nature research

Corresponding author(s):	Helen Fewlass
Last updated by author(s):	Jan 30, 2020

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 Authors & Referees 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	No software was used in data collection.
Data analysis	BATS 4.0, OxCal 4.3.

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/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

All data is available in the manuscript and supplementary materials.

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	New AMS radiocarbon dates from 95 newly excavated human and animal bones provide a full site chronology for Bacho Kiro Cave, spanning the Middle to Upper Palaeolithic transition.
Research sample	Collagen was extracted from archaeological bones from all stratigraphic levels of Bacho Kiro Cave.
Sampling strategy	147 bones+teeth from Bacho Kiro Cave were selected for collagen extraction from across all layers of the stratigraphy with a focus on the IUP layer in the Niche 1 area (Layer N1-I) where it was most extensively exposed. Bones were selected based on their size, level of preservation (physical appearance) and the presence of anthropological modifications (sampling was carried out in collaboration with zoo-archaeologists on-site). All bone+teeth samples were pretreated to extract and purify collagen. 95 collagen extracts were selected for AMS dating based on their level of preservation and quality (collagen weight yield, elemental data (C%, N%, C:N), FTIR analysis) and stratigraphic origin. Samples were chosen from across the archaeological layers with preference for samples with signs of anthropological modifications (which are taken to represent human presence in the cave). Radiocarbon dates were included in the Bayesian model based on outlier analysis.
Data collection	H. Fewlass collected the fauna samples in Dryanovo, Bulgaria, during the 2016 and 2017 archaeological excavation (May/June) and study (October) seasons and the human bones were sampled in the lab at the MPI-EVA in 2017.
Timing and spatial scale	Bones were excavated from the Niche 1 and Main Sector areas of Bacho Kiro Cave during the 2015/2016/2017 field seasons. Samples were collected during the 2016 and 2017 field/study seasons. Bone pretreatment and AMS dating of all samples was carried out over the course of 2016-2018. The year of excavation, year of pretreatment and sample provenience is given for all samples in Supplementary Table 2 and supplementary figures.
Data exclusions	Radiocarbon dates from some samples were excluded from the Bayesian modelling: 9 samples were outside modeling range (>51,000 BP); 4 from the upper N1-3 layers as they could not be linked to the stratigraphy in the Main Sector; 10 from the Layer I/J contact zone as they could not confidently be assigned to one phase; 3 from Layer N1-I which failed the $\chi2$ test when AMS dates from two labs were combined; 1 which was identified post-excavation as originating from next to the 1970s backfill and therefore may not have been in its original context; and 1 which was taken from the 1970s collection (humna bone BK-1653). Outlier analysis was performed for the rest of the dataset (n=67) so that outliers (n=14) could be manually eliminated. Full details are given in the SI.
Reproducibility	Two AMS dating methods across three AMS labs were used to check reproducibility. 11 collagen extracts from different layers were dated with graphite targets on a MICADAS AMS at two labs (ETH-Zurich and MAMS). Results were in statistical agreement for 8 of the extracts. Dates from the two labs were outside 2 sigma for 3 of the oldest extracts (all >40,000 BP). These samples were excluded from further analysis. Collagen from two human bones was dated with graphite targets at ETH-Zurich and in replicate with the gas ion source of the Aix-MICADAS AMS at CEREGE. All measurements were in statistical agreement.
Randomization	N/A
Blinding	N/A

Did the study involve field work? ☒ Yes ☐ No

Field work, collection and transport

Field conditions	Excavations inside the cave in Bulgaria were carried out during May/June in 2015/2016/2017.
Location	All bones in the study were excavated from the Niche 1 and Main Sector areas in the entrance of Bacho Kiro Cave (42° 56′ 48″ N, 25° 25′ 49″ E), near Dryanovo, Bulgaria.
Access and import/export	Most of the sampling was performed in Dryanovo, Bulgaria. Temporary exports of some items were organized between Bulgaria and Germany. Permit delivered by National Museum of Natural History (Sofia) Nr. 4CH30/04.01.19.
Disturbance	The samples were obtained through archaeological excavation of two sections in the cave.

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
☒	☐ Animals and other organisms
☒	☐ Human research participants
☒	☐ Clinical data

Methods

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

Palaeontology

Specimen provenance

All bones were excavated from Bacho Kiro Cave, Bulgaria, through a joint project of the National Archaeological Institute with Museum (NAIM-BAS, Sofia, Bulgaria) and the Department of Human Evolution at Max Planck Institute for Evolutionary Anthropology (MPI-EVA, Leipzig, Germany). Permission to excavate was authorized by the Ministry of Culture, Sofia (permit numbers: 124/11.05.2015; 225/28.04.2016; 47/02.05.2017; 99/17.04.2018).

Specimen deposition

The palaeontological collection will be deposited at the National Museum of Natural History in Sofia.

Dating methods

All samples were collected, pretreated and measured as part of this study. Collagen extraction and purification (including ultrafiltration) was carried out at the MPI-EVA, Leipzig using published protocols. The suitability of collagen extracts for measurement was assessed based on coll % yield, elemental data (C%, N%, C:N) and FTIR analysis. Quality criteria for all samples is included in the supplementary information. Samples were graphitised and measured with a MICADAS AMS at ETH-ZURICH and MAMS. Collagen samples were combusted and measured with the gas ion source of the Aix-MICADAS at CEREGE. Dates were calibrated and modeled using OxCal 4.3 using the IntCal13 dataset.

☒ Tick this box to confirm that the raw and calibrated dates are available in the paper or in Supplementary Information.