The Paleontograph

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

Finally!! Welcome to our latest issue. It's been a while. I think Bob was starting to think that I had died, as he keep writing these past four months and no issues have gone out. I've spent the last months moving from my temporary home to my new home, unpacking, decorating, landscaping, etc. I can finally see the light at the end of the tunnel and get back to some semblance of my normal life. I have a good backlog of articles from Bob as well as a couple from other friends, so without further delay......

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

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Tooth Loss in an Ichthyosaur

Bob Sheridan December 28, 2015

Ichthyosaurs are Mesozoic marine reptiles that converged on the shape of modern tuna or dolphins and are assumed to fill the role of large, fast predators. They ranged in size from about a meter to over 15 meters. Most have very long jaws filled with conical teeth. The particular genus of ichthyosaur we will discuss today is Stenopterygius, which lived in the Early Jurassic and grew to 3-4 meters long. Over 100 specimens have been found, most from Germany. The consensus is that there are three species: quadriscissus, triscissus, and uniter. It is in Stenopterygius that we first observed ichthyosaur embryos inside their mothers.

One interesting feature of Stenopterygius is that most adults seem to have very small teeth, and a reduced number of teeth, whereas some juveniles show a large number of long teeth, which is characteristic of most ichthyosaurs. It has not been clear whether the apparent tooth loss is due to an artifact of unintentionally comparing different species, or taphonomic loss of teeth after death. The second is plausible because in Stenopterygius the teeth are in a dental groove, but not firmly attached to the bones of the jaws. The only way of addressing this is to see if there is a systematic change with age in these animals.

A new study by Dick and Maxwell (2015) examines photographs of 81 specimens of Stenopterygius from three museums in Germany and relates characteristics of the teeth as a function of size. Here size is used as a proxy for age. However, some specimens are definitely juveniles (the embryos found inside another ichthyosaur) and some were definitely adults (the ichthyosaurs containing the embryos). As with most ichthyosaurs, the teeth are Stenopterygius are uniform in size and shape and very simple: a cone (the crown) on top of a cylindrical root. One can measure the crown width and crown height as well as the total tooth length. The size of the specimens is approximated by jaw length.

If one graphs the log of the crown height (averaged over all teeth) vs. the log of the jaw length, one can see that the slope of the line through the data is less than one. That is, there is negative allometry. In this case, this means that as Stenopterygius grows in size, the teeth grow, also but at a slower rate. Therefore the teeth indeed get smaller relative to the size of the animal with age. This trend holds if one examines teeth from specific parts of the mouth. There are two other trends:

1. The total number of teeth decreases with jaw length (137 teeth on the average for one side of the mouth in juveniles and 110 teeth in adults). This is unexpected; for most reptiles more teeth appear to fill the space as the jaw gets longer.
2. The crowns get squatter as the jaw gets longer.

Please note that these trends do not apply to individual teeth. In reptiles, teeth are replaced continuously, so teeth of one shape and size are replaced with others of a slightly different shape and size as the animal ages.

In larger Stenopterygius, the teeth are so relatively small and blunt that they do not extend outside of the dental groove, so an adult Stenopterygius is rendered effectively toothless. This is unusual on two counts:

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Ichthyosaur teeth Cont'd

1. Most animals that are toothless as adults are born toothless or stop growing teeth shortly after birth. We do not see many examples of toothlessness appearing in adults only.
2. Some other specialized anatomical feature (like a beak) did not arise to take the place of the teeth.

From the stomach contents of Stenopterygius we know that much of their diet consists of belemnites and other shelled cephalopods. The authors speculate whether Stenopterygius being toothless is consistent with this observation.

Sources:

Dick, D.G.; Maxwell,E.E.
"Ontogenetic tooth reduction in Stenopterygius quadriscissus (Reptilia: Ichthyosauria): negative allometry, changes in growth rate, and early senescence of the dental lamina."
PLoS ONE 10: e0141904.
doe:10.137/journal.pone.014904

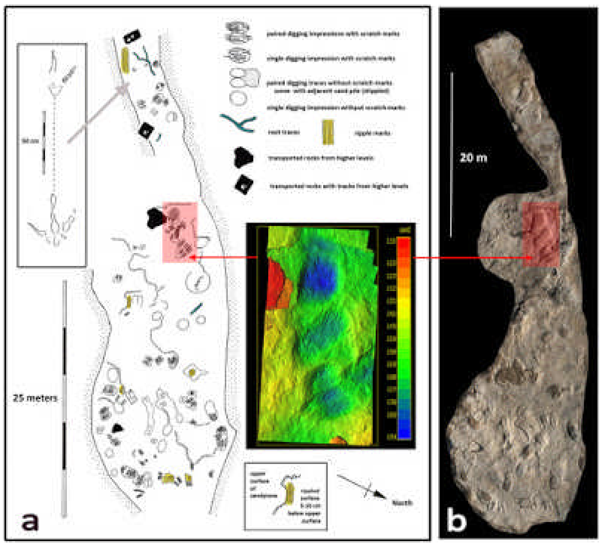
Theropod Scrapes Mean Courtship Behavior?

Bob Sheridan January 17, 2016

Trace fossils are the direct record of the behavior of extinct animals. Most of the trace fossils for dinosaurs are footprints, and there is an abundance of these. However, almost all dinosaur footprints record nothing but a slow walk, so are not particularly informative. Trace fossils that shows something unexpected are very rare. A recent paper by Martin Lockley's group (2016) describes a new kind of dinosaur trace fossil and speculates on what it means.

The new trace is given the ichnotaxon name *Ostendichnus ichnogen* ("to display a trace"). An aside here: Trace fossils are named in a system separate from body fossils because it is very difficult to assign, say, a footprint to the animal that made it. Ostendichnus appears to be a set of three parallel shallow grooves about a meter long, and one or two sets of these grooves may seen parallel to the first. There is a raised rim at the rear of the trace. The obvious interpretation is that a theropod (which are almost always three-toed) has dragged its hind claws against the ground a few times. In at least one site where Ostendichnus is found, there are at least a few typical three-toed theropod footprints of varying sizes, and this supports the interpretation. The largest footprint is ~0.4 m long, indicating a middle-sized theropod. Ostendichnus is found in several sites in Cretaceous Colorado, although this type of trace has not been recognized previously. At the largest site, there are ~60 such traces within an area 15X50 meters.

The association the authors make is with the courtship behavior of extant birds. During mating season many ground-nesting male birds gather in leks to display courtship behavior and the ones with the most attractive behavior are chosen by the female birds. Repeatedly scraping their feet on the ground is part of the courtship behavior of many birds. The authors point out that, although it is quite common to assign bird-like reproductive behavior to theropods, evidence for such is almost always speculative, and the traces discussed here might be the best exception.



Map of Club Gulch site (a) prepared in Photoshop CS5 by MGL, with natural color photogrammetric image (b) at same scale by RTM and LGB. Coloured image (inset in a) shows three large scrapes, together covering 5 m.
Digging traces are classified as paired (bilobed) or single, with or without scratch marks and adjacent sand aprons.

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Courtship Cont'd

The authors discuss a few alternative behavioral explanations for Ostendichnus. One would be that the theropods are digging for food or water as some mammals do. A second is that these are territorial displays, the way a bear might scratch tree bark or a dog would spread its scent. A third explanation is that the scrapes are a failed attempt to dig a nest. The fact that Ostendichnus are so abundant in one site pretty much rules out the first or second explanation. The fact that Ostendichnus is so shallow pretty much argues against the first and third explanation. So far, then, the “lek” idea seems the most likely. One has to wonder, however, why more examples have not been noticed before.

Sources:

Lockley, M.G.; McCrea, R.T.; Buckley, L.G.; Lim, J.D.; Matthews, N.A.; Breitgaupt, B.H.; Houck, K.J.; Gierlinski, G.D.; Surmik, D.; Kim, K.S.; Xing, L.; Kong, D.Y.; Cart, K.; Martin, J.; Hadden, G. “Theropod courtship: large scale physical evidence of display arenas and avian-like scrape ceremony behavior by Cretaceous dinosaurs.” Scientific Reports 2016 6:198952.

Paleontology Anecdote Debunked

Bob Sheridan February 6, 2016

It is very common to find extremely well-preserved mammoths frozen in Siberia. There are numerous anecdotes about the meat of such animals being fresh enough for dogs or people to eat. The frequency of such anecdotes led some paleontologists to propose catastrophic mechanisms that would allow mammoth carcasses to be frozen in a time short enough to preserve the meat in edible condition. It is hard to know how much credence to put in individual anecdotes, however.

Today’s story involves one well-known, fairly recent (1951), anecdote about eating mammoths: that at the 47th Explorers Club Annual Dinner, the members dined on a frozen mammoth, which was supposedly found in Alaska by explorers Father Bernard Rosecrans Hubbard and George Francis Kosco. This was published in newspaper accounts. At the time, eating very exotic foods from far-flung locations did not seem particularly unusual for the Explorers Club, so the story seemed within the realm of plausibility.

Here’s where things get interesting; we can potentially verify the story. A supposed sample of the meat (about 10 cm long) was saved by the Explorer’s Club chairman Wendell Phillips Dodge and given to Paul Griswold Howes, the curator of the Bruce Museum in CT. Strangely, the label on the specimen written by Dodge is “Megatherium” (the giant ground sloth) instead of “mammoth.” One wonders why this did not raise a red flag with Howes immediately. It is obvious that the meat could never have been from Megatherium since, although there are fossil sloths from North America, the genus Megatherium was and is still known only from South America, and a carcass of Megatherium could probably not end up in Alaska.

A new paper by Glass et al. (2016) endeavors to identify the meat by DNA analysis. The specimen is currently preserved in alcohol at the Yale Peabody Museum. Preserving the specimen in this way would not prevent DNA analysis from being done. These investigators extracted the DNA from a small sample, and amplified it by PCR, looking for the mitochondrial cytochrome b gene. The amplified DNA was sequenced (up to 363 base pairs) and compared to other sequences in a database.

Yale Peabody Museum of Natural History

The closest sequences to the DNA from the specimen are from Chelonia (a sea turtle). Sequences from mammoths (for which we have the entire nuclear genome and mitochondrial genome) or living sloths (we do not have a sequence from Megatherium) are very far away.

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Mammoth for Dinner Cont'd

While it might be remotely possible that mammoth meat was served at the Explorers Club, but sample of the wrong meat (perhaps from turtle soup) was given to Howes, it is much more likely that the mammoth story was a publicity stunt perpetrated by Dodge. There is no evidence among the writings and photographs of Hubbard and Kosco of finding a frozen mammoth. Also, there is a jocular confession of the hoax by Dodge in the Explorers Club's newsletter, but no one seems to have taken the confession seriously, not even members of the Club. Thus, in retrospect, it is clear tall tale, which could have been debunked at the time had anybody cared to look closer, was eventually accepted as fact.

The authors make two important points. First, that hoaxes and fictional stories find their way into popular thought, and even scientific thought, where they can be seriously misleading. Second, it important to for specimens to be saved by museums so that extraordinary claims can be examined.

Sources:

Glass, J.R.; Davis, M.; Walsh, T.J.; Sargis, E.J.; Caccone, A.
"Was frozen mammoth or giant ground sloth served for dinner at the explorers clubs?"
PLoS ONE 2016, DOI:10.137/journal.pone.0146825

Crinoids from the Mound

Kenneth Quinn

In 1979 I was hired by Phillips Petroleum to work on a very interesting project, due to my background in automated data retrieval and a BS in geology. Well, between the time I was hired and the time I started the project was canceled and I was put on another muh less desirable job. To say I was unhappy was an understatement, but my bridges were burned. I made the best of the situation; I was stationed in Bartlesville, Oklahoma and thus able to do a lot of fishing (a favorite activity) and even better - some incredible fossil hunting was available right outside city limits!

The Mound is a conical hill immediately east of the Bartlesville airport and composed of Pennsylvanian shale capped by sandstone; I do not know its exact age. It's famous for its crinoids, many of them intact calyces with arms still attached. I assume that in many cases there were collapses of silt banks, burying colonies of live crinoids. However, I did not find any specimens still attached to stems or holdfasts. Other fossils were not common - I remember only a few brachiopods.

This locale has been famous for crinoids for a long time. Harrell Strimple first wrote about them at this site in 1938, and indeed described the crinoid genus Moundocrinus! It was not my pleasure to meet him, though I did write him. He visited Bartlesville while I was on a trip and my wife handed him what I collected - my fun was to collect them, not to keep them.

This was not the only good fossil spot near Bartlesville. North Of Dewey I found an outcrop of shale with abundant brachiopods and the enigmatic fossils called conularids. Again, the formation was Pennsylvanian in age but I cannot identify its exact name.

After several years I decided the best course of action was to take a leave of absence to get an MS in geology. Phillips expressed an interest in hiring me back once I got the MS - although they failed to do so. Once some of my fellow students saw a few of the crinoids I had collected at the Mound, they expressed interest in visiting the spot. I made inquiries and found out that Phillips now owned the property but got permission for us to visit. One of us sat down with me at a particular place and we started finding a number of calyces immediately. After five minutes, he said, "I bet I'm sitting on one", and stood up. Yep! In 15 minutes, the two of us must have found at least 30! Between that trip and leading them to an ammonite locality on Lake Texoma, I got a reputation as the fossil guru of Oklahoma State University!

Microscopic Preservation of Soft Tissue in Dinosaur Bones

Bob Sheridan October 10, 2015

It's been about 10 years since work by Mary Schweitzer suggested that the original soft tissue, e.g. collagen fibers and blood vessels, could be preserved inside dinosaur bones. (The first study was done on a Tyrannosaurus femur.) This claim was met with very strong skepticism. It was and is widely believed that in fossils, particularly ones tens of millions of year old, all soft tissue is replaced by minerals, so that best one can find a mold of soft tissue, not the original material. It has been hard to eliminate the possibility that the supposed soft tissue in ancient bones is some kind of artifact. For example the "blood vessels" could be modern bacterial mats filling microscopic channels in the bone, or that the "dinosaur collagen" is from the glue used to preserve the bones. In the past ten years, attempts were made to sequence collagen from fossil bones and do other chemical analyses. Amounts of organic material are so small that analysis is on the edge of being doable with today's technology. There is still the belief that the presence of soft tissue in fossil bones, if it exists at all, requires extraordinary conditions of preservation and so should be quite rare.

Papers about the analysis of soft tissue in dinosaur bones are also rare in the literature. A recent one I came across is by Bertazzo et al. (2015). These workers examined eight arbitrarily selected dinosaur bones from the Dinosaur Park Fm. and Lance Fm. (Late Cretaceous of Alberta and Wyoming). An important point is that these bones were not particularly well preserved. However, specimens where the pore spaces in spongy bone were filled by matrix were not studied, so some selection was done. Care was taken in the study to avoid the exposed surface of the bones, to be sure the studied surfaces were not contaminated. Techniques used here were SEM (scanning electron microscope), FIB (focussed ion beam), TEM (transmission electron microscopy), and mass spectroscopy. SEM, FIB, and TEM are used to visualize microscopic structures. TEM requires that the specimen be thinly sliced, so one sees a series of 2D cross-sections. SEM and FIB capture 3D images. FIB can be used to ablate material from a specimen to reveal a fresh surface. Mass spectroscopy is used to separate molecules by molecular weight. In this application, the investigators can extract the molecules from a very small portion of the surface exposed by FIB.

SEM, TEM, and FIB studies of one specimen (a claw of an unspecified theropod) find round structures 1.2-3.2 micrometers in diameter with an internal structure. These can interpreted as red blood cells with nuclei (birds and reptiles have nucleated red blood cells), although it should be noted that modern red blood cells are about three times larger. Most of the bone specimens show evidence of fibers about 54 nanometers in diameter. These fibers show bands ~67 nanometers apart along the long axis. Since modern collagen fibers show banding with the same spacing, this is good evidence that the fibers are collagen.

Mass spectroscopy show peaks associated with the amino acids glycine, proline, and alanine (the most common amino acids in collagen), from parts of the surface where fibers are seen, but not in other parts of the surface. In the area where there are "red blood cells", there are mass spectrum peaks for folic acid and hydroxycholesterol, and ceramide. Very similar peaks are seen from a sample of modern emu blood. These peaks are not seen from areas of the specimen where there are no "red blood cells." Overall, the spectra for "red blood cells" and "emu blood" is not very similar, but certainly some components of the "dinosaur blood" would be expected to be degraded relative to fresh blood.

This paper adds to the increasing evidence that organic material can be preserved in dinosaur bones tens of millions of years old, and since such structures were observed in six out of 8 arbitrarily selected specimens, it also suggests that such preservation is common. It seems less likely that the data can be explained by artifacts. Just a final note: Since collagen and red blood cells are probably the most abundant structures in living animals, it is not surprising that anything organic preserved in a fossil would have to be those. Fibrous proteins like collagen are remarkably stable against degradation. This is in contrast to DNA , which is a very fragile molecule, seldom preserved in a fossil older than a few tens of thousands of years. So any "Jurassic Park" scenarios are still implausible.

Sources:

Bertazzo, S.;Maidmen, S.C.R.; Kallepitis, C.; Fearn, S.; Stevens, M.M.; Xe, H.-N.
"Fibres and cellular structures preserved in75-million-year-old dinosaur specimens."
Nature Communications 2015
6:7352 DOI: 10:1038/ncomms8352.

Chuckatuck Quarry

Alan Russo

Not long ago I was going through some boxes in my shed and found a small box labeled 'Chuckatuck with Tom'. I pulled the fossils out of the box and started to look at them. Many of the bivalves were filled with debris and I remember keeping the debris in there to hold the shells together and to protect them during transport. Many of the shells were familiar as they have similar or identical cousins in the modern shallow coastal waters of the east coast.

I had some time so I decided to clean some of the shells off and try to pull apart the bivalves without breaking them. Turns out, just sticking them in a bucket of water loosened the debris inside and the shells came apart easily. Unfortunately some were broken but most were intact. Looking at the debris from inside the shells I noticed it was mostly tiny shell fragments with some sand and pebbles. Looking more closely, I noticed some very tiny complete shells.

It instantly brought me back to a time when I was a budding naturalist. I would spend hours at the beach identifying shells, algae, plants birds and anything else I could find. I have always been fascinated by the tiny over looked things in nature and loved magnifying glasses and microscopes. I would spend many an hour on my belly in the sand looking for supper tiny shells with a hand lens and collecting then to bring home to ID.

I rinsed some of the debris from inside the Chuckatuck shells, laid it out in the sun and waited for it to dry before bagging it for the trip to my "lab". I put some of the debris under the dissecting scope and went on a mini expedition to see what I could find. It was fascinating! I found very tiny shells that looked like perfect miniatures of the adults. I found gastropods, mollusks, bivalves, univalves and some really cool crystals, including a small chunk of pyrite.

I looked up Chuckatuck online, and sadly, I read it has been reclaimed. It is now a lake or a pond. I did see some photos of the quarry some posted online and it brought back memories of being there a long time ago with my fossil buddy Tom. Glad we got to go there before it evolved into what it is today.

Eurohippus, the Oldest Known Pregnant Horse Fossil

Bob Sheridan October 17, 2015

The Messel Shale, near Messel Germany, is an Eocene lagerstatten. Specimens here (mammals, birds, reptile, and insects) are unusually preserved, including traces of soft tissue. The usual scenario given for why so many land vertebrates are exceptionally preserved is that they were overcome with volcanic gases, fell onto the lake bottom and were buried in sediment. Once excavated, Messel specimens, which are almost always flattened, have to be protected because they crumble to dust if allowed to dry. Usually, once a slab is split into part and counterpart, one side of each slab is coated with epoxy resin, the opposite side is prepared, and then coated with resin once preparation is done. It is thought that traces of soft tissue are preserved in the fossil because bacterial mats on the corpse precipitate iron carbonate, which ends up as a black stain.

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Horse Cont'd

Our story today deals with Eohippus, of which several dozen specimens are known from Messel. You have probably seen pictures of this animal. It is a horse ancestor that is very primitive, i.e. not much like a modern horse. It is about 1 foot high at the shoulder. It has four toes on the front feet and three toes on the back. It has short legs and teeth with conical bumps. The originally described species was *Eohippus parvulus*, but there is another named species *Eohippus messelensis*. One can often see the outline of ears and individual hairs in these specimens, and stomach contents are often preserved. Males can be distinguished from females based on the width of the pelvic channel. Almost half of the known "female" specimens appear to have been pregnant at death, as indicated by few scattered bones of a fetus inside the abdominal cavity.

This month Franzen et al. (2015) describe in detail a particular specimen SMF-ME-11034 of *Eohippus messelensis*, which was excavated in 2000. The fetus in this specimen is more intact than previously seen, as well as being 2 Myr. older. SMF-ME-11034 is complete, but not completely articulated. The ribs are displaced backward toward the abdomen, and the dorsal and lumbar spine and pelvis are twisted off and lie almost upside down relative to the rest of the skeleton. Consequently, the femurs are disarticulated from the pelvis and from the the lower hind legs, which are in the correct position. The anatomy of the animal is described in this work as if the spine and pelvis were in the correct position. Nothing is said about the taphonomy of this specimen in this paper, but one speculation is that, unlike most Messel specimens, this specimen was torn apart by a scavenger or exploded from decay gases before it was buried.

The bones of the fetus are confined to an area in front of the pelvis. Fetal arm and leg bones can be identified, as well as ribs and vertebrae. Many bones are missing or disarticulated. This is partly because the fetus is only partly ossified, but also because it seems to have been crushed. However, enough is preserved that we can tell the fetus would have been about one-third the length of the mother. High-resolution x-ray was used to see through the specimen to obtain more detail; with that technique some scattered teeth of the fetus can be seen. Overall, the head of the fetus is pointing to the rear of the mother. It is interesting to note that in this specimen and earlier specimens containing fetuses, there is only one fetus present in the uterus, as is the case in larger extant ungulates, including horses. The fetus was not close to being born since it is not very far toward the rear of the pelvis.

The most interesting part of SMF-ME-11034 is that the outline of placenta, uterus, and supporting muscles and ligaments are preserved. The uterus is larger than the area in which the bones are contained, there are two horns to the uterus, and one can see a "broad ligament" attaching the uterus to the lumbar vertebrae, much as in a modern horse. There is some wrinkling of the uterus, which could indicate that it was ruptured before fossilization, but there is no sign that the fetus was expelled from its proper location because of it.

The authors conclude that Eurohippus is very "horse-like" in its reproduction, which is remarkable given that the animal is very non-horselike overall.

Sources:

Franzen, J.L.; Aurich, C.; Habersetzer, J. "Description of a well preserved fetus of the European Eocene Equoid Eurohippus." PLoS ONE 2015, DOI 0.1371/journal.pone.0137985

Multiple Injuries in Dilophosaurus

Bob Sheridan March 20, 2016

Healed skeletal injuries are fairly common in dinosaurs. The record-holder for the most injuries for an individual animal is probably “Big Al,” a sub-adult Allosaurus from Wyoming with 19 skeletal abnormalities to ribs, fingers, etc. The injury that is speculated to be the fatal one is an infected middle toe bone, which would have prevented Big Al from running after prey.

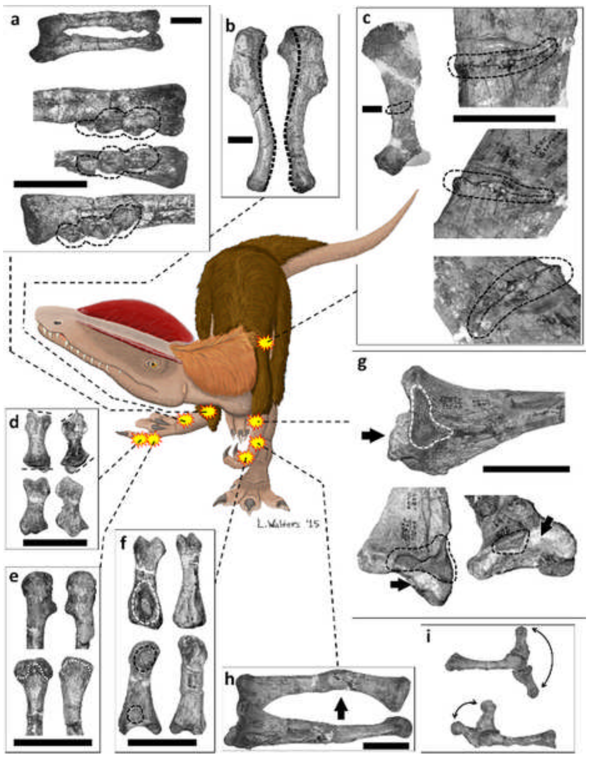
Today’s story is specifically about forelimb injuries in theropods, which would include the scapula, arms, and hands. Those are fairly rare in the sense that only a handful of specimens has more than one injury per animal. Senter and Juengst (2016) describe a specimen of Dilophosaurus with eight injuries to its forelimbs. The specimen UCMP 37302 is currently at the University of California Museum of Paleontology, but is from the Early Jurassic Kayenta Formation in Arizona.

Dilophosaurus is a fairly small (6 meter) theropod with two upward-pointing, roundish plate-like crests on its nose. Dilophosaurus was depicted in Jurassic Park movie as a venom-spitting animal with a neck apparatus like a frilled lizard. Also, it is likely that the theropod footprints named “Eubrontes,” which are very common in the eastern US, were made by Dilophosaurus.

The injuries to UCMP 37302 include:

1. A transverse partial break in the left scapula.
2. A fracture in the left radius.
3. A bony growth in the left ulna.
4. A cavity in the left thumb.
5. A torsion in the right humerus.
6. Three bony tumors in the right radius.
7. A misshapen distal portion of the metacarpal of the third finger of the right hand, preventing flexing that finger.
8. The proximal phalange of the same finger is also deformed.

The authors list most of the ways, irregularities in bone can occur. For example: arthritis, bone cancer, infection, injury, gout, rickets, etc. Interestingly, the appearance of these diseases may differ between birds/reptiles and mammals. For each individual injury in UCMP 37302, the authors assign the most likely cause. For instance, the cavity in the left thumb appears to be due to an infection. The break in the left radius is most probably due to a mechanical injury. However, it is impossible to tell when in time the causes occurred. It is conceivable that most of the abnormalities were due to a collision with a tree or a rock, and the remaining injuries due to a fight. Clearly the animal lived long after the incident(s), and had to get along without the use of its forearms.



The authors note that UCMP 37302 is the type specimen for Dilophosaurus, but its description in 1984, which was otherwise quite thorough, mentions only one bone pathology, the one on the left thumb. One reason for this is that abnormalities in bones might not be considered relevant to the description of an individual animal, and so would be left out of the description of a type specimen. Another reason is that abnormalities might not be recognized right away.

Sources:
Senter, P.; Juengst, S.L.
“Record-breaking pair: the largest number and variety of forelimb bone maladies in a theropod dinosaur.”
PLoS ONE, 2016, 11, e0149140
doi:10.137/journal.pone.0149140