

## ABELISAURIA (THEROPODA, DINOSAURIA) TEETH FROM BRAZIL <sup>(1)</sup>

(With 3 figures)

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**ABSTRACT:** Teeth preserved with an incomplete skeleton (DGM 859-R) of an Abelisauria (Dinosauria, Theropoda) from the continental cretaceous deposits of Mato Grosso State (Brazil) are described, providing the first detailed information about the tooth's structure of a member of this theropod clade. The teeth are strongly compressed laterally, have an elliptic transverse section and a long root. The denticles are chisel-like, 2 (base) to 1.8 (top) denticles per millimeter. They differ from most theropod teeth described in the literature, particularly spinosaurids (transverse section, denticles), dromaeosaurids (size, shape and number of denticles per millimeter), tyrannosaurids (transverse section, blood grooves), and taxa like *Giganotosaurus* Coria & Salgado, 1995 and *Carcharodontosaurus* Stromer, 1931 (lack of wrinkles on the enamel). They also differ markedly from most isolated teeth found in Brazilian deposits, and show only some similarities with one morphotype found in Cretaceous layers that outcrop in the surroundings of Peirópolis (Minas Gerais State). Until abelosaur teeth from different taxa are described, no particular characterization of the dental features of this theropod clade can be made.

**Key words:** teeth, Abelisauria, Theropoda, Cretaceous, Mato Grosso.

**RESUMO:** Dentes de Abelisauria (Theropoda, Dinosauria) do Brasil

Dentes associados a um esqueleto incompleto (DGM 859-R) de Abelisauria (Dinosauria, Theropoda) de depósitos continentais do Cretáceo do Estado de Mato Grosso (Brasil) são descritos, fornecendo as primeiras informações detalhadas da estrutura dentária de um membro deste clado de terópodos. Os dentes são comprimidos lateralmente, possuem uma seção transversal elíptica e uma raiz longa. Os denticulos são espatulados com 2 (base) até 1,8 (topo) denticulos por milímetro. Estes dentes diferem daqueles pertencentes a outros terópodos já descritos, sobretudo dos espinossaurídeos (seção transversal, denticulos), dromaeossaurídeos (tamanho, forma e número de denticulos por milímetro), tiranossaurídeos (seção transversal, fendas interdenticulares) e táxons como *Giganotosaurus* Coria & Salgado, 1995 e *Carcharodontosaurus* Stromer, 1931 (ausência de cristas e sulcos transversais sobre o esmalte). Este material também difere da maior parte dos dentes isolados procedentes de depósitos brasileiros, possuindo algumas semelhanças com apenas um morfótipo encontrado em depósitos cretáceos dos arredores de Peirópolis (Minas Gerais). Até que dentes de outros membros deste clado sejam descritos em detalhe, não é possível propor uma caracterização adequada da estrutura dentária de Abelisauria.

**Palavras-chave:** dentes, Abelisauria, Theropoda, Cretáceo, Mato Grosso.

<sup>1</sup> Received on January 14, 2002. Accepted on February 2, 2002.

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## INTRODUCTION

Abelisauria is a clade of ceratosaurian theropods that has been reported in several regions of Gondwana (NOVAS, 1997; BITTENCOURT & KELLNER, 2001). Three species were described from Argentina: *Abelisaurus comahuensis* based on an incomplete skull (BONAPARTE & NOVAS, 1985), *Xenotarsosaurus bonapartei* known from a partial hindlimb and two vertebrae (MARTINEZ *et al.*, 1986), and *Carnotaurus sastrei* based on an almost complete skeleton (BONAPARTE, 1985). *Majungatholus atopus*, first described by SUES & TAQUET (1979) and *Majungasaurus crenatissimus* (Depéret, 1896) are two species registered in Madagascar that have been referred to abelisaurs and also contain cranial material (SAMPSON *et al.*, 1996; SAMPSON *et al.*, 1998). Two Indian species based on posterior elements of the skull, *Indosuchus raptorius* Huene & Matley, 1933 and *Indosaurus matleyi* Huene & Matley, 1933, have also been regarded as abelisaurs by some authors (BONAPARTE, NOVAS & CORIA, 1990; NOVAS, 1997). Despite the fact that several cranial material are known for abelisaurs, there is no information about the dentition of this group either because in most specimens the teeth are not preserved or were just not described.

Recently, an incomplete skeleton of a new theropod (DGM 859-R) found in the continental Cretaceous of Mato Grosso was reported by KELLNER & CAMPOS (2000a) and is classified within the Abelisauria. Several teeth were found associated with this specimen, along with elements of the hind limb, pelvis and caudal vertebrae. The formers are described here, providing the first information about abelisaurs teeth.

## DESCRIPTION AND COMPARISON

The material (DGM 859-R) consists of nine teeth, all found isolated (no jaw element was recovered with the specimen). None is complete: four are fragmentary consisting essentially of the root and five are better preserved but lack several portions of the enamel. The crown and root, lacking most of the posterior region and part of the lingual facet compose the most complete one. The presence of the root indicates that none are replacement teeth and must have fallen out during the fossilization process of this theropod.

Where observable, all teeth are strongly compressed laterally, have an elliptic transverse section, and a straight long root. The best preserved one (Figs.1, 2) is 84.3mm long (crown: 49,7mm; root: 34,6mm), with the crown slightly curved backwards. In anterior view, this tooth is almost symmetric, with the carina slightly curved lingually. The antero-posterior length of the base is 25mm while the maximum labio-lingual width is almost half that size (13mm). There are 2 denticles per millimeter on the base and medial region of the anterior carina (Figs.2, 3). On its tip, this value is slightly lesser (1.8 per mm). Only a short denticulate segment on the tip of the posterior carina is preserved, with 1.8 denticles per millimeter.

The basal portion of another tooth also shows 2 denticles per millimeter, but it is not possible to determinate if this denticulate segment belongs to the anterior or posterior carina.

The denticles on the anterior carina are as long as wide and chisel-like in lateral view (Fig.3). Most have the tip broken but the better preserved ones are distally rounded. The blood grooves, clearly visible along the anterior carina, are curved towards the base of tooth. The denticles on tip of both carinae are worn down.

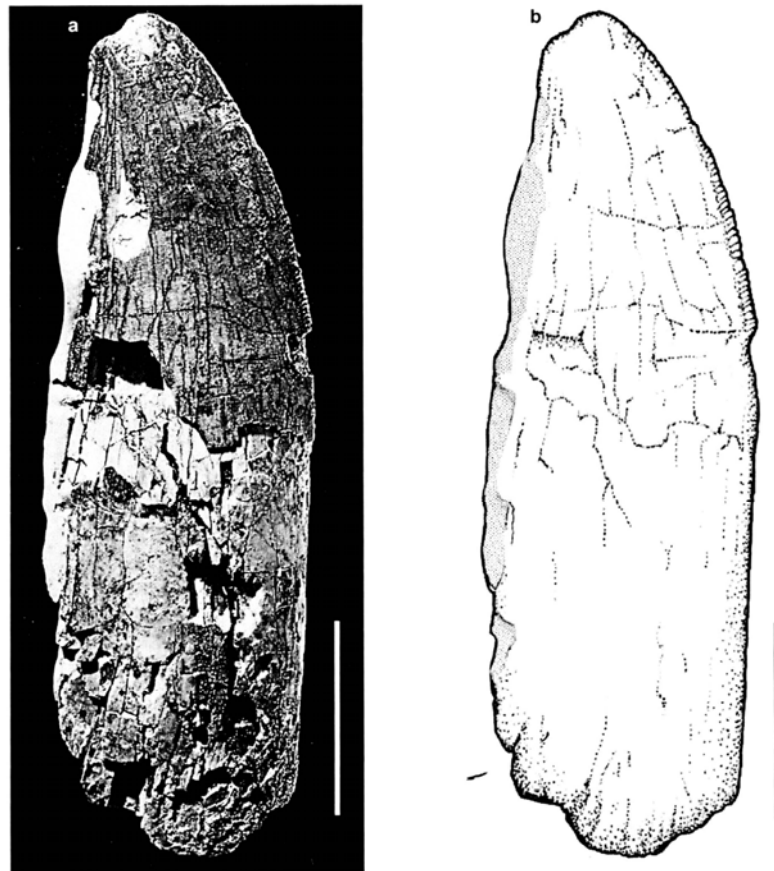


Fig.1- DGM 859-R, best preserved tooth: a) photograph, b) drawing. Scale bar: 20mm.

Comparisons of the teeth from the specimen DGM 859-R is hindered by the limited information available from other theropod taxa. This includes all remaining abelisaurids, since, as pointed out before, in none dental features were studied in detail.

One of the few detailed theropod teeth descriptions was provided by CURRIE, RIGBY JR. & SLOAN (1990), who examined some specimens from the Judith River Formation (Alberta, Canada). The dromaeosaurid (Dromaeosaurinae) *Dromaeosaurus albertensis* Matthew & Brown, 1922 bears slightly curved denticles, with blood grooves oriented perpendicularly to the longitudinal axis, differing from the chisel-like denticles and curved blood grooves found in the Brazilian material. Also differing from DGM 859-R, the denticles of the dromaeosaurid (Velociraptorinae) *Sauromitholestes langstoni*

Sues, 1978 are sharply pointed and strongly curved towards the apex of the tooth. Furthermore, the latter has finely denticulate anterior carinae, with 7 denticles per millimeter. The troodontid *Troodon formosus* (Leidy, 1856) presents strongly hooked and sharply pointed denticles (even more than *Sauromitholestes*) once again differing from the conditions found in the Brazilian material described here. The teeth serration of *Richardoestesia gilmorei* (Maniraptora *indet.*, CURRIE, RIGBY JR. & SLOAN, 1990) is restricted to the posterior carina, also differing from DGM 859-R.

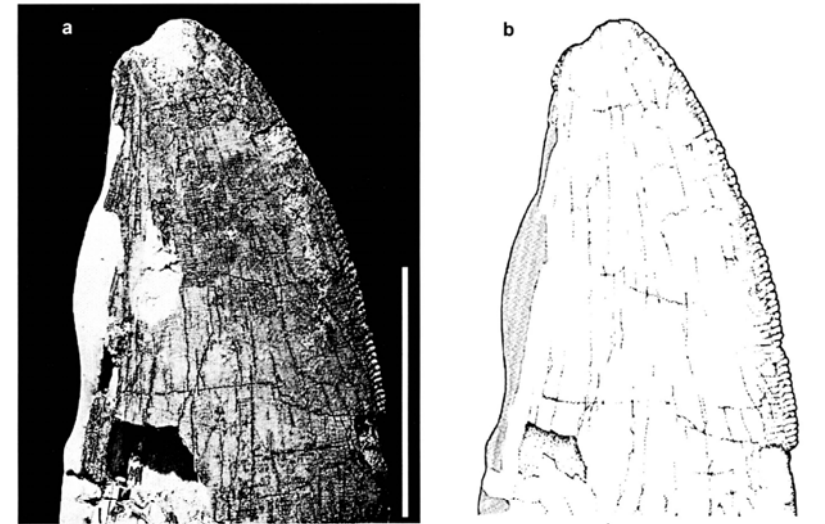


Fig.2- DGM 859-R, detail from the same tooth of figure 1: a) photograph, b) picture. Scale bar: 10mm.

The Brazilian specimens share some similarities with the tyrannosaurid teeth described by CURRIE, RIGBY JR. & SLOAN (1990), which are typically 80mm height and show 2 denticles per millimeter in both carinae. Furthermore, the blood grooves are curved towards the base of the tooth, as observed in DGM 859-R. The main difference is the transverse section, which in tyrannosaurids tends to be D-shaped, differing from the more elliptical and laterally compressed condition found in the Brazilian abelisaurid. Furthermore, sharp ridges of enamel along the denticles were reported in the tyrannosaurid teeth (CURRIE, RIGBY JR. & SLOAN, 1990) and are not present in the DGM 859-R.

A few studies of isolated theropod teeth from the Bauru deposits in Brazil were carried out recently. In a preliminary examination of some material collected in the Peirópolis surroundings, KELLNER (1995, 1996) recognized six morphotypes, which can be compared with the abelisaur material described here. DGM 859-R shares with the teeth of Kellner's morphotype 1 (KM-1) the degree of lateral compression and the distal curvature of the anterior margin. Both have straight and chisel-like denticles, which differ by being longer than wide in the Peirópolis material (contrary to the more sub-equal condition found in DGM 859-R). The main difference, however, is the number of denticles per millimeter, which in DGM 859-R varies from 2 on the base of

the anterior carina to 1.8 on the top *contra* 3 and 2,5 in KM-1, respectively. Kellner's second morphotype (KM-2) differs by having hooked denticles on the basal portion of the crown and number of denticles per millimeter (3 on base, 2 on top).

Compared with DGM 859-R, the most distinctive of Kellner's morphotypes are the third (KM-3) and fourth (KM-4), which have an oval cross-section, and longer denticles. The number of denticles per millimeter also differs (varying in KM-3 and KM-4 from 3 to 1.5, depending on the position on the carina, if anterior or posterior margin). KM-4 further differs by having a split anterior carina, a feature only known in dinosaurs (KELLNER, 1996).



Fig.3- DGM 859-R, detail of the denticles of the same tooth of figure 1 (drawing). Scale bar: 10mm.

The two remaining morphotypes found in Peirópolis (KM-5, KM-6) also differ by being overall much smaller than DGM 859-R and having inclined and hooked denticles. KM-5 further differs in the number of denticles (3-4 per millimeter) and longer blood grooves, which extend onto the surface of the crown, particularly on the posterior basal portion; KM-6 differs by having an inflated labial portion (giving it a very asymmetric aspect in antero-posterior view), oval to sub-circular basal cross-section (but has 2 denticles per mm, similar to DGM 859-R).

Still from the Peirópolis surroundings, CANDEIRO & BERGQVIST (2000) mentioned the presence of more isolated theropod teeth, but did not provide any details that could be used for comparison purposes.

BERTINI (1996) described a fragmentary premaxilla and one isolated tooth referring both to Abelisauridae, although no particular reason was presented (or can be observed on the published illustration) that could confirm this classification. Regarding the tooth, this author pointed out that it was not very well preserved and did not provide any detailed anatomical information other than that it is long and laterally compressed.

BERTINI *et al.* (1997) briefly mentioned the occurrence of theropod teeth from the Bauru deposits collected in sites of the State of São Paulo, but did not provide any morphological detail that could be used to compare with DGM 859-R. A detailed study of this material will be published soon (Aldirene Franco-Rosas, Rio de Janeiro, pers. com.).

SILVA & KELLNER (1998) reported the presence of two peculiar teeth, one from the Bauru deposits at Serra da Galga, Minas Gerais State - latter figured by KELLNER & CAMPOS (2000b) - and the other from the continental Cretaceous deposits of the Morro do Cambambe, Mato Grosso State, tentatively attributed to theropods closely related to *Carcharodontosaurus* (from Morocco) or *Giganotosaurus* (from Patagonia, Argentina). They contrast with DGM 859-R by the presence of transverse wrinkles on the enamel, which are also known in the African (SERENO *et al.*, 1996) and Argentinean material

(present in some teeth but not all, A.W.A.Kellner, MNRJ, pers. obs.). The isolated tooth from Serra da Galga also differs in the number of denticles per mm (2.5 - 1.5), while in the specimen from Morro do Cambambe this number is similar to DGM 859-R (2.2).

Also from the Morro do Cambambe, FRANCO-ROSAS (2001) briefly mentioned the presence of theropod teeth with 3 and 4 denticles per millimeter, that are curved towards the apex of the tooth, differing from the abelisaurid tooth described here.

#### DISCUSSION AND CONCLUSION

At present, there are only a few detailed studies of theropod dentition. Even of quite well-known taxa, when it comes to teeth, the available information is very slim and in most cases does not exist. Although some authors have pointed out the validity of using theropod teeth as a systematic tool (*e.g.*, CURRIE, RIGBY JR. & SLOAN, 1990) there is practically no dental synapomorphic characters used to diagnose a particular clade (or species). Perhaps the most significant exception are the Spinosauridae, whose peculiar dentition is listed among the features that distinguish this group from other theropods (STROMER, 1915; BUFFETAUT, 1992; KELLNER & CAMPOS, 1996). At present, it cannot be decided if the absence of dental characters in theropod diagnoses is related to a supposed homoplastic nature of the dentition, with several different theropod groups developing very similar teeth, or just due to the general lack of knowledge of theropod teeth in general.

If the teeth of DGM 859-R exemplify the main conditions present in all (or at least most) abelisaur taxa (what can only be established when more dental descriptions become available), the dental features of this theropod clade can be easily separated from the sub-circular transverse section of spinosaurids, some of which lack serrations like *Angaturama* (KELLNER & CAMPOS, 1996) or are only finely serrated like *Baryonyx* (CHARIG & MILNER, 1997), *Suchomimus* (SERENO *et al.*, 1998), and *Cristatusaurus* (TAQUET & RUSSEL, 1998). DGM 859-R also differs from the dromaeosaurid taxa from which teeth are known basically by the shape and number of denticles per millimeter (see CURRIE *et al.*, 1990).

The teeth of DGM 859-R show some similarity with the condition known in tyrannosaurids, particularly the number of the denticles, but differ by lacking the D-shaped transverse section (CURRIE, RIGBY JR. & SLOAN, 1990). The material described here also lacks the wrinkles of the enamel found in the allosaurid *Carcharodontosaurus* or the neotetanuran *Giganotosaurus* (CORIA & SALGADO, 1995).

From all isolated teeth described from Brazilian deposits, DGM 859-R is more similar to one morphotype (KM-1) described by KELLNER (1995, 1996). If the latter belong to abelisaur taxa cannot be confirmed at the time being. A characterization of the dental features with the eventual establishment of synapomorphies of Abelisauridae must await the detailed dental description of different taxa of this theropod clade.

#### ACKNOWLEDGEMENTS

The authors wish to thank Diogenes de Almeida Campos (Museu de Ciências da Terra/DNPM - RJ) for the access to the material described in this paper, and Maurílio S. Oliveira (Museu Nacional - Rio de Janeiro), for the drawings published here. D.A. Campos and Valéria Gallo (UERJ) are thanked for reviewing earlier versions of the manuscript. This project was partially funded by the Fundação Carlos Chagas de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ - E-26/150.912/99) and is connected to the project Arcossauros do Mesozóico Brasileiro (UFRJ-SID 37010221003-9).



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