

Humans**Before the Stone Age: Were the first tools made from plants not rocks?**

Our ancestors probably used a wide range of plant-based tools that have since been lost to history. Now we're finally getting a glimpse of this Botanic Age


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There are few things more irritating in everyday life than getting something stuck between your teeth. Thankfully, we can reach for a toothpick – and it seems our ancient ancestors did the same. In fact, a fragment of a 1.2-million-year-old toothpick is perhaps the earliest direct evidence we have of hominins using plants as tools.

Our [ancient ancestors](#)  /definition/human-evolution/ probably made frequent use of implements made from plants. But finding evidence of this is extremely tough because botanical materials are so quick to rot away. This means the archaeological record of human tool use is deeply skewed towards the much harder stone.




A cave in France is revealing how the Neanderthals died out

Discoveries from the genomes of the last Neanderthals are rewriting the story of how our own species came to replace them

 /article/mg26435120-800-a-cave-in-france-is-revealing-how-the-neanderthals-died-out/

All this suggests that the origins of human technology could have been profoundly misunderstood.

Stone Age

The conventional view is it all started with the [first stone tools](#)  /article/2358821-early-hominin-paranthropus-may-have-used-sophisticated-stone-tools/ and the dawn of the Stone Age over 3 million years ago. But what if, even before that, there was a botanical age, one based on woodworking and weaving of plant materials? For some researchers, it is absurd not to think that plants would be part of the story.

“Perishable material culture is an essential element in our evolutionary past,” says Linda Hurcombe at the University of Exeter in the UK.


Now, we are finally getting a clearer view of this lost age. New techniques are making it possible to find traces of plant-based tools that would otherwise have been missed. And by studying the way modern primates use plants, researchers are getting clues as to how traces of the human Botanic Age might be preserved in the fossil record. All in all, it’s a shift that might lead to a radical rethink of the origins of human technology.

There is an undeniable logic behind the burgeoning idea of a Botanic Age. The use of tools made from plants is universal across non-industrialised societies and in our closest ape relatives, so it seems inconceivable that ancient hominins [overlooked these versatile resources](#) <https://onlinelibrary.wiley.com/doi/10.1002/ajpa.24835>. That is certainly Hurcombe’s view. In fact, she and other researchers like her think that implements made from organic materials make up the “missing majority” of artefacts upon which the foundations of the Stone Age probably rest. A small but growing number of these researchers are dedicating themselves to finding evidence of this undiscovered era of human evolution.

Archaeology

So far, the oldest direct evidence we have of this period is that fragment of ancient toothpick. This was discovered in 2016 when [Karen Hardy](#) <https://www.gla.ac.uk/schools/humanities/staff/karenhardy/> at the University of Glasgow, UK, and her colleagues found a [tiny piece of non-edible wood](#) <https://link.springer.com/article/10.1007/s00114-016-1420-x> in the [fossilised tooth plaque](#) <https://link.springer.com/article/mg25133524-400-the-microbial-gunk-that-hardens-on-teeth-is-revealing-our-deep-past/> of a 1.2-million-year-old hominin from Atapuerca, Spain. The fragment was next to characteristic straight scratches on the teeth, called interproximal grooves, which scientists believe indicate [repeated use of prehistoric toothpicks](#) <https://www.sciencedirect.com/science/article/abs/pii/S000399690000128X?via%3Dihub>.

But it is likely that plant-based tools and implements were in use far earlier than this. Indeed, in the 1970s, the feminist anthropologists [Nancy Tanner](#) <https://www.newspapers.com/article/santa-cruz-sentinel-obituary-for-nancy-m/51287344/> and [Adrienne Zihlman](#) https://anthro.ucsc.edu/faculty/academic_personnel.php?uid=azihlman suggested that containers such as [baskets were among humanity’s earliest possessions](#) <https://www.jstor.org/stable/3173144>. They were pushing back against the “man the hunter” dogma that placed men and their activities at the forefront of hominin


evolution. “It wasn’t really picked up on... but it was a vastly important insight,” says [Dean Falk](https://anthro.fsu.edu/person/dean-falk)  <https://anthro.fsu.edu/person/dean-falk> at Florida State University.



How did Paranthropus, the last of the ape-people, survive for so long?

Paranthropus was an ape-like hominin that lived on in a world dominated by big-brained early humans. Recent archaeological discoveries, like stone tools, are revealing how they lived

 </article/mg26034660-800-how-did-paranthropus-the-last-of-the-ape-people-survive-for-so-long/>

Their idea was that having a way of securely carrying and storing gathered food and water would have been fundamental for hominins from very early on. This hypothesis extends to something else that would have been equally important to carry: babies. It is thought that this need stemmed from a uniquely human transition that started more than 6 million years ago, well before the Stone Age – the move to [walking on two legs](#)  </article/2438905-when-did-human-ancestors-start-walking-on-two-legs/>.

With the transition to bipedal walking came a corresponding shift in the position of the big toe that reduced our ability to grip with our feet. This, combined with losing most of our body hair, meant that babies could no longer cling onto their mothers like

other primates do – and dropping your baby is a pretty big setback, not least from an evolutionary perspective.



▲ Chimpanzees use stick tools to harvest termites

Alejandra Pascual-Garrido

Falk, who is writing a book on humanity's Botanic Age, says that baby slings were a clear solution to this problem and that “baskets on the hips”, as she calls them, may have been the first human-modified plant tools. “Even just a strap of vine or grass could have been the first slings,” she says. For Falk, this would have been “an obvious light-bulb moment” for early hominins. This idea is supported by ethnographic evidence showing that [baby slings are widespread among contemporary hunter-gatherer populations](#) 🔗

<https://www.taylorfrancis.com/books/edit/10.4324/9780203789445/hunter-gatherer-childhoods-barry-hewlett>, with caregivers using organic materials such as plants, animal skins and fabrics to secure infants to their chests or backs.

The problem is that there is no direct archaeological evidence for this early technology, and there may never be. “It’s tantalising, but until somebody comes up with some other way to get at that question, I don’t know what we can do with it,” says [Dietrich Stout](#) 🔗 <https://anthropology.emory.edu/people/bios/stout-dietrich.html> at Emory University in Atlanta, Georgia. We aren’t going to find something used as a baby sling by hominins that far back in time, he says.

Ancient hominins must have started to use containers at some point, but even if these survived, how could you prove that prehistoric people used, say, a leaf as a cup, like modern-day chimps do? “Archaeologically, we have this roof, where we have really clear evidence for containers only after about 100,000 years ago,” says [Michelle Langley](https://experts.griffith.edu.au/8914-michelle-langley) <https://experts.griffith.edu.au/8914-michelle-langley> at Griffith University in Australia. This came from [the discovery of an ochre-processing workshop](https://www.science.org/doi/10.1126/science.1211535) <https://www.science.org/doi/10.1126/science.1211535> at Blombos cave in South Africa, where a liquid ochre paste was produced and stored in abalone shells. All traces of the containers that must have been used before this time have disappeared.

Oldest wooden artefact

But, very occasionally, botanical artefacts are discovered. Currently, the oldest wooden artefact modified by hominins seems to be an approximately [750,000-year-old polished willow plank](https://www.sciencedirect.com/science/article/abs/pii/S004724849190015N) <https://www.sciencedirect.com/science/article/abs/pii/S004724849190015N> unearthed in the 1990s in northern Israel. But this is far from clear-cut, and [Annemieke Milks](https://www.reading.ac.uk/archaeology/staff/dr-annemieke-milks) <https://www.reading.ac.uk/archaeology/staff/dr-annemieke-milks> at the University of Reading, UK, says the find needs to be reassessed using modern techniques to double-check that it is indeed an early example of woodworking. That makes last year’s discovery of [476,000-year-old notched logs](https://www.sciencedirect.com/science/article/abs/pii/S004724849190015N) [/article/2392894-earliest-evidence-of-buildings-made-from-wood-is-476000-years-old/](https://www.sciencedirect.com/science/article/abs/pii/S004724849190015N) at Kalambo Falls, Zambia, perhaps used as part of wooden structures, the earliest unequivocally hominin-modified botanical artefact.

There is then a gap of a few tens of thousands of years before the next evidence appears: [the Clacton spear found in Essex](https://www.tandfonline.com/doi/full/10.1080/00665983.2015.1008839) <https://www.tandfonline.com/doi/full/10.1080/00665983.2015.1008839>, UK, from 400,000 years ago, four other wooden tools from Kalambo Falls including a digging stick and a wedge from 324,000–390,000 years ago and the [Schöningen spears and throwing sticks](https://www.pnas.org/doi/10.1073/pnas.2320484121) <https://www.pnas.org/doi/10.1073/pnas.2320484121> found in Germany, which date back 300,000 years.

At the moment, researchers are relying on these lucky finds to piece together humanity’s Botanic Age. But [Bruce Hardy](https://www.kenyon.edu/directory/bruce-hardy/) <https://www.kenyon.edu/directory/bruce-hardy/> at Kenyon College in Ohio says that “if we’re going to make any more headway in palaeolithic archaeology, we have to find a way to detect those perishable materials”. To do this, he says, we need to get out our microscopes.



Thousands of Denisovan tools reveal their Stone Age technologies

A cache of Denisovan tools shows how these extinct humans moved from using sharp stone flakes 150,000 years ago to stone blades and chisels around 60,000 years ago

[/article/2235308-thousands-of-denisovan-tools-reveal-their-stone-age-technologies/](#)

In 2016, Hardy was handed a stone tool with a little white fleck on its underside that had been dug up from a Neanderthal site in south-eastern France. He placed it in a vacuum chamber and fired up a scanning electron microscope. Incredibly, Hardy could discern plant fibres that were clearly the remnants of an intricately made [50,000-year-old three-ply twisted thread](#) [/article/2240117-oldest-ever-piece-of-string-was-made-by-neanderthals-50000-years-ago/](#). He could even identify the long structure of the cells in enough detail to say the [fibres were constructed from the innards of a conifer tree](#) <https://www.nature.com/articles/s41598-020-61839-w>.


Hardy thinks the cord was saved by being beneath the stone tool it was found attached to. Although the twisted fibre could be completely unrelated to the tool, the stone stopped the decay process by acting as a protective barrier from groundwater. Other plant residues can also stick to stone for millennia, such as microscopic silica particles called [phytoliths](#) [/article/mg21829132-000-nana-from-heaven-how-our-favourite-fruit-came-to-be/](#). The oldest evidence of woodworking tools comes from


phytolith remains [attached to approximately 1.5-million-year-old stone tools](#) 

<https://www.sciencedirect.com/science/article/abs/pii/S0047248400904664> called hand axes from Tanzania, which suggest they were used for chopping wood, perhaps from a type of acacia.

But Hardy says that many researchers who study stone tool finds may be inadvertently destroying these crucial botanical residues. When looking at the fine marks left behind from repeated activity, known as use-wear analysis, researchers often scrub away anything on the stone's surface to get a more fine-grained image of the damage. "Once we wash it, we lose that evidence," says Hardy. "There's likely to be so much more stuff out there. If you don't look for it, you don't know."

Was there a technological Botanic Age before the dawn of the Stone Age?

This isn't to say that use-wear analysis isn't a valuable source of indirect evidence for prehistoric plant processing. In fact, this is how Hermine Xhaufclair at the University of the Philippines Diliman and her colleagues discovered that [39,000-year-old stone tools](#)  <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0281415> from Tabon cave in the Philippines had been used to strip plants. But "the devil's in the details with all of that kind of research", says Stout, and often the evidence is debatable as to whether the particular pattern of modification was caused by a certain behaviour. "It's easier to find something if you know what it looks like," he adds.

To do this, researchers are turning to our living, tool-using, primate cousins for inspiration. For instance, [Alejandra Pascual-Garrido](#)  <https://www.anthro.ox.ac.uk/people/dr-alejandra-pascual-garrido> at the University of Oxford is looking specifically at chimp tech that early hominins are known to have also used, and is tracking the signatures they leave behind. This new strand of primate archaeology, what she calls the "archaeology of the perishable", is focused on establishing the use-wear patterns left when making and using plant tools.



▲ **Baby slings made from organic materials could have been humanity's earliest technological creation**

Graham Prentice/Alamy


Pascual-Garrido's research focuses on chimpanzees using wooden probes to fish for termites, which [archaeological and ethnographic evidence](https://linkinghub.elsevier.com/retrieve/pii/S0047248413002479) <https://linkinghub.elsevier.com/retrieve/pii/S0047248413002479> suggests hominins also used. Currently, the oldest evidence for this behaviour comes from research from 2001 showing that *Paranthropus*, an ancient hominin that lived in southern Africa, used bones to dig into termite mounds to obtain a protein-rich meal [up to 1.8 million years ago](https://www.pnas.org/doi/full/10.1073/pnas.98.4.1358) <https://www.pnas.org/doi/full/10.1073/pnas.98.4.1358>. Although this isn't a botanical find, delicate probes made from plants are much less likely to preserve over such long periods.

So, rather than looking for the sticks themselves, archaeologists may have more luck keeping an eye out for fossilised versions of where the tools were sourced from. Pascual-Garrido is trying to form a library of the scars on the trees that form when chimps make their tools, for archaeologists to compare finds with.




Learning from primates

Between 2014 and 2016, she visited three Tanzanian chimpanzee communities and discovered their recently used termite-fishing spots. Turning her back on the mounds, she inspected the surrounding trees. She found [highly distinctive scars](https://www.newscientist.com/article/mg26435164-200-before-the-stone-age-were-the-first-tools-made-from-plants-not-rocks/) <https://www.newscientist.com/article/mg26435164-200-before-the-stone-age-were-the-first-tools-made-from-plants-not-rocks/>

<https://onlinelibrary.wiley.com/doi/10.1002/ajp.22921>, with the outer bark of thin branches having a 60 to 80-centimetre-long and 0.5-centimetre-wide strip peeled off, as well as incisor bite marks from where the chimp used its teeth to remove the strip for use as a probe.

These bark scars were still identifiable after three years, showing the lasting nature of these signatures. That is critical because it might take some time before the living tree becomes part of the archaeological record. [Katarina Almeida-Warren](#)  <https://www.isca.ox.ac.uk/people/katarina-almeida-warren>, who collaborates with Pascual-Garrido at the University of Oxford, says that tracking how these scars change over time is key to being able to find any preserved archaeological traces. This involves following how the colour of the scars transforms as the bark heals and watching how the tree then regenerates itself.

Pascual-Garrido has spent the past two years back with the Tanzanian chimps and says her early findings are showing that the apes “leave characteristic traces in the environment that can be identified for much longer than we currently think”. This gets us one step closer to being able to identify botanical evidence of termite-fishing in the early human record.

Meanwhile, another group of researchers is hunting for a different type of plant tech: pounding tools. Currently, the [earliest hominin stone tools](#)  <https://www.nature.com/articles/nature14464> are a selection of chunky, 3.3-million-year-old stones called cores, used for pounding open hard resources, perhaps nuts or bones. Modern-day chimpanzees in Taï National Park, Ivory Coast, use these kinds of bulky stones to crack nuts, but, crucially, they also use wooden hammers, [selecting which medium to use](#)  <https://linkinghub.elsevier.com/retrieve/pii/S0003347214004412> according to the nuts' properties. [Lydia Luncz](#)  <https://www.eva.mpg.de/technological-primates/staff/lydia-luncz/> at the Max Planck Institute for Evolutionary Anthropology in Germany thinks it is reasonable to speculate that early hominins would have also used wooden hammers and is leading a project that is searching for these early wooden pounding tools. “Most people doubt that they can be found in the archaeological record, ” says Luncz. “We’re a small crowd who believe they can.”



Stone Age network reveals ancient Paris was an artisanal trading hub

Ancient stone goods found across France may have been made by skilled craftspeople in what is now Paris, who traded along vast networks

[/article/2453552-stone-age-network-reveals-ancient-paris-was-an-artisanal-trading-hub/](#)

By looking at chimps' discarded wooden hammers, Luncz and her team found that this repeated percussive activity leaves [distinctive traces](#)

<https://linkinghub.elsevier.com/retrieve/pii/S2589004222015875>. The grain on the surface becomes much less horizontal at the points of impact and the wood forms obvious pits. Critically, they discovered there is also irreversible damage to the internal cell wall structures, which become compressed in a highly diagnostic way. Internal cellular anatomy is [preserved in fossil wood](#)

https://link.springer.com/chapter/10.1007/978-90-481-9956-3_10, so these findings could help us spot evidence of pounding in the ancient human record. That is what Luncz and her colleagues are working on now.

Although rare, [hundreds of pieces of fossilised wood](#)

<https://linkinghub.elsevier.com/retrieve/pii/S0047248417303433> that are over a million years old have been found at African hominin sites. Luncz's team is looking at pieces of fossil wood from [Koobi Fora](#) <https://museums.or.ke/koobi-fora/> in

northern Kenya, a site known as “the cradle of mankind”, where many hominin species lived from around [4 million years ago](#) 

<https://www.nature.com/articles/376565a0>. She says she is hopeful that by applying the results of the chimp research to these remains, she and her team will be able to identify pounding in the archaeological record.

All of these efforts mean there has been steady, if gradual, progress in revealing humanity’s possible pre-Stone Age botanical period. From this, we may one day learn that species we had previously assumed weren’t tool users, because their fossil remains hadn’t been found with any stone tools, were actually tech savvy.

Hunting for traces of humanity’s earliest botanical possessions is certainly far more challenging than unearthing stone artefacts, but it has the potential to shine a completely new light on the lives of our ancient ancestors. “It will open up some really interesting questions,” says Almeida-Warren.