Vertebrata PalAsiatica

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Abstract

Advances in X-ray computed tomography (CT) and three-dimensional (3D) reconstruction technologies have revolutionized zoological, paleontological, and evolutionary research by enabling non-destructive visualization and quantitative analysis of anatomical structures. Open-access repositories such as MorphoSource have highlighted the growing importance of digital morphology resources. However, access to high-quality, taxonomically comprehensive, and systematically curated 3D datasets remains uneven, particularly for fossil vertebrates and regionally significant biodiversity collections. Here we introduce the Archives of Digital Morphology (ADMorph), an open-access digital repository hosted by the Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences (IVPP). ADMorph currently archives more than 60000 3D models derived from over 10000 fossil specimens and 4200 extant vertebrate specimens, including approximately 3000 anatomically segmented datasets. ADMorph integrates a large and continuously expanding collection of CT-derived, segmented 3D datasets covering both fossil and extant vertebrates, and provides a centralized platform for their storage, visualization, dissemination, and long-term preservation. The repository archives both raw volumetric CT datasets and derived surface models in standardized formats, supported by structured metadata, searchable records, and interactive visualization tools. ADMorph hosts several specialized anatomically segmented collections, including early vertebrate fossil reconstructions, the digital shark atlas, vertebrate embryological series, and the Yangtze heritage collection of endangered freshwater taxa. The platform also supports community-driven data contributions and curated datasets spanning comparative anatomy, developmental biology, functional morphology, and evolutionary research. By facilitating access to high-quality 3D digital specimens, ADMorph supports a wide range of applications, including virtual paleontology, geometric morphometrics, biomechanical modeling, science education, and public outreach. Collectively, ADMorph improves the global accessibility of vertebrate morphological data, enhances research reproducibility and data sharing, and provides scalable infrastructure for large-scale comparative studies of extant and extinct biodiversity, thereby advancing research on vertebrate evolution across deep time.

Full Text

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ADMorph: an open-access 3D morphological database for the study of vertebrate evolution

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Abstract Advances in X-ray computed tomography (CT) and three-dimensional (3D) reconstruction technologies have revolutionized zoological, paleontological, and evolutionary research by enabling non-destructive visualization and quantitative analysis of anatomical structures. Open-access repositories such as MorphoSource have highlighted the growing importance of digital morphology resources. However, access to high-quality, taxonomically comprehensive, and systematically curated 3D datasets remains uneven, particularly for fossil vertebrates and regionally significant biodiversity collections. Here we introduce the Archives of Digital Morphology (ADMorph), an open-access digital repository hosted by the Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences (IVPP). ADMorph currently archives more than 60000 3D models derived from over 10000 fossil specimens and 4200 extant vertebrate specimens, including approximately 3000 anatomically segmented datasets. ADMorph integrates a large and continuously expanding collection of CT-derived, segmented 3D datasets covering both fossil and extant vertebrates, and provides a centralized platform for their storage, visualization, dissemination, and long-term preservation. The repository archives both raw volumetric CT datasets and derived surface models in standardized formats, supported by structured metadata, searchable records, and interactive visualization tools. ADMorph hosts several specialized anatomically segmented collections, including early vertebrate fossil reconstructions, the digital shark atlas, vertebrate embryological series, and the Yangtze heritage collection of endangered freshwater taxa. The platform also supports community-driven data contributions and curated datasets spanning comparative anatomy, developmental biology, functional morphology, and evolutionary research. By facilitating access to high-quality 3D digital specimens, ADMorph supports a wide range of applications, including virtual paleontology, geometric morphometrics, biomechanical modeling, science education, and public outreach. Collectively, ADMorph improves the global accessibility of vertebrate morphological data, enhances research reproducibility and data sharing, and provides scalable infrastructure for large-scale comparative studies of extant and extinct biodiversity, thereby advancing research on vertebrate evolution across deep time.

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1 Overview of ADMorph

Recent advances in open-access digital-morphology platforms, such as MorphoSource (Boyer et al., 2016; Blackburn et al., 2024), Phenome10K (Goswami, 2015) and Ozboneviz (Weisbecker et al., 2025), have substantially expanded the availability of three-dimensional (3D) data for evolutionary research (Bardua et al., 2020; Fabre et al., 2021; Almécija et al., 2024) and the thriving field of virtual paleontology (Cunningham et al., 2014; Sutton et al., 2016). These initiatives have demonstrated the value of large-scale, community-driven repositories for promoting open data sharing, reproducibility, and cross-institutional collaboration (Davies et al., 2017). However, existing databases remain comparatively limited in their coverage of vertebrate fossils and detailed annotated, anatomically segmented datasets. To address these gaps, we introduce the Archives of Digital Morphology (ADMorph), a comprehensive digital repository dedicated to preserving and disseminating morphological data from both extinct and extant vertebrates.

ADMorph serves as a project-based archive that enables users to browse, visualize, and download digital morphological resources while enabling contributors to publish, organize, and share their 3D datasets. By integrating fossil specimens, developmental embryological series, and comparative anatomical collections within a unified framework, ADMorph establishes an open-access and collaborative platform that enhances the discoverability, accessibility, and reuse of digital phenotypic data on a global scale.

1.1 Platform framework

The ADMorph platform is structured into six primary navigation modules: Home, Browse Data, Featured Datasets, Tools, Guideline, and About Us (Fig. 1). The Home page serves as the central portal of the repository, providing platform announcements, updates, featured news, and navigation guidance. The Browse Data interface enables users to explore collections through a hierarchical taxonomic framework encompassing non-vertebrate chordates, stem vertebrates, cyclostomes, jawed vertebrates, and major extant vertebrate clades. Additional filtering options allow users to search datasets by geological age, preservation type, geographic region, data format, and access status. The Featured Datasets

Fig. 1 Homepage of ADMorph at the time of writing (June 2026)

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module highlights curated thematic collections, including *Reconstructed Species in the International Union for Conservation of Nature (IUCN) Red List*, *Digital Shark Atlas*, *Jawless Vertebrate 3D Reconstruction*, *Yangtze*

Heritage Collection, 3D Embryos, Primate Skeletal Dataset and others. Additional specialized collections are continuously developed and incorporated into the platform. The Tools module provides access to freely downloadable visualization and analysis software integrated within the repository. These include Vayu (v1.0; Lu, 2023), a freeware application for surface-mesh visualization, annotation, and virtual reality (VR) presentation; and Drishti (v3.2; Limaye, 2012), an open-source, cross-platform volume-exploration suite for the visualization and analysis of complex tomographic and electron-microscopy datasets (Hu et al., 2024; Wang et al., 2024). The Guideline module offers operational support for users by providing detailed documentation on data policies, submission standards, user registration, dataset access, and procedures for contributing new datasets and media resources. Together, these modules provide a comprehensive framework for the discovery, visualization, sharing, and preservation of digital morphological data.

1.2 Online functionality and user workflow

ADMorph provides multiple pathways for accessing digital morphology resources, including keyword-based searches, taxonomic queries, project-level browsing, and exploration through thematic collections. Each dataset is accompanied by a standardized specimen

Fig. 1 Homepage of ADMorph at the time of writing (June 2026)

information panel and metadata record. The metadata framework is compatible with Darwin Core standards and incorporates mandatory fields, such as Specimen ID, Repository Institution, Higher Taxonomy, and Data Access Status. Each published dataset is assigned a unique persistent DOI that enables long-term tracking and linkage to associated digital resources. For fossil specimens, additional metadata include geological age, stratigraphic context, and geographic locality.

A key feature of the platform is its web-based 3D visualization system, which enables users to interactively examine digital specimens via standard web browsers. Without the need for specialized software, users can rotate, zoom, pan, and selectively display individual anatomical structures, allowing detailed exploration of reconstructed morphology. This functionality facilitates rapid inspection of digital specimens, improves data accessibility, and supports both research and educational applications.

Workflow for searching and downloading data from ADMorph. The figure shows: Step 1 Sign up for an account; Step 2 Select target specimen; Step 3 Submit download request; Step 4 Download after authorization.

Figure 2: Workflow for searching and downloading data from ADMorph. The figure shows: Step 1 Sign up for an account; Step 2 Select target specimen; Step 3 Submit download request; Step 4 Download after authorization.

The repository hosts two principal categories of digital assets: volumetric tomographic datasets and derived 3D surface models. ADMorph supports both standard web-based uploads and a dedicated Upload Center for large datasets. While routine submissions are limited to 500 MB per dataset, large CT volumes and high-resolution 3D models can be uploaded through the Upload Center, which accommodates files ranging from tens to hundreds of gigabytes. To balance open accessibility with data protection and contributor rights, ADMorph implements a tiered access framework comprising four levels: “Online Preview” , “Open Download” , “Request Download” , and “Restricted Access” . User registration and account creation are freely available. For datasets designated as “Request Download” , registered users are required to submit a standardized request form specifying their contact information, institutional affiliation, and a brief description of research purposes (Fig. 2). Requests are reviewed by repository administrators or data contributors based on verification of institutional affiliation and the alignment of the proposed use with non-commercial scientific or educational purposes. Upon approval, users are granted permission to access and download the requested datasets. Downloaded resources are distributed under the CC BY-NC 4.0 license by default, unless contributors specify alternative licensing terms. This framework promotes responsible data sharing while ensuring appropriate stewardship of sensitive, unpublished, or institutionally managed digital resources.

ADMorph also supports community-driven data sharing via a secure contributor workflow. Registered contributors may upload their raw CT datasets or processed 3D surface models along with comprehensive metadata. Contributors retain authorship and data ownership while controlling the accessibility level of their submissions.

Prior to publication, all datasets undergo a centralized quality control process, including verification of file integrity and format compatibility, assessment of reconstruction quality, and validation of specimen metadata. Following approval, datasets are incorporated into the public repository and become available for interactive visualization, discovery, and download. Each

published dataset is assigned standardized citation information to ensure proper attribution and facilitate data reuse.

Fig. 2 Workflow for searching and downloading data from ADMorph

Fig. 3 Generalized ADMorph workflow for data acquisition, processing, modeling, and dissemination

Figure 3: Fig. 3 Generalized ADMorph workflow for data acquisition, processing, modeling, and dissemination

2 Data acquisition and digital reconstruction workflow

Digital resources archived in ADMorph are generated through a standardized workflow that transforms physical specimens into high-fidelity digital datasets for visualization, analysis, and dissemination (Fig. 3). The workflow begins with specimen selection, preparation, and imaging. CT imaging was performed using a suite of industrial and micro-computed tomography systems at IVPP, including the 160 kV Micro-CL, 225 kV micro-CT, 450 kV industrial CT, GE v|tome|x m300&180, SNCT-800 Spectral micro-CT, and Xradia 515 Versa

platforms. Scanning parameters varied according to specimen size and preservation, with source voltages typically ranging from 80–450 kV and voxel resolutions from submicron to approximately 30 μm. Depending on their preservation state, soft-tissue specimens often require specialized preprocessing prior to CT imaging. Techniques such as diffusible iodine-based contrast-enhanced CT (dice-CT) and critical point drying (CPD) are deployed to enhance tissue contrast, enabling high-resolution visualization of unmineralized anatomical structures. Following established dice-CT methodologies (Gignac et al., 2016; Lesciotto et al., 2020), specimens are typically stained using I_2KI- or PTA-based solutions (commonly 1–5%), and processed through standard graded ethanol dehydration and liquid CO_2 critical-point drying protocols. Specific staining durations and processing parameters vary among projects and are documented within the metadata of individual datasets.

Fig. 3 Generalized ADMorph workflow for data acquisition, processing, modeling, and dissemination

Following data acquisition, anatomical structures are segmented using a combination of semi-automated and manual approaches in professional 3D segmentation software packages, including Materialise Mimics, Avizo, VG Studio MAX, as well as open-source suites like 3D Slicer. The segmented 3D models are subsequently refined, annotated, and color-coded using Vayu (Lu, 2023) or Blender (Blender Online Community, 2018) to facilitate visualization, interpretation, and scientific communication. For scattered and damaged fossil components, they are systematically aligned and digitally restored following established protocols for virtual specimens (Lautenschlager, 2016). Final digital models are archived in standardized STL or PLY formats, while volumetric CT datasets are preserved in DICOM or TIFF-stack formats when available, accompanied by structured metadata documenting specimen provenance, taxonomic information, imaging parameters, reconstruction methods, and associated publications. Following quality control and administrative review, verified datasets are de-

Fig. 4 Curated featured collections and special datasets of ADMorph

Figure 4: Fig. 4 Curated featured collections and special datasets of ADMorph

posited within the ADMorph repository, where they are made available via interactive web-based visualization and managed download services according to access policies.

3 Database content and special collections

To date, ADMorph archives more than 60000 3D models derived from over 10000 fossil specimens and 4200 extant vertebrate specimens. Among these, approximately 3000 key datasets have already undergone full or partial anatomical segmentation and annotation, providing high-resolution digital resources for comparative, developmental, and evolutionary research. The repository encompasses a broad taxonomic range, including fish, amphibians, reptiles, birds, and mammals. Most datasets were contributed by the IVPP, in collaboration with museums, universities, and research institutions in China and abroad. In addition to individual specimens, ADMorph integrates a series of curated thematic collections spanning both extant and extinct vertebrates (Fig. 4). These collections include CT-derived anatomical reconstructions, fossil-based 3D restorations, comparative anatomical collections, and

Fig. 4 Curated featured collections and special datasets of ADMorph
A. reconstructed species in the IUCN Red List sub-collection, presenting segmented 3D digital reconstructions of endangered species; B. the Digital Shark Atlas, showing anatomically segmented 3D shark models organized by taxonomic order (e.g., Carcharhiniformes and Squaliformes); C. the Primate Skeletal Dataset, highlighting taxonomically diverse, CT-derived skeletal models (e.g., *Cercocebus*, *Macaca*, and *Papio*) for comparative anatomical analysis and virtual dissection. Scale bars = 15 cm; A, B are not to scale.

embryological series. Together, they provide comprehensive phenotypic resources across a wide range of taxonomic groups, developmental stages, and evolutionary timescales. The following featured collections highlight the breadth of taxonomic coverage and scientific applications within ADMorph, illustrating the role of the platform as a centralized resource for vertebrate digital morphology. All specimens represented in these collections were obtained, curated, and digitized under the relevant institutional authorizations and applicable national regulations. For protected or threatened taxa, specimen acquisition and use complied with relevant wildlife protection legislation and permitting requirements.

3.1 The Digital Shark Atlas

The *Digital Shark Atlas* represents one of the most comprehensive openly accessible collections of anatomically segmented and annotated shark datasets

Fig. 5. Examples of research and outreach applications of CT scans and 3D models obtained from ADMorph

Figure 5: Fig. 5. Examples of research and outreach applications of CT scans and 3D models obtained from ADMorph

currently available (Yao et al., 2026a). This dataset is derived from published X-ray computed tomography (CT) data (Kamminga et al., 2017), providing systematically segmented and anatomically annotated 3D segmentation of skeletal elements, cranial musculature, and major visceral organ systems (Fig. 5A). The dataset currently includes 117 individuals representing 72 species, 25 families, and all nine extant shark orders, comprising 115 full-body reconstructions and 2 head-only models. By combining broad taxonomic coverage with detailed anatomical segmentation, the *Digital Shark Atlas* provides a valuable resource for future studies on sharks (López-Romero et al., 2023; Staggl et al., 2023).

3.2 The Jawless Vertebrate 3D Reconstruction

The *Jawless Vertebrate 3D Reconstruction* is a specialized 3D collection focused on galeaspids, a highly diverse group of jawless vertebrates that flourished in the Silurian and Devonian of South China (Zhu and Gai, 2007). Unlike most datasets in ADMorph, which are derived directly from CT-based segmentation, this collection consists primarily of 3D reconstructions of head shields generated from fossil specimens, published anatomical descriptions, and comparative morphological evidence (Fig. 5F).

The collection currently includes 98 taxa representing the major galeaspid lineages—Huananaspiformes, Polybranchiaspiformes, and Eugaleaspiformes—and provides one of the most comprehensive virtual references available for this important group of early vertebrates. By standardizing morphology across a broad phylogenetic spectrum, the collection enables direct comparisons among taxa and large-scale analyses of morphological variation and evolutionary patterns. In addition, the models will be optimized for quantitative analyses and engineering-based approaches (Yao et al., 2026b).

3.3 The Yangtze Heritage Collection

The *Yangtze Heritage Collection* documents representative vertebrates of the Yangtze River Basin through CT-based anatomical reconstructions. Developed in collaboration with

Institute of Hydrobiology, Chinese Academy of Sciences (IHB), the collection archives digital morphological data from endemic fishes and aquatic mammals of exceptional evolutionary, ecological, and conservation significance. CT imaging for many specimens was conducted using a uCT 760 scanner at the United Imaging Tongji Modern Medical Imaging Diagnostic Center, Wuhan, China.

Fig. 5 Examples of research and outreach applications of CT scans and 3D models obtained from ADMorph
A. phylogenetic framework illustrating the taxonomic coverage of the 3D anatomical shark dataset and a 3D skeletal model of *Squatina squatina* for comparative anatomical analysis (Yao et al., 2026a) Scale bar = 10 cm; B. computational fluid dynamics (CFD) simulation of hydrodynamic performance based on the fossil galeaspid *Sanchaspis megalorostrata* (Pan and Wang, 1981). Scale bar = 2 cm; C. virtual museum exhibition presenting high-resolution digital reconstructions of headshield morphology in endemic Chinese galeaspids; D–E. exhibitions integrating 3D reconstructions for public outreach; F. radiographic-style rendering of fish skeletal structures, serving as reference material for scientific illustration and digital animation; G. life-sized exhibition sculpture of the extinct arthrodire apex predator *Dunkleosteus*, produced from digital mesh-based reconstruction data; H. Digital-to-Physical Paleobiology Lab, developed by NICE (Nature, Intelligence, Cosmos & Evolution) Paleo-VisLab, IVPP, creates scientifically accurate skeletal specimens and biological models for exhibitions, research, and education; I. interactive exhibition utilizing immersive virtual reality (VR) for community outreach; J. 3D prints used in teaching vertebrate comparative anatomy.

A key feature of the collection is the inclusion of rare digital datasets for iconic and critically endangered taxa—including the extinct Chinese paddlefish (*Psephurus gladius*), the functionally extinct Yangtze River dolphin, or Baiji (*Lipotes vexillifer*; Wang et al., 2006; Zhang et al., 2020), and the endemic Chinese sucker (*Myxocyprinus asiaticus*). Many specimens have undergone detailed anatomical segmentation, providing high-resolution reconstructions of skeletal and cranial structures that are otherwise difficult to access for research and education. By preserving digital representations of these threatened and lost components of freshwater diversity, the *Yangtze Heritage Collection* helps to safeguard the anatomical record of one of the world' s most ecologically vulnerable freshwater ecosystems.

3.4 Other featured curated collections

In addition to its major fossil and extant vertebrate collections, ADMorph hosts several specialized collections that broaden its taxonomic, developmental, and conservation coverage (Fig. 4). The *Reconstructed Species in the IUCN Red List* sub-collection compiles anatomically segmented 3D models of threatened vertebrates categorized under the IUCN conservation framework, linking morphological data to biodiversity conservation and extinction-risk assessment. The *Primate Skeletal Dataset* contains high-resolution, CT-derived reconstructions of cranial and postcranial anatomy from a diverse range of non-human primates (e.g., *Cercocebus*, *Macaca*, and *Papio*). The collection is restricted to non-human taxa and provides valuable resources for comparative anatomy, functional morphology, and primatological research. The 3D Embryos collection comprises 3D developmental datasets representing major vertebrate lineages, enabling in-

teractive visualization of embryonic development, organogenesis, and skeletal differentiation across ontogenetic stages.

4 Representative scientific, educational, and public applications

The digital assets hosted within ADMorph are intended primarily for non-commercial research, education, and public outreach. Supported by an extensive collection of anatomically segmented 3D models and scientifically validated fossil reconstructions, the repository provides high-quality digital resources that combine anatomical accuracy with analytical utility. A further key feature of ADMorph is its interactive visualization environment, which allows users to explore digital specimens directly in a standard web browser. This functionality improves data accessibility and supports research, teaching, and public engagement by making vertebrate anatomical and paleontological resources readily accessible to a global audience.

For scientific research, CT datasets and 3D surface meshes support a broad range of comparative and functional studies, including phylogenetic reconstruction, geometric morphometrics (Adams et al., 2004; Zelditch et al., 2012), finite-element analysis (FEA; Rayfield et al., 2001; Rayfield, 2007), and computational fluid dynamics (CFD; Rahman, 2017)

(Fig. 5A, B). The integration of fossil and extant vertebrate datasets within a unified platform enables direct comparisons across major evolutionary transitions.

For museum exhibitions and collection management, ADMorph supports the long-term preservation, documentation, and dissemination of rare, fragile, or unique specimens through its digital archiving (Fig. 5C). Its open-access models provide anatomically and geometrically accurate reference data for researchers, students, digital artists, sculptors, and scientific animators, supporting the creation of scientifically informed visualizations and reconstructions (Fig. 5F). In addition, these digital resources provide museums with compelling materials for science communication and public engagement, including interactive exhibitions, immersive virtual reality (VR) experiences, and the production of physical replicas through 3D printing and fabrication technologies (Fig. 5D, E, G, I).

ADMorph also serves as a valuable educational resource through its interactive web-based visualization tools and 3D-printable datasets. For primary and secondary education, these resources provide intuitive access to vertebrate anatomy and biological structure. At the undergraduate and graduate levels, they support advanced training in comparative anatomy, morphological analysis, digital dissection, and evolutionary biology (Fig. 5H, J). By combining high-quality anatomical data with accessible digital technologies, ADMorph expands opportunities for vertebrate anatomy education and public engagement across both virtual and physical learning environments.

5 Future directions

The future development of ADMorph will focus on strengthening its role as a comprehensive open-access platform for digital vertebrate morphology. A major priority is the implementation of AI-assisted workflows for automatic segmentation, reconstruction, and anatomical annotation (Knutsen and Konovalov, 2024; Zhang et al., 2025). Recent advances in deep-learning-based segmentation frameworks, including Biomedisa (Lösel et al., 2020) and nnU-Net (Isensee et al., 2021), demonstrate the potential of automated approaches for processing complex volumetric datasets. By integrating similar methodologies, ADMorph aims to substantially improve the efficiency, scalability, and consistency with which large volumes of digital morphological data are processed.

Future development will also improve FAIR compliance (Wilkinson et al., 2016) through the implementation of persistent identifiers and interoperable metadata standards. In addition, ADMorph will continue to expand its archives through ongoing fieldwork, new fossil discoveries, and targeted digitization initiatives focused on both extinct and threatened extant vertebrates. We actively encourage collaborations with universities, research institutes, museums, and other scientific organizations worldwide. Through continued community participation and technological development, ADMorph will progressively broaden its

taxonomic, temporal, and geographic coverage, establishing a sustainable digital infrastructure for vertebrate biodiversity and evolutionary research of morphological data.

6 Conclusions

ADMorph provides a unified platform for accessing, visualizing, and sharing digital vertebrate morphology across both fossil and extant taxa. By integrating CT volumes, anatomically segmented models, and scientifically reconstructed fossil specimens, the platform enables direct comparisons across major evolutionary transitions that were previously difficult to achieve using geographically dispersed collections. Supported by standardized data formats, rich metadata, and detailed anatomical annotations, ADMorph provides a high-quality phenotypic resource for comparative anatomy, geometric morphometrics, macroevolutionary analyses, and biomechanical modeling. Furthermore, ADMorph provides a sustainable mechanism for the long-term preservation of rare, fragile, and irreplaceable paleontological and zoological heritage against physical deterioration or loss. As the repository continues to expand and incorporate AI-assisted analytical tools, it will shift the field from documentation to big-data driven discoveries at the intersection of morphology, biodiversity science, and virtual paleontology. By facilitating the large-scale digitization, archiving, and sharing of vertebrate morphological data, ADMorph advances open science and promotes data reuse and reproducibility, establishing a lasting digital infrastructure for global evolutionary research.

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ADMorph: A Three-Dimensional Morphological Database for Vertebrate Evolutionary Research

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Abstract: The development of computed tomography (CT) and three-dimensional reconstruction technologies has enabled non-destructive quantitative analysis of anatomical structures and promoted research on vertebrate morphology. This paper introduces ADMorph (Archives of Digital Morphology), a three-dimensional morphological database established by the Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences. The platform contains large amounts of CT data and three-dimensional segmentation models of fossil and extant specimens, supports data upload, standardized storage, web-based interactive visualization, and open download, and constructs···

established specialized datasets including IUCN Red List threatened species, vertebrate embryos, reptile bones, and freshwater fauna of the Yangtze River basin. ADMorph enhances the openness and accessibility of digital morphological data, providing data support for research on vertebrate evolution at deep-time scales.

Keywords: ADMorph, computed tomography (CT), three-dimensional reconstruction, vertebrate morphology, open-access database, three-dimensional segmentation dataset, comparative anatomy, FAIR data principles, virtual paleontology

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Note: Figure translations are in progress. See original paper for figures.