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IGUANODONTIAN DINOSAURS FROM THE LOWER CRETACEOUS BAUXITE SITE FROM ROMANIA

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Abstract. The Early Cretaceous vertebrate fauna from the bauxite deposit of Cornet - Lens 204, Romania comprises dinosaurs, pterosaurs and possibly birds. Among dinosaurs, ornithopods are over-represented, but rare ankylosaurs and theropods were reported as well. Iguanodontid dinosaurs are described on the bases of distal femur, metacarpals, metatarsals and ungual phalanges of the pes. The majority of the Iguanodontidae material from Cornet can be identified as *Iguanodon* sp., and only for few of them *Iguanodon atherfieldensis* can tentatively be proposed.

Keywords: Early Cretaceous, Iguanodontidae, Romania

HISTORY OF THE SITE

The Early Cretaceous vertebrate fauna from the bauxite deposit Cornet - Lens 204, was discovered by two miners in 1978. Paleontologists from Ţării Crişurilor Museum Oradea Tiberiu Jurcsák and Elisabeta Popa excavated tones of bauxite and associated bones by blasting. E. Popa prepared most of the material, producing a collection of ten thousand bones.

Between 1979-1983 small-scale excavation campaigns were organized by the Ţării Crişurilor Museum, coordinated by Tiberiu Jurcsák, who made the first taxonomic interpretations. Thus, he determined in the Cornet dinosaur fauna the following ornithopods: *Hypsilophodon* sp., *Valdosaurus canaliculatus*, *Iguanodon* cf. *mantelli* and *Vectisaurus valdensis;* among ankylosaurs the nodosaurid cf. *Hylaeosaurus* sp. and a carnivorous dinosaur *Aristhosuchus* sp. (Jurcsák & Popa, 1978, 1979, 1983b; Jurcsák, 1982; Jurcsák & Kessler, 1991). Jurcsák was also the first to mention the dwarfism of the Cornet fauna (Jurcsák & Kessler, 1991).

Jurcsák & Popa (1983a, 1984) listed three pterosaur species, which include *Gallodactylus* sp., *Ornithocheirus* sp. and a partial maxilla of *Dsungaripterus* sp., which might represent the crest of a "Tapejara-like" animal (E. Frey, oral communication, 2002).

Kessler & Jurcsák (1984, 1986), reported two new bird species: a grebe-like bird *Eurolimnornis corneti* Kessler and Jurcsák, 1984, and a flightless ratite *Palaeocursornis biharicus* Kessler and Jurcsák, 1984. Kessler & Gáll (1995) considered that the femur fragment of *Palaeocursornis biharicus* is a bone of a penguin-like bird. The identifications of birds were subject to discussions, Benton et al (1997) considered the bird specimens as belonging to archosaurians, and stated that those bones could come from theropod dinosaurs or pterosaurs as well.

In 1978-1979 Dr. Florian Marinescu from the Geological Institute of Bucharest excavated by hand a collection of over 500 bones. Marinescu (in Patrulius et al, 1983) mentioned the presence of *Iguanodon* and of an endemic form derived from *Camptosaurus* and named a new genus *Bihariosaurus bauxiticus* Marinescu, 1989. This latter taxon may be regarded as a *nomen nudum*, because there is no diagnostic description and illustrations are not proper to distinguish it from any other ornithopods (Marinescu, 1989).

The mine was flooded in 1983 and field researches ceased until 1994, when the Ţării Crişurilor Museum and the University of Bristol started a research project, which allowed the mine to be re-opened. Dr. Florian Marinescu donated his collection to the Ţării Crişurilor Museum in 2000, in the same year the mine was flooded again and since then the access to the site is obtruded by water.

Recently re-identification of the ornithopod specimens has started. Tallodi-Posmoşanu and Popa (1997) identified *Camptosaurus* sp., based on teeth and fused carpal bones, mentioning that the structure of the dentary teeth closely resembles *Iguanodon hoggii* Owen, 1874, which is known only by a mandibular ramus. Recently, Norman and Barrett (2002) revised this species, including it in *Camptosaurus hogii* (Owen, 1874) Norman and Barrett, 2002, on the base of the following features: lingual surface of the dentary teeth crowns equally sub-divided by simple, well-defined and equal-sized primary and secondary ridges, tertiary ridges essentially absent and the absence of an abbreviated cingullum formed by an inrolling of the denticulate distal edge of the lower distal corner of the crown. Tallodi-Posmoşanu and Popa (1997) also confirmed *Valdosaurus* sp. on the basis of the distal end of a femur.

Posmoşanu (2002) described a small *Camptosaurus* based on a neurocranium fragment and a left humerus and stated that *Hypsilophodon* is not present in the Cornet fauna. Posmoşanu (2003) identified cf. *Hylaeosaurus* sp. on the base of scapulae.

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STRATIGRAPHIC RANGE OF THE DEPOSIT

The age of the fossiliferous bauxite deposit from Cornet is not clearly resolved yet. Patrulius et. al (1983) suggested Late Berriasian - Earliest Barremian for the continental interval represented by bauxite formation and lacustrine - brackish limestone that overlays the bauxite.

Dragastan et al (1988) determined the age of the bauxite deposit from Cornet on the base of ostracod fauna as being Late Berriasian - Early Valanginian.

Cociuba (2000) re-described Upper Jurassic and Lower Cretaceous calcareous deposits in the South-Western part of Pădurea Craiului Mountains, defining formal lithostratigraphic units. He included the bauxite deposit from Cornet Lens 204 at the base of the Dobresti Member, which is Valanginian - Hauterivian in age.

The Late Berriasian - Valanginian interval for the bauxite deposit of Cornet was confirmed by Posmoşanu (2003). She identified the Lower Wealden, based on the presence of *Hylaeosaurus*, *Iguanodon* and *Valdosaurus* in the Cornet fauna, using biostratigraphic correlation models formerly established by Norman (1987a), Martin et Buffetaut (1992) and Pereda-Suberbiola (1993).

IGUANODONTIDAE FROM CORNET

Left distal femur

The distal half of a left femur (MTCO 21362/7290+9124) is a quite robust bone, its distal articular condyles are missing and the proximal half is also broken off (Plate I, Fig. 1). There are several bite marks on the shaft of the femur, which can explain the lack of the condyles as well, since carnivorous prefer the cartilaginous end of limb bones. The anterior inter-condylar groove is very well defined and very deep, being a channel-like tubular groove. The anterior intercondylar groove is deep and the lateral walls which enclose this tubular groove almost meet above it. This tubular shape anterior intercondylar groove is characteristic to *Iguanodon atherfieldensis* and *I. bernissartensis* (Norman, 1980, 1986). The form of this intercondylar groove is different from that of *Camptosaurus*, where it is wide and of moderate depth (Gilmore, 1909), and of *Valdosaurus*, in which the anterior intercondylar groove is very deep and has a square outline (Galton & Taquet, 1982).

There is a slight curvature of the shaft of the femur and more proximally above the inner distal condyle there is a low ridge on the rostral (dorsal) surface of the shaft, features that are present in *Iguanodon* as well.

Thus, on the base of the channel-like tubular inter-condylar groove, this femur can be identified as *Iguanodon* sp.

Metacarpals

There are only few well-preserved metacarpals, among them isolated left metacarpal II (MTCO 18.999) and left metacarpal III (MTCO 21.104/CM) are the best preserved specimens. Metacarpal II (MTCO 18999, Plate I, Fig.2) is a slender bone, the proximal and distal ends are slightly developed articular surfaces. The medial surface of the shaft is roughly rounded proximally, whereas its medial surface is flattened with ligament scar marks. The distal end is expanded dorsoventrally and is somewhat compressed mediolaterally.

Metacarpal III (MTCO 21.104/CM, Plate II, Fig. 1) has the proximal and distal ends expanded, whereas its shaft is sub-quadrangular in cross section. The distal end is slightly damaged, so the accurate width of the articular end cannot be determinate. Both lateral and medial sides of the shaft bears ligament scars. The general appearance of these metacarpals resembles those of *Iguanodon* sp. (Norman, 1980, 1986).

Metatarsals

Some of the best preserved metatarsals of the Cornet collection closely resemble those of *Iguanodon* in their general appearance. Right metatarsal II (MTCO 21.093/CM, Plate II, Fig. 2) is one of the best preserved metatarsal II and it clearly shows the impression of metatarsal I in an oblique position. The proximal end of this metatarsal is flattened laterally and expanded rostro-caudally, forming a rostral edge which overhangs the shaft below. Distally the shaft is contracted laterally and expanded again at the distal end, which is flattened transversely. Just below the middle of the shaft, on the rostro-lateral edge of the shaft, a small lip is developed. These features closely resemble those of *Iguanodon atherfieldensis* and *I. bernissartensis* (Norman, 1980, 1986).

There are several metatarsals from the third digit, among which isolated right metatarsal III (MTCO 17.679/3455) is one of the best preserved specimen (Plate III, Fig.1). Its proximal end has a triangular shape with a flattened medial surface for attachment to metatarsal II. Beneath its proximal end the shaft is contracted, on its lateral surface there is a rounded vertical ridge and on its rostral medial surface, about halfway down the shaft, a shallow depression is developed, in order to receive the lip-like process of metatarsal II. The distal end is expanded into a well-developed articular condyle. Galton & Powell (1980) defined the ratio "maximum antero-posterior width / maximum length of metatarsal III" and established this ratio as being 0.39 - 0.46 in *Camptosaurus*, 0.15 in *Hypsilophodon*, 0.26 in *Dryosaurus* and 0.34-0.51 in *Iguanodon*. This ratio has lower values for *Iguanodon atherfieldensis* and it has higher values in *Iguanodon bernissartensis*, giving its more robust aspect. For the majority of metatarsals III in the Cornet collection, it's impossible to measure the rostro-caudal width of the proximal end, because

these are abraded or broken, or the distal end is missing, so the maximum length is impossible to estimate. In MTCO 17679/3455 this ratio is 0.38, whereas in some other specimens such as MTCO 17.680/6086 this ratio is 0.32. These values suggest the presence of *Iguanodon atherfieldensis* in the Cornet fauna.

The metatarsals from Cornet are distinctly smaller than those belonging to large adult *I. bernissartensis* or *I. atherfieldensis*. Minter et al. (in prep) consider the small size of the Cornet ornithopods as a result of dwarfing, which most likely have occurred via progenetic paedomorphosis.

However, nothing is known about ontogenetic variations of limb bones in *Iguanodon*, therefore, these metatarsals might belong to younger *I. bernissartensis* specimens or to another species of *Iguanodon* (Pascal Godefroit, written communication, 2003).

Ungual pes phalanges

Typical hoof-like ungual phalanges of the pes are quite frequent among the Cornet unguals.

In the Cornet collection unguals of digit II-IV are flattened and broad. The best-preserved third digit unguals of the pes MTCO 14567, MTCO 14.749 and MTCO 20.892/CM, MTCO 20.907/CM are very broad, symmetrical, hoof-like bones (Plate III, Fig.2-5). The proximal ends are dorso-ventrally flattened and mediolaterally expanded, with two adjacent articular depressions. From their proximal end, the unguals become more compressed dorsoventrally and terminate in a blunt distal end. This conditions is similar to *Iguanodon* (Norman, 1980, 1986), contrary to the unguals of *Camptosaurus,* in which the unguals have pointed distal ends (Gilmore, 1909).

The nail groove is present and equally well-developed on the lateral and medial sides as well. This description closely resembles the features of unguals belonging to *Iguanodon atherfieldensis* and *I. bernissartensis* (Norman, 1980, 1986).

Norman (1998) established among the shared characters for Iguanodontia (Iguanodonidae + *Probactrosaurus* + Euhadrosauria), that pedal ungual phalanges of digits II-IV are flattened and broad.

Thus the above mentioned unguals can be determined as *Iguanodon* sp.

Pes unguals MTCO 14.669/2100, MTCO 20.821/CM, MTCO 20.893/CM are distal phalanges of Digit II or IV, having also dorsoventrally flattened proximal ends, but the claw grooves are not equally developed and the unguals are laterally or medially curved. The proximal ends are nearly rectangular and the distal ends of these unguals terminate into blunt ends. These specimens can be determined as *Iguanodon* sp., because there are no differences in the ungual phalanges among *Iguanodon atherfieldensis* and *I. bernissartensis*.

CONCLUSIONS

If Early Cretaceous dinosaur faunas are relatively abundant in Western Europe, they remain poorly known in Eastern Europe. *Iguanodon* remains are quite frequent in Wealden deposits in Britain, Belgium, Germany, France and Spain.

The precise age of dinosaur-bearing Wealden formations is still very badly established. *Iguanodon*-bearing deposits in France are mostly marine and well-dated (Martin & Buffetaut, 1992), whereas the deposits where *Iguanodon* remains were discovered in Britain and Belgium (Bernissart) are continental and their age is still not accurately known.

Norman (1987a) was the first who tentatively used biostratigraphic correlations based on dinosaur distribution. Thus he stated that *Iguanodon fittoni* and *I. dawsoni* are present in the Lower Wealden (Late Berriasian - Valanginian) *and I. atherfieldensis* and *I. bernissartensis* are present together in the Upper Wealden (Barremian - Aptian).

The affinities of two Lower Wealden *Iguanodon* species: *I. fittoni* and *I. dawsoni* are brought into question by the reassigment *of Iguanodon hoggii* Owen 1874 in *Camptosaurus hoggii* by Norman and Barrett (2002).

Iguanodon atherfieldensis has a distribution from Hauterivian in France (Martin & Buffetaut, 1992), from Hauterivian - Barremian in Britain (Norman, 1987a), whereas *Iguanodon atherfieldensis* and *I. bernissartensis* are thought to be present together in the Barremian - Aptian in Britain (Norman, 1987a), in Barremian of France, Saint Dizier area of Haute-Marne (Martin & Buffetaut, 1992) and Spain, Provincia de Teruel (Sanz, et al., 1984), and in Aptian of Germany and Belgium (Norman, 1980; 1986; 1987b).

Among ornithopod remains those of *Iguanodon* are quite frequent in the Cornet material. The characters of Iguanodon-tidae are undoubtedly present, but identifications on species level are obstructed by lack of any anatomical connection. The bones belong to different individuals, probably of different ontogenetic ages as well.

The majority of the Iguanodontidae material can be stated as *Iguanodon* sp., and only in some cases *Iguanodon atherfieldensis* can tentatively be proposed.

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PLATES

PLATE I

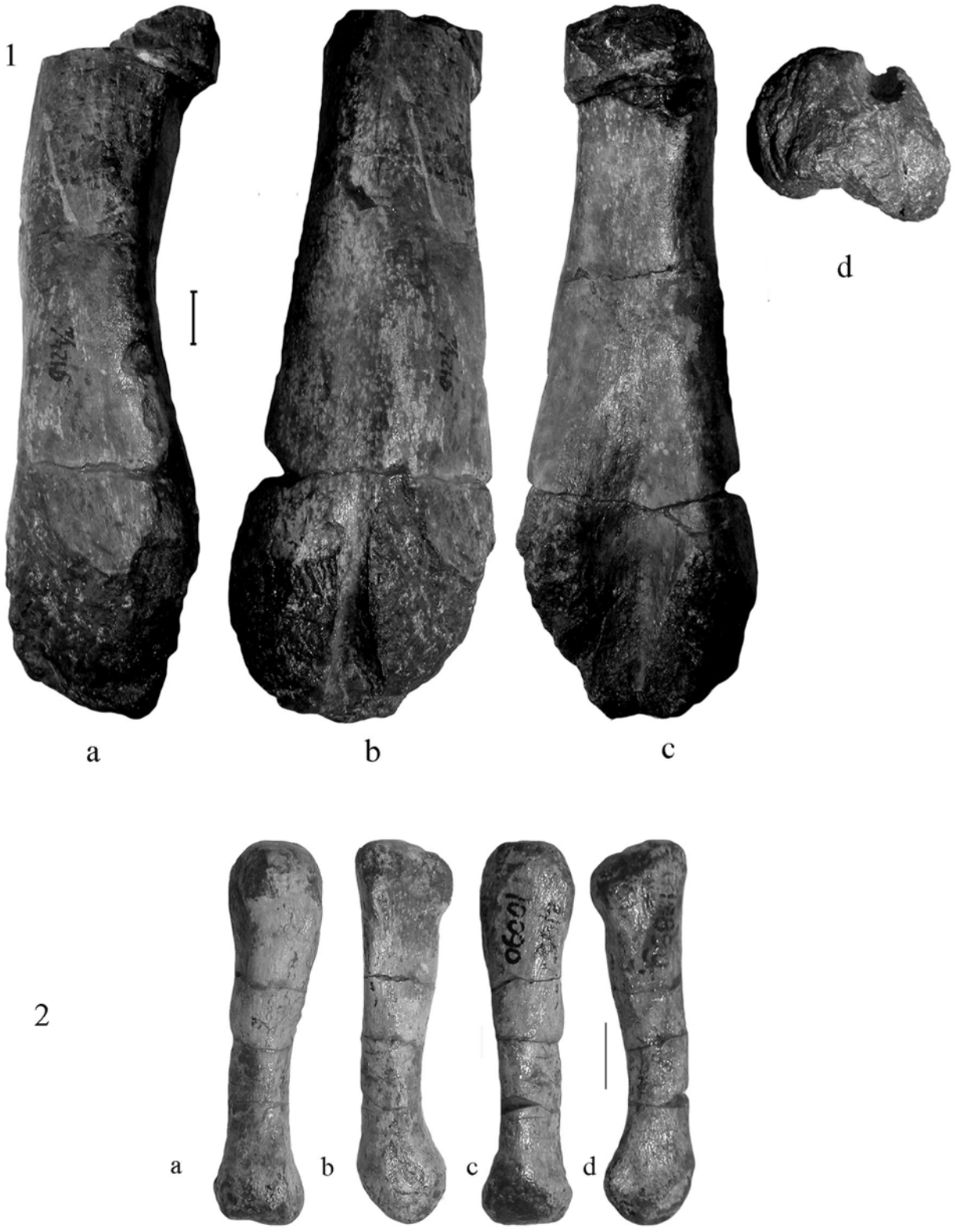
Fig. 1. *Iguanodon* sp., left distal femur (MTCO 21.362/7290+9124); a. lateral view, b. rostral view, c. caudal view, d. distal view.
Fig. 2. *Iguanodon* sp. left metacarpal II (MTCO 18.999); a. caudal view, b. lateral view, c. rostral view, d. medial view. Scale bars indicate 1 cm.

PLATE II

Fig. 1 *Iguanodon* sp. left metacarpal III (MTCO 21.104/CM), a. rostral view, b. medial view, c. caudal view, d. proximal view, c. distal view.
Fig. 2. *Iguanodon* sp., right metatarsal II (MTCO 21.093/CM); a. medial view, b. lateral view, c. proximal view, d. distal view. Scale bars indicate 1 cm.

PLATE III

Fig. 1 *Iguanodon atherfieldensis*, right metatarsal III (MTCO 17.679/3455); a. lateral view, b. medial view, c. rostral view, d. caudal view.
Fig. 2. *Iguanodon* sp., ungual pes phalanx digit III (MTCO 14.567/511), a. dorsal view, b. ventral view, c. proximal view.
Fig. 3. *Iguanodon* sp., ungual pes phalanx digit III (MTCO 14.749), a. dorsal view, b. ventral view.
Fig. 4. *Iguanodon* sp., ungual pes phalanx digit III (MTCO 20.892/CM), a. dorsal view, b. ventral view, lateral view.
Fig. 5. *Iguanodon* sp., ungual pes phalanx digit III (MTCO 20.907/CM), a. dorsal view, b. ventral view, c. proximal view. Scale bars indicate 1 cm.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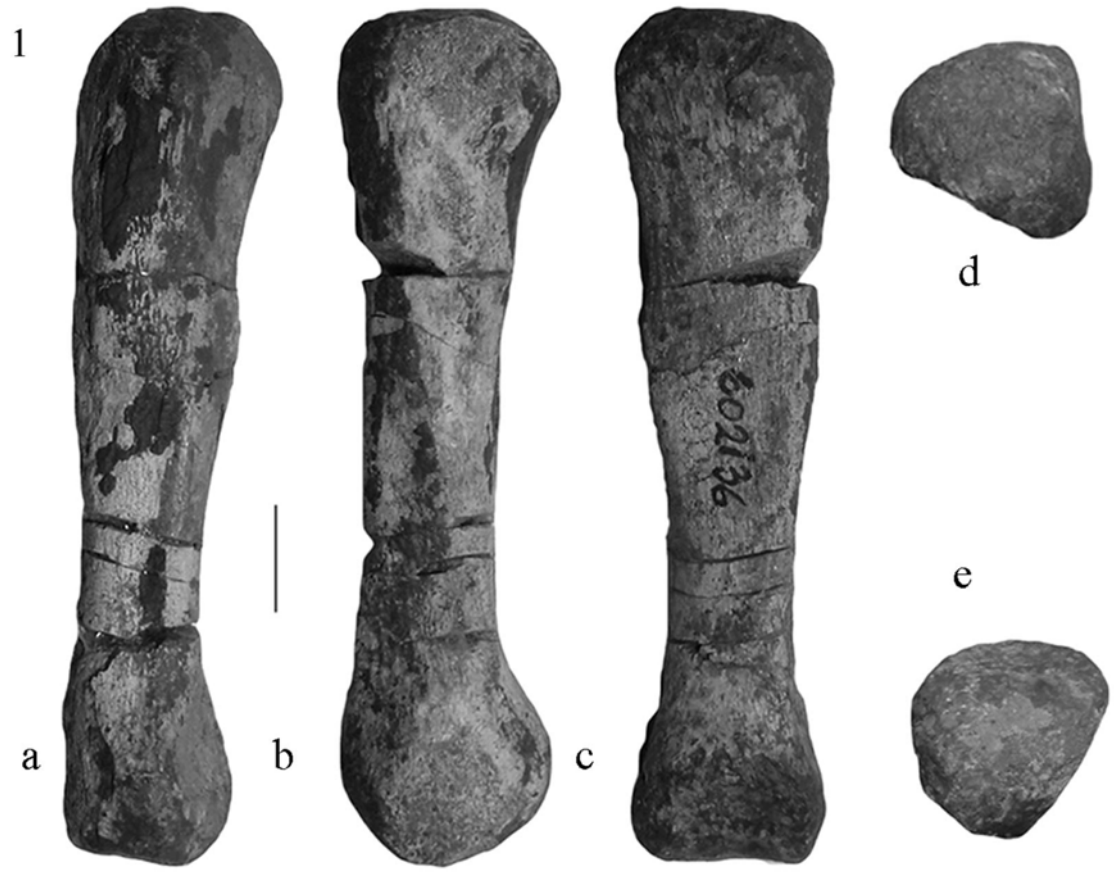
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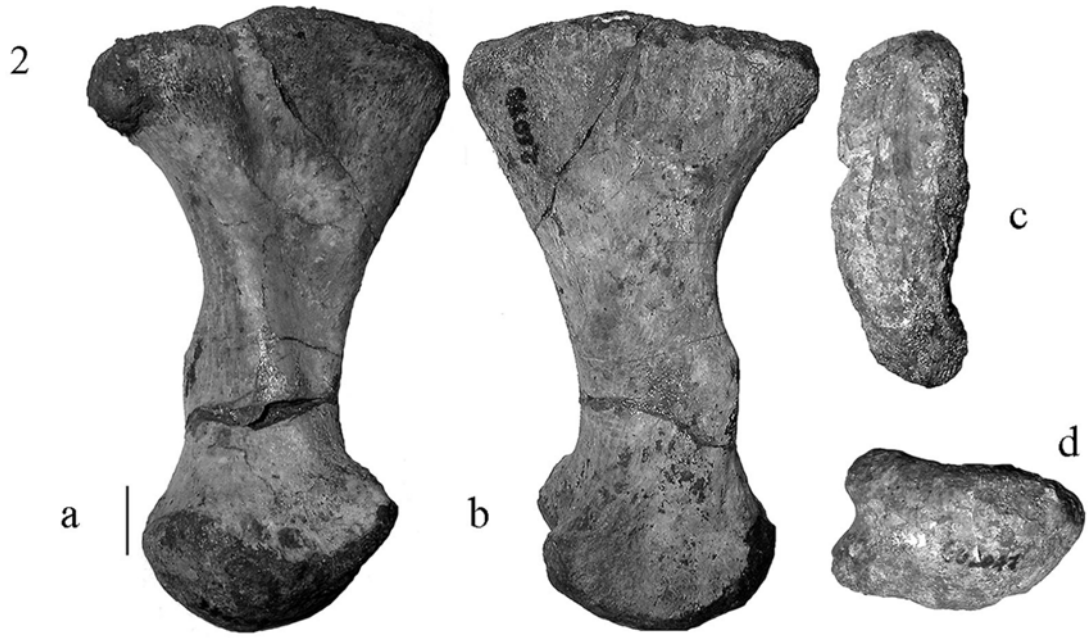
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