

ISOLATED DRYOSAURID (DINOSAURIA: ORNITHOPODA) CRANIAL REMAINS FROM THE LATE JURASSIC OF PORTUGAL

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INTRODUCTION

Ornithopod dinosaurs were among the most successful clades of dinosaurs during the Mesozoic. By the Late Jurassic, many derived species (iguanodontians) differentiated and spread around the globe, although they were not the main component of faunal assemblages (Forster, 2007). The main ornithopod clades recognized at that time are Dryosauridae, Camptosauridae and basal Styracosterna. In Portugal, the Kimmeridgian – Tithonian Lourinhã Formation, located in the central sector of the Lusitanian Basin (Antunes and Mateus, 2003), has yielded most of the ornithopod material dated to the Late Jurassic. Here, we redescribe isolated dental and dentary material belonging to Ornithopoda, and housed at Museu da Lourinhã.

Geographical and Geological setting

A small fragmentary dentary and two isolated dentary teeth were recovered in Lourinhã (Portugal), in Zimbral and Peralta localities, respectively. Geologically, they come from the Praia Azul Member of Lourinhã Formation, which consists mainly of tabular marls and mudstones, with occasional sandstone channels displaying bioturbations, cross-bedding and wave ripples. The environment is interpreted as a meandering fluvial system, flowing in a low-lying coastal plain, connected with deltas and other transitional environments such as sandy bay shorelines and brackish lagoons. It has been dated to Kimmeridgian – Tithonian (Mateus *et al.*, 2014). Other remains collected in this same Member include the holotype of *Draconyx loureiroi* (Vale Frades locality) and fragmentary material attributed to Dryosauridae indet. (Mateus *et al.*, 2017).

MATERIAL AND METHODS

Here we describe ML 768, a fragmentary right dentary with teeth and ML 2304 and 2305, two isolated dentary teeth. Nomenclature follows Galton (1983), Araújo *et al.*, (2001) and Weishampel (1984). To assess the phylogenetic position of ML 768 we included it in the dataset of Han *et al.*, 2017 (characters and states hereinafter referenced along the text as (Ch.X:X), and performed a heuristic search with 1000 replicates, keeping 10 trees per replicate. All materials are housed at Museu da Lourinhã.

RESULTS

Description

ML 768 is a fragment of a right dentary bone, fractured both in caudal and rostral ends, first reported by Mateus (2007) as aff. *Dryosaurus* sp. (Fig.1b). It preserves fifteen close-packed alveoli (grouped in seven pairs and one isolated, two erupting teeth and six roots. In dorsal view is sinuous in shape (Ch.167:1), and the medio-lateral section is slightly concave-convex. The lateral surface is smooth (Ch. 169:0) bearing seven visible foramina on two different levels. On the medial surface a deep Meckelian sulcus runs for all the entirety of the tooth-row. The margins of the sulcus are neat and straight. Caudally on the medial surface, and dorsally respect to the Meckelian sulcus, the splenial contact is preserved showing a high dense capillary vascular system. The teeth preserved are diamond-shaped (Ch.205:2), possessing a rounded apex (Ch.206:1). Numerous apicobasally extended ridges are distributed on the lingual surface of the tooth-crown (Ch.207:1). The margin of the crown possesses various well-developed tongue-shape denticles (Ch.224: 1; Ch. 225: 1), which are more numerous than the crown ridges (Ch. 208:0). Two main ridges are positioned toward the midline of the crown on the lingual surface (Ch.210:1), being the primary slightly offset caudally. ML 2304 and 2305 are dentary teeth presenting high grade of crown-wearing and root-resorption. No *cingulum* is present in the contact between the root and the crown (Ch.214:0). On the lingual surface two thick partially preserved main ridges are distinguishable, being sub-equal in size (Ch.210:1). The veneer of enamel is present just on the lingual surface, being the labial surface occupied by a slightly concave occlusal surface. An apico-basal extended resorption pit flares from the root-base. The mesial and distal sides present contact facets.

Phylogenetic analysis

The analysis resulted in 2970 most parsimonious trees (MPTs) of 1213 steps (C.I. 0,37, R.I. 0,71). The global topology of the consensus is the same as the one published by Han *et al.* (2017). Despite the fragmentary condition of the specimen studied, it is recovered within Iguanodontia in all MPTs, in a more derived position than *Zalmoxes*. In the resulting strict consensus, the Portuguese specimen is placed in a polytomy with *Camptosaurus*, *Dryosaurus*, *Tenontosaurus* and the clade formed by *Iguanodon*, *Ouranosaurus* and *Probactrosaurus* (Fig.1a).

DISCUSSION

The phylogenetic analysis points out more derived affinities for ML 768 respect to the enigmatic *Gideonmantellia* and *Zalmoxes*, although, given the fragmentary condition of the specimen, it is impossible to further resolve its position within the polytomy formed by *Tenontosaurus* + Dryomorpha (Fig.1a).

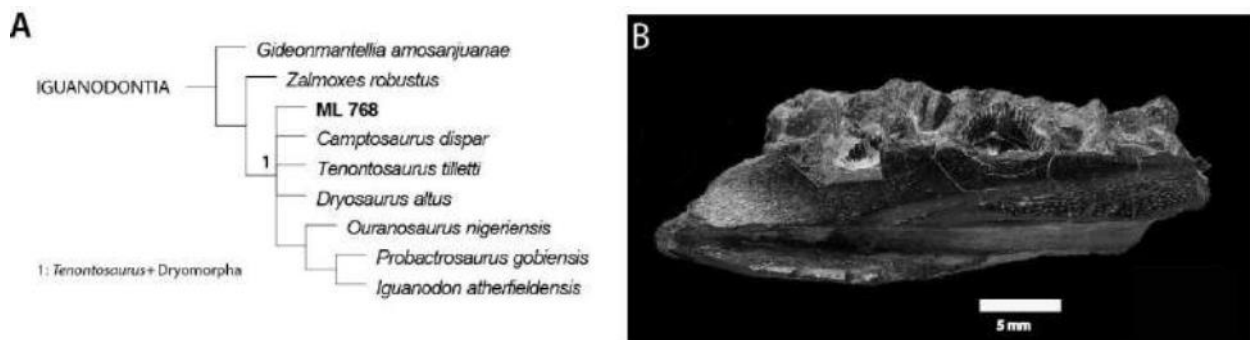


Fig. 1. A: phylogenetic position of ML 768; B: ML 768 in medial view. See the text for further detail. Photo credit: Carlos Natario.

Considering the general morphology of the erupted teeth, the medial position and size of the two main ridges, the arrangement of the accessory ridges and the thick tongue shape denticles, strikingly resemble the conditions seen in *Dryosaurus altus* and *Dysalotosaurus lettowvorbecki* (Galton, 1983, 2006), indicating dryosaurid affinities for this specimen. Escaso *et al.* (2014) described the first Portuguese dryosaurid species, *Euosdryosaurus nanohallucis* from the same Formation and Member, based on post-cranial remains. Since the lack of overlapping material, it is not possible to surely attribute ML 768 to this species, although given the geographical proximity of the type locality of *Euosdryosaurus* to the locality the material comes from, and the close age of both localities, the new

remains may represent the same taxon. The two dentary teeth, they are attributed to Dryomorpha on the basis of the lack of the *cingulum* (Galton, 2006) and to Dryosauridae on the basis of two sub - equal thick main ridges. Given the high grade of resorption and wear, a possible early ankylopollexian ontogenetic stage for these two specimens, cannot be ruled out.

CONCLUSIONS

Isolated ornithopod materials from Lourinhã Formation are here re-described or reported for the first time. ML 768 is a tooth-bearing partial dentary, here identified as Dryosauridae indet. Two isolated dentary teeth are also tentatively attributed to Dryomorpha indet. These findings, improve our knowledge of Portuguese dryomorphan cranial anatomy, since most of the specimens are now represented by post – cranial elements.

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