Beyond prometheus: pursuing the origins of fire production among early humans

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Summary

Humankind's relationship with fire extends back more than two million years, likely prior to the dawn of our genus. As this relationship matures, so does the evidence for fire use in the archaeological record. The slow progression from observing fire in the environment, to casual interaction, to active exploitation of this natural resource likely resulted in few—if any—identifiable traces. Collecting and confining fire within discrete combustion areas, around which the day-to-day activities of stone tool making and preparing food was often performed, imbued anthropogenic fire with its own archaeologically recognizable signature, one that has remained largely unchanged for the vast majority of human (pre)history. Despite the increased control of fire exhibited by our early ancestors, this relationship would have remained—at least initially—largely opportunistic, having been gathered from occasional wildfires ignited by lightning strikes or lava flows, and then maintained and transported from place to place. This 'taming' of fire could be considered our first attempt at domestication—though our hold was a tenuous one, in that fire, without proper tending, can quickly be lost. It was not until some unknown member of our lineage first produced fire using tools they had readily at hand that this act of domestication became largely complete. This study aims to bring the field closer to knowing when this crucial transition took place.

Since it is largely acknowledged that modern humans were capable fire starters, Neandertals—known to be capable users of fire, but apparently lacking the means to produce it—seemed to be the logical starting point from which to potentially push backwards into time our understanding of early fire making technology. A two-pronged approach was undertaken to confront this gap in our knowledge. The first employed literature study and computer simulation to gain a better understanding of how various environmental conditions may have influenced Neandertal fire use practices (including fire making) and how these, when viewed through the lens of time and taphonomic processes, might manifest in the archaeological record. The second arm of the study combined actualistic experiments with microwear (or use-wear) analysis to explore the possibility of identifying fire making tools within Middle Palaeolithic artefact assemblages, thereby providing direct evidence of fire making by Neandertals.

This study contests the hypothesis that Neandertals were merely fire collectors and did not make fire artificially, originally proposed by Sandgathe and colleagues in their 2011 *PaleoAnthropology* paper. These researchers suggest reduced evidence for fire in archaeological layers deposited during colder climatic intervals is related to less frequent lightning-ignited fires in the landscape, limiting Neandertal access to natural fires. This thesis, on the other hand, argues that this explanation is too simplistic and that a combination of environmental, cultural and taphonomic factors together more likely led to suppressed fire signals during colder periods. These findings are largely supported by our 'fiReproxies' computer simulation model, which was designed to test these hypotheses. Moreover, we hypothesise that having the ability to make fire on an 'as needed' basis—as opposed to being forced to constantly maintain one's fire so as not to lose it—could have allowed Neandertals to be much more economical with their use of wood fuel during colder periods when trees were much less prevalent in the landscape, thereby leading to weaker archaeological evidences for fire use.

The best way to provide added validity to these hypotheses would be to determine if Neandertals were, in general, capable of and did indeed make fire. It is argued herein that the only way to do this is to provide direct evidence of fire production through the identification of the fire making tools themselves. Operating under the 'expedient strike-a-light model', we hypothesise that Neandertals may have selected simple flake tools as ad hoc 'strike-a-lights' to be used only for single fire making events, while multi-purpose curated tools (e.g. Mousterian of Acheulean Tradition, or MTA, bifaces or Quina scrapers) with longer use-lives may have also been used to make fire, perhaps multiple times. Fire making experiments using flint strike-a-light tools in conjunction with pyrite provided practical information that was used to both predict what Neandertal fire making tools might look like and to identify them using microwear analysis. To test these predictions, we analyzed numerous western European Middle Palaeolithic stone artefact assemblages dating to the Last Glacial period, some geared towards flake production, and others with higher instances of curated elements (i.e. MTA bifaces from southwestern France dating to around 50 kya). No convincing strike-a-lights were identified among the flake tools, either due to their absence, or due to the weakly developed nature of use-wear traces expected of single-use tools, making them difficult to identify. However, our analysis of a sample of 27 extended-use MTA bifaces resulted in the identification of 20 tools bearing mineral use-wear traces comparable to experimental traces resulting from fire making. Moreover, ten other bifacial thinning flakes were identified exhibiting similar traces. These findings provide the first evidence for systematic fire making by a pre-sapiens hominin and reinforce the importance of fire among Palaeolithic peoples.