

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
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	Photographs of IVPP V31985 under normal light were taken using a Nikon D850 Camera. Laser stimulated fluorescence photographing were taken using a 500 milliwatt 450 nanometer blue laser (MDL-III-450-1W, Changchun New Industries Optoelectronics Tech. co., Ltd), with a LP-500-62 light yellow longpass filter and a Nikon D850.
Data analysis	Maximum parsimony analyses were performed using the TNT software package (v.1.5). Bayesian tip-dating analysis was conducted using MrBayes (V. 3.2.8). Phylogenetic comparative analyses were conducted using the R v 4.0.3. The following R packages are used in this study: paleotree (v. 3.4.4), phytools (v. 1.0-3), smatr (v. 3.4-8), lmodel2 (v.1.7-3). zircon U-Pb samples were dated using the laser ablation (LA)-ICP-MS method, using a ThermoX2 ICP-MS connected to a GeoLas Pro 193 nm laser ablation system. The U-Pb isotope ratios and contents were calculated using the software ICPMSDATAAL (v. 10.0). Isoplot (v.3.0) was used to plot the concordia diagram and to calculate the weighted mean U-Pb age.

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](#)

The R code and raw data used in morphometric analyses are available at figshare (<https://doi.org/10.6084/m9.figshare.22548385>). The specimen (IVPP V31985) described in this study is archived and available on request from the Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, Beijing, China. Measurements and phylogenetic data matrix that support the findings of this research are included as Supplementary Information.

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

Reporting on race, ethnicity, or other socially relevant groupings

Population characteristics

Recruitment

Ethics oversight

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

Research sample

Sampling strategy

Data collection

Timing and spatial scale

Data exclusions

Reproducibility

Randomization

Blinding

Did the study involve field work? ☒ Yes ☐ No

Field work, collection and transport

Field conditions	The IVPP V31985-bearing horizon belongs to the Upper Jurassic Nanyuan Formation.
Location	The holotype of <i>Fujianvenator rapidus</i> (IVPP V31985) was discovered in Daxi Basin near Yangyuan Village, Zhenghe Country, Nanping City, Fujian Province, Southeast China.
Access & import/export	The specimen (IVPP V31985) described in this study is archived and available on request from the Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, Beijing, China.
Disturbance	not applicable

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 holotype of <i>Fujianvenator rapidus</i> (IVPP V31985) was discovered in Daxi Basin near Yangyuan Village, Zhenghe Country, Nanping City, Fujian Province, Southeast China.
Specimen deposition	The specimen (IVPP V31985) described in this study is archived and available on request from the Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, Beijing, China.
Dating methods	zircon U-Pb dating experiments were conducted, which constrained the IVPP V31985-bearing horizons to 150.2±1.1 Ma--149.9±1.1 Ma, and the Zhenghe Fauna to 150±1.8 Ma--148±1.1 Ma.
☒ Tick this box to confirm that the raw and calibrated dates are available in the paper or in Supplementary Information.	
Ethics oversight	The holotype of <i>Fujianvenator rapidus</i> (IVPP V31985) was discovered in Daxi Basin near Yangyuan Village, Zhenghe Country, Nanping City, Fujian Province, Southeast China, by the joint expedition of the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP) and the Fujian Institute of Geological Survey (FIGS) from 14 October to 14 November 2022.

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