The Paleontograph

A newsletter for those interested in all aspects of Paleontology
Volume 5 Issue 4 December, 2016

From Your Editor

Welcome to our latest and fourth issue this year. The year is winding down and winter will be here next week. We've had a few snow events here in CO already but nothing much. I am looking forward to the cold weather so I will stay in my workshop and work on my stupidly large backlog of fossils to prep. Sometimes, I feel like one of those museums you hear about that have unopened jackets of fossils sitting on shelves for twenty or thirty years. My problem is that I am a sick person who can't stop acquiring fossils. I see it, think "wow that's cool" and then buy it or dig it up. I've been working on a collection of Green River fish I picked up that numbers almost a thousand.

Along with the snow and cold weather, December brings thoughts of the upcoming shows in Tucson. It is one of my favorite trips each year. Two friends and I spend four or five days in warm weather surrounded by fossils, what could be better.

Congratulations to Bob Sheridan, the author of 95 percent of our articles, on his retirement. Bob has a doctorate in chemistry and an obviously very strong interest in paleontology, luckily for us. I lost count long ago on how many articles he has written. It is well over 500. He is a truly amazing guy.

I wish you all a happy holiday season.

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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Lucy on the Ground with Fractures

Bob Sheridan September 23, 2016

"Lucy" is the type specimen of *Australopithecus afarensis* discovered in the Afar region of Ethiopia in 1974. Lucy is ~3.2 million years old and is about 40% complete. The consensus thought about the lifestyle of *Australopithecus afarensis* is that, while they walked perfectly upright, they spent much of their time in trees.

As with most hominin specimens, Lucy's bones were found in pieces and assembled into a partial skeleton by paleontologists. One usually assumes the bone fracturing happened after death. One possibility is that the bones lay on the surface after an animals's death and were cracked by predators or by drying in the sun before being buried. Another is that the fossil bones cracked apart through erosion once exposed on the surface.

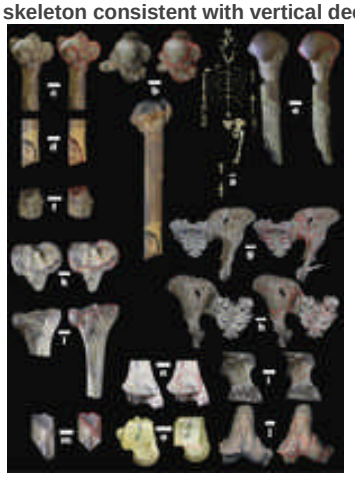
A recent paper by Kappelman et al. (2016) suggests that some of the bone fracturing happened when Lucy was alive and the fractures caused her death. This suggestion is made on the basis of CT scans performed at the University of Texas. The authors list 16 injuries to arms, legs, ribs, cranium, and mandible on both sides, usually close to the joint. Most of these are compression fractures, i.e. due to strong forces being applied along the axis of the bone. For instance, the head of the humerus appears to be crushed and the bony processes surrounding the head are splayed outward. Similar types of fractures are seen in medical practice. For instance bilateral fractures to the head of the humerus often occur when a person attempts to break a fall with his arms. If Lucy indeed has those types of fractures, it is likely she was conscious when the fracture occurred. It is plausible, therefore, that the other fractures occurred at the same time. Since there is no evidence of healing in any of the fractures, and if we assume Lucy was alive at the time they occurred, it probably caused her death.

How did Lucy get a number of simultaneous compression fractures? The authors suggest Lucy fell out of a large tree. This is plausible. There is evidence that large trees did grow in the Afar region 3.8 Myr. Also, apes today sleep in trees several stories above the ground and occasionally fall. The authors have a very detailed scenario where Lucy landed hard on her feet, breaking her knee, tibia, and pelvis, then fell forward onto her outstretched arms, compressing her humerus. Finally, her head hit the ground, breaking her cranium and mandible.

Figure 2: Reconstruction of Lucy's vertical deceleration event.

We hypothesize that Lucy fell from a tall tree, landing feet-first and twisting to the right, with arrows indicating the sequence and types of fractures.

Figure 1: Perimortem fractures in A.L. 288-1 postcranial skeleton consistent with vertical deceleration event.



a, Lucy. b, c, Right humerus (b, top: stereo, superior, medial up; bottom: lateral; c, stereo, posterior) preserves valgus head-shattering four-part proximal fracture. d, Hinge and spiral fracture elevated, displaced, and fractured righ…

The authors suggest further that because Australopithecus was adapted for upright walking, they were not as good at climbing, and more likely to fall out of tress.

All these scenarios depend on being able to distinguish fossil fragments of an injured bone being reconstructed perfectly versus fragments of a healthy bone being reconstructed slightly incorrectly or suffering distortions from fossilization. I wish the authors had discussed how that distinction is made.
Sources:

Kappelman, J.; Ketcham, R.A.; Pearce, S.; Todd, L.; Akins, W.; Colbert, M.W.; Feseha, M.; Maisano, J.A.; Witzel, A.
"Perimortem fractures in Lucy suggest mortality from fall out of tall tree."
Nature 2016, 537, 503-507.

The Humerus of Acanthostega

Bob Sheridan October 1, 2016

First, a review of Acanthostega ("spiny roof"). It is a stem tetrapod from the Devonian. To us it would look like a cross between a fish and a salamander, about 2 ft long. It had a head flattened from top to bottom, four obvious limbs, and a full pelvic girdle. On the other hand, it could not position its arms underneath its body, which would be required for walking on land. Therefore it's likely Acanthostega was still fully aquatic and used its limbs to walk underwater. The best specimens were unearthed in Greenland by Jenny Clack in 1987. At least 20 animals are represented in a small amount of space, so the site probably represents a mass death. As an interesting aside, Acanthostega has eight fingers on each hand and seven toes on each foot, debunking the idea that five is the primitive number of digits for tetrapods.

Since this story involves the humerus of Acanthostega, I should note that while the humerus of more advanced tetrapods is a long cylinder, the humerus of early tetrapods is a broad, slightly obtuse L-shape, with the top of the L articulating with the shoulder girdle, and the radius and ulna coming off the bottom of the L.

Jenny Clack of the University of Cambridge has published on Acanthostega for a few decades now, and the latest publication (Sanchez et al., 2016) appeared a few months ago. This work involves a collaboration with the Synchrotron Radiation Facility in France. It is apparently now possible to do nondestructive microscopic (resolution ~10 micrometers) histological studies by CT scanning fossil bones using synchrotron radiation. This is in contrast to having to cut a bone into thin sections and examine the sections with a microscope. These investigators scanned four humeri from the original Greenland specimens, especially looking at two aspects: the degree of ossification and the number of LAGS. To review, LAGS (lines of arrested growth) are found in the outer part of the shaft of a long bone in ectotherms, and represent times when the growth of the bone slowed. It is assumed that, as with modern amphibians and reptiles, the slow growth period corresponds with the winter, and so we can estimate the age of the animal in years from the number of LAGS. Also, decreasing space between LAGS indicates that growth is slowing, i.e. the animal is reaching full size.

The first observation is that the humeri were still mostly cartilage in the center even in the oldest (approximately six years) of the four animals, in which growth is starting to slow. This is unlike modern amphibians where the humerus is ossified fairly soon. This is consistent with the idea that Acanthostega was not bearing weight on its arms. Also, there seems to be no correlation between the size of the humerus and its age. To the authors this represents some kind of flexibility of the growth process, although four specimens is rather too few to say much about it.

The authors also note that in none of the specimens has growth ceased, which might imply that all the specimens are sub-adults, although we would need an unambiguously adult specimen to make that statement with more certainty.

Sources:
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"Teenage tetrapods."
Nature 2016, 537, 311-312.

Sanchez, S.; Tofforeau, P.; Clack, J.A.; Ahlberg, P.E.
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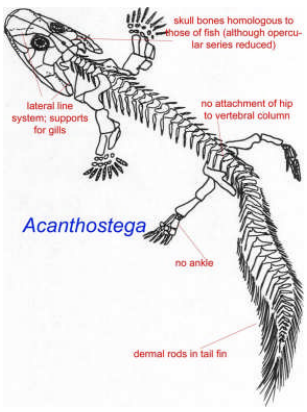
Nature 2016, 537, 408-411.



The Tyrannosaur Chronicles

--A Review

Bob Sheridan October 2, 2016

Every now and then a book comes out about a particular group of dinosaurs. Those are usually about Tyrannosaurus and his relatives, since Tyrannosaurus is by far the most popular dinosaur and has been since it was first discovered in 1903, despite larger theropods being unearthed more recently. The latest such book is "The Tyrannosaur Chronicles" by David Hone. The study of tyrannosaurs has been changing rapidly, mostly because earlier ancestors, some going back as far as the Jurassic, are being found at a rapid pace.

David Hone is a Lecturer in Zoology at the University of London. TTC is his first book, but he has done much writing on-line. You can check out his blogs at https://www.theguardian.com/profile/david-hone and https://archosaurmusings.wordpress.com/.

TTC is a good attempt to comprehensively discuss the biology of tyrannosaurs for a popular audience. It consists of 19 Chapters. Some chapters are very well grounded in fact. For example, the anatomy of tyrannosaurs and how that links the small early ancestors and the large later varieties is very well explained. Other chapters, especially the ones on physiology and behavior, are necessarily more speculative, but Hone is very honest about what can be said with confidence. I think Hone makes a good case for the "predator" vs. "scavenger" argument from the 1990s being irrelevant. I especially like the chapter "Tyrannosaurus Fact and Fiction," where many tropes about Tyrannosaurus that are trotted out in the popular press are shown to be closer to unsupported ideas than facts. In that chapter is a good discussion of Nanotyrannus and the specimen Jane. It is a continuing controversy whether these represent specimens of a juvenile Tyrannosaurus or a separate smaller species. Also in that chapter is a discussion of whether there really are two Tyrannosaurus "morphs" representing male and female.

TTC is as comprehensive, well-written, and as up-to-date as can be expected. However, be aware the target audience is people who are interested in dinosaurs, but have not been been following the literature regularly. Serious amateurs like me will find themselves wanting more technical information that they were not already aware of. (In this TTC is much like "My Beloved Brontosaurus".) Skeletal drawings in the style of Gregory S. Paul by Scott Hartman are seen throughout the book and there is a center section with color photos of fossils, but overall I would say this book is under-illustrated. I would have appreciated more graphs and tables.

Sources:
Howe, D.
"The Tyrannosaur Chronicles. The Biology of the Tyrant Dinosaurs."
Bloomsbury Sigma, New York, 2016, 304 pages
$27 (hardcover)

Seven Skeletons--A Review

Bob Sheridan October 16, 2016

What makes one fossil hominin languish in a museum drawer when another becomes a cultural icon? According to the new book "Seven Skeletons," it has nothing to do with the specimen's value to science; it's because the latter have more engaging stories associated with them. The author of this book Lydia Pyne appears to be a science journalist, not a professional paleoanthropologist. This is good the sense that paleoanthropology has always been very contentious field, and practitioners tend to have strong biases, but journalists do not have a "dog in the fight." Also Pyne's writing skills are top-notch.

The specimens covered in SS are rather few:

1. The "Old Man"
2. Piltdown Man
3. Taung Child
4. Peking Man
5. Lucy
6. Flo
7. Sediba

You can perhaps argue with the choices. Why these seven specimens and not others with equally good stories? But the stories are certainly engaging.

Cont'd

Seven Cont'd

The “Old Man of La Chapelle” is the skeleton of a Neanderthal, curled into a fetal position, discovered in 1908 in a cave in south central France. This is not the first Neanderthal skeleton discovered. That was in 1856 in the Neander valley of Germany (that also has an interesting story not covered in this book), and by 1908 Neanderthals were already recognized as a different species of human. The new skeleton was studied by Marcellin Boule, who was then director of the Museum of Natural History in Paris. Boule produced short articles on the skeleton between 1908 and 1911, and a very long monograph in 1911. The conclusions of the monograph were unchallenged for a very long time. According to Boule, the Old Man had a very curved spine and bent knees, and concluded that

Neanderthals could not stand up fully. Also the low skull and heavy brow ridges indicated a lack of intelligence. If you are looking for the source of the shambling, hairy, stupid “caveman” stereotype (which is still with us to some extent), Boule’s monograph is a good candidate.

The early twentieth century was a time when newspapers were becoming a powerful medium and early articles about the Old Man were widely read. Cavemen characters started showing up in science fiction. A book and later a movie “The Quest for Fire” (1911) showed three types of hominins competing to control fire, with the implication that the winner would be the surviving species. (The movie was remade in 1981, and is a cult classic.)

By the 1950’s, many more Neanderthal remains were discovered and reexamination of the Old Man indicated that he was suffering from crippling arthritis. The caveman stereotype did a complete flip: The fact that the Old Man lived a long time despite his deformities suggests that he was helped by his fellow Neanderthals, and the fact that the Old Man was probably deliberately buried indicates a behavioral sophistication, even a kind of spirituality.

Piltdown Man is famous for being the fake that misled paleoanthropology for decades. In 1912 Charles Dawson, a legal solicitor and amateur naturalist, discovered some bone fragments in a gravel pit near Lewes in southern England. Dawson’s tale of the discovery was told several times in several different ways, so we really cannot be sure of the truth. The Piltdown site gathered a lot of scientific attention over a period of one or two years. The specimen, once fully assembled by 1913, appeared to be human-like cranium with a apelike jaw. The large amount of attention given to the specimen (named Eoanthropus) is due to a number of factors. Most importantly, it was discovered in England, which was at the time the epicenter of geology and biology expertise. Second, it was consistent with the current idea that a large brain was the first human-like character attained by our ancestors. Much of paleoanthropological thought revolved around Piltdown for decades.


The San Diego Union-Tribune

PILTDOWN MAN WAS A HOAX

(Continued On Page 15A)

Piltdown Man Named Hoax, Jolts Science

London, Nov. 21 (INS)—Three British scientists branded the famous "Piltdown man" a deliberate fake today and set off a controversy that may engage the scientific world for years to come.

By the 1940s Piltdown was appearing more of anomaly. Many other smaller-brained, small-jawed human remains were being discovered, most famously Java Man in Asia. In particular, the canine tooth in the Piltdown jaw was perceived as very apelike compared to the other human specimens. It was not until 1953 that the Piltdown remains were dated by a new fluorometric test, and was shown to be very young. **Cont'd**

Seven Cont'd
The final interpretation: the skull was from a modern human, the jaw was from an orangutan, and the teeth from a chimpanzee. The bones were stained to make them look old, and parts were broken or filed to prevent correct identification.

Many books have been written about the Piltdown hoax, and there have been many speculations about why anyone would want to pull it off, and who would have enough expertise to do so. However, that remains a mystery. Now Piltdown is held up as an cautionary tale: scientists seizing onto poor evidence to support what they expect to find.

The Taung Child has a romantic discovery story. In 1924 Raymond Dart, then an anatomist at the University of Witwaterstrand in Johannesburg, while dressing as best man for a friend's wedding, received a crate of fossils from a limestone quarry near Taung in South Africa. Immediately Dart noticed in the shipment a small endocast of a primate brain. Later he assembled the partial cranium and mandible that went with the endocast. He quickly published his description of the fossil in Nature. To Dart, the specimen represented an juvenile version of ape-like creature, probably ancestral to humans. He gave it the species name *Australopithecus africanus* (one of the few species names of hominids from the 1920's that we still use), but its nickname remains the Taung Child. The Taung Child, however, did not match the contemporary image of a human ancestor. First, the conventional thought was that human origins lay in Asia, not Africa (as exemplified by Java Man).

Also Piltdown had reinforced the idea that early humans had big brains, and big jaws**.** A small-brained, small-jawed human ancestor like the Taung Child did not fit. Also, and perhaps more scientifically valid, since juvenile apes look somewhat more human than adult apes, it was possible to interpret the Taung Child as a juvenile non-human ape instead of a human ancestor.

By the 1930s and 1940s the tide was turning. More australopithecine fossils were discovered in Africa, and Dart was recognized in the 1950's as having been right all along, especially once Piltdown was exposed as a fake. Dart is now held out a as a scientific hero. Those of us who grew up in the 1960s probably remember Dart best for his interpretation of australopithecines as "predatory hunters," something that was reflected in Robert Ardrey's book "African Genesis" and "2001: A Space Odyssey." However, nowadays we think of early humans more like prey than predator.

The most interesting thing about Peking Man is that, while casts exist throughout the world, the original specimens are missing. Peking Man is the collective name given to fossils unearthed in the period from 1929 to 1937 at the Zhoukoudian locality (near the city of Beijing, China, known at the time as Peking). The specimens (given the genus name Sinanthropus--Chinese Man) consist of partial crania, mandibles, teeth, and a few scattered bones. Now we recognize these remains as a variety of *Homo erectus*, and they are probably between 500,000 and 300,000 years old.

These fossils were stored in Peking Union Medical College until just before the attack on Pearl Harbor in 1941. At that time it was feared the Japanese would seize the fossils, and plans were made to ship them to the United States or Europe. They were packed into two crates and shipped by train to an American Marine base to be loaded onto a ship the USS President Harrison. The train was captured by the Japanese, and the President Harrison was deliberately scuttled by the Americans. What happened to the crates is unknown. Witnesses at the time told a number of contradictory stories, so we are left with speculation only.

Several attempts have been made to locate the fossils. In 1972 a financier named Christopher Janus offered a reward for the fossils and borrowed money for the purpose of finding them. He later wrote a book "The Search for Peking Man," which gives a lot of cloak-and-dagger details about the secret meetings he had with people claiming they knew where the fossils were. It is not clear how much of the book is factual. In any case Janus was indicted for fraud; much of the money he obtained for the search ended up for personal use. As late as 2006, Beijing's district governor looked for witnesses of the events of 1941 and generated a number of leads, but none of the leads panned out.

"Lucy" , whose official name is AL 288-1, is the name given to the first discovered specimen of *Australopithecus afarensis*, which was unearthed in 1974 in the Afar Triangle in Ethiopia. The name Lucy is from the fact that, on the night following the initial discovery, the Beatle's song "Lucy in the Sky with Diamonds" was repeatedly played in camp. You may not be aware that the specimen has another nickname in the local language: "Dinkinesh" ("you are marvelous"). **Cont'd**

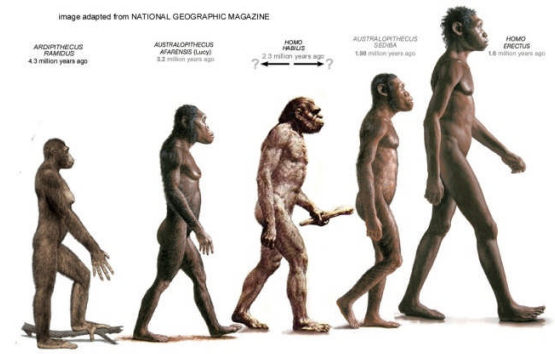
Seven Cont'd

Surprisingly, Lucy is not the type specimen for *A. afarensis*. That honor goes to LH-4 an isolated mandible found in Tanzania by Mary Leaky the same year. The date for Lucy is ~3.2 Myr.

At the time, Lucy was the most complete early hominin specimens. One can easily get a good picture of the individual, which was impossible in previous specimens: female, 1.1 meters tall, probably around 60 pounds. The pelvis and femurs indicate a creature that could walk perfectly upright, but the brain is ape-size and the arms are long. The ability to get such a mental picture probably helped Lucy's fame. There is enough information to make life reconstructions of Lucy, and many exist as sculptures and paintings.

Donald Johanson, the discoverer of Lucy proposed a link between Lucy and other specimens from East Africa, but also set up *Australopithecus afarensis* as the stem species from which the genus Homo presumably evolved. Now, any discussion of any new hominin specimen in the popular press must mention Lucy, similarly to how any new dinosaur specimen must be compared to Tyrannosaurus.

Now we get to the contemporary specimens. The specimen LB1, discovered in 2003 by a team from the University of New England, Australia, was a big surprise. Excavated from Liang Bua cave on the Indonesian island of Flores, it consists of a complete skull, complete legs, and other bits. The specimen had a very small stature, about a meter tall, a very small brain, and a very young age. LB1 is clearly a fully grown adult, having all teeth erupted and a fused skull. No one expected anything except modern humans to exist as recently as 18,000 years. The original nickname of the specimen was "Flo", after Flores, but the nickname that has stuck in popular media is "hobbit", probably because of the popularity of the "Lord of the Rings" movie series at the time. Interesting, the species name went through a revision. The original choice in the draft manuscript was *Sudanthropus floresianus* ("man from the Sunda region of Flores"). Reviewers of the paper noted that LB1 is probably a member of the genus Homo, and that "floresianus" means "flowery anus"; thus the final published name was *Homo floresiensis*.

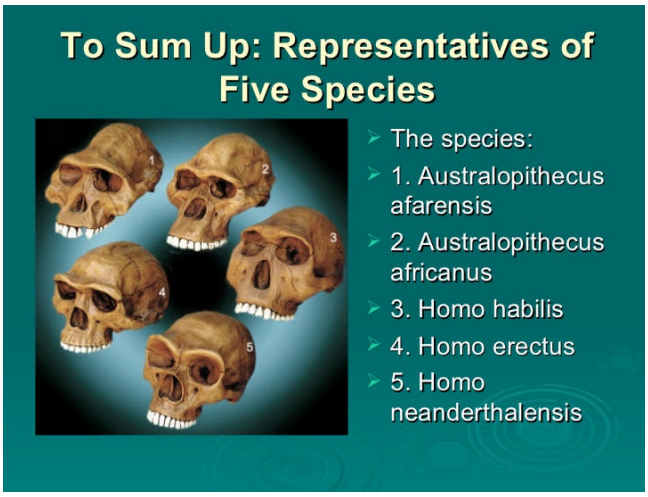


LB1 is best known for the continuing controversy surrounding it, then and now (2016), even though many more (less complete) specimens of *Homo floresiensis* have been unearthed. Does it represent a new, completely unexpected species of hominin, or is it a modern human with some kind of deformity. (This is not new; a very similar controversy surrounded the original Neanderthal specimens.) The scientists who made the discovery favored the former, while the local Indonesian scientists favored the latter. Paleoanthropologists are a contentious lot, and emotionally-charged personal feuds with charges and countercharges about "misconduct" are common. In the case of LB1, Teuku Jacob, senior paleontologist of Indonesia was loaned the original fossils in 2004 and some of them were returned damaged, much to the outrage of the original discoverers. Then, the permits for digging were never issued for the 2005 season, and suspicions were aroused that the Indonesian government was hindering further exploration.

The "Sediba" chapter is something of an outlier. It tells the story of two hominin specimens "Kadanuumuu" ("Big Man") and "Karabo" ("The Answer"). SS is about famous hominin fossils, and I had heard the stories about the previous six specimens, but I hadn't heard of these, perhaps because the stories haven't had time to diffuse to more popular media. Kadanuumuu is a specimen (real name KSD-VP-1/1) of *Australopithecus afarensis*, about 0.4 Myr. older than Lucy, but also from the Afar region in Ethiopia. It was discovered by Yohannes Haile-Selassie of the Cleveland Museum of Natural History in 2010. The "big" in it's nickname refers to the fact that Kadanuumu would have been about 5 feet tall in contrast to Lucy's 3 feet. The scientifically interesting about Kadanuumuu is that it includes the oldest hominin scapula (missing from Lucy) and the lower part of a leg. Both parts indicate upright walking as opposed to hanging from trees. **Cont'd**

The origin story of Karabo is that it was discovered by a 9-year-old boy Matthew Berger in 2008 in a dig site near Johannesburg worked by his paleontologist father Lee Berger. Matthew simply turned over a random rock and found several human bones sticking out. This original specimen, whose proper name is MH1 and is dated to ~2Myr., was about 40% complete (including a cranium) and represents a juvenile. Several other specimens of the same species were also found nearby. The original published interpretation of these specimens, based mostly on the skull, is that they represent a new genus, *Australopithecus sediba*, which is midway between *Australopithecus africanus* and *Homo habilis*. However, this interpretation remains controversial because, as with the Taung Child, it is hard to determine how to relate the skull of a juvenile to those of adults.

The author points out a contrast in popularity between these two specimens, which seem about equal in scientific utility. Karabo has a discovery story with more "human interest". Also, information about Karabo was posted on the internet immediately, including many pictures, and the original specimens were also put on public display quickly. This may represent a new era of "openness" and "crowdsourcing" in paleoanthropology, which unfortunately has a reputation for possessiveness and secretiveness.

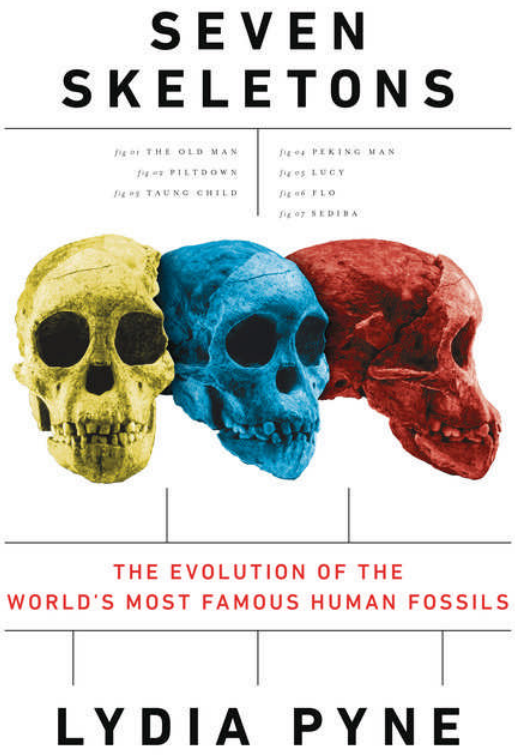


So you get the idea. SS is not about current thought on paleoanthropology, but on the history of the field, and how science interacts, sometimes unpredictably, with popular culture. The fact that this review is as long as it is means I think these stories are interesting enough to tell you readers. Being interested in the history of Science, and a practicing scientist (in chemistry, not in paleontology) whose career is now winding down, I find the unexpected twists and turns Science takes fascinating. Today's brilliant insight could be tomorrow's foolish notion and vice versa. This is especially true in paleoanthropology where the data is sparse and it is very hard to avoid preconceived notions about the subject matter: ourselves.

Ultimately, I don't think the author provides a way to predict which fossils will become "celebrities" and which not. However, we can draw some lessons from the examples in SS: Being in the right place in the right time, with the right type of story, mixed with a bit of luck, certainly helps.

Sources:

Pyne, L.
"Seven Skeletons. The evolution of the world's most famous human fossils."
Viking, New York, 2016, 276 pages. $28 (hardcover)



Shaping Humanity--A Review

Bob Sheridan October 29, 2016

One serendipitous result of me reviewing the book "Seven Skeletons," which is about why some hominin specimens become cultural icons, was to become aware of the book "Shaping Humanity" by John Gurche, which was published in 2013. I used to think of John Gurche as one of the old-school paleoartists that specialize in painting dinosaurs, since most of the work I was familiar with is from before 1990. That is way too limiting. Gurche nowadays specializes in early humans, and he is also an amazing sculptor.

"Shaping Humanity" describes how he constructed eight life-size sculptures based on specific hominin specimens. Most of these are in the Smithsonian Hall of Human Origins: *Sahelanthropus tchadenis*, Australopithecus afarensis ("Lucy"), *Australopithecus africanus* (STS 5), *Paranthropus boisei* (OH 5), Homo erectus ("The Nariokoto Boy"), *Homo neanderthalensis* (La Ferrassie II), *Homo floresiensis* ("Flo"). Some of these sculptures are in silicone and are meant to give the illusion of a living creature, and some are cast in bronze.

Any attempt to construct a life restoration of any extinct animal is a combination of interpreting the (usually fragmentary) fossils that are available and educated guess work based on related living animals. Fortunately, we understand the anatomy of living humans and apes fairly well, and it can be assumed the hominins will be an interpolation between the two. Some features can be extrapolation from the skeleton: barrel-chest (human) or funnel-chest (ape), projecting nose (human) or not (ape), etc. There are a number of fiddly details that need to be decided when the fossils can give no information: are the "whites" of the eyes pigmented (ape) or non-pigmented (humans). What size should the ears be? Since we are very familiar with living humans and apes, as opposed to, say, dinosaurs, these types of details matter and it is easy to generate something that looks wrong.

The great strength of "Shaping Humanity" is that, in relating how these decisions are made, Gurche thoroughly reviews for the reader what is known about certain specimens, what has to be guessed at, and what is a purely artistic choice. Gurche approaches these sculptures in a very systematic way that takes many months to complete. Bones are reconstructed from cast fossils. After a pose is worked out, the reconstructed bones are arranged on a metal armature. Clay muscles are added to the bones, and finally clay skin with folds and wrinkles (and sometimes impressions of hair for bronze sculptures) is laid on top. A mold is made of the clay sculpture. A silicone cast can be made at this point for a lifelike sculpture. Glass eyes are added and hair is punched into the silicon. Bronze sculptures require a second step, a cast is made in wax, and another heavier mold is made from the wax cast. Bronze is poured into the heavy mold, burning off the wax.

In the previous paragraph, I glossed over the pose. Apparently as much thinking goes into picking an evocative pose as any of the anatomical details. The idea is to distill in the pose something characteristic about the hominin in question but make the pose look entirely natural: Lucy stepping down from a branch (a transition from climbing to walking), a *Homo erectus* woman carrying an antelope carcass (this species travels a log), a Neanderthal woman scraping a skin (showing the use of teeth as tools), etc. No one can deny that the poses chosen are brilliantly chosen and executed.

Finally, all the sculptures, silicone or bronze, appear extremely realistic. Your mind says: Yes, that's exactly what that animal should be, and it is an individual "person". The silicon restorations are amazing lifelike, even a little disturbing. Gurche puts it this way: "If people react to your sculptures by feeling a little creeped out because they sense a living presence there, you know you've done well."

"Shaping Humanity" is a coffee table book in the best sense; it is full of extremely well done illustrations: photographs of original fossil specimens, sketches, photos of sculptures in various stages of completion. Get rid of all the text, and it still would be worth looking at.

Since this title is a few years old, one can get it at bargain prices on Amazon as a used book. Well worth it.

Sources:

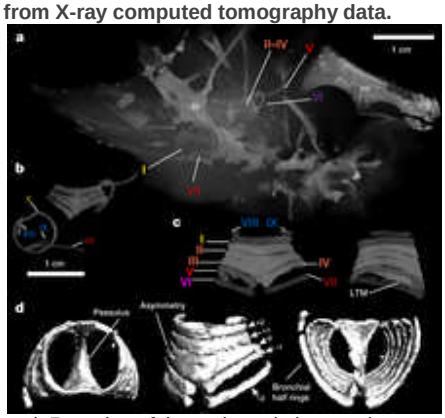
Gurche, J.
"Shaping Humanity. How Science, Art, and Imagination Helps Us Understand Our Origins."
Yale University Press, New Haven, 2013, 345 pages. $43 (hardcover)

When Did Birds Go from Larynx to Syrinx?

Bob Sheridan November 12, 2016

In vertebrates, the air passages, the trachea and two bronchi leading to the lungs form an inverted-Y. These cylindrical tubes have perpendicular rings of cartilage that help keep them from collapsing. Sometimes the cartilage may be partly mineralized. In most vertebrates, there is a structure at the top of the trachea (i.e. near the throat) called the larynx, which is made mostly of cartilage. The larynx is the organ where sound is produced, and there are specialized structures to produce vibrations in the air (e.g. "vocal cords" in mammals). On the other hand, in birds there is a swelling of the junction of the trachea and bronchi called the syrinx (plural "syringes"). Sound is produced by vibration of the walls of the syrinx, and controlled by muscles. Adjacent cartilage rings surrounding the syrinx may be fused, and the rings around a syrinx tend to be half-rings to allow enough flexibility for the syrinx to vibrate. There may be an extra bar of cartilage called the pessulus at the lower surface of the junction of bronchi.

Figure 2: Syrinx elements in *Vegavis iaai* (MACN-PV 19.748) from X-ray computed tomography data.



a–d, Remains of the syrinx relative to other postcranial elements in the block shown in Fig. 1e–g (a), isolated from these elements (b), and reconstructed showing the inferred position of a lateral tympaniform membrane (LTM), between ri…

From the article, caption incomplete.

Somewhere in their history birds acquired a syrinx, but when? Clarke et al. (2016) describe a partial bird skeleton from the Latest Cretaceous (66-69 Myr.) of Antarctica (specimen name MACN-PV 19.748) that appears to be preserved in three dimensions. The authors assigned this bird to *Vegavis iaai*, which is a Mesozoic "anseriform", i.e. thought to be related to the ancestors of modern ducks and geese. The authors studied by CT scanning: the above mentioned Vegavis fossil, a fossil specimen of Paleocene anseriform Presbyornis (61-62Myr.), plus a dozen specimens of modern birds and an alligator. The goal was to produce producing a 3D model of the rings surrounding the syrinx. (Being partly mineralized, the rings would be preserved and visible in both fossil and living animals.) There is much variation of size and shape and fusion of the rings among all the specimens studied. However, Vegavis and Presbyornis are much like the modern birds; they have enlarged and fused rings where the syrinx would be expected, plus some of the rings are half-rings. The alligator lacks any sign of a syrinx, as expected.

The authors suggest that syringes (yes, that is the correct plural name) appeared late in bird evolution. However, all we really know is that by the Late Cretaceous at least some birds already had one. Since we know of no preserved trachea of Early Cretaceous birds or of bird-like theropod dinosaurs, we cannot eliminate the possibility that syringes could have arisen much earlier. There will now be some incentive to start looking.

Sources:

Clarke, J.A.; Chatterjee, S.; Li, Z.; Riede, T.R.; Agnolin, F.; Goller, F.; Isasi, M.P.; Martinioni, D.R.; Mussel, F.J.; Novas, F.E.
"Fossil evidence of the avian vocal organ from the Mesozoic."
Nature 2016, 538, 502-505.
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"Ancient avian aria from Antarctica."
Nature 2016, 538, 468-469.