

**Muscular reconstruction and functional anatomy of *Plesiotypotherium achirensense* (Mammalia, Notoungulata, Mesotheriidae) from the late Miocene of Bolivia**

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We provide a muscular reconstruction and we infer functional properties of the forelimb of *Plesiotypotherium achirensense* Villarroel, 1974 from the late Miocene of Achiri, Pacajes Province, Bolivia. The osteological sample available for the forelimb of this species (study based in seventy-eight postcranial elements) is much wider than for any other mesotheriid notoungulate, thus providing exceptional insights about osteological features and muscular areas. Recent mesotheriid-focused studies have concluded to a highly conservative postcranial skeleton, with a scratch-digging faculty. In order to test this hypothesis, our comparison sample included extant mammals with similar functional abilities, such as *Vombatus ursinus*, *Tamandua* sp., *Hystrix cristata*, *Taxidea taxus*, *Orycteropus afer*, and *Nasua nasua*. As a result, *Plesiotypotherium achirensense* shows typical fossorial osteological structures: i) distally located suprascapular fossa, ii) well-developed deltoid crest, iii) complete scapular girdle, iv) well-developed entepicondyle, ectepicondyle, and supracondylar crest of the humerus, v) enlarged olecranon, and vi) strong manus with robust carpals and metacarpals and phalanges. The form-function forelimb complex was then inferred thanks to osteological features and muscular reconstruction: the different muscular groups acted together combining their function and resulting in a biomechanical average, perfectly compatible with a scratch-digging life style, with favored limb and humeral retraction, and antebrachium supination pronation and flexion.

# MUSCULAR RECONSTRUCTION AND FUNCTIONAL ANATOMY

*Plesiotypotherium achirens* (Mammalia, Notoungulata, Mesotheriidae)

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## CONCLUSIONS

According to the osteological and muscular features compared with extant animals of similar osteological of well-known locomotion, we inferred a consistent **scratch-digger** lifestyle for *Plesiotypotherium achirens*

1

**SHOULDER-HUMERAL JOINT:** Well-stabilized by strong muscular configuration: *m. supraspinatus*, *m. infraspinatus*, *m. coracobrachialis*, *m. subscapularis*. And osteological features: complete scapular girdle, enlarged acromion, and well-developed deltoid crest

2

**HUMERO-ULNAR AND HUMERO-RADIAL JOINTS** Well-developed entepicondyle, ectepicondyle, and supracondylaris crest, medial lip of the trochlea distally oriented, elbow sesamoid, and enlarged olecranon

3

**Strong manus with robust carpals, metacarpals and bifurcated phalanges**

## INTRODUCCION

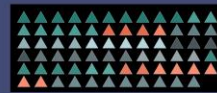
Mesotheriidae is a family of the native ungulates of South America assigned to the Notoungulata order. *Plesiotypotherium achirens* is the type specie of the genus, found in the late Miocene Achiri site, located in Pacajes Provinc, of La Paz department, Bolivia



## MATERIAL AND METHODS

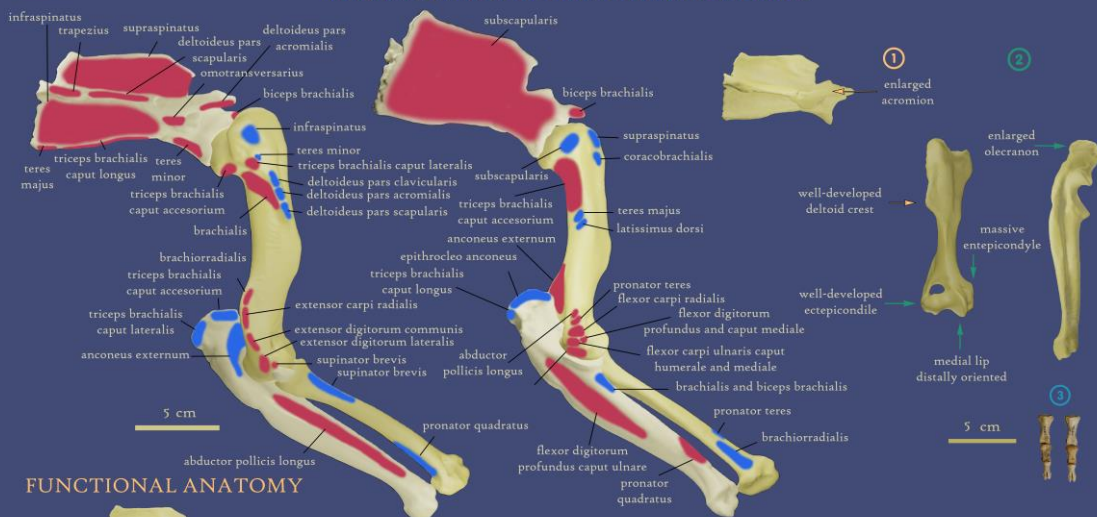
We study the forelimb material housed in the MNHN Bol, LaPaz, Bolivia. The fossil material is the most abundant known for any mesotheriid

Humerus  
Radius  
Ulna  
Mt I  
Mt II  
Mt III  
Mt IV  
Mt V

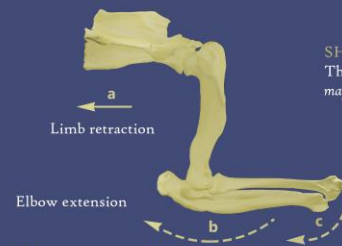


Lunar  
Scaphoid  
Pyramidal  
Trapezoid  
Trapezium  
Magnum  
Unciform

## MUSCULAR AND OSTEOLOGICAL FEATURES



## FUNCTIONAL ANATOMY



### SHOULDER-HUMERAL JOINT:

The shoulder-humeral joint is strongly stabilized with mainly flexor muscles *m. deltoideus*, *m. teres major*, and *m. teres minor*, and adductor muscles *m. infraspinatus*

### HUMERO-ULNAR AND HUMERO-RADIAL JOINT:

Well-developed extensors *m. triceps brachii*, supinator *m. brachiorradialis* and *supinator brevis*, and pronator muscles *m. pronator teres* and *pronator quadratus*



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