EARTH SCIENCES
RESEARCH JOURNAL
Earth Sci. Res. J. Vol. 29, No. 2 (June, 2025): 195 -199

UNIVERSIDAD NACIONAL DE COLOMBIA

PALAEONTOLOGY

First record of Crocodyliformes Osteoderm from the Upper Cretaceous Bauru Group, State of Goiás , Brazil.

Thainara Aparecida Divina Arruda de Paula[1,2], Carlos Roberto dos Anjos Candeiro[1]*, Tamires do Carmo Dias[1], Luciano Vidal[3], Paulo Victor Luiz Gomes da Costa Pereira[2]

1. Laboratório de Paleontologia e Evolução, Curso de Geologia, Campus Aparecida de Goiânia, Universidade Federal de Goiás, Estrada Municipal S/N Quadra e Área Lote 04 – Bairro Fazenda Santo Antônio, 74971-451 – Aparecida de Goiânia – Brasil.

2. Sendo Programa de Pós Graduação em Biodiversidade Animal, Universidade Federal de Goiás

3. Departamento de Geologia, Instituto de Geociências, Universidade Federal do Rio de Janeiro, Ilha Do, Av. Athos da Silveira Ramos, 274 – Cidade Universitária, 21941-909, Rio de Janeiro – Rj, Brasil.

*Corresponding author: candeiro@ufg.br

ABSTRACT

The Crocodyliformes from the Late Cretaceous of South America were one of the main components of the tetrapod faunas found in rocks of the Bauru Group at Goiás, Minas Gerais and São Paulo states, Brazil. The presence of osteoderms has been reported in articulated specimens or found isolated in the palaeontological record. In the present work, we describe the first osteoderm of Mesoeucrocodylia from the Campanian-Maastrichtian of the Marília Formation (Bauru Group) of the state of Goiás. Paleo-UFG-114 has a quadrilateral shape, a rough external texture with radially oriented corrosion, an internal facet with the presence of intersecting grooves, foramina in the internal and external region and the presence of a poorly developed keel. These features differentiate them from the osteoderms of titanosaur dinosaurs found in the rocks of this geological unit. The presence of Paleo-UFG-114 in the state of Goiás reaffirms that mesoeucrocodylians were important components of the reptile fauna, and contributes to increasing knowledge about the group's geographic distribution in this poorly-explored region of Central Brazil.

Keywords: Osteoderm, Mesoeucrocodylia, Late Cretaceous, Bauru Group, Central Brazil.

Primer registro de un osteodermo Crocodyliformes del Cretácico Superior del Grupo Bauru, estado de Goiás

RESUMEN

Los Crocodyliformes del Cretácico Tardío de América del Sur fueron uno de los componentes principales de las faunas de tetrápodos halladas en rocas del Grupo Bauru en los estados de Goiás, Minas Gerais y São Paulo, Brasil. La presencia de osteodermos ha sido reportada en especímenes articulados o encontrados aislados en el registro paleontológico. En el presente trabajo describimos el primer osteodermo de Mesoeucrocodylia del Campaniano-Maastrichtiano de la Formación Marília (Grupo Bauru) del estado de Goiás. El espécimen Paleo-UFG-114 tiene una forma cuadrilátera, una textura externa rugosa con corrosión orientada radialmente, una faceta interna con presencia de surcos intersectados, forámenes en las regiones interna y externa y una quilla poco desarrollada. Estas características los diferencian de los osteodermos de dinosaurios titanosaurios encontrados en las rocas de esta unidad geológica. La presencia de Paleo-UFG-114 en el estado de Goiás reafirma que los mesoeucrocodilianos fueron componentes importantes de la fauna de reptiles y contribuye a aumentar el conocimiento sobre la distribución geográfica del grupo en esta región poco explorada del centro de Brasil.

Palabras clave: Osteodermo; Mesoeucrocodylia; Cretácico tardío; Grupo Bauru; Brasil central.

Record
Manuscript received: 20/12/2024
Accepted for publication: 25/05/2025

How to cite this item:
Paula, T. A. D. A., Candeiro, C. R. D. A., Dias, T. D. C., Vidal, L., & Pereira, P. V. L. G. D. C. (2025). First record of Crocodyliformes Osteoderm from the Upper Cretaceous Bauru Group, State of Goiás, Brazil. *Earth Sciences Research Journal,* 195-199. https://doi.org/10.15446/esrj.v29n2.118095

Introduction

The Bauru Group outcrops at areas of the states of Goiás, Mato Grosso do Sul, Minas Gerais and São Paulo (Fernandes & Coimbra, 1996; Batezelli *et al.*, 2019). Recently studies have proposed a new lithostratigraphic arrangement for this geological unit composed of the Adamantina, Uberaba, Marília and Serra da Galga formations (Batezelli *et al.*, 2019; Soares *et al.*, 2020). These layers have a rich fossil content regarding by plants, invertebrates and vertebrate remains found mainly in the Adamantina, Marília and Serra da Galga formations at the Minas Gerais and São Paulo states (Ihering, 1911; Pacheco, 1913; von Huene, 1931, 1933; Candeiro *et al*., 2006; Martinelli & Teixeira, 2015; Santos-Pereira *et al*. 2016; Candeiro & Figueirôa, 2017; see review in Brusatte *et al*., 2017; Candeiro *et al.*, 2018; Candeiro *et al*., 2020). Records of crocodyliforms have been reported since the beginning of the last century for these states (Price, 1945; Buffetaut, 1980; Brandt Neto *et al*., 1991, 1992; Carvalho and Bertini, 1998, 1999, 2000).

Crocodyliforms from the Bauru Group are known from complete skeletons and isolated teeth (Carvalho *et al*., 2004; Candeiro *et al*., 2018). Records of osteoderms have been described and are important elements found of this group (Marinho *et al*., 2006), being present on Baurusuchidae, conforme table 1. These osteoderms, along with associated cranial and postcranial remains, are often preserved with structural integrity. Several baurusuchid specimens, for instance, exhibit well-preserved anatomical features and low degrees of weathering and transport, suggesting favorable taphonomic conditions within the depositional environments of the Bauru Group (Bandeira *et al*., 2018).

Table 1. Crocodyliformes groups of Bauru Group with osteoderms used as comparisons.

TAXA	SELECTED AUTHORS
Peirosauridae such as *Montealtosuchus arrudacamposi*	Carvalho, Vasconcellos, Tavares, 2007
Peirosaurus torminni	Price, 1955
Uberabasuchus terrificus	Carvalho, Ribeiro, Avilla, 2004
Itasuchidae as *Itasuchus jesuinoi*	Price, 1955
Isolated osteoderms	e.g., Torres *et al.*, 2001
Baurusuchidae	Marinho *et al*., 2006

The south of the state of Goiás presents outcrops of sedimentary rocks belonging to the Adamantina and Marília formations, with great fossiliferous potential with records of invertebrates (Mezzalira, 1974), plants (Basilici & Dal'Bo, 2010; Candeiro *et al*., 2022), fish, turtles, crocodyliforms, sauropods and theropods (Candeiro *et al.*, 2018, 2020, 2024). This region has a great fossiliferous potential for crocodyliforms material findings, which could increase the knowledge about de diversity and distribution of this group at Central Brazil. In 2022, unpublished materials of crocodyliforms and dinosaurs were collected from Marília Formation in the municipality of Quirinópolis, state of Goiás by Laboratório de Paleontologia e Evolução (Curso de Geologia, Universidade Federal de Goiás) researching team. This article aims to describe the first crocodyliform osteoderm for the state of Goiás and thus contribute to records of this taxon on the region.

Geological setting

The municipality of Quirinópolis is located in the south of the state of Goiás (Brazil), where rocks from the Adamantina and Marília formations of the Bauru Group are exposed (Fig. 1; Soares *et al*., 1980). Ages are estimated to vary between Campanian-Maastrichtian to Adamantina Formation and aged as Maastrichtian to Marília Formation (*sensu* Batezelli *et al.*, 2019). The Marília Formation in the state of Goiás is the most prolific in terms of Cretaceous vertebrate remains in the state, but with records concentrated in the neighboring municipality of Rio Verde (see review in Candeiro *et al.*, 2020).

Institutional abbreviation

Paleo-UFG: Coleção de Paleontologia, Laboratório de Paleontologia e Evolução, Universidade Federal de Goiás, Aparecida de Goiânia, state of Goiás, Brazil.

UFG: Universidade Federal de Goiás

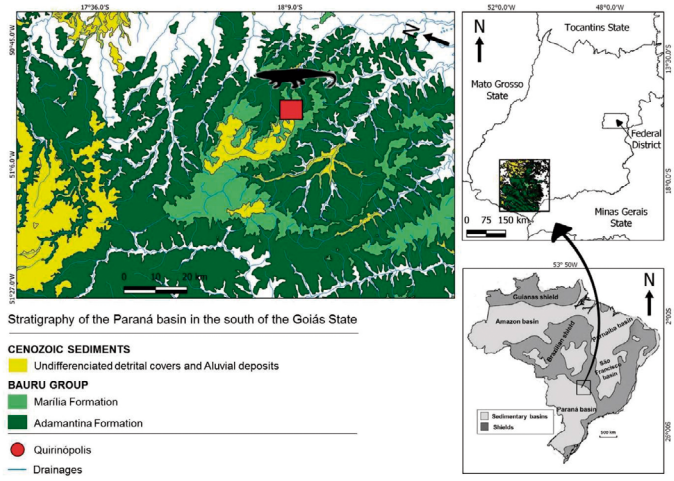

Figure 1. Lithostratigraphic map of the Bauru Group and the study area in the municipality of Quirinópolis, Goiás, Brazil (adapted from SIGAS, 2003).

Morro da Antena rural outcrop in Quirinópolis municipality (Marília Formation)

Fine-grained deposits, mainly claystones, siltstones and fine sandstones, form tabular to cuneiform bodies up to 8 m thick and are laterally extensive and intercalated between dune units (fine-grained sandstones with cross bedding) (Fig. 2). Internally, these units are characterized by massive to laminated claystones from 4 to 22 cm thick and siltstones where does the osteoderm studied here come from, this level presents abundant rootlets and desiccation cracks. In addition, there are beds from 2 to 17 cm thick, composed of laminated claystones interspersed with fine sandstones, mainly massive or with asymmetrical subcritical climbing ripples. A very striking feature of these deposits is that both the upper and lower contacts are non-erosive abrupt.

Figure 2. (A) stratigraphical profile of Morro da Antena outcroup of the Marília Formation; **(B)** locality of Morro da Antena in rural area of the municipality of Quirinópolis, southern Goiás State, indicating the level at which the osteoderm Paleo-UFG/114 was found (black silhouette).

Materials and methods

Paleo-UFG/114 consists of an osteoderm in a good state of preservation from Morro da Antena, municipality of Quirinópolis, state of Goiás, Brazil. The material is housed at Laboratório de Paleontologia e Evolução, Universidade Federal de Goiás of city Aparecida de Goiânia, state of Goiás, Brazil. The morphological description followed the criteria outlined by Marinho *et al.* 2006, considering the overall shape, external and internal ornamentation patterns, and the orientation and position of the keel. Identification of the specimen as pertaining to Mesoeucrocodylia was based on comparisons with published descriptions and figures of similar osteoderms from the Bauru Group and other Upper Cretaceous crocodyliforms. These comparisons were conducted using images and diagnostic features available in the literature. This approach allowed the recognition of shared morphological traits consistent with Mesoeucrocodylian taxa.

Paleo-UFG/114 was collected manually in the field in 2023 and prepared in 2023 and 2024 at the Laboratório de Paleontologia e Evolução, Curso de Geologia, Universidade Federal de Goiás. Measurements were recorded using

a Mitutoyo caliper from the 500 series, ABSOLUTE AOS Digital model with Absolute technology, with a capacity of 150mm/6. The views were taken using a Leica model EZ4 binocular stereomicroscope and the photographs were taken using a Canon EOS Rebel T4i camera with a Canon 18-55 lens. The measurement accuracy is on average ±0.02mm. Samples and reference and comparison figures came from publications.

Results

Systematic palaeontology

Crocodylomorpha Walker, 1970
Crocodyliformes Hay, 1930 (*sensu* Clark, in Benton & Clark, 1988)
Mesoeucrocodylia Whetstone & Whybrow, 1983
Notosuchia Gasparini, 1971

Material o specimen and provenance: The material consists of an isolated osteoderm of Crocodyliformes found in the Maastrichtian Marília Formation, Bauru Group and is listed in the Laboratório de Paleontologia e Evolução of the Universidade Federal de Goiás under number Paleo-UFG/114.

Description

The fossil is well preserved and has signs of breakage on the sides. The preservation and slight abrasion of the material indicate that it was rolled from a previous location until the collection site. Paleo-UFG/114 has a nearly flat internal face and a slightly convex external face, measuring 3 cm in length, 0.62 cm in depth and 2.15 cm in width. It has a quadrilateral shape and is compressed dorsoventrally (Fig. 3).

The external surface has a rough texture, with grooves of different sizes well distributed throughout the region and a slightly centralized keel (Fig. 3A and B), not extending beyond the edge of the specimen. The internal face exhibits a range from smooth to finely pitted bone, pierced by numerous vascular foramina and intersecting grooves consistent with the condition described for Mesoeucrocodylia (Marinho *et al*., 2006). Lateral margins bear semi-rounded, polished breakage surfaces, indicating transport abrasion prior to final burial or by other biostratinomic interactions such as predation or necrophagy, although we believe this is less likely due to the aspects of wear seen throughout the osteoderm.

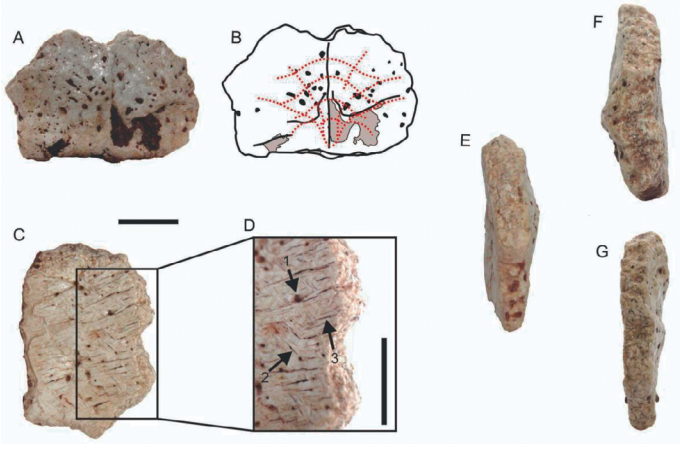

Figure 3. - Paleo-UFG/114, A: view of the external region; B: line drawing of the external region. The red line indicates the reconstructed keel. The gray shapes indicate abrasion on the surface; C: view of the internal region; D: detail of the internal region showing foramina [arrow 1] and intersecting grooves [arrows 2 and 3]; E, F and G: side view showing the slightly arched keel. Scale A, B = 2cm.

When compared to osteoderms of *Baurusuchus albertoi* Nascimento & Zaher, 2010, which are arranged in two parasagittal rows and show progressive enlargement from small cervical plates (~1 cm long) to large, imbricating caudal shields with pronounced midline crests and reticulate microtexturing (Nascimento & Zaher, 2010), Paleo-UFG/114 differs in keel development (more subdued and centrally confined) and lacks true imbrication. Relative to *Mariliasuchus amarali* Carvalho & Bertini, 1999, whose dorsal osteoderms are quadrangular with a continuous, prominent principal crest flanked by secondary crests and irregular grooves fading toward the border (Nobre & Carvalho, 2013), Paleo-UFG/114 presents a more irregular network of sulci, a weaker crest, and a dorsolateral plate geometry rather than the broad, tile-like arrangement seen in *Mariliasuchus*. Finally, the pattern of internal vascular canals and secondary remodeling in *Paleo-UFG/114* most closely matches that of *Montealtosuchus arrudacamposi* Carvalho, Vasconcellos & Tavares, 2007, whose osteoderms (13–53 mm long) bear an elevated median keel, shallow grooves, and punctate vascular canals within a predominantly woven–parallel-fibered bone matrix (Tavares *et al*., 2015)

Discussion and conclusions

Osteoderms are not exclusive for Crocodylomorphs, being present also in titanosaur sauropods (e.g., D'Emic *et al*. 2009). Comparing with other groups that have titanosaurian osteoderms, Paleo-UFG/114 differ from those due to the lack of a rough internal surface, with an interlaced bone pattern, the presence of a bulb and root separated by a cingulum, according to morphology regarded by D'Emic *et al*. (2009). The identification of Paleo-UFG/114 as a crocodyliforms osteoderm is based on: (1) its rough external texture with radially oriented pitting; (2) an internal facet, with the presence of intersecting grooves that may have been caused by contact with underlying tissue, with the presence of foramina in this region; (3) presence of a keel whose elevation differs according to the region to which the osteodems belongs (Marinho *et al.,* 2006).

When dealing with crocodyliforms, osteoderms are separated into nuchal (cervical), dorsal (thoracic), caudal, gastral (ventral/abdominal) and appendicular parts of the body (Ross and Mayer, 1983; Frey, 1988; Salisbury and Frey, 2001). Hill (2010) subdivided the dorsal osteoderms into paravertebral and dorsal accessory regions, the latter of which may be the region belonging to the osteoderm described here in this work because they are quadrilateral, dorsoventrally compressed, similar to plates in general structure and with the presence of a slight keel that does not exceed the margin of the osteoderm. Also according to Hill (2010), this type of osteoderm can vary in its dimensions depending on the region in which it is found, being the closest to the dorsal accessory wide than longer and those located more laterally can be the equal or longer and the keel also presents variations in its development, especially as it is positioned more laterally on the dorsal dermal shield (Filippi *et al*. 2013). On the inner surface of Paleo-UFG/114, there are intercrossing grooves reported for other osteoderms of *Notosuchia,* Mesoeucrocodylia, such as *Itasuchus* (Marinho *et al*., 2006) and *Montealtosuchus* (Tavares *et al*., 2015).

The Notosuchians form a clade of crocodyliforms of varying sizes and habits known, mainly from the Upper Cretaceous strata of South America (Carvalho, *et al.* 2004; Tavares *et al.,* 2015; Candeiro *et al*., 2018). Recently, postcranial remains belonging to mesoeucrocodilians were reported from the strata of the Marília Formation at Rio Verde municipality (Candeiro *et al.,* 2018) and the first skeleton of *Caipirasuchus* from the state of Minas Gerais, Brazil, described by Martinelli *et al.* (2018). Paleo-UFG/114 is the first osteoderm occurrence of this type of material in the state of Goiás. Therefore, the discovery presented reinforces the morphological diversity of these elements and their importance for the paleoecological and paleobiogeographic interpretation for the region. Additionally, it contributes to the group's knowledge in the state of Goiás, indicating the fossiliferous potential of the location and increasing the understanding of the Cretaceous

paleofauna in Central Brazil.

Acknowledgements

Our collaborative project was funded by a grant from the Fundação de Amparo à Pesquisa de Goiás (FAPEG, 2023/24).

References

Basilici, G. & Dal' Bo, P. F. F. (2010). Anatomy and controlling factors of a Late Cretaceous aeolian sand sheet depositional system - the Marília and the Adamantina formations, NW of the Bauru Basin, Brazil. *Sedimentary Geology*, 226:71-93.

Batezelli, A., Ladeira, F.S.B., Nascimento, D.L. & Silva, M.L. (2019). Facies and palaeosol analysis in a progradational distributive fluvial system from the Campanian –Maastrichtian Bauru Group, Brazil. *Sedimentology* 66(2):699-735. https://doi.org/10.1111/sed.12507.

Brandt Neto, M., Barcha, S.F., Manzini, F.F. & conferir para todos Brighetti, J.M.P. (1991) Nova ocorrência de crocodilianos na região noroeste do Estado de São Paulo. Geociências, UNESP, v. 10, pp. 191-203.

Brandt Neto, M., Manzini, F.F. & Bertini, R.J. (1992) Sobre um membro locomotor dianteiro de Baurusuchidae (Crocodylia), da região de General Salgado (SP). Resumos Expandidos do 2° Simpósio sobre as Bacias Cretácicas Brasileiras, Rio Claro, 1992, UNESP - Campus de Rio Claro/SP, pp. 163-164.

Buffetaut, E. (1980) Histoire biogéographique des Sebecosuchia(Crocodylia, Mesosuchia): un essai de interprétation. Annales de Paléontologie (Vertébrés), v. 66, pp. 1-18.

Brusatte, S. L., Candeiro, C. R. A., & Simbras, F. M. (2017). The last dinosaurs of Brazil: the Bauru Group and its implications for the end-Cretaceous mass extinction. Anais da Academia Brasileira de Ciências, Rio de Janeiro, 89, 1465 1485.

Candeiro, C. R. A., Martinelli, A. G., Avilla, L. S. & Rich, T. (2006). Tetrapods from the Upper Cretaceous (Turonian-Maastrichtian) Bauru Group of Brazil - a reappraisal. Cretaceous Research, 27, 923-946.

Candeiro, C. R. A. & Figueirôa, S.F.M. (2017). Early twentieth-century paleontological research of Freidrich von Huene - contributions to the knowledge of Late Cretaceous vertebrates of Central Brazil. Historical Biology, 29, 1-10.

Candeiro, C. R. A. *et al.*, (2018). New reports of Late Cretaceous reptiles from the Bauru Group of southern Goiás State, Brazil. Journal of South American Earth Sciencer, v. 85, p. 229-235, 2018.

Candeiro, C. R. A.; Brusatte, S. L. & Simbras, F. M. (2018). Occurrence of tetrapod fossils in Goiás state: A rediscovery in Central Brazil. In: Figueiredo, A. E. Q., Oliveira, P. V. (Eds). Proceedings of the XI Simpósio Brasileiro de Paleontologia de Vertebrados; Jul 16-20; Teresina (PI): Boletim de Resumos.

Candeiro, C. R. A.; Brusatte, S. L.; Simbras, F. M.; Costa, R. G. F.; Ulian, M.; Ferreira, B. M.; Lima, C. V.; Pereira, P. V. & Morais, E. M. (2020). First record of a theropod (Dinosauria, Theropoda) from the Late Cretaceous of the Bauru Group, southern Goiás state, Brazil. Research, Society and Development, 9, e563985261.

Candeiro, C. R. A.; Lima, C. V.; Canile, F. M.; Brusatte, S. L.; Dias, T. C.; Ferreira, B. M.; Lopes, R. F. & Rodrigues, J. E. C. (2022). Late Paleozoic, Late Cretaceous and Pleitocene-Holocene reptiles and mammals fauna: a review from Goiás State, Brazil. BOLETÍN GEOLÓGICO Y MINERO 133 (4):37-53.

Candeiro, C. R. A.; Ribeiro, T.; Paula, T. A.; Pereira, P. V. G. C.; Vidal, L.; Gil, L. M.; Dias, T.; Gonzalez-Riga, B.; Brusatte, S. L. & Carabajal, A. P. (2024). The northernmost record of Abelisauridae (Theropoda: Ceratosauria) from the Upper Cretaceous Bauru Basin, Brasil. Journal of South American Earth Sciences *submitted*.

Carvalho, I.S. & Bertini, R.J. (1998) Paleoenvironments of the Brazilian Cretaceous notosuchians. Prog. and Abst. Crocodilian Biology and Evolution Conference, Australia, 1998, Department of Zoology, The University of Queensland, p. 19.

Carvalho, I.S. & Bertini, R.J. (1999) *Mariliasuchus*, um novo Crocodylomorpha (Notosuchia) do Cretáceo da Bacia Bauru, Brasil. Revista Geol. Colombiana, v. 24, pp. 83-105.

Carvalho, I.S. & Bertini, R.J. (2000) Contexto geológico dos notossúquios (Crocodylomorpha) cretácicos do Brasil. Revista Geol. Colombiana, v. 25, pp. 163-184.

Carvalho, I.S.; Ribeiro, L.C.B. & Avilla, L.S. (2004). *Uberabasuchus terrificus* sp. nov. a new crocodylomorpha from the Bauru Basin (Upper Cretaceous), Brazil. Gondwana Research, 7(4):975-1002.

Carvalho, I. S.; Vasconcellos, F. M. & Tavares, S. A. S., (2007). *Montealtosuchus arrudacamposi*, a new peirosaurid crocodile (Mesoeucrocodylia) from the Late Cretaceous Adamantina Formation of Brazil. Zootaxa 1607, 35e46.

D'Emic, M. D.; Wilson J. A. & Chatterjee S. (2009). The Titanosaur (Dinosauria: Sauropoda) osteoderm record: Review and First Definitive Specimen from India. Journal of Vertebrate Palenontology 29(1):165-177, Mach 2009.

Fernandes, L. A & Coimbra, A. M. (1996). A Bacia Bauru (Cretáceo Superior, Brasil). Anais da Academia Brasileira de Ciências, Rio de Janeiro, v. 8, n. 2, p. 195205.

Filippi, L. S.; Cerda, I, A. & Garrido, A. C. (2013). Morfología e Histología de OSteodermos de Un Peirosauridae de la Cuenca Neuquina. AMEGHINIANA - 2013 - Tomo 50 (1): 3-13

Frey, E. (1988). Das Tragsystem der Krokodileeine biomechanische und phylogenetische Analyse. Stuttgarter Beitr ¨age zur Naturkunde A 426:1–60.

Hill, R. V. (2010). Osteoderms of *Simosuchus clarki* (Crocodyliformes: Notosuchia) from the Late Cretaceous of Madagascar, Journal of Vertebrate Paleontology, 30:sup1, 154-176, DOI: 10.1080/02724634.2010.518110

Ihering, F. (1911). Fósseis de São José do Rio Preto. Revista do Museu Paulista, 8, 141-146.

Lindoso, R. M.; Marinho, T. S.; Santucci, R. M.; Medeiros, M. A. & Carvalho, I. S. 2013. A Titanosaur (Dinosauria: Sauropoda) osteoderm from the Alcântara Formation (Cenomanian), São Luís Basin, Northeastern Brazil. Cretaceous Research 45:43 - 48.

Marinho, T. S., Ribeiro, L. C. B. & Carvalho, I, S. (2006). Morfologia de Osteodermos de Crocodilomorfos do Sítio Paleontológico de Peirópolis (Bacia Bauru, Cretáceo Superior). Anuário do Instituto de Geociência - UFRJ. Vol. 29 -2 /2006. p. 44-53

Martinelli, A. G. & Teixeira, V. P. A. (2015). The Late Cretaceous vertebrate record from the Bauru Group at the Triângulo Mineiro, southeastern Brazil. Boletin Geologico y minero, 62, 129-158.

Martinelli, A. G., Marinho, T. S., Iori, F. V. & Ribeiro, L. C. B. (2018), The first Caipirasuchus (Mesoeucrocodylia, Notosuchia) from the Late Cretaceous of Minas Gerais, Brazil: new insights on sphagesaurid anatomy and taxonomy. PeerJ 6:e5594; DOI 10.7717/peerj.5594

Mezzalira, S. (1974). Contribuição ao conhecimento da estratigrafia e paleontologia do arenito Bauru. Boletim do Instituto Geográfico e Geológico, 51:1-163.

Pacheco, J. A. (1913). Notas sobre a geologia do vale do Rio Grande a partir da foz do Rio Pardo até sua confluência com o Rio Paranaíba. Comissão Geográfica Geológica, 1, 33-38.

Price, L.I. (1945) A new reptile from the Cretaceous of Brazil. Notas preliminares e estudos. Departamento Nacional da Produção Mineral, v. 25, 8p.

Price, L.I. (1955). Novos crocodilídeos dos arenitos da Série Bauru. Cretáceo do Estado de Minas Gerais. Anais da Academia Brasileira de Ciências. 27: 487-498.

Ross, F. D. & G. C. Mayer. (1983). On the dorsal armor of the Crocodilia; pp. 305–331 in A. G. J. Rhodin and K. Miyata (eds.), Advances in Herpetology and Evolutionary Biology (Essays in Honor of Ernest E. Williams). Museum of Comparative Zoology, Cambridge, Massachusetts.

Salisbury, S. & E. Frey. 2001. A biomechanical transformation model for the evolution of semi-spheroidal articulations between adjoining vertebral bodies in crocodilians; pp. 85–134 in G. C. Grigg, F. Seebacher, & C. E. Franklin (eds.), Crocodilian Biology and Evolution. Surrey Beatty and Sons, Chipping Norton, New SouthWales.

Santos-Pereira, C.; Figueiredo-Lima, C. & Candeiro, C. R. A. (2016). Resultados preliminares del análisis de sedimentos del Grupo Bauru del sur de la Provincia de Goiás en la búsqueda de microvertebrados. In: Novas, F. E. (Ed). Proceedings of the XXX Jornadas Argentinas de Paleontología de Vertebrados Libro de resúmenes; May 17-20; Buenos Aires. p. 111.

Soares, P. C.; Landim, P. M. B.; Fulfaro, V. J. & Sobreiro Neto, A. F. (1980). Ensaio de caracterização do Cretáceo no Estado de São Paulo, Revista Brasileira de Geociências, 10:177-185.

Soares, M. V. T.; Basilici, G.; Marinho, T. S.; Martinelli, A. G.; Marconato, A.; Mountney, N. P.; Colombera, L.; Mesquita, Á. F.; Vasques, J. T.; Abrantes, F. R. & Ribeiro, L. C. B. (2020). Sedimentology of a distributive fluvial system: The Serra da Galga Formation, a new lithostratigraphic unit (Upper Cretaceous, Bauru Basin, Brazil). Geological Journal, v. x, p. 105807, 2020.

Tavares, S. A. S.; Ricardi-Branco, F & Carvalho, I. S. (2015). Osteoderms of *Montealtosuchus arudacamposi* (Crocodyliformes, Peirosauridae) from the Turonian-Santonian (Upper Cretaceous) of Bauru Basin, Brazil. Cretaceous Research 56: 651-661.

Torres, S. R.; Avilla, L. S.; Abrantes, E. A. L. & Bergqvist, L. P. (2001). Dinosaur osteoderms from the Adamatina Formation, Upper Cretaceous of São Paulo state, Brazil. Anais da Academia Brasileira de Ciências (2002) 74(2):361-370

Von Huene, F. (1931). Verschiedene mesozoische Wirbeltierreste aus Südamerika. Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, Abteilung A, 66, 181-198.

Von Huene, F. (1933). Ein Versuchzur Stammesgeschichte der Krokodile. Central blatt für Mineralogie, Geologie und Paläontologie, Abteilung B, 11, 577-585.