

Reporting Summary

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Please do not complete any field with "not applicable" or n/a. Refer to the help text for what text to use if an item is not relevant to your study.

For final submission: please carefully check your responses for accuracy; you will not be able to make changes later.

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	Figures were produced using Adobe Photoshop 24.3.0 (https://www.adobe.com/ar/products/photoshop.html) and Adobe Illustrator 27.4.1 (https://www.adobe.com/ar/products/illustrator.html)
Data analysis	The phylogenetic analysis was performed using the phylogenetic software PAUP*4.0a (Swofford, 2003) and the data matrix was compiled in Mesquite (version 3.04).

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](#)

n/a

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

Description of new taxon of a stem tetrapod from the early Permian, represented by several large specimens including a semi-articulated skeleton; a new phylogenetic analysis was performed to infer its relationships.

Research sample

Specimens studied are listed in the manuscript (a single holotype specimen, two paratype specimens, and one referred specimen) and represent the currently-known collection of material attributable to this species. All housed in the GNF (Geological Survey of Namibia, National Earth Science Museum).

Sampling strategy

Sample size is limited to the specimens collected in this study.

Data collection

Description of the collecting specimens in the field, and taphonomic and sedimentological data are provided in the Supplementary Information under section 2. Geological setting and taphonomic data.

Timing and spatial scale

Specimens were collected during 2014, 2015, 2019 field seasons. Information on the collecting area and bearing levels are provided in the Supplementary Information under section 2. Geological setting and taphonomic data.

Data exclusions

No data were excluded.

Reproducibility

All data are contained within the manuscript and Supplementary Information file. All parameters for phylogenetic analysis are reported in the Methodology and Supplementary Information under section 3. Character list and phylogenetic datasets.

Randomization

Randomization was not relevant for the study conducted herein.

Blinding

Blinding was not relevant to the anatomical study of the fossils specimens and the phylogenetic analysis performed.

Did the study involve field work?

☒ Yes

☐ No

Field work, collection and transport

Field conditions

The field work was done during the southern hemisphere winter season (June-August) in the Huab region of northwestern Namibia, a hyper-arid desert with < 500mm rainfall per year.

Location

Detailed information of the collecting area (map, coordinates) and bearing levels (section) is provided in the Supplementary Information under section 2. Geological setting and taphonomic data.

Access & import/export

Geological field work, fossil collecting, and exporting permits to Iziko Museums Cape Town for fossil preparation were done with the

Access & import/export

corresponding permits issued by the Geological Survey of Namibia and the National Heritage Council of Namibia (permits #02/2014 issue 07-08-2014, #09/2015 issue 07-10-2015, and #01/19 issue 05-13-2019)

Disturbance

Disturbance was limited to small excavations typical of field palaeontology research. All sites were cleaned and reclaimed following excavation.

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

Geological field work, fossil collecting, and exporting permits to Iziko Museums Cape Town for fossil preparation were done with the corresponding permits issued by the Geological Survey of Namibia and the National Heritage Council of Namibia (permits #02/2014 issue 07-08-2014, #09/2015 issue 07-10-2015, and #01/19 issue 05-13-2019).

Specimen deposition

The holotype, paratypes and referred specimens of *Gaiaasia jennyae* are catalogued and available for study to qualified researchers at GSN (Geological Survey of Namibia, National Earth Science Museum).

Dating methods

No new dates were provided.

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

Ethics oversight

No ethics oversight was required for this study as it pertains to paleontological and geological research that does not involve human or archaeological remains or living organisms.

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