# The Paleontograph

**A newsletter for those interested in all aspects of Paleontology**
**Volume 7 Issue 4 December, 2018**

## From Your Editor

Welcome to our latest edition. Happy Holidays to you all. As promised, here is this year's fourth issue. Wow, time really does fly. We are finishing up our seventh year of this version of The Paleontograph. I started out doing this newsletter in 1995 for the NJ Paleo Society. Some of you have been getting it since then.

As usual, Bob has given us a nice array of topics. In addition we have an article from another contributor. I am always looking for articles so feel free to submit one. There really are no rules other than it be paleo related.

Happy New Year!!

The Paleontograph was created in 2012 to continue what was originally the newsletter of The New Jersey Paleontological Society. The Paleontograph publishes articles, book reviews, personal accounts, and anything else that relates to Paleontology and fossils. Feel free to submit both technical and non-technical work. We try to appeal to a wide range of people interested in fossils. Articles about localities, specific types of fossils, fossil preparation, shows or events, museum displays, field trips, websites are all welcome.

This newsletter is meant to be one by and for the readers. Issues will come out when there is enough content to fill an issue. I encourage all to submit contributions. It will be interesting, informative and fun to read. It can become whatever the readers and contributors want it to be, so it will be a work in progress.   TC, January 2012

**Edited by Tom Caggiano and distributed at no charge**

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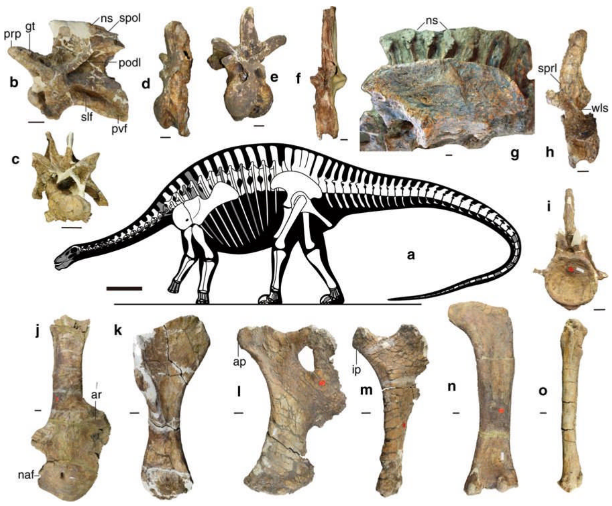
## Lingwulong—A Middle Jurassic Diplodocid from China

***Bob Sheridan July 26, 2018***

Sauropods were enormous herbivorous dinosaurs with long necks and tails. They lived as a group from the Late Triassic until the Late Cretaceous and were distributed world-wide, although they did not attain large sizes until the Jurassic. They came in many varieties varying in size, armor, structure of the bones, etc. Today's story is about the subgroup called the diplodocids. These are considered fairly advanced sauropods: very long neck and tail, long head with peg-like teeth in front, nostrils at the top of the head, heavily sculpted neck vertebrae, whip-like tails, etc.. Some famous examples of diplodocid genera: Diplodocus, Apatosaurus, Barosaurus, Dicraeosaurus. Most are from the Late Jurassic of North America (~145 Myr) and were discovered over 100 years ago (which is why they are so familiar to us), although Dicraeosaurus and some other diplodocids are from Africa.




Xu et al. (2018) describe a new sauropod *Lingwulong shenqi* ("amazing dragon from the Lingwu region") from the Middle Jurassic (~174 Myr) of China. Lingwulong is based on 7-10 fragmentary specimens. So far the following are known: partial skull including the braincase and teeth, a few dorsal and caudal vertebrae, sacrum, partial shoulder, partial fore and hind limbs. Given the known anatomy, it is almost certain that Lingwulong is a diplodocid, specifically related to Dicraeosaurus. Calculating its size is somewhat problematical because the remains are so fragmentary, but size estimates can be based on comparing the corresponding fragments of Lingwulong and sauropods of known length. The authors draw it as a fairly large: about 23 meters long, almost as long as Diplodocus.

The two most interesting things about Lingwulong is that it is the earliest known diplodocid ever, and that it is the only diplodocid known from East Asia. The first fact suggests that advanced sauropods existed as early as the Middle Jurassic and were widely distributed, being in both China and North America. The second fact is interesting because a number of reasons have been suggested as to why China had its own types of Jurassic dinosaurs, in particular no diplodocids among Chinese sauropods. For example, the East Asian Isolation Hypothesis posits that a seaway divided Central and East Asia from the rest of Laurasia during the Jurassic, such that diplodocids were unable to migrate in, and by the time a land bridge existed in the Early Cretaceous, the diplodocids were already extinct. The presence of a diplodocid in Middle Jurassic China makes that isolation scenario unlikely.

Sources:

Xu, X.; Upchurch, P.; Mannion, P.D.; Barrett, P.M.; Regaldo-Fernandez, O.R.; Mo, J.; Ma, J.; Liu, H. "A new middle Jurassic diplodocid suggests an earlier dispersal and diversification of sauropod dinosaurs."
Nature Comm. 2018. 9: 2700.

## Xiaophis—A Baby Snake in Amber

***Bob Sheridan August 4, 2018***

It is fairly rare to find vertebrate specimens in amber for the simple reason that most are large enough to extract themselves from tree sap before it hardens. However, vertebrates in amber are not totally unknown. For example, there are several specimens of anole lizards from Dominican amber. More recently, a number of specimens of amber containing feathers (one still attached to a "dinosaur tail") were described from Burmese amber.

Today's story is about two specimens from Burmese amber that appear to contain parts of snakes, as described by Xing et al. (2018). Burmese amber is from the mid-Cretaceous (~100 Myr.), and represents a forested environment.

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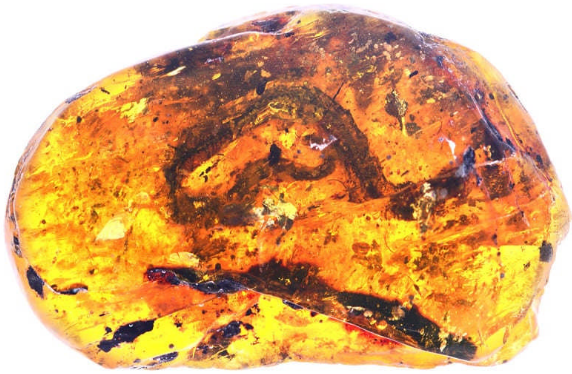


The first amber specimen (called DIP-S-0907) contains a very small (~48 mm long) almost complete (but headless) snake that the authors are calling Xiaophis myanmarensis ("dawn" + Xiao Jia, the person who donated the specimen + Myanmar, the current name for Burma). The classical way of studying amber inclusions is to cut and/or polish a flat surface onto the amber so that the inclusions can be studied using an optical microscope. Nowadays, it is also common to CT scan the amber as well. Most of the study on Xiaophis is based on CT scans of the bones. There is no sign of limbs, pelvis, or pectoral girdle, so the authors are confident Xiaophis is a true snake and not, say, a limbless lizard. The authors refer to the specimen as a neonate (newly hatched) because of its tiny size, and also because the details of the vertebrae resemble those of modern embryo or neonate snakes. The fact that Xiaophis resembles a modern baby snake suggests that the development of snake embryos was the same in the Cretaceous as now.

A separate amber specimen (called DIP-V-15104) contains a partial shed skin. The skin consists of diamond-shaped scales. While it is probably snake skin, from a snake larger than DIP-S-0907, it cannot be determined whether it is from the same species as Xiaophis.

Two things that can be inferred from the existence of Xiaophis:

1. Since what is now Myanmar was in Laurasia (the northern continent in the Cretaceous), and Xiaophis resembles fossil snakes from Gondwana (the southern continent), it seems that snakes had a world-wide distribution by the mid-Cretaceous.
2. Since Burmese amber is from a forested region, at least some mid-Cretaceous snakes could live in the forest. There has been no evidence of that type of lifestyle from previously known fossil snake specimens.

Sources:

Xing, L.; Caldwell, M.W.; Chen, R.; Nydam, R.L.; Palci, A.; Simoes, T.R.; McKellar, R.C.; Lee, M.S.Y.; Liu, Y.; Shi, H.; Wang, K.; Bai, M.
A mid-Cretaceious embryonic-to-neonate snake in amber from Myanmar.
Sci. Adv. 2018, 4: eaaat5042.

## Biggest Sauropod Foot?

***Bob Sheridan August 20, 2018***

Sauropods (huge long-necked, long-tailed dinosaurs) came in a variety of families. They were most diverse in the Late Jurassic and many are known from North America, particularly from the Morrison Formation in the American west. Today's story deals with Bobcat Pit, which is a quarry in the northeast corner of Wyoming at the extreme north of the Morrison Formation. Bobcat Pit has produced several types of sauropods: camarasaurids, diplodocids, and brachiosaurids. The particular finding under discussion here consists of several disarticulated ankle, foot and toe bones (the astralgus, several metatarsals, and several phalanges, including a claw) excavated at different times and up to several meters apart in the quarry. Maltese et al. (2018) propose that these bones, given several specimen numbers, represent the left foot of a single animal.

Although some of these specimens were found under disarticulated bones of a Camarasaurus, they are the wrong shape and too big for the Camarasaurus found in the quarry. In addition the foot bones of the Camarasaurus are already accounted for. Maltese et al. note that, because all the bones in question have an unusual texture of grooves on their articulated surfaces, they probably belong to the same individual animal.

So if not Camarasaurus, what kind of sauropod does this foot belong to? The authors note resemblance of the bones to those of Sonorasaurus (Middle Cretaceous, Arizona) and Giraffatitan (Late Jurassic, Africa), which are brachiosaurids. Brachiosaurids (named for the genus Brachiosaurus) are a family of sauropods, that are very large (up to 80 tons), have long arms and an upward angling neck.

**Cont'd**

Unfortunately, the foot bones of Brachiosaurus itself are unknown. (It is still a matter of controversy whether Brachiosaurus and Giraffatitan are separate genera.) If the identification of the foot as from a brachiosaurid is correct, this would be the northernmost example of a brachiosaurid in the Morrison Formation.

The metatarsals of this foot are somewhat larger than those of Girafatitan and Dreadnoughtus, which are already considered very large sauropods. The only genus that might come close in size is Turiasaurus (Late Jurassic, Spain). Thus, the foot described in Maltese et al. might represent the largest sauropod in the Late Jurassic. It cannot be argued yet that this foot represents the largest sauropod ever, since we do not have the foot bones of the very largest sauropods Argentinosaurus and Patagotitan (Cretaceous South America).

Sources:

Maltese, A.; Tschopp, E.; Holwerda, F.; Burnham, D. “The real bigfoot: a pes from Wyoming, USA is the largest sauropod pes ever reported and the northern-most occurrence of the brachiosaurids in the Upper Jurassic Morrison Formation.” PeerJ 2018, 5250.

## Cretoparacucujus, the Cretaceous Cycad-Pollinating Beetle

***Bob Sheridan August 24, 2018***

Burmese amber is from the mid-Cretaceous (~100 Myr.), and represents a forested environment. A paper by Cai et al. (2018) describes a new beetle specimen from Burmese amber which they call *Cretoparacucujus cycadophilus* (“cycad-loving Cretaceous Paracucujus”).

1mm scale bar

Since this story involves cycads, a small diversion. Cycads are a very ancient (perhaps going back as far as the Carboniferous, but certainly by the Permian) branch of gymnosperm plants with a straight unbranched trunk and pinnate leaves. (They superficially look like short palm trees.) Modern examples live mostly in the southern hemisphere or near the equator. Before the rise of angiosperms, cycads were a dominant form of plant life. Cycads have separate male and female plants and therefore their pollen must be transported some distance from the plant for reproduction to happen. For some time it was believed that cycads were wind pollinated, but now it is believed that most pollination is done by insects.

Now back to the amber specimen. Cretoparacucujus was studied in the classical way: cut and/or polish a flat surface onto the amber piece so that the inclusions can be observed using an optical microscope. This specimen of Cretoparacucujus is about 1.6 cm long. It has a large head with large compound eyes, sharp mandibles, and large maxillary palpi. Phylogenetic analysis shows that it is most closely related to Paracucujus, an extant beetle from Australia and New Zealand (hence the name given to the fossil beetle). Both extant and fossil beetles would belong to a family called “boganiids.” Beetles in this family have been identified as existing as long as the Middle Jurassic and modern examples are known to eat cycads and help pollinate them. Some of the extant ones have small notches at the base of their mandibles with hairs that accumulate pollen. Cretoparacucujus has similar mandibular notches.

The amber specimen contains a dozen clusters of pollen grains. (However, it must be pointed out that none of the pollen grains is touching the beetle.) Each individual grain is an ovoid about 20 micrometers long. (To my eyes they resemble roasted coffee beans.) To the authors these most resemble the pollen of a fossil cycad called Cycadopites that existed all through the Mesozoic.

Thus, we have a fossil beetle in a family that today pollinates cycads in association with cycad pollen. Therefore it appears this family of beetles pollinated cycads at least back to the mid-Cretaceous.
Sources:

Cai, C.; Escalone, H.E.; Li, L.; Yin, Z.; Huang, D.; Engel, M.S.
“Beetle pollination of cycads in the Mesozoic.”
Current Biology 2018, 28, 1-17.

## Eorhynchochelys —A New Triassic Stem Turtle with a Beak

***Bob Sheridan August 28, 2018***

If you go back a decade or so, a hot topic in paleontology was whether turtles represent “primitive” or “advanced” reptiles. Arguments for the “primitive” side came from the fact that turtles have no openings in their skulls aside from the orbit and nostril, like many early “anapsid” reptiles such as pareiasaurs. Arguments for the “advanced” side point to a genetic resemblance of turtles to later “diapsid” (with two additional holes in the skull) reptiles like lizards and snakes. The latter would argue that the turtle’s skull became convergent on the anapsid condition well after the origin of turtles. This question has not been completely resolved.

Trying to figure out which type of reptile is ancestral to turtles based on anatomy is very difficult because turtles are very unique among living (and most fossil) reptiles. First, they always have a toothless beak. Second, they are covered in a bony box, made of a “carapace” above and a “plastron” below, with the two fused at several points. The shoulder blades of turtles are inside their ribs, which is totally unlike any other tetrapod. Most modern turtles can withdraw their heads, and sometimes their limbs, inside the shell. Turtles also tend to have very short tails for reptiles.

As with many interesting fossil groups, modern-looking turtles seem to appear very suddenly in the fossil record, in this case in the Triassic. For example, Proganochelys (~214Myr.) has a full carapace and plastron and also has a toothless beak. The biggest difference from modern turtles is that it could not withdraw its head, and it had teeth on its palate. Otherwise, it looks like a heavily armored snapping turtle.

Every few years a new stem turtle is described, and these provide some clues about when turtles developed their characteristic features. I have read about at least three: Odontochelys (~220 Myr.), Eunotosaurus (~260 Myr.), and Pappochelys (~240 Myr). Odontochelys has a plastron, but not a fused carapace. It also has teeth on upper and lower jaws. Eunotosaurus resembles a lizard, but one with very broad and flat ribs that touch each other and reach far to either side of the body. However, it does have turtle-like vertebrae and details on the ribs look turtle-like. Until recently, it was debatable whether Eunotosaurus was a turtle ancestor, or an unrelated reptile that had converged on some turtle characteristics. Pappochelys has wide ribs above and thick gastralia below, but these are not fused into a carapace or plastron. The tail is long. The skull has teeth in the upper and lower jaw. Pappochelys appears to be an anatomical intermediate between Odontochelys and Eunotosaurus, One possible anomaly is that Pappochelys appears to have clearly diapsid skull, whereas Odontochelys and Eunotosaurus are generally regarded as having anapsid skulls.


Recently, Li et al. describe a new stem turtle *Eorhynchochelys simensis* (“dawn beak-turtle from China”) with is from the Falang Formation in southwestern China (~228 Myr.). The specimen is articulated and nearly complete. This animal would be 2.3 meters long including its (unturtle-like) long tail. Anatomically, Eorhynchochelys is a mosaic of the characters of primitive stem turtles and more advanced ones like Proganochelys. Neither a plastron or carapace is present, but its ribs are widened and reach out far from the midline of the body. The limbs of Eorhynchochelys are long and have robust joints, which suggest to the authors that it had a partly terrestrial lifestyle. The scapula is attached to the spine forward of the large ribs, as is seen in some other stem turtles. This is consistent with the expected intermediate state between having the scapula attached outside the ribcage (most vertebrates) and having the scapula inside the ribcage (modern turtles).

Eorhyncochelys has a very small head, but with a new combination of features for stem turtles. While most of the mouth has tiny conical teeth, the very front of the mouth has a toothless beak (hence the name).

Sources:

Li, C.; Fraser, N.C.; Rieppel, O.; Wu, X.-C.. “A triassic stem turtle with an edentulus beak.” Nature 2018, 560, 476-479.

## Falls of the Ohio State Park: The Epicenter of Geology Activities in 2019

***Alan Goldstein***, Interpretive Naturalist

The Falls of the Ohio State Park was created in 1990 to preserve and interpret the 390 million-year-old Devonian fossil beds on the floor and banks of the Ohio River. They are one of the first-known North American fossil localities, noted by the earliest explorers who navigated the Ohio River in canoe and flat boat. Native Peoples used the Falls extensively for hunting and fishing, as well as selectively collecting fossils, too.

In 2016, the park's Interpretive Center underwent a six-million-dollar renovation. Geology exhibits include a video wall showing a living Devonian sea, interactive components and new fossils on display. The origin of the Ohio River is revealed through a series of short video clips narrated by an expert. Our six-foot mammoth tusk has a new case. A half-million dollar UHD orientation movie was unveiled in September 2018. The park celebrates the museum's silver anniversary in 2019 with a special event January 26 & 27, and monthly programs the rest of the year focusing on new knowledge since 1994.

We are offering more geology programs to visitors, such as the **"Marine Life of Today and Yesterday" series**, with programs by marine biologist Dr. Dominique Hansen on the links of today's global climate change to issues like mass extinction, ocean geology, and coral reef significance. The series includes the on-going "Meet the Paleontologist" covering fossils in different geological periods, geological time, how fossils form, etc.

In an effort to revamp a local geology club, a series of **six geology programs** will be offered throughout 2019. Scheduled programs include Pennsylvanian plants, why people collect, fluorite, dinosaur discoveries, the Cambrian explosion, and the early Dutch-American collector, Gerard Troost.

August 24, 2019 will be our 24$^{th}$ year of celebrating geology and archaeology with **Digging the Past**. This event, sponsored by IMI, features hands-on activities in geology and archaeology, collecting piles, fossil bed hikes, food, and presentations on how to become an archaeologist and paleontologist.

October 19 – 21, 2019 **Paleontology Camp for Adults**. After years of offering a career camp for teens, we will have a paleontology camp for the post-high school crowd. Participants will learn about fossils, explore the fossil beds with a paleontologist, go fossil collecting and learn how to identify what you find. This immersive camp is for anyone 18 and over. Cost is $200. Contact the Falls of the Ohio State Park for details.

**For geology clubs** with a group reservation, we will offer a special behind the scenes tour and fossil lab at no extra cost. The Falls of the Ohio State Park is one of the few Indiana state parks with a collections store room. If scheduled when the staff is available, a group may tour the space and get a sneak peek at our fossils and other collections. Between May 1 and November 14, groups have the option of an indoor lab or a guided tour of the fossil beds. The expansive fossil beds are best seen from August – November, while the upper fossil beds are exposed most of the year, except when the Ohio River is higher than normal.

Clubs may dig in the collecting piles – and while collecting tools aren't permitted anywhere else in the park, they are allowed in the collecting piles. We plan to dramatically increase the size of the collecting piles with additions of fossil-rich Silurian Waldron Shale and subsoil with Devonian fossils from local quarries.

To schedule club field trip or request more details, contact Alan Goldstein, Interpretive Naturalist / Park Paleontologist – agoldstein@dnr.in.gov. Program details are available through Falls of the Ohio Foundation website - www.fallsoftheohio.org, the park's official Facebook page - www.facebook.com/fallsoftheohio, and the Indiana State Parks Falls of the Ohio state Park web page - https://www.in.gov/dnr/parklake/2984.htm.

Falls of the Ohio State Park Interpretive Center hours are 9 a.m. - 5 p.m., Monday-Saturday, and 1-5 p.m. Sunday. Admission is $9 age 12 & up, $7 age 5 to 7, under 5 is free. Parking is $2 per vehicle in the lot behind the museum. Group visit reservations are suggested, especially if you would like a guided program on the fossil beds (May 1 – November 15), river level permitting.

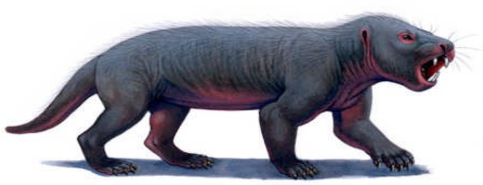
Falls of the Ohio State Park, 201 West Riverside Dr., Clarksville, IN 47129, (812) 280-9970, is located north of downtown Louisville, KY, and a mile west of I-65.

## Kayentatherium and Her Many Babies

***Bob Sheridan September 1, 2018***

Today's story involves Kayentatherium ("Kayenta Beast" after the Kayenta Formation). Remains of Kayentatherium are from the Early Jurassic of North America. This animal is a cynodont, an advanced synapsid that had some mammalian characteristics, for example hair and differentiated teeth, but was not a true mammal in that it retained more than one bone it its lower jaw and had a relatively small brain. Cynodonts are also known for having two dome-shaped bulges at the back of the skull. Kayentatherium is an example of a particularly advanced type of cynodont called tritylodontidae, which had interlocking teeth. Kayentatherium was about a meter long and very robust, with a deep skull and very large jaw.

There is much excitement this week about a new specimen of Kayentatherium from Arizona described by Hoffman and Rowe (2018). The bones of a partial adult skeleton are visible in a large field jacket about 0.7 meter wide. However, CT scanning of the field jacket reveals many other tiny bones under what would be under the adult's chest.



The tiny bones appear to be of very small individuals. While these bones are generally disarticulated, there are a 10 complete skulls and many post-cranial elements. The number of individuals is estimated (by counting the number of lower jaw bones) as at least 38. Given that the tiny bones are only partially ossified and the teeth show no wear and are all the same size, it is reasonable that these are baby Kayentatherium from the same clutch. The authors call them "perinates" because it cannot be determined whether they are unhatched embryos or hatchlings. There is no sign of egg shells, but stem mammals would not be expected to produce mineralized eggs like dinosaurs or birds.

Live birth can be ruled out since the largest litters of placental mammals are only about 12 individuals

The perinate skulls are 1/20 the size of an adult skull, the smallest relative size of juveniles to adults previously known for stem mammals. Among modern reptiles and placental mammals, the ratio of the total weight of the babies per clutch/litter compared to the weight of an adult is more or less constant, and Kayentatherium appears to follow this expectation. However, Kayentatherium is producing many small babies, as is typical of reptiles, instead of a few large babies, as typical of mammals.

Another interesting aspect is that the perinate skulls have the same proportions as adult skulls. This is unlike mammals (and some reptiles) where the snout of juveniles are relatively short. However, the parts of the skull associated with the size of the jaw muscles (the width of the zygomatic arch, the length of the coronoid process, etc.) are relatively smaller in the perinates than in the adult.

The perinates have at least some of their teeth, specifically incisors and two molars. The authors devote a great deal of discussion to how this reflects on the development of interlocking teeth in cynodonts.

The authors note that Kayentatherium demonstrates a relationship between a small brain and a large litter, and note that true mammals have larger brains than cynodonts and small litters. However, this must be speculative because we know very few other examples of litters from other stem mammals.

Sources:

Hoffman, E.A.; Rowe, T.R.
"Jurassic stem-mammal perinates and the origin of mammalian reproduction and growth."
Nature 2018, 561: 104-108.

## Clues that Ediacaran Fauna are Animals.

***Bob Sheridan September 21, 2018***

Ediacaran fauna (named for the Ediacara Hills in Australia where they were first identified) are a group of Precambrian fossil organisms that lived world-wide 600-545 Myr. Most of the fossils are only sediment-filled impressions in rock, and had no hard parts. Most appear to have very simple symmetrical structures, resembling "fronds", "air-mattresses", "spirals", etc. A few have more complex structures, but these appear fractal in nature, i.e. tubular branches coming off larger branches, which come from even larger branches. Linking the Ediacaran fauna to any type of later organism by anatomy has been very difficult so far. There have been a number of suggestions as to their identity: early forms of animals seen later in the Cambrian, a form of animal life no longer living, giant protozoa, lichens, algal mats, etc.. Of course, the Ediacaran fauna are diverse in form and it is possible that some are algal mats and some are true animals. Given only a shape (and probably a shape completely flattened during fossilization), it is hard to tell.

Two very recent papers suggest links between Ediacaran fauna and later animals. The first is from Hoyal Cuthill et al. (2018). This paper compares a number of Ediacaran genera to Stromatoveris from the Lower Cambrian in China. Stromatoveris (up to 10 cm long) is a "petalonamid" , i.e. it superficially resembles modern "sea pens" in that there is a short cylindrical "stalk" (assumed to be a "holdfast") topped by a bilaterally symmetric blade. In the case of Stromatoveris, the blade is made of parallel tubes running out from the axis of symmetric. Each tube appears to be a twisted braid of smaller tubes. That is, there is a fractal nature to Stromatoveris.

The major thesis of Hoyal Cuthill et al. is that in a phylogenetic analysis, Stromatoveris nests closely with several frond-like Ediacaran genera such as Rangea, Pteridinium, and Ernietta. Given that other Cambrian petalomamids have anatomic resemblance to living phyla it could be argued that at least some Ediacaran genera are therefore "animals." However, it is hard to eliminate the possibility that Stromatoveris is a non-animal survivor from the Precambrian, or that the resemblance in fractal structure between Stromatoveris and Rangea is converegent.

Another approach to the identity of Ediacaran fauna is a chemical analysis of Dickinsonia and Andiva by Bobrovskiy et al. (2018). Dickinsonia is a flat bilaterally symmetric oval (up to 1.4 meters long) with ribs perpendicular to its longest axis. Andiva is a similar organism, but more egg-shaped than oval and much smaller. The particular specimens under study in here are from Russia.

Chemical analysis of such fossils is possible because, even though the original body of a fossil organism is gone, it may leave behind a thin film of organic residue. One can sometimes pick out individual compounds from this film by mass spectroscopy or gas chromatography. Here the authors are looking for steranes. Most eukaryotes use steroids (cholesterol-like molecules) for various functions, and these degrade anaerobically into steranes. The interesting thing is that different groups of organisms produce different steroids (which differ in the number of carbon atoms) in different ratios, and therefore the presence of certain steranes in fossils can be used to diagnose the group to which the fossil belongs. Three classes of steroids under discussion are cholesteroids (C27), ergosteroids (C28), and stigmasteroids (C29). Green algae produce mostly stigmasteroids. Fungi produce mostly ergosteroids. Animals other than sponges and some molluscs produce mostly cholesteroids. The Dickinsonia fossil contains almost exclusively cholesteroids, while the sediment around the fossil contains almost exclusively stigmasteroids. Presumably any contamination of the fossil would be seen in the sediment and therefore the presumption is that the cholesteroids in the fossils are from the organism itself.

The Andiva results are less clearly different from the sediment, but the authors feel that the Andiva steranes are mostly cholesteroids. This suggests an animal affinity for Ediacaran fossils, at least those that resemble Dickinsonia. Lichen and algae affinity for Dickinsonia appears to be ruled out.

Sources:

Bobrovskiy, I.; Hope, J.M.; Ivansov, A.; Nettershelm, B.J.; Hallmann, C.; Brocks, J.J.
"Ancient steroids establish the Ediacaran fossil Dickinsonia as one of the earliest animals."
Science 2018, 361, 1246-1249.

Hoyal Cuthill, J.F.; Han, J.
"Cambrian etalonamid Strmatoveris phylogenetically links Ediacaran biota to later animals."
Paleontology 2018, 1-11.

Summons, R.E.; Erwin, D.E.
"Chemical clues to the earliest animal fossils."
Science 2018, 361, 1198-1199.

## Piranhamesodon

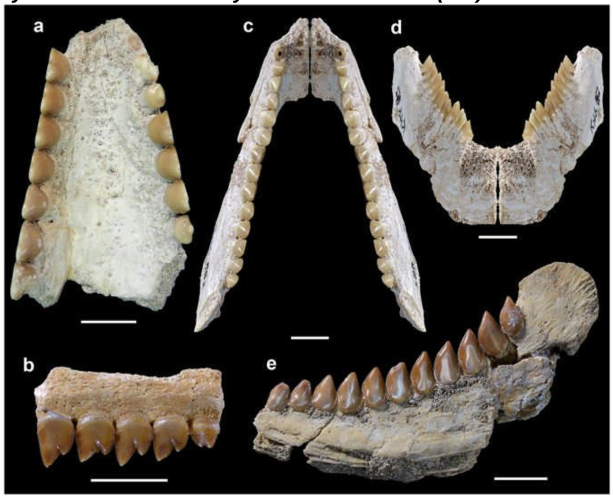
***Bob Sheridan October 28, 2018***

Pycnodontiforms are a group of fossil fish that lived from the Late Triassic to the Eocene, and appear to be world-wide in distribution. They are nearly circular in profile as seen from the side and laterally compressed. They all have short jaws and flattened teeth, presumably suitable for crushing coral or molluscs. Modern tangs and triggerfish seem good analogs for the shape, although these fish are not related.

Kolbol-Ebert et al. describe a new pycnodontiform from the Plattenkalk quarry in Bavaria, which is Late Jurassic in age. The specimen (JME-ETT4103) was excavated in 2016. In life it would be about six inches long. The most unusual aspect of this specimen is its teeth. Instead of having the flat crushing teeth expected for pycnodontiforms, it has dagger-shaped serrated teeth with conical bases. The teeth resemble that of the modern piranha, hence the new species name *Piranhamesodon pinnatomus* ("Piranha-like Mesodon: fin cutter", where Mesodon is a genus of pycnodontiforms).

***These are typical crushing type Pycnodont fish teeth (Ed.)***

***These are pictures of jaws from a different Cretaceous Pycnodont fish recently found in Morocco (Ed.)***




Much of this paper describes the jaw length and the theoretical jaw strength of Piranhamesodon, comparing it to other fish. We would expect pycnodontiforms to have short strong jaws that can apply a large crushing force, while most carnivorous fish tend to have longer weaker jaws that can swallow prey whole. The jaws of Piranhamesodon seem more consistent with other pycnodontiforms. Piranhas also have short, strong jaws, unlike most carnivorous fish. The inference is that Piranhamesodon converged on the lifestyle of modern piranhas and took small bites out of the bodies and fins of its prey. The authors note that other some other fossil fish specimens from the same deposits show fin injuries. The authors speculate that resembling other (harmless) pycnodontiforms helped Piranhamesodon get close to unsuspecting fish; this is known as "aggressive mimicry."

Piranhamesodon is the earliest known ray-finned fish that is an obvious carnivore.

Sources:

Kolbol-Ebert, M.; Ebert, M.; Bellwood, D.R.; Schulbert, C.
"A Piranha-like Pycnodontiform fish from the Late Jurassic."
Current Biol. 2018, 28, 1-6.

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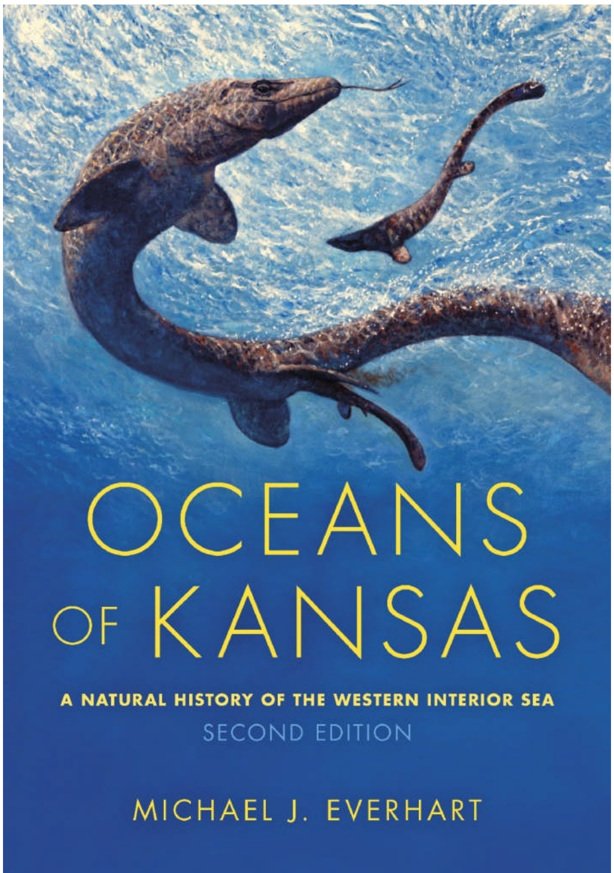


The 2nd Edition of _Oceans of Kansas – A Natural History of the Western Interior Sea_ will be available from Indiana University Press on September 11, 2017. The digital version is already available from Amazon. The second edition is updated with new information on fossil discoveries and additional background on the history of paleontology in Kansas. The book has 427 pages, over 200 color photos of fossils by the author (including Tom Caggiano's dinosaur bones in hand shot), is printed on acid free paper, and weighs in at a hefty 3.6 pounds.

A review from *Copeia*....

"Oceans of Kansas remains the best and only book of its type currently available. Everhart's treatment of extinct marine reptiles synthesizes source materials far more readably than any other recent, nontechnical book-length study of the subject."
—Copeia

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