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The Golden Age of Fossils in America

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Aller au sommaire du numéro

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REVIEW

The Legacy of the Mastodon: The Golden Age of Fossils in America

Keith Thomson
Yale University Press, New Haven (2008)
xvii + 386 p.
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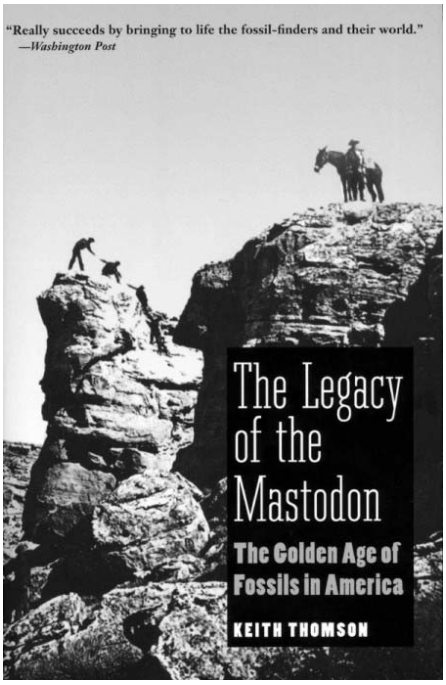
In this scholarly and thoughtful book, written as a tribute to his teacher, Alfred S. Romer, Keith Thomson surveys the history of vertebrate fossil collecting in North America between about 1750 and 1890. Thomson has had a long and distinguished career in biology, palaeontology, and natural history that includes stints on faculty and in museum administration at several institutions including Oxford and Yale universities and the Academy of Natural Sciences, Philadelphia. Perhaps not coincidentally, these institutions house many of the historically important fossil specimens that are the focus of his account. During the past twenty years or so, he has written more than ten other well-received books, mainly focusing on the history of science and natural history, ranging from *The Young Charles Darwin* (2009) to *Living Fossil: The Story of the Coelacanth* (1991).

Thomson characterizes the study of fossil vertebrates as a "*uniquely American science*" that is marked by three themes, comprising a "*straight forward practical empiricism*", "*the adventure of exploration and discovery*" and the growing professionalization of geology as it emerged from natural science (p. 7). Thomson situates fossil collecting within the American western expansionist movement during the late eighteenth and especially nineteenth century. As it partakes of the restless urge for exploration, he regards it as

> "*in every sense tied directly to, and contingent upon, the greater history of the opening and population [sic] of the American West"* (p.7).

Appropriately enough, Thomson begins his survey with a tale that is part of this frontier mythos: the kidnapping in 1755 of Mary Draper Ingles from her pioneer homestead in the Appalachians by a group of raiding Shawnee. She was set to work processing salt at Big Bone Lick, Kentucky, a place that, as its name suggests, yielded abundant large animal bones. This site and the faunal remains collected there form the starting point for Thomson's narrative. In 1752, mineralogist Jean-Étienne Guettard described one large tooth specimen that had been collected from this site by a French military officer in 1739. Thomson explains that this tooth, which we now know to be from a mastodon, stimulated a great deal of interest because of its puzzling characteristics. It was similar to but different from elephant teeth and it also differed from the mammoth teeth that were already known from Siberia. Speculation abounded as to what animal produced this strange knobbly tooth. A peculiar species of elephant? A different type of elephant-like animal? A hippopotamus? Perhaps some kind of carnivore? And, more to the point, did this strange animal still roam North America?

Thomson continues by describing how this and similar finds raised questions among the educated



and scientific elite, generating interest and stimulating exploration and fossil hunting in America. More discoveries prompted more scientific scrutiny, including some perceptive observations by Benjamin Franklin. The finds also attracted the attention of the intellectually curious and politically powerful Thomas Jefferson. Jefferson wanted to find evidence to repudiate the Comte de Buffon's supercilious 1766 dismissal of America's fauna and peoples as undersized and degenerate. Discovering a large elephant-like, possibly carnivorous, American animal would definitely be one way to squelch the patronizing Europeans! Jefferson thought he had found his carnivore in the remains of the 'great claw' found in 1797, until this was identified by Caspar Wistar as a giant sloth, now known as *Megalonyx*. As has happened at other times, science got mixed up with politics. As Thomson sees it, Jef-

ferson had an

> "*almost visceral need to describe American creatures in terms of their ferocity and power*" (p. 37). In this way they "*could then be projected as powerful symbols of the new nation and described in terms matching the belligerence and strength that allowed America to become independent from its European forefathers*" (p. 37).

Of course, neither the browsing mastodon nor the massive but herbivorous ground sloth really projected the image of ferocity and energy that Jefferson wanted to cultivate! Perceptively, Thomson notes that "*the same issues of size, strength and aggressiveness*" came into play again with the dinosaur discoveries of the nineteenth century and, he suggests, continue today.

Jefferson wrestled with the same conundrum that struck everyone who examined the mastodon and other remains. Did these represent animals that were still in existence? And, if so, where were they? When Jefferson sent out Lewis and Clark in 1805 to explore the American west, their mandate included instructions to search for living representatives of these animals (p. 60). Nevertheless, it was starting to dawn on observers that these animals might be extinct. Extinction, however, was a difficult concept for many people, including Jefferson, to fit into their existing belief systems, as Thomson explains in the second section of his book, called 'Fossils and Geology'.

Here Thomson switches his attention to what was happening in natural philosophy in the late eighteenth century and early nineteenth century, especially in Britain and Europe. Thomson traces the origin of ideas on stratigraphy from Steno to William Smith and describes the gradual recognition that the record of the rocks indicated immense intervals of time. This again flew in the face of religious tradition, which held that the earth was only a few thousand years old. In Europe, Georges Cuvier was the recognized authority on ancient animal remains and he began characterizing strata around the Paris Basin by their included fossils. In England, the discovery of large animal bones, notably by Mary Anning and Gideon Mantell, generated much popular and scholarly interest. However, these animal bones showed greater affinities with lizards than with mammals, leading to the definition of the Dinosauria by Richard Owen in 1842. As Thomson's account shows, the discovery of animals so different from anything living had already predisposed most scientists and educated people to accept the reality of extinction and species change by the time of Darwin's formulation of evolution in 1859, although this provided the conceptual framework or "*intellectual underpinning*" (p. 298) for the developing discipline of palaeontology.

As exploration of the western areas of the North American continent continued in the early and mid nineteenth century, more evidence of large fossil animals was found. From here on, Thomson's narrative becomes a litany of famous names as geologists and fossil collectors move from region to region, locality to locality: the Dakota Badlands, the Black Hills, Nebraska Territory, Green River Basin, Powder River Basin, Wasatch Basin, Bridger Basin, parts of Kansas, and Como Bluff, Wyoming. Throughout the 1850s and 1860s, many of the collected fossils found their way east to the laboratory of Joseph Leidy in Philadelphia, where he described and published accounts of them, identifying and naming many new species, notably of mammals found in the Tertiary strata of the badlands in the upper Missouri. Unlike most modern palaeontologists, he did not specialize in any one fossil group or geologic interval; he also recognized and described fish, turtles, and marine reptiles. Many of these fossils were sent to him by Ferdinand Vandiveer Hayden, one of the most colourful, prolific, productive and influential geologists working in the west. The informal partnership between Hayden, as fossil collector, and Leidy, as fossil describer, is one of the main stories to emerge from Thomson's account of this era. Leidy is perhaps best remembered now for two studies: the naming of *Hadrosaurus foulkii* in 1858 from a specimen found in New Jersey (p. 44) and his description of fossil horse specimens in 1846 (p. 107). He looms large in Thomson's story, playing a significant role in raising awareness of fossil finds. Thomson clearly feels admiration for his skills and expertise, observing that he practiced science in a "*restrained and gentlemanly style*" (p. 126), although, as he regretfully comments, Leidy's "*reputation [has] been eclipsed by others with a keener feel for self-promotio*n" (p. 106).

By the late 1860s, Hayden became increasingly impatient with what he perceived as Leidy's slow pace in working his way through the crates of fossils being generated from each field season. Hayden still sent fossils to Philadelphia, including some to an ambitious young zoologist, Edward Drinker Cope, but he also began distributing fossils to Professor Othniel Charles Marsh at Yale University. This marked a shift from Philadelphia as the dominant centre of palaeontological activity. And so the 'fossil rush' of the 1870s and 1880s began, with field crews competing to discover new fossil-bearing localities, extract the specimens, and transport them back east.

Despite Thomson's avowed intent not to make this story a rehash of the Cope and Marsh rivalry (p. 165), much of the third and longest part of the book (called *Giant Saurians and Horned Mammals*) inevitably devolves into an account of the unedifying 'bone wars' between these two scholars. Thomson's analysis of this rivalry shows that the rush to publish is nothing new. Competition to claim precedence for naming new species even led Cope to advance telegrams sent from the field as evidence of prior publication (p. 233). Although they dominate this story, several other colourful personalities, especially Hayden but also Benjamin Mudge, Theophilus Turner, Sam Smith, James Van Allen Carter, and George M. Sternberg, played prominent roles in the extraction and study of fossils from the west. Inevitably, many people in the geoscience world were dragged into the squalid Cope–Marsh enmity. Much of this story treads over familiar ground that has been extensively covered in other books dealing with the history of palaeontology. Nevertheless, Thomson provides a literate and well-documented account of this important interval, especially the 1870s when the pace of discovery seems almost breathtaking.

Thomson winds up this story in the fourth section with a view forward towards the twentieth century. By

1890 in the USA, he concludes, the frontier phase of exploration and fossil collecting was ended. A new generation of palaeontologists was taking over, of whom perhaps the best known is Henry Fairfield Osborn, based for much of his career at the American Museum of Natural History in New York. The era of synthesis had begun, as "*scholars had turned from simple documentation of the fossil record to understanding what it all meant*" (p. 318). For Canadian readers, Thomson's book nicely sets up the background for the 'Great Canadian Dinosaur Rush' of the early twentieth century in western Canada, another interval of intense field and collecting rivalry that can be seen as an outgrowth of this western USA story.

Thomson concentrates on the fieldwork and collecting aspects of palaeontology. He describes field conditions and collecting methods, highlighted by extracts from journals kept by students involved in the four Yale College collecting expeditions led by Marsh between 1870 and 1873 (p. 181-190). Interestingly, one of those students was George Bird Grinnell, later to become well known for his work in ethnology. Some personalities and field sites are shown in a section of 28 black-and-white photos, while a few useful maps help make sense of the travels. Even now, many of these collecting areas are in remote and sparsely inhabited areas of the USA, but in the mid-nineteenth century fieldwork required considerable fortitude and tolerance of discomfort. Yet, these expeditions occurred as cross-country travel was becoming easier and quicker through expansion of the railway network and the telegraph system made communication faster. Rail cuts also proved useful in regions where bedrock exposures were otherwise few. Nevertheless, field conditions were often harsh and difficult, made more trying by ongoing conflicts between aboriginal people and the US military. After the Civil War, Thomson says, field parties needed an army escort (p. 175) and the situation remained tense in 1876, marked by the Battle of the Little Big Horn, when Cope headed to Montana (p. 273). Cope remained undaunted by the possibility of violence, airily writing to his wife that the Sioux would be preoccupied elsewhere. Marked threads running through this account are the close connection between fossil collectors and the military in the west and the way in which paleontological work was piggybacked onto what was regarded as the more serious and economically important work of various geological survey expeditions.

Nowadays, no natural history museum is complete without a dinosaur exhibit or two. Thomson's museum background is reflected in his interesting discussion of the display history of the fossils. These include Leidy's Hadrosaur specimen, assembled for display in lifelike pose by Benjamin Waterhouse Hawkins in 1868, and Charles Willson Peale's travelling mastodon exhibit of the early 1800s. Showmanship formed an early association with fossils, although Thomson identifies the greatest mania for fossil displays as occurring in the late nineteenth century. Thomson includes information about where some of the most famous fossils are now. Indeed, several are still on display. A cast of Leidy's Hadrosaur can be viewed at the Academy of Natural Sciences in Philadelphia, while the original bones are part of that institution's collection. It is heartening to realize that new generations of scholars can re-examine and re-interpret these specimens. I would have liked more, though, about the post-field aspects of the fossils' history. How were they prepared? How were they curated? How were they recorded and preserved? How were the identifications done? Clearly, identification of fossils was often difficult, given their fragmentary nature and the limited comparative material available. Thomson includes several examples of misidentifications, including a whale that, in 1834, Richard Harlan thought was a plesiosaur. Thomson remarks that "*any odd variant fossils that were found tended to be described as new species or genera*" (p. 84), which created some difficult work for later palaeontologists who sorted out the confusion. For me, the most interesting parts of Thomson's account are those dealing with the early fossil discoveries in North America and how these encouraged thinking about 'former worlds' and stimulated the search for more fossils. From this perspective, North American palaeontology can indeed be seen as springing from, or the legacy of, the discovery of that first mastodon specimen.