Elasmosaurus platyurus and A Page from the Cope-Marsh War

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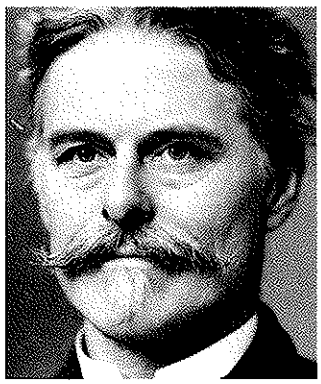


Of all the rivalries to be found in the academic world, perhaps the most famous, and indeed, one of the most bitter, was that between two nineteenth century American vertebrate paleontologists. Edward Drinker Cope (Fig. 1) of the University of Pennsylvania and Othniel Charles Marsh (Fig. 2) of Yale were intelligent, determined, powerful men whose common interests and ambitions brought them into direct conflict during the pioneer days of paleontology. The story of their ensuing feud during the last three decades of the 1800s is one of the most interesting in the history of science.

Both men will long be remembered as leaders in their field and their respective contributions to the science of paleontology were truly great. Each was responsible for the discovery, collection, and study of scores of new vertebrate fossil species. Here at Yale, for example, Marsh's original specimens of the dinosaurs "*Brontosaurus*" (*Apatosaurus*), *Stegosaurus* and *Camptosaurus* can now be seen in the Great Hall of the Peabody Museum.

Unfortunately, however, both Cope and Marsh were occasionally given to fits of somewhat less than ethical conduct when dealing with the other. Distanced by the years, the story of the feud appears as a colorful, romantic, even humorous adventure but its impact was profound. It has been recounted on numerous occasions[1] with varying degrees of accuracy and neutrality. Just some of the alleged episodes that make for interesting reading are the raids on each other's fossil localities and laboratories, the rerouting of rival fossil shipments, and the predating of each's own published manuscripts.

Cope Describes an Unusual Fossil Reptile

Among the many treasures in the vertebrate paleontology collections of the Peabody Museum is a rare manuscript by E.D. Cope which bears directly upon the possible origin of the feud. In August, 1869, Cope produced a monograph in the *Transactions of the American Philosophical Society*, Vol. XIV, entitled "Synopsis of the Extinct Batrachia, Reptilia and Aves of North America, Part I." A major work, this paper described in detail many fossil vertebrates discovered by Cope and his collectors, in particular a strange new reptile from the Niobrara Cretaceous of Fort Wallace, Kansas.[2] Cope correctly recognized that this animal was allied to the plesiosaurs, a group of fossil marine reptiles that were already well known from the rocks of western Europe. In his description of the animal he published illustrations of many of the bones along with a full skeletal reconstruction, and named it *Elasmosaurus platyurus*, the "flat-tailed, thin plate reptile" in reference to the appearance of its greatly expanded limb girdles and its long tail.

Elasmosaurus seemed to have been a truly remarkable animal. Unlike most plesiosaurs, Cope's reconstruction possessed a rather short neck, whereas its tail was extremely long and tapering. Additionally, the interlocking vertebral articulations of *Elasmosaurus* were the reverse of those of typical vertebrates.[3] For this reason Cope erected a new order of reptiles, the Streptosauria. A life reconstruction of the animal as it appeared to Cope was printed in the *American Naturalist*[4] (Fig. 3).

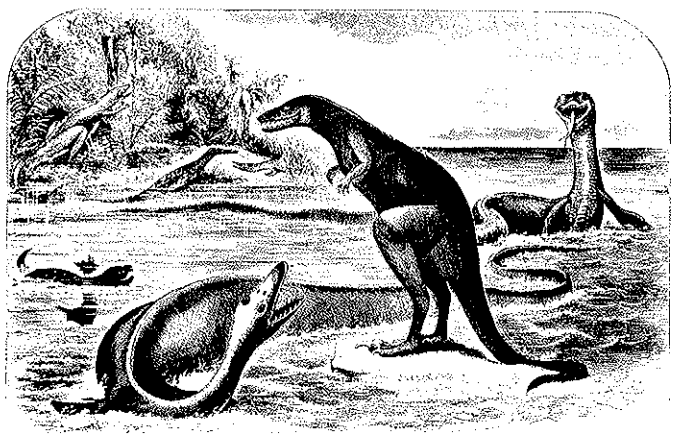


Fig. 1 (upper left) Vertebrate paleontologist Edward Drinker Cope, 1840–97. (Courtesy Yale Peabody Museum Of Natural History.)

Fig. 2 (upper right) Yale paleontologist Othniel Charles Marsh, 1831–99. (Courtesy Yale Peabody Museum of Natural History.)

Fig. 3 (bottom) A rather fanciful reconstruction, prepared under Cope's direction, of (foreground, left to right) *Elasmosaurus*, the carnivorous dinosaur *Dryptosaurus* (*Laelaps*), and the marine lizard *Mosasaurus*.

Fig. 4 Cope's original, and erroneous, skeletal reconstruction of *Elasmosaurus platyurus* from the first version of "Synopsis of the Extinct Batrachia, Reptilia and Aves of North America, Part I." It was this illustration upon which the reconstruction in Figure 3 was based.

Story of Feud Becomes Public

The only problem with Cope's view of *Elasmosaurus* was that he had reconstructed the animal backwards, with the head at the wrong end! (See Fig. 4.) This error was soon corrected (after some embarrassment) but is of interest to us because of the role which it played in the war between Cope and Marsh. Although the dispute had waged openly for twenty years, it was not until 1890 that it received widespread public exposure. In that year a reporter, William H. Ballou, printed the story of their rivalry in the *New York Herald* along with a series of letters from the antagonists which unleashed a barrage of charges and countercharges.[5] In one of these letters, published January 19, 1890, Marsh refers to the story of *Elasmosaurus* as the immediate cause of the conflict:

The skeleton itself was arranged in the Museum of the Philadelphia Academy of Sciences, according to this restoration, and when Professor Cope showed it to me and explained its peculiarities I noticed that the articulations of the vertebrae were reversed and suggested to him gently that he had the whole thing wrong end foremost. His indignation was great, and he asserted in strong language that he had studied the animal for many months and ought at least to know one end from the other.

It seems he did not, for Professor Leidy in his quiet way took the last vertebra from the end of the tail, as Cope had placed it, and found it to be the atlas and axis, with the occipital condyle of the skull in position. This single observation of America's most distinguished comparative anatomist, whom Cope has wronged grievously in name and fame, was a demonstration that could not be questioned, and when I informed Professor Cope of it his wounded vanity received a shock from which it has never recovered, and he has since been my bitter enemy. Professor Cope had actually placed the head on the end of the tail in all his restorations, but now his new order was not only extinct, but extinguished.

Whether this eloquent account truly depicts the start of the feud no one can now say. Was Marsh actually involved in pointing out Cope's mistake? This is at least a possibility. Although Joseph Leidy, the father of vertebrate paleontology in America, had announced his rebuttal of Cope's restoration at a meeting of the Academy of Natural Sciences of Philadelphia on March 8, 1870, his remarks were printed in Yale's *American Journal of Science*[6] with which Marsh was intimately familiar.

Marsh's letter to the *Herald* continues with an allegation that Cope, following the realization of his error, attempted to recall all of the existing copies of his monograph by circulating a printed announcement from Philadelphia, dated March 25, 1870:

An error having been detected in the letter press of the "Synopsis of the Extinct Batrachia and Reptilia of North America," by Edward D. Cope, it will be necessary to cancel and replace one of the forms. The author therefore requests that the recipient of this notice would please return his copy of said work to the author's address, at his expense. The volume will be returned, postpaid, with Part II. of the same work, which will be sent to those who have received the corrected Part I.

Marsh then claims that "Later he issued a second edition of the volume, containing a new restoration, with the head in the proper position, but there was nothing to show that a previous edition of the work had been published."

In the issue of the *American Journal of Science* immediately following Leidy's reversal of *Elasmosaurus*, Cope insisted "It might be added that the description and restoration are correct in 'The Synopsis Extinct Batr. Reptilia, etc., North America,' the error having appeared in a few extra copies only."[7] Then, on January 20, 1890, during the *Herald* outburst, his statement to Ballou read "To the charge of turning a lizard[8] without a head wrong end about I answer, 'peccavi' to some extent." There was, however, no mention in either reference to a false date for an edition of his "Synopsis."

Rare Manuscript Supports Marsh's Claim

On this one occasion, at least, it seems that Marsh's account is the more truthful, for his reprint library, preserved at Yale, contains two different versions of Cope's monograph, both of which bear the same date. Marsh had dutifully returned one inaccurate edition at the author's request, but did not return two others that were subsequently acquired! One of these, and the erroneous illustration from the second, still exist, along with the revised copy. Collectively, they point an accusing finger at Cope.

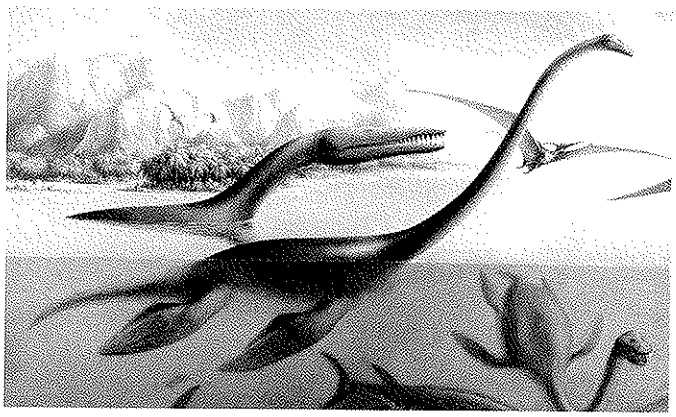
A comparison of the two versions reveals that they are identical except for certain key points. In the revision, the restoration of *Elasmosaurus* is, of course, "updated" (Fig. 5), while the captions of certain figures are exchanged. Little is

Fig. 5 Cope's revised reconstruction of *Elasmosaurus*, this time with the head on the correct end.

modified in the description of the animal other than such original references to "caudals," for example, which are now "cervicals," tail now neck, and vice versa. The same applies to hip and shoulder elements, pelvis and pectrum respectively, which were similarly reversed. Finally, there is no longer mention of a new order, Streptosauria. Most strikingly, however, is the date which, as Marsh pointed out, is 1869 on both. The error, of course, was not pointed out until 1870!

Cope nearly succeeded in removing all evidence of his mistake. The rarity of version one of his synopsis attests to this.[9] As very few copies are now known to remain, Marsh's foresight in keeping an original was fortunate indeed. Sadly, his cunning is known to have extended to other areas of the feud in which he was himself guilty of misdeeds. Still, Marsh's apparent reliability in the telling of this tale suggests at least the possibility that the feud began here, just as Marsh had claimed.[10]

Fig. 6 A modern interpretation of *Elasmosaurus* (center and lower right). The giant short-necked plesiosaur *Kronosaurus* swims behind, while *Pteranodon* flies above. (From a painting by Rudolph Zallinger, courtesy Yale Peabody Museum of Natural History.)



Notes

1. See, for example:
E. H. Colbert, *Dinosaurs*, E.P. Dutton and Co., New York, 1961.
U. Lanham, *The Bone Hunters*, Columbia University Press, New York, 1973.
J.S. McIntosh, Marsh and the dinosaurs, *Discovery*, Yale Peabody Museum of Natural History 1:31–37. 1965.
H.F. Osborn, *Cope: Master Naturalist*, Princeton University Press, Princeton, 1931.
R. Plate, *The Dinosaur Hunters*, David McKay Co., New York, 1964.
A.S. Romer, Cope Versus Marsh, *Systematic Zoology* 13:201–7. 1964.
C. Schuchert and C.M. LeVene, *O.C. Marsh, Pioneer in Paleontology*, Yale University Press, New Haven, 1940.
E.N. Shor, *The Fossil Feud*, Exposition Press, Hicksville, NY, 1974.
R.W. West, *The Dawnseekers*, Harcourt, Brace, Jovanovich, New York, 1975.
W.H. Wheeler, The uintatheres and the Cope-Marsh war, *Science* 131:1171–76. 1960.

2. The original reference to this specimen was made in a paper presented by Cope to the Academy of Natural Sciences of Philadelphia and published in the *Proceedings of the Academy* 20:92–93. 1868.

3. This was first pointed out in the *Proceedings of the Academy of Natural Sciences of Philadelphia* 20:181. 1868.

4. *American Naturalist* 3,2:84–91. 1869.

5. *New York Herald*. January 12, 13, 14, 19, 20, 26, 1890.

6. *American Journal of Science*, Ser. 2,49,147:392. 1870.

7. *American Journal of Science*, Ser. 2,50,148:140–1. 1870.

8. Plesiosaurs are not lizards, but members of an extinct order of reptiles, the Sauropterygia. Cope was fully aware of the differences between the two, and this comment seems to be an attempt to make light of Marsh's charge.

9. As a result of this rarity, Url Lanham was apparently unaware of the existence of the first edition, for the author of *The Bone Hunters* (Note 1) quotes from the second to show that Cope had corrected the error prior to publication. This, of course, was not the case, but Cope's deception had misled Lanham as intended.

10. I thank both Mary Ann Turner and Barbara Narendra for helpful advice and for the loan of materials used in the researching of this article. W. Hartman, J. Ostrom, R. Potts, and R. Tracy each read the manuscript and provided useful criticism. Photographic work was done by William K. Sacco.

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