_________The Paleontograph_______

A newsletter for those interested in all aspects of Paleontology
Volume 1 Issue 8 September, 2012

From Your Editor

Welcome to our latest issue. This issue was a bit late in coming out according to our usual pace but as I explained in the beginning of all this; issues will come out as I have content to fill them. This is the first issue since we started that I've had to rely on articles only from Bob Sheridan. While Bob is a prolific and interesting author I ***really*** would prefer to have contributions from others. So please consider writing. An article on your last collecting trip with a picture or two would be great. Or maybe one about a visit to a museum. I'm pretty easy as long as it is about Paleontology in some way. I will throw out a few topics here: Articles about Criniods, a fossil preparation project, some famous closed locality, Mazon Creek fossils, Ammonites. Pick one!!

I have a trip coming up to the Cretaceous of North Carolina. It is one of my favorite localities and it will be good to get back into it after a few years. The cool weather is starting to set in up here in New York and I will be planning my last few trips before the ice and snow of Winter.

Bob has written some good articles, I hope you enjoy them and they inspire you to write. Please don't turn the editorial page into a monthly begging rant asking for articles.

The Paleontograph was created in 2012 to continue what was originally the newsletter of The New Jersey Paleontological Society. The Paleontograph publishes articles, book reviews, personal accounts, and anything else that relates to Paleontology and fossils. Feel free to submit both technical and non-technical work. We try to appeal to a wide range of people interested in fossils. Articles about localities, specific types of fossils, fossil preparation, shows or events, museum displays, field trips, websites are all welcome.

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

Edited by Tom Caggiano and distributed at no charge

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Earth Before Dinosaurs--A Review

Bob Sheridan July 2, 2012

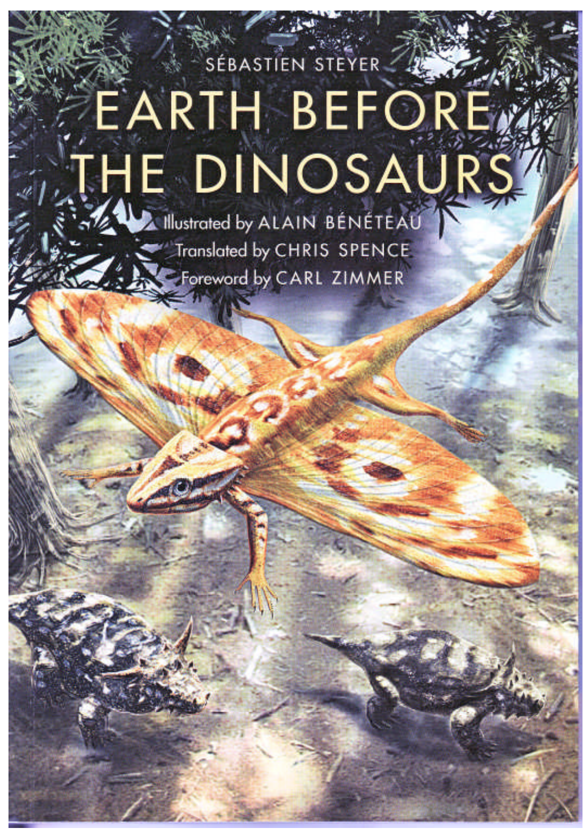
What would be an ideal paleo book for a serious amateur such as myself? One that was well-illustrated and had detailed information about topics with which I am unfamiliar. On the other hand, the book would not assume I knew complex anatomical or geological nomenclature. I recently came across a good example: "Earth Before the Dinosaurs," which popped up as a recommendation on Amazon.com. This book is in the "Life of the Past" series, edited by James O. Farlow. The author Sebastien Steyer is a paleontologist at the Museum of Natural History in Paris. Steyer's words are translated into English by Chris Spence, a translator, journalist and amateur paleontologist. The illustrator is Alain Beneteau, a well-recognized paleoartist. As you might expect, this book is very well illustrated, with about 50% of the page area covered by pictures, most in color. There are many sharp photographs of actual fossils, many easy to understand diagrams, and many paintings of the restored animals. One reviewer on Amazon thought the author's attempts to be humorous or "cute" fell flat, but I disagree. As a "Lord of the Rings" fan, I found the story of the "precious" of Lesotho particularly amusing.

"Earth Before the Dinosaurs" is a rather general title, and other than that it discussed life before the Mesozoic, one would not easily guess the contents. It is a series of topics divided over five chapters:
The transition between fish and the earliest tetrapods in the Devonian.
Amphibians from the Carboniferous to the Permian.
The earliest amniotes (in this case reptiles).
The variety of animals in the Permian and Triassic
General remarks about paleontological methods.

The first four are topics not usually covered in most popular books. Topic one is thoroughly covered by another book "Gaining Ground" by Jennifer Clack, but the first edition was published in 2002. Many more specimens are available now, including the famous Tiktaalik. It is interesting that the fish/tetrapod transition is turning out much like the dinosaur/bird transition: it is very hard to distinguish fish-like tetrapods from tetrapod-like fish, and almost all supposed characteristics of tetrapods (for example, toes) are also found in animals that obviously could never leave the water.

Before reading this book, I could not distinguish temnospondyls from lepospondyls. Now I understand that the difference has to do with the configuration of the backbone. It is not settled how the two classes of amphibians relate to each other or to modern amphibians (lissamphibians). Most of these animals look superficially like salamanders, although given their size and sharp teeth, they may have acted more like crocodiles. Legless amphibians seem to have evolved several times, converging on modern snakes in shape. Interestingly, while there are no modern marine amphibians, there seem to have been many of them in the Triassic. How these animals survived in salt water is not clear.

The only early reptile I could name before reading this book is Seymouria, a two-foot animal from Texas. I remember it because presumably because it is one of the first early reptiles named (in 1870), and because it seems to be named after a person. (Seymouria is named after Seymour, Texas, which is in turn named after a local cowboy Seymour Monday.) There was quite a diversity of early reptiles of which I was unaware. Besides seymouriamorphs, there are anthracosaurs ("coal lizards") and diadectomorphs.



Review Cont'd

The highest diversity of synapsids (reptiles ancestral to mammals) was probably in the Permian. The highest diversity of non-dinosaur diapsid reptiles seems to been the Permian and Triassic. There are too many weird animals to relate here, but here are a few that stand out. Two arboreal reptiles Megalancosaurus and Depanosaurus are found in the Triassic of Italy. The first has a bird-like head, grasping feet and a curling tail with a claw at the end, seeming to converge on the modern cameleon. The second has a hypertrophied claw on its thumb, very much like an anteater. Coelurosaurus (depicted on the book cover) is an early reptilian version of a "flying squirrel" found in the Permian of Europe and Madagascar. Where as modern flying lizards such as Draco use their ribs to form the "wing", Coelurosuaurs has a separate set of by long bony rods in the skin.

The last chapter discusses the toolkit of paleontology, but with an emphasis on less classic techniques: CT scanning, finite element analysis, isotope analysis.

I would give this book a high recommendation if you are looking for a book on "special topics" rather than an exhaustive survey of vertebrate paleontology.

Sources:

Steyer, S. (translation by C. Spence, illustrated by A. Beneteau)

"Earth Before the Dinosaurs"

Indiana University Press, Bloomington Indiana, 2012, 182 pages, $35 (paperback).

Thrips and Gymnosperm Pollen

Bob Sheridan June 24, 2012

Gymnosperms are plants with "naked seeds." This includes conifers, cycads, and the ginkgo. Most gymnosperms spread their pollen by wind, but there are a few that are pollinated by a few specialized insects.

Thrips are small (usually less than a millimeter) cigar-shaped insects with feathery wings and sucking mouth parts. Some feed on pollen, some on plants, and some on other small arthropods. Some thrips are known to be pollinators of some flowering plants, and some of cycads. Thrips are known to sometimes inhabit the male cones of conifers, but they are apparently there to eat the pollen and not transfer it.

Last month in PNAS, Penalver et al. (2012) described six thrips encapsulated in amber from the Late Cretaceous (110-105 Myr.) of Spain. These authors named the animals Gymnopollisthrips ("gymnosperm pollinating thrips") major and minor. The "minor" species is about 2 mm long. The "major" species is presumably larger, but not pictured in this paper. The described specimens have prominent ovipositors, and so are female.

Fossil thrips in amber are not uncommon. The special aspect of these specimens is that they are covered with tens to hundreds of pollen grains. These grains are simple spheroids in shape, about 20 micrometers long and 13 micrometers wide. The authors cannot assign the pollen to specific plants, but they probably belong to a ginkgo or cycad. These plants have separate male and female organs, which may be on different individuals. The authors feel Gymnopollisthrips has specialized setae (bristles) on protruding parts of the body that is meant to collect pollen. These setae have rings at intervals along their length, presumably to increase surface area. While most types of thrips have fairly long setae, this type of "ring setae" is not observed in modern insects.

From National Geographic

The association of Gymnopollisthrips with pollen provides the earliest evidence of pollination by insects. Thrips are not social like bees, so it is not obvious why they would have specialized organs for transporting pollen. (If you were just going to eat the pollen, there would be no reason to transport it on your body.) **Cont'd**

Thrips Cont'd

The authors propose a scenario where where thrips would bringing pollen to their larvae, which probably lived inside conifers. This would necessitate having to transport pollen from different trees. In this way conifers and thrips could eventually establish a mutual relationship. The plants provided the shelter, while the thrips provided the pollination.

I feel a bit skeptical toward this idea, which is based on the assumption that the ring setae are a special adaptation for deliberately transporting pollen, and the observation such ring setae are only on the protruding parts of these thrips. However, the pollen does not seem to stick to the rings, but is seen at the base of the setae. A simpler explanation may be that the thrips were eating pollen at a conifer cone and happened to be covered with pollen. Pollen happened to stick at the base of the setae in these specimens because that is mechanically where it is least likely to be brushed off.

Sources:

Penalver, E.; Labandeira, C.C.; Barron, E.; Delclos, X.; Nel, P.; Nel, A. "Thrips pollination of Mesozoic gymnosperms."
Proc. Natl. Acad. Sci. USA 2012, 109, 8623-8628

The Paedomorphic Skulls of Birds

Bob Sheridan July 21, 2012

Paedomorphism (or sometimes spelled pedomorphism) is the retention of traits in an adult animal that resembles the juvenile trait in related animals. Some examples: the retention of gills in some salamanders, the round human skull compared to the prognathic skull of chimps, floppy ears in adult dogs like those of wolf puppies.

A recent paper by Bhullar et al. (2012) maintains that bird skulls are paedomorphic relative to dinosaur skulls. These authors examined 45 landmarks in a few dozen skulls of birds, non-avian theropods, and primitive archosaurs. While in years past, measurements for study of this type would have been made with calipers on real skulls, this study was done with software measuring the distance between landmarks in digitized CT scans.

Differences among the skulls can be represented by principal components analysis as occurring along two axes. The first axis (PC1) has to do with the parts of the skull from the eye backward (including the brain) being larger than the snout. The second axis (PC2) has to do with the skull being elongated from front to back, as opposed to short. In this space skulls fall into four clusters. Three of the clusters fall along PC1, in order of more enlarged eye and brain:
Non-eumaniraptoran adult dinosaurs (i.e. the theropods least related to birds) and large eumaniraptoran dinosaurs (e.g. Tyrannosaurus).
Primitive eumaniraptoran adults, early bird adults, and embryos of other archosaurs.
Adult birds, juvenile birds, and bird embryos.

The fourth cluster consists of oviraptors, eumaniraptoran dinosaurs with extremely short skulls. (i.e. especially low value on PC2).

We can see that, as birds grow up, the shape of the skull does not change much, in contrast to that of most theropods where the skull becomes long. Also bird skulls are more "juvenile" than even the skulls of archosaur embryos. One can also conclude that adult maniraptorans are more "juvenile" relative to other theropods. That is, there is a progression of increased paedomorphism are theropods more related to birds.

Given that birds are smaller than most theropods, one would have to be sure that these trends were not accounted for by size, i.e. smaller dinosaurs are more "juvenile." This is not the case. Even very small (bird-sized) non-eumaniraptoran theropods like Compsagnathus have elongated skulls with smallish brains relative to the skull length.

The authors speculate that the paedomorphosis was necessary in true birds so that the eyes and brain could be big enough to handle flight. Also, the reduced snout allowed for the enlargement of the beak. However, at present, the timing of flight vs. paedomorphism is not clear.

Sources:

Bhullar, B-A. S.; Lobon-Marugan, J.; Racimo, F.; Bever, G.S.; Rowe, T.B.; Norell, M.A.
"Birds have paedomorphic dinosaur skulls."
Nature 2012, 487, 223-226.

Could Ichthyostega Walk on Land?

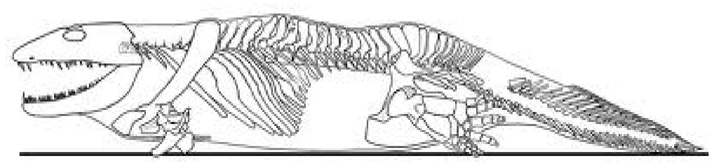
Bob Sheridan July 14, 2012

Ichthyostega is a large (1.5 meter) early tetrapod from the Late Devonian with a large flattened head, clear pectoral and pelvic girdles attached to the spine, and four short limbs with toes (7 toes on each hindlimb, an unknown number on the forelimb). It was first described in 1932 and for a long time was regarded as a perfect example of a transitional creature that could either swim or walk, presumably like a modern amphibian. It has a flattened tail that would be good for swimming. On the other hand, it has thick overlapping ribs to help rigidify its torso, presumably for lifting its body off the ground.

From Science News Julia Molnar

Whether Ichthyostega, or any other early tetrapod, could really move its limbs in a walking motion has never really been tested. A recent article by Pierce et al. (2012) attempts to find the answer. These authors CT scanned a number of Ichthyostega specimens and then made a virtual model of the limbs and their joints. They moved the virtual bones relative to each other to estimate the range of motion. Each joint could be modeled in three rotational degrees of freedom: flexion/extension (moving the joint such that the limb is bent or extended), abduction/adduction (moving the limb away from or toward the midline of the body), and pronation/supination (twisting around the long axis of the limb). These authors did a similar study with modern animals that represent an amphibious lifestyle: a salamander, crocodile, platypus, seal, and otter.

The result of this study is clear and specific. Both the hip joint and shoulder joint have much less range in pronation/supination than any of the modern animals. This is generally explained by the fact that the modern animals have more or less cylindrical femur and humerus with spherical heads, while Ichthyostega has a flattened femur and humeri with long heads, which makes the joint more like a hinge than a ball-and-socket. The authors conclude that Ichthyostega could not have walked with a "normal" asymmetric salamander gate (i.e. left foot forward, then right foot forward). As an alternative, they suggest it might have walked on land with a symmetrical gate (both forelimbs together), more like a seal or mudskipper.



New *Ichthyostega* reconstruction from Ahlberg et al. 2005

There are trackways from the Middle Devonian which seem to show an animal with an asymmetric gate. If the conclusions of this paper are true, then these trackways could not have been produced by Ichthyostega.

This is a ground-breaking paper, but there is certainly room for further investigation. The investigation here looks at the shoulder and hip joints in isolation. Do we know for sure that the shoulder, elbow/knee, and wrist/ankle joints working together could not produce an asymmetric gate? Also, while Ichthyostega is a perfect starting point because its skeleton is known nearly completely, a similar study needs to be done on Acanthostega, Tiktaalik, etc.

Sources:

Pierce, S.E.; Clack, J.A; Hutchinson, J.R. "Three-dimensional limb joint mobility in the early tetrapod Ichthyostega." Nature 2012, 486, 523-526.

A Feathered Dinosaur (not Archaeopteryx!) from Germany

Bob Sheridan August 4, 2012

Ed. Note:

Frank Haase reported on this find in our June 2012 issue before the formal scientific description was published.

So far, feathered dinosaurs have come from two places: various locations around China and (if you count Archaeopteryx) Solnhofen, Germany. Almost all dinosaurs with preserved feathers are from a branch of theropods called coelurosaurs, and the dinosaurs with modern feathers (vances and a central shaft) are closely related to birds. There are one or two examples of preserved integument (but not necessarily "feathers") from ornithiscian dinosaurs (e.g. the bristles on the tail of Psittacosaurus).

From malvit.deviantart.com

Rauhaut et al. (2012) describe a new specimen of theropod from Bavaria, Germany that was preserved in Late Jurassic limestone. They name this animal *Sciurumimus albersdoerferi* ("Albersdorfer's tree squirrel-mimic"--in reference to its bushy tail). The specimen is a complete theropod juvenile about 2 feet long. Juvenile characteristics include a very large head, short hindlimbs, and lack of fusion in the bones.

The integument in Sciurumimus is preserved in several areas around the skeleton. The skin seems smooth, i.e. without scales. The skin also shows long hair-like filaments, that appear to be the same as type I feathers in Compsognathus-like dinosaurs such as Sinosauropteryx. The filaments are preserved mostly along parts of the tail and back. Interestingly, in some parts of the integument, one can see collagen fibers under the skin, and these are different from the putative feathers both in orientation and behavior under UV light. This refutes one of the (incorrect) arguments from the late 1990's that what appeared to be hair-like feathers in dinosaurs were really collagen fibers from the skin.

Phylogenetic analysis of Sciurumimus shows that it belongs to a more primitive class of theropods, the megalosauriods, named after its earliest known member Megalosaurus. So this gives three firsts for Sciurumimus:

1. The most complete megalosaurid.
2. The first evidence of feathers in basal theropods.
3. The first feathered dinosaur outside China that is not Archaeopteryx.

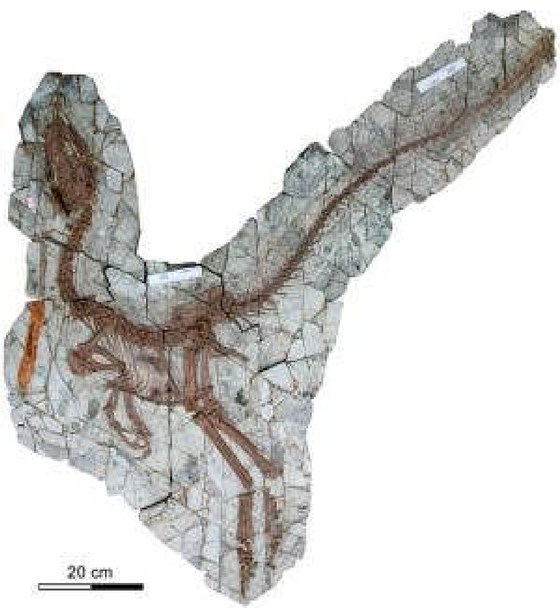
Sources:

Rauhaut, O.W.; Foth, C.; Tischlinger, H.; Norell, M.A.
"Exceptionally preserved juvenile megalosaurid theropod dinosaur with filamentous integument from the Late Jurassic of Germany."
Proc. Natl. Acad. Sci. USA 2012, 109, 11746-11751.

The Stomach Contents of Sinocalliopteryx

Bob Sheridan September 1, 2012

Sinocalliopteryx ("Beautiful feather from China") was described in 2007 based on the holotype specimen JMP-V-05-8-01, which was recovered from the Yixian Formation (Early Cretaceous). It is a largish (6 ft long) compsognathid. Compsognathids are small theropods dinosaur named after Compsognathus, which is a small (3 ft) Late Jurassic theropod from Europe that was described in the 1860's. Like most compsognathids in the Yixian Formation, Sinocalliopteryx is preserved with hair-like feathers. A recent paper by Xing et al. (2012) describes a new specimen of Sinocalliopteryx (CAGS-IG-T1). Both the holotype and the new specimen have preserved stomach contents.



The abdominal contents of JMP-V-05-8-01 appear mostly to be undigested feathers and disarticulated bones. The bones that can be clearly identified appear to be from the right shin and foot of a dromaeosaur.

Definite assignment as to the species is difficult, but, judging by size, they probably are from something like Sinornithosaurus, which would be about three feet long. A few gastroliths are also present.

The abdominal contents of CAGS-IG-T1 are from two different types of animal. There is large number of disarticulated bird bones, probably from at least two individuals. These appear to be from a species of Confusciusornis. However, not all elements of the birds are present. It is not clear whether these were never eaten, were completely digested, or were not recovered with the fossil. There are also two other flattish, somewhat more digested bones from a larger animal. One of those bones is a scapula. The best guess of the authors is that it is from Psittacosaurus, a stem ceratopsid. There are no gastroliths present.

The authors speculate about the digestive system and eating habits of Sinocalliopteryx. Given that one specimen has gastroliths (stones in the abdomen) and another does not probably means that these animals did not have stone-containing gizzards. Any stones present were probably swallowed accidentally. We cannot know for certain whether these Sinocalliopteryx killed their food or scavenged already dead corpses. The authors argue that CAGS-IG-T1 ate two birds in rapid succession (from the fact that all the bones are in the same state of digestion) and therefore this is an example of selective hunting. A land-based animal that can eat birds capable of flying away is not unusual. Modern predators that do this by ambushing the birds and pouncing on them before they can fly. They note that Confusciusornis probably could not take flight as quickly as modern birds.

Sources:

Xing, L.; Bell, P.R.; Persons, W. S. IV. Ji, S.; Miyashita, T.; Burns, M.E.; Ji, Q.; Currie, P.J. "Abdominal contents from two large Early Cretaceous composgnathids (dinosauria: theropoda) demonstrate feeding on Confusciousornithids and Dromaeosaurids."
PLoS ONE 2012, 8, e44012