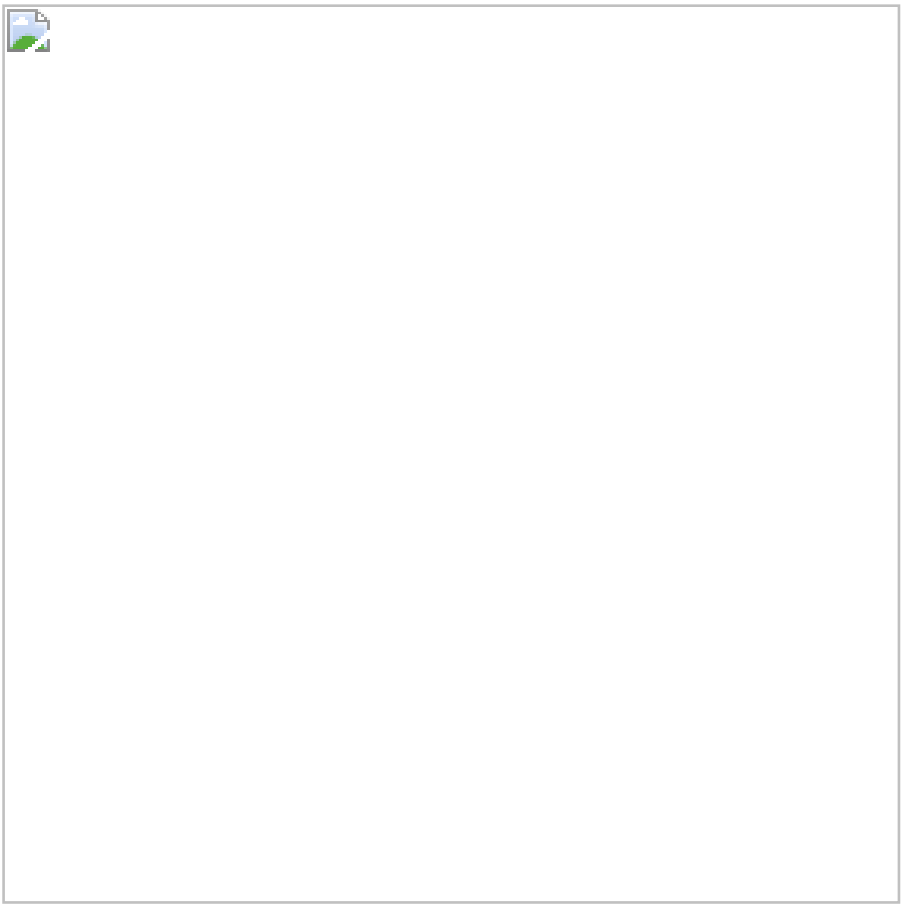

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Send the fossils to me in Philadelphia: Support for early Kansas paleontology by United States Geological Survey of the Territories

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The United States Geological Survey of the Territories published several landmark works of paleontology that dealt with fossils found in Kansas during the decade after the Civil War. Such works appeared as volumes of the Hayden and King Surveys. There were also lesser known USGS publications on Kansas paleontology that preceded these important works. Cope's *Vertebrata of the Cretaceous Formations of the West* (1875) and Marsh's *Odontornithes* (1880). This study concerns the contents of USGS publications concerning paleontology in Kansas to 1875, as well also the role that the USGS publications play today in the study of the history of paleontology in the state as that support is recorded in the publications.

> "By examining the publications of the survey, it will be seen that much attention has been given to the ancient fauna and flora of our Western Territories. The value of [the] studies in connection with geological explorations and surveys is often in danger of being underestimated by not being correctly understood." F. V. Hayden, *Eleventh Annual Report of the United States Geological and Geographical Survey of the Territories Embracing Idaho and Wyoming*, 1877.

> "As it is desirable to develop the science of geology, the writer would be glad if his friends in the West would forward to him, in Philadelphia, at his expense, specimens of bones or teeth which they may find. He will return to them determinations of their nature and credit them with discoveries which may result from their care and interest in preserving them, in the publications of scientific bodies." Edward Drinker Cope, *Preliminary Report of the United States Geological Survey of Wyoming, And Portions of Contiguous Territories*, 1872.

WHY PALEONTOLOGY IN THE SURVEY?

One does not normally think of a United States Geological Survey publication as something containing a plea for help in collecting fossils, yet this is precisely what the young Edward Drinker Cope (1840-1897) placed in his "On the Fossil Reptiles and Fishes of the Cretaceous Rocks of Kansas."(1) Cope had connected with Ferdinand V. Hayden (1828-1889) and was evidently receiving fossils from the field from him as early as 1870. This was probably through the aegis of Cope's mentor, Joseph Leidy (1823-1891), who had a longtime scientific working arrangement with Hayden.(2) Cope was of course in the titular employ of the Hayden Survey in 1872, when he made his fossil collecting trip into the area around Green River, Wyoming. It is known that the monetary support he received from Hayden was paltry to say the least. (3) Thus, his plea to his friends to send him fossils at his own expense takes on an amusing poignancy in the light of history. Cope was never above finagling something at no monetary cost to himself, if he could accomplish it. Perhaps this remark was a jab at Hayden.

It is fascinating to the historian to note just how important paleontology was to the directors of the Federal Surveys of the

Territories. One might certainly expect to find studies of topography, maps, mineral and plant resources, but studies that should have been intended to assist in the opening and exploitation of the West need not necessarily have included paper after paper on fossils. Much of this inclusion of paleontology must have come from the personal interest of Ferdinand V. Hayden and Clarence King (1842-1901). There was considerable precedent for including paleontology in government geological surveys of course. After all, the Lewis and Clark Expedition included paleontology.(4) Throughout the first half of the nineteenth century many state and U. S. government geological surveys and reports contained articles on paleontology. In that context, it was not unusual for the Hayden and King Surveys to also include paleontology. The point is, however, that there was not a particular need for such studies to be included. If Hayden or King had not been interested in fossils, then scientists like Cope would have needed to go elsewhere for publishing support.

Although Hayden and King were personally interested in paleontology, there was an additional reason for its inclusion in the surveys that could be presented to those who might not have understood the utility of this branch of science. Hayden decided to comment upon this in the Survey volume for 1877. He wrote an entire section on the "value of paleontology in the work of the survey." One must assume that this was a refrain he was used to presenting in Washington, but now he felt it important to state it in print. Was this necessitated by Congressional indifference? As one colleague of mine commented, "They made up those lavish presentation copies of works by people like Marsh to give to members of Congress, who probably never even opened them up."(5)

Whatever his motivation, Hayden went to great lengths to point out to his readers that "upon the study of fossil remains that the whole system of geology was originally based, and which study now forms the only reliable foundation of the correct classification of the stratified rocks of the earth." In other words, Hayden was saying that paleontology helped the geologist find valuable mineral resources such as coal. Congressmen and railroad administrators could understand that.(6)

Kansas Paleontology in the Hayden Survey Volumes

This study is concerned with the early history of paleontology in Kansas as it was recorded by publications of the Hayden and King Surveys.(7) Readers may well be familiar with the work done in Kansas by Mudge, LeConte, Cope, and Marsh, and collectors like William Webb and Theophilus Turner who helped them.(8) There is no need to reprise that as such. Herein I propose to look at the activities of various paleontologists in Kansas as a back story to the role of the USGS publications in disseminating their work. The publications themselves constitute a part of early Kansas paleontology, but they also record numerous historical glimpses into the activities and working methods of various persons who collected fossils in Kansas in the decade after the Civil War. In addition, because these are scientific papers, the articles contain lists of previously published material concerning the various fossil specimens.

Paleontologists in the middle of the nineteenth century were looking for venues or monetary support for field work and subsequent publication of their research. The United States Geological Survey volumes had the potential to provide fine looking publications with well-executed illustrations. Further, the Survey itself could provide financial and materiel backing for field work, as well as the very important support of the United States Army. If the reader will forgive a little levity, in the decade after the Civil War, a paleontologist did not just board the Kansas Pacific or the Union Pacific and head

up the line, and then jump off at a likely site for exploration and go wandering around. The Army, with its outposts, supplies and soldiers, was regarded as an essential part of an expedition into what Cope called a "howling wilderness." There were good working relationships between Survey crews and the cavalry. In Kansas various officers made their mark in the history of paleontology. Dr. George M. Sternberg, at Fort Harker, collected for the Smithsonian Institution. Dr. Theophilus Turner, attached to Fort Wallace, discovered the type specimen of *Elasmosaurus platyurus*. Dr. J.H. Janeway from Fort Hays also collected for Cope. During his expedition of 1871 Cope worked with Lieutenant James H. Whitten, one of those he would have called his "friends in the West." Whitten located a partial specimen of *Clidastes stenops* near Butte Creek and was given due credit for his discovery by Cope in *Cretaceous Vertebrata*.(9)

American paleontologists of considerable note were associated with Hayden Survey publications. Although not all of these scientists worked on materials from Kansas, it is worth noting their names. They were a master list of "who was who" in paleontology in the 1860s and 1870s. For example, one of the 1872 volumes contained contributions by Meek, Newberry, Leidy, Lesquereux, and Cope. Meek, long time associate of Hayden, was an authority on invertebrates, Newberry was well known as an expert on fossil fish and fossil plants, Leidy was one of the founders of paleontology in the United States, Lesquereux was the foremost paleobotanist of his time, and Cope was probably the finest paleontologist of the second half of the nineteenth century. All these men worked for Hayden, and several of them published on Kansas fossils.

Two Hayden Survey volumes from 1872, concerning Wyoming and Montana respectively, contained chapters on paleontology in Kansas. Hayden's *Preliminary Report of the United States Geological Survey of Wyoming and Portions of Contiguous Territories, Being a Second Annual Report of Progress*, 1872, included an entire section on paleontology. A general introduction was written by Meek in which he mentioned some specimens of Cretaceous bivalves collected by B. F. Mudge (1817-1879) near Salina, KS. Mudge, of course, was one of the luminaries of paleontology in Kansas. The fact that Meek chose to comment on the activities of Mudge is important to the historical record. As noted above, Survey volumes are filled with such anecdotal information.(10)

Along with his numerous collaborative activities with various other scientists who worked with the Survey, Mudge also contributed a chapter in one Hayden Survey volume. This was "Notes on the Tertiary and Cretaceous Periods of Kansas," which was part of the 1875 volume. This volume mostly dealt with Colorado, but Mudge's contribution contained material on Kansas fossils.(11) This chapter had originally appeared in a shorter form in 1876 in the *Bulletin of the USGS*, Volume II, No. 3.(12)

Mudge discussed vertebrate and invertebrate fossils, giving cursory mention to pterodactyls and specimens of toothed birds that he collected and transmitted to O. C. Marsh. This chapter is brief, but it provides an interesting historical sidelight to Mudge's activities in this period.(13)

Similar collaborations between scientists working with Kansas fossils are noted in Lesquereux's contribution to the 1872 Wyoming volume.(14) Lesquereux's report contained a list of Kansas specimens supplied to him by Mudge and for the most part, by John LeConte (1818-1891). Lesquereux had been associated with LeConte as early as 1867. In this volume, he comments upon several specimens collected by LeConte around Fort Ellsworth, KS. "In 1867 Dr. John

Leconte (sic) had the kindness to send me a small lot of cretaceous fossil plants from Fort Ellsworth, Kansas." He also commented upon some additional specimens collected by Mudge and sent to the Smithsonian Institution.(15)

Cope's contribution to the 1872 Wyoming volume is of considerable historical interest in that it contained an early discussion of several fossil marine reptiles from Kansas, including *Elasmosaurus platyurus,* as well as data on several specimens of *Liodon,* including *L. proriger* (later *Tylosaurus proriger)*. These data are for the most part preliminary. But, the discussion of *Elasmosaurus platyurus* is fairly extensive. Oddly enough, Cope chose to cite his own earlier preliminary mention of the specimen from the *Proceedings of the Academy of Natural Sciences,* 1868, but did not include his later lengthy discussion that was published in the 1869 *Transactions of the American Philosophical Society*. In that document Cope made himself perpetually infamous for placing the skull of the specimen on the wrong end of the vertebral column. By 1872 that error had long since been rectified, as it was immediately recognized in 1869 by Leidy and others. Cope cited his 1869 study from the *APS Transactions* as a reference for his definition of the order Pythonomorpha (sic). Cope used the term, Pythonomorpha, herein, although this group includes mosasaurs rather than plesiosaurs. He passed silently by his own material on *E. platyurus,* although the Hayden 1872 discussion is clearly based on Cope, 1869.(16)

From the standpoint of history, Cope again described the circumstances surrounding the finding of the specimen by Theophilus Turner, and the role of John LeConte in bringing some bones to Cope's initial attention. And, at the end of the section on *Elasmosaurus platyurus* Cope made a remarkable comment concerning where possible additional specimens might be found in Kansas. Today, the specimen described by Cope as *Elasmosaurus platyurus* is not only the type specimen but, the only representative of the genus and species. At the time, Cope did not realize that there would be no further complete, or nearly complete, specimens found. In fact, he apparently thought other specimens had already been collected. He wrote:

> "This species has been found in various parts of Kansas besides that whence the specimen above described was procured. Professor B. F. Mudge obtained vertebrae from a point thirty miles east of Fort Wallace, which probably belonged to this animal."(17)

The present whereabouts of these specimens is unknown. Cope had visited Mudge in Manhattan, KS and had the opportunity to study fossils in Mudge's private collection. Cope commented upon some of these in a short communication to the Academy of Natural Sciences dated October 20, 1871. Although he mentioned that Mudge had been collecting around Fort Wallace in the summer of that year, Cope did not discuss seeing any specimens of vertebrae from *Elasmosaurus*.

The locality that Cope mentions as "thirty miles east of Fort Wallace," is probably along the valley of the Smoky Hill River in Logan County.(18) Cope again mentioned that Mudge had collected vertebrae evidently from *Elasmosaurus* around Fort Wallace in the second USGS volume for 1872 that dealt with Montana and surrounding territories, where he again included a much shorter set of remarks on *E. platyurus*.(19) Further, Cope also left this comment in his 1875, *Cretaceous Vertebrata*. It would seem that he felt this statement accurate.(20)

Cope's entry in the 1872 Wyoming volume makes quite clear the extensive role played by Mudge as scientist and collector in this period. Many of the specimens described by Cope were collected by Mudge. This volume

also contained descriptions of other fossil marine reptiles that would become well known to paleontologists. Various specimens of "*Liodon" (Tylosaurus)* and *Clidastes* are discussed, as well as some species of fossil fish. To these Cope would return in the 1872 Montana volume.

Preliminary Report of the United States Geological Survey of Montana and Portions of Adjacent Territories, Being a Fifth Annual Report of Progress appeared later in the year, 1872. This volume also contained a chapter by Lesquereux on fossil plants and within it a brief section on fossil plants from Kansas, collected by Mudge and sent to Lesquereux.(21)

Cope contributed two sections to this volume, one of which dealt with Kansas. This chapter, "On the Geology and Paleontology of the Cretaceous Strata of Kansas," was published in a draft version in William Webb's 1872 book, *Buffalo Land*. Webb, a land agent for the Kansas Pacific Railroad, wrote *Buffalo Land* to advertise the land and other opportunities to be found along the line's right-of-way to settlers and adventurers. But, Webb was fascinated by paleontology. A friend of Cope, he fashioned a character in *Buffalo Land* after Cope and printed almost word for word the chapter on Kansas paleontology that later appeared in the USGS 1872 Montana volume. Cope must have sent Webb a draft of the chapter so that Webb might use it in *Buffalo Land*. Webb collected for Cope, including the type specimen of the first short necked plesiosaur, *Polycotylus latipinnis.* We find his name mentioned throughout Cope's publications on the Kansas Cretaceous.(22)

From the standpoint of history of science, the 1872 Montana volume and *Buffalo Land* make an ensemble of Cope's work to that point on the fossils of Kansas, and the inclusion of Cope's work in Webb's book speaks to the friendship the men shared as well as to Cope's desire for notoriety. In the Survey volume Cope spoke of others with whom he worked in his early activities in Kansas in 1871. He mentioned Dr. J. H. Janeway, post surgeon at Fort Hays and a gentleman named N. Daniels who was also a friend who supplied fossils.(23) Cope's scientific data in the 1872 Montana volume are equally interesting from the standpoint of history. Some of the specimens mentioned in the earlier 1872 Wyoming volume are briefly discussed, such as *Elasmosaurus platyurus*. But in this volume, Cope now described other Kansas fossils that would become famous among paleontologists. These were the giant marine turtle, *Protostega gigas* and the great fish, *Portheus molossus. Portheus molossus*, (X*iphactinus audax*) fondly nicknamed the "X Fish" today by some paleontologists, became a very well known fossil because of its large size, formidable teeth and some specimens that were found preserved with fish that *Portheus/Xiphactinus* had just eaten. Even Cope found this fish impressive. He wrote of *Portheus molossus*:

> "The Cretaceous ocean of the West was no less remarkable for its fishes than for its reptiles… The head [of *Portheus molossus*] was as long or longer than that of a full grown grizzly bear… the teeth were all sharp cylindric fangs…This fish was known as *Portheus molossus,* Cope. Besides the smaller fishes, the reptiles no doubt supplied the demands of his appetite."(24)

Leidy (1870) had given the fish the name, *Xiphactinus audax*, from a specimen donated by Dr. George M. Sternberg. Cope did not recognize that this was the same fish as his *Portheus molossus*. At one point, he even tried to rename Leidy's specimen.(25)

George M. Sternberg (1838-1915) was attached to Fort Harker, Kansas, in 1866. He spent several years collecting various fossil specimens in the area. He did not publish on these, but the fossils which he collected were

studied and published by Leidy and others. Leidy (1873) published on a number of the fossils that Sternberg had collected between 1866 and 1870. Leidy's "Description of Remains of Reptiles and Fishes From the Cretaceous Formations of the Interior of the United States," was a section in the 1873 Hayden Survey volume that dealt with Kansas fossils, many of which were collected by Sternberg. Leidy credited Sternberg's contribution to paleontology by noting:

> "Most of the fossils were submitted to the examination of the author by the Smithsonian Institution and form part of a collection from the Smoky Hill River, Kansas, and from the Indian Territory, presented to the Army Medical Museum of Washington, by Dr. George M. Sternberg, United States Army."(26) Sternberg's collection included specimens of what Leidy called "mosasaurus-like reptiles." Among these, Leidy named some species of *Clidastes*.(27)

In the Survey Volume for 1873, Leidy also included a short chapter on fossil fish from Kansas, to accompany his discussion of other Cretaceous fossils. This was only a brief section of a few pages, but discussed specimens collected earlier by Hayden and Meek in 1858.(28) Discussions such as these, while brief, are of considerable historical value as they outline the interest in paleontology that men like Hayden and George Sternberg had. They also serve to illustrate the considerable role that the United States Army played in Kansas paleontology.

In 1875 the USGS published Cope's *The Vertebrata of the Cretaceous Formations of the West*. Hayden called it a "very valuable memoir."(29) It was indeed one of Cope's major publications. The *Cretaceous Vertebrata* contained much material already printed in the two previous 1872 volumes. Thus, much of the text was about fossils from Kansas. Cope was somewhat selective in his publication of fossils. Although he did mention, very briefly, the two very famous discoveries of O.C. Marsh, *Ichthyornis* and *Hesperornis*, this was a book by Cope about Cope.(30) He seems to have been determined not to give his rival much credit in this Survey publication. Cope did discuss two species of pterodactyl that had been collected by Marsh, but did not cite any references to Marsh publications concerning pterodactyls.(31)

The *Cretaceous Vertebrata* ran to 303 pages, and was lavishly illustrated with 52 full and double page lithographs produced by the well-known firm of Sinclair and Son, Philadelphia. Sinclair produced many lithographs for various government publications throughout the century. Their work was of a uniform excellent quality. The art work for *Cretaceous Vertebrata* was done by Cope. Cope was an accomplished artist in his own right, and he normally did the preliminary drawings used by his lithographers and engravers.

In this work Cope discussed a number of important Kansas fossils among them *Protostega gigas*, various fossil marine reptiles including *Polycotylus* and *E. platyurus*, "*Liodon" proriger, Platecarpus,* and *Clidastes*. Most of these fossils were represented in the illustrations, as was the great fish *Portheus molossus*. There were two lithographs illustrating the skulls of "*Portheus molossus.*" Plate XXXIX was a two page fold out illustration. Plate XLI, a single page illustration, depicted a skull of a second individual (Fig. 1).

Cope noted several specimens in the illustrations as being in Mudge's collections. He must have drawn them while visiting Mudge.(32) Plate XXVI, figures 4 and 13, depicted vertebrae from various specimens of *Platecarpus*, belonging to Mudge. Similarly, Plate XXVII, figures 1 and 5-10 depicted

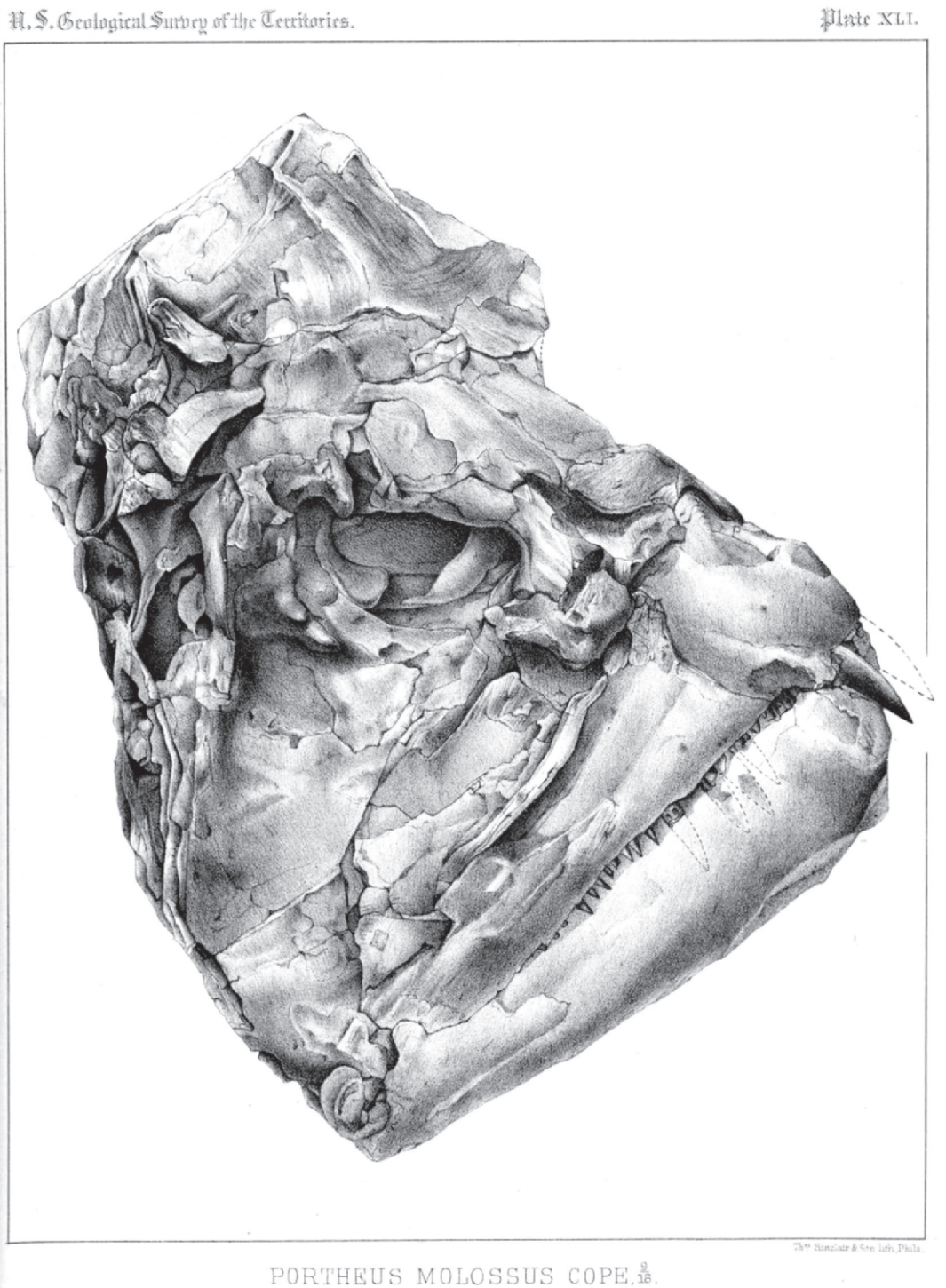

Figure 1. *Portheus molossus* Cope, Plate XLI. From E. D. Cope, *The Vertebrata of the Cretaceous Formations of the West*, 1875. Lithograph based on a drawing by Cope.

additional *Platecarpus* vertebrae from Mudge's collection. This book no doubt enhanced the prestige of the Hayden Survey as well as Cope's prestige and remains among Cope's most significant publications, outdone only by his massive *The Vertebrata of the Tertiary Formations of the West* (1884), itself a Hayden Survey volume.

O.C. Marsh's magnum opus, *Odontornithes*, was published in 1880 as a part of the King Survey of the Fortieth Parallel. Although it falls outside the chronological scope of this study, most of the research conducted on the Kansas "birds with teeth" came within the decade after the Civil War. This book helped make Marsh famous, and it justly deserves discussion here.(33) Marsh told his readers that he found the first specimen of *Hesperornis* in December, 1870,

> "...near the Smoky Hill River in Western Kansas. Specimens belonging to another genus of the *Odontornithes* (sic) were discovered in the same expedition…In June of the following year [1871] the writer again visited the region with a larger party and a stronger escort of United States troops."

According to Marsh, he had abandoned the field in 1870 due to the harsh winter weather and concerns about unfriendly Indians in the area. Marsh noted, "The extreme cold, and danger from hostile Indians, rendered a careful exploration at that time impossible." (34) Marsh went on to describe yet a third trip in the fall, 1872 to collect more bird specimens, "and one nearly complete skeleton of *Hesperornis* - an ample reward for the hardship and danger we endured."(35) These fossils were collected during the various Yale College Expeditions between 1870 and 1872. Some avian fossils were also obtained from Mudge. Marsh's comments on his first find of *Hesperornis* are most interesting in the light of the fact that this is not mentioned at all by Schuchert and Le Vene, who remain Marsh's only biographers. Schuchert and Le Vene's O. *C. Marsh: Pioneer in Paleontology* (1940), printed at length descriptions of the expedition of 1871 and 1872 as these appeared in the *New York Times* (1871) and the *Yale Courant* (1872) and from these we learn about birds with teeth. Not mentioning the earlier discovery in the Marsh biography was obviously was an oversight on Schuchert's part, as certainly he had read *Odontornithes*.(36)

Like Cope's *Cretaceous Vertebrata, Odontornithes* was a large lavishly illustrated book. The were 34 full and double page lithographs based on drawings by Frederick Berger and lithographed by Emile Crisand of Boston. Berger was an artist in Marsh's employ at the Yale Peabody Museum. Berger and Marsh had a long association beginning in 1875 and lasting throughout the remainder of Marsh's life. Berger had actually worked for Emile Crisand before going to work for Marsh. Crisand frequently produced Marsh's lithographs.(37) Presentation copies of Marsh's *Odontornithes* were quite elegant. These were folio-sized books with gold-tipped pages. If those Congressmen didn't open these, it was a pity.

The Place of the USGS Publications in the History of Kansas Paleontology

It is clear that the fossils of Kansas occupied a place of importance in the various publications of the United States Geological Survey of the Territories and the King Survey of the Fortieth Parallel. Volumes dealt mostly with vertebrate fossils. This was perhaps in keeping with the penchant for vertebrates of some of the scientists involved. But paleobotany was not excluded thanks to Lesquereux. Invertebrates were reported in the volumes as well. Some of these works remain among the monuments of nineteenth-century paleontology. They made their authors famous. Of course this was in part why Cope, Marsh, and Lesquereux wanted

their research published by the Surveys. One can argue that the sponsorship of the government did more for the paleontologists than they did for the Surveys. Recall that Hayden had to justify why he included so much paleontology in his volumes. But, there can be no doubt that the Surveys, with their monetary and military support, as well as their publication opportunities played a huge role in the history of paleontology in Kansas. Today these volumes also serve as historical records of the activities of scientists in Kansas between 1865 and 1875. These volumes remain important to historians and scientists alike. From the standpoint of history, they are fascinating first person accounts of what it was like to do paleontology in Kansas after the Civil War.

Acknowledgements

Thanks to Michael J. Everhart for a number of helpful comments concerning this study.

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NOTES

1. Edward D. Cope, "On the Fossil Reptiles and Fishes of the Cretaceous Rocks of Kansas," F.V. Hayden, *Preliminary Report of the United States Geological Survey of Wyoming and Portions of Contiguous Territories, Being A Second Annual Report of Progress,* Washington, D.C., United States Government Printing Office, 1872, p. 286.
2. Hayden had been collecting fossils in the Territories since the 1850s. Some fossils he collected were published in various works by Joseph Leidy. Hayden also published in paleontology with Fielding B. Meek as early as 1856. Meek became well known as a specialist on invertebrates, and published frequently in various members of the Hayden Survey. In 1856-1857 Hayden was a civilian member of the expedition of Capt. G. K. Warren (1830-1882) in Wyoming and Nebraska. Hayden was a member of Lieutenant William F. Raynolds (1820-1894) expedition in 1859-1860, which explored throughout central and northern Wyoming, and into Montana and Colorado. He enlisted in the Union Army in 1862 and resigned his commission at the war's end. In 1866 Hayden was appointed head of the Geological Survey of Nebraska. From that position, he became head of the USGS when the Survey name changed in 1869. Clarence King took over administration of the USGS in 1879.

Biographies of F. V. Hayden leave something to be desired, but a good general study of Hayden's activities can be found in Mike Foster, *Strange Genius: The Life of Ferdinand Vandeveer Hayden*, Niwot, CO, Roberts Rinehart Publishers, 1994. For a study of how Hayden administered his surveys, see James G. Cassidy, *Ferdinand V. Hayden Entrepreneur of Science*, Lincoln NE and London, University of Nebraska Press, 2000.

A recent biography of Clarence King that deals with his field explorations is James Gregory Moore, *King of the 40th Parallel*, Stanford, CA, Stanford University Press, 2006.
3. For a discussion of just what Hayden paid Cope during his work for the Survey in Wyoming in the early 1870s, see Jane P. Davidson, *The Bone Sharp: The Life of Edward Drinker Cope*, Philadelphia, The Academy of Natural Sciences of Philadelphia, 1997, p. 93-100. Decades later, when O. C. Marsh instigated the attempt by the USGS to seize Cope's fossils, Cope complained angrily that they were indeed his personal property because he had paid his way while working for the Hayden Survey. Cope was telling the truth.
4. See the "Discovering Lewis and Clark" web site prepared by E. E. Spamer and R. M. McCourt at http://www.lewis-clark.org/content/content-channel.asp?Channel ID= 372 [July 2007]. This site discusses the contributions to paleontology made by the Lewis and Clark Expedition.
5. I own a presentation copy of Marsh's *Odontornithes* (1880), with signatures where pages were never cut open.
6. Ferdinand V. Hayden, *Eleventh Annual Report of the United States Geological and Geographical Survey of the Territories Embracing Idaho and Wyoming,* Washington, D. C., United States Government Printing Office, 1877, "The Value of Paleontology in the Work of the Survey," p. xxvi-xxviii.
7. I decided to include King's administration of the Survey, although it is later than 1875, because this phase of the USGS published one very significant monograph the field work for which was accomplished prior to 1875. That was Marsh's *Odontornithes*.
8. John LeConte collected a number of specimens of fossil plants and animals which he sent to other scientists, such as Joseph Leidy and Edward Drinker Cope, for further evaluation and study. While he might not necessarily be a "major player" in early paleontology in Kansas, he was certainly an important secondary figure.
9. Edward D. Cope, *The Vertebrata of the Cretaceous Formations of the West, Report of the United States Geological Survey of the Territories, Volume II, F. V. Hayden.* Washington, D.C., United States Government Printing Office, 1875, p. 135.
10. See Meek's comments on p. 289-290 of the 1872 Wyoming volume. He noted, "The specimens from twelve miles southwest of Salina, Kansas, came from a brown ferruginous sandstone belonging to the horizon of the Dakota Group, or the oldest division of the Upper Missouri cretaceous series. For these we are many obligations to Professor B.F. Mudge of the Kansas Agricultural College at Manhattan." The fossils themselves are described in "Preliminary Paleontological Report," p. 287-318, passim.

Fort Ellsworth was renamed Fort Harker on November, 17, 1866. It was abandoned in January, 1867, and the fort was rebuilt a mile away from the original site. As to why Lesquereux continued to use the name, Fort Ellsworth, perhaps he did not know the fort was renamed, or perhaps it was an oversight on his part.

11. F.V. Hayden, *Ninth Annual Report of the United States Geological Survey of the Territories, Embracing Colorado and Parts of Adjacent Territories, Being a Report of Progress of the Exploration For the Year, 1875,* Washington, D.C., United States Government Printing Office, 1877. See p. 277-294.
12. *Ibid*., p. 277.
13. *Ibid*., 287-288.
14. Leo Lesquereux, "On the Fossil Plants of the Cretaceous and Tertiary Formations of Kansas and Nebraska," p. 370-385, in Hayden, 1872, Wyoming (note 10 above).
15. *Ibid*., p. 378-379 and passim in the above chapter. Lesquereux, 1868, "On Some Cretaceous Fossil Plants from North America," American Journal of Science, Series 2, Vol. 46, p. 91, referred to Fort Ellsworth, Nebraska. By 1876 he had corrected his geography, placing Fort Ellsworth in the right state.
16. The history of the erroneous restoration of *E. platyurus* and Cope's publications which showed both the incorrect and correct placement of the skull are discussed in Jane P. Davidson, "Bonehead Mistakes: The Background in Scientific Literature and Illustrations for Edward Drinker Cope's First Restoration of *Elasmosaurus platyurus,"* Proceedings of the Academy of Natural Sciences of Philadelphia 152 (October, 2002), p. 215-240.
17. Edward Drinker Cope, On the Fossil Reptiles and Fishes of the Cretaceous Rocks of Kansas," in Hayden, 1872, Wyoming (note 10 above) p. 400
18. Cope frequently mentions the Smoky Hill River vicinity in his two 1872 Survey volumes. Thanks to Mike Everhart (pers. comm., 2007) for suggesting this as the location for Mudge's find of *E. platyurus* bones mentioned by Cope. Everhart noted that Cope might possibly have made an error in his comment about either the fossils or the locality. Everhart notes that this is the area in which most known elasmosaur specimens have been found. The communication to the Academy was published in the Academy *Proceedings* as "Note of Some Cretaceous Vertebrata in the State Agricultural College, Kansas, U.S.A," Vol. 12, p. 168-170. The article is available in html format at http://www.oceansofkansas.com/Cope1872e.html [July 2007]. See also Michael J. Everhart, "The Occurrence of Elasmosaurids (Reptilia: Plesiosauria) in the Niobrara Chalk of Western Kansas, Paludicola 5(4): 170-183, 2006.
19. F.V. Hayden, *Preliminary Report of the United States Geological Survey of Montana and Portions of Adjacent Territories, Being a Fifth Annual Report of Progress,* Washington, D.C., United States Government Printing Office, 1872, p. 337.
20. E.D. Cope, *The Vertebrata of the Cretaceous Formations of the West, Report of the United States Geological Survey of the Territories, Vol. II, F.V. Hayden,* Washington, D.C., 1875, p. 88.
21. Leo Lesquereux, "Fossil Flora," Montana 1872 volume, p. 301-303.
22. See Jane P. Davidson, "Edward Drinker Cope, Professor Paleozoic and *Buffalo Land*," Kansas Academy of Science, Transactions 107, No. 3-4 (2003), p. 171-191. In *Buffalo Land*, Webb printed the draft of Cope's paper in Chapters XXIII and XXIV as "A chat with Professor Cope." It is this author's contention that E.D. Cope served as much of the model for Webb's character, "Professor Paleozoic."
23. E.D. Cope, "On the Geology and Paleontology of the Cretaceous Strata of Kansas, 1872 Montana volume, *p. 325 and 348.*
24. *Ibid.* For *Portheus molossus*, see p. 324, for the quote; and p. 338-342.
25. See Michael J. Everhart, *Oceans of Kansas: A Natural History of the Western Interior Sea*, Bloomington, IN, Indiana University Press, 2005, p. 76-77.
26. Joseph Leidy, "Contributions to the Extinct Vertebrate Fauna of the Western Territories," in F.V. Hayden, *Report of the United States Geological Survey of the Territories, Volume I*, Washington, D.C., United States Government Printing Office, p. 267. Most of this book dealt with specimens from Wyoming Territory. For information on Sternberg and Leidy, see http://www.oceansofkansas.com/GM_Stern.html [July 2007].
27. *Ibid*., see p. 276-279 and p. 283.
28. *Ibid.,* see p. 312-314.
29. *Ibid., The Vertebrata of the Cretaceous Formations of the West*, p. iii, letter of transmittal by Hayden.
30. *Ibid.,* p. 245-246.
31. *Ibid.* p. 65-67. Marsh was publishing on pterodactyls as early as 1871. See *American Journal of Science*, Series 3, Vol. I, p. 472. Cope gave his own scientific names to similar fragmentary specimens of the same reptiles.

32. See for example Plate XXVI, no. 3 *Platycarpus? mudgei* (sic) which Cope notes was in Mudge's collection. *Platecarpus* is misspelled in the text, clearly an oversight by Cope and his proofreaders.
33. Othniel C. Marsh, *Odontornithes, Monograph on Extinct Toothed Birds of North America. United States Geological Exploration of the Fortieth Parallel. Clarence King*. Washington, D.C., United States Government Printing Office, 1880.
34. *Ibid*., p. 2.
35. See note 33 above. The original specimen of *Hesperornis* was headless. Thus Marsh could not have known it to be a species of toothed birds when it was found.
36. Charles Schuchert and Clara Mae LeVene, *O.C. Marsh: Pioneer in Paleontology*. New Haven, CT, Yale University Press, 1940, Chapter V, passim and see especially p. 126, and 183-187. S.W. Williston, 1898, discusses the Marsh 1870 find, "…late in the season of 1870, Professor Marsh with an escort of United States soldiers, spent a short time on the upper part of the Smoky Hill river collecting vertebrate fossils. The material then collected served for the description of a number of interesting types by Marsh. It included the first known specimen of 'Odontornithes,' a foot bone brought in with the other material, but which was not discovered in the material until after other specimens had been obtained later. In June of the following year, Marsh again visited the same region, with a larger party and a stronger escort of United States troops, and was rewarded by the discovery of the skeleton which forms the type of *Hesperornis regalis* Marsh, together with other material." See S.W. Williston, *Birds, The University Geological Survey of Kansas*, Part II, 4: Topeka, KS, State Printer of Kansas, p. 43-49. See also Michael J. Everhart, *Oceans of Kansas: a Natural History of the Western Interior Sea*, Bloomington, IN, Indiana University Press, 2005, p. 218-219.
37. *Ibid*., Schuchert and LeVene p. 292.