

Reporting Summary

Nature Portfolio 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 Portfolio 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
<i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i> |
| ☒ | ☐ | 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
<i>Give P values as exact values whenever suitable.</i> |
| ☒ | ☐ | 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

Data analysis

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 Portfolio [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 description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our [policy](#)

All data are publicly accessible in the Supplementary Table S1 (and online at <https://tinyurl.com/LediGeraru40Ar39Ar>) and Supplementary Data S1 (and online at <https://tinyurl.com/LediGeraru>).

Research involving human participants, their data, or biological material

Policy information about studies with [human participants or human data](#). See also policy information about [sex, gender \(identity/presentation\), and sexual orientation](#) and [race, ethnicity and racism](#).

Reporting on sex and gender	N/A
Reporting on race, ethnicity, or other socially relevant groupings	N/A
Population characteristics	N/A
Recruitment	N/A
Ethics oversight	N/A

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

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](https://www.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	We describe and taxonomically allocate newly-discovered hominin dental specimens from the Ledi Geraru Research Area, in the Afar Regional State, Ethiopia. Their geological context and bracketing dates are also given.
Research sample	A collection of undescribed early fossil hominin dental remains.
Sampling strategy	Fossils - we compared the teeth to available published early hominin fossils from East and South Africa, bracketing the temporal window of our fossils by roughly 1 million years.
Data collection	The measurements on the fossil subjects of the current study were made and recorded by the authors. Comparative fossil data not collected by the authors comes from published measurements. Geological data collection was made by the authors.
Timing and spatial scale	N/A
Data exclusions	No data were excluded
Reproducibility	N/A
Randomization	Randomization was used in two instances to compare variation in potential fossil single-species groupings with known single-species samples (chimpanzee and gorilla). We used bootstrapping of the comparative ape samples. Rankings of the study data with the bootstrapped distribution were reported directly.
Blinding	N/A

Did the study involve field work? ☒ Yes ☐ No

Field work, collection and transport

Field conditions	None relevant - no field conditions affected data collection or analysis.
Location	Ledi-Geraru Research Area, Afar Region, Ethiopia
Access & import/export	Collections were made under permit from the Ethiopian Heritage Authority (formerly the Authority for Research and Conservation of Cultural Heritage) and through collaboration with the Afar National Regional State Tourism Bureau. Fossils are retained in the National Museum of Ethiopia. All geological samples were imported to the US for analysis under Ethiopian export permits, with the assistance of the National Museum of Ethiopia.
Disturbance	N/A

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
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☐	☒ Palaeontology and archaeology
☒	☐ Animals and other organisms
☒	☐ Clinical data
☒	☐ Dual use research of concern
☒	☐ Plants

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging

Palaeontology and Archaeology

Specimen provenance	Fossils were discovered in the exposures of the Ledi-Geraru Research Area by members of the research team. Permits were issued by the Ethiopian Heritage Authority (formerly the Authority for Research and Conservation of Cultural Heritage) for fossil collection as well as geology sample export.
Specimen deposition	All fossils are kept in the National Museum of Ethiopia, to be shared with other researchers in compliance with museum policies.
Dating methods	New dates published here are documented in the supplemental information.
☒ Tick this box to confirm that the raw and calibrated dates are available in the paper or in Supplementary Information.	
Ethics oversight	Permits were issued by the Ethiopian Heritage Authority (formerly the Authority for Research and Conservation of Cultural Heritage) for fossil collection as well as geology sample export. A representative was also provided by the Afar National Regional State Tourism Bureau.

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

Plants

Seed stocks	N/A
Novel plant genotypes	N/A
Authentication	N/A