The Paleontograph

A newsletter for those interested in all aspects of Paleontology
Volume 7 Issue 3 November, 2018

From Your Editor

Welcome to our latest edition. I've decided to produce a special edition. Since the holidays are just around the corner and books make great gifts, I thought a special book review edition might be nice. Bob writes wonderful, deep reviews of the many titles he reads. Reviews usually bring a wealth of knowledge about the book topic as well as an actual review of the work.

I will soon come out with a standard edition filled with articles about specific paleo related topics and news.

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.

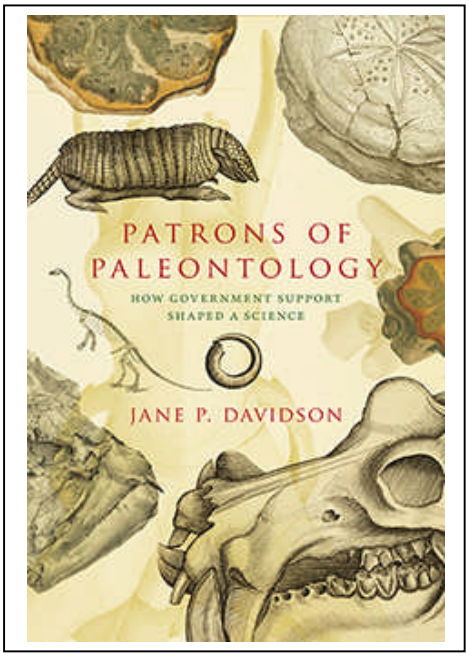
This newsletter is meant to be one by and for the readers. Issues will come out when there is enough content to fill an issue. I encourage all to submit contributions. It will be interesting, informative and fun to read. It can become whatever the readers and contributors want it to be, so it will be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

Edited by Tom Caggiano and distributed at no charge

Tomcagg@aol.com

Patrons of Paleontology--A Review

Bob Sheridan October 14, 2017



Indiana University Press produces the "Life of the Past" series, edited by paleontologist James O. Farlow. There are several dozen books in that series by now, some very specific, and some very general. The latest is "Patrons of Paleontology" by Jane P. Davidson. The author is a professor of art history at the University of Nevada, Reno. She has written at least two other books on paleontology: "The Bone Sharp" (1997), which is a biography of Edward Drinker Cope, and "A History of Paleontology Illustration" (2007), also in the "Life of the Past" series, which I reviewed for the Paleontograph at the time.

"Patrons of Paleontology" is divided into 6 chapters:

1. The beginnings of government support for paleontology.
2. 18th century and early 19th century support for paleontologists and patrons.
3. Developments in government support for paleontology in the United States between 1830 and about 1880.
4. Paleontology in the mid-19th century surveys outside the United States.
5. Government support for paleontology in the late 19th century and the turn of the 20th century: 1880 to about 1940.
6. Conclusion

As you might expect from the chapter titles, this is a fairly specialized book, which is tilted more toward history than science in general, and then very concerned with large illustrated publications about fossils. "Patrons of Paleontology" covers the time before it was widely appreciated that fossils were the remains of ancient life (say about 1700) to fairly recent times. One can summarize this history fairly succinctly. Early on, paleontology was supported by rich aristocrats, when it was fashionable for powerful men to support the "arts" or "scholarship." (This is a liberal interpretation of the word "government".) In the period 1800-1900, when geology was first being established as a science (in England) and when the continental United States was being explored, geological surveys sponsored by the crown or federal government, respectively, were the main source of support. The famous rivals Edward Drinker Cope and O.C. Marsh, for example, greatly benefited from such surveys in the late 19th century. Nowadays, paleontology is supported mostly through government grants to universities. Having support allowed paleontology to go from a gentleman's hobby of collecting curiosities to a real science.

On this journey we do meet most of the giants of paleontology. I will mention just a two examples from the early days, which I think are probably the least familiar, and the most interesting because this was before fossils were distinguished from rocks or other things of non-living origin. Michele Mercati (1541-1593) served as physician to seven popes, but he also acted as a naturalist and curator of the Vatican's natural history collection and botanical gardens. He compiled a large set of descriptions for specimens and had copper plates fashioned by artist Anthoni Eisenhout for an illustrated book. The manuscript was lost after his death, but rediscovered and published as "Metallotheca" (minerals) in 1717, 120 years later. In this book are exquisitely illustrated "formed stones": belemnites, ammonites, echinoids, gastropods, shark teeth, etc.. Robert Plot published a large survey called "The Natural History of Oxfordshire" (1676). It includes many pictures of curious objects, some of which we recognize as fossils.

Patrons Cont'd
Among them is what we now recognize as the distal end of the femur of the dinosaur Megalosaurus (the first illustration of a dinosaur bone), and Plot did recognize that it was probably a bone fragment, although in the book the specimen was labelled "scrotum humanum" because of its shape.

This book is fairly well illustrated, for the most part drawings of fossils from the 19th century and before, plus some sketches by artists on field expeditions. A useful appendix contains short biographies for about a hundred paleontologists and artists from antiquity to the early 20th century.

There are two curious mistakes toward the end of this book, which is consistent with the author not having a paleontological background. One is a mention of the NOVA program "The Four-Winged Dinosaur," which the author says was about Mononychus, whereas the program was about Microraptor. In the short biography section "lagerstatten" is defined as "a massive burial site of a large group of the same species." I think the author meant "monospecific bone bed."

Books in the "Life of the Past" series seldom disappoint. However, despite the fact that I am a student of the history of science and I appreciate paleoart, I find the two books in the series written by Jane P. Davidson ("A History of Paleontological Illustration" and the current "Patrons of Paleontology") not particularly to my liking. Perhaps I want more science with my art history. However, I did like "The Bone Sharp" since Edward Drinker Cope is one of my scientific heroes.

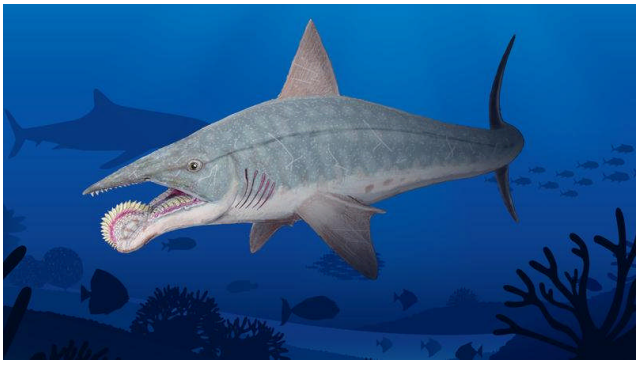
Sources:

Davidson, J.P.
"Patrons of Paleontology.
How government support shaped a science." 2017, Indiana University Press, Bloomington IN, 232 pages $40 (hardcover)

Resurrecting the Shark--A Review

Bob Sheridan December 18, 2017

Helicoprion ("spiral saw") is problematical fossil from the Permian (~290 Myr.), that has been "solved" very recently. The original fossils appeared as a two-dimensional logarithmic spiral (up to 4 turns) apparently composed of outward-pointing shark teeth, with the smallest teeth at the center of the spiral. The teeth show no signs of wear. Some spirals, or "tooth whorls" as they are sometimes called, are only a few inches in diameter, some are as wide as two feet. Helicoprion fossils are found in marine deposits world-wide. Currently three different species are recognized.



Clearly Helicoprion represents part of a shark-like animal, but which part? This turns out to be a surprisingly difficult question to answer. Since sharks have cartilaginous skeletons, only the jaws and teeth are preserved as fossils and we have no idea of how those related to the rest of the animal. Shark skin is often covered in tooth-like structures, so one cannot conclude that something that looks like a tooth is necessarily from the mouth. Paleozoic sharks were very diverse and had a wide variety of elaborate dorsal spines, crests, fins, etc. Also, how their tooth rows were arranged and how the teeth were shaped were also sometimes very different from modern sharks. So since Helicoprion was first discovered in 1890's, almost every possible suggestion has been made for the location of the tooth whorl (some more than once): lower jaw, upper jaw, dorsal fin, tail, back of the throat, nose, etc., and all seemed equally plausible given the information at the time.

The observation of similar sharks like Ornithoprion (from the Carboniferous) in the 1960s suggested that the tooth whorl was in the lower jaw of Helicoprion and that the jaw was short, no longer than the diameter of the whorl. **Cont'd**

Resurrection Cont'd

The breakthrough came in 2012 when a large specimen of Helicoprion at the Idaho Museum of Natural History (IMNH 37899) was CT-scanned. The cartilaginous parts of the skull were visible and this puts the tooth whorl in context relative to the rest of the head. The cartilaginous "nose" is elongated, so Helicoprion probably had an appearance close to that of a modern shark. Now that we know the size of the head, we can estimate the size of the entire Idaho Helicoprion as about that of a modern great white shark. The CT study was published in Biology Letters (Tapanila et al., 2013).

The following, then, is our current interpretation of Helicoprion anatomy. First a few words about modern sharks to set the context. Shark teeth are formed at their final size and individual teeth do not grow, but the size of an individual tooth reflects the size of the owner at the time it was formed. In most modern sharks, there are many rows of teeth in the lower and upper jaw. In each row, teeth are formed inside the mouth and are slowly transported, as with a conveyor belt, toward the outside of the mouth. Once outside the mouth, the teeth drop off. This way the shark produces a constant supply of sharp teeth. In Helicoprion, there is a single tooth row (forming the whorl) at the midline of the lower jaw. The whorl looks something like a circular saw blade, with the largest teeth pointing toward the throat. There are no teeth other than in the whorl. The lower jaw has a unique process that points upward and keeps the mouth from closing far enough that the whorl would puncture the roof of the mouth. Instead of older teeth falling off the "conveyer belt", the conveyor belt, with the teeth still attached, itself winds into a spiral inside the jaw. This is how the whorl is formed. The teeth in the center of the whorl are the smallest because they are the oldest (formed when the shark was small).

The function of the teeth according to a later paper Ramsay et al. (2015) would be the following: The "saw" would be used like a rake: With the mouth fully open, the teeth toward the front of the mouth snag the prey and draw it closer to the roof of the mouth, at which point the largest teeth chop the prey as the mouth closes. Repeated motions would continue to draw the prey toward the throat. The authors imagine Helicoprion grabbing a nautiloid by the tentacles, and drawing the soft parts out of the shell, which is then discarded uncrushed.

Today we recognize a whole group of extinct "whorl tooth" cartilaginous fishes called the Eugeneodontida ("true origin teeth"), which is further divided into two families Helicoprionidae ("spiral saws"--named after Helicoprian) and Edestidae ("those that devour"--named after Edestus). Their closest living relatives are the ratfish.

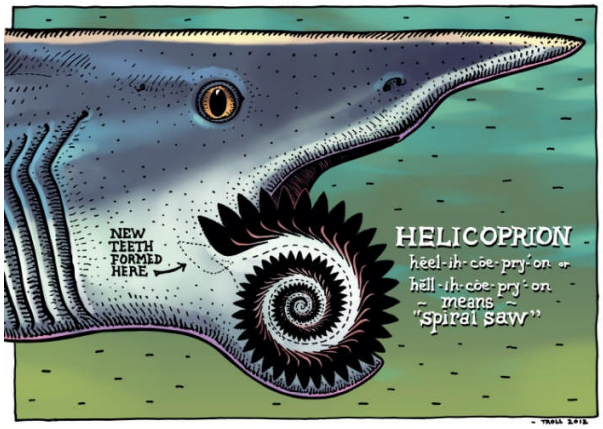
All of the above is to put into context the new book I am reviewing today: "Resurrecting the Shark". The author, Susan Ewing, is a free-lance writer with several dozen books and articles to her credit, of which this book is the first on a paleontological topic. This is the story of how Helicoprion was discovered, interpreted, reinterpreted, became a paleontological hot topic for a while, was ignored for decades, until technology advanced enough to finally solve the mystery. This is an engaging, well written book, although perhaps somewhat repetitive, and loosely organized. Be aware that the focus here is on history and personalities, and not so much on science, although relevant bits of science (such as the place of Helicoprion among the cartilaginous fishes and shark anatomy) are discussed enough to bring out the issues. If you are not familiar with Paleozoic sharks, as most of us are not, this is fascinating stuff.

The most interesting aspect of the history of Helicoprion is that the Alaskan artist Ray Troll, who has been attempting plausible reconstructions of Helicoprion since the early 1990's, catalyzed the definitive CT study of Helicoprion by bringing together multiple fossil shark specialists. The origin of the book is when Ray Troll invited his friend Susan Ewing to attend an exhibit "The Whorl Tooth Sharks of Idaho," which was held at the Idaho Museum of Natural History in 2013, for which Troll had provided the art.

One thing that bothered me about "Resurrecting the Shark" is that it emphasizes "scientific obsession", "mysteries", and "mavericks," as if those sorts of things were unique to the Helicoprion story, whereas those things are very common in paleontology, not to mention science in general.

Illustrations in "Resurrecting the Shark" are confined to a center section. About half are photographs of the principle paleontologists and some key fossils. Almost all of the reconstructions of extinct sharks, including Helicoprion, are by Ray Troll.

Cont'd



While I enjoy Troll's art, and he certainly deserves his key place in the story of Helicoprion, his style is not necessarily the best for scientific discussions. Also, I did miss having some scientific diagrams, which you would normally see in a popular science book. If you are going to talk about the cartilaginous mouthparts of sharks in the text, for instance, it would be nice to see a picture of what is being talked about.

So give this book a try, despite its small flaws.

Sources:

Ewing, S.
"Resurrecting the Shark: A Scientific Obsession and the Mavericks Who Solved the Mystery of a 270-Million-Year-Old Fossil."
Pegasus Books, New York, 2017, 282 pages. $28 (hardcover).

Ramsay, J.B.; Wilga, C.D.; Tapanila, L.; Pruit, J.; Pradel, A.; Sclader, R.; Didier, D.A.
"Eating with a saw for a jaw: functional morphology of the jaws and tooth-whorl in Helicoprion davisii."
J. Morphology 2015, 276, 47-64.

Tapanila, L.; Pruitt, J., Pradel A.; Wilga, C.D.; Ramsay, J.B. ; Schlader, R.; Didier, D.A.
"Jaws for a spiral-tooth whorl: CT images reveal novel adaptation and phylogeny in fossil Helicoprion."
Biol. Lett. 2013, 9, 20130057.

The Rise and Fall of the Dinosaurs —A Review

Bob Sheridan May 10, 2018

Today's review is for a very recent book "The Rise and Fall of the Dinosaurs" (TRAFOTD). The author Steve Brusatte is a paleontologist at the University of Edinburgh. You may have seen his articles "The Unlikely Triumph of Dinosaurs" and "Rise of the Tyrannosaurs" in the May 2018 and May 2015 issues of "Scientific American", respectively, both of which are illustrated by James Gurney.

Here are the chapter headings:

1. The Dawn of the Dinosaurs

This chapter covers the first true dinosaurs, which appeared in the Late Triassic (~230 Myr.). The earliest examples are Herrerasaurus and Eoraptor from South America. However, based on the author's work on fossilized footprints in Poland, there existed so-called dinosauromorphs as early as ~250 Myr.. These are exemplified by the ichnotaxon Prorotodactylus. Prorotodactylus had long narrow feet and its trackways were very narrow from side to side, indicating that its feet were directly under its hips, unusual characteristics for reptiles from that time. It was a quadruped but it appears that its forelimbs were much reduced. The inference that Prorotodactylus was on the way to becoming a dinosaur.

2. Dinosaurs Rise Up

True dinosaurs are known from the Late Triassic, most well-known are theropods like Coelophysis and prosauropods like Plateosaurus. At the time, however, the most common and largest animals were crocodile-like archosaurs. Based on the author's work, we know that the dinosaurs never became as diverse as the other archosaurs during the Late Triassic and that dinosaurs were be confined to the more humid parts of the supercontinent Pangea. Thus, the classic idea of dinosaurs outcompeting other animals because of their intrinsic superiority, is probably not true.

3. Dinosaurs Become Dominant

In Latest Triassic through the the Earliest Jurassic the supercontinent Pangea started to break up, and one consequence of that is that volcanoes erupted at the places were the continents separated. The Palisades are made of lava flows from that period.

Rise and Fall Cont'd

This extreme vulcanism presumably caused the "End Triassic" mass extinction that cleared the Earth of the other archosaurs and let the dinosaurs become more diverse and the most abundant type of large animal. In the Early Jurassic, we suddenly see evidence of larger dinosaurs, as exemplified by the footprints Grallator and Eubrontes. It is, of course, in the Jurassic that dinosaurs became truly colossal, as represented by the sauropods. Part of this chapter is devoted to the author's study of sauropod footprints from the Isle of Skye, Scotland.

For those of us who grew up in New Jersey, one interesting story from this chapter is how the Riker Hill Fossil Site, which preserves a number of dinosaur tracks, was declared a national landmark.

4. Dinosaurs and Drifting Continents

The first half of this chapter concerns the Late Jurassic dinosaurs of North America and the Bone Rush in the latter half of the 19th Century. The second half has to do with the Middle Cretaceous of Africa, specifically the phylogenetic analysis of carcharodontosaurs (Tyrannosaurus size predators of Africa and South America). These are topics that were worked on by the author as an undergraduate in association with Paul Sereno. The "drifting continents" of the chapter title eludes to the fact that by the Late Jurassic there were separate northern and southern continents and dinosaurs on those continents could go their separate evolutionary paths.

5. The Tyrant Dinosaurs

At the very end of the Cretaceous tyrannosaurs were big robust animals with massive heads, spike-like teeth, and tiny arms. Despite some controversy from 20 years ago, it is very likely they were apex predators. We now know of many tyrannosaur ancestors that go back to the Middle Cretaceous (almost all of which are from China). These are small, have longer snouts, more blade-like teeth, and long arms. Their names are unfamiliar to most people: Alioramus, Qianzhousaurus (also know as the "Pinocchio rex" because of its long snout), Kileskus, Guanlong, Dilong, etc. Tyrannosaurs did not become large (i.e. over 30 ft long) until 20 Myr. before the end of the Cretaceous. It is very likely all tyrannosaurs were feathered because we have preserved filaments for small (Dilong) and a large (Yutyrannus) genera.

6. The King of the Dinosaurs

You know the "King" has to be Tyrannosaurus rex. This chapter summarizes what is currently known or plausibly speculated about this animal: probable jaw strength, structure of its brain, lifespan, likely running speed (slower than you might expect), etc. The authors is reporting on the work of others here, and is not adding perspective from his own work. I found this chapter the least satisfying in the sense that, because T. rex is such a popular dinosaur, you probably have heard all this information before. One insight I did not have before, but is obvious if you think about it, is the idea that tyrannosaurs are immigrants to North America, having originated in Asia. They probably crossed the Bering land bridge, much as the first humans did when they came to North America.

7. Dinosaurs at the Top of Their Game

This chapter is a mix of topics having to do with the Latest Cretaceous. This includes excavation of the Triceratops specimen "Homer" from the Hell Creek Formation and the theropods from Brazil, which are very unlike those from North America. Those of us who study the history of paleontology know about Baron Franz Nopcsa (1877-1933). He was an Austria-Hungarian nobleman who did many colorful things, including attempting to become the king of Albania. The most important aspect for our purposes is that he was a genius at interpreting dinosaur remains. TRAFOTD discusses Nopcsa's study of Transylvania dinosaurs. These are similar to dinosaurs elsewhere except that they are much smaller in size. Nopcsa's interpretation was that they were the product of "island dwarfing", consistent with our current knowledge that Europe was a chain of islands in the Cretaceous. Transylvanian dinosaurs are still under study and some have unusual features. For example the genus Balaur (named for a creature in Romanian folklore) appears to be a dromaeosaur, but with two sickle claws on each foot, instead of one.

8. Dinosaurs Take Flight

The dinosaur origins of birds is a very commonly discussed topic, and much of the history of thought on this subject, and the many lines of evidence leading to that conclusion, has been covered elsewhere. However, TRAFOTD does a good job of summarizing it. Two addition bits of interesting information: The author did a PhD project on rates of evolution in theropods and birds; the rate of evolution increased when flying birds appeared.

Rise and Fall Cont'd

Also, it now appears that dinosaurs may have evolved flapping flight more than once, since there is more than one style of wing. A newly discovered genus Yi has a strange, bat-like wing very different than the standard wings of theropods or modern birds.

9. Dinosaurs Die Out

Again, you have probably heard a lot about the evidence for an asteroid/comet strike that ended the reign of the dinosaurs, and again TRAFOTD does a good job of summarizing it. Why certain groups of animals survived and some did not is still a mystery. The author participated in a study on the diversity of dinosaurs to address the question of whether dinosaurs were "on the way out" before the asteroid strike. Generally, the answer appears to be no, in North America and on other continents. Most dinosaurs maintained their number of species until the very end. Only horned dinosaurs and duckbill dinosaurs seemed to be in decline.

10. After the Dinosaurs

This is the shortest chapter. Most of it deals with the discovery of Torrejonia in New Mexico. Torrejonia is an early primate lived 3 Myr after the extinction.

The illustrations in TRAFOTD are black and white photographs of specimens, of paleontologists, and of paleontologists next to specimens. Each chapter header has a very realistic drawing of a restored dinosaur representative of the topic under discussion. I could not find out who did those drawings, which is a shame, because I like them. I would have appreciated a few more diagrams to illustrate scientific points, but there is only one: the dinosaur family tree.

You should be aware of what you are getting into. TRAFOTD is in the style of many recent popular books on paleontology (some examples: "Resurrecting the Shark", "My Beloved Brontosaurus", "The Tyrannosaur Chronicles", "Dinosaurs without Bones"). These are usually an easy, entertaining reads and a combination of history, personal anecdotes, established facts, and some speculation. For most audiences interested in science, this is a perfect combination. However, for knowledgeable amateurs in paleontology who keep up with the topic of dinosaurs, a good portion of the "facts" and "speculation" may already be old news. There was enough new information here to keep me interested, especially that on the earliest dinosauromorphs. Also, you should be aware that TRAFOTD does not try to be a comprehensive treatise on dinosaurs, only on those topics the author has worked or has an interest.

After I write a review on a book, I often come across a published review written by someone else. This is interesting to see how different the perspectives of other reviewers can be. You might enjoy the review of TRAFOTD by Victoria Arbor in the May 2018 issue of "Science" (volume 360, page 611).

Sources:

Brusatte, S.
"The Rise and Fall of the Dinosaurs. A New History of a Lost World"
William Morrow, NY, 2018, 404 pages, $30 (hardcover).

The Palaeoartist's Handbook —A Review

Bob Sheridan October 21, 2018

Paleoart (or "palaeoart" if you use the British spelling) is the depiction of fossil animals and plants as living organisms. Depending on what you think is the first example, paleoart can be considered up to 200 years old, although the word itself was coined by artist Mark Hallet as recently as 1987. Paleoart can be for a very serious purpose, for example illustrating a scientific paper, in which case anatomical accuracy is very important. It can also be for commercial purposes, i.e. designing toys or children's book illustrations, in which case accuracy can be a secondary consideration.

About a year ago I reviewed "Paleoart" by Lescaze and Ford, which is a coffee-table-sized book reviewing paleoart from the past 150 years. Six years ago I reviewed a smaller book "All Yesterdays" by Conway et al., which is a humorous attempt by well-known paleoartists to point out the speculative nature of restoring fossil animals.

A new book "The Palaeoartist's Handbook" by Mark Witton appeared this summer. This is a thorough summary of best practices for restoring prehistoric animals. The book is very densely illustrated with art from Witton and eight other paleoartists.

Paleoartist Cont'd

Witton is a British freelance paleoartist and consultant, known for anatomical rigor. He has been restoring fossil animals for a living for about 10 years, which makes him a relative newcomer. A few years ago I reviewed Witton's excellent book "Pterosaurs." You may have also seen his article "State of the Palaeoart" with Darren Naish and John Conway in Palaeographica Electronica. He has a blog at http://markwitton-com.blogspot.com/, which is well worth checking out.

These are the chapter headings for The Palaeoartist's Handbook:

1. An introduction to palaeoart.
2. A brief history of palaeoart.
3. Researching, resource gathering and planning a palaeoartwork.
4. General reconstruction principles, skeletons, and trackways.
5. Reconstruction principles: guts, muscles, and fatty tissue.
6. Reconstruction principles: skin and coloration.
7. Reconstruction principles: facial tissues.
8. Reconstruction principles: cave art, speculation, and tissue depth.
9. The life appearance of some fossil animal groups.
10. Recreating ancient landscapes.
11. Composition, mood and purpose.
12. Professional practice.
13. Some final advice for aspiring palaeortists.

Art in general has many purposes: convey accurate information, create beauty, tell a story, etc. You can tell by the first chapter that Witton's focus in on the first. This is the key quote: "Palaeortistry may thus be better described as the process of illustrating credible contemporary interpretations of prehistoric animals, where testable aspects accord with fossil data and non-testable aspects are based on well-researched inference." Given that paleoart may be the means by which a mass audience gets introduced to science, artists have a responsibility to get the science as right as possible.

Palaeoart goes back to ancient times in the sense that people have been depicting fanciful creatures (cyclops, unicorns, griffins) based on poorly understood fossil remains for thousands of years. It is not until about 1800 that the nature of fossils was appreciated and there was an attempt at science-based illustration. The first commercial example from 1830 was "Duria Antiquior" by Henry De la Beche. The second chapter has a very nice "timeline" showing major developments in paleoart since 1800. According to Witton, there are three eras: Foundation 1800-1890, Classic (1890-1970), Reformation (1970-2010), and Postmodern (after 2010).

The third chapter combines a crash course in nomenclature and paleontology (geological ages, phylogenetic relationships between fossil organisms), advice on how to approach uncertain or conflicting data, and a plea to avoid two cardinal sins common in paleoartistry:

1. Copying older artwork without attribution or without trying to update the science.
2. Basing the scene on cliches (tropes).

This chapter includes a table of about 20 tropes with various degrees of credibility: Ornitholestes trying to catch Archaeopteryx (they lived on different continents), entelodonts depicted as "hell pigs" (they were more hippo-like), the pterosaur Dimorphodon colored like a modern puffin, animals constantly roaring or attacking, etc.

Life restorations start with "reconstructions", i.e. a complete skeleton. In reality, fossil skeletons are mostly incomplete, fragmented, and distorted. The fourth chapter gives best practices for making guesses about missing bone, using more complete fossil relatives, or in the case of fossil mammals, using knowledge about living relatives. Poses and gaits for a skeletal reconstruction can be inferred from trackway information. One aspect of reconstruction I had not appreciated is "tooth slippage." That is, during decay of an animal body, teeth get loose from their sockets and protrude outward, making the teeth look longer than they would be in life.

Bones usually have clear muscle scars, and since the arrangement of muscles in vertebrates is fairly predictable, guessing where muscles go in fossil animals is fairly straightforward. This is not to say one can be sure how much bulk one can assign to each muscle, other than the fact that species with delicate skeletons have fairly slender muscles One fairly easy thing to assign is the volume of gut, based on whether the animal is a carnivore or herbivore. Modern herbivores need large intestines to digest plant material, and their guts usually extend out to the front and sides quite a big. Fatty tissue is very problematical, since there is no indication from the skeleton where it might accumulate in the body. However, marine animals tend to have fat distributed throughout their body, giving them a smooth appearance.

Paleoart Cont'd

Integument (e.g. skin, scales, feathers, horns, claws etc.) and coloration is the least certain aspect of paleo-restorations. Only in very rare fossil "mummies" (and feathered dinosaurs) is integument preserved. One correlate from modern animals is useful. Where the bones show a rugosity (e.g. in the textured skull of an alligator), it is likely that there is some kind of heavy scaling directly on the bone. Smooth bone on the skull implies that the skin there is fairly thick. In a handful of cases one may infer the colors of feathers from the shape of melanosomes (tiny bodies containing pigments), but this is not universally accepted. Most of the time, for a specific fossil animal, one must arbitrarily make up coloration based on what we know about coloring in modern animals: counter-shading camouflage is common, some animals have bright colors for display, etc. We know from dinosaur mummies that most dinosaur scales are smaller than an inch in diameter, so one should not see the large scales sometimes depicted on restored dinosaurs.

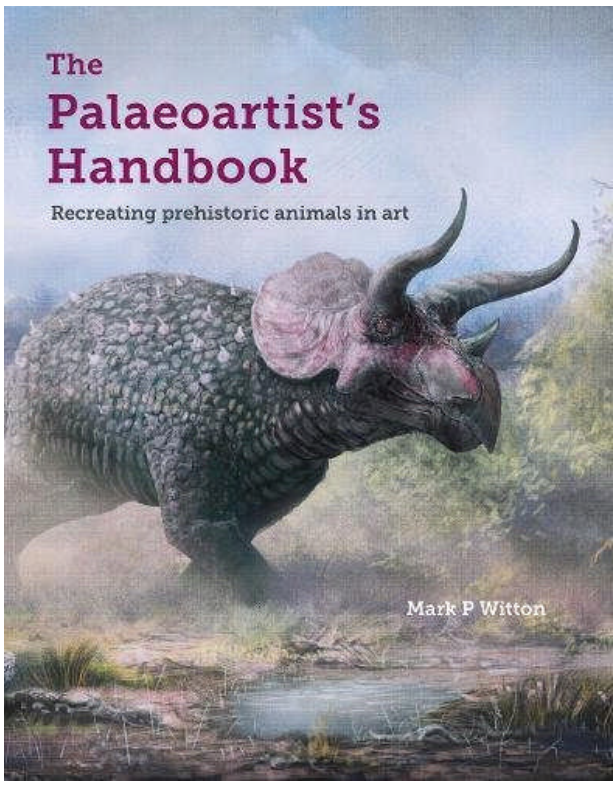
Does you animal have lips, a trunk, a thick capsule over their nostrils, etc.? Most modern animals have enough lip (or beak) and cheek to cover their teeth when the mouth is closed. Most of the nasal opening in the skull is covered, with the nostrils at the very front of the nose. Also the outline of the openings in the skull are not visible. Therefore dinosaur restorations with the teeth being exposed, and the skin covering the foramina depressed are probably wrong. Most of the eyeball of marine animals is covered by an eyelid, therefore one should not restore ichthyosaurs such that the entire orbit is visible. Ear openings for reptiles are easy to restore: somewhere toward the back of the head. In contrast, the shape of external ears in mammals is less predictable. Similarly, tongues vary a lot, although one rule is that browsing herbivores tend to have long flexible tongues.

Many animals that are only fossils now were seen as living animals by stone age artists, including moas, mammoths, and the Irish elk (Megaloceras). Interestingly Megaloceras was drawn with a hump on its shoulders, something that would not be predictable from the skeleton. This chapter also has a detailed discussion on "shrink-wrapping," a style of restoration, popular in the 70's and 80's, where the animal has just enough flesh to cover the skeleton. In reality, living animals have a wide range of "fleshiness" and most have ample covering for their bones. As mentioned in a previous chapter, there are correlates with living animals. Skulls with pits, grooves, and rugosities have minimal tissue depth around the skull. Smooth skulls tend to have thicker skin surrounding them. In addition this chapter discusses the "dressed as" phenomenon: using living (unrelated) species as exact models for color or texture, for example coloring pliosaurs like killer whales or giving early elephants the wrinkled skin of modern elephants. Witton feels negatively about such treatment, but does admit that sometimes using a familiar coloration "found in nature" does help the credibility of restorations.

Chapter 9 is a summary of the likely appearance of some extinct groups based on data other than isolated skeletons. Some of these groups are seldom restored (early amphibians, crocodile-like reptiles), and some are often restored (dinosaurs, birds, pterosaurs, plesiosurs, etc.). One interesting chart in this chapter is the phylogenetic tree of pterosaurs and dinosaurs annotated by the type of integument (scales, filaments, feathers, etc.) observed for them.

Chapter 10 deals with defining the background of the animals being restored. Specifically we would like to know whether the animal lived in a shore, river, or forest environment, and what other animals and plants might have been around at the same time. The first can be problematical because where an animal is buried might not be where it lived; there are many examples where obvious land animals are fossilized in marine sediments. The last is complicated by the fact that we seldom know what an entire contemporary plant looks like because stems, seeds, and leaves often are preserved in isolation. In this chapter is a "broad strokes" chart of plant evolution, pointing out when ferns, flowering plants, and grasses evolved.

Chapter 11 is the one chapter devoted to "story-telling," how your art can have good composition, tell an interesting story, and convey a good idea of the size of the animal. Again we have an appeal from Witton to dial-back the idea that fossil animals were constantly fighting, roaring, or otherwise engaged in frantic activity. Another style he tends not to like is "hyper-foreshortening" where the animal is in a highly dynamic pose and rushing toward the viewer. While this is attention-grabbing, it tends to obscure the anatomy of the animal. Another inappropriate style, according to Witton, is putting in more detail than is justified by the evidence. Assuming the most important purpose of paleoart is to convey information accuracy, these preferences make sense.



Chapter 12 is advice to aspiring artists trying to make a living from paleoart: how to find clients, how to collaborate with scientists, what to charge, etc..

Chapter 13 is a summary of the best practices, mostly a matter of research everything, and assume nothing.

I do dabble in digital illustration as a hobby, but generally do not include fossil animals in my art, so perhaps I am not the perfect audience for The Palaeoartist's Handbook. However, I appreciate paleoart a great deal and, except for Chapters 11 and 12, this book includes a great deal of information of general interest to those who follow paleontology, not just artists. Thus I can give this book a very high recommendation to readers of The Paleontograph.

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).

Lescaze, Z.; Ford, W. "Paleoart Visions of the Prehistoric Past. 1830-1980" Taschen Books, 2017, 289 pages $100 (hardcover).

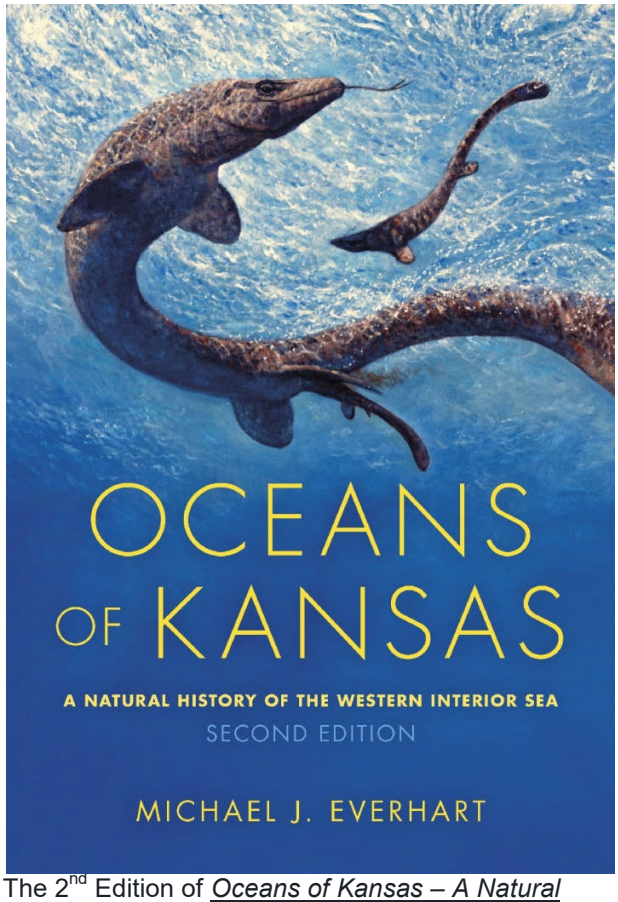
Witton, M.P. The Palaeoartist's Handbook. Recreating prehistoric animals in art." Crowwood Press, Ltd., Ramsbury, Marborough, Wiltshire, 2018, 224 pages, $21 (paperback).

Witton, M.P.; Naish, D.; Conway, J. "State of the Palaeoart", Palaeontologica Electronica, 2014, Vol. 17, Issue 3, 5E.

Witton, M.P. "Pterosaurs" Princeton University Press, Princeton, 2013, 291 pages. $35 (hardcover).

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



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

Tucson 22nd Street Mineral & Fossil Show

January 31 – February 17, 2019

https://www.22ndstreetshow.com/

http://www.ny-nj-gemshow.com/images/banner.png

https://www.coliseumshow.com/wp-content/uploads/2018/09/2018DenverColiseumShow-1.png

Items are posted free of charge but must be paleo related and will be published at my discretion.