The Paleontograph

A newsletter for those interested in all aspects of Paleontology
Volume 2 Issue 1 January, 2013

From Your Editor

Happy New Year and welcome to our first issue of the New Year. For those of you that live in the Northeast, I hope you survived Superstorm Sandy. I survived it but not without a lot of headaches. I had a fifty foot oak tree fall on my roof and into my living room. All is now back to normal so we can get back to putting out newsletters. I hope you all missed me.

I'm excited to be leaving for the show in Tucson in a few weeks. It is one of my favorite trips each year. I meet up with some longtime friends and look at fossils all day. What could be better?

We made it through our first year of The Paleontograph, putting out nine issues and more than doubling the number of people getting the newsletter. I would like to see more of you writing. I always get a note or two following an issue so I know you are out there reading it and enjoying it. Like it says in the box below, issues will come out when I have enough material to fill an issue. This short version uses up the last of the articles I have, so you won't see another issue unless I get some articles. Bob has been busy with some personal stuff and has slowed the pace of his writing and that is OK as this was never meant to be a newsletter with one contributor. But with him slowing up, others must pick up the slack.

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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Silurian Animals from Herefordshire

Bob Sheridan October 6, 2012

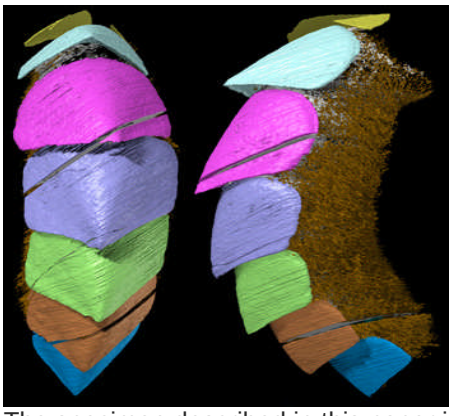
This week I came across two papers from the same laboratory on animals from the Herefordshire Lagerstatte (in England). This formation, mid-Silurian in age, contains volcanic ash and mudstone and often preserves soft-bodied animals in three dimensions. The technique used in these papers is "physical-optimal tomography." That is, one has a rock with the specimen(s) embedded in it. One grinds one side flat and takes a digital photograph. One then grinds off 30 micrometers of rock and takes another photograph, etc. Once the entire specimen of interest is entirely ground away, one stacks the outline of the animal(s) from all the photographs to make a three-dimensional "virtual fossil."

The first paper (Briggs et al., 2012) describes an early horseshoe crab named *Dibasterium durgae* ("mysterious two-legs" + Durga, the Hindu goddess with many arms). Here we need a short digression to discuss horseshoe crabs, which are more closely related to spiders than crustaceans. The modern horseshoe crab genus Limulus has a very wide head shield (prosoma) with a posterior curve, a single abdominal segment (opisthosoma), and a long spike-like tail (telson). Large compound eyes are at the top of the prosoma. Limulus has five pairs of walking legs in the prosoma, the first four of which have claws at the end. Each leg is "uniramous", that is, it consists of a single line of segments. This is in contrast to being "biramous", a condition in many arthropods where the legs split near the base into two segments: the endopodite and the expodite (toward and away from the midline of the body). The opisthosoma of Limulus contains "book gills."

It is usually thought that modern horseshoe crabs are very similar to their ancient ancestors, but in this case it is not particularly true. Dibasterium is very small (a few centimeters long) and more elongated in shape than Limulus. It has a prosoma that is only about a third of its total length, has 10 or so abdominal segments, and a short telson. (My impression is a cross between a horseshoe crab and a pill bug.) There is no evidence of eyes. Dibasterium has the gills in the first five abdominal segments. The most important aspect is that the legs of Dibasterium are biramous, with the branches being of equal size and both branches ending in claws, giving the impression that there are very many legs underneath this animal. Somewhere in evolution a whole set of limb segments has been lost. The authors speculate about what genes might be involved in that loss.

The second paper (Sutton et al., 2012) describes and ancestral chiton. Chitons are marine molluscs of the class polyplacophora. They are flattened ovals with eight overlapping plates on the dorsal side. The shell plates are surrounded by the "girdle." The plates can be smooth or sculpted, and the girdle may be smooth or ornamented.

Kulindroplax perissokomos



The specimen described in this paper is named *Kulindroplax perissokomos* ("cylinder plate, exceedingly hairy"). It is about 4 cm long, has an elongated body and is covered with seven smooth overlapping plates. The girdle is covered with blade-like spicules. The authors feel the elongated body of Kulindroplax links it to the aplacophora, molluscs with thick worm-like bodies and no shell, while the plates are characteristics of polyplacophorans. It has not been clear whether the polypolacophorans or the aplacophorans came first. Phylogenetic analysis puts Kulindroplax and other fossil molluscs near crown-group aplacophora, while fossil and modern polyplacophora are more basal. This suggests the polyplacophora came first and aplacophora lost their shells secondarily, with something like Kulindroplax as the intermediate stage.

Sources:

Briggs, D.E.G.; Siveter, D. J.; Siveter, D.J.; Sutton, M.D.; Garwood, R.J.; Legg, D.
"Silurian horseshoe crab illuminates the evolution of arthropod limbs."
Proc. Natl. Acad. Sci. USA 2012, 109, 15702-15705.

Sutton, M.D.; Briggs, D.E.G.; Siveter, D.J.; Siveter, D.J.; Sigwart, J.D.
"A Silurian armoured aplacophoran and implications for molluscan phylogeny."
Nature 2012, 490, 94-97.

Goniopholis, A Mesozoic Crocodilian

Kenneth Quinn

Goniopholis was a predecessor of modern crocodiles and alligators, fairly close to being a direct ancestor; fossils of this genus have been found in Jurassic and early Cretaceous sediments in North America and Eurasia. Eight species have been named so far, including one named for Rudyard Kipling! It has been described as semi-aquatic, which of course is the same as most modern crocodilians.

My own encounter with this genus occurred in the mid 1970s while I was working for the Arkansas Geological Commission. Another geologist on the staff had visited a gypsum mine near Brier and had recovered some bones from what is now called the DeQueen Limestone, which is in the Trinity Group (Comanchian, early Cretaceous). I was the *de facto* paleontologist, being the only one on the staff with experience in that field at that time. After piecing together the bones, I had an essentially complete skull that was obviously crocodilian and just as obviously in need of study by someone more qualified than me. A bit of research turned up the information that Wann Langston, Jr. at the University of Texas was the expert on such creatures. I got in touch with him and was invited to bring the skull down. When I did so and he opened up the box, his identification was literally instantaneous! He proclaimed it the best of the four specimens of *Goniopholis* that had been so far found in North America. I left the skull with him, but he provided a cast to the Commission, and it appeared on the cover of Geotimes several years later. I am not aware of any publications that mention that particular skull, with that exception!

Goniopholis was part of the prehistoric animal US Postage Stamp series.

Before traveling to Austin, I went to the gypsum mine to see if I could find any other bones, but found none; this is typical of vertebrate fossils, it is very rare to find more than one or at the most a very few associated bones - a complete skeleton is very rare. The sediment at the spot where the skull was found was marl, with a lot of carbonized plant material. This fits in with the semi-aquatic habitat that this reptile is said to have preferred.

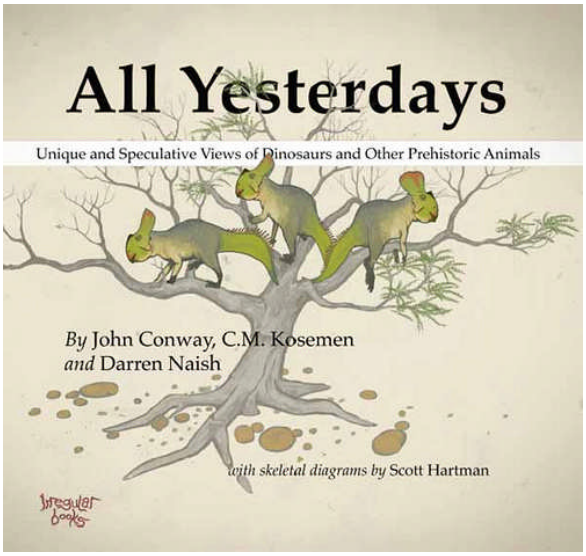
A poor quality photo of another Goniopholis skull.

The DeQueen yielded another remarkable vertebrate while I was at the Commission - an essentially complete skeleton of a fish related to the modern bowfin, preserved on a slab of limestone. This came from another gypsum mine. I regret that I did not have more opportunity to "prospect" that formation!

All Yesterdays--A Review

Bob Sheridan January 5, 2012

Given only the skeleton of a peacock, could anyone guess that it had an enormous tail for the purposes of sexual display? Given only the skeleton of a dog, could one guess the animal lived mostly in the company of a type of advanced primate (humans). Would we know about the long ears of rabbits or the extra-long penises of ducks? The implication such questions is that paleoart (i.e. depicting fossil remains as living animals) depends very heavily on guesswork/speculation and is very likely to get things wrong, mostly because skeletons and soft tissue are not very tightly correlated. Also behavior is almost unpredictable from either hard or soft parts. This is the theme of a new book "All Yesterdays" by paleontologist Darren Naish and three artists: John Conway, C.M. Koseman, and Scott Hartman. This is not a straight science book, but one of those exercises that uses plausible speculation to challenge the way you think about certain topics. (My previous favorite is "After Man. A Zoology of the Future" from 1981.)



The first part of the book, with a little bit of humor, challenges current restorations of dinosaurs by offering alternatives. One particular paleoart paradigm that is criticized here is "shrink wrapping." That is, assuming dinosaurs (or any other type of animal) are so sleek there is not any more flesh on them than can just cover the skeleton. Even Charles R. Knight sometimes went too far in that direction, making dinosaur thighs much too narrow from front to back given the size of the pelvis. Artistic cliques are another issue. Since a Tenontosaurus was found with the remains of several Deinonychus, poor Tenontosaurus has been consistently depicted as under attack. The authors provide about 20 additional alternative restorations. My favorite is the idea that elasmosaur (long-necked marine plesiosaurs) males could compete with each other by holding their necks straight up from the water; a very difficult feat, but not very much harder than some competitive games modern mammals play. The authors point out that Majungasaurus, a short-snouted theropod from Madagascar (relative of Carnotaurus), has an extremely long body, very short legs, and extremely tiny arms. How this animal could run after prey is not clear; instead it might have lain on the grown and pretended to be a log until prey got close enough. The cutest example (which is on the cover) is Protoceratops "climbing trees because they can." This is pretty far-out stuff, but when you think about it, you realize these speculations cannot be ruled out from what we know about the fossil animals, and are not so implausible given what we know about the bizarre behavior of living animals.

The second part of the book guesses how extraterrestrial paleontologists would restore modern animals, given the same limitations we have with fossil animals. Here the authors provide about a dozen examples. My favorite is the rhinoceros, depicted with a low skull lacking a horn (which you will remember is not made of bone, but compressed hair). On the other hand, the tall spines on its back are shown as forming a sail for thermoregulation. Also we have the elephant with its bulbous nasal sac. (No could imagine a "trunk" without having already seen one.) The freakiest example is the cat restored as a scaly, shrink wrapped mammal-like reptile. On the other hand, we have the iguana restored with long fur because "many vertebrates are preserved with hair."

The illustrations are simple, sometimes quasi-sketchy, but are beautifully done and perfect for the subject matter.

The only thing bad I can say is that the price is a little high ($35 even at Amazon) for a small paperback. The Kindle version is $8.

Sources:

Conway, J.; Koseman, C.M.; Naish, D.; Hartman, S. "All Yesterdays. Unique and Speculative Views of Dinosaurs and Other Prehistoric Animals." Irregular books, Lexington, KY, 2012, 99 pages, $35 (paperback).

Feathers on Ornithomimids and the Origin of Wings

Bob Sheridan October 29, 2012

Theropod dinosaurs, including those that are not particularly related to birds, can have a variety of feather types, anything from down-like "fuzz" to extremely modern-looking flight feathers with shafts and vanes. Heretofore, dinosaurs with preserved feathers have come from Solnhofen Germany and China, sites where the sediment is fine-grained limestone. There are many dinosaurs with long feathers on their arms, even where such arms are much too small to be "wings," so leaving aside the possibility that these animals are secondarily flightless birds, it is probable that feathers developed for some reason other than flight.

Ornithomimids are the "ostrich-like" dinosaurs, theropods that are unusual in that they have long necks and toothless beaks. This week in Science Zelenitsky et al. (2012) describe three partial skeletons of Ornithomimus from Late Cretaceous sandstone deposits of Alberta, Canada.
One skeleton is from a young juvenile (~1 yr. old), and the other two incomplete adults. In the juvenile there are long (50mm) filamentous feather preserved as carbonized traces near its arms and body. One adult specimen (missing the arms) also shows carbonized traces of filamentous feathers. The other adult specimen shows dark marks on the radius and ulna (each mark is up to 6.5 mm long and 1.5 mm wide). The orientation of these marks resembles the insertion pattern of covert feathers in modern bird wings. However, no explicit traces of feathers are seen in that specimen.

The interpretation of the authors is that juvenile and adult Ornithomimus had different types of feathers on their arms, down-like in the young, but elongated feathers in the adult. The next step would be to suppose the feathers had to be secondary sexual characteristics, and therefore they were used for some reproductive function like courtship, display, and brooding. The restoration of Ornithomimus in the paper has the animal displaying its feathers very much in the pose of a modern ostrich in a courtship display. This interpretation supports the idea that feathers evolved for something other than flight.

We have seen in an earlier paper by Xu et al. (2010) that a dinosaur, in that case an oviraptor called Similcaudipteryx, could have different feather types depending on its age, so it is certainly plausible that the same could be true of Ornithomimus. The only note of caution is that the marks on the radius and ulna of one adult are the only evidence of elongated feathers in Ornithomimus, and that evidence is not as persuasive as seeing the feather traces that were in the other specimens.

However, we do need to note two novel aspects here:

1. This is the first evidence for feathers in an ornithomimid.
2. This is the first time feather traces have been seen in anything other than fine-grained limestone.

Sources:

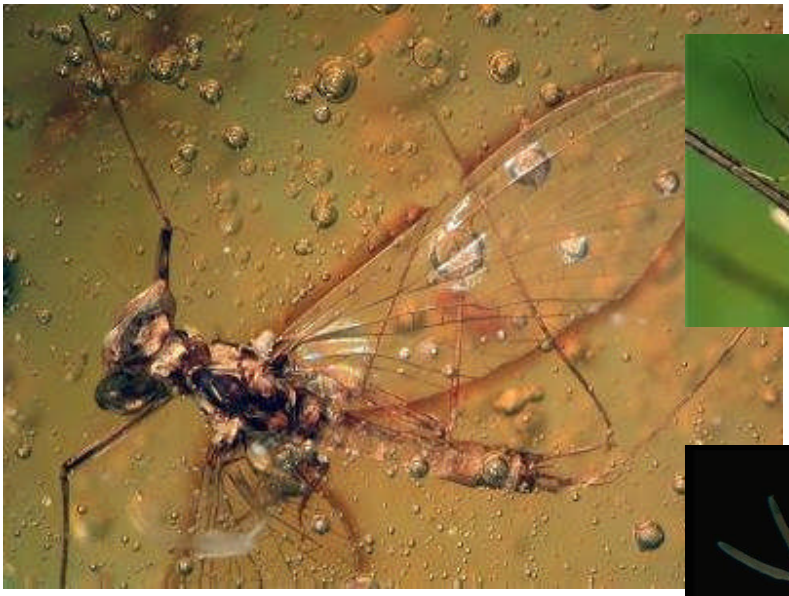
Xu, X.; Zheng, X.; You, H.
“Exceptional dinosaur feathers show ontogenetic development of early feathers.”
Nature 2010, 464, 1338-1341.

Zelenitsky, D.K.; Therrien, F.; Erickson, G.M.; DeBuhr, C.L.; Kobayashi, Y.; Eberth, D.A.; Hadfeld, F.
"Feathered non-avian dinosaurs from North America provide insight into wing origins."
Science 2012, 338, 510-514.

Unexpected Phoretic Behavior Preserved in Amber

Bob Sheridan November 5, 2012

"Phoresis" describes a symbiotic relationship between animals such that one is transported by another. Phoresis is observed among many living arthropods, and also in fossil arthropods preserved in amber. Many of these involve mites clinging to insects.



A Modern Mayfly above and a modern springtail below.

A recent paper by Penney et al. (2012) describes an amber specimen that shows phoresis between mayflies and springtails. Phoresis has not been observed between living insects in those classes. The amber specimen is from the La Bucara mine in the Dominican Republic, and is Miocene in age. The specimen was studied by x-ray tomography and light microscopy. A male winged Borinquena (a mayfly) a few centimeters long is preserved in the amber. A very small (200um) springtail (Sphyrotheca) is seen very close to the base of the Boringuena's wing, hooked by its antennae.

Springtails are often seen in amber clinging to other insects by their antennae. On the other hand, phoresis has not been observed in mayflies, living or fossil. Mayflies live for a year or more as aquatic larvae, and then metamorphose into adults, which live only to mate and die, usually within a day or two. They usually do not travel long distances, so it is unexpected that they would be the host for phoresis. The authors suggest, however, that since the fossil insects and their living relatives are so similar, it would be worth looking for phoresis in living examples of mayfly.

Sources:

Penney, D.; McNeil, A.; Green, D.I.; Bradley, R.S.; Jepson, J.E.; Withers, P.J.; Preziosi, R.F. "Ancient ephemeroptera-collembola symbiosis fossilized in amber predicts contemporary phoretic associations."
PLoS ONE 2012, 7, e47651