

Laudation: Dr. Frido Welker, Twentieth Recipient of the Tübingen Prize for Early Prehistory and Quaternary Ecology

***Laudatio: Dr. Frido Welker, zwanzigster Träger des Tübinger
Förderpreises für Ältere Urgeschichte und Quartärökologie***

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Ladies and gentlemen, friends, colleagues, students, representatives of EiszeitQuell, Dean Rosenstiel, and of course, Dr. Frido Welker, it is a great honor for me to be presenting for the first time the Laudation of the recipient of the Tübingen Prize for Early Prehistory and Quaternary Ecology, a prize that this year marks its 20th anniversary. It is all the more a great pleasure since this year, for the first time, the jury has decided to promote research in the field of proteomics in Archaeology. By doing so, the great contribution of this young field of research in understanding early prehistory and quaternary ecology is being properly acknowledged.

On behalf of the jury, our sponsor, and in the name of the founder of the prize, I would like to present the winner of this year's award, Dr. Frido Welker, and his PhD thesis. Frido Welker was born in 1991 in Harderwijk in the Netherlands. He studied Archaeology at the University of Leiden as a Bachelor student from 2009 to 2012. During this time, he took part in archaeological excavations in his home country, at the sites of Deventer Molbergsweg Zuid and Oegstgeest-Rijnfront. His Bachelor's thesis, supervised by Prof. Thijs van Kolfschoten and Dr. Barbara Gravendeel, aimed at analyzing ancient DNA of coprolites from the extinct mountain goat *Myotragus balearicus* to reconstruct the diet of this extinct ungulate in relation to the paleo-environment of Mallorca. Frido published the content of his thesis in the international peer-reviewed journal *Quaternary Research* in 2014, in an article where he was first author, demonstrating his writing ability at this early stage in his academic career.

The next step in Frido's education was a Master's in Bioarchaeology at the University of York, in the United Kingdom. There he approached Prof. Matthew Collins for "a project that works." Indeed, Frido was a bit frustrated that the project he had been involved in so far did not yield as many positive results as he would have wished. This is how Frido was advised to try ancient proteins. He designed his Master's thesis project and carried it out under the supervision of Prof. Matthew Collins. His goal was to identify hominin



Award ceremony of the twentieth Tübingen Prize for Early Prehistory and Quaternary Ecology on February 01, 2018, at Schloss Hohentübingen / *Verleihung des 20. Tübinger Förderpreises für Ältere Urgeschichte und Quartärökologie auf Schloss Hohentübingen am 01. Februar 2018*. From left to right / *Von links nach rechts*: Bettina Claß, Daniel Gramer, (both EiszeitQuell, sponsor), Prof. Dr. Hervé Bocherens (jury), Achim Jarck (EiszeitQuell, sponsor), Priv.-Doz. Dr. Miriam N. Haidle, Prof. Nicholas J. Conard Ph.D. (both jury), Dr. Frido Welker (recipient / *Preisempfänger*), Prof. Dr. Michael Bolus (jury), Prof. Dr. Wolfgang Rosenstiel (Dean of the Faculty of Science of the University of the University of Tübingen / *Dekan der Mathematisch-Naturwissenschaftlichen Fakultät der Universität Tübingen*), Dr. Britt M. Starkovich, Prof. Dr. Christopher Miller (both jury). Photo: Friedhelm Albrecht, © Universität Tübingen.

bones from remains too fragmentary to allow a morphological identification, which represents the majority of bone material found in prehistoric archaeological excavations. To reach this objective, different experimental approaches were tested that paved the way for Frido's doctoral research. Indeed, several of these approaches failed and were abandoned, while others seemed promising and were continued during the PhD thesis that followed. This general approach to zooarchaeology through mass spectrometry, in short ZooMS, and its potential for hominin identification related to the Middle to Upper Paleolithic transition sparked Marie Soressi's (who was awarded the Tübingen Prize in 2004) and Jean-Jacques Hublin's first interest in ancient protein methodologies. This is an extremely important and controversial topic. This cultural transition is defined by changes in the lithic artifacts and coincides broadly with the replacement of Neanderthals by anatomically modern humans around 40,000 years ago in Europe. However, frustratingly few hominin diagnostic skeletal remains with a secure stratigraphical and chronological position are directly associated with sites where this technological and cultural transition is documented, leaving room for speculation and guesswork. Therefore,

any method that could provide clear information about the key questions, such as who were the makers of the last Middle Paleolithic industries and who were the makers of the first Upper Paleolithic industries, would probably revolutionize this field of research and our understanding of the recent evolution of humans in Europe.

The PhD topic awarded the research prize this year bears the following title: “The Palaeoproteomic Identification of Pleistocene Hominin Skeletal Remains: Towards a Biological Understanding of the Middle to Upper Palaeolithic Transition.” Frido carried out the technical part of his work at the Max-Planck Institute for Evolutionary Anthropology in Leipzig as well as at the University of York. He defended his thesis at the University of Leiden. The PhD is in cumulative form, composed of an introduction and four published articles that correspond to the four chapters of the doctoral thesis.

The first chapter demonstrates how ZooMS could succeed in identifying animal bones of different species among unidentifiable bone fragments, in a case study performed at the site of Les Cottés in southwestern France. With the application of ZooMS, 30 % more bones could be identified taxonomically than the ones that could be identified using their morphology. This led to a more robust evaluation of the proportion of species among the bone remains left behind by prehistoric humans. Moreover, it revealed that more species were actually present than documented by morphological identifications, adding the wild goat ibex, red deer, wild boar and woolly rhinoceros to the species list of the site. These species occur in other contemporaneous sites in the same region but in low abundance, and their identification in Les Cottés delivers further information about the environment around the site. These successful results were published in *Journal of Archaeological Science* in 2015, with Frido Welker as first author.

The second chapter of the PhD thesis showed how it was possible to use the proteomic approach to obtain amino acid sequences of type I collagen from Pleistocene bone specimens. It is indeed very important to test whether protein degradation could lead to incorrect phylogenetic placements, something that had not been done before. This chapter showed not only that old bones from identified species with known collagen sequences were reliable for phylogenetic analysis, but also that the bones of species without such information could work. Using this approach, it was possible for Frido to reconstruct the evolutionary history of two emblematic extinct mammal species from South America that have puzzled scientists since Darwin himself: *Toxodon* and *Macrauchenia*, two taxa that illustrate the uniqueness of Pleistocene South American megamammals. They appear to be most closely related to perissodactyls, the mammal group including horses, rhinoceroses and tapirs, though they split from this group about 60 million years ago. The solution of this scientific enigma had not been possible before due to the poor DNA preservation in these contexts. This study proved that phylogenetic analysis using proteomics could work on bones that did not preserve DNA, opening a wide range of new perspectives, both in time and space. The publication that corresponds to this chapter is nothing less than a *Nature* paper, published in 2015 with Frido as first author. The paper has already been cited 77 times on Google Scholar.

The third chapter of the PhD thesis deals with methodological and technical issues related to certain patterns of degradation of some amino acids that allowed testing the intrusion of some bones from higher stratigraphic levels into older deposits in an archaeological site. The study investigated bones from the Châtelperronian units of the site of

Quinçay in western France and was published in 2017 in the scientific journal *Science and Technology of Archaeological Research*, with Frido as first author.

Finally, the fourth chapter, dealing with an ancient hominin palaeoproteome, truly reached the original objective of the PhD thesis, which was to be able to identify hominin bone fragments that were not morphologically diagnostic and to allocate them to archaic or to modern humans. This was done on bone material from the Châtelperronian layer at the Grotte du Renne at Arcy-sur-Cure and was published as a *PNAS* article with Frido as first author. It was possible to identify 28 additional hominin bone fragments out of 196 tested bone fragments and to allocate them to Neanderthals rather than to modern humans, therefore strengthening the link between Neanderthals and the Châtelperronian lithic industry.

When the PhD thesis defense took place at the University of Leiden, it was awarded the highest honors for a PhD by the University for that year. In the view of both supervisors, Prof. Jean-Jacques Hublin and Prof. Matthew Collins, Frido was probably one of the strongest students they had ever supervised, and this is borne out by his publications as first author that came out in the technical journal *Science and Technology of Archaeological Research* as well as in the very prestigious journals *PNAS* and *Nature*.

To conclude, I will simply cite the words of Prof. Matthew Collins, the supervisor of his Master's thesis in York and his PhD co-supervisor, that summarize well the high quality of Frido Welker's scientific work: "I think he finally got some projects that worked.... He is now one of the leading thinkers in the world of ancient proteins." He also added: "I would not like to be on the wrong side of an argument with him." Most certainly, we will hear again from Frido and his excellent research, especially since he heard three days ago that he was awarded a Marie Curie post-doctoral grant.

I now invite you to hear the presentation of Frido Welker entitled "From bones to proteomes: Gaining a biological understanding of the Middle to Upper Paleolithic transition" that will tell you everything you want to know about this fascinating topic.

Thank you very much for your attention.