

## ***Draconyx loureiroi*, a new camptosauridae (Dinosauria, Ornithopoda) from the Late Jurassic of Lourinhã, Portugal**

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(Received 6 October 2000, accepted after revision 20 December 2000)

**Abstract** — A new ornithopod dinosaur is described here under the name of *Draconyx loureiroi* n gen, n sp on teeth, caudal vertebrae, forelimb, hindlimb, and foot material that were found in association in the Late Jurassic–Tithonian of Lourinhã, Portugal *Draconyx* is a Camptosauridae related to *Camptosaurus* © 2001 Éditions scientifiques et médicales Elsevier SAS

**Dinosaurs / Ornithopoda / *Draconyx* / Portugal / Jurassic**

**Résumé** — *Draconyx loureiroi*, un nouveau camptosauridae (Dinosauria, Ornithopoda) du Jurassique supérieur de Lourinhã, Portugal. Un nouveau dinosaure ornithopode est ici décrit sous le nom de *Draconyx loureiroi* n gen, n sp Des dents, des vertèbres caudales, une partie des membres antérieur et postérieur, et le matériel d'un pied ont été trouvés associés dans le Jurassique terminal–Tithonien de Lourinhã, Portugal *Draconyx* est un Camptosauridae apparenté à *Camptosaurus* © 2001 Éditions scientifiques et médicales Elsevier SAS

**Dinosaures / Ornithopoda / *Draconyx* / Portugal / Jurassique**

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## INTRODUCTION

Remnants of Late Jurassic ornithopods from Portugal have been described by Sauvage [13], Thulborn [15], and Galton [3]. The last one ascribed some limb material to the genus *Camptosaurus*.

In 1991, Carlos Anunciação (member of the Museum of Lourinhã) found some of the foot and limb material of an ornithopod at Vale Frades, Lourinhã (*figure 1*).

Two ornithopod footprints found at Porto Escada in 1999 (unpublished data) might be made by individuals of the species described here.

## SYSTEMATICS

ORNITHISCHIA Seeley, 1888

ORNITHOPODA Marsh, 1871

Iguanodontia Dollo, 1888

Ankylopollexia Sereno, 1986

*Draconyx* n. gen.

**Etymology:** *Draco*, latin word for dragon, and *onyx*, greek word for claw, in recognition of the claw material.

**Diagnosis:** As for the species.

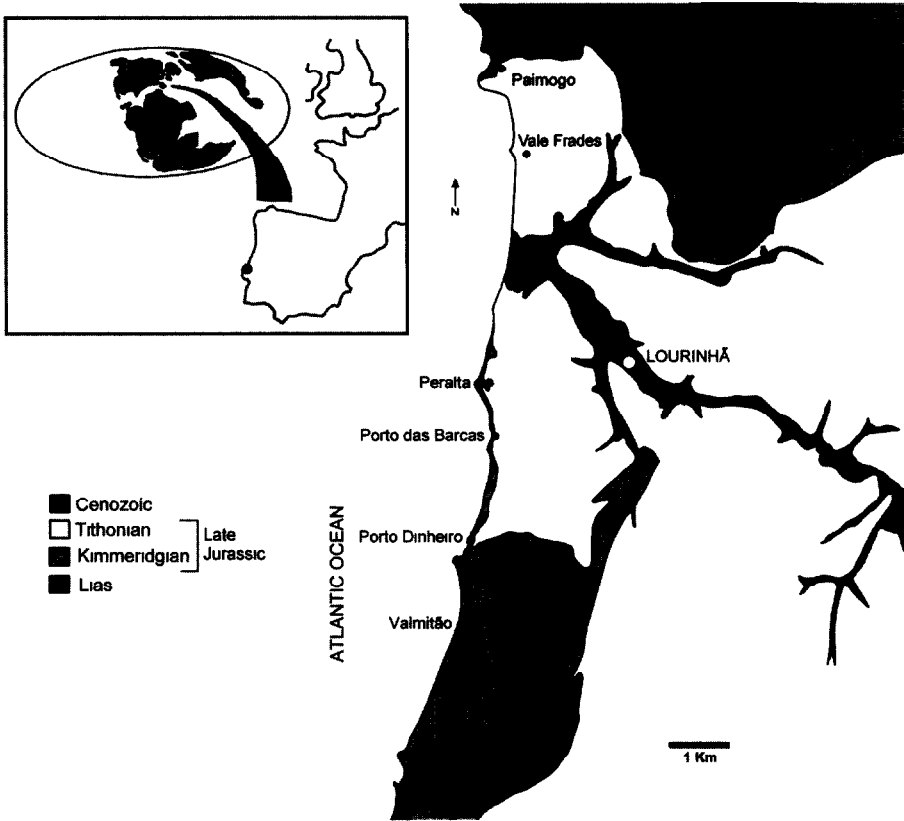
*Draconyx loureiroi* n. sp.

**Etymology:** *loureiroi*, after João de Loureiro (1717 - 1791), portuguese jesuit, pioneer in Palaeontology in Portugal, also an excellent botanist, astronomer and medical doctor, well-known for his “Flora Cochinchinensis” (he spent a large part of his life in Southeast Asia).

**Horizon:** Late Jurassic - Tithonian, “Bombarral” Unit according to Manuppella (1986).

**Locality:** Vale Frades, Lourinhã, western Portugal (*figure 1*).

**Material:** Remains from one individual from Vale Frades (holotype) two maxillary teeth, three mid-anterior caudal centra, one chevron, distal epiphysis of right humerus, one manual phalanx, three manual ungual phalanges, distal epiphysis of right femur, epiphyses of tibia and fibula, astragalus, calcaneum, three tarsals (II-V),



**Figure 1** Simplified geological map based on Manuppella [6]. The following sites are shown from north to south: Paimogo (theropod nest and embryos [7, 8]), Vale Frades (holotype of *Draconyx* gen et sp n., this study), Peralta (holotype of *Lourinhanosaurus* [9]), Porto das Barcas (holotype of *Brachiosaurus atalaiensis*, [5]), Porto Dinheiro (holotype of *Dinheirosaurus* [1]), and Valmitão (*Ceratosaurus* sp., [10]).

**Figure 1.** Carte géologique simplifiée d'après Manuppella [6]. Les sites suivants sont figurés du nord au sud: Paimogo (nid avec des embryons de theropode [7, 8]), Vale Frades (localité type de *Draconyx*, cette étude), Peralta (localité type de *Lourinhanosaurus* [9]), Porto das Barcas (localité type de *Brachiosaurus atalaiensis* [5]), Porto Dinheiro (localité type de *Dinheirosaurus* [1]), et Valmitão (*Ceratosaurus* sp. [10]).

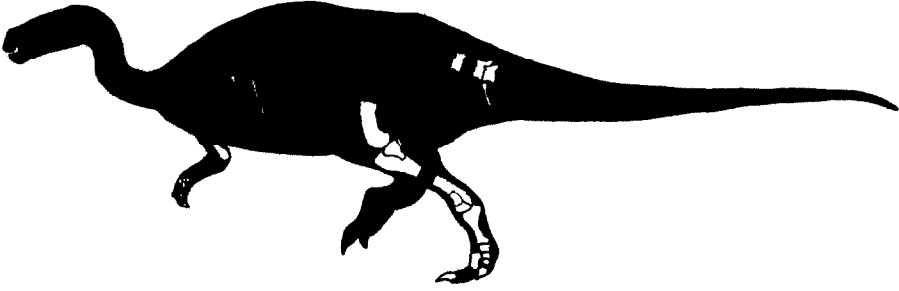
four metatarsals (I-IV) and pedal phalanges. Under the collection number ML 357 at Museum of Lourinhã, Portugal (*figure 2*)

Other referred material: Femur (ML434, *figure 7*) from Praia do Caniçal

**Diagnosis:**

Camptosauridae with the following features

Maxillary teeth with strong primary ridge with five tertiary ridges at the mesial side. The enamel on the labial surface of the tooth crown is lower distally than mesially.



**Figure 2** Holotype of *Draconyx loureiroi* gen et sp nov All these bones are from a single individual (ML357)

**Figure 2** Holotype de *Draconyx loureiroi* gen et sp nov Tous les ossements concernés appartiennent à un seul individu (ML357)

Manual ungual phalanges higher than broad Tibial condyle of femur without lateral projection into the flexor groove Fibular condyle of femur shortly projected, being shorter anteroposteriorly than wide mediolaterally Tibial condyle of femur slightly projected posteromedially and concave on its medial side Short cnemial crest on tibia Astragalus fused to calcaneum Distal tarsal II present Lateral distal tarsal overlaps the medial distal tarsal Metatarsal V absent

## DESCRIPTION

### Teeth

Two maxillary teeth were found The teeth are both higher than wide and relatively compressed mediolaterally

Both teeth bear at their labial face one strong primary ridge, five and two tertiary ridges are present on their mesial and distal side respectively

The tooth enamel is present in labial and lingual crown, but in this last is restricted to the distal half

**Table I.** Teeth Measurements

**Tableau I.** Mesures des dents

Height	Mesiodistal length	Labiolingual width
16.4	9.5	5.9
11.2	8.5	8.8

All measurements are in millimetres

Toutes les mesures sont données en millimètres

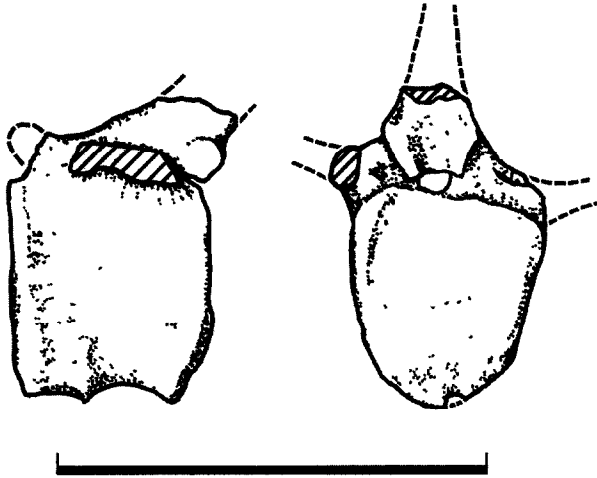


Figure 3 *Draconyx loureiroi* gen et sp nov Caudal vertebra in lateral and posterior views Scale bar 10 cm  
 Figure 3 *Draconyx loureiroi* gen et sp nov Vertèbre caudale, vue laterale et posterieure Echelle 10 cm

The root is sub-cylindrical or slightly ellipsoid  
 Small denticles can be seen on the margins of the crown

**Axial skeleton (figure 3)**

The three caudal vertebrae present have been part of the neural arch and centrum, but the spines (neural and transverse processes) were not found

The three vertebrae are amphiplathyan or slightly opisthocoelic In anterior view, the centrum is rounded and in posterior view it is trapezoid-shaped

The neural channel is narrow and sub-round It is narrower than pedicels.

In these vertebrae the diapophyses are placed at the neural channel level and apparently would be projected upwardly

The centrum is not pleurocoelous The facets for chevrons are very developed, mainly on the ventro-anterior side

One single incomplete chevron is present It is not very expanded distally and is as wide proximally as distally, with a small constriction in the middle

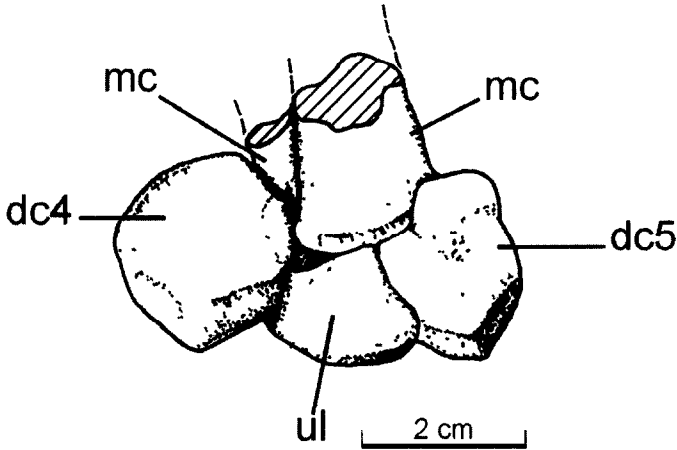
**Table II.** Caudal centra Measurements

**Tableau II.** Centres caudaux Mesures

Length	Height	Width
52	58	60
47	52	50
46	46	46

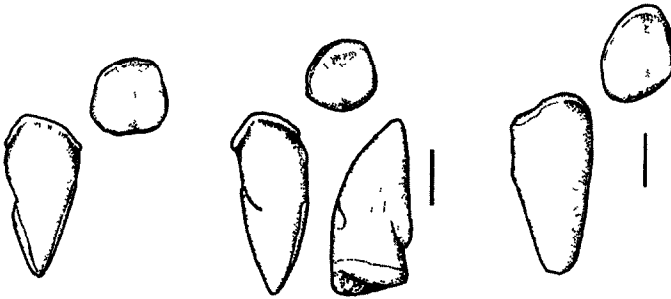
All measurements are in millimetres

Toutes les mesures sont donnees en millimetres



**Figure 4** *Draconyx loureiroi* gen et sp nov Carpal and metacarpal bones dc4- distal carpal 4, dc5- distal carpal 5, mc- metacarpal, ul- ulnare

**Figure 4** *Draconyx loureiroi* gen et sp nov Carpien and métacarpien dc4- carpien distal 4 , dc5- carpien distal 5 , mc- metacarpien , ul- ulnaire



**Figure 5** *Draconyx loureiroi* gen et sp nov Manual ungual phalanges Scale bar 1 cm

**Figure 5** *Draconyx loureiroi* gen et sp nov Phalanges unguéales de la main Echelle 1 cm

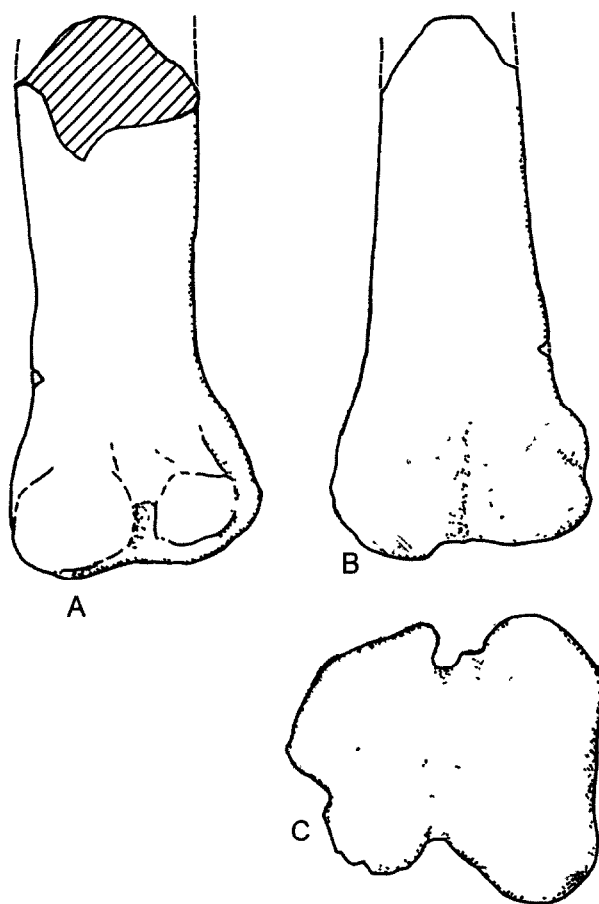
### **Forelimb (figures 4, 5)**

A very badly preserved distal end of the humerus is present with two well defined condyles

The manus is moderately preserved Three unfused carpal bones (distal carpal IV, ulnare, and distal carpal V) and a proximal end of a metacarpal (V?) were found in anatomical connection One phalanx from the digit II or III and three ungual phalanges were found without anatomical connection The three ungual phalanges are higher than broad

### **Hindlimb (figures 6, 7, 8)**

Only the holotype's distal half of right femur is preserved The distal half of the femur is robust Its diaphysis is slightly compressed anteroposteriorly

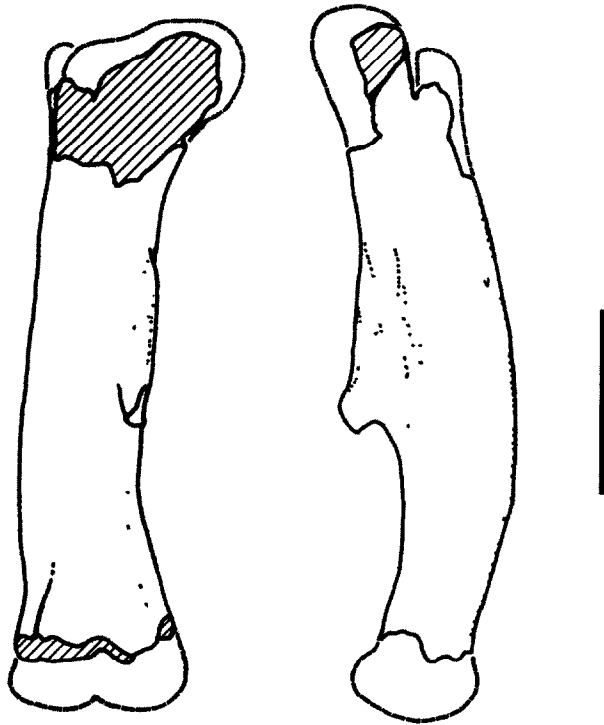


**Figure 6** *Draconyx loureiroi* gen et sp nov Femur of holotype ML357

**Figure 6** *Draconyx loureiroi* gen et sp nov Fémur de l'holotype ML357

An isolated left femur (ML434) with complete diaphysis and part of the epiphyses, was collected at Praia do Caniçal, just 1 km north of *Draconyx* holotype's site. The lesser trochanter is well separated from the greater trochanter. The femur is very bowed posteriorly. The fourth trochanter is posteriorly projected and inclined laterally. Its edge is concave in posteromedial view. Adjacent and anterior to the fourth trochanter there is a caudoiliofemoralis muscle attachment.

In the holotype (ML357) the two femoral condyles are well separated with well developed anterior and posterior intercondylar grooves. The tibial condyle is slightly concave in medial view and has no lateral projection into the flexor groove. The fibular condyle is shortly projected posteriorly, i.e., shorter anteroposteriorly than wide mediolaterally. The fibular condyle is as wide anteriorly as posteriorly.



**Figure 7** Femur of *Draconyx loureiroi* gen et sp nov ML434 Scale bar 10 cm

**Figure 7** Fémur du *Draconyx loureiroi* gen et sp nov ML434 Échelle 10 cm

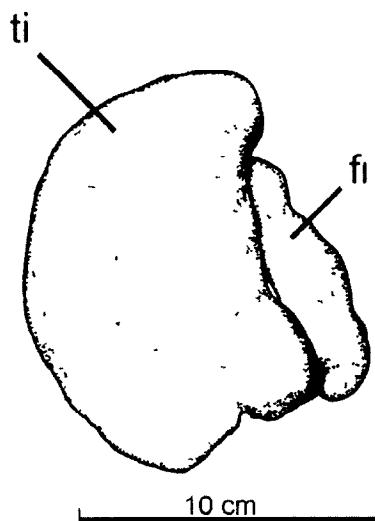
The right tibia is almost completely preserved (about 20 % of the middle of the diaphysis is lacking) The proximal epiphysis is very strong 143 mm anteroposteriorly and 111 mm mediolaterally The fibular condyle of the tibia is narrow and lateroposteriorly projected, it forms a notch with the posterior condyle The cnemial crest is very wide and short

In proximal view the epiphysis is flat and forms a very pronounced, convex half-circle on its medial side The fibula was preserved entirely in connection with the lateral side of the fibular condyle

The diaphyseal section is pointed oval shaped (water-drop shape) Distally the tibia is fused to the astragalus and calcaneum and anatomically attached to the fibula, tarsals and metatarsals It is much expanded lateromedially and compressed anteroposteriorly

The fibula is very slender in comparison with the tibia It is anteroposteriorly expanded and convex laterally On its medial view, it bears the insertion to the fibular condyle of the tibia Distally the fibula is attached to the tibia and the calcaneum covers it dorsally





**Figure 8** *Draconyx loureiroi* gen et sp nov Tibia in proximal view (ML357)

**Figure 8** *Draconyx loureiroi* gen et sp nov Tibia, vue proximale (ML357)

### Foot (figure 9)

The astragalus and calcaneum are almost entirely covered by the distal part of the tibia and fibula. The calcaneum is concave laterally.

Three distal tarsals are present. The lateral distal tarsal (IV) is 65 mm wide and 18 mm long. It contacts dorsally with the calcaneum and astragalus and laterally with the fibula. It ventrally overlaps the medial distal tarsal (III) and the metatarsal IV.

The preservation of tarsal II is very rare in dinosaurs. In this case it is vestigial with ca. 24 mm wide mediolaterally and 8 mm thick anteroposteriorly. It is placed between the tarsal III and the astragalus.

Four metatarsals are present (I to IV). The (inner) metatarsal I is vestigial. The metatarsal I is not completely preserved but its impression on the metatarsal II is perfectly preserved. It is slightly bowed, fitting entirely into the medial side of the metatarsal II in the diagonal position. Distally it is curved upwards.

The metatarsal II has the largest proximal end of these metatarsals. Its proximal surface is longer anteroposteriorly than wide mediolaterally.

The metatarsal III is the longer one and with metatarsals II, IV, and distal tarsal III. The metatarsal IV has uniquely the both ends preserved.

The metatarsal V is not preserved and there are no impressions or anatomical place for it. We may therefore conclude that the metatarsal V was already absent in *Draconyx* (derived character).

*Draconyx* holotype has three articulated phalanges of the pedal digit II. Two other phalanges (one ungual) are present. The digit III just has one articulated phalanx preserved. Two ungual phalanges found might correspond to digit II and IV.

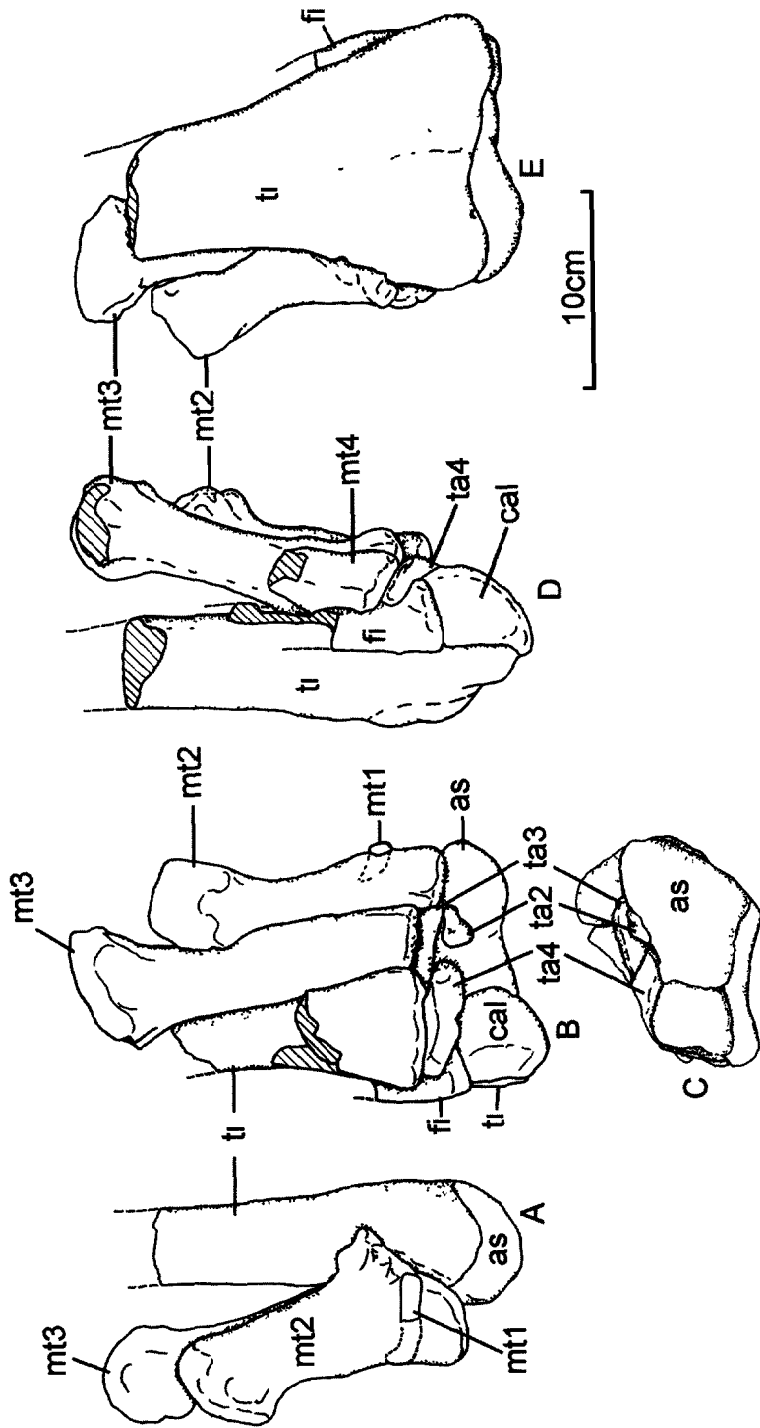


Figure 9 Right foot of *Draconyx loureiroi* gen et sp nov (ML357) as astragalus, cal calcaneum, fi fibula, mt1-4 metatarsus I to IV, respectively, ta2-4 tarsals II, III and IV respectively, ti tibia

Figure 9 Pied droit de *Draconyx loureiroi* gen et sp nov (ML357) as astragalus, cal calcaneum, fi péroné, m t1-4 metatarses I, II, III et IV, respectivement, ta 2-4 tarsens II, III and IV, ti tibia

**Table III.** Metatarsals Measurements

**Tableau III.** Metatarsiens Mesures

	I	II	III	IV
Length	53	152	175	?
Proximal width (anteroposterior/mediolateral)	10/6*	89/26*	7/35*	7/67
Distal width (anteroposterior/mediolateral)	16*/?	52/45	57/64	43/43

All measurements are in millimetres \* Estimated

Toutes les mesures sont données en millimetres \* Estimée

## COMPARISONS AND DISCUSSION

*Draconyx loureiroi* is clearly an Iguanodontia (sensu Coria & Salgado, 1996 = *Tenontosaurus* + Euiguanodontia) because it shows the following characters

- Enamel present on the medial side of maxillary teeth [2]
- Leaf-shaped denticles [14]
- Enamel restricted to the distal half of the crown on the medial side of the maxillary teeth [14]
- Presence of anterior intercondylar groove on femur [2, 14]
- Femur with fibular condyle medially placed

It is an Euiguanodontia (*Gasparinisaura* + Dryomorpha) due to Presence of lateral primary ridge in maxillary teeth [2]

It can be included among the Dryomorpha (*Dryosaurus* + Ankylopollexia, sensu Sereno, 1986) due to

- Diamond-shaped maxillary tooth crown with rounded anterior and posterior corners [14]
- Enamel absent from the medial side of the maxillary teeth [14]
- Channel like anterior intercondylar groove on femur [11]

And among the Ankylopollexia Sereno 1986 (Camptosauridae + Styraocosterna) (=Camptosauria [11]) due to

- The prominent primary ridge on the labial surface of the maxillary teeth crowns [11, 14]
- Partial fusion of ulnare and distal carpals 4 and 5 [14]
- Pes digit 1 relatively shorter and less robust [14]
- Metatarsal 1 markedly less robust relative to the other metatarsals [14]

It can be ascribed to Camptosauridae because

– The maxillary teeth have a strong vertical primary ridge on the distal side of the labial crown

– The femur is curved and has a prominent lesser trochanter

Following Norman [11] Camptosauridae is composed by the genera *Camptosaurus*, *Cumnoria*, *Callovosaurus* and an “unnamed species from Portugal (Galton, 1980)” *Cumnoria prestwichi* was recognised into the genus *Camptosaurus* (as *C prestwichi*) by [3, 4, 12] and commonly accepted *Callovosaurus leedsii* is seen as *nomen dubium* because it was based in two incomplete femoral epiphyses without any strong diagnostic feature

Therefore, we restrict the family Camptosauridae to *Camptosaurus* (with three species *C dispar*, *C amplius* and *C prestwichi*) and *Draconyx loureiroi* that includes the femur from Portugal described as *Camptosaurus* sp by Galton [3] and cited by Norman [11]

*Draconyx* is distinguishable from *Camptosaurus* by (1) tibial condyle of femur without lateral projection into the flexor groove, (2) fibular condyle of femur wider mediolaterally than long anteroposteriorly, (3) vestigial first pedal digit, and (4) absent pedal digit V

## CHRONOLOGICAL AND GEOGRAPHICAL REMARKS

The description of *Draconyx* as Camptosauridae is coherent with the chronology of this family, placed in Kimmeridgian and Tithonian of North America and England (contemporaneous to *Draconyx*'s Vale Frades site) Galton [3] already cited the family to Portugal and discussed its paleogeographical implications. The dinosaur faunal list from the Late Jurassic of Portugal is related to the Morrison formation (with the same families presented in both areas) but often different at the genus level showing some taxonomical divergence due to its paleogeographical separation.

**Acknowledgements** – We are indebted to Carlos Anunciação who found the specimen, to GEAL – Museu da Lourinhã team (Horácio Mateus and Vasco Ribeiro) and Muséum National d'Histoire Naturelle team (Philippe Taquet) for the discussion and preparation support. We are also grateful to LeaderOeste and Programa Ciência Viva that financed part of the laboratorial material. This study was supported by PhD scholarship grant 21616/99 (to O M) of PRAXIS XXI of the Ministério da Ciência e Tecnologia (Centro de Estudos Geológicos). All draws by Octávio Mateus.

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