

Reporting Summary

Nature Research wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Research policies, see our [Editorial Policies](#) and the [Editorial Policy Checklist](#).

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a Confirmed

- ☒ ☐ The exact sample size (n) for each experimental group/condition, given as a discrete number and unit of measurement
- ☒ ☐ A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
- ☒ ☐ The statistical test(s) used AND whether they are one- or two-sided
Only common tests should be described solely by name; describe more complex techniques in the Methods section.
- ☒ ☐ A description of all covariates tested
- ☒ ☐ A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
- ☒ ☐ A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
- ☒ ☐ For null hypothesis testing, the test statistic (e.g. F , t , r) with confidence intervals, effect sizes, degrees of freedom and P value noted
Give P values as exact values whenever suitable.
- ☒ ☐ For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
- ☒ ☐ For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
- ☒ ☐ Estimates of effect sizes (e.g. Cohen's d , Pearson's r), indicating how they were calculated

Our web collection on [statistics for biologists](#) contains articles on many of the points above.

Software and code

Policy information about [availability of computer code](#)

Data collection

In this study the data set is so small, under 1,000 items, that such computer code is not necessary.

Data analysis

The size of this data set is small and it is not possible even to apply normal statistical analyses so no software was used in this aspect of the study. However, as these samples come from the ash layers of hearths, extensive experimental work on ash loss from hearths indicates that at least 95% of the ash would have been lost before being covered with sediment (in this case aeolian sand). Density analysis might have been useful if we had excavated the entire hearth, however, at this state we did not know it was even possible to obtain such samples from this time depth.

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Research [guidelines for submitting code & software](#) for further information.

Data

Policy information about [availability of data](#)

All manuscripts must include a [data availability statement](#). This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A list of figures that have associated raw data
- A description of any restrictions on data availability

The samples analysed for this study are curated and stored at the McDonald Institute for Archaeological Research, University of Cambridge, UK. No gold was used during the SEM analysis so all samples are available for full analysis. The digital images of all the samples are available for view from the corresponding author. The digital images will be made available online by the University of Cambridge by the end of 2020.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☐ Life sciences ☐ Behavioural & social sciences ☒ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see nature.com/documents/nr-reporting-summary-flat.pdf

Ecological, evolutionary & environmental sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description

This study was based on the hypothesis that human genetics show that the adaption to a starch diet, by duplication of our starch digesting genes, happened at the beginning of the evolution of Homo sapiens; if this is so, then there should be archaeobotanical evidence of human consumption of starchy plants in early human occupation sites. The fieldwork for this study, therefore, was conducted at two well-renowned early human occupation sites on the Cape coast of South Africa: Blombos Cave, a site early art, beads, and many human artefacts that define what it is to be human have been unearthed; and Klasies River, a large cave site with early human remains and a 55 ky sequence of human occupancy. This study offers unique findings of plant food processing and food mixing of different plants from analysis of the botanical samples from Blombos Cave. This evidence at 85-81 ky old is 70,000 years earlier than our current oldest evidence of plant food mixing. This paper also discusses the implications for defining human behaviour.

Research sample

The botanical samples came from block samples cut through combustion features (or probable hearths) identified both during archaeological excavation and in section (i.e. the face of an already excavated trench). The samples were cut from combustion features to ensure the best opportunity to identify cooked food remains. The location and collection of samples is described and illustrated in detail in the Supplementary Information. During the fieldwork, modern reference samples were collected with a licensed botanist and a modern reference collection was created.

Sampling strategy

The sampling strategy was a new method created for the specific preservation conditions encountered at Blombos Cave. The most frequently used methods are either dry sieving or floating charred material in water. Such methods were not possible at Blombos Cave because of both the permanent moistness of the sediment and the phosphatisation of the charred samples. Experiments described and photographed in the Supplementary Information prove that all such botanical information is lost through the common flotation method. Small block samples were taken through possible hearths in order to find charred fragments of starchy roots and tubers in laboratory conditions. This strategy worked extremely well. Samples were taken away from the hearths for comparison. At Blombos, in the later levels defined as the "Still Bay levels" two of the combustion events turned out to be humified plant layers and not hearths at all. This sampling strategy was later refined by working with micromorphologists to identify hearths before sampling. The latter is also described in the Supplementary Information.

Data collection

These data were created in the laboratory by initial micro-excavation of the blocks of sediment under a stereo-microscope and then analysed using a scanning electron microscope (SEM). The analyses identified starchy plant tissue called parenchyma. This tissue is common to most plants but is abundant in underground storage organs such as roots, tubers, rhizomes, bulbs etc. The Cape coast of South Africa is particularly rich in the kind of plant that propagates through underground storage organs. Data was collected on a spread sheet that formed part of the first author's Lab Book, a necessary part of her PhD. The categories identified whether the starchy tissue belonged to a tuber, rhizome etc, whether it was unidentifiable, poorly preserved, attacked by fungi, or if it was deformed in some other way. The fragments identified in the paper were initially labelled in this latter category until further research could be conducted. The identifications were subsequently made by comparison with published experimental material and comparison with other, but much later date, archaeobotanical samples of mixed plant foods. The samples themselves are curated on the SEM stubs in special SEM boxes, with detailed labels. The digital images of the these data, along with those from the modern reference collection, will be made available publicly at the end of 2020.

Timing and spatial scale

The original samples were collected in 2014, the year before Larbey's PhD commenced (but was funded). The main analysis was made in 2017-2018. During the PhD, she focussed on the samples from Klasies River first because of the new method using micromorphology through hearths alongside the block botanical samples to ensure the context before sampling. This proved very effective. So the Blombos Cave samples were analysed last. This proved to be fortuitous because having analysed so many samples beforehand, Larbey was able to identify the deformed cell structures of pounded cells very quickly. However, the process of passing PhD, Viva etc got in the way of publishing.

Data exclusions

There are no data exclusions

Reproducibility

These data were preserved through the research process; no gold was used during the scanning electron microscope analysis leaving the parenchyma fragments and non-parenchyma fragments available for future analysis. So these results are reproducible, from that part of the research process. The new method created should allow all future archaeobotanists to reproduce these kind of results from poorly preserved deep time archaeological contexts.

Randomization

This was not a clinical trial but if this concept was to be transferred to this archaeological study, samples were taken away from the targeted areas and the cave to provide comparison from the ambient sediments. But no statistical analysis was used.

Blinding

No statistical or clinical analysis was used in this study.

Did the study involve field work? ☒ Yes ☐ No

Field work, collection and transport

Field conditions	The samples were collected in late November/early December 2014, which is Spring on the Cape coast of South Africa. This period followed the rainy season but were sunny conditions with a temperature around 22-25 degrees centigrade. The samples were collected in optimum conditions within the cave and dried out of the sun within the house.
Location	The sampling and the flotation experiment all took place at Blombos Cave at 34°24'51''S, 21°13'19''E at 34.5 meters above sea level and circa 100 meters from the present day shoreline. The laboratory work was conducted in the GPR Laboratory, McDonald Institute for Archaeological Research, University of Cambridge, UK
Access & import/export	All samples were classified as sediment samples, including dried modern reference samples. These were exported under the project licence acquired annually under the National Heritage Resources Act 25 1999 held by the Project Investigator (Professor Christopher Stuart Henshilwood). They were imported into the UK under the Department of Archaeology's DEFRA Licence (DEFRA Directive 2008/61/EC) held by Professor Charles French. Any plants were collected by botanist Dr Yvette van Wijk under her compound voucher YvWijk6382. These were set up before Larbey left the UK.
Disturbance	This study did not create any disturbance. Blombos Cave is located in the Blombos Private Nature Reserve, 300 km east of Cape Town. The accommodation is in the house of Prof. Henshilwood not far from the site (the land belonged to his family previously and was donated to the nation). The area is almost deserted with almost zero carbon footprint created by our presence.

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
<input checked="" type="checkbox"/>	<input type="checkbox"/> Antibodies
<input checked="" type="checkbox"/>	<input type="checkbox"/> Eukaryotic cell lines
<input type="checkbox"/>	<input checked="" type="checkbox"/> Palaeontology and archaeology
<input checked="" type="checkbox"/>	<input type="checkbox"/> Animals and other organisms
<input checked="" type="checkbox"/>	<input type="checkbox"/> Human research participants
<input checked="" type="checkbox"/>	<input type="checkbox"/> Clinical data
<input checked="" type="checkbox"/>	<input type="checkbox"/> Dual use research of concern

Methods

n/a	Involved in the study
<input checked="" type="checkbox"/>	<input type="checkbox"/> ChIP-seq
<input checked="" type="checkbox"/>	<input type="checkbox"/> Flow cytometry
<input checked="" type="checkbox"/>	<input type="checkbox"/> MRI-based neuroimaging

Palaeontology and Archaeology

Specimen provenance	The paper and Supplementary Information contain extensive photographs and description of specimen provenance. The specimens are microscopic fragments of charred starchy plant tissue called parenchyma. The samples were taken from levels that have been recently re-dated. The licenses used to both excavate and remove samples are those described above, ie All samples were sediment samples, including dried modern reference samples. These were exported under the project licence acquired annually under the National Heritage Resources Act 25 1999 held by the Project Investigator (Professor Christopher Stuart Henshilwood) 2014. They were imported into the UK under the Department of Archaeology's DEFRA Licence (DEFRA Directive 2008/61/EC) held by Professor Charles French. Any plants were collected by botanist Dr Yvette van Wijk under her compound voucher YvWijk6382. These were set up before Larbey left the UK.
Specimen deposition	The specimens have been curated and stored at the McDonald Institute for Archaeological Research, University of Cambridge, UK. However, the digital imagery of all the specimens discussed (and even those not discussed) are available from the lead author.
Dating methods	New dates were not collected as part of this study because a comprehensive study was published in August 2019. The dating study used the optically stimulated luminescence (OSL) dating method and correlated the offshore elements that were part of Blombos Cave, the aeolian sediments and the dates of the stratigraphy (Jacobs et al., 2020). It concluded that the human occupations of Blombos were between 100,000 to 70,000 years ago.
<input checked="" type="checkbox"/>	Tick this box to confirm that the raw and calibrated dates are available in the paper or in Supplementary Information.
Ethics oversight	No ethical approval or guidance was necessary.

Note that full information on the approval of the study protocol must also be provided in the manuscript.