Preparation and Description of a Sauropod Femur from the Morrison Formation at Skull Creek, CO

Sara A. Mitchell
Cedarville University, saraamitchell@cedarville.edu

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Sara A. Mitchell, Senior B.S. Geology Student | saraamitchell@cedarville.edu | Department of Science and Mathematics | Cedarville University | CU Research Symposium 2021

Abstract

The purpose of this research was to prepare and describe a sauropod femur that is approximately 1.5 meters in length. The sample studied was collected from the Morrison Formation in northwest Colorado from the Skull Creek area. The fossil was poorly preserved in a loosely consolidated sandy conglomerate matrix. It was prepared by removing the debris, and restoration was begun by gluing the broken fragments together. The research also focused on understanding the depositional environment of the fossil, as well as investigating the viability of fossil remains for academic study in similar states of preservation. The study could also have potential implications for the dinosaur fossils of the Morrison Formation and how this site compares to other localities. Additionally, a concise lithological study was done to investigate depositional processes and the ramifications for the stratigraphic site. This project concluded that the most likely candidate for the identification of the femur is of the genus *Diplodocus*.

Figure 1. Location of site. (Image from Google Earth)

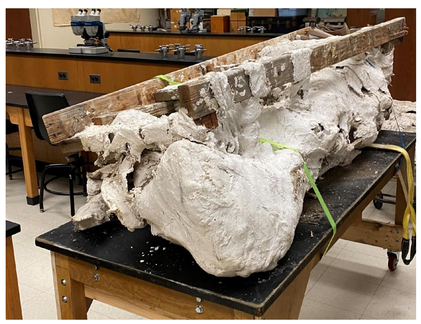


Figure 2. The plaster-jacketed bone upon arrival at Cedarville University in July 2020. The jacket and wood frame help protect the fossil during transport.

Methods

The plaster jacket protecting the bone was removed using a variety of saw tools. The surrounding rock and debris were removed to expose the fossil. Using various thicknesses of cyanoacrylates (superglues), the bone fragments were glued together. A morphological graphical analysis was performed to attempt to determine the genus of the specimen. Data was collected from literature review to compare against four abundant genera of sauropods in the Morrison Formation: *Apatosaurus*, *Camarasaurus*, Diplodocus, *Haplohcanthosaurus*, and *Barosaurus*. Additionally, a lithological study was conducted to learn more about the potential depositional processes of the location and its implications for the site.

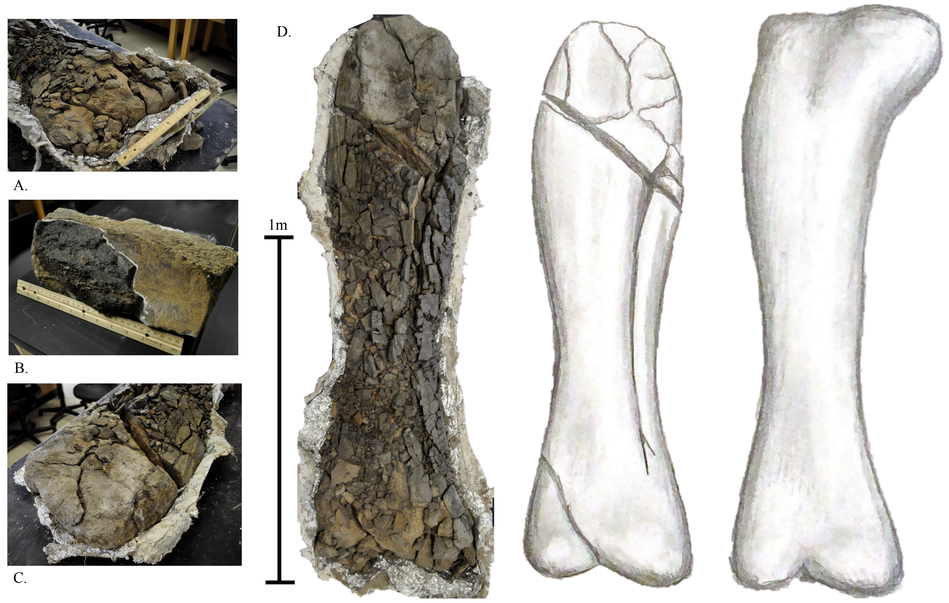
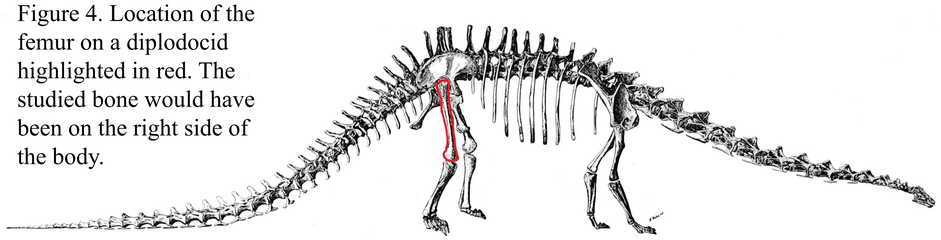


Figure 3. A, B, and C represent the proximal end, detached portion of proximal end, and the distal end, respectively. D shows the full length of the bone as well as artistic rendering of the femur and then an interpretation of what the full bone would have looked like if perfectly preserved

Figure 4. Location of the femur on a diplodocid highlighted in red. The studied bone would have been on the right side of the body.



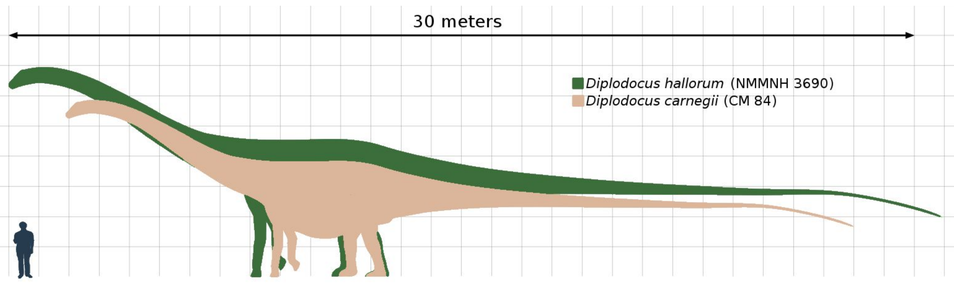


Figure 5. Size and length of two species of *Diplodocus.* Based on the length of the femur, the studied specimen could have ranged from twenty to thirty meters in length. The dinosaur was likely to weigh at least 10 metric tons.

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Results

While full restoration could not be accomplished in the timeframe established for this project, the process was begun and the procedure learned. The full extent of the exposed specimen can be seen in Figure 3. Additionally, the artistic speculation of the bone can be seen in the same figure. A brief lithological study determined that the femur was deposited in sandstone interbedded with thin, polymictic conglomerate layers. The bone was reported to be isolated and unarticulated, while higher stratigraphically a well-articulated *Allosaurus fragilis* was found. Preliminary results based on ratio measurements from anatomical markers on the femur are displayed in Figure 4. The graph indicates that the sample lands close to the *Diplodocus* trendline.

Conclusions

The morphological graphical analysis on the femur suggested that this specimen belongs to a Diplodocid (Figure 1). Because the location is stratigraphically uncertain, utilizing biostratigraphy yields more possible genera to which the specimen could belong. Morrison diplodocids that are likely candidates are *Diplodocus*, *Barosaurus*, *Galeomopus*, or *Kaatedocus*. The latter two are too small to match this specimen. So, the bone most likely belongs to either *Barosaurus* or *Diplodocus*. The limited data acquired from femurs of the former genus, though, makes it difficult to do a comparison of the two statistically/graphically. However, on average the *Barosaurus* is smaller than the *Diplodocus*, and measurements from the specimen indicate that it would have been a large individual for even a *Diplodocus*. The author has concluded, therefore, that this specimen most likely belongs to *Diplodocus sp*. The site might still yield more bones still and is certainly worthy of further investigation. Based on the lithological study, the specimen was likely in a flow regime deposit of some kind. However, due to the unsure exact stratigraphic location and limited field data, a more conclusive explanation for the depositional environment cannot be determined at this time. Studies of the Morrison Formation in general indicate that the strata is likely a part of a depositional basin. Ultimately, due to the poor nature of preservation of the studied specimen, further identification would necessitate more preparation and study that were beyond the scope of this project.

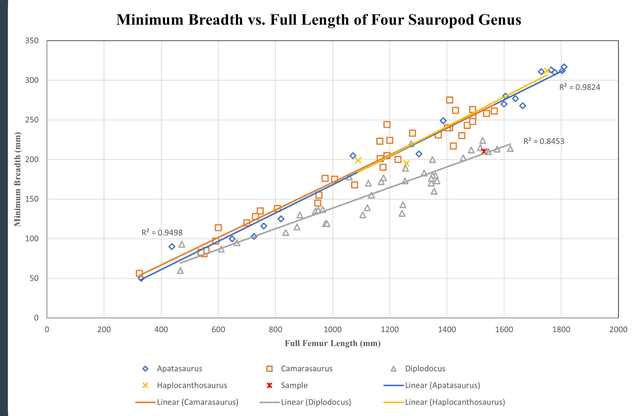

Figure 6. Graphical analysis based on the minimum breadth/full length femur ratio of 4 Morrison sauropod genera compared to the studied femur.

Acknowledgements

I would like to thank my advisors Dr. John Whitmore for his invaluable counsel and direction as well as Jordan Oldham for his helpful guidance. Additionally, I would like to thank Jonathan Maxwell and Sarah Stone for helping with the restoration process.

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