Introducing “fiReproxies”: A computer simulation-based tool for gaining a better understanding of archaeological fire proxy evidence

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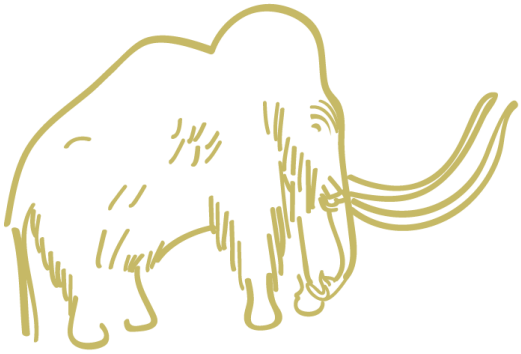

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IV-4. Fire as an artifact: Advances in the study of Paleolithic combustion features

Introducing "fiReproxies": Computer simulation-based tool for gaining a better understanding of archaeological fire proxy evidence

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The presence of fire proxy data within an archaeological layer, usually in the form of heated lithic debris or charred or combusted bone fragments, is often cited as evidence for on-site burning in the past. In instances where these data are tallied, the determined quantities are often used by archaeologists to infer the relative amount of fire used, generally boiling down to higher percentages indicating fire was used often and lower percentages suggesting fire was used only rarely. Despite the logical nature of this conclusion, how much can we truly say about the prevalence of fire use on a site based on these values? The number of variables that factor into the production and preservation of fire residues and proxies is extensive. These include (among others) site occupation frequency, fire size and intensity, lithic production rate, sedimentation rate and site surface area, to name a few. In isolation, the effects that some of these parameters will have on the generation of fire proxies may appear largely intuitive. However, the cumulative effects of these variables on the final percentage of heated lithics within a layer is more difficult to grasp, as is the relative effect of any one variable within the system as a whole. We address this problem by simulating the effects of some of these variables using our R-based model entitled "fiReproxies". Our model adds quantitative values to these effects, thereby producing tangible results that can be compared with extant archaeological fire proxy data. If palaeoenvironmental, depositional or behavioural conditions can be surmised from excavated materials, these can serve as guides for users to estimate the values set for the various parameters currently incorporated into our model in their simulations. If the simulated results align well with known fire proxy quantities, then our interpretations of these conditions could be considered sound. Conversely, if the simulated percentages of fire proxies differ greatly from those calculated from the archaeological material, then researchers can ponder why this disparity exists and begin to parse out what unaccounted for variables could justify this discrepancy. Using the Middle Palaeolithic of western Europe as a backdrop, we demonstrate the utility of our model by applying it to a hypothetical Neandertal cave site. We also briefly discuss a few archaeological instances where our model could be helpful in gaining a deeper understanding of the processes influencing fire proxy signals at Palaeolithic sites. It is our hope that the fiReproxies model could be used in tangent with other analytical methods to gain a better understanding of how prevalent fire use was in the past and under what conditions it was used.

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