Peer Community In Archaeology

New zooarchaeological data from the Upper Palaeolithic site of Nahal Rahaf 2, Israel

Ruth Blasco *based on peer reviews by* ***Joana Gabucio*** *and* ***Ana Belén Galán***

Nimrod Marom, Dariya Lokshin Gnezdilov, Roee Shafir, Omry Barzilai, Maayan Shemer (2022) Faunal remains from the Upper Paleolithic site of Nahal Rahaf 2 in the southern Judean Desert, Israel. bioRxiv, ver. 4, peer-reviewed and recommended by Peer Community in Archaeology. https://doi.org/10.1101/2022.05.17.492258

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The Levantine Corridor is considered a crossing point to Eurasia and one of the main areas for detecting population flows (and their associated cultural and economic changes) during the Pleistocene. This area could have been closed during the most arid periods, giving rise to processes of population isolation between Africa and Eurasia and intermittent contact between Eurasian human communities [1,2].

Zooarchaeological studies of the early Upper Palaeolithic assemblages constitute an important source of knowledge about human subsistence, making them central to the debate on modern behaviour. The Early Upper Palaeolithic sequence in the Levant includes two cultural entities – the Early Ahmarian and the Levantine Aurignacian. This latter is dated to 39-33 ka and is considered a local adaptation of the European Aurignacian techno-complex. In this work, the authors present a zooarchaeological study of the Nahal Rahaf 2 (*ca.* 35 ka) archaeological site in the southern Judean Desert in Israel [3].

Zooarchaeological data from the early Upper Paleolithic desert regions of the southern Levant are not common due to preservation problems of non-lithic finds. In the case of Nahal Rahaf 2, recent excavation seasons brought to light a stratigraphical sequence composed of very well-preserved archaeological surfaces attributed to the 'Arkov-Divshon' cultural entity, which is associated with the Levantine Aurignacian.

This study shows age-specific caprine (*Capra* cf. *Capra ibex*) hunting on prime adults and a generalized procurement of gazelles (*Gazella* cf. *Gazella gazella*), which seem to have been selectively transported to the site and processed for within-bone nutrients. An interesting point to note is that the proportion of goats increases along the stratigraphic sequence, which suggests to the authors a specialization in the economy over time that is inversely related to the occupational intensity of use of the site.

It is also noteworthy that the materials represent a large sample compared to previous studies from the Upper Paleolithic of the Judean Desert and Negev.

In summary, this manuscript contributes significantly to the study of both the palaeoenvironment and human subsistence strategies in the Upper Palaeolithic and provides another important reference point for evaluating human hunting adaptations in the arid regions of the southern Levant.

References:

[1] Bermúdez de Castro, J.-L., Martinon-Torres, M. (2013). A new model for the evolution of the human pleistocene populations of Europe. Quaternary Int. 295, 102-112. https://doi.org/10.1016/j.quaint.2012.02.036

[2] Bar-Yosef, O., Belfer-Cohen, A. (2010). The Levantine Upper Palaeolithic and Epipalaeolithic. In Garcea, E.A.A. (Ed), South-Eastern Mediterranean Peoples Between 130,000 and 10,000 Years Ago. Oxbow Books, pp. 144-167.

[3] Marom, N., Gnezdilov, D. L., Shafir, R., Barzilai, O. and Shemer, M. (2022). Faunal remains from the Upper Paleolithic site of Nahal Rahaf 2 in the southern Judean Desert, Israel. BioRxiv, 2022.05.17.492258, ver. 4 peer-reviewed and recommended by Peer community in Archaeology. https://www.biorxiv.org/content/10.1101/2022.05.17.492258v4

Reviews

Evaluation round #2

Reviewed by Joana Gabucio, 07 July 2022

The authors took into account all the comments of the reviewers, modifying the manuscript in its fair measure. In their reply, they satisfactorily justified their decisions and arguments. Personally, I am glad that they found the comments on the density measures and statistical tests useful. I appreciate the clarification on the classification of the remains in 0.5 sq m grid. Likewise, I thank the authors for the references of Cohen (1988) and Hemphill (2003), which I will certainly consider in the future. I would also like to thank the authors for explaining in more detail their arguments for proposing shorter occupations in the upper levels of the site. Now I understand their reasoning better. Finally, I consider very appropriate the change in the title of the last section (from "Discussion" to "Discussion and Conclusions"), suggested by the other reviewer.

In conclusion, I think this preprint is an excellent work. The manuscript is coherent and easy to read, and reflects the authors' deep knowledge of both the discipline's own methodology and the archaeological work carried out in the Levant area. Last but not least, the results contribute significantly to the study of both the palaeoenvironment and the human subsistence strategies in the Levantine Upper Palaeolithic. Consequently, I strongly recommend this preprint.

Evaluation round #1

DOI or URL of the preprint: https://www.biorxiv.org/content/10.1101/2022.05.17.492258v1

Authors' reply, 25 June 2022

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Decision by Ruth Blasco, posted 22 June 2022

Minor revision

Thank you for submitting your study on faunal remains from the Upper Paleolithic site of Nahal Rahaf 2 to PCI Archaeology. We have received comments from two reviewers on your manuscript. They both find your work of interest, but also have some points that need to be addressed by a minor review. Please pay special attention to how the statistical methods and correlations to measure density values are used in the study. In addition, please consider expanding the discussion on the ephemeral hunts in the assemblages to argue and reinforce the conclusions. Finally, check the References list because we have detected that some works cited in the manuscript are missing.

Reviewed by Ana Belén Galán, 17 June 2022

I think this study is well carried out. From my perspective, this is an interesting paper with important contributions to the Upper Palaeolithic in the Levant. The abstract summarises the arguments in an accurate way. The structure of the manuscript is correct, and the methodology is well presented and developed. In summary, the arguments are well described and flow coherently. The bibliography is a comprehensive compendium, which especially reflects the state of the art (and the description of the phases concerned). It is an interesting research that enhances our knowledge of the Levantine chrono-cultural sequence.

The purpose of this work is to present a faunal analysis (bone remains recovered from two recent excavation seasons, 2019 and 2020) of the Nahal Rahaf 2 (NR2) rock shelter (ca.35 kya, Early Upper Palaeolithic, Israel) and studying the procurement strategies of the site. Thus, the manuscript significantly contributes to our understanding of human arid-land subsistence strategies in Levantine Upper Paleolithic. In spite of the fact that this is not a taphonomic study (as it is pointed out by the authors), some basic information is provided in this regard (e.g. predominant presence of “green” fractures, and humans as main modifying agents) which undoubtedly complements the study very well.

NR2 is a valuable source of information regarding the subsistence strategies of the human groups living in the southern Judean Desert (Israel) during the Early Upper Paleolithic, undoubtedly because of the good preservation of the faunal assemblages (which is rare in this area). The results presented here are really interesting in terms of procurement strategies and suggest, in this case, a long-range foraging in prime adult caprines (*Capra* cf. and *Capra ibex*) and an increase in specialization over time. Carcasses were sometimes selectively transported to camps and tended to bring the heads and upper limbs with them, which indicates they came from a distance or were transported over rough terrain, according to the authors.

Particularly remarkable is the fact that a specific way of longitudinal phalanx splitting was practiced in NR2. Authors point out that according to Jin and Mills (2011), this longitudinal appears to represent an idiosyncratic (for now) butchery behavior for some local Upper Paleolithic groups.

In conclusion, this submission is both scientifically sound and the arguments are well supported by the factual data.

**I would just suggest rephrasing the title of the section “Discussion” as ”Discussion and conclusion”.

Reviewed by Joana Gabucio, 22 June 2022

The strategic location of the Levant as a corridor between Africa and Eurasia makes it particularly interesting for the study of the movements of hominins and fauna between the two continents, as is the case of the expansion of anatomically modern humans out of Africa. The Nahal Rahaf 2 (NR2) site also presents an added interest, since it provides a unique zooarchaeological assemblage for the Judean desert region, where - unlike the caves of the Mediterranean fringe - the archaeological sites are usually characterized by the poor conservation of organic remains. In this sense, the well-written, complete and concise work by Marom et al. fills a research gap, contributing significantly to the knowledge of the palaeoenvironment and the human

subsistence strategies in the Levantine Upper Palaeolithic. However, before recommending the preprint, I would like to suggest some changes to the authors:

1. In the Materials and Methods section (p.5, line 160), the authors reported that all the faunal remains from the site were collected by dry sieving the sediments. This assumes that no Cartesian coordinates are available for the bones. It would be interesting to clarify if, as NR2 is a recently excavated site, the remains have some spatial reference (for example, a classification by m^2) or not.

2. The authors evaluated bone preservation at the site by correlating bone mineral density for caribou provided by Lyman (1984, 1994) and the MAU values of the NR2 assemblage for each scan site. The technique used by Lyman to measure density values, Photon Densitometry, does not take into account neither the external morphology nor the internal cavities of the bones. Subsequent studies have worked to overcome these limitations, as well as to expand the list of scanned taxa (Kreutzer, 1992; Lyman et al., 1992; Elkin, 1995: Cruz & Elkin, 1995; Lam et al., 1998, 1999; Stahl, 1999; Pavao & Stahl, 1999; Dirrigl, 2002; Symmons, 2005). I would recommend the authors to use the density values calculated by Lam et al. (1999) for Rangifer tarandus using the Computed Tomography technique, which starting from similar scan sites exclude internal cavities of long bones in the calculation of density (Lam et al. 1998, 1999, 2003). From my point of view, these density values are more suitable for their correlation with the skeletal representation of archaeological sites, especially in assemblages where diaphysis fragments of appendicular bones abound, as in the case of NR2.

3. I agree with the authors in the use of the nonparametric Spearman's rho test to correlate density measurements with the MAU. However, I do not think that a coefficient of 0.48 can be considered of moderate intensity (p. 6, line 204; p. 15, line 342). Taking into account that a coefficient of 0 would mean the absence of correlation and that the coefficients 1 (positive relationship) and -1 (negative relationship) would indicate a perfect correlation, the value of 0.48 rather reflects a weak intensity.

4. Although the authors have previously used Spearman's rho test to correlate the MAU of the zooarchaeological assemblage with density measurements, when comparing fragmentation intensity with marrow and fat utility indices, they chose parametric statistical methods (p. 16, lines 372-375). It is true that some researchers use parametric methods to deal with utility indices (Binford, 1978; Metcalfe & Jones, 1988; Jones & Metcalfe, 1988). However, like many other authors (Lyman, 1985, 1994; Brink, 1997; Morin, 2007), I consider the use of non-parametric methods such as Spearman's rho and Kendall's tau to be more appropriate. For this reason, I suggest to the authors the use of non-parametric methods in this case as well.

5. In figure 1, the stratigraphic section (B) is difficult to understand due to the small size of the image and the font. The figure would be greatly improved if this part could be enlarged a little.

6. In Table 1, it would be useful to add the percentages (%) of the different taphonomic modifications (although the numbers of altered remains are low), thus facilitating the comparison between levels.

7. I find the proposal to be very suggestive in that, through time, and as the environment slid into dry glacial conditions, hunting forays become more specialized (focused on prime adult caprines) and of shorter duration. While the proposal for an increase in specialization is well supported by data on the age at death and the evolution in the proportion of goats and gazelles, I think that the idea of more ephemeral hunts needs further discussion. The high frequency of weathered remains in the upper levels, in my opinion, is not a sufficient criterion, since it is more related to sedimentation rates (which affect the time that already deposited items are exposed on the surface, before being buried) that with the duration of the occupations themselves.

8. Finally, a review of the references has revealed the absence in the References section of some works cited in the manuscript:

- Alex et al., 2017
- Andri et al., 2021 (in the References section appears as Andri 2021)
- Bar-Yosef & Belfer-Cohen, 2010
- Belmaker & Bar-Yosef, 2011 (in the References section appears as Bar-Yosef & Belmaker 2011)
- Gilead, 1981
- Kadowaki et al. 2016

- Klein, 1995
- Marks, 1981
- Marder et al., 2020
- Orlando, 2019; Orlando et al., 2009
- Sarig et al., 2020 (is this Sadhir et al. 2020?)
- Steiner, 2005
- Stiner et al., 2005 (in the References section it appears Stiner 2005)
- Tejero et al., 2020