Digital Fossils in the High School Classroom

Turning Promise Into Practice

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Webb School Youth's Discovery Of Skull 20 Million Years Old Wins Recognition of Scientists

Believed to be one of the outstanding scientific discoveries of the year, the finding of a fossilized pachycephalosaurus skull by 16-year-old Billy Webb last November near Barlow has placed the Webb School for Boys, north of Pomona, in the limelight of scientific attention, it was learned here today.

Discovery of this fossil supplies a definite link in the evolution of the pachycephalosaurus, the big family that has inhabited the Western hemisphere, scientists have revealed. Young Webb, in the son of Headmaster and Mrs. Thompson Webb.

Approximately 20 million years old is the age of the fossil. Dr. Chester Stock of the California Institute of Technology, who is regarded as the leading mammalian paleontologist in America, has stated, after a comprehensive study of the object, that it places it in the upper Miocene epoch of the tertiary period. The fossil is not only the connecting link in the evolution of that family, but it also gives a more detailed story of the geological and geographical conditions in the Great Basin during that period.

Hunted Fossils on Desert
Accompanied by Raymond M. Alf, biology and mathematics teacher at Webb school, Blood, Billy Webb was one of a party of school boys enjoying a weekend outing about Thanksgiving time on the desert.
Goals of Our Program

- Engage students in the scientific process
- Produce publishable science
- Advance goals of Alf Museum research and collections
- Serve broader scientific & general world
“Joe” the Hadrosaur
Ontogeny in the tube-crested dinosaur *Parasaurolophus* (Hadrosauridae) and heterochrony in hadrosaurids

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**ABSTRACT**

The tube-crested hadrosaurid dinosaur *Parasaurolophus* is remarkable for its unusual cranial ornamentation, but little is known about its growth and development, particularly relative to well-documented ontogenetic series for lambeosaurin hadrosaurids (such as *Corythosaurus*, *Lambeosaurus*, and *Hypacrosaurus*). The skull and skeleton of a juvenile *Parasaurolophus* from the late Campanian-aged (~75.5 Ma) Kaiparowits Formation of southern Utah, USA, represents the smallest and most complete specimen yet described for this taxon. The individual was approximately 2.5 m in body length (~25% maximum adult body length) at death, with a skull measuring 246 mm long and a femur 329 mm long. A histological section of the tibia shows well-vascularized, woven and parallel-fibered primary cortical bone typical of juvenile ornithopods. The histological section revealed no lines of arrested growth or annuli, suggesting the animal may have still been in its first year at the time of death. Impressions of the upper rhamphotheca are preserved in association with the skull, showing that the soft tissue component for the beak extended for some distance beyond the limits of the oral margin of the premaxilla. In marked contrast with the lengthy tube-like crest in adult *Parasaurolophus*, the crest of the juvenile specimen is low and hemispheric in profile, with an open premaxilla-nasal fontanelle. Unlike juvenile lambeosaurins, the nasal passages occupy nearly the entirety of the crest in juvenile *Parasaurolophus*. Furthermore, *Parasaurolophus* initiated development of the crest at less than 25% maximum skull size, contrasting with 50% of maximum skull size in hadrosaurids such as *Corythosaurus*. This early development may correspond with the larger and more derived form of the crest in *Parasaurolophus*, as well as the close relationship between the crest and the respiratory system. In general, ornithischian dinosaurs formed bony cranial ornamentation at a relatively younger age and smaller size than seen in extant birds. This may reflect, at least in part, that ornithischians probably reached sexual maturity prior to somatic maturity, whereas birds become reproductively mature after reaching adult size.

Subjects: Evolutionary Studies, Palaeontology, Zoology

Keywords: *Parasaurolophus*, Ontogeny, Hadrosauridae, Kaiparowits Formation, Cretaceous, Dinosauria, Lambeosaurinae, Ornithischia, Heterochrony
The New York Times

Science

npr

LA NACIÓN

Los Angeles Times
The Ideal

• Researcher scans fossil
• Researcher publishes scientific study, including information on how to access digital scans
• Members of public and scientific community download data, re-purpose for educational and other uses
  – “Shiny Digital Future”
The (Frequent) Reality

• Researcher scans fossil
• Researcher publishes scientific study
• Researcher’s institution produces press release on how the revolution in digital fossils is opening museum collections to the masses
• Data disappear
Why?

- Time factor
- Money factor
- Lack of infrastructure
- Concern about others using the data
  - “Getting scooped”
  - Licensing (and fossil “ownership”)
  - Commercialization concerns
The Coffee Table Treasury of Incomplete Jaws & Teeth

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Pining for petrosals? We got 'em! Hankering for hadrosaurs? Can do!

Hadrosaur radius (left) from Godefroit et al. 2012; sirenian petrosal (right) from Benoit et al. 2013; all CC-BY.
Doing Something!

- DigiMorph (www.digimorph.org)
- iDigBio (www.idigbio.org)
- MorphoSource (www.morphosource.org)
- African Fossils (www.africanfossils.org)
- Alf Museum (via figshare.com and morphosource.org)
This model shows the right side of the skeleton of "Joe" the baby Parasaurolophus. In this depiction, you can see the hind leg, much of the tail, the torso, neck, and part of the head. The original digital model was created using photogrammetry, a technique in which multiple photographs are used to reconstruct a three-dimensional surface. This technology is also used in crime scene reconstruction, engineering, and many other fields.

Having trouble viewing the model? This 3D viewer works best on Firefox, Chrome, and Safari (no Internet Explorer, sorry!). Many of the files are viewable as 3D PDFs (via Adobe Acrobat) for download from the journal article at PeerJ, including a 3D pdf of the skeleton. A table with links to all of the raw data hosted at Figshare (including printable STL files) is available at PeerJ.
Who has seen Joe?

- 25,000 visitors to Alf Museum
- 23,000 viewers of scientific paper
- 190,000 visits to www.dinosaurjoe.org
Research Lab
Mesohippus
Dinictis
Palaeolagus
Hesperocyon
Hyaenodon
Merycoidodon

Miniochoerus
Project 159


Members
Andrew Farke

Data
6 published media
7 specimens

About the project
This project contains surface scans of fossil vertebrates from the White River Group of North America, from the collections of the Raymond M. Alf Museum of Paleontology (Claremont, California, USA).

6 Project Specimens

Order by: Specimen number | Taxonomic name

- RAM-16025, Merycoidodon culbertsoni
- RAM-1684, Mesohippus sp.
- RAM-6236, Hesperocyon gregarius
- RAM-6648, Palaeolagus haydeni
Preliminary Uses
An Invitation

- What specimens can we digitize for you?
- Send an email!
  - afarke@webb.org
Thank you!

Special thanks to: US Bureau of Land Management, Grand Staircase-Escalante National Monument, students, faculty & staff of The Webb Schools, Doug Boyer & the MorphoSource crew; Claudia Grant, Bruce MacFadden & the workshop crew for the invitation; Tara Lepore & Rob Gay for great conversation & inspiration; iDigBio; myFOSSIL