

# Description of Basal Ornithopod Remains from the Hell Creek Formation, Montana

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## Abstract

Five associated dorsal vertebra found in the Hell creek Formation of Montana, are described and their morphology is used to infer the ontogenetic age of the specimens.

## Introduction

Ornithopods are the most abundant subgroup of one of two main groups of dinosaurs, the ornithischians. They are bipedal but may, at times, have evolved quadrupedal locomotion. Ornithopods were herbivorous and some evolved highly developed teeth, which allowed them to be successful in different environments and to reach a wide dispersion through out the world.

Other creatures that also possibly lived along side *Thescelosaurus* include a variety of theropods such as *Tyrannosaurus rex* (Holtz, 2004), *Chirostenotes* (Osmolska et al, 2004), and *Troodon* (Makovicky et al, 2004), as well as, various ornithischian dinosaurs such as *Triceratops* (Dodson et al, 2004), *Ankylosaurus* (Vickaryous et al, 2004), *Edmontosaurus* (Horner et al, 2004), *Pachycephalosaurus* (Maryanska et al, 2004) and *Bugenasaura* (Norman et al, 2004).

The five vertebrae described here were discovered in the Hell Creek Formation of South East Montana (fig,1) in rocks from the Upper Cretaceous Late Maastrichtian, approximately 66 mya (Britannica, 2008). This geologic period, the end of the Cretaceous, marks the wide extinction of many species including the non-avian dinosaurs. Also associated with the vertebrae are other elements found near the same locality. Primary studies suggest that some of the elements are a quadrate, ribs and a metatarsal, may belong to the same *Thescelosaurus*, however further studies are needed. An ungula claw was also found. However, that will belong to a Theropod.

More precisely the specimens were collected about 11 miles South West of the town of Ekalaka, Carter County, Montana (fig 1)

Anatomical comparisons of the vertebrae to other fossils indicate that they belong to *Thescelosaurus*, an ornithopod, which due to its larger build is thought to have used its front limbs when feeding and in locomotion. Its overall size has been estimated to be between 8 feet and 13 feet long and its weight is thought to have been between 450 and 660 pounds.

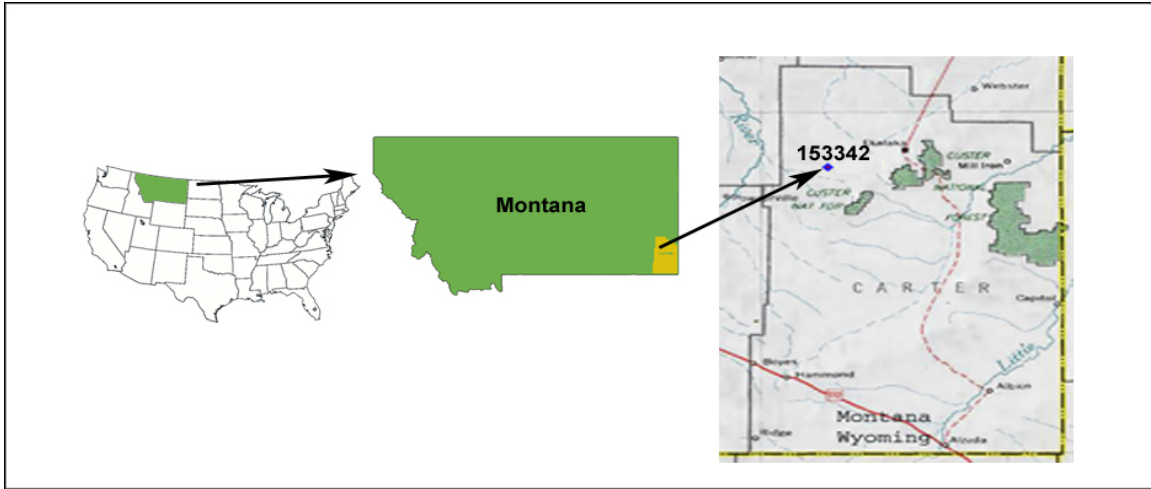


Fig.1. Map showing locality of specimen in South West of the town of Ekalaka, Carter County, Montana (LACM 153342)

### Description

The five vertebrae are not very diagnostic as to suggest their precise position within the vertebral column and much less to suggest with a high degree of confidence what species they belong to. However, comparisons suggest that the specimen being looked at is a *Thescelosaurus neglectus* or something closely related to this Ornithopod.

By comparing and looking at their shapes in ventral view, it can be observed that they are dorsal vertebrae and follow normal trends found in *Thescelosaurus* and ornithopods (fig 2). Dorsal vertebrae in ornithopods are spool-shaped and rectangular in lateral view (Norman, 2004). The anterior and posterior articular surfaces of the centra are slightly concave in *Thescelosaurus* (Galton 1974b). This concave trait is also found in other ornithopods, such as the *Hypsilophodon*, where all the centra are amphicoelous (Galton 1974a). Cervical vertebrae have shapes that resemble parallelograms, therefore the possibility that these vertebrae are cervical was ruled out. Likewise, caudal vertebrae have clear angles, ventrally, where the chevrons would be attached was also ruled out. So

the identification of the vertebrae as caudals was also ruled out. Although the vertebrae are dorsal, they are not preserved well enough to determine their precise position within the dorsal series. It is also, difficult to identify which specie of a *Thescelosaurus* the vertebrae come from.

It is possible that the vertebrae belong to *Thescelosaurus neglectus* rather than a *Thescelosaurian garbani*. The size of *Thescelosaurus neglectus*'s vertebrae in the collection is closer in proportion to the vertebrae that are examined here than to the much larger *T. garbani*. In the collection at LACM, there is a *T. garbani* pes, although not a vertebra, it seems to be more robust and larger compared to the gracile *T. neglectus*.

The morphology of the vertebrae described here allows us to determine, in general, the ontogenetic age of the specimen. It is evident that LACM 153342 did not reach maturity or adulthood because the neural arches are not fused to the centra. Fusion is a good indicator that an individual has attained adult size (Makovicky, 1995). There are Also two specimens in the collection at LACM with vertebral materials. One, which is a little bit smaller in dimensions and has the neural arch available, is not fused, indicating that it is probably younger and not yet an adult. The second one is just one vertebra, but it is a little bit larger and completely fused, indicating that it is in an adult. Thus, the size of the centra of LACM 153342 agrees with the inferred immaturity of this specimen.

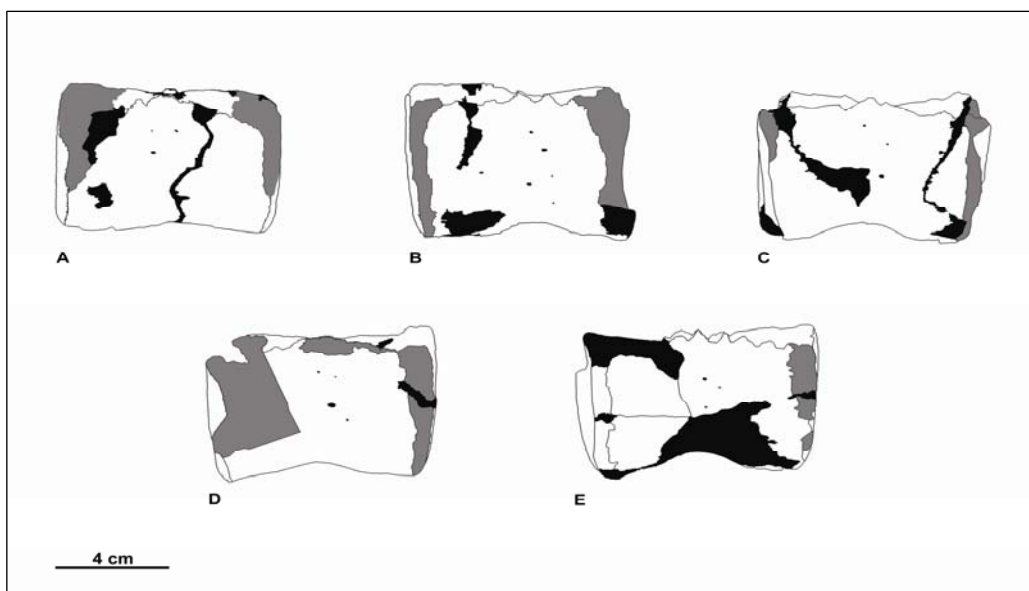


Fig. 2 A – E, show a series (although perhaps not consecutive) of dorsal vertebrae (LACM 153342) in lateral view.

## Discussion

The dorsal vertebrae resemble each other, in shape and in size making it difficult to specify which number vertebrae they are. Perhaps, they are adjacent vertebrae because of the close resemblances. The vertebrae are also missing the neural arches making it difficult to diagnose. By comparing other specimen from the LACM collection, it can be deducted that the vertebrae may be of a young *Thescelosaurus*.

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