Did Neanderthals eat their vegetables? Study provides first direct evidence of plants in Neanderthal diet

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Homo neanderthalensis, adult male. Credit: John Gurche, artist / Chip Clark, photographer

The popular conception of the Neanderthal as a club-wielding carnivore is, well, rather primitive, according to a new study conducted at MIT. Instead, our prehistoric cousin may have had a more varied diet that, while heavy on meat, also included plant tissues, such as tubers and nuts.

Scientists from MIT and the University of La Laguna in Spain have identified human fecal remains from El Salt, a known site of Neanderthal occupation in southern Spain that dates back 50,000 years. The researchers analyzed each sample for metabolized versions of animal-derived cholesterol, as well as phytosterol, a cholesterol-like

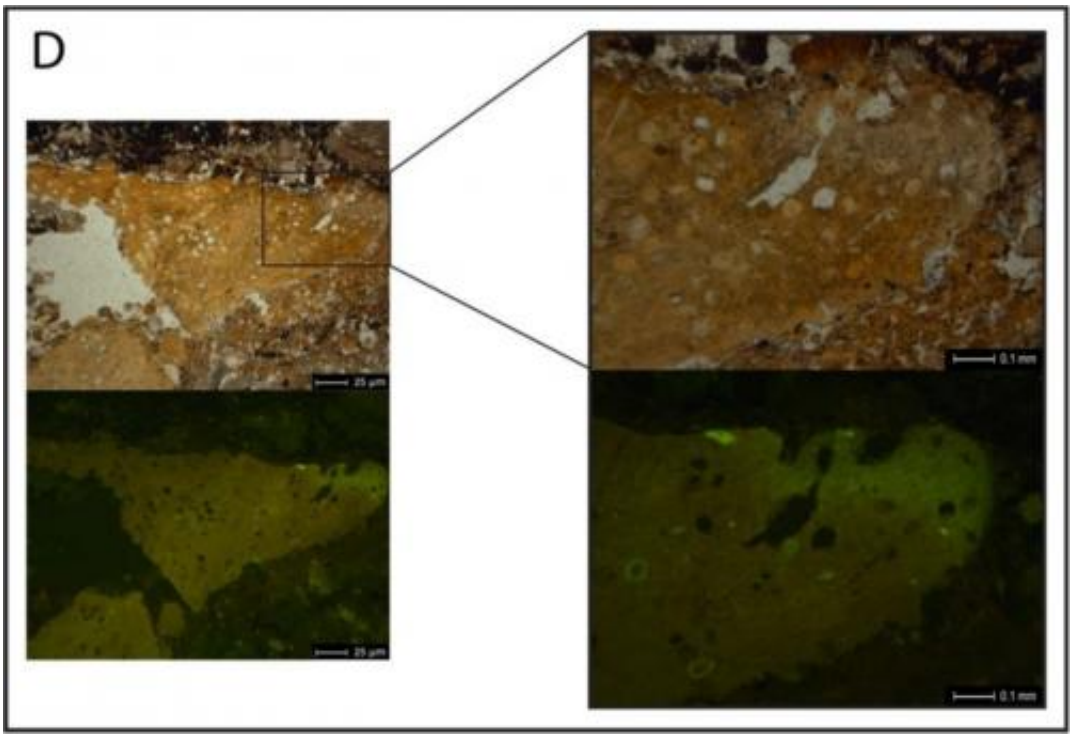
compound found in plants. While all samples contained signs of meat consumption, two samples showed traces of plants—the first direct evidence that Neanderthals may have enjoyed an omnivorous diet.

"We have passed through different phases in our interpretation of Neanderthals," says Ainara Sistiaga, a graduate student at the University of La Laguna who led the analysis as a visiting student at MIT. She and her colleagues have published their study in the journal *PLoS ONE*.

"It's important to understand all aspects of why humanity has come to dominate the planet the way it does," adds co-author Roger Summons, a professor of geobiology in MIT's Department of Earth, Atmospheric and Planetary Sciences. "A lot of that has to do with improved nutrition over time."

Unearthing a prehistoric meal

While scientists have attempted to reconstruct the Neanderthal diet, much of the evidence has been inconclusive. For example, researchers have analyzed bone fragments for carbon and nitrogen isotopes—signs that Neanderthals may have consumed certain prey, such as pigs versus cows. But such isotopic data only differentiate between protein sources—underestimating plant intake, and thereby depicting the Neanderthal as exclusively carnivorous.



The top panels show the coprolite, while the bottom panels show phosphate fluorescing under blue light. Credit: PLOS ONE, CC BY

Other researchers recently identified plant microfossils trapped in Neanderthal teeth—a finding that suggests the species may have led a more complex lifestyle, harvesting and cooking a variety of plants in addition to hunting prey. But Sistiaga says it is also possible that Neanderthals didn't eat plants directly, but consumed them through the stomach contents of their prey, leaving traces of plants in their teeth.

Equally likely, she says, is another scenario: "Sometimes in prehistoric societies, they used their teeth as tools, biting plants, among other things. We can't assume they were actually eating the plants based on finding microfossils in their teeth."

A view of El Salt archeological site. Credit: Ainara Sistiaga

Signs in the soil

For a more direct approach, Sistiaga looked for fecal remains in El Salt, an excavation site in Alicante, Spain, where remnants of multiple Neanderthal occupations have been unearthed. Sistiaga and her colleagues dug out small samples of soil from different layers, and then worked with Summons to analyze the samples at MIT.

In the lab, Sistiaga ground the soil into a powder, then used multiple solvents to extract any organic matter from the sediment. Next, she looked for certain biomarkers in the organic residue that would signal whether the fecal remains were of human origin.

Specifically, Sistiaga looked for signs of coprostanol, a lipid formed when the gut metabolizes cholesterol. As humans are able to break down

more cholesterol than any other mammal, Sistiaga looked for a certain peak level of coprostanol that would indicate the sample came from a human.

She and Summons then used the same geochemical techniques to determine the proportions of coprostanol—an animal-derived compound—to 5B-stigmastanol, a substance derived from the breakdown of phytosterol derived from plants.

Each sample contained mostly coprostanol—evidence of a largely meat-based diet. However, two samples also held biomarkers of plants, which Sistiaga says may indicate a rather significant plant intake. As she explains it, gram for gram, there is more cholesterol in meat than there is phytosterol in plants—so it would take a significant plant intake to produce even a small amount of metabolized phytosterol.

In other words, while Neanderthals had a mostly meat-based diet, they may have also consumed a fairly regular portion of plants, such as tubers, berries, and nuts.

"We believe Neanderthals probably ate what was available in different situations, seasons, and climates," Sistiaga says.

Sistiaga, Summons, and their colleagues plan to use similar geochemical biomarker techniques, coupled with micromorphological analysis, to analyze soil samples in Olduvai Gorge, Tanzania—a 1.8-million-year-old site where some of the earliest evidence of human ancestry have been discovered.

"We're working in a micro context," Sistiaga says. "Until now, people have carried out residue analysis on pots, tools, and other objects, but 90 percent of archaeology is sediment. We're opening a new window to the information that is enclosed in Paleolithic soil and sediment."

More information: Sistiaga A, Mallol C, Galvan B, Summons RE (2014) The Neanderthal Meal: A New Perspective Using Faecal Biomarkers. *PLOS ONE* 9(6): e101045. doi:10.1371/journal.pone.0101045. dx.plos.org/10.1371/journal.pone.0101045