The Paleontograph

A newsletter for those interested in all aspects of Paleontology
Volume 8 Issue 3 July, 2019

From Your Editor

Welcome to our latest edition. I hope all is well with you. Time is just flying, we are well into Summer. The weather here has been nice, not too hot and a good amount of rain. Enough rain that I missed out on a trip or two. But that's life.

I've been working hard getting fossils prepped for the Denver Show coming in September. I'm finally working thru a backlog of stuff that has been piling up for years. Yesterday, I found some Green River fish plates that I collected in 2004. That means I carried them to New York after I collected them and then moved them to Colorado when I moved almost four years ago. Pretty crazy.

I have a nice selection of articles from Bob as well as a new expanded Advertising page. I want to give special mention to White River Preparium. They have done some great work for me on dinosaur teeth. Super high quality work at a reasonable price. Please check out the new ads pages.

TC

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

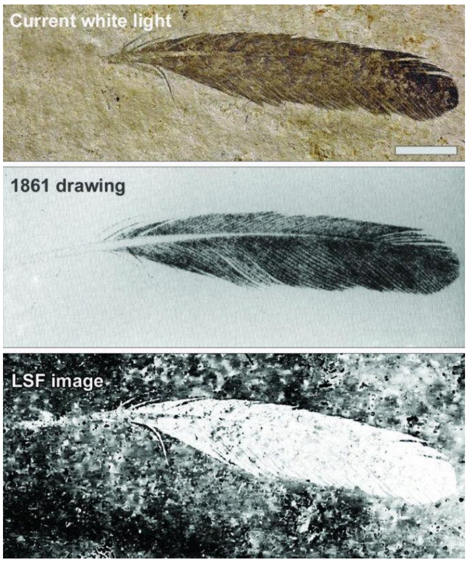
News About Archaeopteryx

Bob Sheridan February 15, 2019

Since its discovery in 1861 in the Late Jurassic Solnhofen limestone in Germany, Archaeopteryx has been regarded as the perfect transition between reptiles and modern birds, or as “the first bird.” The main reason for the second name is its possession of modern looking feathers, present as a darkened film or at least an impression in the limestone. At the time of discovery, feathers were known only from birds. The main reason for the first name is that it is very much like a small theropod dinosaur in skeletal anatomy: long tail, teeth, three fingers on the hand, etc. Nowadays, we know many theropod dinosaurs (almost all from China) who have similar feathers but who are clearly not capable of flight because their arms are too small. Archaeopteryx can thereby plausibly be demoted from “the first bird,” to “just another feathered dinosaur.” It has remained a matter of debate whether Archaeopteryx could take part in powered flight.

There are about 12 specimens of Archaeopteryx, if by “Archaeopteryx” you mean “a raven-sized theropod dinosaur from Solnhofen with long arms, often found with feather impressions”. It is not clear whether all specimens called Archaeopteryx are the same genus, because they differ in size and some are too fragmentary for a complete comparison. It has been suggested that there may be at least two difference species of *Archaeopteryx: lithographica and siemensii.*

Archaeopteryx has been iconic for so long that any new study is usually big news. The first specimen of Archaeopteryx is an isolated feather (1860-1861). It appears to be about 5.8 cm long and 1.2 cm wide, has an asymmetrical vane, and otherwise strongly resembles a modern flight feather. To the naked eye, the specimen appears to be missing the calamus, the part of the shaft proximal to the vane. This is the part that attaches to the bird. However, through laser-stimulated fluorescence, the calamus is visible and appears to curve relatively sharply relative to the remainder of the shaft.



In the 1860’s it was natural to assume that this isolated feather and the more complete Archaeopteryx skeletons were from the same type of animal. However, the feather appears much smaller than expected from even the smallest Archaeopteryx skeleton with feathers, so it has been suggested that it might be from a juvenile. Or it might be from another animal altogether. So is the original feather from Archaeopteryx? A recent paper from Kay et al. (2019) argues that it might not be. This is based on superimposing the feather vane and the shaft of the isolated feather on the different types of feathers seen with Archaeopteryx skeletons, and also on the feathers seen in modern birds. Feathers on the wings of modern birds are divided into primary (connected to the hand), secondaries (connected to the forearm), and coverts (which cover other feathers—also called contour feathers). Coverts can be further divided into primary coverts and secondary coverts. There are also long feathers (retrices) from the tail. The tail feathers of Archaeopteryx are long and symmetrical, unlike the isolated feather. The authors feel that the shaft in primary feathers from Archaeopteryx are much straighter than in the isolated feather. The secondary feathers from Archaeopteryx are much more elongated than the isolated feather. Unfortunately, no covert feather of Archaeopteryx is preserved enough that its shape can be compared to the isolated feather. However, in modern birds, the shaft of primary coverts is S-shaped, unlike in the isolated feather, and the shaft of secondary coverts is thin compared to that of the isolated feather.

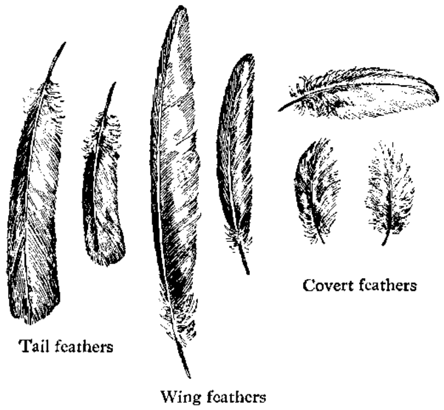
Cont'd

Archaeopterryx Cont'd

Thus, the authors feel any connection between the isolated feather and Archaeopteryx is weak, and the only possibilities are:

The isolated feather may be an Archaeopteryx covert feather, but we must assume Archaeopteryx covert feathers are different than modern covert feather.

The isolated feather may be from a different bird/dinosaur altogether.



Our second story concerns the eighth discovered specimen of Archaeopteryx, called the Daiting specimen (after the village of Daiting), which was discovered in 1996. It is thought to be from the Mormsheim Formation, which would make it about 100,000 years younger than the Solnhofen skeletons. The specimen is fragmentary, consisting of most of a skull, the pectoral girdle and arms, and fragments of the leg bone. Since its discovery it was sold several times, but since 2009 resides in the Bavarian State Collection of Paleontology and Geology in Munich. Kundrat et al. (2019) recently reanalyze this specimen using high-resolution CT-scanning. Trace elemental analysis of the matrix confirms that it is from the Mormsheim Formation, rather than Solnhofen.

The authors feel that, because of many skeletal details, which the paper goes into, the Daiting specimen is distinct enough from the Solnhofen skeletons, usually assigned the species *Archaeopteryx lithographica*, that it deserves its own species name *Archaeopteryx albersdoerferi* (named after the paleontologist who purchased the specimen last and made it publicly available). There are some characteristics that make *A. albersdoerferi* more "bird-like" than the older specimens, for example, there is more fusing of the skull bones, fewer teeth, and stronger hand bones.

Those who have been following the literature on the phylogenetic analysis of Archaeopteryx, early birds, and bird-like dinosaurs know that the assignment of Archaeopteryx as a primitive bird (avalian) as opposed to an advanced bird-like dinosaur like a dromaeosaur is not very robust in the sense that the "answer" can be affected by exactly what specimens are included and what characters are chosen to analyze. This is not surprising because the definition of "bird" is somewhat arbitrary and species have different mixes of primitive and advanced characteristics. However, the phylogenetic analysis using *Archaeopteryx albersdoerfi* made by the authors unambiguously places it as closely related to the other Archaeopteryx specimens, and as a primitive bird.

Sources:

Kaye, T.G; Pittman ,M.; Mayr, G.; Schwarz, D.; Xu, X.
Detection of lost calamus challenges identity of isolated Archaeopteryx feather.
Nature Scientific Reports, 2019, 9, 1182

Kundrát, M.; Nudds, J.; Kear, B.P.; Lü, J; Ahlberg, P.
The first specimen of Archaeopteryx from the Upper Jurassic Mörnsheim Formation of Germany
Historical Biology, 2019, 31, 3-63.

Bird Foot in Amber

Bob Sheridan April 18, 2019

Amber is fossilized tree sap. It is an important source of well-preserved invertebrate fossils. It is rare for entire vertebrates to be found in amber, mostly because most vertebrates are large enough to pull themselves free from tree sap. On the other hand, detached parts of vertebrates (feathers, scales, etc.) are common. Amber as old as the Cretaceous is fairly rare; some sources are New Jersey and Myanmar (called "Burmese amber"). Burmese amber, for example, is ~100 Myr. old.

Today's story is a paper by Xing et al. (2019) who describe the dismembered right foot and detached wing portion of a bird included in a piece of Burmese amber. The original piece of amber is 1.4 X 2.2 X 1.0 cm, and was discovered in a commercial amber market in Myanmar. The amber piece was studied by optical microscopy and CT-scanning. The foot is about 0.7 cm long and consists of partial metatarsals and four almost complete phalanges. (Missing portions of the end of two claws would have extended outside the piece.) It is presumed the bird was already dismembered before being preserved.

Soft tissue and feathers are preserved with the foot. The fact that the bones are fully ossified indicates that this is not a hatchling. The curvature of the toes is consistent with a perching bird and the shape of the bones are consistent with the bird being an enantiornithine although the genus cannot be specified. Enantiornithines are so-called "opposite birds", with the concave-to-convex articulation of the scapula and coracoid opposite that of all living birds. Almost all enantiornithines have some teeth and retrain finger claws, although they appear quite modern otherwise. No enantiornithine survived the end of the Cretaceous.

Soft tissue on the foot includes scutes and scutellae, what we would call the "scales" on bird feet. The metatarsals have attached pennaceous feathers, and the toes have filamentous feathers. Color banding is observable in the contour feathers. This is similar to feathers found on the feet of modern birds.

This piece of amber also includes a fragment from the wing (presumed to be from the same individual) that consists of portions of 10 asymmetric flight feathers. The feathers are not complete; the distal and proximal parts of the feathers would extend outside the piece and are not preserved.

This is not the first time an enantiornithine was preserved in Burmese amber. The same authors (Xing et al., 2017) describe an entire precocial hatchling.

Sources:
Xing, L.; McKellar, R.C.; O'Connor, J.K.; Bai, M.; Tseng, K.; Chiappe, L.M.
A fully feathered enantiornithine foot and wing fragment preserved in mid-Cretaceous Burmese amber.
Nature Scientific Reports, 2019, 9: 927.

End of the Megafauna—A Review

Bob Sheridan January 21, 2019

Megafauna are defined as any animal with an adult weight > 100 pounds. In what is called "Near Time" (i.e. younger than 50,000 years), a large fraction of the megafauna across the Earth have gone extinct. This happened at different times in different places: Pacific Islands and Australia (~40,000 years ago), Japan (~30,000 years ago), North America (~12,000 years ago), Madagascar (~2,000 years ago), New Zealand (< 1,000) years ago. If you expand the time being considered back to a few million years, there are also megafaunal extinctions in Africa, Asia, and South America.

While these extinctions were minor compared to the Big Five mass extinctions, they are still large enough to need explanation. Those of us who follow paleontology as a hobby are aware of least two major families of explanations: (hunting by humans, climate change), and at least a few fringe type of explanations (for example, meteorite impact and disease). We should be aware that large animals are more vulnerable than small animals to extinction, whatever the cause, because they reproduce and mature slowly and require more food.

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A new book "End of the Megafauna" summarizes the strengths and weaknesses of the current ideas about megafaunal extinctions. The author Ross MacPhee is a paleontologist with the American Museum of Natural History. The illustrator Peter Schouten specializes in natural history subjects, including the restoration of extinct animals. You may want to check out the following interview and talk by MacPhee:

https://www.scientificamerican.com/article/interview-with-ross-macph/

https://www.amnh.org/explore/videos/scicafe-lectures/scicafe-end-of-the-megafauna-with-ross-macphee

Currently, the most plausible explanation for megafaunal extinctions is that humans caused them. The original idea put forth by Paul Martin at the University of Arizona in 1966, usually called "overkill" or "blitzkrieg," is that humans hunted all the large animals beyond the point of recovery. Direct hunting is not necessarily the cause for extinction; habitat destruction by humans is also sufficient (as we know from current extinctions). The what this explanation has in its favor has always been the coincidence in time: the extinctions seem to happen within a few thousand years of when humans arrived on a continent or island. The exception seems to be Africa and Eurasia, which did not suffer an extinction in Near Time although humans were there for at least a million years. The explanation could be that the animals on Africa and Eurasia were already familiar with humans, while animals on other continents were "naive" and could be approached closely. The major weakness with "overkill" is that it seems implausible that a few humans could have such a large effect, and there is no evidence for large scale butchering of animals (other than mammoths or mastodons) from that time. Also, as dating of fossils get more precise, the coincidences don't seem as strong.

The other historically favored hypothesis is that climate change was an issue, since at least the extinction in North America coincided with the end of the last ice age. However, this is has always been a very weak explanation since there have been very many cycles of cooling and warning in the fast few million years, and no extinctions are observed for all except the last.

A popular "fringe hypothesis" has to do with "hyperdisease", which might be introduced to continents by humans or their domesticated animals. This keeps the idea that humans caused the extinctions, but gets around the implausibility of humans killing entire populations of animals. However, while there are some terrible diseases that reduce populations of animals by a large fraction, we know of no diseases that can wipe out many entire species at the same time.

There is indirect evidence for a bolide impact about 12,000 years ago (the "Clovis comet hypothesis"). This includes shocked quartz, glass melts, a higher trace concentration of platinum, and "black mats" of material (soot from wildfires) at certain strata. There are only a few sites in North America, western Eurasia, and South America where such evidence can be found. One might have some sympathy with this suggestion, since the idea that an asteroid impact caused the K-T extinction was once a fringe idea, but so far the evidence for an end-Pleistocene impact is fairly weak.

MacPhee points out that all current hypotheses have something appealing about them, but also suffer from very large flaws. It is possible that there was a different cause for each regional extinction or that for each extinction a number of small causes added up. In this type of situation, however, it becomes almost extremely difficult prove any cause one way or the other.

The epilogue of "End of the Megafauna" is a short discussion of whether it would be possible to bring back at least some megafaunal species by genetic engineering.

This is a very densely illustrated book. Some of the illustrations are drawings of fossils and a few are diagrams. However, the majority of the illustrations are of the fauna of a particular location and time. These are wonderful. I was not familiar with the work of Peter Schouten before, but he is on a par with Anton Mauricio in terms of depicting fossil animals (particularly mammals) realistically.

I am not an expert about end-Pleistocene extinctions, so I found this book to hit the right balance of being informative and being easy to understand.

Sources:

MacPhee, R.D.E

"End of the Megafauna. The Fate of the World's Hugest, Fiercest, and Strangest Animals."

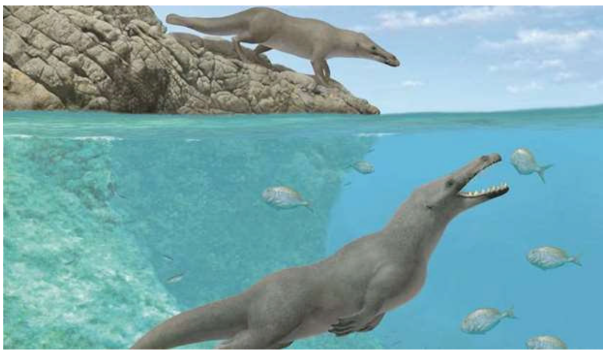
W.W. Norton & Co. New York, 2019, 236 pages. $35 (hardcover).

Peregocetus

Bob Sheridan April 20, 2019

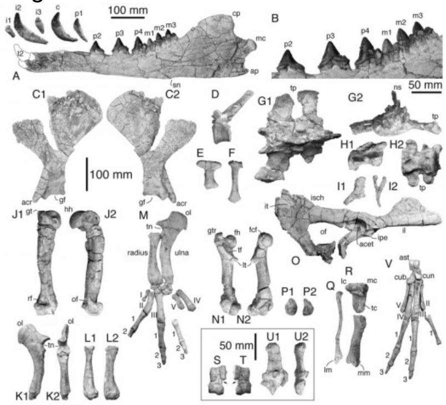
The development of whales and their relatives (cetaceans) from land mammals (specifically, even-toed hoofed animals, the artiodactyls) is a story that can now be followed fairly well because of fossils found in Egypt, India, and Pakistan since the mid-1990’s. There are a number of intermediate fossil forms that range from purely land-dwelling hoofed animals to clearly aquatic near-whales with flippers and vestigial legs. The features that link all these animals to modern whales are an elongated skull with triangular teeth and a unique type of capsule around the inner ear. Where legs are present, all share the “double-pulley” ankle characteristic of artiodactyls. Most of the land to water transition happened during the Eocene. At one time it was thought that wolf-like hoofed predators from the Oligocene called mesonychids were the ancestors of whales. However, genetic evidence shows unmistakably that the closest living artiodactyl to whales are hippos, hence the nickname “whippos” applied to the two groups.

The group of whale ancestors that could both walk and swim are collectively known as “protocetids.” Possible protocetid fossils have been found outside Indo-Pakistan, some as far as North America, but these have been very fragmentary. Lambert et al. (2019) describe a new protocetid from the southern coast of Peru. It is complete enough that one can conclude that protocetids reached the southern hemisphere and the Pacific Ocean in the Middle Eocene (42.6 Myr.). Hence the name Peregocetus pacificus (“traveling whale that reached the Pacific”).



The specimen of Peregocetus (MUSM 3580) is only partially complete, consisting of the pelvis, front and rear limbs, vertebrae, ribs fragments, and a lower jaw. The state of ossification indicates it is an adult. The live animal would have been about 4 meters long. It had five fingers and four toes with tiny hooves. The tail vertebrae has lateral processes that the authors imply broadens the tail, making it more useful for swimming, as in otters or beavers. It appears to be similar to Indo-Pakistani protocetids such as Maiacetus and Rodhocetus, which are a few million years older.

The pelvis of Peregocetus is firmly attached to the spine, indicating that it could bear weight and probably could walk. On the other hand, no protocetid could walk from Africa or South Asia to South America, so it must have been able to swim long distances in the ocean.



Sources:

Lambert, O.; Bianucci, G.; Salas-Gismondi, R.; Di Celma, C.; Steurbaut, E.; Urbina, M.;

de Mulzon, C.

A amphibious whale from the Middle Eocene of Peru reveals early South Pacific dispersal of quadrupedal cetaceans.

Current Biology, 2019, 29, 1-8.

My Favorite Fossil Quote
TC

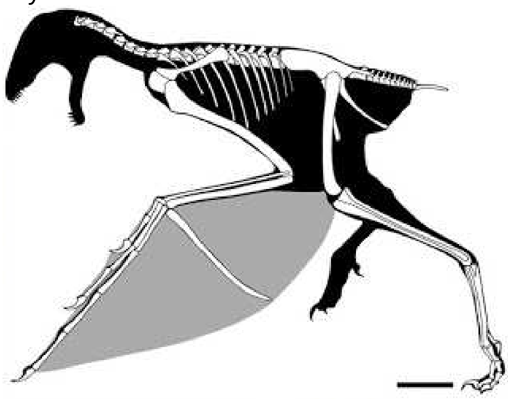
"Fossil hunting is by far the most fascinating of all sports. The hunter never knows what his bag will be, perhaps nothing, perhaps a creature never before seen by human eyes! The fossil hunter does not kill, he resurrects. And the result of his sport is to add to the sum of human pleasure and to the treasures of human knowledge"

George Gaylord Simpson

Ambopteryx

Bob Sheridan May 21, 2019

There are many ways of making wings good enough to fly with. For most birds, the aerodynamic surface is made of feathers. In contrast, in bats the surface is made of membrane stretched between elongated fingers the body. In pterosaurs the wing is a membrane stretched between an elongated fourth finger and body. One would expect all theropods close to the ancestry of birds to be of the "feathers only" type. That is why the description of *Yi qi* ("strange wing") in 2015 was such a surprise. Yi, a pigeon-size theropod from the Late Jurassic of China, is feathered . Yi has a very elongated third finger and a rod-like elongated wrist bone called the "styliform element".



Presumably these bones support a membrane-based wing, and part of a membranous structure is preserved. Yi belongs to a family of bird-like theropods called the scansorioptergids, which has two other members: Epidexipteryx and Scansoriopteryx. These have very long third fingers and backward pointing toes and are therefore thought to be able to live in trees. However, only Yi has good evidence for a membranous wing. The inference is that theropods found an alternative way to build a wing. (BTW, Yi holds, and will always hold, the record for the shortest dinosaur genus.)

Wang et al. (2019) describe a new scansoriopterygid from the Late Jurassic of China which they name *Ambopteryx longibranchium* (both wing with a long forelimb). The specimen is almost complete, and some soft tissue and feathers are preserved.

Ambopteryx longibranchium

It shows stomach contents including gastroliths and some unidentified bone fragments. Ambopteryx is a fairly large scansoriopterygid, about 32 cm long. It has very long send slender forearms. As with Yi, but no other dinosaur, it has a styliform element (about as long as the radius) extending from the end of the ulna. This confirms that the styliform element is "real" in Yi and Ambopteryx, and not some misidentified bone from another animal. The matrix around the left hand seems to be coated in a continuous layer with ripples; this is presumably the same as the "wing membrane" in Yi. The styliform element can be considered to be analogous to the pteroid bone extending from the wrist bones of pterosaurs, although in pterosaurs this bone is short compared to the radius.

Phylogenetic analysis shows Yi and Ambopteryx are very closely related and nested within the family of scansoriopterygids, and scansoriopterygids are very close to the split between bird-like dinosaurs and other feathered theropods. Analysis of the relative sizes of the bony elements (humerus, radius, metacarpals, carpals) shows that scansoriopterygids are not like other theropods, dinobirds, or true birds. In particular scansoriopterygids have a long humerus and ulna but short metacarpals, whereas dinosaurs and dinobirds have short humeri and long metacarpals, presumably for attachment of flight feathers.

Sources:

Wang, M.; O'Conner, J.K.; Xu, X.; Zhou, Z.

"A new Jurassic scansoriopterygid and the loss of membranous winds in theropod dinosaurs."

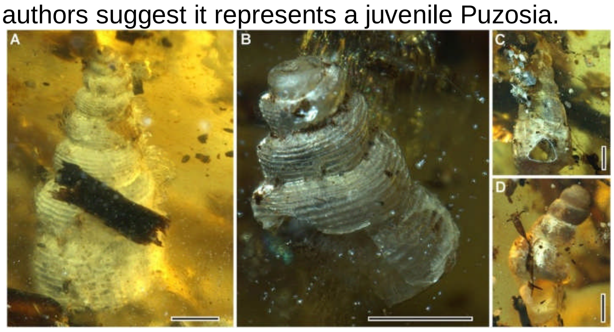
Nature 2019, 569, 256-259.

Ammonite in Amber

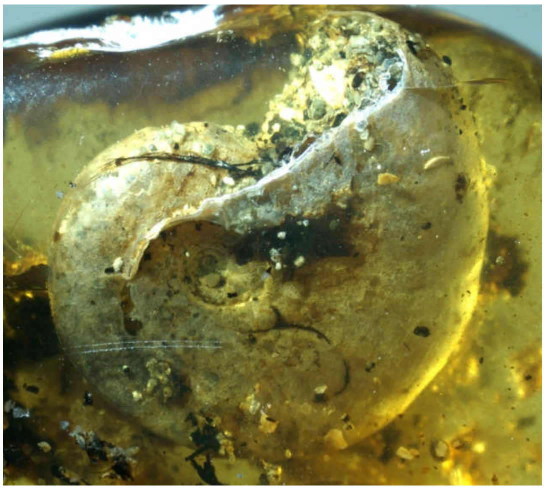
Bob Sheridan May 18, 2019

Since amber is the fossilized tree sap of conifers, and conifers are usually far from the ocean, it is unexpected that amber would include marine animals as inclusions. However, a recent paper by Yu et al. (2019) describes a counter-example. The piece of amber in question was collected near Noije Bum Village in Myanmar. Usually Burmese amber is mid-Cretaceous, and dating of the matrix around the amber confirms an age of 100 Myr. The piece is 33 X 9.5 X 29 millimeters in size and contains at least 40 individual specimens. The piece was studied by optical microscopy and CT-scanning. Most of the specimens are expected for a forest floor environment: mites, spiders, millipedes, cockroaches, beetles, flies, isopods (pill bugs), and wasps. That diversity alone makes this piece of amber fairly unusual. Not all of these specimens can be identified at the genus level, since some are degraded.

The unexpected specimens in this piece of amber are: four marine gastropods, two of which can be identified as the genus Mathilda, and a single ammonite. The ammonite is about 12 millimeters in diameter. It is probably a juvenile based on the spacing of the septa within the shell. Identification of the ammonite is uncertain, but likely genera from that time are Beudanticeras and Puzosia. The authors suggest it represents a juvenile Puzosia.



Since the gastropod and ammonites shells are empty and partly damaged, they are consistent with dead shells being washed up on a beach. The most likely scenario is that the resin is from a tree growing near the beach. The resin rolled down the trunk, capturing the land arthropods, and eventually hit the sand, where it engulfed the marine shells. (However, it is not clear why amber on a beach would not be destroyed by waves.) A less likely scenario is that a flood from the sea came inland and splashed water containing the marine specimens on the resin as it sat on a tree trunk.



One interesting aspect of amber is that it cannot be directly dated. The date must be inferred from the sediment the amber is buried in, and the possibility of amber being reburied in sediments younger than the amber itself cannot be ruled out. However, in this case the ammonite genus is consistent with the date of the sediment.

Sources:

Yu, T.; Kelly, R.; Mu, L.; Ross, A.; Broly, P.; Xia, F.; Zhang, H.; Wang, B.; Dilcher, D.

"An ammonite trapped in Burmese amber."

Proc. Natl. Acad. Sci. USA, 2019, 116, 11345-11350.

FYI

For those who enjoy echinoids and want to see an exhaustive database of specimen photos from around the world, check out this site:

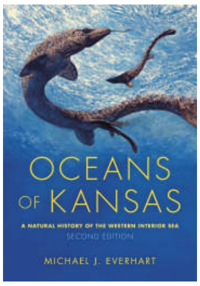
http://www.nhm.ac.uk/research-curation/projects/echinoid-directory/taxa/index.jsp

If anyone out the in **Paleontograph** land has a good website they would like to mention, let me know.
TC

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

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 (including Tom Caggiano's dinosaur bones in hand shot).

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

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https://www.fossilsafari.com/

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PALEONTOGRAPH ADVERTISMENT & EVENTS PAGE

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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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