

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 (<i>n</i>) 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. <i>F</i> , <i>t</i> , <i>r</i>) with confidence intervals, effect sizes, degrees of freedom and <i>P</i> 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 <i>d</i> , Pearson's <i>r</i>), 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	Avizo 7.1 (VSG), 9.2 (FEI/Thermo-Fisher Scientific), and Avizo Lite 2019 (ThermoScientific)
Data analysis	MrBayes 3.2.7a; PAUP* 4.0a.168; Avizo 7.1 (VSG), 9.2 (FEI/Thermo-Fisher Scientific), and Avizo Lite 2019 (ThermoScientific); CloudCompare 2.13.alpha; Blender 3.3.1

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](#)

AMNH FARB 30899 is cataloged into the Fossil Amphibians, Reptiles, and Birds collections at the American Museum of Natural History, New York, New York, USA. Details regarding the generation of digital files and their derivatives in this study are included in Supplementary Information and archived on MorphoSource.

Morphological character matrices, output files from phylogenetic analyses, coordinates corresponding to aligned scan data and derivative polygons, a 3D PDF of aligned scan data and derivative polygons, and surface files of retro-deformed skeletal elements are available on Dryad (<https://doi.org/10.5061/dryad.n02v6wx3k>).

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	Not applicable.
Reporting on race, ethnicity, or other socially relevant groupings	Not applicable.
Population characteristics	Not applicable.
Recruitment	Not applicable.
Ethics oversight	Not applicable.

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	Descriptive/comparative study of a new fossil skull from the bird <i>Vegavis iaai</i> from the Late Cretaceous of Antarctica.
Research sample	AMNH FARB 30899, a nearly complete bird skull preserved in two parts of a concretion collected in 2011 from Vega Island, Antarctica, and deposited in the American Museum of Natural History.
Sampling strategy	Anatomical data were collected from direct observation, light microscopy, and micro-computed tomography.
Data collection	The two parts comprising the concretion containing AMNH FARB 30899 was collected by E. Roberts by hand on 1 March 2011 during an expedition that took place 10 February-19 March 2011. Mechanical preparation was done by D. Pickering (Carnegie Museum of Natural History). The specimen was micro-CT scanned at University of Texas at Austin and Ohio University. Initial processing of micro-CT scan data was done by E. Gorscak and S. Aftabizadeh (Ohio University [OU]); final processing of micro-CT scan data and processing of digital derivatives (i.e., mesh files of skeletal elements) were done by J. Groenke and C. Torres. Interpretation and comparison of anatomy were done by C. Torres, P. O'Connor, J. Clarke, M. Lamanna, and G. Musser. Phylogenetic analysis were done by C. Torres.
Timing and spatial scale	The specimen was collected in 2011. Mechanical preparation was done in 2013-2016. The specimen was micro-CT scanned in 2014, 2018, 2020, and 2021. Digital preparation was done primarily in 2018-2021. Post-processing of digital derivatives (i.e., mesh files of skeletal elements) was done in 2021-2023.
Data exclusions	No data were excluded.
Reproducibility	All derivative data (i.e., CT scan data, derivative models, morphological character scorings) and the code required to reproduce phylogenetic analyses are available online on MorphoSource and Dryad (https://doi.org/10.5061/dryad.n02v6wx3k).
Randomization	Not applicable.
Blinding	Not applicable.
Did the study involve field work?	☒ Yes ☐ No

Field work, collection and transport

Field conditions	Fieldwork was conducted 10 February-19 March 2011 in the James Ross Basin, Antarctica.
Location	The concretion containing AMNH FARB 30899 was collected from the lowermost three meters of first Sandwich Bluff Member of the Lopez de Bertodano Formation on Sandwich Bluff, Vega Island, Antarctica.
Access & import/export	Specimen collection and export were conducted under the oversight of the United States Antarctic Program in accordance with provisions under the Antarctic Treaty System.
Disturbance	The concretion containing AMNH FARB 30899 was collected from the surface, and so collection involved minimal disturbance to the environment.

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	The concretion containing AMNH FARB 30899 was collected from the lowermost three meters of first Sandwich Bluff Member of the Lopez de Bertodano Formation on Sandwich Bluff, Vega Island, Antarctica. Fieldwork was funded by the National Science Foundation grant EAR ANT-0636639 to RDE MacPhee. Logistical support in the field and in specimen transport was provided by the United States Antarctic Program. Fieldwork and specimen collection were conducted in accordance with provisions under the Antarctic Treaty System.
Specimen deposition	AMNH FARB 30899 is resposited in the American Museum of Natural History.
Dating methods	No new dates were obtained for this contribution; age constraints were taken from Roberts et al. 2022.
☐ Tick this box to confirm that the raw and calibrated dates are available in the paper or in Supplementary Information.	
Ethics oversight	Fieldwork and specimen collection were conducted under the oversight of the United States Antarctic Program in accordance with provisions under the Antarctic Treaty System.

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

Plants

Seed stocks	Not applicable.
Novel plant genotypes	Not applicable.
Authentication	Not applicable.