

## A MAMMALIAN HUMERUS FROM THE UPPER JURASSIC OF COLORADO

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**ABSTRACT.**— The first reported mammal fossil from Dry Mesa Quarry (Upper Jurassic Morrison Formation, Mesa County, Colorado) is the distal end of a right humerus. It is very similar to humeri described by Jenkins (1973) from the Morrison Formation at Como Bluff, Wyoming. It has a distinct ulnar condyle and a spiral humero-ulnar joint, both features found in prototherian mammals but not in therians.

Postcranial remains of Jurassic mammals are extremely rare. An articulated skeleton of a dryolestid therian mammal has been reported from the Jurassic of Portugal (Henkel and Krebs 1977), but is still undescribed. Early Jurassic mammalian postcranial fossils are also known from India (Datta et al. 1978), but are undescribed. A few fragmentary postcranial remains of mammals have been described from the Upper Jurassic of England (Seeley 1879, Simpson 1928, Haines 1946) and from the Upper Jurassic Morrison Formation of Wyoming (Jenkins 1973). Of the five important mammal-producing localities in the Morrison Formation (listed in Clemens et al. 1979:23–26), two have produced mammalian postcranial fossils prior to this paper: Como Bluff, Wyoming (Jenkins 1973), and the Fruita Paleontological Area, Mesa County, Colorado (Rasmussen and Callison 1981).

In 1977, the distal portion of a right humerus of a mammal was found in Dry Mesa Quarry, Mesa County, Colorado. This specimen (BYU 2026) was first mentioned by Clemens et al. (1979:24), and is described below.

### LOCALITY AND ASSOCIATED FAUNA

Dry Mesa Quarry is located in the lower section of the Brushy Basin Member of the Upper Jurassic Morrison Formation, 135 feet below its contact with the overlying Cretaceous Cedar Mountain Formation. The quarry sediments include very fine to coarse sands, grits, and fine gravels containing angular to well-rounded clay and bone pebbles. Stream gradient was sufficient to move very large bones, with the long axes of all large

bones usually oriented at right angles to the stream flow. Sorting was biased by shape rather than by size.

Sediments overlying the bone layer are predominantly light-colored, cross-bedded sands with occasional lenses of clay and fine gravel, the latter often containing clay pebbles. Sediments underlying the bone layer are principally a light, blue-green clay with occasional traces of bright yellow zones of oxidation.

The bone layer consists of an unusual variety of disarticulated bones of all sizes, including specimens representing crocodylians, fish, turtles, pterosaurs, four new theropods, an unknown variety of sauropods, some ornithopods, and the mammal described herein. Due to the great variety of disarticulated bones in the deposit, and the generic novelty of the fauna, descriptive work has been postponed until enough material is available. Field work has been carried out for the last 10 years. The following have been identified so far:

Lungfish tooth plate (probably *Ceratodus*—K. Thomson, pers. comm.)

Pterodactyloid phalanx (Jensen and Ostrom 1977)

*Torvosaurus tanneri*, a megalosaur (Galton and Jensen 1979)

Prototherian mammal humerus (this paper)

### DESCRIPTION

BYU 2026 (Fig. 1) is the distal portion of a right humerus of a mammal. It has been broken at midshaft, but is otherwise well preserved. There is relatively little evidence of crushing or distortion. The shaft cross-section

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is a mediolaterally compressed triangle with the apex pointing anteriorly. Distally the shaft expands transversely to form the large medial and lateral epicondyles. The distal end of the humerus is naturally flattened anteroposteriorly. The long axis of the distal end is not perpendicular to the major axis of the shaft cross-section, but is rotated about 20 degrees clockwise (viewed from the distal end). The shaft of the humerus has a strong anterior crest that is deflected anterolaterally. This crest is probably the distal end of the deltopectoral crest. A faint posterolateral crest merges with the lateral epicondyle.

The medial epicondyle is considerably more prominent than the lateral epicondyle. It flares medially and is anteroposteriorly compressed. The entepicondylar foramen is visible in anterior view. It is broken at the anterior end, where it passes anteromedially. The lateral epicondyle merges with the radial condyle. It is connected to the shaft of the humerus by a thin posterolaterally arched crest. The radial and olecranon fossae are interconnected, forming an apparent supratrochlear foramen. This feature may be an artifact of breakage, however.

In anterior view, the main body of the shaft bifurcates to form crests joining the radial and ulnar condyles. These crests surround the radial fossa. In posterior view, the olecranon fossa is broadly concave and extends partially up the shaft. From this view the apparent supratrochlear foramen has an irregular margin that is clearly enlarged by breakage.

In distal view, three main features are seen: the medial epicondyle, the ulnar condyle, and the radial condyle-lateral epicondyle. The latter two features are confluent and separated only by a shallow groove. The ulnar and radial condyles, on the other hand, are separated by a narrow, deep intercondylar groove. The radial condyle is broad and bulbous in anterior view. The spiral ulnar condyle is very similar to that shown by Jenkins (1973, Fig. 13). It is wrapped around the distal end of the humerus, with a proximolaterally oriented extensor surface and a proximodistally oriented flexor surface. However, the anterior portion of the ulnar condyle is more bulbous than the same feature in the humerus figured by Jenkins (1973, Fig.

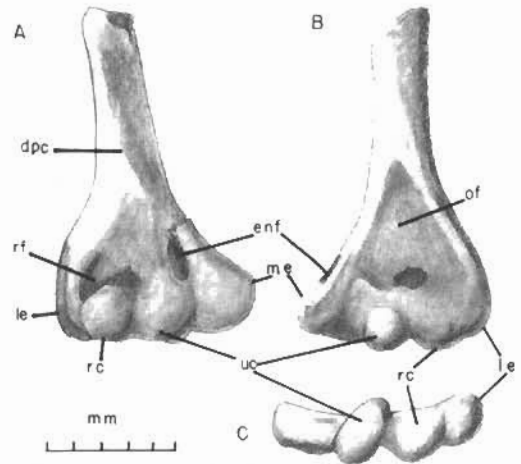


Fig. 1. BYU 2026, distal end of a right humerus. A, Anterior view; B, Posterior view; C, Distal view. Abbreviations: dpc, deltopectoral crest; enf, entepicondylar foramen; le, lateral epicondyle; me, medial epicondyle; of, olecranon fossa; rc, radial condyle; rf, radial fossa; uc, ulnar condyle.

18). The axis of the ulnar condyle as it crosses over the distal end of the humerus is at an approximately 60 degree angle to the transverse (interepicondylar) axis of the humerus (seen in distal view). This compares with angles of 58–65 degrees reported by Jenkins (1973:286) for several humeri from Como Bluff, Wyoming.

#### DISCUSSION

The Dry Mesa Quarry mammal very closely resembles the Como Bluff humeri described by Jenkins (1973). It differs from them in having a more bulbous and broader ulnar condyle. In this respect, it is more like the humeri referred to the multituberculate *Catopsalis* by Jenkins (1973, Fig. 19). The multituberculates *Tugribataar* (Kielan-Jaworowska and Dashzeveg 1978) and *Ptilodus* (Gidley 1909), the triconodont *Eozostrodon* (Jenkins and Parrington 1976), and the monotremes (Howell 1937, Haines 1946) also have prominent bulbous ulnar condyles. BYU 2026 clearly does not have a trochlear condyle, which Jenkins (1973) considers characteristic of therian mammals.

The only other feature that distinguishes the Dry Mesa Quarry mammal from the Como Bluff humeri is the apparent supratrochlear foramen. As noted above, this feature may be an artifact of breakage.

The affinities of BYU 2026 are difficult to assess based on such limited evidence. The presence of a distinct ulnar condyle with a spiral humero-ulnar joint is characteristic of prototherian mammals (Jenkins 1973). The advanced therian trochlear condyle is known from rocks as old as the Lower Cretaceous (Jenkins 1973, footnote 3). The Dry Mesa Quarry mammal humerus could have belonged to a number of prototherian mammal taxa presently known from the Morrison Formation (Prothero 1981, Clemens et al. 1979). It could also have come from some of the primitive Morrison therian mammals that may or may not have had a trochlear condyle. Until the Portuguese dryolestid therian skeleton (Henkel and Krebs 1977) is fully described, we cannot rule out the possibility that the Dry Mesa Quarry humerus belonged to a very primitive therian mammal. Of the possible candidates among nontherian mammals, BYU 2026 resembles the known humeri of multituberculates and triconodonts. The skeleton of docodonts is presently unknown. The systematic affinities of the Dry Mesa Quarry mammal cannot be determined more precisely at present than *Mammalia incertae sedis*.

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