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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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Citation

Power, R. C. F. (2016, November 1). *Evaluating the dietary micro-remain record in dental calculus and its application in deciphering hominin diets in Palaeolithic Eurasia*. Retrieved from <https://hdl.handle.net/1887/43970>

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Issue Date: 2016-11-01

Acknowledgements

I am deeply grateful to my supervisor and group leader Amanda Henry. During my studies in the group, Amanda Henry supported my work and ensured my development, patiently to a fault. In no way could the project have advanced as smoothly without her foresight, expertise and generosity, even letting me use lab resources after my dissertation submission. I am in appreciate not just for giving me the opportunity to write a doctorate in the Plant Group but for sharing four years of formation. I am grateful to second supervisor, Domingo C. Salazar-García for who guided me through the PhD process. He always selflessly gave time to ensure every spontaneous deadline could be met. His contributions to my doctoral thesis and my formation are not easily summarised or quantified. Jean-Jacques Hublin deserves thanks for his insightful comments through my studies. He always made me feel welcome as a Research Group member hosted by the Department of Human Evolution. Wil Roebroeks, for his tips and mentoring along the way.

Aside from my supervisory team, many others contributed to the progress of the PhD. Fellow PhD candidate Stephanie who deeply enriched my perspectives on the evolution of nutrition. Chelsea Leonard on many occasions kindly gave her time to critique and develop my ideas and papers. Shira Gur-Arieh, for her grounding comments and pharmacological support.

This project was carried forward immeasurably by the support of the Department of Primatology and the Taï Forest Project staff. Roman Wittig's openness to arrange the collection of plants in the Taï Forest made the convoluted task of building a reference collection possible. I am indebted to Roger Kami Nabo and the other staff in the forest who took the time to collect the reference plants, dry fresh plants and return them to Leipzig. I also wish to note the support of the Ministère de la Recherche Scientifique and the Ministère de l'Environnement et des Eaux et Forêts of Côte d'Ivoire, Centre Suisse de Recherches Scientifiques at Abidjan, Côte d'Ivoire, the Office Ivoirien des Parcs et Reserves, the Director of the Taï National Park for authorisation of this research. Utah Schwarz sorted out all the practicalities of sampling the chimpanzee skeletal collection. Julia Riedel answered many questions on working with Taï Chimpanzee observational data. Loki du Toit made it possible for me to use these observation records. Geraldine Fahy, Gottfried Hohmann and Tobias Deschner took the time to fill me in with much essential

background information and providing valuable plant samples. I am also thankful to the Head of Primatology Christophe Boesch who kindly allowed my sampling of the Tai Skeletal Collection.

Many helpful archaeological scientists assisted the project by advising on microremain and material identifications such as Marco Madella, Paschal Verdin, Sanjay Eksambekar, Arlene M. Rosen, Irwin Rovner Linda Perry, Angela Perri, Vera Aldeias, and Dan Cabanes. The extensive statistics and programming support from Colleen Stephens and Roger Mundry without whom I would not have complete the projects data analysis. Maria Bendžuchová helped by providing spectroscopy technical advice. I am also grateful to Philip Gunz, Layne Vashro, and Andre Strauss who also helped on data analysis and programming.

I am keen to mention Ian Reid of Nano Imaging and Material Analysis Centre at the University College Dublin for SEM-EDX analysis of many dental calculus samples. Pat O'Reilly of Nature First, genially identified spores that were found in certain dental calculus samples. A great number of people provided the archaeological contexts of the many sites where I sourced dental calculus. Authorities such as Bence Viola, Ivor Karavanić, Julià Maroto Genover, Philip Nigst and Fred Smith kindly gave the time to give all the background information the project required.

The diligence, professionalism and kindness of the group's technical staff Antje Hutschenreuther, Joerg Watzke, Simone Schmidt, Thomas Büdel, Annabell Reiner and Steffi Hess deserve a lot of credit. Their work unfailingly kept the labs and protocols running when other events took my attention. For the time spent outside the laboratories, I thank Victor Weiler, Silke Streiber, and Conny Schicke for administrative assistance and helping me adapt to Germany and Lukas Westphal for superb ICT support. Also helpful were, Roswitha Manning and Anneke Hendriks for Leiden University assistance. Marie Soressi, for support at the Faculty of Archaeology in Leiden University. Frido Welker, for translating my doctorate summary into Dutch and Karen Ruebens for QGIS advice.

I appreciate the archaeologists and curators who saw the value of this project and provided access to skeletal material for sampling. Michael J. Walker (University of Murcia, Spain) permitted access to the Sima de las Palomas del Cabezo Gordo material, and Mariano López helped to make our collaboration happen. Jadranka Lenardić, Dejana Brajkovic and Ivan Gusic (Croatian Academy of the Sciences, Croatia) allowed me to sample the Vindija hominin remains. Rosa Alsius (Farmàcia

Rosa Alisus in Banyolas, Spain) allowed me to access to the Banyolas mandible. Raffaele Sardell and Mauro Rubini (Servizio di Antropologia, Italy) permitted access to Grotta Guattari and Grotta Fossellone. Andreas Darlas (Greek Ministry of Culture) and Katerina Harvati-Papatheodorou (Eberhard-Karls-Universität Tübingen, Germany) permitted access to the Kalamakia remains. Joaquín Lomba, María Haber and Azucena Avilés for kindly allowed access to the Camino del Molino calculus samples. In addition, the project benefited from plant samples provided by Martin Freiberg from the Leipzig Botanical Gardens. The doctorate required drawing approaches and data from many different disciplines outside my training such as palaeoclimatology to take into account all the factors that affected Neanderthals. It is due to the advice of Dave Pollard, Robert Foley, Kathryn Fitzsimmons and William Davies that integrating palaeoclimatology approaches was successful.

A word of acknowledgement is needed for my friends and fellow Max Planck students and colleagues; Nicole Antonette del Rosario for helping me develop my thoughts thoroughly and for diligently proofreading my work, Cynthia Debono Spiteri, Mariska Carvalho, Nadia Scott, Sylvio Tüpke, Liu Huan, Tao Chen, Marcello Mannino, Zewdi Tsegai, Collin Moore, Nina Doerschner, Dawit Desta, Nick Stephens, Viktoria Oelze, Stefanie Stelzer, Will Archer, Adeline Le Cabec, Sahra Talamo, and Vaidas Suncovas at the Max Planck Institute for Evolutionary Anthropology, who raised my spirits during the hard slog of the doctorate. Each made the institute a uniquely enriching place to work.

My family played a large role in writing this dissertation. I am appreciative to my brother John for proof reading many drafts along the way and Eunhee for her kindness. At this point I must acknowledge my parents John and Julie Power, whose endless encouragement above all motivated me. Their personal sacrifices for me not only made it all happen but have been an inspiration.

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.