The concrete *Diplodocus* of Vernal

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**Abstract**

XXX to follow

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# Introduction

*Diplodocus* is a diplodocid sauropod from the Late Jurassic of North America, found in the extensive Morrison Formation of the western states. Although larger and more complete sauropods are now known, *Diplodocus* was the first giant dinosaur known from a substantially complete skeleton: the Carnegie Museum’s iconic specimen CM 84. As explained below, casts of this important specimen were sent all around the globe, and as a result this individual became — and remains — the single best-known dinosaur in the world.

Among the many *Diplodocus* casts that have been mounted, many have been made in plaster, including all the oldest ones; and many have been made in modern lightweight materials such as water-expanded polyester (WEP). But one stands along, having been cast in concrete.

In this paper, we will summarise the history of the original Carnegie *Diplodocus*, discuss how the concrete cast came to be, and consider its legacy.

## Nomenclature

A distinction is made between molds and casts. A mold is a negative structure made from an original specimen (or, less commonly, a cast), in which the spaces inside the mold match the shapes of the original specimen. A cast is a positive structure, a copy made of a specimen made by filling a mold, and its shape matches that of the original specimen.

Vertebrae are designated as follows, for a vertebra at position *n* in a part of the spinal column: cervical vertebrae C*n*, dorsal vertebrae D*n*, and caudal vertebrae Ca*n*.

## Institutional abbreviations

* AMNH — American Museum of Natural History, New York, New York, USA.
* CM — Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, USA.
* **UNUSED** HMNS — Houston Museum of Nature and Science, Houston, Texas, USA.
* **UNUSED** MB — Museum für Naturkunde Berlin, Berlin, Germany; specimen numbers for fossil reptiles take the form MB.R.*nnnn*.
* **UNUSED** USNM – United States National Museum, Washington DC, USA.
* **UNUSED** YPM — Yale Peabody Museum, New Haven, Connecticut, USA.

# Historical background

## The Carnegie *Diplodocus*

1898: The *New York Journal and Advertiser* published an illustrated article about giant dinosaurs (Anonymous 1898), depicting a “Brontosaurus giganteus” in bipedal posture, peering into the an 11th story window. In fact, the dinosaur depicted in this article, “Most colossal animal ever on Earth just found out west”, was extrapolated from a single femur, described as being eight feet long, but shown in a photograph as being the same height as an adult man. Nevertheless, industrialist and philanthropist Andrew Carnegie was inspired by this article, and instructed the Pittsburgh museum that he founded and funded to obtain a giant dinosaur skeleton for exhibit.

1899 (July 4): Dr. Jacob L. Wortman found the first bones of a largely complete sauropod specimen at Sheep Creek in Albany County, Wyoming. He and his team collected it for the Carnegie Museum (Hatcher 1901:3–4). This specimen was designated CM 82. It consisted of 14 cervical vertebrae C2–15 (although see Taylor 2022:8–11 on uncertainties about the neck material), all 10 dorsal vertebrae D1–10, sacrum, caudal vertebrae Ca1–12, 18 ribs, both sternal plates, left scapulocoracoid (not right as stated by Hatcher), almost complete pelvis, right femur, and two thin bones of uncertain identity which Hatcher thought might be clavicles (McIntosh 1981:20).

1900: Mr. Olof A. Peterson collected another, slightly smaller, specimen of the same species of sauropod from the same quarry (Hatcher 1901:3). This specimen was designated CM 84. It consisted of nine cervical vertebrae, nine dorsal vertebrae, sacrum, 39 caudal vertebrae, fragments of ribs, five chevrons, both sternal plates and scapulocoracoids, the complete pelvis, left femur, and right tibia, fibula, astralagus and pes (McIntosh 1981:20).

Both specimens were prepared out of their matrix by a team led by Mr. Arthur S. Coggleshall.

1901: John Bell Hatcher described both specimens, illustrating CM 84 in some detail, in a classic monograph (Hatcher 1901). The illustrations included a skeletal reconstruction of *Diplodocus* (Hatcher 1901:plate XIII).

1902, October: King Edward VII paid a surprise visit to Carnegie at Skibo Castle in Scotland. Seeing a skeletal reconstruction of *Diplodocus*, probably that of Hatcher (1901:plate XIII), he requested a specimen for the British Museum (Steenhard, 2017 XXX or find it in Nieuwland). Carnegie, keen to gain favour with men of influence, happily promised to provide one as a gift.

1902–1904 (more precision would be good): Carnegie Museum makes molds of Diplodocus. “A team of Italians skilled in making statues created Dippy’s molds over a two-year period, and the replicas were then cast by Serafino Augustini at a cost of thirty thousand dollars each.” (Sassaman 1988, XXX find in Nieuwland.)

1904: Five casts are made from these molds

1905, May 12: The first cast from these molds is erected as the mount at the BMNH, the second mounted sauropod in the world after the American Museum of Natural History’s composite *Brontosaurus*, AMNH 460.

1907, April: The actual fossils (and some sculpted elements) are mounted at the Carnegie Museum.

1908: further casts are erected in Berlin and Paris. The Berlin cast sparks a debate about posture (Hay 1908, Tornier 1909, Hay 1910, Holland 1910).

1909: the last two casts of the original batch are mounted in Vienna and Bologna.

1909-1910: five further casts are made from the molds

1910: a cast is mounted in St. Petersburgh (now Leningrad). Discuss posture.

1912: another cast is mounted in La Plata

1913: another cast is mounted in Madrid

1914: The Great War breaks out, ending Carnegie's arbitration campaign that was the main reason for donating casts, and reducing the pace of creating new casts.

1917 at the latest: the molds went into storage and are not used again, according to Untermann (1959:364).

1919: Carnegie dies

1932: the penultimate cast is mounted in Mexico (with missing/damaged parts produced and added in 1931/2), funded in part by Carnegie’s widow Louise.

1934: the final cast is sent to Munich, but never mounted.

## The Field Museum in Vernal

1948, October 29: The Utah Field House museum opens in Vernal.

1952: Vernal native J. LeRoy Kay, Carnegie's curator of vertebrate paleontology, gifts the original molds to the Field House. They arrive on or shortly before 7 August (Untermann 1952). By this time, they were "deteriorating" (Gangewere 1999:17), "almost unusable" (Nieuwland 2019:251) and "in pretty bad shape" (Ken Carpenter, pers. comm. 2022).

1957: The Utah Field House's concrete cast is created, and mounted outdoors (Gangewere 1999:17). This is the last time the original molds are used. “The molds finally fell apart because of old age soon after it was made” (Sussaman 1988).

1950s or 1960s: The Field House posted a notice in the SVP news bulletin offering the plaster molds to whoever wanted them (Ken Carpenter, pers. comm., 2022), but there seem to have been no takers.

1960s: the original molds are thrown away by Carnegie Museum (Ilja Nieuwland, pers. comm., 2022). So the invitation that concludes Untermann (1959:369), "Does anyone wish to cast the twelfth?" seems to have gone unanswered.

1979: The British Museum’s cast of the Carnegie *Diplodocus* is moved from the Hall of Reptiles to the main atrium, where it will remain until removed in 2018 to make space for corporate events.

## The lightweight cast in Vernal

1988, January: plans are made to have a lightweight indoor replica of the Field House concrete cast created by the Las Vegas Museum, but these plans fall through.

1989, April: Jim Madsen of Dinolab is contacted to make new plans for creating a replica from the concrete cast

1989, June 30 onwards: Dinolab repaired the deteriorated concrete cast, stabilizing, restoring and sealing the bones. Jim Madsen of Dinolab made new molds from the repaired concrete Diplodocus, using them to create a new lightweight indoor Diplodocus cast for the Field House, from WEP (water-expanded polyester), and reserving the right to make up to 20 additional casts (Madsen et al. 1989)

1991, not later than June 30: Dinolab is contracted to deliver the indoor mount (Madsen et al. 1989) — but I don't know when it actually arrived. It was mounted above the admission counter at the front of the Field House lobby (Ken Carpenter, pers. comm. 2022).

1991?: When the concrete specimen was returned to the Field House, it was in bad shape and went into storage rather than being remounted.

## Further uses of the molds

XXX Some time subsequent to 1989: Jack McIntosh arranges a deal between Dinolab and RCI whereby the Dinolab creates casts of the Diplodocus elements needed to make up the missing part of the AMNH Barosaurus mount. See Gordy (1991), Norell et al. (1991), Dingus (1996:20–29).

Subsequent years: further casts are made from the Dinolab molds, including one in the Las Vegas Natural History Museum and one in the Houston Natural History Museum.

## The fate of the concrete *Diplodocus*

2004: The Field House moves to a new building, and the WEP cast is remounted in the entry hall.

2012: The collections are moved from the old Field House building to the new one, but there is no space for the concrete cast.

2013: The concrete cast is sent to Utah State University Eastern Prehistoric Museum on effectively permanent loan, and to be repaired. It was intended to be mounted outside a new museum in Price, but this museum was never built and the cast remains in storage on the Utah State University Eastern campus.

2019: Dinolab storage in Ogden, Utah, is scheduled for demolition. The Diplodocus molds that were taken from the concrete cast are moved to RCI, where they are kept in storage: some in good condition, some in rough shape. These are probably the only Carnegie Diplodocus molds in the world.

# Discussion

XXX Photographs of the concrete *Diplodocus* can be found at the J. Willard Marriott Digital Library of the University of Utah: <https://collections.lib.utah.edu/>

# Acknowledgements

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# References

Anonymous. 1898. Most colossal animal ever on Earth just found out west. *New York Journal and Advertiser*, 11 December 1898, p29. <https://www.loc.gov/resource/sn83030180/1898-12-11/ed-1/?sp=33&r=-0.061,-0.031,0.196,0.117,0>

Dingus, Lowell. 1996. *Next of Kin: Great Fossils at the American Museum of Natural History*. Rizzoli, New York.

Gangewere, R. Jay. 1999. This is huge, really huge. *Carnegie Magazine* July/August 1999:12–18.

Gordy, Molly. Dinosaur’s Last Stand? Exhibit’s pose is all wrong, experts assert. 1991. *New York Newsday* **52(88)** for 29 November 1991:3, 27.

Hatcher, John B. 1901. *Diplodocus* (Marsh): its osteology, taxonomy and probable habits, with a restoration of the skeleton. *Memoirs of the Carnegie Museum* **1**:1–63 and plates I–XIII.

Hay, Oliver P. 1908. On the habits and the pose of the sauropodous dinosaurs, especially of *Diplodocus*. *The American Naturalist* **42**:672–681.

Hay, Oliver P. 1910. On the manner of locomotion of the dinosaurs, especially *Diplodocus*, with remarks on the origin of birds. *Proceedings of the Washington Academy of Sciences* **12**:1–25.

**UNUSED** Holland, William J. 1906. Osteology of *Diplodocus* Marsh with special reference to the restoration of the skeleton of *Diplodocus carnegiei* [sic] Hatcher presented by Mr. Andrew Carnegie to the British Museum, May 12 1905. *Memoirs of the Carnegie Museum* **2(6)**:225–278.

Holland, William J. 1910. A review of some recent criticisms of the restorations of sauropod dinosaurs existing in the museums of the United States, with special reference to that of *Diplodocus carnegiei* [sic] in the Carnegie museum. *American Naturalist* **44**:259–283.

**UNUSED** Holland, William J. 1924. The skull of *Diplodocus*. *Memoirs of the Carnegie Museum* **9(3)**:379–403.

Madsen, James H., James E. King, Jerry A. Miller, Alden H. Hamblin and Richard L. Barker. 1989. Agreement between Dinolab, inc., and the Utah Field House of Natural History State Park. Private agreement.

McIntosh, John S. 1981. Annotated catalogue of the dinosaurs (Reptilia, Archosauria) in the collections of Carnegie Museum of Natural History. *Bulletin of the Carnegie Museum* **18**:1–67.

Nieuwland, Ilja. 2019. *American dinosaur abroad: a cultural history of Carnegie’s plaster* Diplodocus. University of Pittsburgh Press. ISBN: 978-0822945574. doi:10.2307/j.ctvh4zh5n

Norell, Mark A., Lowell W. Dingus and Eugene S. Gaffney. 1991. *Barosaurus* on Central Park West. *Natural History* **100(12)**:36-41. <http://hdl.handle.net/2246/6497>

Sassaman, Richard. 1988. Carnegie had a dinosaur too. *American Heritage* **39(2)**:72–73.

Steenhard, Rens. 2017. *Diplodocus carnegii*, peace diplomacy by dinosaur. Peace Palace Library, 13 July 2017. <https://peacepalacelibrary.nl/blog/2017/diplodocus-carnegii-peace-diplomacy-dinosaur>

Taylor, Michael P. 2022. Almost all known sauropod necks are incomplete and distorted. *PeerJ* **10**:e12810. doi:10.7717/peerj.12810

Tornier, Gustav. 1909. Wie war der *Diplodocus carnegii* wirklich gebaut? *Sitzungsbericht der Gesellschaft naturforschender Freunde zu Berlin* **4**:193–209.

Untermann, G. Ernest. 1952. Moulds for huge dinosaur model arrive from Carnegie Museum. *Express* (Utah Press Association), Thursday, August 8, 195, p1.

Untermann, G. Ernest. 1959. A replica of *Diplodocus*. *Curator* **2(4)**:364–369. doi:10.1111/j.2151-6952.1959.tb00520.x

# Figure Captions

**Figure A.** XXX