

‘Forest Moss’: no part of the European Neanderthal diet

James H. Dickson^{1,*}, Klaus Oeggl² & Daniel Stanton³

In recent years, the study of Palaeolithic people has been a vigorous, productive topic, with the increasing knowledge of diet contributing significantly to the debate’s liveliness (e.g. Richards 2009; Henry *et al.* 2010; Hardy *et al.* 2012, 2016; El Zaatari *et al.* 2016).

While Weyrich *et al.* (2017) present an exciting insight into prehistoric diet through their application of shotgun sequencing and metagenomic analysis, they also betray some striking limitations of those same techniques, to the point of over interpretation. Even in this age of increasing availability of whole genomes, many taxonomic groups are vastly undersampled, and identifying organisms based on short fragments of DNA is still fraught with false attributions. These should not be fatal when used with considerable caution to identify broader clades, but are deeply misleading when combined with unwarranted speculation. The latter is the case with the claims advanced by Weyrich *et al.* (2017) concerning the plant and fungal components of the Neanderthal diet. Based on their genomic data from Neanderthal calculus, these Eurasian late Pleistocene hominins show a high variety in nutritional habits. According to Weyrich *et al.* (2017), in north-western Europe, the Neanderthal diet relied strongly on meat (e.g. woolly rhinoceros, wild sheep), whereas in southern Europe, they fed only on plants and fungi (e.g. mushroom, pine nuts, mosses). Upon closer inspection of the species list, however, hardly any of the taxa identified through metagenomics are plausible dietary candidates. They are instead often model organisms that have been speculatively linked to misleadingly detailed dietary claims. *Pinus koraiensis*, although a source of possible edible ‘pine nuts’, is endemic to East Asia. *Schizophyllum commune* is not, itself, considered an ‘edible mushroom’, being of the consistency of cardboard. In both of these cases, however, one can at least suggest plausible dietary items that might be phylogenetically somewhat close, even if this still requires unacknowledged speculation. Yet more problematic is the purported consumption of ‘forest moss’, which is a concocted name.

The ‘forest moss’ in question is *Physcomitrella patens* (Hedw.) Bruch & Schimp. (Figure 1). An accepted common name for this is Spreading Earth-moss. It is a moss with no special connection to woodlands, and so the common name used by Weyrich *et al.* is

¹ School of Biology, University of Glasgow, Glasgow G12 8QQ, UK

² Institut für Botanik, University of Innsbruck, Sternwartestrasse 15, Innsbruck 6020, Austria

³ Department of Ecology, Evolution and Behavior, University of Minnesota-Twin Cities, Saint Paul, MN 55108, USA

* Author for correspondence (Email: prof.j.h.dickson@gmail.com)

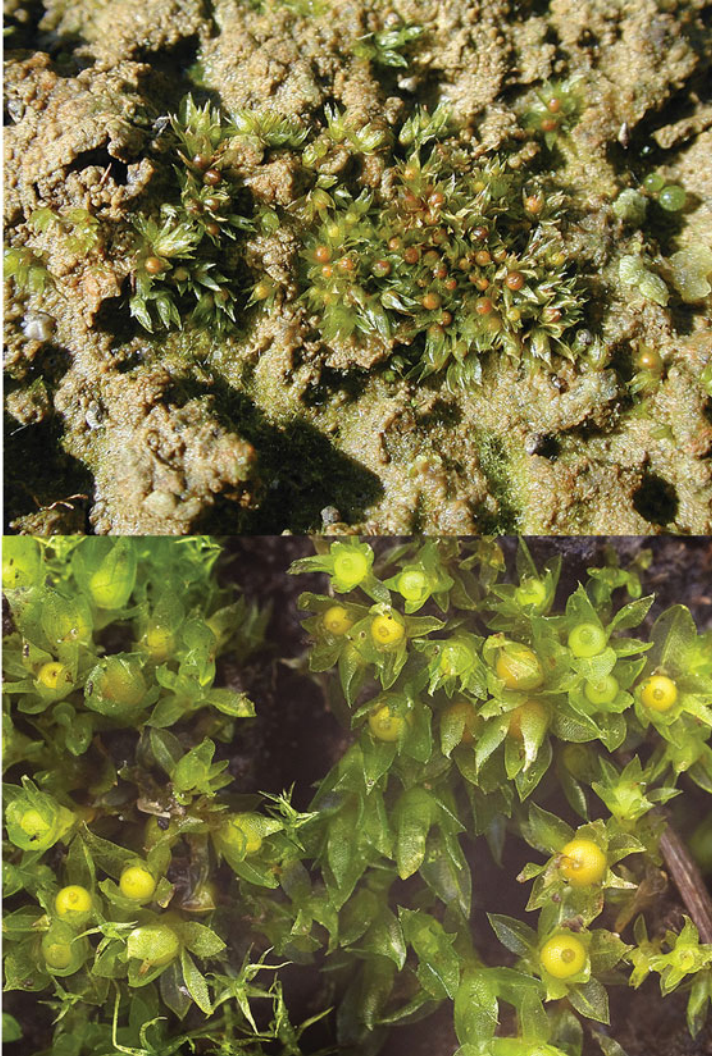


Figure 1. *Physcomitrella patens* is a diminutive moss only a few millimetres in length, and is unknown in archaeological contexts; Knivista, Sweden (photographs by Michael Lüth and Tomas Hallingbäck).

inappropriate, misleading and tendentious. Its usual habitat is the mud at the edges of pools and rivers, and in muddy fields. It is a very small moss, reaching a mere 2.5mm or so; for that reason, it is a very improbable food source.

Regarding plant diet, humankind depends totally on flowering plants (seeds, fruits, stems, leaves, tubers) as staples. Also consumed to greater or lesser extent are algae (seaweeds), ferns (rhizomes, young fronds), conifers (seeds) and even cycads (tubers and stem starch). Mosses are conspicuous absentees from this list. The authors know of no evidence from anywhere in the world at any time, present, recent or distant past, which shows that mosses are or have been used as food on a regular basis. Mosses are not staples,

© Antiquity Publications Ltd, 2017



Figure 2. Up to many centimetres in length, *Sphagnum palustre* is a bogmoss known from two Bronze Age cists in Britain (photograph by J.H.D.).

and a good reason that they are not consumed as food (except in the most minor ways) is that they are neither palatable nor nutritious. There is very little early ethnographical literature mentioning the use of mosses as food, although there are slight indications of the use of mosses as famine food (Glime 2006). There is also only slight evidence for mosses being used as internal medical treatments, but never in the case of *Physcomitrella patens*. By contrast, the use of the *Sphagnum* (Bogmoss; Figure 2) species as wound dressings is well documented. The Tyrolean Iceman, for example, had a badly cut right palm (Dickson *et al.* 2009; Dickson 2011). The two tiny pieces of *Sphagnum* recovered from the alimentary tract have been interpreted as accidental ingestions, remnants of the dressing adhering to bloody fingers.

There are many instances of mosses recovered from both historic and prehistoric European archaeological sites, but never from contexts unequivocally indicative of their consumption as food (Dickson 1973, 2011; Frahm & Wiethold 2004). No remains of mosses have ever been recovered from the numerous Palaeolithic occupation sites excavated in Europe. At such sites (often comprising caves in limestone cliffs), the usually sparse macroscopic plant remains are carbonised. Little organic material survives, other than bone and charcoal—the latter of which often survives in very small pieces. Being mainly thin plants with little or no hard tissue, mosses rarely carbonise. While there can be little doubt that Palaeolithic people used mosses (for whatever purposes they may have had), there is no current proof of any use.

Mosses recovered from archaeological contexts of whatever period are overwhelmingly large species—at least several centimetres in length such as *Hylocomium splendens* (Figure 3)—gathered for purposes such as caulking, packing, wrapping, insulation or hygienic wiping (Harris 2008; Dickson 2011; Saatkamp *et al.* 2011). Small mosses do occur



Figure 3. Frequently 100mm or more in length, *Hylocomium splendens* is often recovered from archaeological contexts (photograph by J.H.D.).

but always very sparsely; this indicates not deliberate collection but accidental gathering among the larger species. *Physcomitrella patens* has never been found as a macrofossil. That such a species could have been a food plant comes as a completely unexpected surprise to the bryologist or ethnobotanist. It seems odd that the tiny *Physcomitrella patens*—being that very moss with the most studied genome—should appear in Neanderthal dental calculus.

The presence of moss in dental calculus does not prove deliberate ingestion as food, but only the presence of the moss in the mouth. There are potentially crucial problems, which must be considered, such as contamination and taphonomy, also demonstrated by Birks and Birks (2015) in assessing DNA data. The moss DNA was not only in El Sidrón I, but also in Spy I from Belgium—yet Weyrich *et al.* (2017: 359) dismiss that as “probably the results of contamination”. Even the very presence of fragments of mosses in the human gut does not necessarily prove their ingestion as food. The sparse submicroscopic fragments of several mosses—mainly *Neckera complanata* (Figure 4)—recovered from the intestines of the Tyrolean Iceman, has been interpreted as remnants of food wrapping (Dickson 2000, 2011).

The recognition of moss DNA in the dental calculus is one thing, but deduction about the plant’s significance in the diet is another. No quantification is possible and therefore the statement that “dietary components” included “moss” (Weyrich *et al.* 2017: 357) is not justifiable. The work of Weyrich *et al.* (2017) does not show that Neanderthals ate moss in whatever quantity—if any.

This criticism is not intended to undermine the impressive capabilities of the methods used, but rather to insist that these do not replace the need for due caution and for applying taxonomic and ecological expertise.



Figure 4. Up to several centimetres or more in length, *Neckera complanata* is often found in archaeological contexts (photograph by J.H.D.).

References

- BIRKS, H.J.B. & H.H. BIRKS. 2015. How have studies of ancient DNA from sediments contributed to the reconstruction of Quaternary floras? *New Phytologist* 209: 499–506. <https://doi.org/10.1111/nph.13657>
- DICKSON, J.H. 1973. *Bryophytes of the Pleistocene*. Cambridge University Press.
- 2000. Bryology and the Iceman: chorology, ecology and ethnobotany of the mosses *Neckera complanata* Hedw. and *Neckera crispa* Hedw., in S. Bortenschlager & K. Oeggl (ed.) *The Iceman and his natural environment: palaeobotanical results* (The Man in the Ice 4): 77–88. Vienna: Springer.
- 2011. *Ancient ice mummies*. Stroud: The History Press.
- DICKSON, J.H., W. HOFBAUER, R. PORLEY, A. SCHMIDL, W. KOFLER & K. OEGGL. 2009. Six mosses from the Tyrolean Iceman's alimentary tract and their significance for his ethnobotany and events of his last days. *Vegetation History and Archaeobotany* 18: 13–20. <https://doi.org/10.1007/s00334-007-0141-7>
- EL ZAATARI, S., F.E. GRINE, P.S. UNGAR & J.-J. HUBLIN. 2016. Neanderthal versus modern human dietary responses to climatic fluctuations. *PLoS ONE* 11: e0153277. <https://doi.org/10.1371/journal.pone.0153277>
- FRAHM, J.-P. & J. WIETHOLD. 2004. Die Moosflora des Mittelalters und der Frühen Neuzeit in Mitteleuropa. *Herzogia* 17: 303–24.
- GLIME, J. 2006. Bryological interaction. *Bryophyte Ecology*. Michigan Tech: Digital Commons. Available at: <http://digitalcommons.mtu.edu/bryophyte-ecology/> (accessed 17 July 2017).
- HARDY, K., S. BUCKLEY, M.J. COLLINS, A. ESTALRRICH, D. BROTHWELL, L. COPELAND, A. GARCÍA-TABERNO, S. GARCÍA-VARGAS, M. DE LA RASILLA, C. LALUEZA-FOX, R. HUGUET, M. BASTIR, D. SANTAMARÍA, M. MADELLA, J. WILSON, A. FERNÁNDEZ CORTÉS & A. ROSAS. 2012. Neanderthal medics? Evidence for food, cooking, and medicinal plants entrapped in dental calculus. *Naturwissenschaften* 99: 617–26. <https://doi.org/10.1007/s00114-012-0942-0>
- HARDY, K., S. BUCKLEY & M. HUFFMAN. 2016. Doctors, chefs or hominin animals? *Antiquity* 90: 1373–79. <https://doi.org/10.15184/aqy.2016.134>
- HARRIS, E.S.J. 2008. Ethnobotany: traditional uses and folk classification of bryophytes. *The Bryologist* 111: 169–217. [https://doi.org/10.1639/0007-2745\(2008\)111\[169:ETUAFJ\]2.0.CO;2](https://doi.org/10.1639/0007-2745(2008)111[169:ETUAFJ]2.0.CO;2)

- HENRY, A.G., A.S. BROOKS & D.R. PIPERNO. 2010. Microfossils in calculus demonstrate consumption of plants and cooked foods in Neanderthal diets (Shanidar III, Iraq; Spy I and II, Belgium). *Proceedings of the National Academy of Sciences of the USA* 108: 486–91. <https://doi.org/10.1073/pnas.1016868108>
- RICHARDS, M.P. 2009. Stable isotope evidence for European Upper Palaeolithic human diets, in J.-J. Hublin & M.P. Richards (ed.) *The evolution of hominin diets: integrating approaches to the study of palaeolithic subsistence*: 251–57. Vienna: Springer.
- SAATKAMP, A., M. GUYON & M. PHILIPPE. 2011. Moss caulking of boats in upper French Rhône and Saône (eastern France) from the 3rd to the 20th century and the use of *Neckera crispa* Hedwig. *Vegetation History and Archaeobotany* 20: 293–304. <https://doi.org/10.1007/s00334-011-0301-7>
- WEYRICH, L.S., S. DUCHENE, J. SOUBRIER, L. ARRIOLA, B. LLAMAS, J. BREEN, A.G. MORRIS, K.W. ALT, D. CARAMELLI, V. DRESELY, M. FARRELL, A.G. FARRER, M. FRANCKEN, N. GULLY, W. HAAK, K. HARDY, K. HARVATI, P. HELD, E.C. HOLMES, J. K Aidonis, C. LALUEZA-FOX, M. DE LA RASILLA, A. ROSAS, P. SEMAL, A. SOLTYSIAK, G. TOWNSEND, D. USAI, J. WAHL, D.H. HUDSON, K. DOBNEY & A. COOPER. 2017. Neanderthal behaviour, diet, and disease inferred from ancient DNA in dental calculus. *Nature* 544: 357–61. <https://doi.org/10.1038/nature21674>