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

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## Contributions

Robert C. Power has designed the research with input from Dr Amanda G. Henry and Dr Domingo C. Salazar-García, done all lab work, data analysis, written the papers and interpreted results. Dr Amanda G. Henry and Dr Domingo C. Salazar-García have supervised this PhD. Both gave feedback and guidance along all steps of the process to Robert C. Power.

### Contributions to each paper

#### **Paper 1:**

#### **Assessing use and suitability of scanning electron microscopy in the analysis of micro remains in dental calculus**

This paper was written following analysis of the dental calculus from two populations with multiple means of microscopy. As author, I developed the concept of comparing microremain data gathered from different methods of microscopy (optical microscopy/scanning electron microscopy and energy-dispersive X-ray spectroscopy). It allowed me to develop an approach to assess the potential of energy-dispersive X-ray spectroscopy to detect starch exposed to salivary amylase. I performed all sampling of dental calculus and all microscopy and spectroscopy, but scanning electron microscopy and spectroscopy was conducted with assistance of Ian Reid for SEM–EDX analysis (NIMAC UCD). Roman Wittig and Domingo C. Salazar-García provided materials. I prepared and wrote the manuscript, with input from all authors and guidance of my supervisors (A.G.H and D.C.S.G.).

#### **Paper 2:**

#### **Dental calculus evidence of Tai Forest Chimpanzee plant consumption and life history transitions**

This project was conducted in four steps- initially I employed Tai observational records to develop a chimpanzee diet profile. This was used to build an extensive reference collection of the microremains present in Tai Chimpanzee diet, allowing me to create a replicable method to classify microremains frequent in their diet. Lastly, I analysed chimpanzee dental calculus and matched identified starch and phytoliths to dietary records. I sampled calculus and conducted microscopy of all dental calculus and plant reference material. Roman Wittig

advised on using Tai Forest data to meet research goals, and organised the collection of plant reference samples from the Tai Forest National Park. This reference collection was supplemented with plants from the Institute of Botany that were supplied by Martin Freiberg. Geraldine Fahy supplied some useful additional plant reference samples. I conceptualised the statistical approach to identifying microremains found in dental calculus with input from Amanda G. Henry, Colleen Stephens and Roger Mundry, these last two helped me to design the statistical analysis methodology. I performed all of the analysis required for the project. This was completed in a framework devised in with liaison with Amanda G. Henry, Roman Wittig and Domingo C. Salazar-García. I compiled the findings, wrote the paper, and edited it along with all authors. Amanda G. Henry and Domingo C. Salazar-García, supervised the process.

### **Paper 3:**

#### **Dental calculus indicates widespread plant use within the Neanderthal dietary niche**

My contribution to this paper involved designing and leading the project at all stages with support of Amanda G. Henry and Domingo C. Salazar-García. This study of Neanderthal dental calculus required traveling for sampling to a variety of museums and research institutions that curated Neanderthal and fauna remains. The Kalamakia teeth were sampled in Leipzig by Amanda G. Henry, and the Sima de las Palomas del Cabezo Gordo samples were taken in the University of Murcia by Amanda G. Henry and Domingo C. Salazar-García. I examined each sample of dental calculus using microscopy. I identified all finds with plant reference material and prepared the results. Drs. Domingo C. Salazar-García, Mauro Rubini and Jadranka Lenardic assisted with interpreting archaeological site data. I then accompanied pollen, charcoal and fauna with palaeotemperature simulations from the Stage Three Project, and used it to build a model of dietary breadth with the guidance of Colleen Stephens and Roger Mundry. I wrote the article with the guidance of Amanda G. Henry, Domingo C. Salazar-García. Amanda G. Henry and Domingo C. Salazar-García helped me revise and finalised the article.



## Curriculum vitae

The author of this dissertation, Robert C. F. Power, was born in Waterford in Ireland. After receiving his Leaving Certificate at Waterpark College in 2007, he read for a Single Honours Bachelor in Arts (Archaeology) in University College Cork, National University of Ireland. In Cork he began his interest in ancient diets by studying macro and microbotanical research. During this time participated in archaeological excavations of prehistoric and historic sites in Ireland and Canada. In addition, he has carried out post-excavation analysis as an archaeobotanical research assistant at the Discovery Programme in Dublin, Ireland. He was also an officer in the University's Medieval and Renaissance Society. His interest in the complexity of human interactions with the natural world led him to specialise in Environmental Archaeology. He pursued this in 2010 with a Master of Science in Environmental Archaeology from the Institute of Archaeology, University College London in the University of London. He received his Master of Science in 2011 with a dissertation on using phytoliths from Raqefet Cave in Israel to infer plant use by Natufian foragers. After the Master of Science, he started his PhD in 2011, focusing on dental calculus in dietary studies and reconstructing Neanderthal plant use in the Plant Foods in Hominin Dietary Ecology Research Group at the Max Planck Institute for Evolutionary Anthropology. In addition to the doctorate research, he has presented his work at international conferences and published his work in several peer-reviewed, international journals such as the *Journal of Anthropological Archaeology*, *Quaternary International* and the *Proceedings of the National Academy of Sciences*. He is now employed as a research fellow at the Max Planck Institute for the Science of Human History in Jena in Germany.