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The early Aurignacian at Lapa do Picareiro really is that old: A comment on 'The late persistence of the Middle Palaeolithic and Neandertals in Iberia: A review of the evidence for and against the "Ebro Frontier" model'

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In his review of the MP-UP transition in Iberia, Zilhão (2021: 25) mistakenly altered the data presented in two of our recent publications (Benedetti et al., 2019; Haws et al., 2020) using an imprecise (rounded) datum elevation in Benedetti et al. (2019) to reconfigure the associations of artifact, bones, and radiocarbon dates at Lapa do Picareiro. He apparently read the statement, "Elevations in and around the cave are tied to a vertical datum (571 m above sea level) …"(Benedetti et al., 2019: 6) to mean the datum elevation is precisely 571.000 m asl. In fact, the datum elevation used throughout the excavation is 571.483 m asl. We reported elevations as either meters below this datum (mbd; Benedetti et al., 2019) or meters above sea level (m asl; Haws et al., 2020). The data presented in these articles are entirely consistent, with all points maintaining the same provenience and stratigraphic relationships relative to the fixed datum. Zilhão (2021: 25) used the incorrect datum of 571.000 m asl to recalculate the depths of radiocarbon dated bones, to redraft a stratigraphic diagram (Haws et al., 2020: Fig. 3), and to reinterpret the significance of the site.

Zilhão (2021) could have easily determined the datum elevation from the radiocarbon dates we presented. For instance, noting that sample Wk-32219 was plotted at ~565.1 m asl (565.083 m asl, to be precise) in Haws et al., (2020) (Fig. 3), one could simply add the corresponding depth of 6.40 mbd (Benedetti et al., 2019: Table 1) to arrive at an estimated datum elevation of ~50 cm above 571.000 m asl.

There are numerous other problems with Zilhão's (2021) discussion of Lapa do Picareiro that merit clarification. Of his four main criticisms, the first two are based entirely on the incorrect datum.

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Clearly his multiple redrafts of our profile diagram (Zilhão et al., 2021: Fig. 14A, B, and C), presented in support of these criticisms, are invalid. To preclude any further confusion, we have reproduced the original figure (Haws et al., 2020: Fig. 3) here with the depth axis labeled in both m asl and mbd (Fig. 1). Zilhão's (2021: 26) two other criticisms involve the provenience and anthropogenic origin of radiocarbon-dated bone, the distribution of artifacts in levels GG-II, and potential mixing of sedimentary layers. These speculative arguments ignore or misinterpret the stratigraphic and age data that were carefully laid out in our publications.

Another radiocarbon sample cited as problematic (Zilhão, 2021: 26), Beta-247964 was a charcoal sample collected in 2008. This was the first sample collected from level FF and we initially presumed the date of 28,610 ± 300 BP was accurate. In 2010, we sought to confirm the age by dating a red deer bone. That sample (Wk-28843) returned a date of 27,721 ± 260 BP but there was insufficient collagen to obtain C:N or isotopic data and the sample quality could not be confirmed. The following year we obtained dates on bones from stratigraphically higher levels with good quality collagen and C:N within acceptable range, leading us to suspect that the level FF dates must be too young. Subsequent attempts to date the level using charcoal and bone sent to three different labs showed consistently older ages by 4–5000 years. The two previous dates (Beta-247964, Wk-28843) did not meet the minimum threshold of 60% confidence in the Bayesian model, and were dismissed as outliers from our age-depth model (Benedetti et al., 2019: 14). Including all the radiocarbon ages reported in both papers (Benedetti et al., 2019; Haws et al., 2020), there are only 7 outliers reported among 74 ages, and only 3 of these within the levels discussed by Zilhão (2021). Importantly, none of the samples using ultrafiltration and enhanced collagen extraction pretreatments (MAMS lab codes) have produced outliers. This strongly suggests that the anomalous ages are due to degradation and contamination of some previously dated bones, rather than mixing between stratigraphic layers.

Zilhão (2021: 26) also claimed that there were no artifacts, anthropically modified bones or charcoal between level GG and the top of JJ-lower, citing supplemental Tables S4 and S5 in Haws et al. (2020). These tables list artifacts from "GG" and not "GG-II," although Table S6 does. As stated in the text, "(t)he earliest

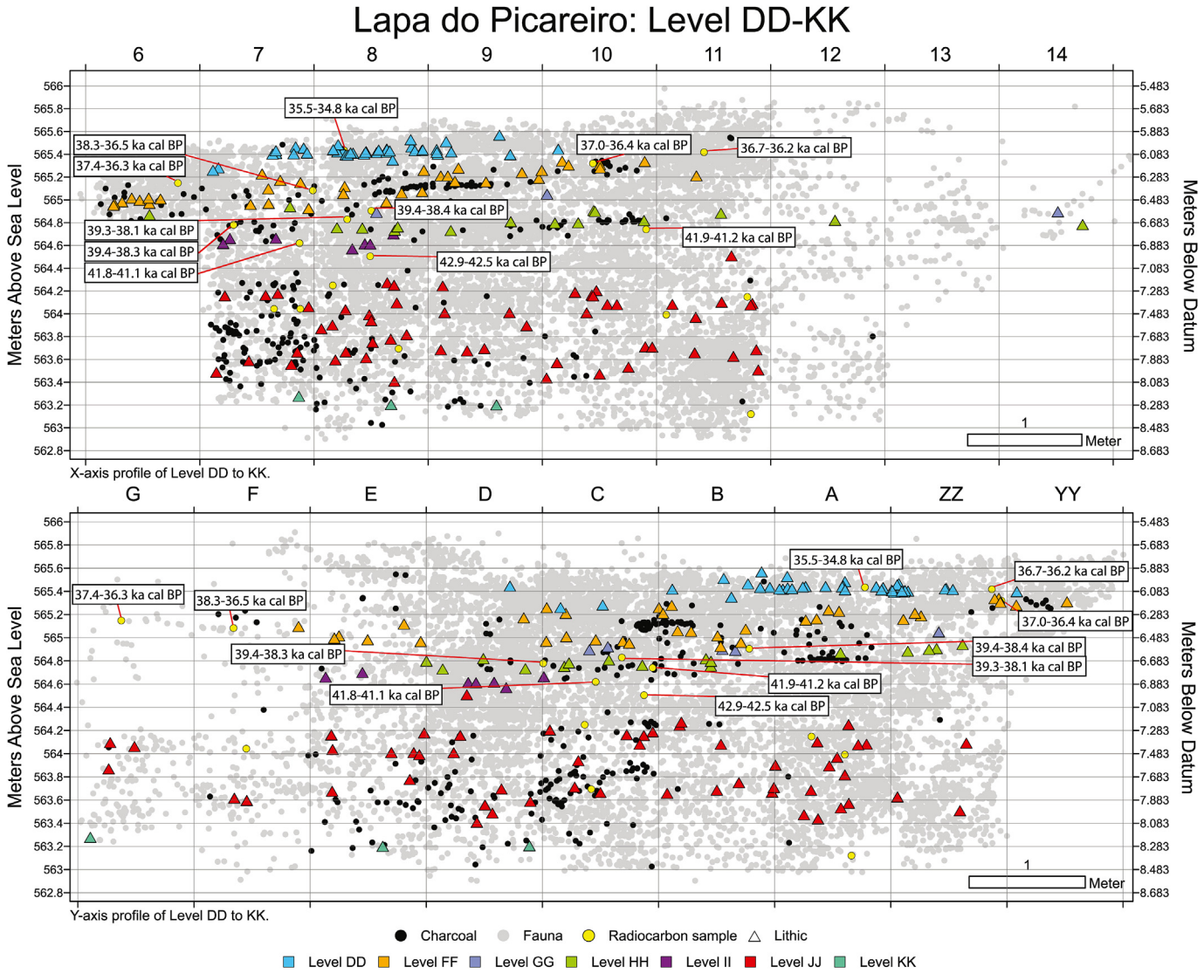

Fig. 1. Plots lithic artifacts and radiocarbon-dated samples from Lapa do Picareiro: A) X-axis profile of the cave, perpendicular to the central axis, B) Y-axis profile, lengthwise from front to back.

Aurignacian artifacts are distributed throughout the muddy matrix from the base of the large clasts of level GG through level II." (Haws et al., 2020: 25417). Furthermore, the radiocarbon dates in level II come from within the artifact distribution not below as stated by Zilhão (2021: 26). The dated bones show percussion scars but no carnivore tooth punctures or scoring. All dated samples in levels GG and II are closely associated with charcoal and bladelets.

The artifacts from levels GG-II reflect a technologically distinct assemblage from those immediately below and above. Level JJ has discoidal core reduction of flakes characteristic of the Middle Paleolithic and level FF has simple flake core reduction. Both levels are dominated by quartz and quartzite. Levels GG-II contain carinated core technology to produce bladelets on chert. Due to the small sample size, technological similarity, and spatial distribution of the assemblage, we aggregated the artifacts in levels GG-II. The largest number of artifacts were actually found in level HH (Fig. 1), "within a ~20 cm linear band between the dated samples …," (Haws et al., 2020: 25419). Thus, we can say with certainty that at least one occupation took place between 41.1 and 38.1 ka cal BP. In describing the lithics, we deliberately used lowercase "early" Aurignacian and did not try and fit the assemblage into a rigid typological category. We expect future excavation and recovery of larger sample sizes to inform on this topic. We object to Zilhão's reference to the site's "Early Aurignacian" (2021: 26), with the capitalized "Early" in quotation marks implying that we made this typological claim when we specifically did not.

Finally, Zilhão (2021: 26) speculates that artifacts in FF and GG-II include inherited material. To accept Zilhão's argument, one would have to believe that lithic artifacts are susceptible to translocation based on raw material: the chert cores, blades, and bladelets were somehow separated from quartz and quartzite cores and flakes into discrete layers. Zilhão (2021: 26) also mis-characterized the debris flow argument from Benedetti et al. (2019: 9), which stated, "while not prevalent, some muddy beds contain large clasts floating within a fine matrix." Where they occur, the debris flows are thin, muddy, matrix-supported beds. This does not apply to levels FF and GG-II, which are clast-supported. In addition, Zilhão (2021: 26) claims that dated bones and artifacts fell through the open voids between the clasts in levels FF and GG-II. These levels cannot have both inherited material by debris flows, and downward percolation of small elements through voids. As we have argued here and previously, the stratigraphic integrity of these levels is quite clear based on multiple lines of evidence: thin lenses of sediment containing discrete artifact assemblages, a very strong relationship between radiocarbon ages and depth (with only a few outliers), and sharp variations in sedimentological parameters (including mud content and magnetic susceptibility). Any of these patterns would have been obscured and smoothed if the levels were affected by widespread bioturbation, debris flows, or other mixing processes.

In trying to defend his Ebro Frontier hypothesis against all potential challenges, Zilhão (2021) has seriously misrepresented our work, creating controversy where there is none. His criticisms of the archaeological sequence at Picareiro are mostly based on invalid assumptions, as explained above. We are disappointed that he devoted so much space in his review to speculation about errors in our work, instead of contemplating the ramifications of a clearly documented early Aurignacian occupation at the site. The evidence from Picareiro remains a challenge to the idea of a "hard border" between Neanderthal and modern human populations between 42–37 ka. We encourage readers to evaluate for themselves the data and interpretations presented in Benedetti et al. (2019) and Haws et al. (2020).

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Author contributions

J.H. oversees the excavation and coordinates scientific analyses along with M.B. M.B. is responsible for the sedimentological analyses. N.B. and J.C. analyzed the lithic assemblages, M.C. and J.H. produced the faunal analyses, and M.G.E. produced the spatial data of the artifact and bone assemblages. L.F. is a biological anthropologist and co-PI of the excavation. T.P. conducted the artifact refittings. S.T. produced many of the AMS radiocarbon dates for the site.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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