

Cope, Caves, and Skeletons in the Closet

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The next time someone tells you that the lives of scientists are boring, tell the story of Professor Cope. Edward Drinker Cope was born in Philadelphia on July 28, 1840, to a wealthy Quaker family. His interest in natural history was sparked when he was just six years old, when his father took him to see an exhibition of skeletons and fossils mounted by Dr. Albert Koch. In 1845, Koch had excavated in Alabama the remains of at least five different individuals of two different genera of fossil whales. Instead of separating the pieces by individuals, he put all the bones together and "reconstructed" a single specimen 114 feet long, about 30 feet longer than the blue whale, the largest mammal believed to have ever lived on Earth. He claimed that the skeleton belonged to a sea serpent. This bizarre reconstruction was exhibited in several American cities, including Philadelphia. A few days later, Cope wrote a letter to his grandmother telling her how impressed he was with this great skeleton of a serpent. He had seen the light. He was to become a naturalist.

He did not start going to school until the age of nine, and he continued intermittently until he was nineteen, being taught many times by private tutors. His father wanted him to become a farmer. He was sent to the farms of relatives during the summer months, experiences that furthered his interest in natural history to the point that in 1858 he began working for free at the Academy of Natural Sciences in Philadelphia. He published his first paper when he was eighteen.

His only formal university education was in 1860 and 1861, when he took just one class at the University of Pennsylvania, comparative anatomy, taught by Dr. Joseph Leidy, the founder of American paleontology. When he entered the university, he had already published thirty papers.

To keep him out of the Civil War, his father, a sincere Quaker with pacifist and abolitionist leanings, sent him to study in Europe in 1863. There he studied the natural-history collections of the most important museums in Berlin, Leyden, Munich, Vienna, Paris, and London. On his return to the United States in 1864, Cope became Professor of Comparative Zoology and Botany in Haverford College, a position he kept until 1867. In July 1865, he married his distant cousin Annie Pim. In the summer of 1867, he took his family, including one-year-old daughter Julia, to Virginia, where he explored caves.

His great interest in fossils led him to begin field work in the western United States in

1871. His wealth enabled him to support his own expeditions until 1880. Cope was one of the last zoologists to explore and collect specimens under the threat of hostile Indians (and sometimes whites). He often traveled with soldier escort, but he even took his wife and daughter on one of these trips. In 1876 he camped in Sioux territory within a day's ride of the major encampment of Sitting Bull, shortly after the battle of Little Big Horn.

He lost most of his inheritance of a quarter of a million dollars in a mining fraud in Colorado and New Mexico. To pay for his expeditions, he became a popular scientific lecturer. He also had to reduce his field work in the western fossil fields, and in 1894 he sold his valuable scientific collection to the American Museum of Natural History. Fortunately, the University of Pennsylvania appointed him to a teaching position in geology and mineralogy in 1889, and in 1896 he was promoted to Chairman of Zoology and Comparative Anatomy, a post he retained until his death.

Cope also had an interesting personal life. Wealthy and handsome, he was the center of attention wherever he went. He spoke German, French, Spanish, and, to a limited extent, some native American languages. He was noted for his wit and his sparkling conversational style. Because he was a workaholic and regarded himself as a perfectionist, he expected perfection in others, and many people thought him arrogant. He had an oddly fiery temperament, being aggressive and abrasive. He tended to interrupt colleagues while they were presenting papers. Contemporary observers called him churlish, pugnacious, and quarrelsome. Even in the circles he frequented the most, like the Academy of Natural Sciences and the American Philosophical Society, he had many enemies. Once he got a black eye (and gave one, too) in a fight with Persifor Frazer in the halls of the Philosophical Society.

But Cope was one of the most prolific American naturalists. He published about fourteen hundred papers and books and named more than twelve hundred vertebrate species. Because he was always in a hurry to publish his research, he produced many things that were not quite right from a scientific point of view. He also loved speculation.

Cope was not a simple character, and he did not have an ordinary life. He not only made important contributions to speleology, but was embroiled in one of the most bitter and public scientific controversies in the



nineteenth century. And his private life was also the subject of gossip and innuendo.

CAVE EXPLORATIONS

Cope published twenty-seven papers pertaining to speleology, which made him one of the pioneers of the science in the United States. His first contribution to speleology, however, was no contribution at all. In 1864 he published a paper in which he claimed to have discovered a new species of blind cave fish. In 1863 he had received two specimens of catfish from Conestoga Creek, a tributary to the Susquehanna River in Pennsylvania. He decided, mostly on the basis of what he thought were rudimentary eyes, to create a new genus and species, *Gronias nigrilabris*. To Cope, this was an example of "animals deprived of the sense of sight," and he wrote that his new species "is supposed to issue from a subterranean stream." However, ichthyologist after ichthyologist who have since examined these specimens have come to a different conclusion. The specimens of Cope's alleged new species are nothing more than representatives of a very widespread North American freshwater fish, the brown bullhead *Ameiurus nebulosus*. Contrary to Cope's report, the eyes are present, but asymmetrically developed due to some error during the fishes' growth.

When it came to bones and fossils, however, Cope had a better sense of what is important and what is not. He knew that caves are always a good place to scout for them, and most of his contributions to speleology came from his efforts to identify and analyze fossil remains from caves. Cope's first search for bones in caves was in June 1864, when he journeyed to the Catskill Mountains in southeastern New York and visited Howe's Cave, where he found a number of fossilized bones. For two months in the summer of 1867, he explored caves in southwestern Virginia, where he found a bear's lair in one cave and bones in another, as well as remains of a blind beetle and big

cats and other mammals. Among the caves visited in that area were Erharts Cave in Montgomery County and Spruce Run and Big Stony Creek caves in Giles County.

But one of his most interesting discoveries came from a cave he never visited. In 1868 he examined bones and teeth found in cave soil brought from the Caribbean island of Anguilla, probably from Cavanaugh Cave. Cope found those remains extremely remarkable. He thought that these bones belonged to a chincilla-like animal. Actually, it probably resembled a large capybara more than anything else, although the two animals are not closely related. What was really impressive about the remains was the size of the animal, comparable to that of an American black bear. Recent studies by Donald McFarlane at Claremont College



Amblyrhiza inundata, modern reconstruction. Painting by Dan Bruce, courtesy of R. D. E. MacPhee

have shown that the individuals represented by the bones weighed from fifty to two hundred kilograms. Cope named this new species *Amblyrhiza inundata*. The genus name roughly translates into "strange root," for to Cope it was an aberrant beast. In order to explain how such a large animal could be found on such a small island, he came up with the hypothesis that all those islands had been connected to South America by land bridges that had disappeared when the sea level rose about 125,000 years ago. That is why the species name is *inundata*, flooded. Subsequently, it has been learned that there was an ice age at the time the rodent lived, and that the lower sea level had made Anguilla, St. Martin, and St. Barts into a single large island capable of supporting such a large animal.

In 1869, Cope visited Jefferson County in eastern Tennessee. There he found cave insects and centipedes and bones of a cave rat. In 1871, he went to Wyandotte Cave, Crawford County, Indiana, where he claimed to have gone 9.5 miles into that cave in what was to be his last cave exploration.

But he was not through with speleology. In 1871, Cope studied bone remains from a cave discovered by limestone miners, Port Kennedy Cave in what today is Valley Forge National Historical Park. He described thirty-four species of mammals from that cave, thirteen new to science. Additional species have been described since, but the precise location of the cave is unknown. Its entrance has apparently been filled, and the National Park Service is trying to relocate it.

Another speleological contribution by Cope came with the description of a fossil bear from California. This species is now known as the North American short-faced bear, *Arctodus simus*. Since he had found it in a cave, he thought he had discovered a species of cave bear. These bears were the largest land carnivores in North America during the last two million years, 1.5 meters tall when walking and 3.4 meters tall when standing on their hind legs. They would have been able to reach 1.2 meters above a basketball hoop. They ranged from Alaska and the Yukon to Mexico and from coast to coast. A recent estimation of the autumn weight, with full complement of fat for the winter, of a large short-faced bear is 700 kilograms. (The largest polar bear ever weighed was 660 kilograms.) The common name of the bear derives from its lack of a well-defined forehead and its short, broad muzzle, more resembling that of a lion than living North American bears. The muscles from the broad cheek bones to the lower jaws were extremely well developed, as would be expected in a carnivore adapted to crushing bones for marrow.

Rather than being "pigeon-toed" and waddling like a modern bear, *Arctodus simus* had toes extending straight forward, presumably allowing it to move more easily in bursts of speed or long-distance travel in search of prey or carcasses. It was probably a rather solitary predator or scavenger of large herbivores such as bison, musk-oxen, caribou, deer, horses, and ground sloths. The wide face allows great width between the canine teeth for a good grip on prey, and it might also have allowed a wide snout for a keenly developed sense of smell. In this respect it resembled the polar bear, the most carnivorous living bear.

Additional remains of these bears have been found in caves. Bones of eight individuals from Potter Creek Cave, California, were all females, suggesting that they denned there for reproductive purposes. However, bones of both sexes have been found in other caves. They occasionally suffered from diseases such as osteomyelitis and tuberculosis-like and possibly syphilis-like infections. *Arctodus simus* died out toward the close of the last glaciation, perhaps partly because of the earlier extinction of some of its large prey and partly because of increased competition with brown bears, which apparently appeared in North America about 150,000 years ago. Of course, Cope did not know all these details, but his pioneering work on the fossils of this species opened the door to these and many other discoveries.

One of Cope's last letters, dated March 10, 1897, was on cave fauna. He wrote to his daughter, "I am finishing the Fort Kennedy investigation and will soon turn the

papers in for publication. I have now identified 56 species of Vertebrata of which 50 were of Mammalia. Of the latter all are extinct except six species, which are still living, and are conspicuous species of the present inhabitants of the wild of this country."

Cope was also the leading neo-Lamarckian in the United States. Together with two other American naturalists interested in cave faunas, Alpheus Hyatt and Alpheus Spring Packard, he thought that cave organisms lost their eyes and pigmentation simply as a result of disuse and then passed that loss on to their offspring in an example of the now-discredited notion of inheritance of acquired characteristics.

Despite our searches at the American Museum of Natural History in New York and the Academy of Natural Sciences in Philadelphia, where many of Cope's papers and memorabilia can be found, I could not locate a single picture of him doing speleological work. This is not surprising. Not only was field photography uncommon at that time, but much of his cave research took place with specimens from caves he never visited.

THE BONE WARS

No biography of this American scientist can be complete without mentioning two aspects of his life for which he is better known than for his speleology. One is the bone wars, and the other is the story of his own bones.

The American paleontologist Othniel C. Marsh seemed to have a lot in common with Cope. He too went to Europe to escape from the Civil War. He had an interest in fossils, in his case sparked by diggings in the Erie Canal near his home. Marsh had a millionaire uncle, George Peabody, who financed his education and bequeathed one hundred thousand dollars to Yale, which offered Marsh a professorship there in the new Peabody Museum. The deal was good; Marsh would receive his salary directly from his uncle, so he did not have to teach and could spend more time studying fossils. He became the first official professor of paleontology in the country.

Marsh met Cope at the University of Berlin in 1863. They started out as friends and later hunted fossils together in the eastern United States. Trouble began when Marsh visited one of Cope's digs in New Jersey and covertly paid Cope's crew to send future finds to him. To make things worse, Marsh was a major critic of Cope's most famous scientific blunder. Cope had reconstructed the skeleton of a marine reptile in a way that looked very odd, with a very long tail and a short, stubby neck. This animal looked so strange that Cope thought he had discovered a species quite different from any other fossil reptile,

and he rushed to publish his findings. Unfortunately, he had mounted a plesiosaur skull on the tip of its tail, not on the end of its neck. Cope was so mortified at his mistake that he tried to buy up all the printed copies of the publication, but Marsh was unforgiving. In 1870, he pointed out Cope's mistake and made Cope look like a sloppy scientist who was so untrained he could not get his vertebrae straight. Cope would never forgive nor forget, and what followed in the next twenty-five years or so was to be known as the Great Bone Wars.

Partially to rebuild his reputation, Cope embarked on a race to show who was the better scientist, a race that would consume him for the rest of his life. Obviously his having published fourteen hundred papers by the time of his death at the age of fifty-six meant that he not only had to write quickly, but also that he became sloppy and superficial, a feature of Cope's character that even his most loyal friends recognized. For example, many times he sent papers by telegram, leading to misspellings. Cope had difficult handwriting, and a telegrapher once mistakenly sent the name *Lefalophodon*, a name previously claimed by Marsh for another fossil.

Cope and Marsh became paranoid of each other. Their crews would open quarries, strip them in months, and destroy what they could not remove, so that the other could not get anything from those sites. They both coded messages containing news of finds or deals. They used false names and even laid dummy trails to confuse spies. Crates of specimens awaiting shipment were put under heavy guard. Both had double agents working for their competitor.

Marsh, too, was not a pleasant character. He was pugnacious and quarrelsome and had few, if any, friends, while the number of his enemies was quite large. This earned him the nickname The Great Dismal Swamp. He was autocratic and a tightwad, someone who never paid his employees on time. Trying to further damage Marsh's reputation, Cope passed on to a reporter from the *New York Herald* damaging information on Marsh. They publicly exchanged accusations and insults. Cope wrote of Marsh, "I suspect that a Hospital will yet receive him." Marsh responded by saying, "... I had some doubts about his sanity." Cope suggested that Marsh, who had never married, was a homosexual by saying that he was not "normally or properly constituted." While Marsh accused Cope of incompetence, Cope accused Marsh of plagiarism, the ultimate scientific crime. This accusation was based on the fact that, unlike his rival, Marsh rarely ventured into the field. He instead directed field excursions from his home in New England. Many discoveries credited to Marsh were actually made by his field associates,

but he rarely mentioned their names in his papers. Marsh, in return, tried to have Cope fired from the University of Pennsylvania by asserting that Cope had libeled him in the press to the president of the university, William Perry.

Despite the confrontations, the Bone Wars generated one of the most productive eras in the history of paleontology. Cope and Marsh described 136 species of dinosaurs. Before them, only nine had been named. Among their discoveries were dinosaurs very familiar to us today, such as triceratops, allosaurus, diplodocus, stegosaurus, and what used to be called brontosaurus.

SKELETONS IN THE CLOSET

Because of Cope's celebrity status in his time and the large number of enemies he had, some rumors about him have persisted until today. Cope separated from his wife sometime in 1894 or 1895. Although the letters between them during the time of separation do not show any hostility, rumor had it that she left him because he was a philanderer. Those rumors have not been substantiated, which does not necessarily mean they were not true. Another rumor is that he died of syphilis. Fortunately this rumor can be investigated, because Cope donated his brain and skeleton to the American Anthropometric Society, hoping he could become a type-specimen for human beings. The skeleton was lost for many years, but it reappeared in 1966 in a collection of primate material in Pennsylvania's Museum of Archaeology and Anthropology. Dr. Jane Pierce Davidson, a professor of history at the University of Nevada in Reno, who recently wrote a biography of Cope, arranged for a forensic pathologist to examine the skeleton for evidence of syphilis. None was found. Cope had died on April 12, 1897, probably from prostatitis, a condition he carried for many years.

ACKNOWLEDGMENTS

Dr. Donald A. McFarlane provided information and useful advice on the section about *Amblyrhiza*. Dr. Ross D. E. MacPhee of the American Museum of Natural History graciously gave us permission to reproduce the illustration of *Amblyrhiza* painted by Dan Bruce. Dr. William Turnbull of the Field Museum of Natural History at Chicago provided also very useful information on the *Arctodus*, the "cave" bear discovered by Cope. Mr. William G. Saul of the Academy of Natural Sciences of Philadelphia provided the authors with useful information about the alleged cave fish *Gronias nigrilabris* deposited at that institution. We also thank Prof. James Stewart, at Macalester College, with whom we discussed some aspects of American history during Cope's times.

LITERATURE CONSULTED

Biknevicius, A. R., R. D. E. MacPhee, and D. A. McFarlane. 1993. Body Size in *Amblyrhiza inundata* (Rodentia: Caviomorpha) an Extinct Megafaunal Rodent of the Anguilla Bank, West Indies: Estimates and Implications. *American Museum Novitates* (3079): 1-25.

Bowler, P. J. 1977. Edward Drinker Cope and the Changing Structure of Evolutionary Theory. *Isis* 68(242):249-265.

Davidson, J. P. 1997. *The Bone Sharp: The Life of Edward Drinker Cope*. Philadelphia: The Academy of Natural Sciences of Philadelphia. 237 pp.

Grady, F. V. 1987. Edward Drinker Cope's Contributions to Speleology. *J. Spelean History* 21(3-4):35-37.

McFarlane, D. A., R. D. E. MacPhee, and D. C. Ford. 1998. Body Size Variability and a Sangamonian Extinction Model for *Amblyrhiza*, a West Indian Megafaunal Rodent. *Quaternary Research* 50:80-89.

McNierney, M. 1982. The Great Bone Wars. *The American West* 19(3):52-61.

Osborn, H. F. 1931. *Cope: Master Naturalist*. Princeton, New Jersey: Princeton University Press. 740 pp.

Werkley, C. E. 1975. Professor Cope, not Alive but Well. *Smithsonian* 6(5):72-75.