The Paleontograph

A newsletter for those interested in all aspects of Paleontology
Volume 9 Issue 1 March, 2020

From Your Editor

Welcome to our Coronavirus edition. This edition marks the beginning of our ninth year in this post NJ Paleo Soc. version. But Bob and I having been doing this for many more years than that. It's probably somewhere around twenty years when we combine the two versions. My, does time fly!!

So, if you are like me, you are sitting home, holed up, waiting for the end of life as we know it. However, I am pretty sure you and I will both see the first issue of next year's Volume 10. So don't panic, stay safe, practice proper social distance, wash your hands a lot and sit back and enjoy this issue. Bob has a lot of good stuff to share.

Be well.

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 Story of the Dinosaurs in 25 Discoveries—A Review

Bob Sheridan August 4, 2019

Almost four years ago I reviewed for the Paleontograph two books: "A History of Life in 100 Fossils" by Paul Taylor and Aaron O'Dea (2014) and "The Story of Life in 25 Fossils" (2015) by Donald Prothero. I recently came across another "number" book by Prothero: "The Story of Dinosaurs in 25 Discoveries."

Prothero is an adjunct professor at the California Polytechnic University and a research associate at the Natural History Museum of Los Angeles County. He is also the author of several popular books in paleontology and related subjects, and I have reviewed at least three of his books (other than "Story of Life") for the Paleontograph: "Evolution: What the Fossils Say and Why It Matters", "Rhinoceros Giants", and "Abominable Science." At this point I can pretty much recommend anything by this author. He has a very engaging writing style and the information he presents is very up-to-date.

As with "Story of Life," in the "Story of Dinosaurs" the jumping-off point is a series of key discoveries. However, each chapter covers an entire group of dinosaurs (tyrannosaurs, stegosaurs, diplodocids, hadrosaurs, earliest dinosaurs) represented by the discovery. A typical chapter starts with the history of the discovery and ends with the latest thought and controversies about the group. For people like me who like the history of science, this book is an excellent source. It covers much of the same material about personalities and early dinosaur specimens as covered in the last book I reviewed "Assembling the Dinosaur," but in a more engaging way. Many times I have complained about books that claim to present the latest discoveries about dinosaurs. Since I follow paleontology as a hobby, from my point of view most of these books are full of "old news". "Story of Dinosaurs" is a happy exception in that, while each chapter starts with something familiar, it ends with something I hadn't heard of before.

Here are the 25 discoveries in chapters: Megalosaurus, Iguanodon, Cetiosaurus, Hadrosaurus, Eoraptor, sauropods, Plateosaurus, Apatosaurus and Brontosaurus, Diplodocus, Giraffatitan, Patagotitan, Theropods, Coelophysis, Cryolophosaurus, Spinosaurus, Tyrannosaurus, Giganotosaurus, Deinonychus, Velociraptor, Sinosauropteryx, ornithiscians, Henterodontosaurus, Stegosaurus, Ankylosaurus, Corythosaurus, Stegoceras, Protoceratops, Triceratops.

Since these chapters are not in chronological order of the discovery and some chapters cover subsets or supersets of topics covered by other chapters, you could can regard this book as "survey of the history of dinosaur science," rather than a "story" with a beginning, middle and an end. This is not a complaint; the results are very good.

Normally in a book review I would summarize each chapter, but in this case it would be a lot of work, and I am sure you don't want to read a ten page review. So I will just relate one example of the type of discussion you can find here. Let us consider the old story of Apatosaurus vs. Brontosaurus. O.C. Marsh named both animals in the late 1870's. Both specimens lacked skulls, but Marsh assigned a hypothetical blunt skull to Brontosaurus that we now recognize belongs to a completely different family of sauropods, probably from Camarasaurus. By1903 it became clear that Brontosaurus and Apatosaurus were probably the same animal and the older name Apatosaurus took precedence. However by that time, "Brontosaurus" was so embedded in popular culture that most museums kept the name Brontosaurus for their mounts. It was not until the 1970s that the proper skull for Apatosaurus/Brontosaurus was widely accepted. In 2015 a very thorough phylogenetic study of sauropods claimed that specimens called Brontosaurus were sufficiently different from Apatosaurus that the old genus name could be resurrected. However, this may present a problem of ecological plausibility. In modern times we hardly ever see similar large animals living in the same environment at the same time, because they would compete for the same resources. However, we have many named sauropod genera from the same locations in the Late Jurassic: Apatosaurus, Diplodocus, Barosaurus, Camarasaurus, and Haplocanthosaurus (and that is just at Dinosaur National Monument!). It seems likely that at least some of these names represent the same animal, and especially unlikely that two very similar animals Brontosaurus and Apatosaurus would occupy the same environment.

Cont"d

I would put this book on your "must read" list if you are interested in dinosaurs or the history of science. Sources:

Prothero, D.R. "The Story of Life in 25 Fossils. Tales of Intrepid Fossil Hunters and the Wonders of Evolution." Columbia University Press, New York, 2015. 389 pages. $35 (hardcover)

Prothero, D.R. "The Story of the Dinosaurs in 25 Discoveries. Amazing Fossils and the People Who Found Them." Columbia Universary Press, NY, 2019, 472 pages $35 (hardcover).

Rieppel, L. "Assembling the Dinosaur. Fossil hunters, tycoons, and the making of a spectacle." Harvard University Press, Cambridge Mass. 2019, 325 pages $30 (hardcover).

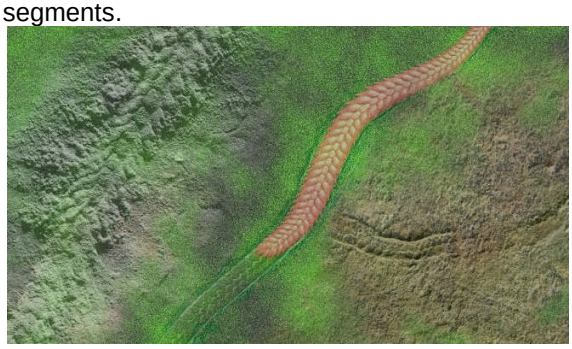
Taylor, P.D.; O'Dea, A. "A History of Life in 100 Fossils." Smithsonian Books, Washington DC, 2014. 224 pages. $40 (hardcover)

Yilingia

Bob Sheridan September 11, 2019

The Ediacaran Period (635-541 Myr.) is known for its strange mixture of soft-bodied animals. The first known Ediacaran deposits were discovered in Australia (the Ediacara Hills), but there are ~30 localities around the world. Some of the Ediacaran animals are like symmetrical air-mattresses in shape. Others are fronds with repeating structures at different scales (i.e. fractal-like). Still others are worm-like. Since most of the time Ediacaran fossils consist of impressions in sediment, the appearance of the living creature is sometimes hard to reconstruct. It has always been controversial about whether these fossils even represent animals (i.e. some could be algal mats or lichens), and, if animals, whether these are the ancestors of Cambrian animals, or whether they represent a group of that left no descendants. Any of the above could be true depending on the fossil. (Recently, opinion has shifted toward "ancestor.") Very few Ediacaran animals are "bilaterans", i.e. show right and left symmetry. Trace fossils, tracks and burrows, etc. are often found in Ediacaran sediments, but the maker of these traces is almost always unknown.

Chen et al. (2019) describe a new Ediacaran animal from the Dengying Formation of south China based on 35 specimens. They give this animal the name ***Yilingia spiciformes*** ("spiky animal from the Yiling district"). Yilingia is superficially worm-like, about 27 centimeters in length and about 2.5 cm wide. Front-to-back, it consists of about 50 segments. Each segment has a left, right, and central portion (i.e. it is "trilobate"). The right and left lobes (lateral lobes) point backwards and downwards and end in a point (hence "spiky"). More of the central lobe is exposed on the "top" of the animal. Thus the front and back of Yilingia are differentiated as well as the top and bottom. The left and right are symmetrical. This makes Yilingia like most bilateran animals from the Cambrian and later, and not like most Ediacaran animals. However, unlike with Cambrian animals, there is no clear "head" or other differentiation of the segments.



There are a number of traces from the same sediments that are of the form of grooves about as wide as Yilingia. Some of the grooves have a chevron pattern, while others are smooth. One trace fossil is a "mortichnum", i.e. it is directly associated with a body fossil of Yilingia. (Having an animal die in its tracks, i.e. on a "death march", while not unknown, is quite rare in the fossil record.) From this association, we know for sure that Yilingia was mobile and could burrow through sediment, whereas we have no such evidence for most Ediacaran fauna. This suggests that some previously known Ediacaran trace fossils could have been produced by similar animals. This brings up the question of whether segmentation is a necessary condition for an animal to be mobile.

The authors speculate as to whether Yilingia might represent the ancestor of segmented animals such as annelids (segmented worms) or arthropods (since the lateral lobes seem analogous with legs). Sources:

Barras, C.
"Worm fossil recasts origins of animal life."
Nature 2019, 573, pg. 15

Chen, Z.; Zhou, C.; Yuan, X.; Xia, S.
"Death march of a segmented and trilobate bilateran elucidates early animal evolution."
Nature 2019, 573, 412-415

Sex Bias in Mammal Fossil Collections

Bob Sheridan September 25, 2019

Male and female mammals are born with equal frequency, but will that be reflected in fossil remains? If fossils are biased toward one sex, our samples will not be representative of a whole population. At present, determining the sex of a fossil is reliable only if one can measure the relative concentrations of DNA "signatures" from the X and/or Y chromosome. On the plus side, this can be done with only fragments of bone. On the minus side, DNA is preserved only in the most recent fossils, and more likely to be preserved in colder climates, so this can be done mostly for Pleistocene fossils recovered near the arctic. A recent study indicated a 75% male bias (an unbiased sample would be 50%) in a collection of 98 mammoth bones collected across the arctic region. A new study by Gower et al. (2019) followed up this study by looking at a few more species: 186 bison fossils, 91 brown bear fossils, 9 dwarf bovids of the genus Myotragus, plus many bones from collections of modern mammals. Information was collected about the environment of the fossil site, including whether it was in a cave, or whether the fossil was from the cranium or post-cranium, or whether the fossil is from the Alps.

The bison sample is biased at 74% male for non-cave environments but biased toward females for cave environments, the brown bear sample is biased at 64% overall, but biased toward females for fossils from the Alps. All the Myotragus specimens were male. The modern fossil collections were sexed by observation rather than DNA. Overall, the male ratio is larger than 50%, except for bats, sloths, and anteaters. It appears that male bias in mammal collections is large and widespread.

Why is there such a bias in mammal fossils? Possible reasons:

1.Male bones are thicker and denser, and thus are more likely to be preserved as fossils.
2. Male bones are bigger, and fossil hunters go for more impressive "trophies."
3. Male DNA is more easily detectable or preserved better than female DNA.
4. Males wander over more territory, and have more opportunities to be killed in ways that would preserve them, like falling into tarpits or bogs.

Since there is some environmental influence (Alps, caves), the authors favor explanation 4. However, a combination of explanation 1 and 3 is plausible, i.e. DNA is more likely to be preserved in thicker bones.

Sources:

Gower, G.; Fenderson, L.E.; Salis, A.T.; Helgen, K.M.; van Leonen, A.L.; Heiniger, H.; Hofman-Kaminska, E.; Kowalczyk, R.; Mitchell, K.J.; Llamas, B.; Cooper, A.
"Widespread male sex bias in mammal fossil and museum collections."
Proc. Natl. Acad. Sci. 2019, 116, 19019-19024.

Fukuipteryx

Bob Sheridan November 23, 2019

Since the 90's, so many feathered dinosaurs (including dromaeosaurs) and so many early birds have been discovered in China that the line between dinosaur and bird is very blurred. Characteristics we once thought were specific to birds: feathers, a retroverted pubis, a furcula, air sacs, etc. are found in a number of theropods, even some not particularly related to birds. It is debatable if Archaeopteryx is truly an ancestral bird, a non-dromaeosaur theropod closely related to birds, or just another feathered dromaeosaur...assuming these categories are actually different.
The most obvious thing about bird-like dinosaurs, dinobirds, and early true birds as a group, from the Late Jurassic to the Early Cretaceous, is that they are often mosaics. That is, any given genus can be a mix of primitive (filamentous feathers, long tail, heavy skull, teeth, flat sternum) and advanced (asymmetric flight feathers, short tail, toothless beak, keeled sternum) characteristics, although birds from later times tend to have more advanced features.

Except for Archaeopteryx (from the Solnhofen limestone quarries in Bavaria), almost all the dinobirds and early birds we know about are from northeast China (the Jehol Formation) and are preserved in 2D. Imai et al. (2019) describe a basal bird specimen from the Kitandani Formation of central Japan (Early Cretaceous). This is given the name ***Fukuipteryx prima*** ("first wing from the prefecture of Fukui "). The authors especially note the preservation is in 3D. This specimen represents an animal about pigeon size. Histological analysis shows it is less than a year old, and perhaps not fully grown. **Cont'd**

Fukui Cont'd

The specimen is incomplete, consisting of forelimb and hindlimb elements, a few vertebrae, a furcula, and the tail. However there are enough characteristics that a phylogenetic analysis can be done. Fukuipteryx turns out to be among the most primitive of all birds, somewhere more advanced than Archaeopteryx (which can be considered a feathered dinosaur), but less advanced than Jeholornis, which is considered an early bird. The most striking anomaly with this relationship is that, while Archaeopteryx and Jeholornis have long bony tails, Fukuipteryx has a short tail, called a pygostyle, which is an advanced characteristic that is found in modern birds. This implies that the pygostyle can develop as a convergent character and may or may not be related to other flight-related characteristics such as a keeled sternum. This may be considered a surprise, as it is in this paper, or it may just be another example of mosaicism, albeit an extreme one.

The reconstruction of Fukuipteryx in the popular medium has a large toothless beak (rather like a kingfisher). Since the surangular (a bone in the lower jaw that does not bear teeth) is the only part of the skull preserved, it is a stretch to make that assumption. More likely, since Archaeopteryx and Jeholornis have teeth, Fukuipteryx did also.

Fukuipteryx also suggests primitive birds can be found outside China.

Sources:

Imai, T.; Azuma, Y.; Kawabe, S.; Shibata, M.; Miyata, K.; Wang, M.; Zhou, Z.
"An unusual bird (Theropoda, Avialae) from the Early Cretaceous of Japan suggests complex evolutionary history of basal birds."
Communications Biol. 2019, 2: 399.

Neandertal Social Group by Footprints

Bob Sheridan November 22, 2019

Fossil bones provide very little insight into animal behavior, whereas footprints or trackways give a record of the living animal, specifically for locomotor behavior. In some rare cases, when there are footprints from more than one individual, something might be inferred about social behavior. For hominins, the Laetoli footprints (of Australipithecus aferensis) are a good example. Another example is the footprints in Happisburgh, England (of Homo antecessor).

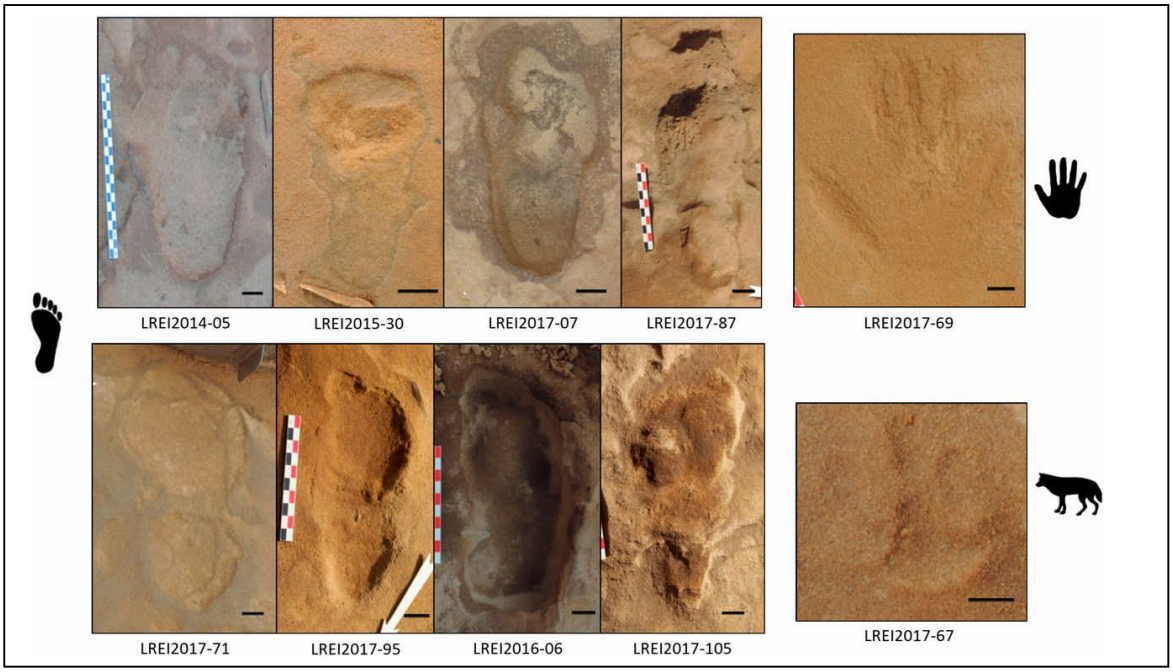
Today's story concerns Neandertal footprints from Normandy, France, specifically from the Le Rozel site, which is dated to about ~80,000 years. This site has been explored since the 1960 and has yielded hundreds of hominin footprints, a few hominin handprints, many animal tracks, as well as stone tools. Duveau et. al (2019) describe a set of 257 footprints in 5 trackways. About 88 of the prints are good enough to be unambiguously identified as human, with clear impressions of heel and toes. The length of the tracks varies from 11.4 to 28.7 and widths from 4.5 to 14.2 centimeters. The individuals would be between ~70 to ~189 centimeters tall using scaling from modern people. The number of individuals, based on different track sizes, is at least 13. Since modern humans were not in Europe 80,000 years ago, and the stone tools at Le Rozel are like those associated with Neandertals, it is very likely these are tracks from Neandertals.

We know of enough Neandertal skeletons of different ages (measured by, e.g. tooth eruption) to relate age with size of the foot. A large majority of the footprints at Le Rozel would be produced by children and adolescence (at least one as young as 2 years), with very few adults. The authors also feel they can distinguish adult males from adult females, and both are present in Le Rozel, based on the shape of the footprints. What kind of social group this is, is unclear; most assemblages of Neandertal body fossils show a majority of adults.

The authors compared the shapes of these tracks to those of contemporary people between the ages of 1 to 36, and to the Laetoli footprints. All of the prints are distinguishable by species. Neandertal feet are somewhat wider than modern human footprints of the same length and have a lower arch. This is consistent with what we know of the Neandertal and modern human foot bones.

Sources:

Duveau, M.; Berillon, G.; Verna, C.; Laisne, G.; Cliquet, D.
"The composition of a Neandertal social group revealed by the hominin footprints at Le Rozel." *Proc. Natl. Acad. Sci.* USA, 2019, 116, 19409-



Too Big to Walk—A Review

Bob Sheridan November 26, 2019

Some of us have been around long enough to remember the book "The Dinosaur Heresies", wherein Robert T. Bakker made the case that dinosaurs were warm-blooded, fast-growing, agile creatures, with complex behavior, unlike most modern reptiles. On one hand, many of the arguments in this book were shown in the following decades to be oversimplified. For instance, most paleontologists would agree that dinosaurs occupy some middle ground between warm- and cold-blooded. On the other hand, the majority of the one-time "heresies" are now "orthodoxies," in dinosaur science and especially the popular mind.

I came across a new book of "heresies" called "Too Big to Walk" by Brian J. Ford. Ford is an independent research biologist, author, lecturer, and television personality. That is to say, he has no qualifications as a paleontologist. That by itself is not necessarily bad, because many non-professionals have contributed to dinosaur science, but read further on.

These are the chapters:

1. Preface
2. Dinosaurs and the Ancients
3. Emerging from the Shadows
4. The Public Eruptions
5. Great American Discoveries
6. Drifting Continents
7. Reptile Dysfunction
8. How Microbes Made the World
9. Wading with Dinosaurs
10. Copulating Colossus
11. Truth Will Out
12. The Life and Death of Dinosaurs

Normally in a review I would elaborate on each chapter and its contents. In this case, each chapter is a mix of topics, not necessarily related to the title. Instead I will just classify the contents into three types:

1. Historical information on dinosaur science from the antiquity until now. This has an emphasis on how ideas on evolution, geology, and paleontology have changed radically. The author obviously identifies with the underdogs that have minority views that eventually turned out to be correct. Two stick out in my mind. One is that the notion of evolution came up generations before Darwin and one can even see antecedents to the mechanism of "natural selection." Therefore, the author feels that Darwin gets too much credit. I disagree with this view. Almost any scientific idea has precursors. It is the person who gathers enough evidence to make a case strong enough to convince his contemporaries who ought to get the credit, and that is Darwin. The author also spends a great deal of time on the idea of "continental drift" as first formulated by Alfred Wegener. Wegener accumulated paleontological evidence that the continents were once joined into a single mass. At the time (1912-1915), geologists could not envision any mechanism that would allow continents to move and rejected that idea. It took until the 1960's for the idea to be revived as "plate tectonics," the idea that continents are sitting on rocky plates that float on top of, and are carried along with, flows of convecting magma. No one can deny that Wegener was right about continental drift, but was treated badly, mostly because he was an outsider (a meteorologist rather than a geologist or paleontologist). One the other hand, one has to realize it is hard to accept continental drift without a plausible mechanism.
2. An explanation of his aquatic theory of dinosaurs. Much more detail in the next paragraph.
3. Complaining that the scientific establishment will not let him publish his ideas in technical journals and therefore he needs to publish them in this book. As a professional scientist, I usually find complaints about how the scientific establishment will not consider one's ideas a red flag. There is a selection bias in remembering "crazy ideas" from outsiders that eventually turn out to be correct. For example, continental drift. However, in practice, only a small fraction of crazy ideas turn out to be correct. By extension, most people who complain that their ideas are being ignored by mainstream science don't appreciate that it is almost always because their ideas are untestable or otherwise contain obvious flaws.

Cont'd

The new theory in this case is that (at least) the large dinosaurs were aquatic, or at least spent most of their time wading up to their hips (hippos and crocodiles being the modern analogies) in water, although they came up to land to lay eggs. The argument is as roughly as follows:

1. The largest animals on Earth currently are aquatic.
2. Sauropods are much too heavy to support their own weight, especially since they appear to have much more gracile leg bones, than, say, an elephant, which has one-tenth the weight of a typical sauropod. Living in water, on the other hand, would offset the weight.
3. Dinosaur footprints are much shallower than expected given the expected weight of dinosaurs. Sometimes trackways show hind feet and no forefeet, and some the opposite. Some footprints seem to be claw scratches only. This is easily explained by assuming the dinosaurs were wading and/or swimming.
4. Some dinosaurs have oxygen ratio indicative of an aquatic diet, plus fish scales in the stomach contents. Spinosaurus, and Baryonyx are examples.
5. Dinosaurs, being heavy and long, would find it hard to turn. In water, on the other hand, one could use the tail to push against the water.
6. It would be impossible for dinosaurs to copulate on land, for example, it would be too hard to move the tail out of the way.
7. No modern reptiles are warm-blooded, but dinosaurs seemed to have growth rates consistent with a constant body temperature. This was because they were immersed in warm water.
8. Some dinosaurs have nostrils at the top of their heads like aquatic mammals.
9. Dinosaurs became extinct when sea levels fell and less of the land was covered in water.

If point 2 seems familiar, up to the middle twentieth century the prevailing view of sauropods, at least, was that they needed the buoyancy of water to remain upright. Nowadays, sauropods are thought to be primarily land-dwellers, although no one thinks sauropods could not swim if they wanted to. On the other hand, there is mainstream agreement that Spinosaurus, a very large theropod, was probably aquatic, as is Halszkaraptor, a small feathered dinosaur. The author takes credit for first thinking of Spinosaurus a aquatic based on tooth shape and isotope ratios.

I would not even call this a “theory,” more like series of speculations that seem superficially plausible. To be claiming a theory one should have some calculations or comparisons and should be able to make predictions. For example, why not compare the body shapes and weights of dinosaurs to living animals that are aquatic or semi-aquatic. Or ask for oxygen isotope ratios of sauropods. But we see none of that kind of thing in “Too Big to Walk.” Most professional paleontologists could easily point out difficulties and contradictions with making most dinosaurs obligatory aquatic animals, and could also point out alternative explanations for the seeming anomalies with footprints, etc. Four difficulties that come to me immediately as an amateur paleontologist:

1. Most contemporary aquatic large animals have a barrel-shaped bodies (think hippopotamus) or are flattened from top to bottom (crocodilians), whereas most dinosaurs are narrow from side to side.
2. Most large aquatic animals have some ballast (e.g. solid bones) to maintain neutral buoyancy. Dinosaurs have air sacs and hollow bones to become lighter.
3. If sauropods could walk on land to lay eggs, they could walk on land. (No fair pointing out that sea turtles, which generally swim, can crawl onto land to lay eggs. Sauropods had their legs locked underneath their bodies and have no method of locomotion on land other than walking.)
4. Large dinosaurs like hadrosaurs have pine needles as stomach contents. Pine trees are not aquatic plants.
5. That fact that some dinosaurs have aquatic characteristic X (e.g. nostrils at the top of their heads, strange oxygen isotope ratios), does not mean most dinosaurs were aquatic.

Underneath this book, I think, is a misunderstanding by the author of how Science needs to work. Sometimes, as with other human endeavors, in hindsight ideas off the mainstream can be ignored for longer than they should be. However, Science needs to combine open-mindedness with conservatism, so new ideas can be considered, but the new ideas have to meet certain levels of proof before being accepted. Extraordinary claims must have extraordinary proof.

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Heretical new ideas can eventually become orthodoxies, but arguing and by pointing out anomalies is only the beginning. One has to gather large amounts of evidence and show that the new ideas fit the facts better than the old ones.

I have mixed feelings about "To Big to Walk". The historical parts are actually pretty engaging and informative. If you are going to read this book, that would be the main reason. You already know how little I am convinced about the "radical new view of dinosaurs" presented therein, but it is useful sometimes to read about new ideas, even when they are not particularly convincing.

Sources:

Bakker, R.T.
"The Dinosaurs Heresies. New Theories Unlocking the Mystery of the Dinosaurs and Their Extinction." Zebra Books, 1986, 481 pages.

Ford, B.J.
"Too Big to Walk. The New Science of Dinosaurs." William Collins, London, 2018, 316 pages, $25 (hardcover).

Amber and a Hadrosaur Jaw

Bob Sheridan December 1, 2019

Although amber from the Cretaceous is plentiful, dinosaur bones and amber are almost never preserved together. An exception has been described by McKellar et al. (2019). The specimen under consideration is called UALVP 53367, and was excavated in 2010 in Dinosaur Provincial Park, Alberta, Canada. It is ~75 Myr old. UALVP 53367 is an isolated jawbone of a hadrosaur, probably Prosaurolophus. The novel aspect is that there is a circular blob of amber stuck on the lingual surface of the jawbone. The blob is about 7 cm in diameter and 0.8 cm thick. At ~300 grams, this would be among the largest pieces of amber from the late Cretaceous of western Canada. The amber contains one inclusion, an aphid in the family that is thought to feed on conifer bark. The aphid is 0.7 mm long.

Infrared spectral analysis of the amber suggests it is the remains of what is called "cupressaceus-araucarian" resin, which means it is probably from either the conifer families Araucariaceae or Cupressaceae. This is not unusual for amber fragments from Dinosaur Provincial Park. The a hydrogen/deuterium ratio that suggests the amber formed not far from the Western Interior Sea at a temperature of > 33 Celsius.

Much of McKellar et al. deals with the possible circumstances of the association of amber with a jawbone. Clearly, the dinosaur was already skeletonized and disarticulated when the amber stuck to it. However, since the jawbone appears unweathered, it was not transported far. On the other side, since the amber contains impressions of the tooth rows on the lingual side of the jawbone, it was pliable, but not liquid, when it made contact. The authors suggest that the resin mass (with the aphid already on board) and jawbone entered a river system at the same time, stuck together and were buried together in sediment.

Sources:

McKellar, R.C.; Jones, E.; Engel, M.S.; Tappert, R.; Wolfe, A.P.; Muelenbachs, K.; Cockx, P.; Koppelhus, E.B.; Currie, P.J.
"A direct association between amber and dinosaur remains provides paleoecological insights." Scientific Reports, 2019, 9, 17916.

PALEONTOGRAPH ADVERTISMENT & EVENTS PAGE

Ads and events are listed here for free. They must be paleo related and are subject to editorial approval. Submissions can be sent to tomcagg@aol.com

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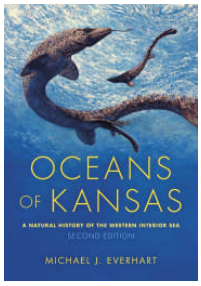
NJ GEM, MINERAL AND FOSSIL SHOW
April 15 – 19, 2020 at the NJ Expo Center, Edison, NJ

Tom Caggiano personal recommendation.



The 2nd Edition of *Oceans of Kansas – A Natural History of the Western Interior Sea* from Indiana University Press. The digital version is 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 .

Tom Caggiano personal recommendation.

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https://www.fossilsafari.com/

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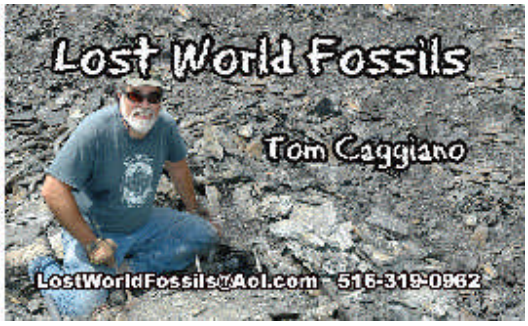
AAPS, Association of Applied Paleontological Sciences
96 East 700 South, Logan, UT 84321-5555,
Phone: 435-752-7145

AAPS, The Association of Applied Paleontological Sciences was organized in 1978 to create a professional association of commercial fossil dealers, collectors, enthusiasts, and academic paleontologists for the purpose of promoting ethical collecting practices and cooperative liaisons with researchers, instructors, curators and exhibit managers in the paleontological academic and museum community.

The Paleontograph back issues are archived on the Journal Page of the AAPS website.
https://www.aaps-journal.org/



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