcaneus using CT scans. Their research utilizes a sample of calcanei obtained from Mesolithic specimens, and also from recent suids kept in natural habitat, large pen, and stall. Their results suggest that bone microanatomy is more affected by population differences than by mobility patterns, as illustrated by the similarity between Mesolithic boar calcanei and their difference from recent, free wild boar.

This is an important negative result, and, as Max Price has remarked in his review, such results are biased against in the scientific literature. Beyond the merit of its careful planning and execution, I find the study thought-provoking, as it marks a scale threshold below which the plastic signal of mobility is lost. At the same breath, the close similarity between Mesolithic boars in the microanatomical scale opens a door to the investigation of inter-population anatomical differences beyond that threshold.

References:

Cottureau R, Ortiz K, Locatelli Y, Houssaye A, Cucchi T (2022), bioRxiv, 504790, ver. 5 peer-reviewed and recommended by Peer Community in Archaeology. <https://doi.org/10.1101/2022.08.22.504790>

Harbers H, Neaux D, Ortiz K, Blanc B, Laurens F, Baly I, Callou C, Schafberg R, Haruda A, Lecompte F, Casabianca F, Studer J, Renaud S, Cornette R, Locatelli Y, Vigne J-D, Herrel A, Cucchi T (2020) The mark of captivity: plastic responses in the ankle bone of a wild ungulate (*Sus scrofa*). *Royal Society Open Science*, 7, 192039. <https://doi.org/10.1098/rsos.192039>

Reviews

Evaluation round #1

DOI or URL of the preprint: <https://doi.org/10.1101/2022.08.22.504790>

Authors' reply, 16 November 2022

I would like to thank the reviewers for their helpful and positive comments that have helped to improve our manuscript. I hope that these revisions will prove satisfactory to you, and I am at your disposition if you have any comment or request.

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Decision by **Nimrod Marom** , posted 06 October 2022

Editorial decision: revision

Dear M. Cottureau,

Your preprint entitled: "Can growth in captivity alter the calcaneal microanatomy of a wild ungulate?" has now been reviewed by two referees, who are unanimous in their opinion that it should be recommended by PCI Archaeology. Both reviewers, however, noted points that should be elaborated or corrected before recommendation.

I join the reviewers in their opinion on the quality of the preprint, the rigour of the research design, and the robust data analysis. The preprint, however, will have to be revised in view of their comments before it is recommended. I also attach two short comments/questions of my own.

Sincerely,

Nimrod [Download recommender's annotations](#)

Reviewed by **Max Price**, 26 September 2022

This is a really interesting paper that answers a great question – do we see bone density and other structural changes in the calcaneus of the DOMEXP wild boar? This is important because we need new and better tools for examining the origins of animal husbandry in the Neolithic. It would also be nice to have more tools for understanding animal husbandry in ANY period.

As the authors note, previous studies identified morphological differences (via 3d GMM) in the calcaneus, so this seemed like a good element to focus on (although see below). The results are disappointing for those of us interested in applying new techniques to understand the initial development of animal husbandry strategies in

the Neolithic. Nevertheless, this is an important contribution and should be published, even if there is a strong bias against "negative data" in academic publishing.

I do think it would be worthwhile, however, to explore other elements. Other elements, such as the phalanges or distal long bones, would be good to examine. These bones bear more weight than the calcaneus and thus might be more sensitive to locomotion.

A few small notes:

1) the authors refer to their study as one targeting "microanatomy." I'm not sure cortical density and trabecular bone volume really count as "micro." For bones, I think of Haversian canals or even collagen fibrils when I think "micro."

2) The authors suggest in the discussion that diet might play a role in impacting these factors. Possibly, but certainly not "probably" as the authors say. It's certainly worth following up on (if one were to repeat the DOMEXP experiment), but I suspect there would be little impact from diet except in cases of severe and long-term malnourishment.

Reviewed by Ignacio A. Lazagabaster, 20 September 2022

Thank you for the opportunity to review this manuscript. The authors explore the internal anatomy of wild boar calcanea to investigate a potential relationship between internal phenotypic variation and mobility patterns (e.g., of individuals that roam free vs those that are kept in stalls). By doing this, the authors hope to gain further insights into historical domestication processes through the analyses of zooarchaeological specimens. Nonetheless, the authors use both archaeological samples (Mesolithic) and calcanea from modern boar populations, including from the wild and from a genetically-homogeneous population in which different individuals were raised with various mobility restrictions. The calcanea were analyzed using CT-scan data and I found the methodology to be sound and robust. The authors conclude that -inter and probably -intra-population variability is higher than the differences observed between different mobility patterns and therefore, that calcaneal internal anatomy (contrary to external shape, which seems to at least partially work) cannot be used (at least with the variables and methods used) to examine domestication processes unless the populations examined are more or less genetically homogenous (needless to say this is a utopic situation in the archaeological record). Even though the results are not what the authors hoped for (a priori), I find the paper to be highly interesting and an important contribution to zooarchaeologists and zoologists, and thus, worthy of publication.

I attach a pdf with suggestions and comments, most of which are grammatical corrections or small comments, though various sentences have to be entirely rephrased. However, I want to point out the most important suggestions:

- The authors mention Table 2 throughout the manuscript but I could not find Table 2. Obviously, this needs to be fixed.
- I suggest the authors include a table (if this was not detailed in Table 2) with summary statistics (with statistical comparisons if relevant).
- Fig. 5. could be improved if the convex hull around archaeological samples is not drawn and symbols are made larger.
- Finally, I urge the authors to be consistent with the terminology used throughout the text (see pdf attached).

[Download the review](#)