Evaluating the dietary micro-remain record in dental calculus and its application in deciphering hominin diets in Palaeolithic Eurasia

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Summary

Dietary studies have transformed our understanding of hominin palaeobiology. Establishing the diet of Neanderthals has been crucial for understanding the basis of their ecology. The gradual expansion of research using macromammal remains has allowed substantial insights into Neanderthal meat consumption, hunting techniques, and social cooperation. More recent approaches in archaeological sciences such as dental wear, isotope, biomarker, and dental calculus analyses have allowed considerable strides to be made in building a more complete view of their dietary ecology, as they have raised further questions.

Zooarchaeological and isotopic research has shown that Neanderthals widely hunted large- and medium-size game. Further evidence of the importance of animal-based foods is also apparent from analysis of wear on teeth, which suggest that across their range Neanderthals relied heavily on animal foods. Recent foragers from northern environments, purportedly analogous to those in which some Neanderthal populations lived, have shown that staples other than animal foods may provide up to half of total dietary energy. However, researchers still debate the role of non-animal foods in Neanderthal subsistence. Palaeodiet studies have so far allowed only partial recovery of the Neanderthal diet, as there are biases against the survival of many foods particularly plants. An alternative means of exploring plant use is to retrieve microbotanical particles that become trapped in dental plaque as it calcifies into hard dental calculus. Some of this debris can be identified to specific plant taxa and plant parts. This methodology can provide direct evidence of foods and other substances that have entered the mouth. Yet it is still unclear whether the data generated does represent diet and other behavioural activities, because it could possibly be merely a product of background plant debris, which is unrelated to diet. To test the impact of these potential problems so that a working methodology could be applied to Neanderthals, my project assessed the reliability of dental calculus in reconstructing diets of individuals in two different populations. The first is an archaeological sample from southeastern Iberia, and the second is a skeletal population of West African chimpanzees. Using a comparative analysis, my project was able to identify the utility of dental calculus to shed light not only on diet, but also on other life history traits. The results from the Iberian assemblage prompted me to question whether dietary reconstructions based on traditional dental calculus studies can stand alone. Microremains from these populations exhibited evidence for behaviours such as water intake and inhalation of airborne suspensions, as well as

diet. This work also characterised some of the microenvironments that likely shield plant microremains from degradation. In the next stage of analysis, I assessed how accurately dental calculus can record long-term diet by examining plant microremains preserved in chimpanzees from a population with over two decades of documented dietary history. The project then built an extensive reference collection of Côte d'Ivoire forest plants for microremain identification, and compared the calculus microremains to the expected presence of plants based on examination of the feeding records. The results indicate that microremains accumulate as long-lived dietary markers and some can reflect the proportions of plants in the diet.

After consolidating dietary inferences obtained from the study of plant microremains in dental calculus, my dissertation analysed Neanderthal dental calculus from five archaeological sites to document variation in Neanderthal plant consumption. This identified reliable evidence of plant use across different regions. Observed remains were positively identified as Neanderthal foods by comparing plant microremains retrieved from calculus to a control dataset. We then used published literature and databanks with a substantial database of Eurasian plants to identify food plants across Neanderthal range. Contrary to expectations, when the results were compared with data from previous studies, we found the breadth of food plants with evidence of consumption was unrelated to Eurasian eco-geography. This suggests that although southern Neanderthals relied on plants considerably more than northern populations, Neanderthals in central and northern Europe still consumed a diversity of plants that are comparable with Neanderthals from southern territories. These findings open new perspectives on Neanderthal dietary ecology. Overall, Neanderthals were foragers that combined plant use with large-scale mammal hunting as part of a unique dietary niche adapted to Eurasia.