The Paleontograph

A newsletter for those interested in all aspects of Paleontology
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From Your Editor

Welcome to our latest edition. I hope all is well with you and that winter has not been too hard on you. The weather is getting crazier and no longer what we used to consider 'normal". Hopefully none of you were impacted by one of the hurricanes or one of the larger than life blizzards.

Weather here is crazy also. Sunday, I was walking around in a t-shirt and we had about six inches of snow on Monday. Pretty weird.

I went to Tucson for the show but failed to see anything earth shattering, at least in my mind. I am now getting ready to do the Edison, NJ show in early April. If you live nearby, please stop in and say hello. The show has some nice exhibits planned including the "Titanoboa: Monster Snake" from the Smithsonian. At 48 feet, that alone is worth the trip. My booth is Lost World Fossils near the main entrance.

As usual, Bob has served up a varied and well written selection of articles.

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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The Ends of the World --A Review

Bob Sheridan August 11, 2017

Our topic for today is mass extinction. Even early in the history of geology it was noticed that entire groups of organism disappeared from the fossil record and were replaced by others. In the early 1980s Jack Sepkowski and David Raup compiled a database of marine organisms as a function of time from the Cambrian to the Present. (Marine animals are useful because their fossils are so abundant and more likely to be preserved than those of land animals.) It quickly became apparent that the number of marine animal families dropped suddenly (at time scales of less than a few million years) at specific points in history. The five worst extinctions are called “The Big Five”:

1. End-Ordovician (450-440 Myr.)
2. Late Devonian (375-360 Myr.)
3. End-Permian (252 Myr.)
4. End-Triassic (201 Myr.)
5. End-Cretaceous (also called the K-T extinction) 65 Myr.

Although the mass extinctions were based on data from marine organisms, land animals were also affected at the same times. Note the ranges in years do not necessarily imply that the extinctions themselves took place over millions of years, only that there is uncertainty in dating them.

It was also in the 1980s that the “Alvarez hypothesis” was accumulating enough evidence to convert a number of paleontologists to the idea that the K-T extinction was caused by a large bolide striking the Earth. (“Bolide” is what you say when you don’t want to specify whether the impactor was a comet or asteroid.) There was a lot of debate at the time whether mass extinctions were sudden or slow, whether was a periodicity to them, whether they could all be explained by terrestrial or extraterrestrial causes, etc. Those topics are still a matter of controversy, even though there is much more data now than then. One big result from that time is that the “blame” for extinction was shifted from the “unfitness” of individual organisms to the fact that the whole Earth, at widely spaced intervals, becomes hostile to the life. Another result is that Uniformitarianism in geology, the doctrine that all processes proceed with the same intensity as we can observe today, was thoroughly discredited. Sometimes really big destructive events happen. Fortunately the big ones are infrequent, much too rare to be observed in a human lifetime, but almost certain to occur on a scale of tens of millions of years.

There is no end of “fringe” mechanisms proposed for extinctions, but only a handful are testable:
1. Climate change. Since the temperature of the oceans can be measured from the isotope ratios in the shells of sea creatures, we can date large changes in climate and relate them to extinctions. Climate is controlled by a number of factors: brightness of the sun (which has slowly increased), concentration of greenhouse gasses, reflectivity of the Earth, etc. We also know today that climate tends not to be stable but is subject to a number of positive feedback loops, which means climate can swing wildly (e.g. balmy to an ice age or vice versa) in as short a time as a few decades.
2. Continental drift. Land masses have come together and broken apart during the Earth’s history. This changes the reflectivity of the Earth, the total area of continental shelves, the circulation of the oceans, etc., which affects climate. Unfortunately, determining the position of a continent during a particular time is not easy.
3. Volcanoes. We have seen smallish eruptions like Mt. St. Helens during our lifetime. However, in Earth history there have been eruptions big enough to cover areas of millions of square kilometers in lava several kilometers deep. The fact that the evidence for these large eruptions is easy to find and date by geologists no doubt contributes to their usefulness in explaining extinctions. Also, what a volcano emits determines the effect it has on global climate. Ash and sulfur dioxide tend to block sunlight and cool the climate. Carbon dioxide, a greenhouse gas, tends to warm the climate. Space rocks. 4. Obviously one of these hitting a planet releases a lot of energy. There are lots of rocks around capable of hitting the earth and a small fraction of them are big enough to do severe damage. Impact craters can be dated fairly well and related to times of extinction.
5. Living organisms doing something toxic on a scale that kills many other organisms. The first example of this is photosynthetic algae producing so much oxygen in the Precambrian that anaerobic organisms could not survive. It could be argued that humans fall under this category.

Interestingly, almost exactly ten years ago I wrote an article for The Paleontograph noting that our ideas about causes for mass extinctions may be politically influenced.

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The End Cont'd

In the 1980's (when Ronald Reagan seemed to support the idea of a limited nuclear war), Carl Sagan linked a potential "nuclear winter" with the effect of the bolide strike at the end of the Cretaceous, and in later decades our current worries about "global warming" were linked to times in the past when there was a maximum "greenhouse effect" on Earth. This is not to say nuclear winter or global warming aren't real concerns, just that we may put extra credence in hypotheses for mass extinction that are projections of our current anxieties.

Popular books on the phenomenon of mass extinctions hit a peak in the 1990s. Most were K-T centric and emphasized bolide strikes as a cause, obviously because this is a very dramatic and "cinematic" idea. Among the most popular were "Extinction: Bad Genes or Bad Luck" (David Raup, 1991) and "T. rex and the Crater of Doom" (Walter Alvarez, 1997). More recent books concentrated on the End-Permian extinction, where the extinction was much more severe, but the cause not so clear-cut. Examples are: "When Life Nearly Died" (Michael Benton, 2005) and "Under a Green Sky" (Peter Ward, 2007).

Now we come to the most very recent book on mass extinctions "The Ends of the World" by Peter Brannen. Brannen is a science journalist and this is his first book. As we might expect from a journalist, face-to-face interviews from the major scientific players feature prominently. Through these interviews we learn the current thinking about a particular mass extinction and how the current thinking got that way. In this sense, TEOTW it is much more like a book-length article in a popular science magazine like "Discover" than a scientific review written for a large audience. There is an advantage to this. Unlike authors who are also players in a particular field, a journalist can present many different points of view and less likely to be biased by his or her own work.

Here are the Big Five as discussed in TEOTW:

End-Ordovician

This is entirely a marine extinction, because marine fossils are the only ones we know from this time. Currently, the most likely culprit seems to be a climate change: the Appalachian mountains rose at that time, weathering of those mountains sequestered carbon dioxide from the atmosphere, this caused a severe global ice age, and sea levels fell about 300 feet. Given that most life existed in shallow seas, an extinction was inevitable. For some reason "gamma ray burst" was proposed by astronomers at the University of Kansas in 2003. A gamma ray burst is a jet of radiation produced from a nearby star collapsing into a black hole. While this is physically possible, there is no geological evidence for it whatever.

Late Devonian

There were at least three separate pulses of extinction at the end of the Devonian. Placoderm armored fish are the most famous of the lost marine animals. There are several geological events close in time to those extinctions and it is hard to assign a cause to each pulse because the dating is uncertain. Here are some suggested mechanisms:

1. The rise of forests caused nutrients to leach from the continents into the oceans, causing a world-wide algae bloom that removed all the oxygen.
2. The rise of forests depleted carbon dioxide, triggering an ice age and sea level fall.
3. Volcanism in what is now Siberia may have injected enough carbon dioxide into the atmosphere to cause severe warming of the ocean, which also can lead to deoxygenation.

As an aside, the story of Gilboa, NY, home of fossilized Devonian "forests," is well-told here.

End-Permian

This extinction was by far the worst ever; about 96% of marine species were lost, hence the nickname "The Great Dying". Trilobites are the most famous marine group that was lost. On land, it was the mammal-like reptiles. Again, the extinction probably took place in at least three stages over a period of a few million years. Proposed causes:

1. The formation collision of land masses into a single continent Pangea simply reduced the area of shallow seas.
2. Volcanism in Siberia injected massive amounts of carbon dioxide into the atmosphere, causing global warming, which also may have melted methane-containing ices, making a the warming much worse, since methane is a more potent greenhouse gas than carbon dioxide.

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The End Cont'd

It also has been suggested the volcanos burned through fossil fuels layered above them, such that much more carbon dioxide was released than would be from the volcanos alone.

3. Global warming from the carbon dioxide may have reduced oceanic circulation such that the oceans became anoxic, allowing the growth of green sulfur bacteria which produced poisonous hydrogen sulfide.

4.There was a suggestion of an bolide impact causing the End-Permian extinction, but the evidence for this, including the dating of the proposed impact craters, has become less credible.

End-Triassic

The Triassic was a time where reptiles ruled the earth. However, while there were some early dinosaurs, most dominant archosaur reptiles were crocodilians, which had very varied lifestyles. After the extinction, all the dominant reptiles were dinosaurs. In the sea, most bivalves and corals went extinct. Here are some suggestions:

1. The single continent Pangea had a completely dry interior, so that there was not enough weathering to draw down carbon dioxide, resulting in gradual global warming.
2. Massive volcanism, which created the Palisades, injected carbon dioxide, which caused global warming. Melting of methane-containing ices could make it worse.

End-Cretaceous

This is the most widely-known extinction because it marked the end of the dinosaurs. Ammonites are the most well-known lost marine group. Since the End-Cretaceous is a very recent extinction, lots of evidence is accessible. This is the only extinction for which there is anything like a “smoking gun.” Most evidence points to an bolide impact: world-wide iridium deposits, shocked quartz, “fern spike”, a large crater of exactly the right age (Chixculub) , etc. Besides the immediate “blast effects” of an asteroid impact, there probably was a time where dust obscured the sun and killed photosynthesis.

This is a clear case in the history of science where a crazy idea from an outsider (a physicist, Walter Alvarez), accumulates enough evidence (controversy and name-calling notwithstanding) to become the accepted paradigm.

By the way, the usual cinematic depiction of the K-T impact takes several seconds: asteroid drifts toward Earth, asteroid hits the atmosphere and starts to glow. The collision happens, producing a big fireball, etc. The reality of a 6-mile rock traveling at a velocity of many miles per second is that it all happens in a fraction of a second; any potential witnesses would be vaporized and their atoms thrown into space almost before they realized that anything unusual was happening.

As attractive as the bolide hypothesis is, not every puzzle piece fits. There are those who point out that there are bigger craters than Chixculub dated to times when there were no mass extinctions. There are also holdouts for the volcanic theory, which has been out of favor for a few decades. Almost simultaneously (within a few hundred thousand years) with the bolide impact, volcanos erupted in India, covering the whole continent in lava. (It has been suggested that this is too much of a coincidence in timing and that the shock of the impact set off the volcanos.) Sulfur dioxide from the volcano cooled the climate. Given that volcanism features prominently in the explanations for the other Big Five extinctions, it certainly remains plausible as a major cause.

End-Pleistocene

This is a lesser event, not one of the Big Five, but discussed in detail. This is the extinction of many large mammals in North America ~12,000 years ago. Traditionally the two most likely explanations were climate change (specifically warming after the ice ages) and the arrival of humans, the so-called “overkill hypothesis.: There are a number of instances where extinctions happened shortly after humans arrived on other continents, and this is currently considered the most likely explanation, although one can point to Africa as an exception.

“Sixth Extinction”?

There is much debate whether we are in the midst of a human-caused mass extinction. Certainly, for the past two centuries many large animals have been going extinct at a very high rate through direct killing or destruction of habitat. There are those who argue calling this a mass extinction is misleading.

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the end of "The End"
Mass extinctions are defined by common marine families disappearing world-wide on a time scale measured in hundreds of thousands or millions of years. One cannot really compare a situation where hundreds of fairly rare, large animal species go extinct over a period of hundreds of years.

On the other hand, human-caused global warming by release of carbon dioxide through the burning of fossil fuel is very scary because it looks like the beginning states of proposed scenarios for some of the Big Five. It is not clear whether the Earth will reach some tipping point where warming caused by carbon dioxide will cause other phenomena that will make a bad situation even worse. Certainly, Earth has withstood much warmer periods in the past (for instance the Eocene was 8 degrees C hotter on the average than now), but only a small amount of warming (say 2 degree C) would be enough to destroy civilization by any of a number of mechanisms.

I would recommend "The Ends of the World" to readers of The Paleontograph. It is well written and informative to non-experts such as myself. The only negative I can point to is the lack of relevant illustration. There is a section of color plates, but for the most part these show the type of life at various periods in the Earth's history, or pictures of rock layers. I would have appreciated some diagrams that explain mechanisms of extinction.

Sources:
Brannen, P.
"The Ends of the World. Volcanic apocalypses, lethal oceans, and our quest to understand Earth's past mass extinctions."
Harper Collins, New York, 2017, 322 pages $28 (hardcover)

Another Troodont with Asymmetrical Feathers

Bob Sheridan May 9, 2017

About eight years ago Hu et al. (2009) describe a new feathered dinosaur from China called *Anchiornis huxleyi*. The original specimen of Anchiornis (LPM=B00169) is a crow-sized dinosaur from the Tiaojishan Formation of western Liaoning, China, which is Jurassic in age. The specimen is partly disarticulated, but it clearly has feathers on its arms tail, legs, and even its feet. In that it is similar to the dromaeosaur Microraptor. One can even distinguish two types of feathers: those that consist of parallel filaments, and those that have a central vane. Interestingly, these long feathers have asymmetrical vanes, and therefore are fairly modern-looking. These were the interesting things about Anchiornis at the time:

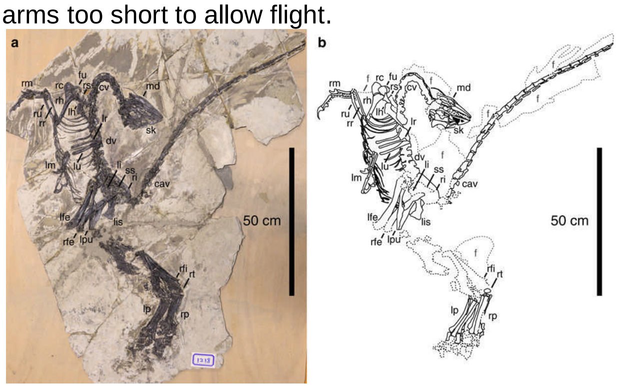
1. Anchiornis predates Archaeopteryx by 5-10 Myr., making it a feathered dinosaur older than the "first bird".
2. Anatomically, Anchiornis appears to have many features of troodontids, which are a sister group to dromaeosaurs. (The dromaeosaurs have traditionally been thought to be the ancestors of birds.) However, it is a primitive troodont because it does not have every troodont character. It remains the earliest known troodontid. One interpretation is that modern looking feathers were common to dromaeosaur and troodontids and thus predate the immediate ancestors of birds.

By 2017 hundreds of specimens of Anchiornis have been excavated and in several of these the feathers have been examined in close detail. Anchiornis is one of the first feathered fossil animals from which the colors of feathers have been guessed based on the microscopic melanosomes in its preserved feathers.

A new paper by Xu et al. (2017) describes another troodontid, this time from the Early Cretaceous Jehol Formation in China. Named *Jianianhualong tengi* (after the Chinese company that supported the study, plus "dragon"), this specimen (DLXH 1218) represents a chicken-sized dinosaur with a short head and small recurved teeth. The skeleton of Jianianhualong appears to be a mosaic of derived and primitive troodont characteristics, the head and the hindlimbs looking more derived, and the pelvis and forelimbs looking more primitive. There is at least one other troodontid, Sinusonasus, that appears to be a mosaic.

troodontid Cont'd

This specimen of Jianianhualong also has traces of feathers around the forelimbs, hindlimbs, and tail. The tail has at least one asymmetrical feather, where the vane on one side of the central shaft (the rachis) is wider than on the other. Unfortunately the feathers on the rest of the specimen are not well preserved enough to say if they are asymmetrical or not. Asymmetrical feathers are considered a property of "flight feathers" in modern birds. However, this type of feather is found in many feathered dinosaurs, even those that would have arms too short to allow flight.



Some have argued that Anchiornis might not have been a true troodontid. However, since Jianianhualong is clearly a troodontid, it seems certain that that long feathers appeared in the common ancestor of troodontids and dromaeosaurs, and some of these feathers were asymmetrical. This confirms the original inference from Anchiornis.

Sources:

Hu, D.; Hou, L.; Zhang, L.; Xu, X.
"A pre-Archaeopteryx troodontid theropod from China with long feathers on the metatarsus."
Nature 2009, 461, 640-643.

Xu, X.; Currie, P.; Pittman, M.; Xing, L.; Meng, Q.; Lu, J.; Hu, D.; Yu, C.
"Mosaic evolution in an asymmetrically feathered troodont dinosaur with transitional features."
Nature Comm. 2017, 8: 14972

Scoliosis in a Permian Marine Reptile

Bob Sheridan October 2, 2017

Mesosaurs, from the Early Permian, are the earliest land reptiles to return to the sea and become (perhaps) totally aquatic. Mesosaurs are fairly small (1 meter or less), and they look superficially like slender miniature crocodiles except for having longer, spikier teeth. Mesosaurs have a number of aquatic adaptations, including thickened bones (to make them neutrally buoyant), the ability to give live birth, and long fingers and toes (presumably to support webbed feet). There are three major genera: Mesosaurus, Stereosternum, and Brazilosaurus. Fossils are usually found in South America and Africa. These are fairy common and I am sure you have seen them at various mineral shows.

Today's story concerns a particular specimen (ZPAL R VII/1) of Stereosternum which was excavated from the Iraty Shale Formation in Brazil. It is nearly complete and almost entirely articulated. The specimen was described in 1999. Its most unusual feature was not noted at that time, but it is discussed in a new paper by Szczygielski et al. (2017). The feature is a defect in the 17th and 18th vertebrae. The side of the centrum of the 18th vertebra appears fused to the posterior end of the 17th, where it would be normal for the anterior end of the 18th would articulate to the posterior end of the 17th. The 18th vertebra is called a "hemivertebra" because the right half of it is missing. This defect gives the spinal column an S-shaped sidewards kink (a scoliosis). The rib one would expect to be associated with the 18th vertebra is atrophied on the left side, and the transverse processes for vertebrae 17-19 appear abnormal. The paper speculates that this is a developmental defect, rather than, say, the result of injury.

Many specimens of vertebrates do show apparent displacement defects and curves in their spine, but this is almost always due to post-mortem distortions, for instance through scavengers, decomposition, or folding of the rocks in which they are embedded. If that were the case in this specimen, the vertebrae and ribs would be displaced, but still present and complete. Thus, the authors conclude that the defect was present during the life of the specimen. Since this specimen is probably an adult because if its size (80cm) and state of fusion in its bones, the defect probably had little effect on the animal's ability to keep itself fed. This would imply that undulating the torso was not the major mechanism by which mesosaurs swam and/or they did not have to swim very fast.

Sources:

Szczygielski, T.; Surmik, D.; Kapuścińska, A.; Rothschild, B.M.;
"The oldest record of aquatic amniote congenital scoliosis."
PLoS ONE 2017, 12, e0185338.

The Robust Arms of Smilodon Kittens

Bob Sheridan October 8, 2017

Smilodon is the most well-known saber-tooth cat. The major reasons for this are that it is very recent (Pleistocene) and thousands of bones are preserved in the La Brea Tar Pits. There are three species of Smilodon in order of decreasing size: populator, fatalis, and gracilis. The skeleton of Smilodon is much more robustly built than most modern big cats (more like a bear), especially in the forelimbs. In this context a “robust” bone has a higher ratio of width or (circumference) vs. its length. It may can also mean that the walls of a bone are thicker compared to its diameter.

From its robustness, it is inferred that Smilodon hunted by ambushing rather than chasing its prey. Also, it probably used its muscular forelimbs to hold down prey before delivering a bite to the throat with the saber-teeth. One question is whether Smilodons got more robust in the forelimbs as they reached adulthood or whether they started robust. Most baby cats (and for that matter most mammals) start with stubby limb bones and these grow more gracile with time, i.e. while both length and width of the bone increase, the ratio of length to width gets larger. This is an example of allometry, i.e. one measurement (call it A) changes while another (call it B) changes in the same direction, but not as fast. One measures allometry by plotting log(B) vs. log(A) for objects (in this case specimens of the same bone) that vary in A and B. (Here “log(A)” means the logarithm of A. It usually does not matter one uses the common or natural logarithm.) Normally the objects fall on a straight line. The degree of allometry depends on the slope of the line.

A new study by Long et al. (2017) measures the allometry of bones from the La Brea Tar Pits. The bones studied are the long bones of the limbs: femur, tibia, humerus, radius. The fossil species studied are Smilodon fatalis and Panthera atrox. The latter is the American lion, which is also found at La Brea, but is not as common as Smilodon. At La Brea there are enough subadult specimens to make a study of this type possible. I estimate the smallest Smilodon specimens are roughly one-third the linear dimension of the largest. However, despite the title of the article, there are no actual fossil “kittens” measured--presumably very young cats would not be hanging around tar pits. For comparison, the authors study modern cats like tigers and cougars, for which there are very small specimens.

The major results for this study are plots of log(circumference) vs. log(length) for limb bones and species. Not surprisingly, these objects fall on straight lines for each bone/species combination. Surprisingly, the slopes for all these combinations are roughly the same. This means the limbs of all big cats grow more gracile at roughly the same rate. The only difference is that the forelimb (but not the hindlimb) bones for Smilodon are shifted relative to the other cats toward higher circumference for a given length. That, is Smilodon forelimbs are robust later in life because they started robust when the animal was small. Presumably this extrapolates back to even smaller sizes not included in the sample, i.e. to Smilodon kittens.

Sources:

Long, K.; Prothero, D.; Madan, M.; Syverson, V.J.P. “Did saber-tooth kittens grow up musclebound? A study of postnatal limb bone allometry in felids from the Pleistocene of Rancho La Brea.” PLoS ONE 2017, 12, e0183175

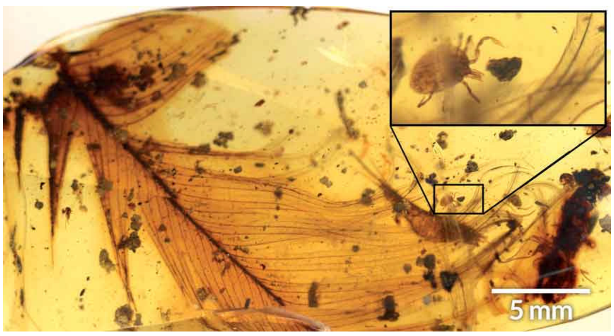
Visual comparison of the forelimbs of large felids all shot in the same frame for scale, showing the relative robustness of *Smilodon* compared to cats of similar size.
The light-colored bone on the left end is the cougar, *Puma concolor*; the light-colored bone second from left is the tiger, *Panthera tigris*; the dark bone(s) in the middle are *Smilodon fatalis*; the light-colored bone second from right is the lion, *Panthera leo*; the dark bone on the right is the Ice Age lion, *Panthera atrox*;. Scale bar in cm. Humerus shown here. Photos by DRP.

Ticks in Burmese Amber

Bob Sheridan December 24, 2017

Ectoparasites live on the skin of their host but not inside the body. The two most common blood-sucking ectoparasites are fleas (which are insects) and ticks (which are arachnids). Both are of medical importance because they transmit disease between hosts. Fleas prey mostly on mammals, and ticks prey on mammals and birds. Fossil fleas and ticks are known from amber. In most cases, the fossils are in Dominican amber, which is fairly young (15-20 Myr). Good examples are found in Poinar (2015) and Poinar (2017). Ticks go back as far as the Cretaceous (90-94 Myr.), as seen in amber from New Jersey (Klompen and Grimaldi 2001). There has long been speculation that ticks preyed on dinosaurs, since they were the most common large animal in the Cretaceous with feathers.

Since today's story is about ticks, more detail is required. Modern ticks are divided informally into "hard" and "soft" varieties. Hard ticks have a rigid plate on the back called a "scutum", and the mouth parts are visible from the top. The females are usually larger than the males. Soft ticks are wrinkled in appearance, have mouthparts that are underneath the body. The females and males are about the same size. Hard ticks are more likely to use humans as hosts and therefore transmit more diseases.



Penalvar et al. (2017) report on three specimens of Burmese amber (99 Myr.) containing ticks. The first specimen is a previously described species *Cornupalpatum burnanicum*. It is less than a millimeter long and appears to be immature because it does not show sexual characteristics. Cornupalpatum is a hard tick. The most interesting thing about the specimen is that it appears to be grasping an isolated pennaceous feather. The feather appears to be of a very advanced type, asymmetric, with barbs and hooklets. The authors describe it as being from a feathered dinosaur. The authors also feel the tick was holding the feather before being engulfed in amber, and if that is true, this is the first direct evidence that ticks might prey upon dinosaurs. (The authors argue that the feather is not from a true bird because of its age, but that possibility is hard to eliminate at present.)

The second specimen of amber contains two individual ticks of the same new species, which is named *Deinocroton draculi* ("terrible tick" and "Dracula," the fictional vampire). These appear to be soft ticks. Each is about 5 millimeters long. One is male, one female, based on their genitalia. A very interesting aspect of these specimens is that they seem to be covered in long hairs from dermestid beetle larvae. Since some modern dermestid beetles occupy bird's nests, the implication is that the newly named ticks also could be found in the nests of feathered dinosaurs.

A third specimen of amber contains an engorged female Deinocroton, which is about 8 times the volume of the previously mentioned female. This implies a "rapid" feeding strategy like that of a modern tick: fill yourself with blood and drop off the host.

Sources:

Klompen, H.; Grimaldi, D.
"First mesozoic record of a parasitiform mite: a larval argasid tick in cretaceous amber (Acari: Ixodida: Argasidae)"
Ann. Entom. Soc. Amer. 2001, 94, 10-15.

Poinar, G. Jr.
"A new genus of fleas with associated microorganisms in Dominican amber."
J. Med. Entomol. 2015, 52, 1234-1240.

Poinar, G. Jr.
"Fossilized mammalian erythrocytes associated with a tick reveal ancient piroplasms."
J. Med. Entomol. 2017, 54, 895-900.

Penalvar, E.; Arillo, A.; Delclos, X.; Peris, D.; Grimaldi, D.A.; Anderson, S.R.; Nascimbene, P.C.; Perez-de la Fuente, R.
"Parasitized feathered dinosaurs as revealed by Cretaceous amber assemblages."
Nature Comm. 2017, 8: 1924.

Demolishing an Old Argument about “Protofeathers” Being Collagen Fibers

Bob Sheridan May 3, 2017

Those of us who followed paleontology about twenty years ago will remember the discovery of the first feathered dinosaur. It was a specimen of Sinosauropteryx from the Jehol fauna of China. This specimen is a small theropod dinosaur that appears to be surrounded by a halo of fuzz, especially along the head and back. To some this was clearly a dinosaur covered with some kind of protofeather and confirmed the idea that birds were a subtype of theropod dinosaur, an idea which until then was suggested purely on the basis of skeletal anatomy. Others found this idea repugnant and argued that Sinosauropteryx was not a true dinosaur but a flightless bird, or that the fuzz could not be feathers. By 2017 there are several dozen known genera of theropod dinosaur with every type of feather imaginable, including quite modern-looking flight feathers. These feathers have been examined structurally and chemically and appear genuine. If you now argue that birds are not theropod dinosaurs, you are a “denier” rather than a “skeptic.”

A recent paper by Smithwick et al. (2017) revisits one of the “not really feathers” arguments applied to Sinosauropteryx. At the time of the publication of Sinosauropteryx (1996), and for many years afterward, a few authors suggested that the fuzz surrounding the specimen was frayed collagen fibers from its decaying skin. In this view, the fuzz along the head and back represented the remains of a frill. “Beading” of individual fibers of the fuzz was consistent with dehydration of collagen. The fact that some ichthyosaur specimens and decaying modern dolphins also showed some apparent fibers seemed to support the idea that apparent fuzz can be something other than protofeathers. Some of the fuzz appeared to show crossing fibers, which would be expected in skin. Also, it looked like Sinosauropteryx had “scales” outside the fuzz, which would not be expected if the fuzz were feathers.

A number of these claims were based on photographs of the specimens, including some low-resolution black and white ones. Smithwick et al. examined the original specimens to see if the claims hold up.

1. The ichthyosaur specimen (SMF R 457) with the putative “radial” collagen fibers. Upon close examination, most the the “fibers” are scratches in the matrix (probably generated during the preparation of the specimen) or cracks (probably left over from when the specimen was assembled from pieces). That is, there are no collagen fibers in that specific specimen, and no other ichthyosaur specimens show collagen fibers.
2. The “beading” of fibers in the Sinosauropteryx fuzz. Apparent beading is suggested in some photos from 2007 that are cut and pasted without revealing the original context. It appears to Smithwick et al. that the “beads” might actually be shadows cast by an uneven matrix surface. Examination of the original specimen shows that the protofeather fibers are long and taper distally with no beading visible.
3. Cross-fibers. The fibers suggested on the Sinosauropteryx to be “cross-fibers”, appear to be either shadows of scratches, probably made with an airscribe during preparation, or sedimentary layers in the matrix.
4. Scales. What appear to be scale-like shapes in photographs are features of the matrix. Scale-like objects are also seen in parts from the matrix far from the animal.

Overall, the collagen fiber argument appears to be almost completely without foundation. Given that many lines of evidence make the dinosaur ancestry of birds as certain as anything gets in paleontology, why examine a contrary argument from decades back that is, in retrospect, misleading? The most obvious lesson is that, in making arguments about specimens, one should examine the original specimens and not photographs, which are more subject to misinterpretation. The second lesson is that confirmation bias is very much alive in science. Scientists are people and, given a chance, people cherry-pick data and grasp at any interpretation that supports their views even when the evidence is weak and they should know better.

Sources:

Smithwick, F.M.; Mayr, G.; Saitta, E.T.; Benton, M.J.; Vinther, J.
“On the purported presence of fossilized collagen fibres in an ichthyosaur and a theropod dinosaur.” Paleontology 2017, 60, 409-422.

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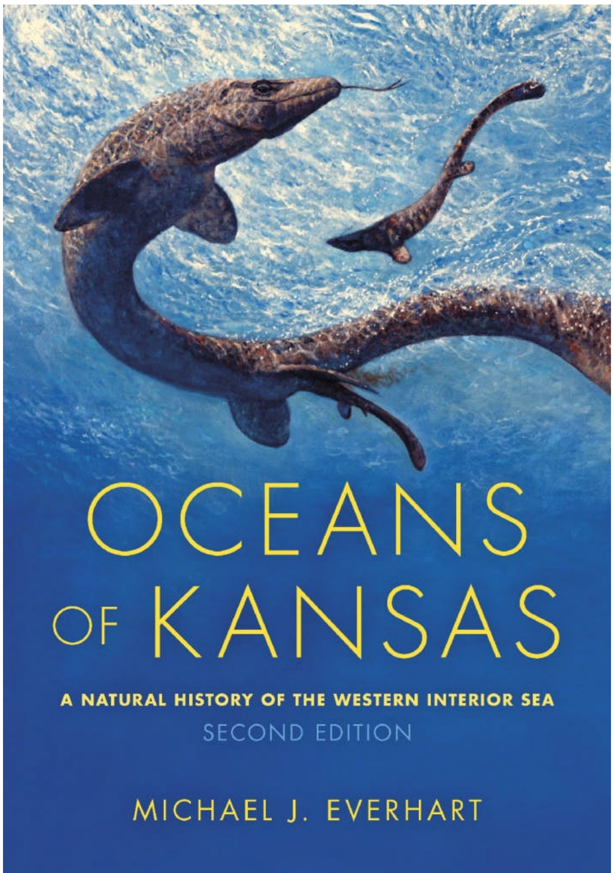

The 2nd Edition of *Oceans of Kansas – A Natural History of the Western Interior Sea* will be available from Indiana University Press on September 11, 2017. The digital version is already available from Amazon. The second edition is updated with new information on fossil discoveries and additional background 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*....

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