

Creation of Virtual Museums Available
to All through Use of

MORPHO SOURCE



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What is goal of “collection digitization” ?

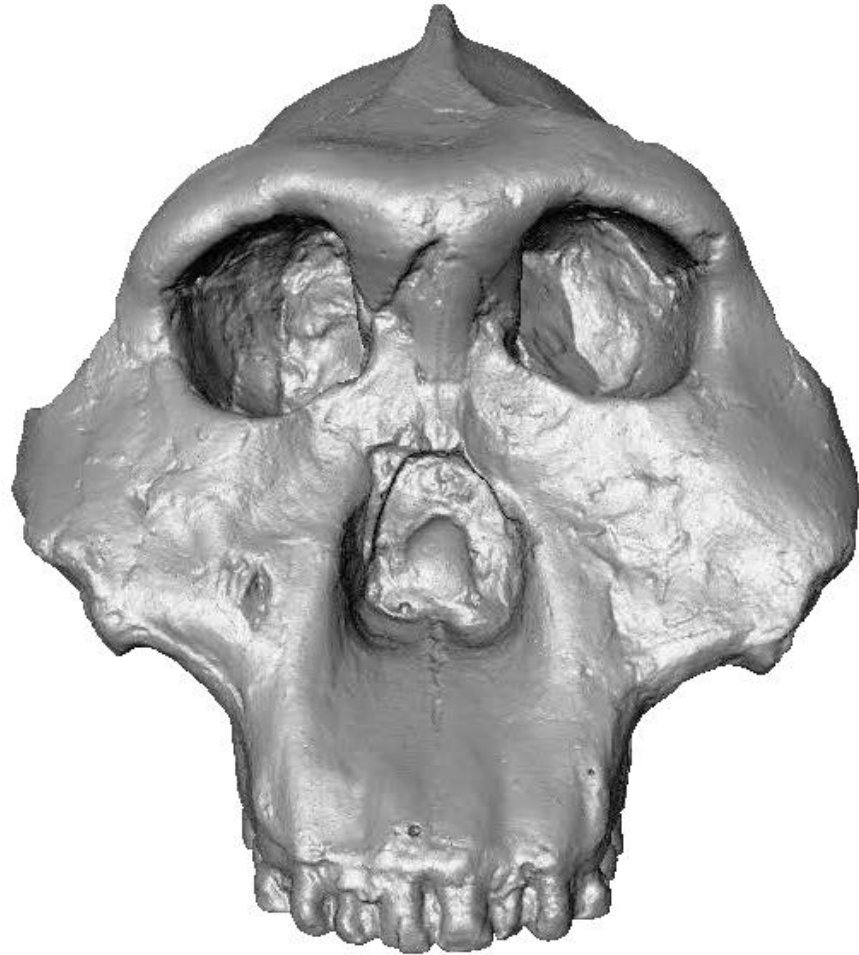
- To make specimen records more discoverable
- To make specimen data more accessible
- Facilitate research/education utilizing those collections

MORPHO SOURCE



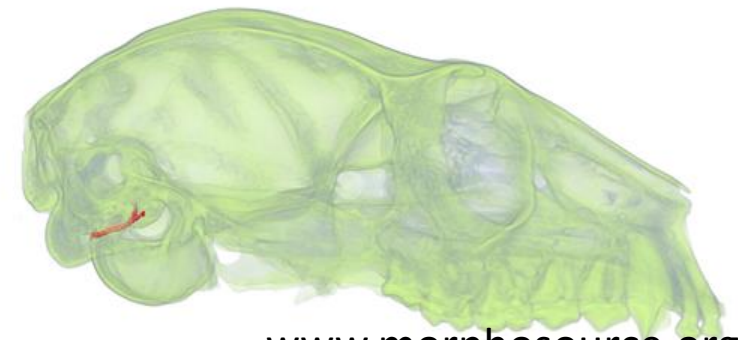
...aims to fulfill these goals with high fidelity 3D
digital avatars

What's the big deal about 3D models?



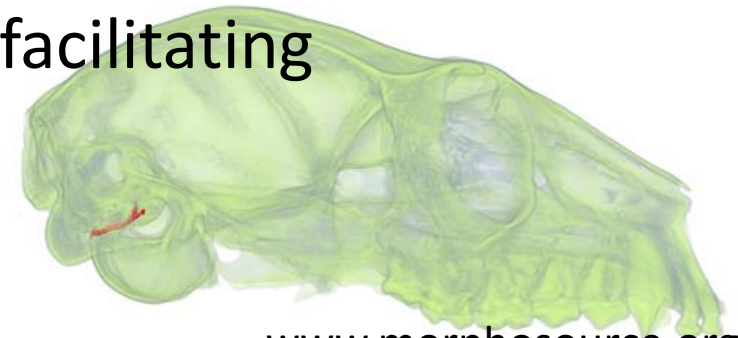
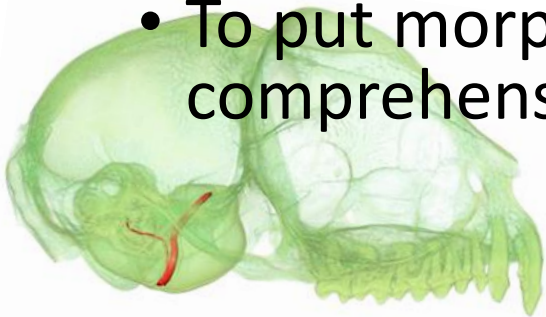
Benefits of high fidelity 3D Digital Data

- **Easier access** to specimens in remote locations
- **More rapid access** to larger sample sizes
- **More quantitative** approaches
- Access **internal morphology**
- Relax demand to handle fragile museum specimens
- Involve **beginning students and public** with unique and valuable specimens



Organism Structure is integral to understanding evolution

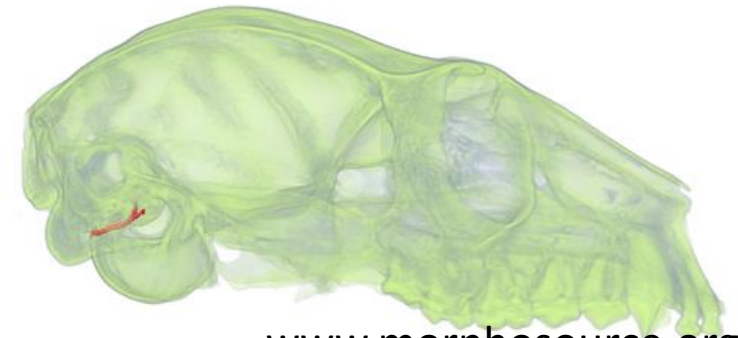
- Observation of morphological variation is a foundation of evolutionary theory.
- Interactions between physical environment and an organism (via its anatomy) explain selective pressures and evolutionary histories.
- Genomic advances stem partly from relative ease of **accessing** raw sequence data. (i.e., Genbank)
- The **information content** and explanatory power of morphology remains virtually untapped due to difficulty of access.
- To put morphology on the same level as genomics, facilitating comprehensive **access** to raw data is key.



Access is key

How to best promote access?

- **Consolidate** repository holdings
- Allow scan searches that will **highlight availability across repositories** (e.g., by taxon, element, data type, publication, geographic location, etc.)
- Allow efficient download of data records returned by searches.
- Give **EVERYONE** the opportunity to be direct contributors



Researcher-Generated, Repository-Consolidating archive (RG-RCA) is needed

MorphoSource (www.morphosource.org) is being developed as a proof-of-concept/testing ground

- Based out of Duke University
- Development started in 2012
- Active since Spring, 2013



Why isn't



=



?



requires addressing challenges
outside current scope of



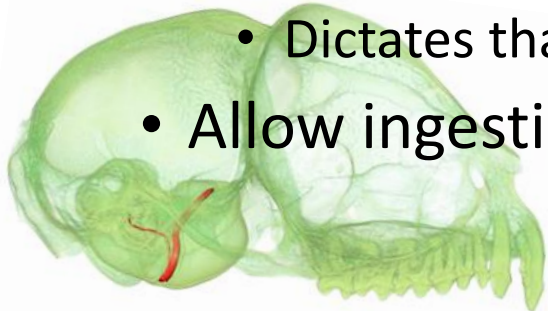


Development issues

- Specific and detailed digital media metadata
- Routines for reliable upload/download of large datasets
- Routines for reliable 3D viewing of large datasets

Governance issues

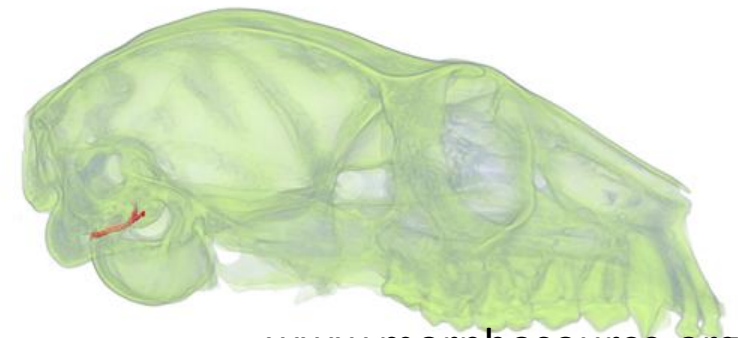
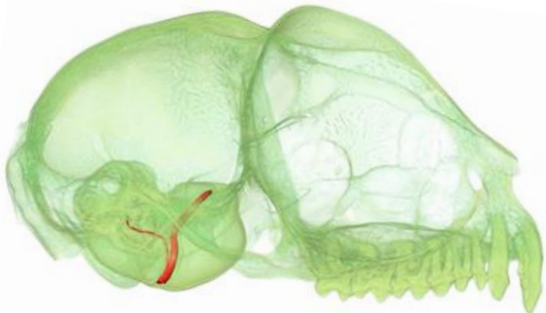
- Address data curation/sustainability problems
- Needed to address researcher & museum concern about maintaining control of shared data and giving credit for its production
 - Dictates that site is not 100% open access.
- Allow ingestion of federal and international collections when appropriate





To provide

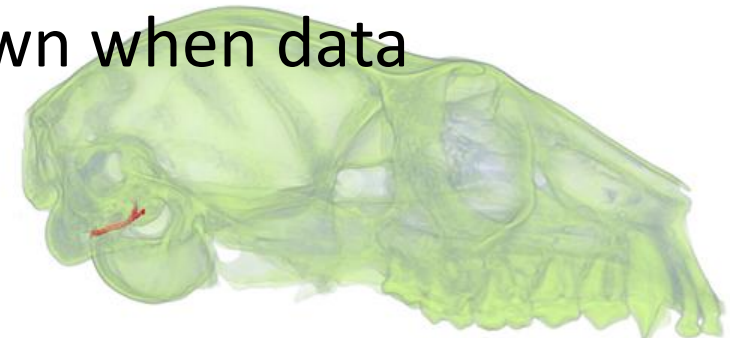
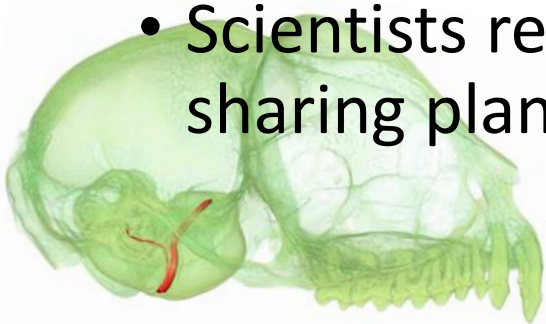
1. researchers a way to access, distribute, and archive 3D data as efficiently and effectively as possible
2. researchers & museums tools to manage & track 3rd party data usage
3. A framework for public education through unprecedented access to research quality natural science objects



Mandates for Data Sharing in USA

NSF requirements for data sharing tightened - need is critical

- Memorandum (Feb 22, 2013): “Increasing Access to the Results of Federally Funded Research”
- Executive Order (May 9, 2013): “Making Open and Machine Readable the New Default for Government Information”
- Memorandum (May 9, 2013): “Open Data Policy – Managing Information as an Asset”
- Scientists requests for grant support are turned down when data sharing plans are perceived to be inadequate.



Stats

- 6,200 media files
 - Tiff/DICOM stacks
 - 3D Mesh files
- 1,998 specimens
- 446 taxonomic names
- 64 institutions
- 24 scanning facilities
- 392 user accounts
- 3,800 downloads

Specimen Information

Specimen: [DPC-18651](#). *Parapithecus grangeri*

Specimen taxonomy: *Parapithecus grangeri*

Institution: Duke Lemur Center Divison of Fossil Primates, Durham, NC, USA

Scan Information

Type: Image (TIFF)

Filesize: 710.14 MB

Is this media copyrighted?: Yes

Copyright permission: Person loading media owns copyright and grants permission for use of media on MorphoSource

Copyright license: Attribution-NonCommercial CC BY-NC - reuse but noncommercial

Copyright Holder: Duke Division of Fossil Primates

Facility: Duke SMIF

X res: 0.035305630415678 mm

Y res: 0.035305630415678 mm

Z res: 0.035305630415678 mm

Voltage: 140 kv

Amperage: 200 µa

Watts: na

Projections: 2900

Frame averaging: 2

Wedge: none

Scanner calibrations: No calibrations are listed

Technicians: Gabriel Yapuncich

Media created on: June 6 2013 at 13:04:26

Media last modified on: September 8 2014 at 12:50:55

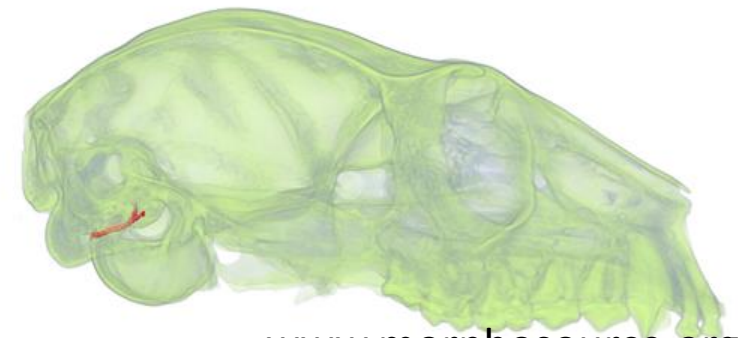
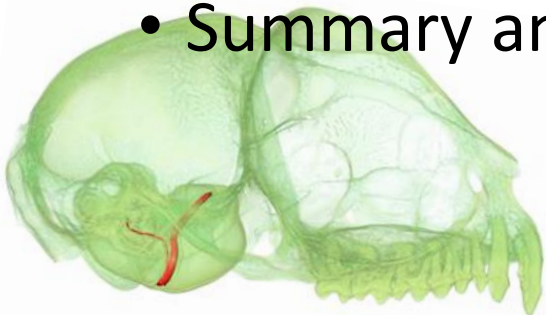


[DOWNLOAD MEDIA](#)



Outline

- Examples of contributed datasets
- How to use the site
 - Improving data access, distribution, & citability/transparency
- Governance
 - Sustainability/growth/security
 - Features for promoting ethical conduct
- Summary and Conclusions



Datasets on MorphoSource

Media results

Specimen results

Published Datasets for download

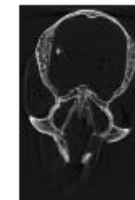
- 431 specimens of extant primate skulls & skeletons
 - Harvard Museum of Comparative Zoology (MCZ)
 - Media includes tiff/dicom stacks
 - Data author is Prof. Lynn Copes of Quinnipiac School of Medicine

Jump to page: GO 311 results ‹ Previous page 1/39 Next ›

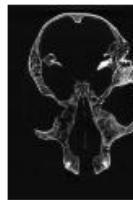
OPTIONS ›



M2601
[MCZ-25626](#),
[Cercocebus torquatus](#)
DICOM medical
imaging data image
series ZIP file
3.01 MB



M2602
[MCZ-25630](#),
[Cercocebus torquatus](#)
DICOM medical
imaging data image
series ZIP file
2.59 MB



M2852
[MCZ-62639](#),
[Cercocebus torquatus](#)
DICOM medical
imaging data image
series ZIP file
2.63 MB



M2853
[MCZ-32625](#),
[Cercocebus torquatus](#)
DICOM medical
imaging data image
series ZIP file
3.47 MB



M2854
[MCZ-32624](#),
[Cercocebus torquatus](#)
DICOM medical
imaging data image
series ZIP file
3.44 MB



M2860
[MCZ-23195](#),
[Cercocebus sp.](#)
DICOM medical
imaging data image
series ZIP file
2.82 MB



M2861
[MCZ-19982](#),
[Cercocebus torquatus](#)
DICOM medical
imaging data image
series ZIP file
3.52 MB



M2862
[MCZ-19184](#),
[Cercocebus torquatus](#)
DICOM medical
imaging data image
series ZIP file
3.54 MB

308 results

[MCZ-10131, Saimiri oerstedii](#)
[MCZ-10132, Saimiri oerstedii](#)
[MCZ-10133, Saimiri oerstedii](#)
[MCZ-10134, Saimiri oerstedii](#)
[MCZ-10138, Ateles geoffroyi](#)
[MCZ-12758, Macaca fascicularis](#)
[MCZ-14657, Eutoticus elegantulus](#)
[MCZ-14659, Galago alleni](#)
[MCZ-14725, Cercocebus albigena](#)
[MCZ-15312, Pan troglodytes troglodytes](#)
[MCZ-15324, Saquinus sp.](#)
[MCZ-16075, Galago senegalensis](#)
[MCZ-16354, Eulemur fulvus fulvus](#)
[MCZ-16356, Eulemur fulvus rufus](#)
[MCZ-16370, Eulemur fulvus rufus](#)
[MCZ-16375, Propithecus verreauxi verreauxi](#)
[MCZ-16382, Varecia variegata variegata](#)
[MCZ-16390, Lemur catta](#)
[MCZ-16391, Lemur catta](#)
[MCZ-16392, Lemur catta](#)
[MCZ-16393, Eulemur fulvus rufus](#)
[MCZ-17548, Perodicticus potto](#)
[MCZ-17550, Perodicticus potto](#)
[MCZ-17589, Galago alleni](#)
[MCZ-17590, Eutoticus elegantulus](#)
[MCZ-17591, Eutoticus elegantulus](#)
[MCZ-17592, Eutoticus elegantulus](#)
[MCZ-17593, Eutoticus elegantulus](#)
[MCZ-18607, Perodicticus potto](#)

Datasets on MorphoSource

Published Datasets for open access download

- 124 specimens of lower second molars used to compute dental topographic metrics in Boyer (2008)
 - AMNH, USNM, MCZ collections
 - Media includes tiff/dicom stacks
 - Surface meshes

124 Project Specimens

[VIEW AS LIST](#)

[NEW SPECIMEN](#)

Order by: [Specimen number](#) | [Taxonomic name](#)



[AMNH-M-100503](#), *Indri indri*



[AMNH-M-100504](#), *Indri indri*



[AMNH-M-100512](#), *Varecia variegata variegata*



[AMNH-M-100513](#), *Varecia variegata rubra*



[AMNH-M-100514](#), *Varecia variegata rubra*



[AMNH-M-100517](#), *Eulemur fulvus rufus*



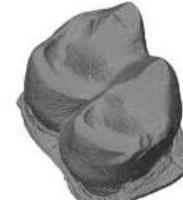
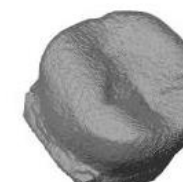
[AMNH-M-100569](#), *Eulemur fulvus rufus*



[AMNH-M-100598](#), *Lemur catta*



[AMNH-M-100632](#), *Daubentonia*



[AMNH-M-100632](#), *Daubentonia*



Datasets on MorphoSource

Published Datasets for open access download

- 251 specimens of calcaneal scans used in Boyer et al. (2013) to generate basic anatomical measurements
 - AMNH, USNM, MCZ, NMB, UCM, UCMP collections and more
 - Media includes tiff/dicom stacks
 - Initial & smoothed surface renderings
 - Some fossils include Photographs

251 Project Specimens

[VIEW AS LIST](#)

[NEW SPECIMEN](#)

Order by: [Specimen number](#) | [Taxonomic name](#)



[AMNH-FM-10016](#), *Adapis parisiensis*



[AMNH-FM-11474](#), *Notharctus* sp.



[AMNH-FM-11478](#), *Notharctus* sp.



[AMNH-FM-12613](#), *Hemiacodon gracilis*



[AMNH-FM-129382](#), *Notharctus* sp.



[AMNH-FM-131763](#), *Smilodectes* sp.



[AMNH-FM-131774](#), *Smilodectes* sp.



[AMNH-FM-131945](#), *Notharctus* sp.



[AMNH-FM-131956](#), *Notharctus* sp.



[AMNH-FM-13766](#), *Notharctus* sp.



[AMNH-FM-16852](#), *Cantius trigonodus*



Datasets on MorphoSource

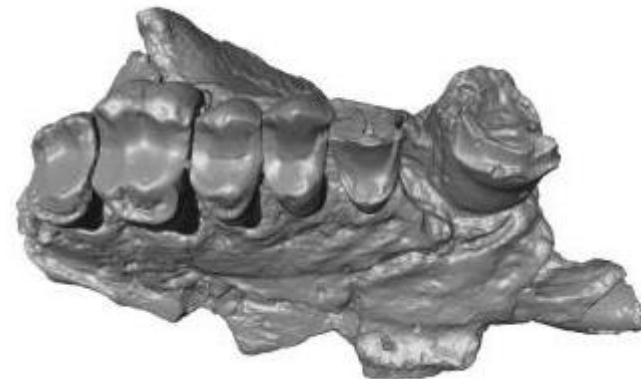
UCMP 38762

Holotype for

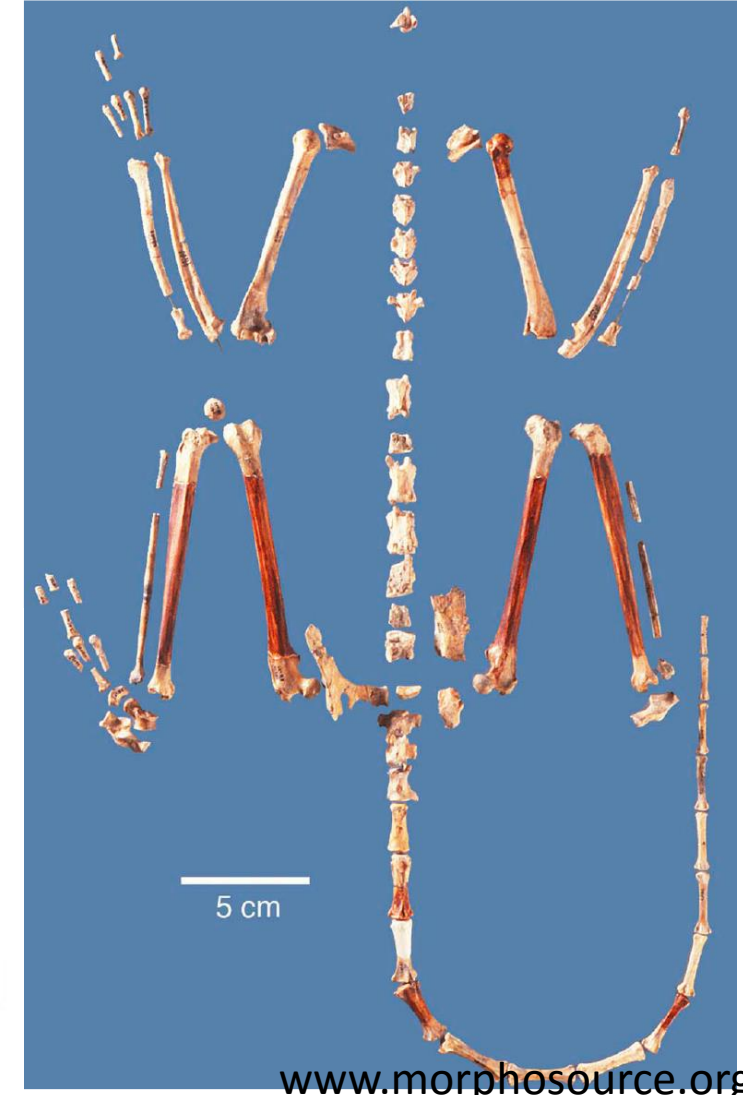
Cebupithecia sarmiento
(largely complete skeleton)

Published Datasets for download

- 4 type specimens of Miocene Primates from La Venta, Columbia
 - UCMP collection
 - Media includes tiff stacks
 - Mesh files
 - 296 media files



DOWNLOAD MEDIA



Datasets on MorphoSource

Published Datasets for download

- New centipedes from Croatia

Specimen Media



[M1642](#), New centipede source images
unknown image series ZIP file, 1.86
GB

Specimen Information

Specimen: CBSS-CHP517-1, *Eupolybothrus cavernicolus*,
Unvouchered, Female

The Croatian Biospeleological Society (CBSS) is non-governmental, non-profit organization acknowledged, registered and supported by Ministry of Science, Education and Sport that has been working successfully since its foundation in 1996. It is an organization for biospeleology that deals with research and conservation of subterranean fauna and its habitats on the whole territory of the Republic of Croatia with its members being both scientists, experts and cavers.

Locality: country: Croatia; stateProvince: Knin; locality: NP Krka, village Kistanje, Hydroelectric power plant Miljacka, cave Miljacka II; verbatimElevation: 115 m;
44.000306, 16.016250

Institution: Croatian Biospeleological Society (CBSS), Zagreb, Croatia

Bibliography

Pavel Stoev, Ana Komericki, Nesrine Akkari, Shanlin Liu, Xin Zhou, Alexander M. Weigand, Jeroen Hostens, Christopher I. Hunter, Scott C. Edmunds, David Porco, Marzio Zapparoli, Teodor Georgiev, Daniel Mietchen, David Roberts, Sarah Faulwetter, Vincent Smith, Lyubomir Penev. 2013. *Eupolybothrus cavernicolus* Komericki & Stoev sp. n. (Chilopoda: Lithobiomorpha: Lithobiidae): the first eukaryotic species description combining transcriptomic, DNA barcoding and micro-CT imaging data. *Biodiversity Data Journal*. Vol. 1. Pensoft Publishers.

Datasets on MorphoSource

Published Datasets for download

- beetles

Media results

3 results

OPTIONS



M6432
[ZSM-C CT1](#),
[Limbodessus baliem](#)
Limbodessus
baliem, male
2 files

ADD



M6433
[ZSM-C CT3](#),
[Limbodessus alexanderi](#)
Limbodessus
alexanderi female
2 files

ADD



M6434
[ZSM-C CT2](#),
[Limbodessus alexanderi](#)
Limbodessus
alexanderi male
2 files

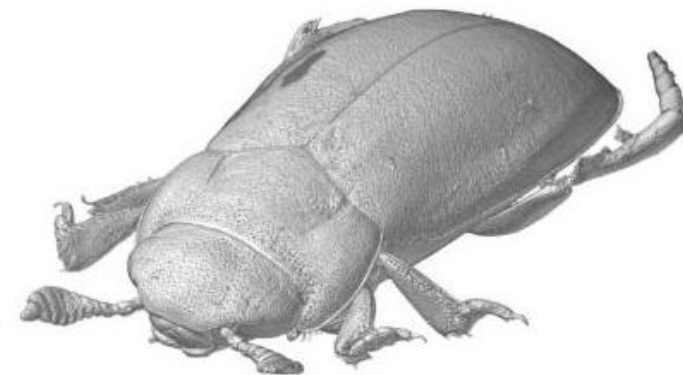
ADD

Specimen results

3 results

[ZSM-C CT1, Limbodessus baliem](#)
[ZSM-C CT2, Limbodessus alexanderi](#)
[ZSM-C CT3, Limbodessus alexanderi](#)

M6433



ZSM-C CT3, *Limbodessus alexanderi*
SNSB X-ray facility

CONTACT | USER GUIDE

Source media is strictly prohibited.

Datasets on MorphoSource

How to get datasets

- Enter DOI's into browser or search by specimen, taxon, institution, publication **project**
- Login/Create an account (anyone)
- Click "download"

Media results

Jump to page: GO

45 results

◀ Previous page 4/6 Next ▶

OPTIONS ▶



M502
[AMNH-M-109366](#),
[Tarsius spectrum](#)
DICOM medical
imaging data image
series ZIP file
283.48 KB



M503
[AMNH-M-196485](#),
[Tarsius spectrum](#)
3D Mesh (Polygon File
Format)
18.93 MB



M504
[AMNH-M-196485](#),
[Tarsius spectrum](#)
3D Mesh (Polygon File
Format)
8.03 MB



M505
[AMNH-M-196485](#),
[Tarsius spectrum](#)
3D Mesh (Polygon File
Format)
8.31 MB

Specimen results

12 results

[AMNH-M-203297](#), [Tarsius syriacta carbonarius](#)
[AMNH-M-187935](#), [Tarsius syriacta syriacta](#)
[AMNH-M-109367](#), [Tarsius spectrum](#)
[AMNH-M-109369](#), [Tarsius spectrum](#)
[AMNH-M-203296](#), [Tarsius syriacta carbonarius](#)
[AMNH-M-106649](#), [Tarsius bancanus](#)
[AMNH-M-106754](#), [Tarsius borneanus](#)
[AMNH-M-109368](#), [Tarsius spectrum](#)
[AMNH-M-109366](#), [Tarsius spectrum](#)
[AMNH-M-196485](#), [Tarsius spectrum](#)
[AMNH-M-196480](#), [Tarsius spectrum](#)
[AMNH-M-166856](#), [Tarsius syriacta carbonarius](#)

Datasets on MorphoSource

How to get datasets

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- Login/Create an account (anyone)
- Click "download"

Specimen Information

[EDIT](#)

Specimen: AMNH-106649, *Tarsius bancanus*, Vouchered, Female

Relative Age: recent, **Absolute Age:** recent
Body Mass: 123*

Institution: American Museum of Natural History, New York, NY, USA

Bibliography

Doug M. Boyer. 2008. Relief index of second mandibular molars is a correlate of diet among prosimian primates and other euarchontan mammals. *Journal of Human Evolution*. Vol. 55.

Jonathan M. Bunn, Doug M. Boyer, Jukka Jernvall, Yaron Lipman, Ingrid Daubechies. 2011. Dirichlet normal surface energy of tooth crowns, a new technique of molar shape quantification for dietary inference, compared with previous methods in isolation and in combination. *American Journal of Physical Anthropology*. Vol. 145.

Julia Winchester, Doug M. Boyer, Elizabeth St. Clair, Ashley Gosselin-Ildari, Siobhan Cooke, Justin Ledogar. 2013. Dental topography of platyrrhines and prosimians: convergence and contrasts. *American Journal of Physical Anthropology*. Vol. 153(1).

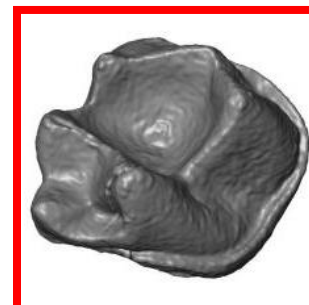
Specimen Media



[M2243](#), Raw surface file (Left) (Calcaneus)
3D Mesh (Polygon File Format), 46.18 MB



[M2244](#), Smooth surface file (Left) (Calcaneus)
3D Mesh (Polygon File Format), 21.3 MB



[M489](#), Cropped Surface/Smooth (second mandibular molar)
3D Mesh (Polygon File Format), 9.24 MB



[M490](#), Zipped microCT image stack (second mandibular molar)
TIFF image series ZIP file, 663.61 KB

Datasets on MorphoSource

How to get datasets

- Enter DOI's into browser or search by specimen, taxon, institution, publication, **project**
- Login/Create an account (anyone)
- Click “download”

Specimen Information

Specimen: [AMNH-M-106754](#), [Tarsius borneanus](#)

Specimen taxonomy: *Tarsius borneanus*

Institution: American Museum of Natural History, New York, NY, USA

Scan Information

Type: 3D Mesh (Polygon File Format)

Filesize: 10.21 MB

Notes: Smooth crop.

Grant support: American Society of Mammalogists Grant Evolving Earth Foundation NSF DDIG BCS-0622544

Is this media copyrighted?: Yes

Copyright Holder: Doug Boyer

Facility: Stony Brook Univ. Center for Biotechnology

X res: 0.01 mm

Y res: 0.01 mm

Z res: 0.01 mm

Frame averaging: 1

Wedge: air

Scanner calibrations: No calibrations are listed

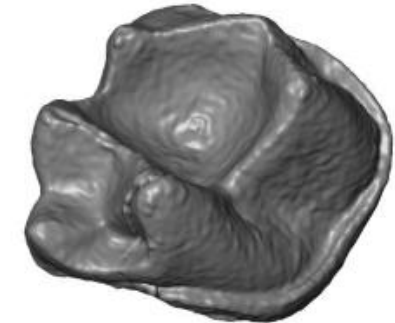
Technicians: Doug Boyer

Media created on: June 28 2013 at 16:02:36

Media last modified on: February 18 2014 at 10:39:53

Bibliography

Doug M. Boyer. 2008. Relief index of second mandibular molars is a correlate of diet among prosimian primates and other euarchontan mammals. *Journal of Human Evolution*. Vol. 55. pp. 1118-1137.



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Specifically for educators



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- [Terms](#)
- [User Guide](#)



foot of Daubentonia madagascariensis scanned at 38micron resolution at Duke Evolutionary Anthropology department's new high resolution microCt facility. [Click here if you are interested in details on the facility](#)

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PROJECT

Projects

[K12 - Base-Ten Conversions](#)

Sets of scans of fossilized mammalian teeth from the FLMNH to help students understand multiplying and dividing by tens, the amount of difference that place values represent, scientific notation, and other concepts related to the base-ten system.

Members: Richard Hulbert, Suzanne Strait, Natasha Vitek

Data: 2 published media, 3 specimens

PROJECT INFO

[K12 - Horse Evolution](#)

These set of fossil horse teeth have been selected by Florida Museum scientists to help K12 students understand concepts related to horse evolution and climate change. In collaboration with science teachers, we have created a unit (3 lessons) that c... [More >](#)

Members: Douglas Boyer, CLAUDIA GRANT, Sean Moran

Data: 15 published media, 15 specimens

PROJECT INFO

[K12 - Titanoboa](#)

Members: Douglas Boyer, CLAUDIA GRANT, Sean Moran

Data: 6 published media, 6 specimens

Specifically for educators

Project: K-12 Megalodon

[BACK](#)

Members

Douglas Boyer, CLAUDIA GRANT, Sean Moran

Data

22 published media

24 specimens

More Information

<http://www.paleoteach.org/specimens/megalodon/>

About the project

This page is dedicated to the learning of EVOLUTION and EXTINCTION of the giant shark *Carcharocles megalodon*. Here, you will find all the information you need in order to access the specimen in a scientific database, download and print the files, science lessons, math lessons, and rubrics. Our hope is that your students learn about what scientists do by mimicking their scientific process. Ultimately, your students will be able to reconstruct a megalodon jaw and calculate the size of the animal. The availability of his jaw is made possible by Dr. Gordon Hubbell, who has donated the specimen to the Florida Museum of Natural History for K12 purposes.

<http://www.paleoteach.org/specimens/megalodon/>

22 Project Specimens

Order by: [Specimen number](#) | [Taxonomic name](#)



[UF-311000 LL 01](#)



[UF-311000 LL 03](#)



[UF-311000 LL 04](#)



[UF-311000 LL 05](#)

Being used for PaleoTeach modules

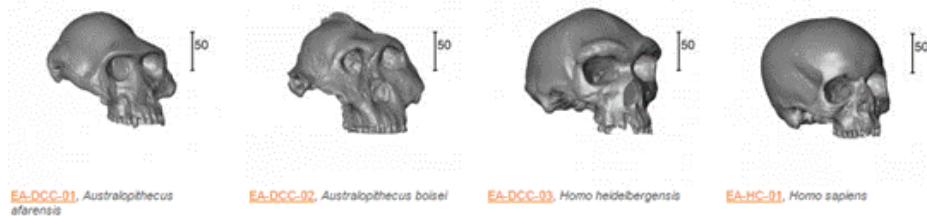
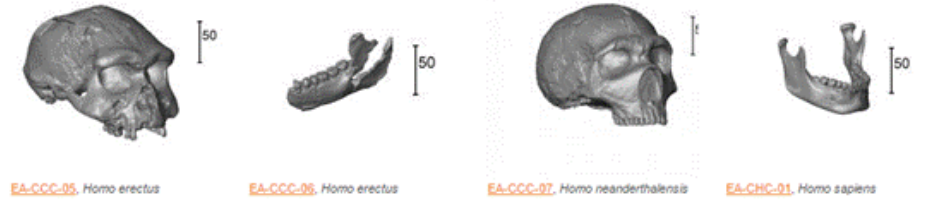
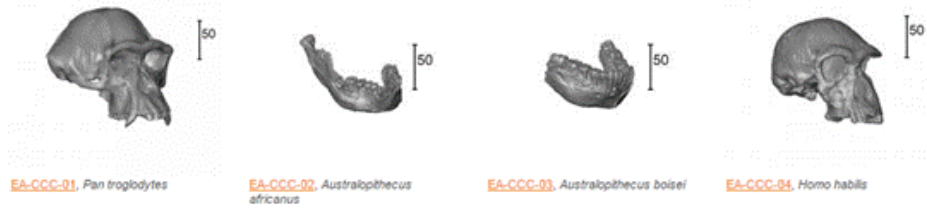
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MANAGE: BIBLIOGRAPHY FACILITIES INSTITUTIONS PROJECTS TAXONOMY SPECIMEN USERS STATS

K-12 Human Evolution

MEDIA BIBLIOGRAPHY TAXONOMY FACILITIES

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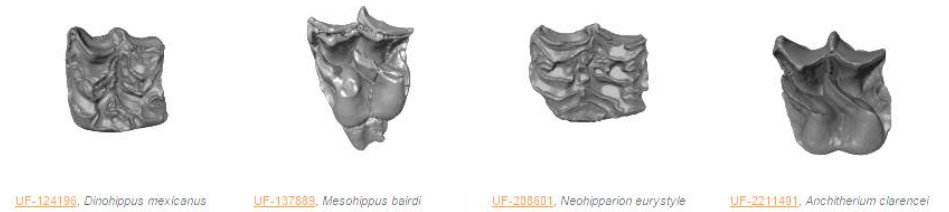
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K12 - Horse Evolution

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K12 - Horse Evolution

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15 Project Specimens

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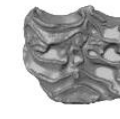
Order by: [Specimen number](#) | [Taxonomic name](#)



[UF-124196](#), *Dinohippus mexicanus*



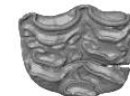
[UF-137888](#), *Mesohippus bairdi*



[UF-208601](#), *Neohipparion eurystyle*



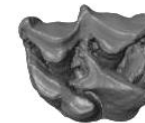
[UF-2211491](#), *Anchitherium clarencei*



[UF-22614](#), *Nannippus peninsulatus*



[UF-252687](#), *Sifrhippus sandrae*



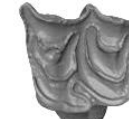
[UF-270648](#), *Parahippus barbouri*



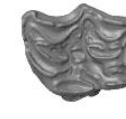
[UF-302417](#), *Nannippus aztecus*



[UF-53577](#), *Calippus elachistus*



[UF-60323](#), *Calippus cerasinus*



[UF-62288](#), *Neohipparion trapasense*



[UF-6597](#), *Parahippus leonensis*

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[UF-311000 LL 04](#)



[UF-311000 LL 05](#)



[UF-311000 LL 06](#)



[UF-311000 LL 07](#)



[UF-311000 LL 08](#)



[UF-311000 LL 09](#)



[UF-311000 LL 10](#)



[UF-311000 LL 11](#)



[UF-311000 LR 02](#)



[UF-311000 UL 01](#)

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Project: K12 - Titanoboa

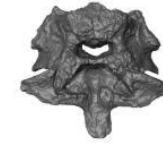
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[UF-2210, Eunectes murinus](#)



[UF-IGM-1, Titanoboa cerrejonensis](#)



[UF-IGM-2, Titanoboa cerrejonensis](#)



[UF-IGM-4, Titanoboa cerrejonensis](#)



[UF-IGM-5, Titanoboa cerrejonensis](#)



[UF-IGM-13, Titanoboa cerrejonensis](#)

Are there other sites?



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[UF-311000 LL 06](#)



[UF-311000 LL 07](#)



[UF-311000 LL 08](#)



[UF-311000 LL 09](#)



[UF-311000 LL 10](#)



[UF-311000 LL 11](#)



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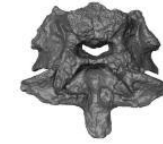
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[UF-IGM-1, Titanoboa cerrejonensis](#)



[UF-IGM-2, Titanoboa cerrejonensis](#)



[UF-IGM-4, Titanoboa cerrejonensis](#)



[UF-IGM-5, Titanoboa cerrejonensis](#)



[UF-IGM-13, Titanoboa cerrejonensis](#)

Yes

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[UF-311000 LL 03](#)



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[UF-311000 LL 05](#)



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[UF-311000 LL 07](#)



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[UF-IGM-1, Titanoboa correjonensis](#)



[UF-IGM-2, Titanoboa correjonensis](#)



[UF-IGM-4, Titanoboa correjonensis](#)



[UF-IGM-5, Titanoboa correjonensis](#)



[UF-IGM-13, Titanoboa correjonensis](#)

Yes

Many sites now provide collections with associated resources

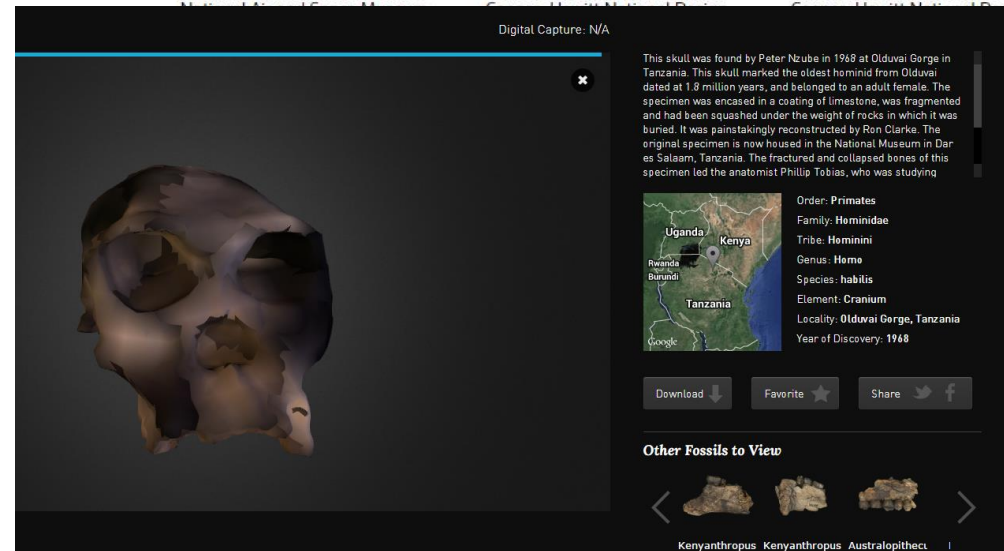
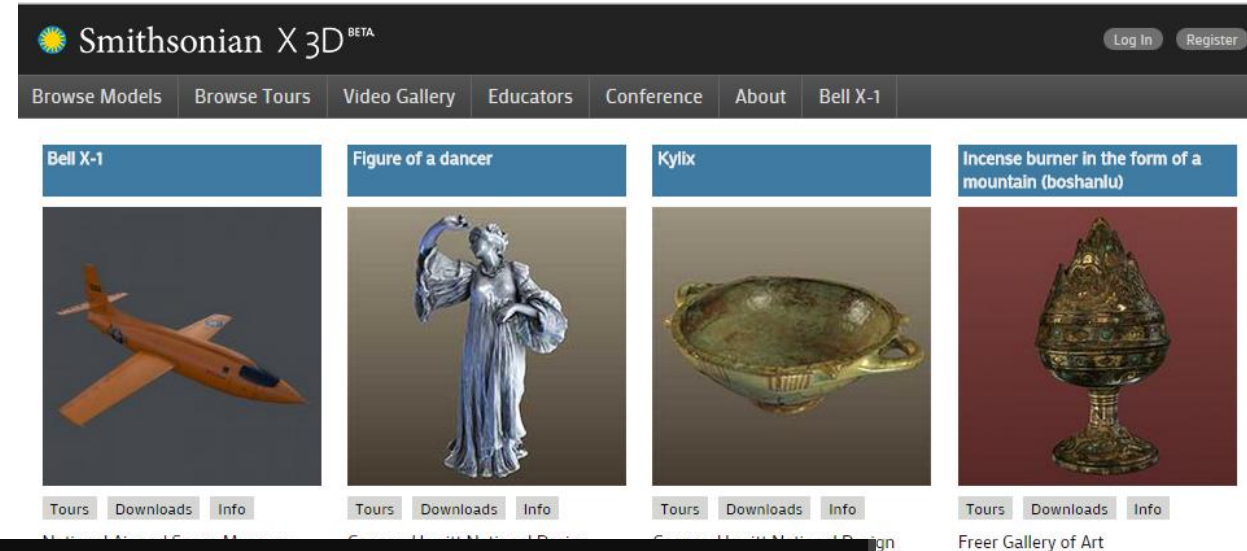
- Smithsonian (<http://3d.si.edu/>)
- TBI (<http://africanfossils.org/>)
- Digimorph (<http://www.digimorph.org/>)
- Check them out regularly they are excellent resources!

The image shows a screenshot of the Smithsonian X 3D BETA website. The top navigation bar includes links for 'Browse Models', 'Browse Tours', 'Video Gallery', 'Educators', 'Conference', 'About', and 'Bell X-1'. Below the navigation bar, there is a grid of four 3D model thumbnails: 'Bell X-1' (an orange airplane), 'Figure of a dancer' (a silver statue), 'Kylix' (a golden cup), and 'Incense burner in the form of a mountain (boshanlu)' (a golden incense burner). Each thumbnail has 'Tours', 'Downloads', and 'Info' buttons below it. In the foreground, a larger window displays a 3D model of a fossil skull. To the right of the skull is a text description: 'This skull was found by Peter Nzube in 1968 at Olduvai Gorge in Tanzania. This skull marked the oldest hominid from Olduvai dated at 1.8 million years, and belonged to an adult female. The specimen was encased in a coating of limestone, was fragmented and had been squashed under the weight of rocks in which it was buried. It was painstakingly reconstructed by Ron Clarke. The original specimen is now housed in the National Museum in Dar es Salaam, Tanzania. The fractured and collapsed bones of this specimen led the anatomist Phillip Tobias, who was studying'. Below the text is a map of East Africa showing the location of Olduvai Gorge in Tanzania. Further down, there are 'Download', 'Favorite', and 'Share' buttons. At the bottom, there is a section titled 'Other Fossils to View' with a carousel of three fossil images labeled 'Kenyanthropus', 'Kenyanthropus', and 'Australopithecus'.

Why use MorphoSource?

Many sites now provide collections with associated resources

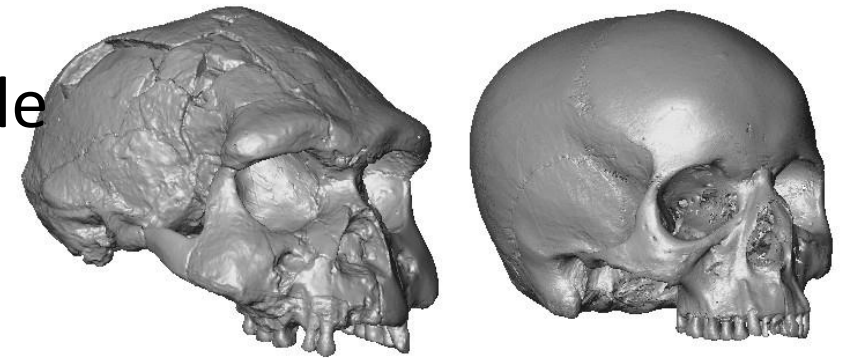
- Smithsonian (<http://3d.si.edu/>)
- TBI (<http://africanfossils.org/>)
- Digimorph (<http://www.digimorph.org/>)
- Check them out regularly they are excellent resources!



Why use MorphoSource?

Only site that

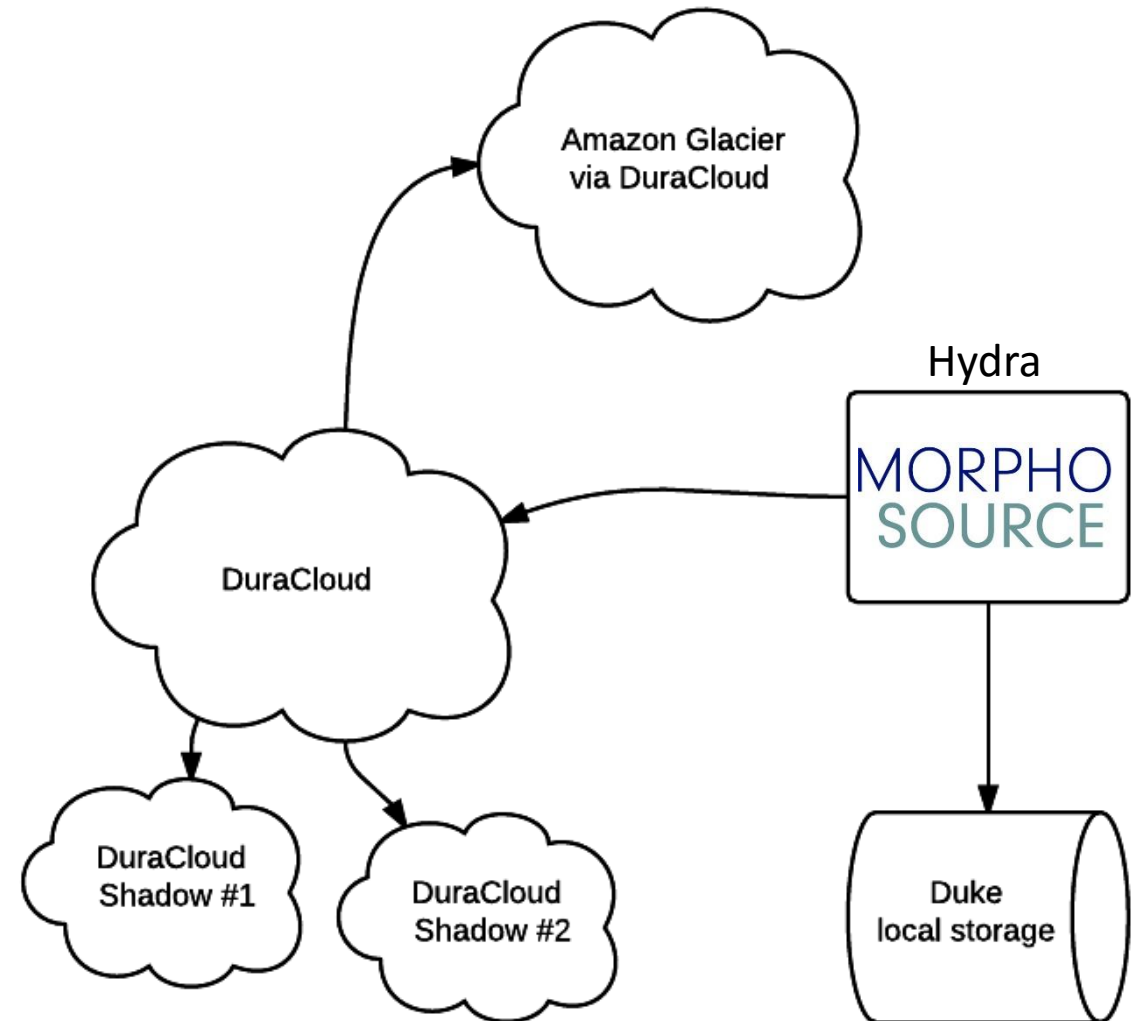
- Hosts raw, research quality data comprehensively for immediate download (e.g., USNM's scans will be accessible here).
- Designed to allow new academic and educational contributors on a moments notice.
- Can be used to reorganize materials contributed by others into new lesson plans.
- Provides research-quality specimens for broad scale consumption at the click of a 'download' button
- No taxonomic or temporal limits to scope



MorphoSource Sustainability

Supported by Duke University Information Technology and Library

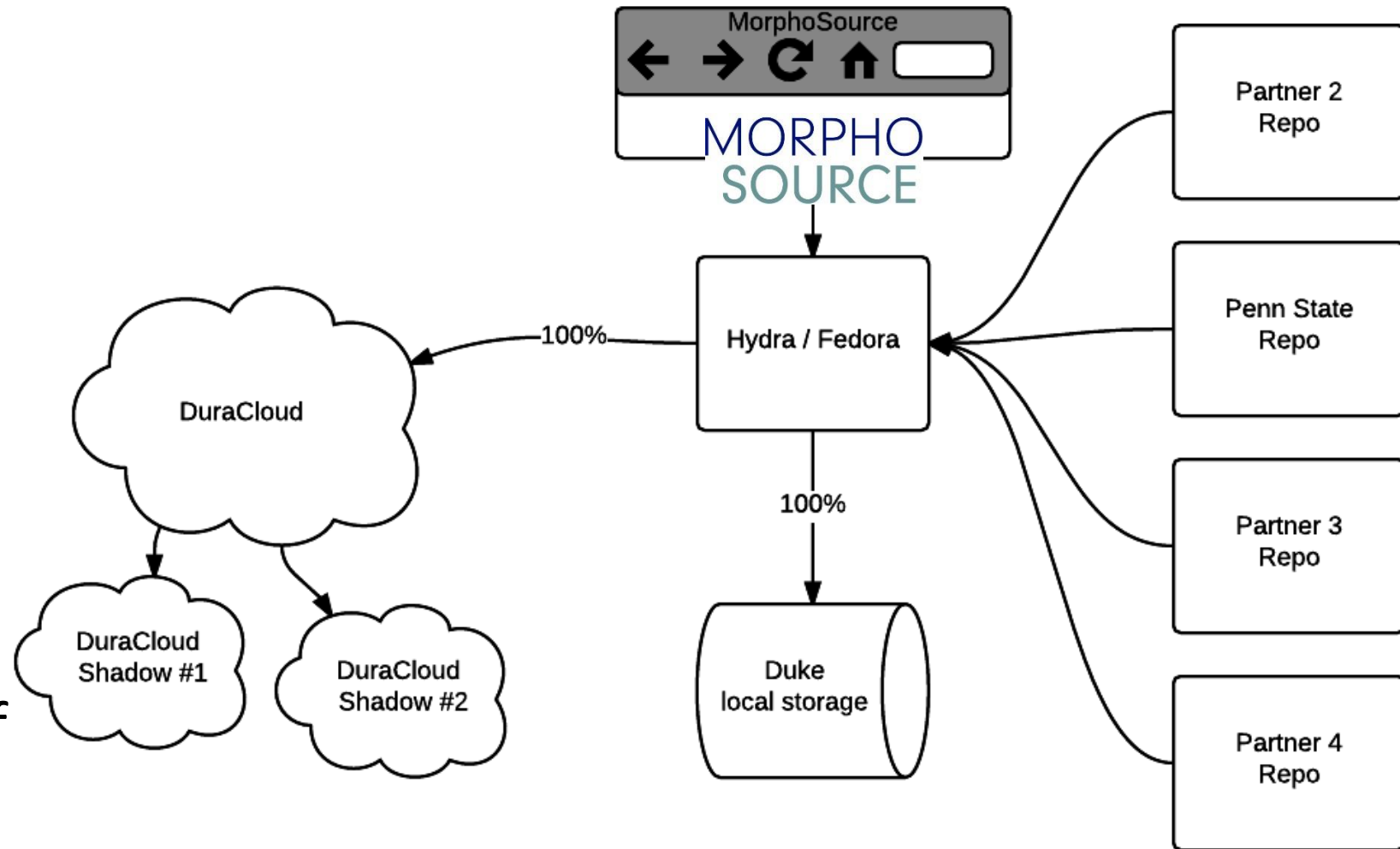
- Currently planned for 10-20 Terabytes of growth/year
- Data mirrored on multiple servers in different physical locations on RAID encoded drives
- Planning to shift to Fedora/Hydra/Duraspace with Duke Library for even higher security
- Partners needed!



MorphoSource Sustainability

Future development

- Partners store one copy of data relating to their own specimens
- Duke provides/maintains application, hosts a copy and manages cloud.
- Eases difficulty of digitization for partners & increases discoverability of collections (good for everyone)



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Contributors set “publication status” for each media file

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Publication status

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Facilitating ethical conduct

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Specimen: [DPC-0139](#), *Otolemur crassicaudatus*

Specimen taxonomy: *Otolemur crassicaudatus*

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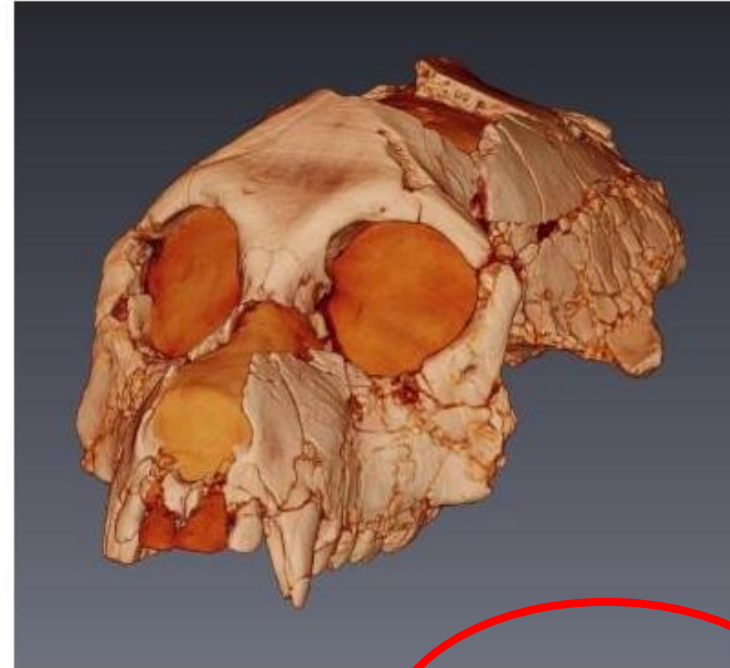
Media: M2376

Specimen Information

Specimen: [CGM-40237, *Aegyptopithecus zeuxis*](#)
Specimen taxonomy: *Aegyptopithecus zeuxis*
Institution: Cairo Geological Museum, Cairo, Egypt

Scan Information

Type: Image (TIFF)
Filesize: 1.1 GB
Grant support: Pennsylvania State University
Media citation instructions: Alan Walker provided access to these data originally appearing in Simons et al. 2007, the collection of which was funded by Pennsylvania State University. The files were downloaded from www.MorphoSource.org, Duke University.
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Doe, Jane	Yes	<u>1</u>	October 28 2013 at 4:12:46
Doe, Jane	Yes	<u>1</u>	March 5 2014 at 15:57:58

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 - Instructions on grant numbers to be cited in third party use
 - Instructions on preferred acknowledgment format

Specimen: [AMNH-FM-131945](#), [Notharctus sp.](#)

Specimen taxonomy: Notharctus sp.

Institution: American Museum of Natural History, New York, NY, USA

Type: 3D Mesh (Polygon File Format)

Filesize: 21.3 MB

Notes: smooth crop.

Grant support: NSF BCS 1317525 to DMB and ERS

Media citation instructions: Doug Boyer provided access to these data originally appearing in Boyer et al. (2013), the collection of which was funded by NSF BCS 1317525. The files were downloaded from www.MorphoSource.org, Duke University.

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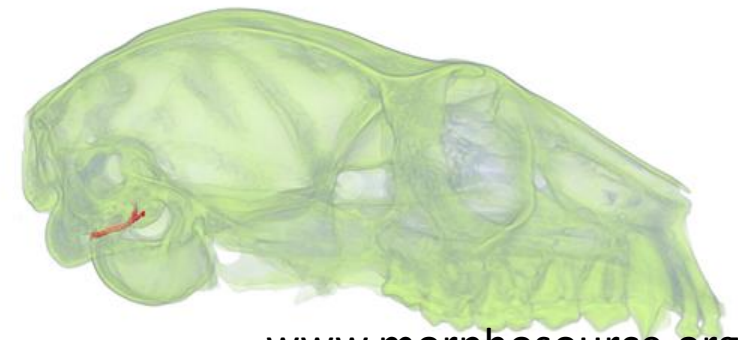
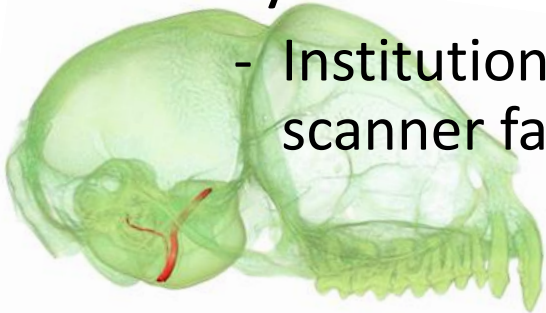
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- Data authors may transfer control of media files to accounts of museum curators (or any other account holder)
- Curator accounts can effectively become researcher generated (crowd sourced) digital archives for museums
- Leverages help from the entire community instead of placing the burden on individual institutions
- Curators can vet contributed data

Demonstrating value of collections

Demonstrating Data Impact

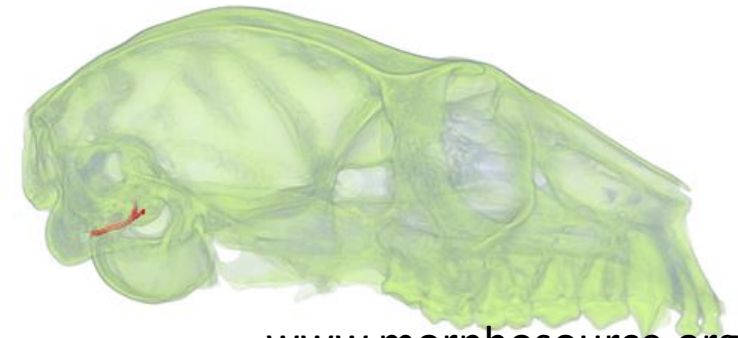
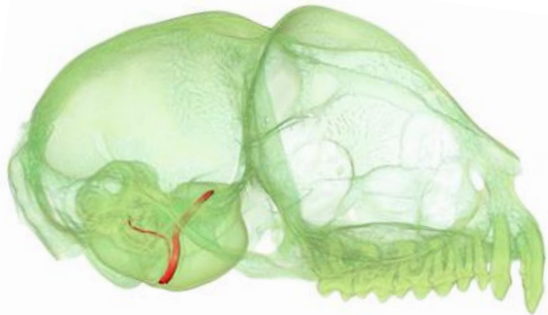
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Summary & Conclusions

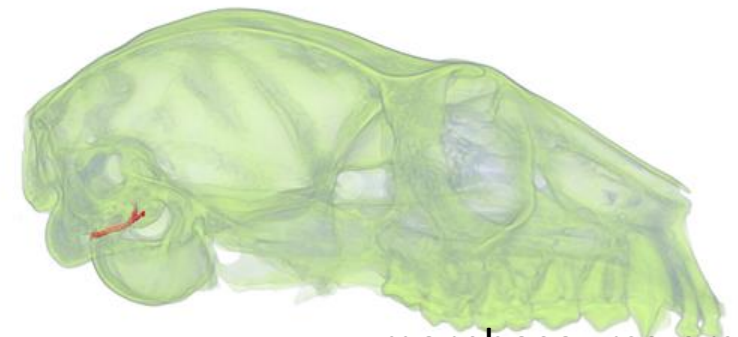
3D digital avatars of natural history collections can be rapidly accumulated and accessed by **anyone**

This is a potentially transformative tool for researchers and educators



We need your help!

- MorphoSource is a work-in-progress **we want to make it better**
- We need feedback from
 - Researchers
 - Curators
 - Teachers
 - Students
- We want partners
- Thanks for your help!





Acknowledgments



For invitation to speak and support to attend

- Claudia Grant & Bruce MacFadden

For support & funding of MorphoSource Development

- Duke University Trinity College of Arts & Sciences (major funder so far)
- NSF (BCS 1317525, BCS-1304045)
- Duke Shared Materials Instrumentation Facility
- Duke Biology IT Center

For discussion leading to development of concepts

- Jukka Jernvall, Alistair Evans, & Gudrun Evans

For work loading specimen media

- Workstudy students: Mercedes Zapata-Garcia, Shane Daly, Sunghoon Liu, Ksenia Sokolova, Anne Driscoll, Kevin Vo, Annie Lott.
- Dr. Lynn Copes & Dr. Kari Allen