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Postcranial skeleton of *Campinasuchus dinizi* (Crocodyliformes, Baurusuchidae) from the Upper Cretaceous of Brazil, with comments on the ontogeny and ecomorphology of the species

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ABSTRACT

The Baurusuchidae is one of the most representative families of Crocodyliformes from the Upper Cretaceous of Brazil. Amongst the ten recognized species of the family in the world, eight are recovered from Bauru Basin outcrops. Despite its relative diversity and abundance, information on postcranial elements of species of the family is scarce in the literature. *Campinasuchus dinizi* is a baurusuchid found in the neocretaceous redstones of the Adamantina Formation of Bauru Basin (SE Brazil). The postcranial skeleton of the species is described based on five specimens, with the following bone elements identified: proatlas, intercentrum of the atlas; pedicles of the atlas; odontoid process; axis; three postaxial cervical vertebrae; nine dorsal vertebrae; eight caudal vertebrae; seven ribs and gastralia fragments; eleven chevrons; twelve osteoderms; pectoral and pelvic girdle; humerus; radius; ulna; *manus*; femur; tibia; fibula; and *pes*. *Campinasuchus dinizi* has the smallest and most delicate postcranial skeleton when compared with examined Baurusuchidae, with an inferred body mass of approximately 28 kg. Some elements of the postcranial skeleton of *C. dinizi* are also comparatively more robust (*e.g.* neural spines higher and more developed; vertebral body thicker; pelvic girdle more proeminent; limbs more elongated) than in some notosuchians, such as *Mariliasuchus amarali* and *Notosuchus terrestris*, and extant crocodyliforms such as *Caiman latirostris* and *Melanosuchus niger*. The mostly straight limbs of *C. dinizi* indicate a terrestrial habit, and suggests a semi-upright to upright posture during locomotion. The first descriptions of postcranial bones of a young specimen of *C. dinizi* and osteoderms of Pissarrachampsinae as well as comments about the distinct anatomy of some of those elements are also presented.

1. Introduction

An abundant fauna of cretaceous crocodyliforms assigned to the Notosuchia (*sensu* Pol et al., 2014) has been recovered in outcrops of the Bauru Basin (southeastern Brazil) (Carvalho et al., 2010). Species were mainly found in the Marilia and Adamantina formations and are included in three mesoeucrocodylian families: Baurusuchidae Price, 1945, Sphagesauridae Kuhn, 1968, and Peirosauridae Gasparini, 1982. The Baurusuchidae is one the most diversified fossil family of Crocodyliformes in terms of number of species and known specimens. Eight species of the Baurusuchidae are recognized in the Cretaceous of Brazil: *Baurusuchus pachecoi* Price, 1945; *Stratiotosuchus maxhechti* Campos, Suarez, Riff and Kellner, 2001; *Baurusuchus salgadoensis* Carvalho, Campos and Nobre, 2005; *Baurusuchus albertoi* Nascimento and Zaher, 2010; *Campinasuchus dinizi* Carvalho, Teixeira, Ferraz, Ribeiro, Martinelli,

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Neto, Sertich, Cunha, Cunha and Ferraz, 2011; *Pisarrachampsa sera* Montefeltro, Larsson and Langer, 2011; *Gondwanasuchus scabrosus* Marinho, Iori, Carvalho and Vasconcellos, 2013 and *Aplestosuchus sordidus* Godoy, Montefeltro, Norell and Langer, 2014. So far, the postcranium of *Baurusuchus albertoi* (Nascimento and Zaher, 2010), *B. salgadoensis* (Vasconcellos, 2009 [unpublished thesis]), *Stratiotosuchus maxhechti* (appendicular skeleton) and *Pissarrachampsa sera* (Godoy et al., 2016) are described (Riff and Kellner, 2011). Based on the cranial and dental analysis, terrestrial habits and hypercarnivory diet are proposed for these species (*e.g.* Riff and Kellner, 2001; Carvalho et al., 2005; Godoy et al., 2014).

Campinasuchus dinizi was described by Carvalho et al. (2011) based on four skulls found in the Adamantina Formation (Bauru Basin, Turonian-Maastrichtian *sensu* Dias-Brito et al., 2001). Postcranial remains belonging to five specimens of *C. dinizi* were subsequently recovered from the same locality. Those elements are described herein, and comparisons are made with other representative baurusuchids and relevant non-baurusuchid taxa. In addition to being properly described for the first time, features of the postcranial skeleton of *C. dinizi* are also very valuable for understanding the overall anatomy and postcranial variation in the Baurusuchidae.

2. Geological setting

The intense tectonic events in the Early Cretaceous related to the rupture of Gondwanaland and the opening of the Atlantic Ocean lead to an event of magma extrusion over the Paraná Basin, forming what is usually regarded as the Serra Geral Formation (Fernandes and Coimbra, 1996; Fernandes, 2004).

The Bauru Basin was formed by thermomechanical subsidence, being filled during the Coniacian-Maastrichtian, in a semi-arid to arid climate (Suguio et al., 1977; Paula e Silva and Cavaguti, 1994; Fernandes and Coimbra, 1996; Dias-Brito et al., 2001). The basin occupies an area of approximately 370.000 km^2, covering parts of the Brazilian states of Paraná, São Paulo, Mato Grosso do Sul, Mato Grosso, Goiás and Minas Gerais, in addition to northeastern Paraguay (Carvalho, 2000; Fernandes and Coimbra, 2000).

The postcranial elements described herein were recovered at Fazenda “Três Antas” (19°30′47″S, 50°06′20″W), Campina Verde, Minas Gerais State, Brazil, in outcrops of the Adamantina Formation (Carvalho et al., 2011). The Adamantina Formation is a unit that crops out in a large portion of the exposed area of the Bauru Basin, being only partially covered by the Marilia Formation in the central to eastern portion of the Bauru Basin (Dias-Brito et al., 2001; Carvalho et al., 2011; Fig. 1).

The Adamantina Formation is composed by fine-grained sandstones, reddened siltstones and grayish or greenish oxidized mudstones of Turonian-Santonian age (Dias-Brito et al., 2001; Paula e Silva, 2003). Faciological variations are observed in the sandstones of the Adamantina Formation, with cross laminations and cross stratification in a fluvial braided system (Paula e Silva et al., 2005). The paleoenvironment of the Adamantina Formation is inferred to have had been an alluvial plain reworked by fluvial systems with shallow lakes and a seasonal climate, intercalated between flood and arid periods, with a mostly dry and hot climate (Carvalho et al., 2011).

3. Materials and methods

3.1. *Specimens of* Campinasuchus dinizi *examined and comparative taxa*

Material examined consists of several postcranial elements of five specimens of *C. dinizi* (CPPLIP 1235 – holotype; CPPLIP 1237; CPPLIP 1435; CPPLIP 1436; CPPLIP 1437) recovered from the same outcrops of the holotypes and paratypes in the Adamantina Formation, Bauru Basin (Upper Cretaceous), Brazil. Those specimens are deposited in the “Centro de Pesquisas Paleontológicas Llewellyn Ivor Price” (CPPLIP), Uberaba, Minas Gerais state, Brazil. The following postcranial bone elements were identified: CPPLIP 1235 – proatlas, pedicles of the atlas, odontoid process and axis articulated to the skull; CPPLIP 1237 – the proatlas, the 4th, 6th, and 7th cervical vertebrae, the 5th to 10th dorsal vertebrae, and three posterior dorsal vertebrae, two anterior, two posteromedian, and four posterior caudal vertebrae (three terminal), the 2nd cervical rib and six dorsal ribs, two chevrons, and six osteoderms, a fragment of the scapular lamina, one coracoid, the right and left humerus, and one carpal (ulnar), the right and left ilium, the ischium, the right and left femur, the right and left tibia, the astragalus; CPPLIP 1435 – the first ten caudal vertebrae articulated among themselves and their respective chevrons; CPPLIP 1436 – the right and left humerus, the right and left radius, the right and left ulna, the carpals (ulnar, radial, pisiform and one distal carpal), the metacarpals and manual phalanges, the left tibia without the proximal epiphysis, one fragment of a tarsal (a fibular articular surface fragment), the metatarsals and pedal phalanges, CPPLIP 1437 – the proatlas, abdominal ribs (gastralia), and six osteoderms, the left scapula, a fragment of the right coracoid, the left humerus, the pubis, the left tibia and the proximal epiphysis of the right tibia, the left fibula.

Bone elements were kept in the sedimentary rock matrix due to their fragility, and also for preserving taphonomic information that might be useful in future studies. Comparative morphological analyses were performed through direct observations on phylogenetically relevant taxa of Crocodylomorpha and also from information gathered in technical literature. The complete list of comparative species (specimens and literature) is presented in Table 1.

3.2. Anatomical nomenclature

Anatomical terminology follows Reynolds (1897), Mook (1921a), Chiasson (1962), Tarsitano (1981), Romer and Parsons (1977), Wilhite (2003), Hildebrand and Goslow (2006), Kardong (2009), Pol et al. (2012) and Liem et al. (2013). The skeleton was described according to its likely position during life, and structural changes originating from the taphonomic process are highlighted.

Institutional Abbreviations: **AMNH** – American Museum of Natural History, New York, U.S; **DGP-MN-UFRJ** – Departamento de Geopaleontologia do Museu Nacional, Rio de Janeiro, Brazil; **MUZSP** – Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil; **UFRJ-DG** – Departamento de Geologia, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil; **DGM** – Divisão de Geologia e Mineralogia, Rio de Janeiro, Brazil; **CPRM** – Companhia de Pesquisas e Recursos Minerais, Rio de Janeiro, Brazil; **CPPLIP** – Centro de Pesquisas Paleontológicas Llewellyn Ivor Price, Minas Gerais, Brazil; **MACN-RN** – Rio Negro Collection, Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”, Buenos Aires, Argentina; **MUC** – Museo de Geología y Paleontología, Universidad Nacional del Comahue, Neuquén, Argentina; **MMP** – Museo de Historia Natural “Galileo Scaglia,” Mar del Plata, Argentina; **MPEF** – Museo Paleontológico “Egidio Feruglio”, Trelew, Argentina; **MPCA** – Museo Provincial “Carlos Ameghino”, Cippoletti, Argentina; **MCT** – Museu de Ciências da Terra – Companhia de Pesquisa de Recursos Minerais (CPRM), Rio de Janeiro, Brazil; **UA** – University of Antananarivo, Antananarivo, Madagascar; **UNESA** – Universidade Estácio de Sá, Rio de Janeiro, Brazil.

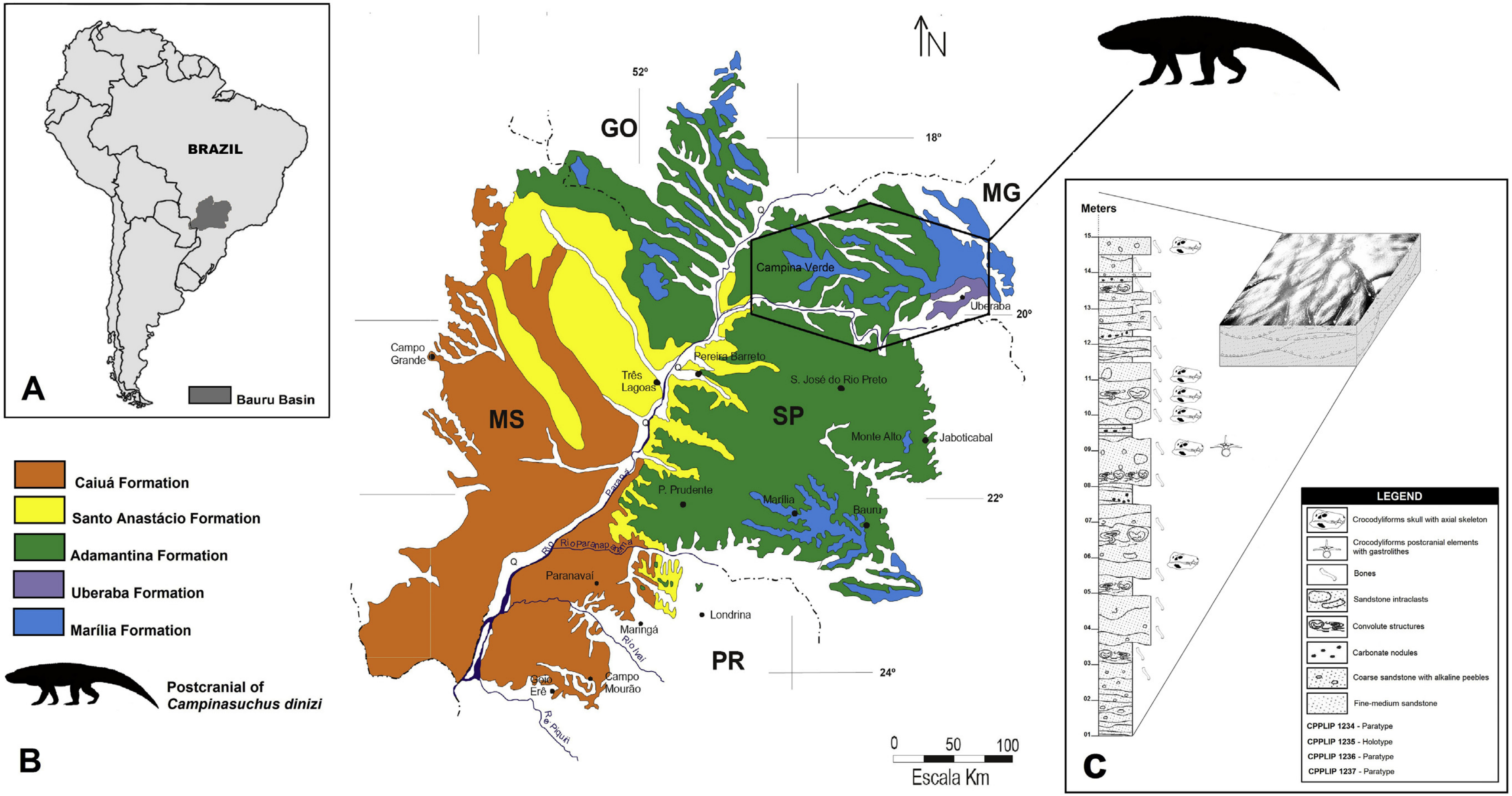


Fig. 1. Geological map of the Bauru Basin. Locality of the Bauru Basin in South America in **A**; Bauru Basin with location of the specimens of *Campinasuchus dinizi* highlighted in **B**; stratigraphic profile of the Adamantina Formation in **C** (modified from Carvalho et al., 2011).

Table 1
Comparative taxa.

Species	Specimens/Reference
Baurusuchus salgadoensis Carvalho, Campos and Nobre, 2005	UFRJ-DG 285-R; UFRJ-DG 288-R; UFRJ-DG 306-R; UFRJ-DG 307-R; UFRJ-DG 342-R; UFRJ-DG 417-R.
Baurusuchus albertoi Nascimento and Zaher, 2010	MZSP-PV 140; Nascimento and Zaher, 2010.
Stratiotosuchus maxhechti Campos, Suarez, Riff, and Kellner, 2001	DGM 1477-R; DGM-1430-R; MCT-1714-R; Riff, 2007; Riff and Kellner, 2011.
Pissarrachampsa sera Montefeltro, Larsson and Langer, 2011	LPRP/USP 0019; LPRP/USP 0739; LPRP/USP 0740; LPRP/USP 0741; LPRP/USP 0742; LPRP/USP 0743; LPRP/USP 0744; LPRP/USP 0745; LPRP/USP 0746; Godoy et al., 2016.
Mariliasuchus amarali Carvalho and Bertini, 1999	UFRJ-DG 50-R; UFRJ-DG 105-R; UFRJ-DG 106-R; Nobre and Carvalho, 2013.
Notosuchus terrestris Woodward, 1896	MACN-RN 1037, MACN-RN 1044, MUC-PV 287, MPCA-PV 249, MPCA-PV 250; Pol, 2005.
Simosuchus clarki Buckley, Brochu, Krause and Pol, 2000	UA8679; FMNH PR 2596; FMNH PR 2598; FMNH PR 2597; FMNH PR 2599; UA 9753; UA 9776; Georgi and Krause, 2010; Sertich and Groenke, 2010.
Yacarerani boliviensis Novas, Pais, Pol, Carvalho, Mones, Scanferla and Riglos, 2009	MNK-PAL5064-A; MNK-PAL5064-B; MNK-PAL5064-C; MNKPAL5064-D; MNK-PAL5064-E; Leardi et al., 2015.
Sebecus icaeorhinus Simpson, 1937	AMNH 3159; MMP 235; MPEF-PV 1776; MPEF-PV 3970; MPEF-PV 3971; MPEF-PV 3972; Pol et al., 2012.
Mahajangasuchus insignis Buckley and Brochu, 1999	UA 8654; Buckley and Brochu, 1999.
Caiman latirostris Daudin, 1802	DGM 156-RR; UNESA (No number identification)
Alligator mississipiensis Daudin, 1802	DGM 133-RR; Amer. Mus. Nº 7130; Mook, 1921a.
Caiman crocodilus (Linnaeus, 1758)	Vieira, 2011.
Melanosuchus niger Spix, 1825	Mook, 1921a; Franzo, 2010; Vieira, 2011.
Tomistoma schlegelii Müller, 1838 *apud* Mook, 1921a	Nº 12459; Mook, 1921a.
Crocodylus acutus Cuvier, 1807	Amer. Mus. Nº 7139; Mook, 1921a.
Crocodylus niloticus Laurenti, 1768	Reynolds, 1897.
Crocodylus palustris Lesson, 1831 *apud* Reynolds, 1897	Reynolds, 1897.
Crocodylus rhombifer Cuvier, 1807	Mus. Comp. Zool. Nº 4042; Mook, 1921a.
Crocodylus intermedius Graves, 1819 *apud* Mook, 1921a	Amer. Mus. Nº 8790; Mook, 1921a.

3.3. *Body mass estimation*

Body mass was estimated based on the total length of the femur (L_f) following Farlow's et al. (2005) equation $\mathbf{M_{(Kg)} = 191 \times 10^{-6} L_f^{3,33}}$ for the Crocodyliformes. Total length of the femur was measured considering the distance between the tip of the proximal epiphysis and the most distal point of the distal epiphysis, at its lateral condyle. The measurements were converted from centimeters to millimeters seeking a greater accuracy in the analysis. Values are presented in Table 2. A correlation analysis was subsequently performed using the software "Paleontological Statistics (Past)" in order to check if the degree of development of the femur is correlated with the body mass inferred for Crocodyliformes included in this study. Average of lengths was considered in cases where measurements of bones are different in the left and right femur, such as in *S. maxhechti*.

4. Systematic paleontology

Crocodylomorpha Walker, 1970
Crocodyliformes Hay, 1930 *sensu* Benton and Clark, 1988
Mesoeucrocodylia Whetstone and Whybrow, 1983 *sensu* Benton and Clark, 1988
Notosuchia Gasparini, 1971 *sensu* Pol et al., 2012
Baurusuchidae Price, 1945
Pissarrachampsinae Montefeltro, Larsson and Langer, 2011

Campinasuchus dinizi Carvalho, Teixeira, Ferraz, Ribeiro, Martinelli, Neto, Sertich, Cunha, Cunha and Ferraz, 2011
(Figs. 2–10)

Holotype. CPPLIP 1235, a well-preserved posterior skull and partial rostrum (according to Carvalho et al., 2011).
Paratypes. CPPLIP 1234, partial skull, its posterior portion missing; CPPLIP 1236, nearly complete rostrum; CPPLIP 1237, skull associated with postcranial elements (according to Carvalho et al., 2011).
Referred specimens. CPPLIP 1235, proatlas; CPPLIP 1237, most of the postcranium; CPPLIP 1435 – caudal vertebrae and chevrons; CPPLIP 1436 – forelimbs and hindlimbs; CPPLIP 1437 – part of the axial and appendicular skeleton.
Locality and horizon. The specimens were collected in outcrops of the Adamantina Formation (Turonian – Santonian), Bauru Basin, located in the Três Antas Farm, Minas Gerais State (MG), Brazil.
Diagnosis. According to Carvalho et al. (2011).
Emended diagnosis. Proatlas lateroventrally expanded with an aspect of an inverted "V"; pre and postspinal lamina mainly straight*; posterior edge of vertebral body slightly more expanded than anterior edge; articular facets of zigapophyses semielliptical; vertebral foramen rounded in the dorsal vertebrae, semielliptic in posterior dorsal vertebrae (presacrals); ribs thicker and more elongated than in Crocodylia; lateral bulge present in median dorsal ribs; capitulum shorter than tuberculum in cervical ribs, longer than tuberculum in median dorsal and posterior dorsal ribs; processes of hemal archs not connected; scapular lamina robust, anteroposteriorly expanded and lateromedially flattened; coracoid slightly compressed lateromedially; foramen of the coracoid located posteromedianally in the bone; ilium short and anteroposteriorly expanded; small and pointed protuberance in the anterodorsal portion of the preacetabular process of the ilium; postacetabular process of the ilium elongated and strong; acetabular crest developed; acetabulum concave and moderately deep; ischial process approximately rounded; ischial lamina moderately dorsoventrally elongated, with a acuminated posteroventral portion; pubis anteroposteriorly elongated and

Table 2
Length of the femura of Baurusuchidae.

Specimens	cm	mm
Left femur of *Campinasuchus dinizi* (CPPLIP 1237)	14.2	142
Right femur of *Campinasuchus dinizi* (CPPLIP 1237)	14.3	143
Left femur of *Pissarrachampsa sera* (LPRP/USP0019)	24.1	241
Right femur of *Baurusuchus salgadoensis* (UFRJ-DG 418-R)	20.0	200
Left femur of *Baurusuchus salgadoensis* (UFRJ-DG 285-R)	24.2	242
Right femur of *Baurusuchus salgadoensis* (UFRJ-DG 288-R)	29.6	296
Left femur of *Baurusuchus salgadoensis* (UFRJ-DG 417-R)	30.0	300
Right femur of *Baurusuchus albertoi* (MZUSP 140-R)	32.8	328
Right femur of *Stratiotosuchus maxhechti* (DGM 1477-R)	34.5	341
Left femur of *Stratiotosuchus maxhechti* (DGM 1477-R)	35.3	353

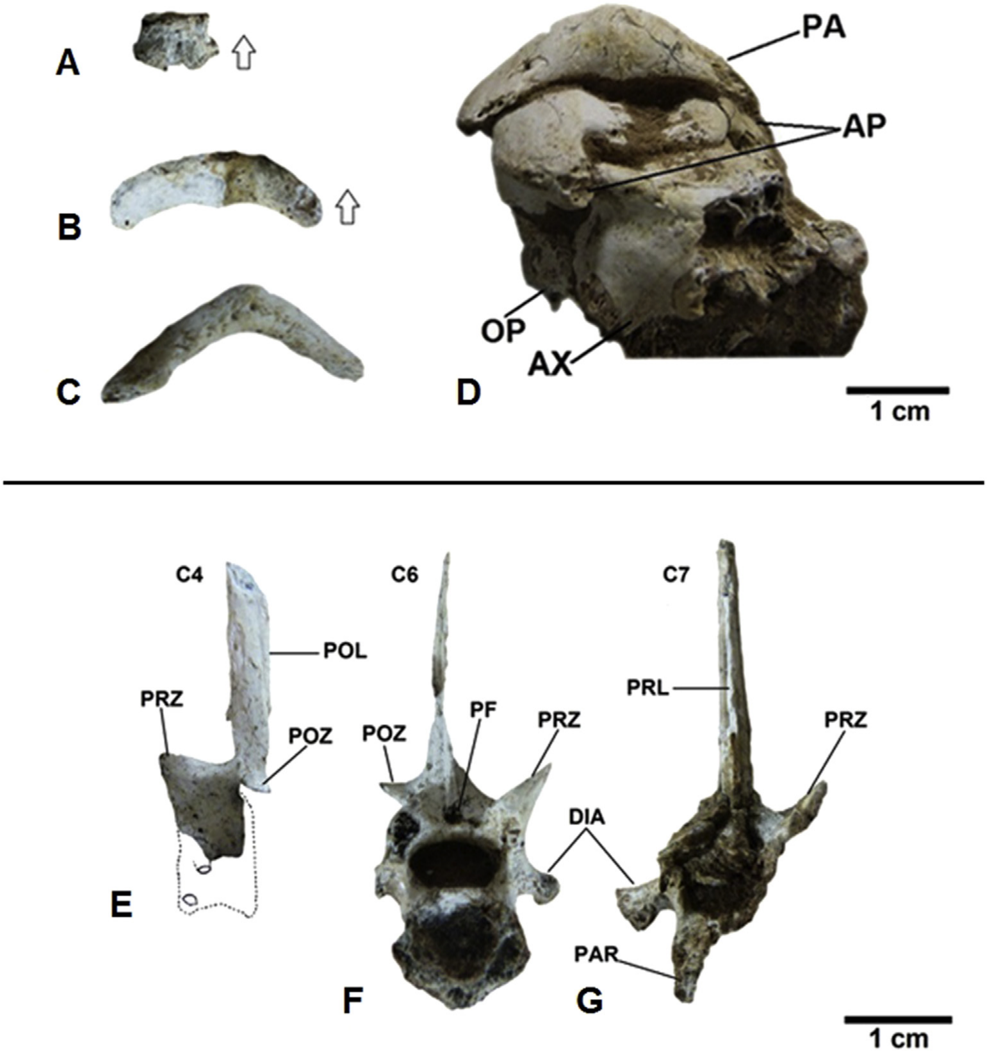


Fig. 2. Cervical vertebrae of *Campinasuchus dinizi*. Intercentrum in **A** (CPPLIP 1237) – ventral view; proatlas in **B** (CPPLIP 1237) – dorsal view; **C** (CPPLIP 1437) – posterior view; proatlas, pedicles of the atlas, odontoid process and axis in **D** (CPPLIP 1235) – posterior view; postaxial vertebrae in **E** (CPPLIP 1237) – lateral view (C4); in **F** and **G** – anterior view (C6 and C7, respectively). **Abbreviations**: AP – Atlas pedicles; AX – Axis; DIA – Diapophysis; OP – Odontoid process; PA – Proatlas; PAR – Parapophysis; PF – Prespinal fossa; POL – Postspinal lamina; POZ – Postzigapophysis; PRL – Prespinal lamina; PRZ – Prezigapophysis. Arrows indicate the anterior direction.

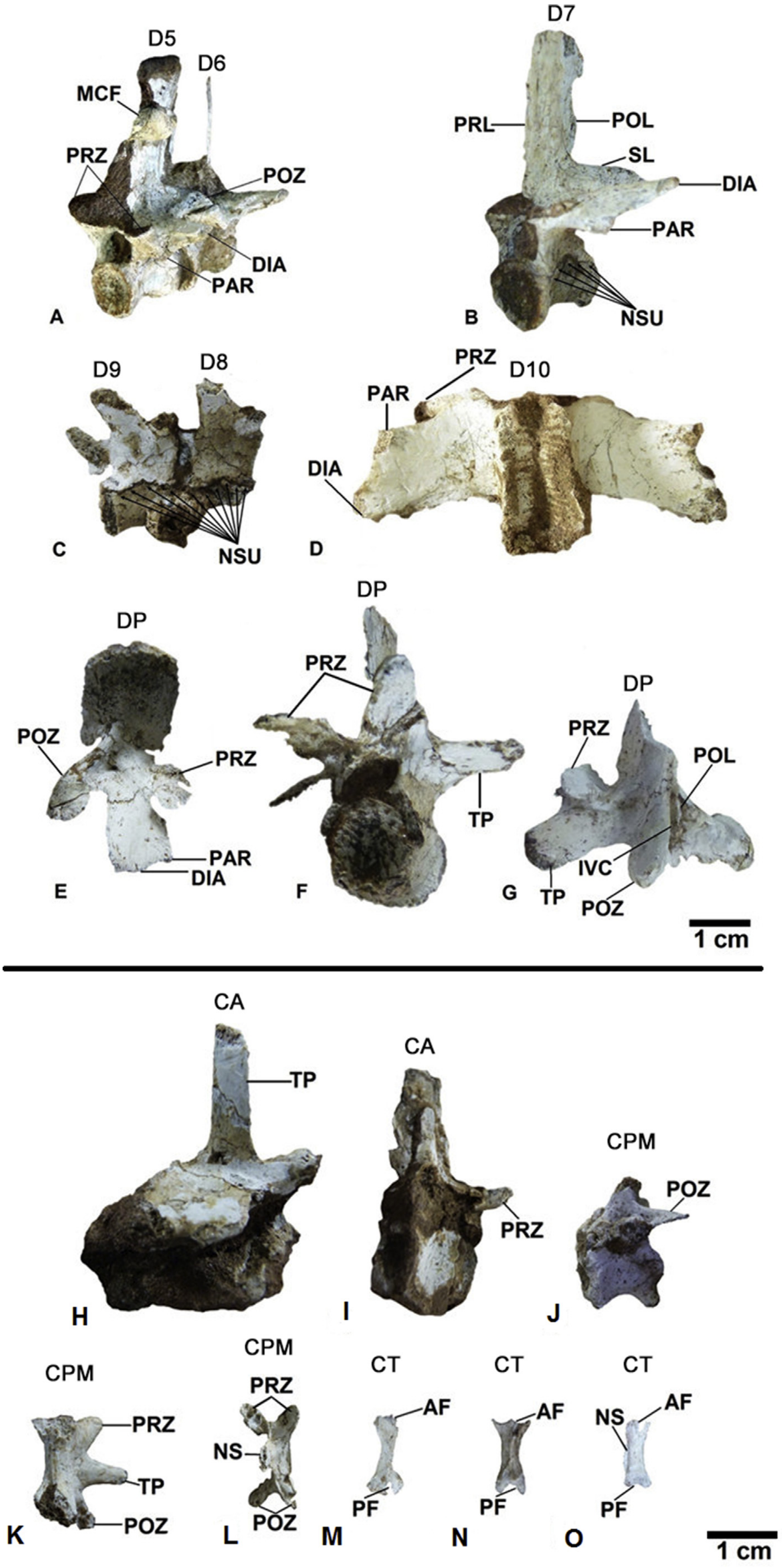
dorsoventrally flattened, with proximal tip more robust than the distal tip; proximal epiphysis of the femur with reduced medial orientation; fourth and greater trochanter moderately developed, less than in Crocodylia; proximal epiphysis of the tibia located in the anterolateral region of the bone; anterior margin of the proximal epiphysis of the fibula slightly convex, but posterior margin of the same structure moderately concave*; diaphyses of the stylopodium and zeugopodium more straight than curved*.

5. Description

5.1. Axial skeleton

Proatlas: The proatlas is well preserved in dorsal (Fig. 2B), lateral (Fig. 2B) and posterior (Fig. 2C and D) views in three specimens of *Campinasuchus dinizi* (CPPLIP 1235, CPPLIP 1237, CPPLIP 1437). In CPPLIP 1437, the bone is also partially observed in ventral view (Fig. 2D).

The proatlas is expanded lateroventrally and moderately compressed dorsoventrally. Its mid portion is thicker than the lateroventral borders, which are slightly oriented posteriorly. Overall, the proatlas of *C. dinizi* resembles an inverted "V" in anterior and posterior views, a common condition for Crocodylomorpha (Romer, 1956). The structure is also roughly similar in general shape to the condition present in other species of the Baurusuchidae (*e.g. Baurusuchus salgadoensis*; *Stratiotosuchus maxhechti*). In CPPLIP 1237, however, the proatlas is mainly expanded laterally, being smaller, slender, and less expanded posteriorly than in other specimens of *C. dinizi* and other baurusuchids where the structure is known (Fig. 2B). A similar condition occurs in young crocodilians (*e.g., Caiman crocodilus* [Linnaeus, 1758]; *Melanosuchus niger* [Spix, 1825]), where the proatlas is thin and laterally expanded, whereas in adults of those species the proatlas is more developed and lateroventrally oriented (Lima et al., 2011; Vieira, 2011). Shape of the proatlas is also variable in different species of the Alligatoridae. In *Caiman latirostris* Daudin, 1802, for instance, the proatlas is dorsoventrally flat and anterolaterally expanded, whereas the proatlas of *Melanosuchus niger* is slightly dorsoventrally flattened and is lateroventrally expanded, in a condition that is more reminiscent of the one in the Baurusuchidae (Vieira, 2011).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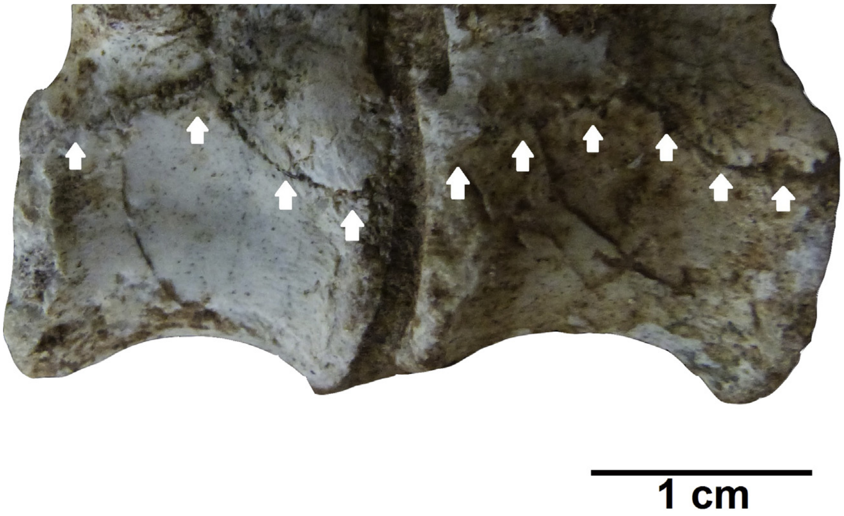

Fig. 4. Neurocentral suture open in dorsal vertebrae (D5 and D6) of *Campinasuchus dinizi* (CPPLIP 1237).

Atlas: The intercentrum and pedicles of the neural arch are preserved in CPPLIP 1237 (Fig. 2A) and CPPLIP 1235 (Fig. 2D), respectively.

The intercentrum is disarticulated and mostly embedded in the matrix, being observed ventrally and partially in anterior and posterior views (Fig. 2A). The pedicles, in turn, are articulated anteriorly with the occipital condyle, dorsally with the proatlas, posteroventrally with the axis and ventrally with the odontoid process (Fig. 2D).

The dorsomedial margins of the pedicles of the neural arch are convex, whereas their posterior margins are slightly pointed in their dorsal portion and concave medianally and ventrally. The lateral surface of the pedicles is bulged and has an anteroposterior crest that separates medianally their dorsolateral and dorsomedial portions. The ventral portion of the pedicles is hidden by the matrix in the single specimen were the structure was found (CPPLIP 1235; Fig. 2D).

The pedicles of the atlas of *C. dinizi* are more robust and laterally convex than the pedicles of *Baurusuchus albertoi*, being more similar to the condition present in *Baurusuchus salgadoensis* and *Stratiotosuchus maxhechti*. The pedicles of the atlas of *C. dinizi*, *Baurusuchus* and *Stratiotosuchus* are also markedly more developed in relation to the pedicles of the atlas of the sphagesaurid *Yacarerani boliviensis* (Leardi et al., 2015), being more expanded anteroposteriorly and laterally. In addition, the lateral surface of the pedicles of *C. dinizi*, *Baurusuchus* and *Stratiotosuchus* is convex-shaped, whereas in *Y. boliviensis* this region of the bone is only slightly convex (Fig. 2D). The pedicles in some extant crocodyliforms (*e.g. Caiman latirostris*), in turn, are peculiarly shaped when compared with the examined fossil crocodyliforms, with its dorsal region slender and expanded posteriorly, whereas the ventral region is narrower and slightly convex anteriorly.

The intercentrum of the atlas of *C. dinizi* (CPPLIP 1237) is short, wide and slender dorsoventrally, with a roughly square shape. The intercentrum body is constricted medianally and its anterior and posterior portions are expanded. In addition, its anterior portion is dense, narrow and its articular facet is slightly concave, while the posterior portion is very thin dorsoventrally, posterolaterally expanded and medianally divided by a small concavity. The intercentrum of *C. dinizi* is similar to the intercentrum of *Baurusuchus salgadoensis*, *B. albertoi*, *Simosuchus clarki* and in the Crocodylidae since the structure is short and wide in all those taxa. When compared with some non-Baurusuchidae fossil crocodyliforms such as *Mahajangasuchus insignis* Buckley and Brochu, 1999, however, the intercentrum in the Baurusuchidae and in the Crocodylidae is longer and narrower (Buckley and Brochu, 1999; Georgi and Krause, 2010; Nascimento and Zaher, 2010). The intercentrum of *C. dinizi* is also similar to that of *Simosuchus clarki* (Georgi and Krause, 2010), but the posterior margins of the structure in the former are slightly less expanded than in the latter. In *Mahajangasuchus insignis*, in turn, the posterior margins of the intercenter are markedly shorter than in *Simosuchus* and *Campinasuchus*.

Axis: Only the vertebral body of the axis of CPPLIP 1235 was preserved, albeit fragmented, with its posterior articular facet, neural spine and some regions in its anterolateral surface, missing. The structure is articulated dorsoanteriorly with the pedicles of the neural arch of the atlas and anteriorly with the odontoid process (Fig. 2D).

The prezygapophyses of the axis are very short and laterally projected as in *Baurusuchus albertoi* and *Yacarerani boliviensis*, but in a condition less marked than in *Simosuchus clarki* and Crocodylia (Nascimento and Zaher, 2010; Leardi et al., 2015). The facets of the prezygapophyses were not observed since they are articulated with the pedicles of the neural arches of the atlas.

The body of the axis is slightly convex laterally and its mid-dorsal portion is narrower than its mid-ventral portion. The

Fig. 3. Dorsal and caudal vertebrae of *Campinasuchus dinizi* (CPPLIP 1237). D5, D6 and D7 in **A, B** – anterolateral view; D8 and D9 in **C** – lateroventral view; D10 in **D** – ventral view; DP in **E** – lateral view; **F** – anterior view; **G** – in posterior view; Anterior CV in **H, I** – ventral and anterolateral views, respectively; Posteromedian CV in **J, K** – lateral and ventral views, respectively; terminal CV in **L, M, N, O** – laterodorsal, ventral, dorsal and lateroventral views. **Abbreviations**: AF – Anterior articular facet; DIA – Diapophysis; IVC – *Incisura vertebralis caudalis*; MCF – Metacarpal fragment; NS – Neural spine; NSU – Neurocentral suture; PAR – Parapophysis; PF – Posterior articular facet; POL – Postspinal lamina; POZ – Postzigapophysis; PRL – Prespinal lamina; PRZ – Prezigapophysis; SL – Suprapostzygapophyseal lamina; TP – Transverse process.

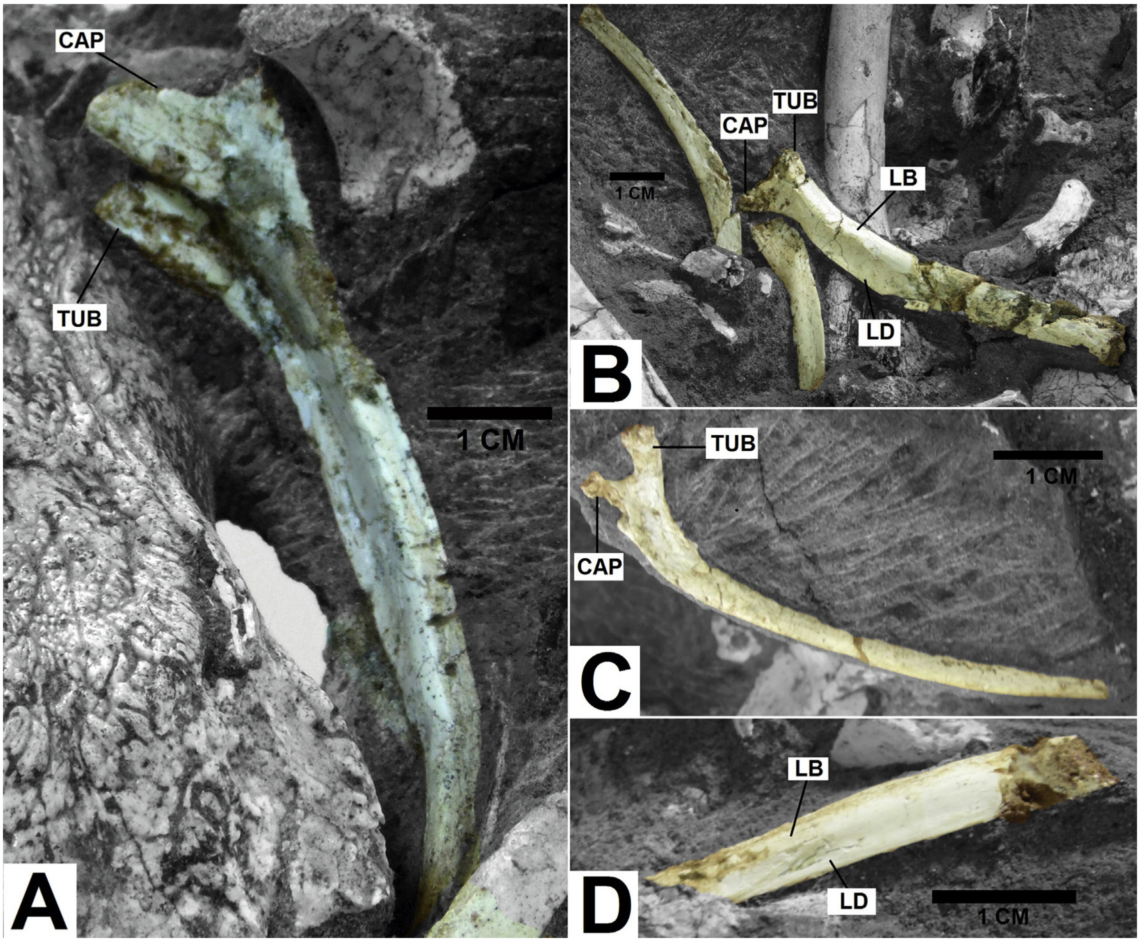

Fig. 5. Cervical and dorsal ribs of *Campinasuchus dinizi* (CPPLIP 1237). Cervical rib in **A** – medial view; mid-dorsal ribs in **B** – lateral view; posterior distal rib in **C** – lateral view; posterior rib fragment in **D** – lateral view. **Abbreviations**: CAP – Capitulum; LB – Lateral bulging; LD – Lateral depression; TUB – Tuberculum.

exposed portion of the bone is robust and slightly square shaped, but the odontoid process of the axis is partially embedded in the matrix (Fig. 2D).

The axis of *C. dinizi* is the smallest and thinnest among baurusuchids where the structure is known. When compared with other crocodyliforms examined (*e.g. Simosuchus clarki*; Georgi and Krause, 2010; *Mariliasuchus amarali*; Nobre and Carvalho, 2013), the vertebral body of the axis is more developed and its lateral surfaces are slightly more convex in the Baurusuchidae.

Postaxial cervical vertebrae: The cervical vertebrae C4, C6 and C7 of CPPLIP 1237 are preserved, with C4 exposed in lateral view, whereas C6 and C7 are exposed in lateral and anterior views (Fig. 2E–G).

Postaxial cervical vertebrae are higher than wide. Their neural spines are high, slender and medioposteriorly located in the neural arches, with a gradual difference in sizes. The distal tip of the neural spine of C4 is missing, but that spine seems to be the lowest of the cervical series, whereas the neural spine of C7 is the highest and more robust of them (Fig. 2E and G). In addition, the neural spine of C7 is slightly posteriorly inclined, being similar in this respect to the neural spine of the first dorsal vertebrae (Fig. 2G). The spinal laminae of the neural spines are thin and barely pronounced, but the postspinal lamina is slightly more posteriorly extended than the prespinal one.

Neural spines of the cervical vertebrae of *C. dinizi* are slenderer than those present in *Baurusuchus* and *Stratiotosuchus*, but those spines are lower in *Campinasuchus* and *Baurusuchus* when compared with *Stratiotosuchus.* Neural spines of the cervical vertebrae in the Baurusuchidae is also very distinct when compared with the less developed and shorter neural spines of *Notosuchus terrestris, Mariliasuchus amarali*, *Yacarerani boliviensis*, and the Crocodylia (Pol, 2005; Nobre and Carvalho, 2013; Leardi et al., 2015).

The anterodorsal region of the neural arch of C6 has a small, deep and rounded pre-spinal fossa (Fig. 2F). A pre-spinal fossa is also present in the same region of C7, but in this case, the structure is slightly oval, larger and deeper than the one in C6 (Fig. 2G).

The prezygapophyses of the cervical vertebrae are small, slightly directed anterodorsally and located close of the sagittal axis, although the most posterior prezygapophyses gradually becomes closer to the longitudinal axis. The articular facets of the prezygapophyses are oriented dorsomedially and are small and rounded in C4, but larger and elliptical in C6 and C7.

The postzygapophyses of C4, C6 and C7 are slightly larger and are located more dorsally than the prezygapophyses. The articular facets of the postzygapophyses are included in the matrix.

Overall, zygapophyses of the cervical vertebrae of *C. dinizi* are similar to the condition in *Baurusuchus* and *Stratiotosuchus*, being larger and longer than the same structures in *Yacarerani boliviensis*, *M. amarali*, *N. terrestris* and Crocodylia.

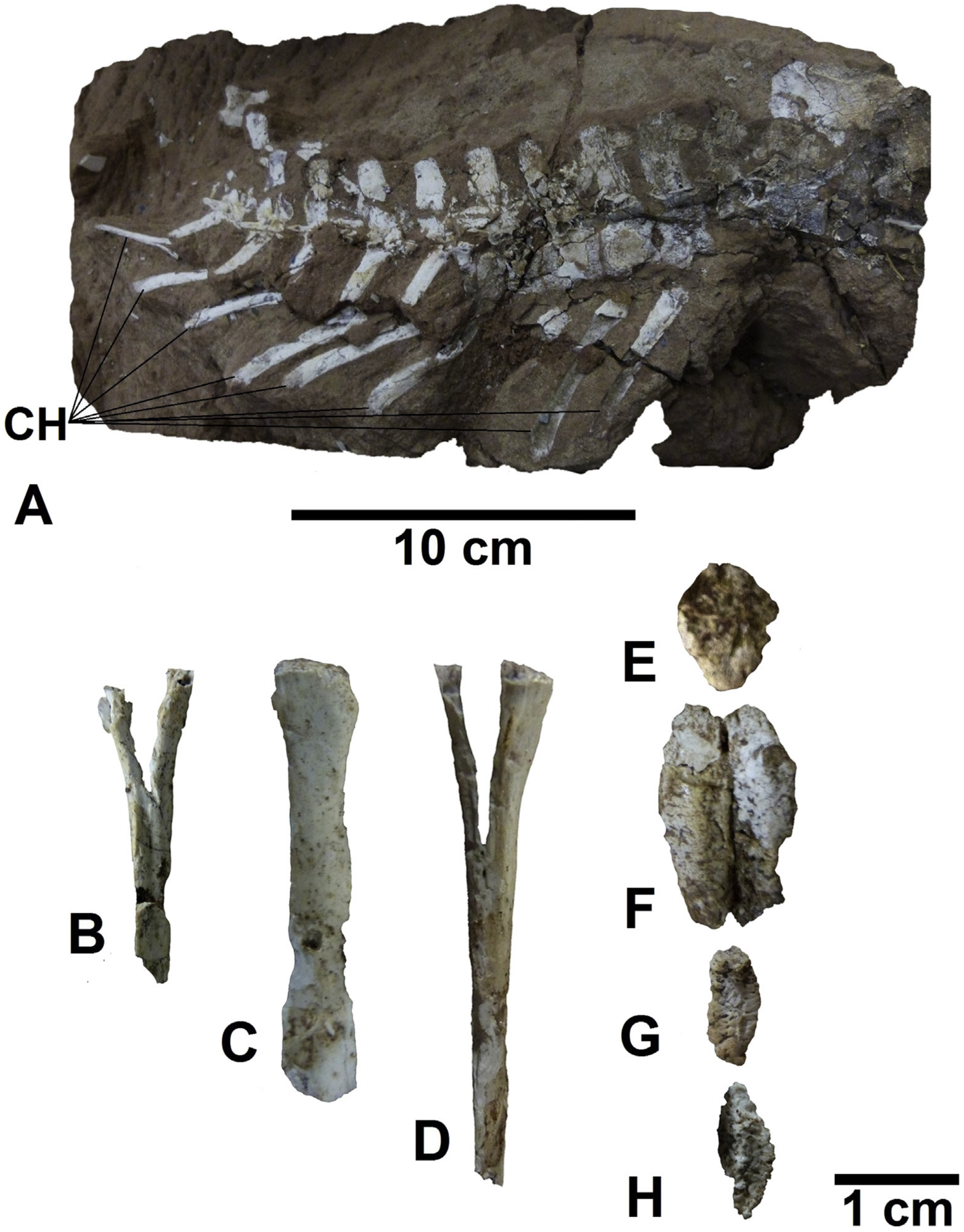

Fig. 6. Chevrons and osteoderms of *Campinasuchus dinizi*. Chevrons articulated with caudal vertebrae in **A** (CPPLIP 1435) – lateral view; chevrons in **B, C, D** (CPPLIP 1237) – anterior, lateral and posterior view, respectively; osteoderms in **E, F** (CPPLIP 1237), **G, H** (CPPLIP 1437) – dorsal view. **Abbreviations**: CH – Chevrons.

The suprapostzygapophyseal lamina of C6 extends lateroposteriorly, from the region of the neural spine to the dorsal margin of the postzygapophyses. The structure is slightly concave and reduced when compared with other crocodyliforms, such as *Yacarerani boliviensis*.

The diapophysis of C7 is lateroventrally expanded, located at the base of the neural arch, and its facet is slightly oriented laterally (Fig. 2G). The diapophysis of C6 is fragmented, but the structure seems to be shorter than the diapophysis of C7 (Fig. 2F). Parapophyses of the cervical vertebrae are mostly missing, with only a fragment of the proximal portion of a parapophysis preserved in C7 (Fig. 2G). This fragment is more expanded ventrally than the diapophysis, and both structures are lateroventrally projected.

The diapophyses of the cervical vertebrae of *C. dinizi* are slightly higher and closer to the transverse axis when compared with the condition of those structures in *Simosuchus clarki*, *Yacarerani boliviensis*, *Sebecus icaeorhinus*, and *Mahajangasuchus insignis*. In addition, diapophyses of *Campinasuchus* are longer than in *Sebecus icaeorhinus*, *Yacarerani boliviensis* and extant examined crocodyliforms, but shorter than in *Mahajangasuchus insignis* and *Simosuchus clarki*, being similar to the condition present in *Baurusuchus* (Buckley and Brochu, 1999; Georgi and Krause, 2010; Nascimento and Zaher, 2010; Pol et al., 2012; Leardi et al., 2015). The facets of the diapophyses are anteroposteriorly narrower than the condition observed in *Yacarerani boliviensis*, being also similar to the condition in *Baurusuchus* (Leardi et al., 2015). The fragment of the parapophysis of C7, in turn, indicates that the structure is more dorsally located than in *Sebecus icaeorhinus* and *Mahajangasuchus insignis* (Buckley and Brochu, 1999; Pol et al., 2012).

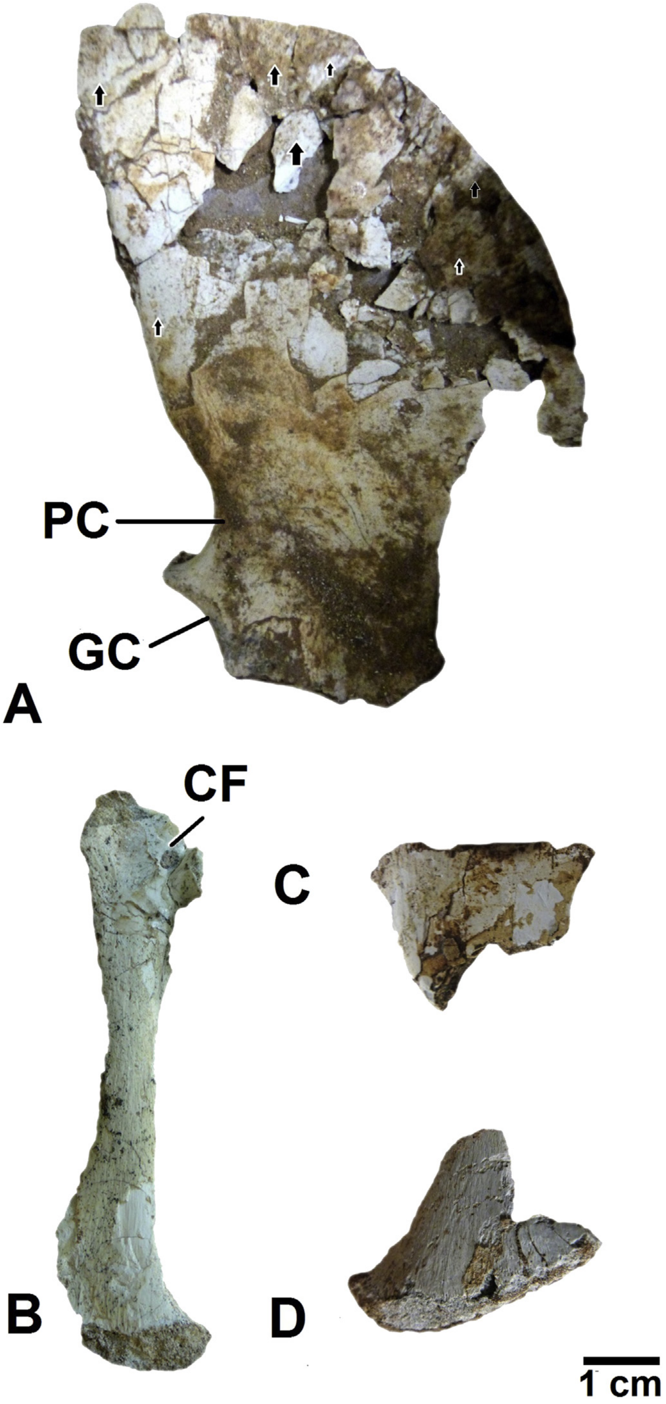

Fig. 7. Pectoral girdle of *Campinasuchus dinizi*. Scapula in **A** (CPPLIP 1437) – medial view; Coracoid in **B** (CPPLIP 1237) – lateroventral view; Fragment of the scapular lamina in **C** (CPPLIP 1237) – lateral view; Fragment of the distal end of the coracoid in **D** – lateral view. **Abbreviations**: CF – Coracoid foramen; GC – Glenoid concavity; PC – Posterior concavity. Arrows indicate muscle scars.

The vertebral foramen of the cervical vertebrae of *C. dinizi* is wider than high, resulting in an elliptical shape, and is located below the zygapophyses. When compared with other taxa, the vertebral foramen of the cervical vertebrae of *C. dinizi* is wider and lower than in *Sebecus icaeorhinus*, *Yacarerani boliviensis* and *Mahajangasuchus insignis*.

The mid-portion of the vertebral body of C6 is constricted laterolaterally, its ventral surface is concave, and the margins of its articular facets are expanded. In addition, the anterior margin of the articular facet of the vertebral body of C6 is more expanded than the posterior one. The anterior articular facet of the vertebral body is concave, but the posterior articular facet is hidden in the matrix. The hypapophysis of C6 is located at the anteroventral edge of the vertebral body, but it is not possible to infer the original shape of the structure, since that hypapophysis is fragmented (Fig. 2F). Hypapophysis in the posterior cervical vertebrae were also observed in other fossil crocodyliforms (*e.g. Yacarerani boliviensis*; *Simosuchus clarki* and *Sebecus icaeorhinus*), and the structure is slightly laminar in some species, such as in *S. icaeorhinus* (Pol et al., 2011; Leardi et al., 2015).

Dorsal vertebrae: Mid-dorsal vertebrae D5 to D10 (Fig. 3A–3D) and the last three posterior dorsal vertebrae (DP; Fig. 3E–G) were preserved in CPPLIP 1237. Vertebrae D5 and D6, and D8 and D9, are articulated to each other. All other preserved dorsal vertebrae are disarticulated.

The dorsal vertebrae can be observed in lateral and anterior (D5, D6, D7, D9, DP), ventral (D8, D9, D 10, DP), and dorsal and posterior views (DP).

Neural spines of dorsal vertebrae are higher and more robust than those of the cervical region, except DP, where the neural spine is lower and more anteroposteriorly expanded when compared with other dorsal vertebrae. Neural spine of DP is actually the more robust in the dorsal series, in spite of its relatively reduced height. Neural spines in general are located medioposteriorly in respective neural arches and are slightly inclined posteriorly, even though in a less pronounced degree when compared with spines of the cervical vertebrae. The condition in DP, again, is different, since neural spine of this vertebra is not inclined (Fig. 3E–G). The dorsal margin of neural spines is slightly rounded. Spinal laminae of the dorsal vertebrae are straight, more robust, and thicker than spinal laminae of the cervical vertebrae, especially the prespinal lamina. The postspinal lamina of DP is lower and shorter than the postspinal lamina of other dorsal vertebrae.

Neural spines of the dorsal vertebrae of *C. dinizi* are lower and slender than in *Baurusuchus*, *Stratiotosuchus* and non-baurusuchids, such as *Mahajangasuchus insignis* (Buckley and Brochu, 1999). However, neural spines in the Baurusuchidae (except *Pissarrachampsa sera*, where the neural spines of dorsal vertebrae are not preserved) are still developed than in most analyzed crocodyliforms such as *Mariliasuchus amarali*, *Yacarerani boliviensis* and members of the Crocodylia. Neural spines of the cervical and dorsal vertebrae of *Campinasuchus* also differ from the condition in *Mariliasuchus amarali* and *Notosuchus terrestris* in terms of position, since those structures are located medioposteriorly in their respective neural arches, whereas in *M. amarali* and *N. terrestris* neural spines are more medianaly located in the arches.

Neural spines of the dorsal vertebrae of *Campinasuchus*, *Baurusuchus* and *Stratiotosuchus* are also more inclined posteriorly than in *Mariliasuchus amarali*, *Simosuchus clarki*, and *Yacarerani boliviensis*, but differ in terms of inclination from the condition more marked in *Mahajangasuchus insignis* (Buckley and Brochu, 1999; Georgi and Krause, 2010; Nobre and Carvalho, 2013; Leardi et al., 2015).

Spinal laminae of neural spines of the cervical and dorsal vertebrae of *C. dinizi* are typically short and straight, similar to the condition in *Mahajangasuchus insignis* (Buckley and Brochu, 1999). However, margins of the spinal laminae of examined specimens of *C. dinizi* are strongly fragmented, and may have been more expanded during life, perhaps similar to the condition described for *Baurusuchus salgadoensis*.

The postspinal lamina of the neural spine of a posterior dorsal vertebra of *C. dinizi* in posterior view is extends dorsoventrally

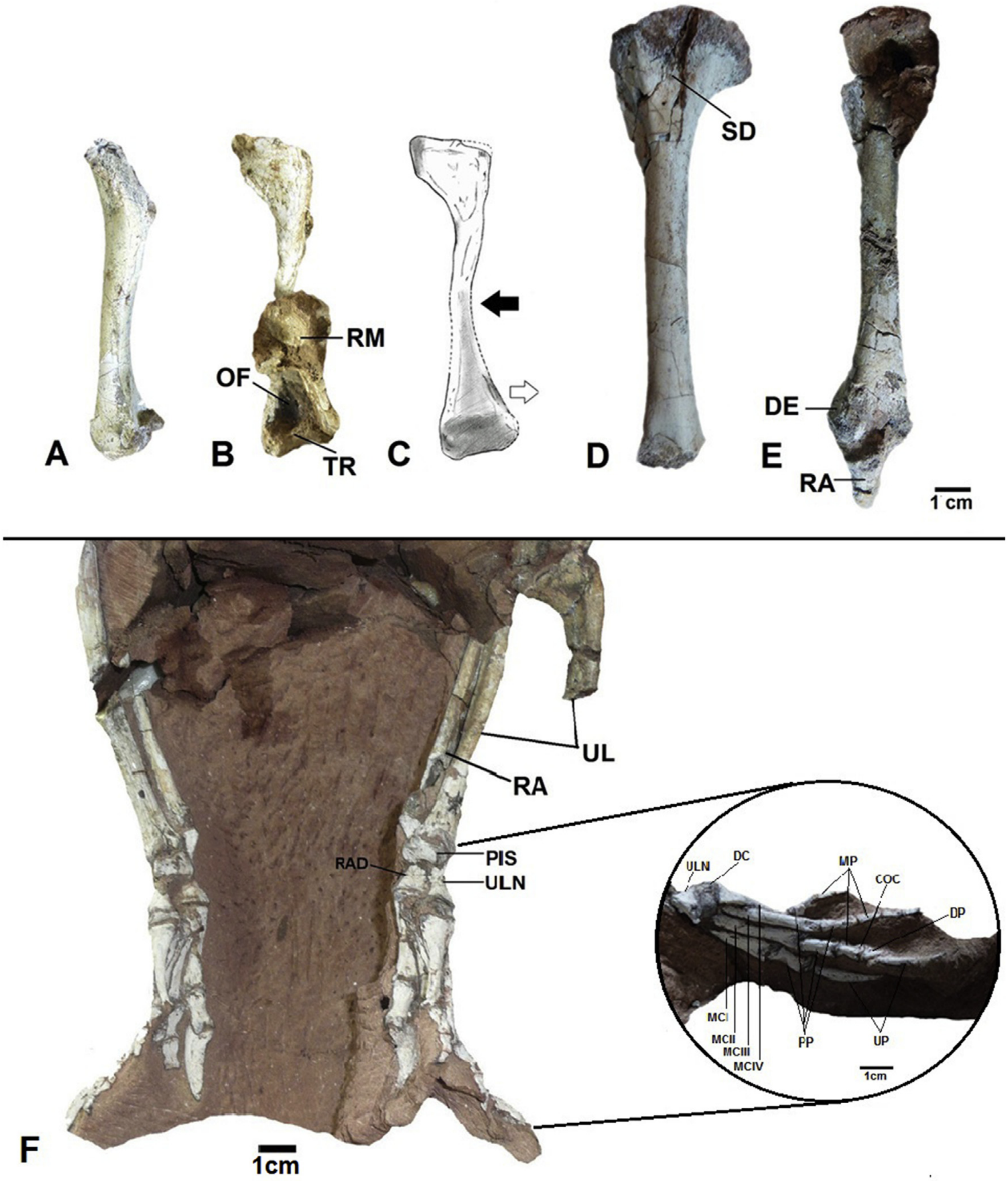

Fig. 8. Forelimbs of *Campinasuchus dinizi*. Humerus in **A** (CPPLIP 1237) – lateral view; **B** – anterior view; **C** – illustration indicating fractured region in anterior view; **D** and **E** (CPPLIP 1437) – posterior view; zeugopodium and autopodium in **F** (CPPLIP 1436) – posterior and dorsal (*pes* in highlighted) views. **Abbreviations**: COC – Collateral concavity; DC – Distal carpal; DE – Distal epiphysis; DPH – Distal phalanges; MC I to IV – Metacarpals (I – IV); MP – Mid phalanges; OF – Olecranon fossa; PIS – Pisiforme; PP – Proximal phalanges; RA – Radius; RAD – Radial; RM – Rock matrix; SD – Semicircular depression of the humerus; TR – Trochlea; UL – Ulna; ULN – Ulnar; UP – Ungueal phalanges. Black arrow indicate the fractured region and white arrow indicate the shift direction of the distal epiphysis.

through the mid portion of a wide and deep postspinal fossa shaped in the form of a triangle, in the region between the postzygapophyses (Fig. 3G). This condition in C. *dinizi* is different from the narrow, shallow and elliptical postspinal fossa of the posterior dorsal vertebrae of *Yacarerani boliviensis* (Leardi et al., 2015). In addition, the postspinal lamina of the posterior dorsal of *C. dinizi* also is different from *Y. boliviensis* in this respect, since in that species the postspinal lamina is restricted to the region of the neural spine only, not reaching the postspinal fossa.

Neural arches of the dorsal vertebrae are lower than the same structures in the cervical vertebrae. A somewhat triangular-shaped depression is located laterally in the arches, in the region between the diapophysis and the postzygaphoysis. In the posterior dorsal vertebrae of all crocodyliforms examined, this depression gradually becomes more posteriorly located along the series, paralleling the growth of the lateral expansion of the transverse process and the gradual horizontalization of the zygapophyses. Among specimens included in this study, this depression is slightly deeper in the

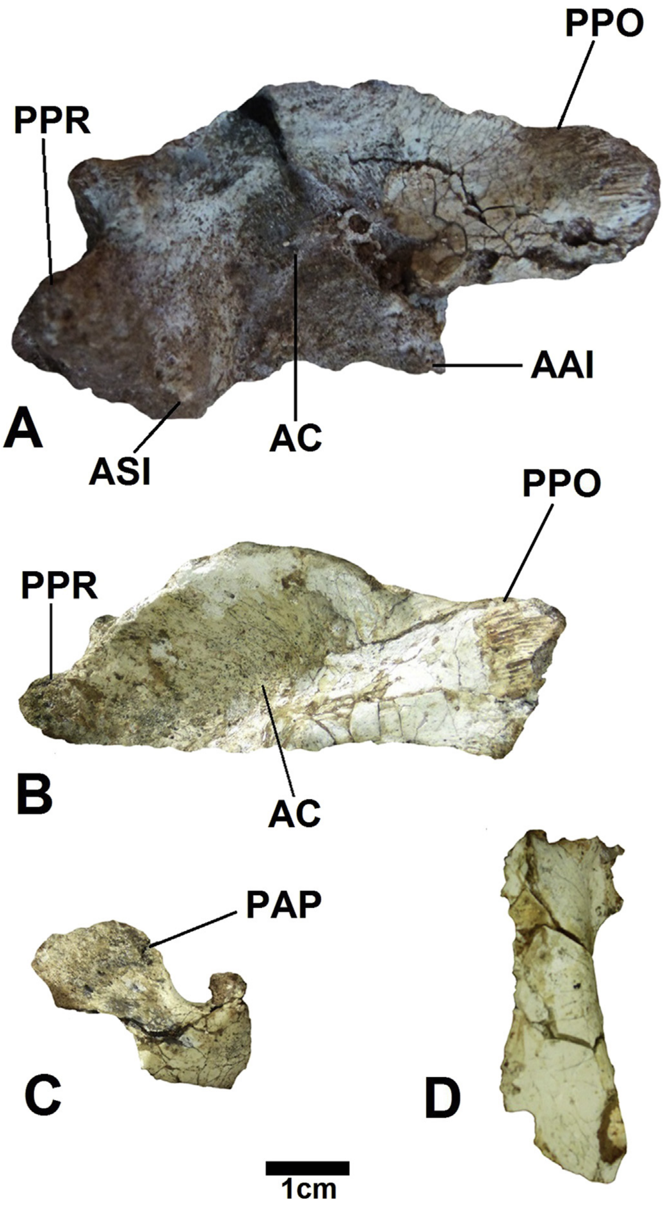

Fig. 9. Pelvic girdle of *Campinasuchus dinizi* (CPPLIP 1237; CPPLIP 1437). Left ilium in **A** (CPPLIP 1437) and **B** (CPPLIP 1237) – ventral view; anterior articular process of the ischium in **C** (CPPLIP 1237) – medial view; ischial lamina in **D** (CPPLIP 1237) – medial view. **Abbreviations**: AAI – Acetabular antitrochanter of the ilium; AC – Acetabulum; ASI – Articular surface for the ischium; PAP – Proximal articular process; PPO – Posteroacetabular process; PPR – Preacetabular process.

Baurusuchidae, including *Campinasuchus*, than in the remaining Crocodyliformes, as *Mariliasuchus amarali* and *Yacarerani boliviensis* (Nobre and Carvalho, 2013; Leardi et al., 2015). In modern species, such as *Caiman latirostris*, that depression is shallow.

Prezygapophyses of D5 and D6 are more horizontal than prezygapophyses of the cervical vertebrae, and their facets are oriented dorsomedially (Fig. 3A). However, prezygapophyses of D7 and DP are located mainly in the transverse axis and their facets are oriented dorsally (Fig. 3B, E–G). Postzygapophyses of D5 and their facets are located lateroventrally, in D7 and DP postzygapophyses are closer to the transverse axis and their articular facets are oriented ventrally. Compared with preceding vertebrae, prezygapophyses of DP are shorter and closer to the neural spine, whereas its postzygapophyses are lateroventrally longer and the suprapostzygapophyseal lamina is more expanded (Fig. 3E–G).

Margins of the articular facets of the zygapophyses of the dorsal vertebrae are mostly articulated to each other or partially hidden in the matrix, but the exposed portions of that structure indicate that their margins are rounder than in cervical zygapophyses. Zygapophyses of the dorsal vertebrae of *Campinasuchus* are also smaller and somewhat less elongated than in *Baurusuchus salgadoensis*, *Stratiotosuchus maxhechti*, *Sebecus icaeorhinus* and *Mahajangasuchus insignis*. The structure is nevertheless slightly more elongated, expanded and less rounded than in *M. amarali*, *N. terrestris*, *Yacarerani boliviensis* and *Simosuchus clarki* (Pol, 2005; Georgi and Krause, 2010; Nobre and Carvalho, 2013; Leardi et al., 2015). The dorsal zygapophyses of the dorsal vertebrae of *C. dinizi* are mostly similar to the condition in *Pissarrachampsa sera* than in other baurusuchids. The suprapostzygapophyseal laminae in the dorsal vertebrae of *C. dinizi* and other baurusuchids are, in turn, higher and more robust when compared with *M. amarali*, *N. terrestris*, *Yacarerani boliviensis*, *Simosuchus clarki*, and the Crocodylia.

Parapophysis of D5 is expanded laterally and located slightly ventrally to the prezygapophyses. Diapophysis of D5, in turn, is more expanded laterally and is located close to the transverse axis (Fig. 3A). The parapophysis and diapophysis of D10 are almost completely fused among themselves, being separated only by a small parapodiapophyseal lamina (*sensu* Pol et al., 2012; Fig. 3D). In the subsequent vertebrae, diapophyses and parapophyses are gradually expanded laterally and closer to each other in each vertebra, being totally fused in DP, forming the transverse process of that vertebra. The transverse process of DP is fragmented, but it seems to be shorter and narrower than in other dorsal vertebrae (Fig. 3E–G). The dorsal migration of the parapophyses of the dorsal vertebrae is more gradual in *Campinasuchus* than in *Yacarerani boliviensis*, with the parapophyses located more ventrally in the D5 in the former than in the later. The condition of the structure in regards to its position in the vertebrae in *Campinasuchus* is also more similar to one present in *Pissarrachampsa* and *Baurusuchus*, when compared with *Yacarerani*. However, the dorsal migration of the parapophyses of the dorsal vertebrae of all examined crocodyliforms in which this structure is preserved is distinct of the abrupted condition of this migration in *Simosuchus clarki*, where parapophyses of dorsal vertebrae are completely aligned with the diapophyses from D5 to the end of the series (*sensu* Leardi et al., 2015).

The articular facets of the parapophyses and diapophyses of the dorsal series are mostly missing, but judging from the general shape of their preserved portions, they were probably rounded at D5 to D10 (Fig. 3A–D).

The vertebral foramen is mainly rounded in the dorsal vertebrae, except in DP, where it is subeliptic in shape and located below the zygapophyses. In addition, the vertebral foramen in anterior dorsal vertebrae is smaller than in other dorsal vertebrae, but wider than in the cervicals. Those conditions are similar in *Campinasuchus* and in *Baurusuchus* (Nascimento and Zaher, 2010). The vertebral foramen of the dorsal vertebrae of *Campinasuchus* is also distinct from the more rounded foramen present in *Stratiotosuchus maxhechti*, *Sebecus icaeorhinus*, *Simosuchus clarki*, *Mahajangasuchus insignis* and in the Crocodylia (Buckley and Brochu, 1999; Georgi and Krause, 2010; Vieira, 2011; Pol et al., 2012). *Mahajangasuchus insignis* also has a small and rounded protuberance located in the dorsomedial face of the vertebral foramen of the cervical and dorsal vertebrae, which is absent in *Campinasuchus*.

The vertebral body of the dorsal vertebrae is constricted laterolaterally and concave ventrally. The edges of their articular facets are more expanded when compared with cervical vertebrae, with the posterior edge more expanded than the anterior edge in the same vertebra. The articular facets of the vertebral bodies are also

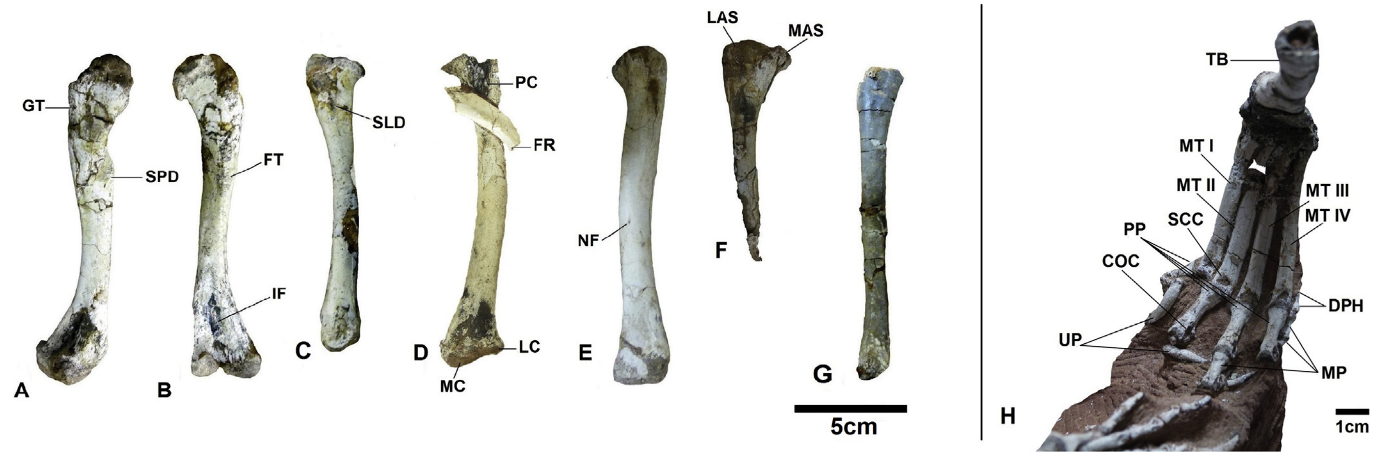

Fig. 10. Hindlimbs of *Campinasuchus dinizi* (CPPLIP 1237; CPPLIP 1437). Left and right femur in **A** and **B** (CPPLIP 1237) – posteromedial and posterior views, respectively; left and right tibia in C and D (CPPLIP 1237) – lateral and posterior views, respectively; left tibia in E (CPPLIP 1437) – posterolateral view; proximal epiphysis of the right tibia in F (CPPLIP 1437) – anterior view; left fibula in G (CPPLIP 1437) – lateral view; tibia and *pes* in H (CPPLIP 1436) – dorsal view. **Abbreviations**: COC – Collateral concavity; DPH – Distal phalanges; FT – Four trochanter; GT – Great trochanter; IF – Intercondilar fossa; LAS – Lateral articular surface; LC – Lateral condyle; MAS – Medial articular surface; MC – Medial condyle; MP – Mid phalanges; MT (I, II, III, IV) – Metatarsals (I, II, III, IV); NF – Nutrient foramen; PC – Posterior cleft; PP – Proximal phalanges; RF – Rib fragment; SCC – Metatarsal semicircular concavity; SLD – Shallow lateral depression; SPD – Semicircular protuberance of the diaphysis; TB – Tibia; UP – Ungueal phalanges.

slightly concave, even though only a small portion of the posterior articular facet of D6 is exposed from the matrix (Fig. 3A).

The vertebral body of the cervical and dorsal vertebrae of *C. dinizi* is small and slender when compared with *Baurusuchus* and *Stratiotosuchus*, being more similar to the condition of the dorsal vertebrae of *Pissarrachampsa sera* (Godoy et al., 2016). However, the edges of the articular facets of the cervical and dorsal vertebrae of baurusuchids are more developed than in *Simosuchus clarki*, *Mariliasuchus amarali*, *Notosuchus terrestris*, *Yacarerani boliviensis*. Those edges are also less posteroventrally projected in baurusuchids than in *Sebecus icaeorhinus* and *Mahajangasuchus insignis* (Buckley and Brochu, 1999; Georgi and Krause, 2010; Pol et al., 2012; Nobre and Carvalho, 2013). In addition, the anficelic condition in the cervical and dorsal vertebrae of *C. dinizi* and other baurusuchids is more pronounced than in *Yacarerani boliviensis*, *Mariliasuchus amarali* and *Simosuchus clarki* (Georgi and Krause, 2010; Nascimento and Zaher, 2010; Nobre and Carvalho, 2013).

Neurocentral sutures are open in vertebrae D5 to D9 and in DP of CPPLIP 1237 (Figs. 3A–C, E, F and 4), as well as in all dorsal vertebrae of *Pissarrachampsa sera* (Godoy et al., 2016).

Caudal vertebrae: Eight disarticulated caudal vertebrae (CV) are preserved in CPPLIP 1237: two anterior CV (Fig. 3H and I); two posteromedian CV (Fig. 3J and K); four posterior CV, of which three are terminal CV (Fig. 3L–O). In CPPLIP 1435, the anteriormost ten caudal (CV), with chevrons, were preserved articulated as in the living condition (Fig. 6A). All caudal vertebrae are somewhat fragmented. In CPPLIP 1435, they are markedly compressed laterally (Fig. 6A).

Overall, the neural spines of the anterior CV of *C. dinizi* are higher and slender than the neural spines of the more posterior dorsal vertebrae. The neural spines of CV in CPPLIP 1435 are higher than the neural spines of all vertebrae of CPPLIP 1237. A fragment of the proximal portion of the neural spine is preserved in a posteromedian CV (Fig. 3J), suggesting a more robust and longer condition in this region when compared with posterior CV. The neural spine of the posterior CV, in turn, is very small, short and slender, and approximately of the same size of their postzygapophyses. A fragment of the proximal portion of the neural spine is also preserved in one terminal CV, being very small and approximately laminar (Fig. 3O). The dorsal margin of the neural spines of CV is more convex than in the dorsal vertebrae. In addition, the spinal laminae of neural spines of CV are slightly more expanded than the spinal laminae of the dorsal vertebrae.

Neural spines in the caudal vertebrae are located in the middle-posterior region of the neural arches, as in other vertebrae of *C. dinizi*, except for the posterior caudal vertebrae, where spines are more located in the middle of the vertebrae, but still not at its center (Fig. 3L and O). A similar condition in regards to the position of neural spines in the arches is shared with other baurusuchids, in addition to *Sebecus icaeorhinus*, *Yacarerani boliviensis* and *Mahajangasuchus insignis*. In *Mariliasuchus amarali* and *Notosuchus terrestris*, however, neural spines of CV are mostly located in the middle of the neural arch (Buckley and Brochu, 1999; Pol, 2005; Pol et al., 2012; Nobre and Carvalho, 2013; Leardi et al., 2015). In addition, neural spines in all vertebrae of *C. dinizi* are higher than in *M. amarali* and *N. terrestris*. Neural spines of all vertebrae of *C. dinizi* are also slightly inclined posteriorly, as in *Baurusuchus* and *Stratiotosuchus*, but that condition is not as developed as in *Mahajangasuchus insignis*, where neural spines are strongly inclined posteriorly (Buckley and Brochu, 1999). Neural spines of the caudal (and also the cervical) vertebrae of *Mahajangasuchus insignis* (Buckley and Brochu, 1999) and the Crocodylia have a laterolateral protuberance that is absent in *C. dinizi*, as well as in *Baurusuchus* and *Stratiotosuchus*.

Zygapophyses of CV are the more elliptical and shorter of the vertebral series. Their articular facets are shallower and are located in a more dorsal region of the neural arches than when compared with the presacral vertebrae (Fig. 3I and J). In addition, zygapophyses are smaller and closer to the neural spines in the posterior CV (Fig. 3K and L), being totally absent in the terminal CV (Fig. 3M–O). Zygapophyses of CV of *C. dinizi* are also similar in terms of shape to the ones in *Baurusuchus*, but differ from the shorter zygapophyses of *Stratiotosuchus maxhechti*. When compared to non-Baurusuchidae taxa, zygapophyses of CV of *Campinasuchus* and *Baurusuchus* are more developed, also differing in this respect from the further shortened zygapophyses of the CV of *Mariliasuchus amarali*, *Notosuchus terrestris*, *Yacarerani boliviensis* and *Simosuchus clarki*, which are also more flat when compared with

Campinasuchus (Pol, 2005; Georgi and Krause, 2010; Nobre and Carvalho, 2013; Leardi et al., 2015).

The transverse process is more expanded laterally and thick in the anterior CV (Fig. 3H), but gradually becomes thinner and shorter in subsequent CV (Fig. 3K). The transverse process is absent in the terminal CV (Fig. 3M–O).

The vertebral foramen of the anterior CV is wide and elliptical (Fig. 3H), but it is small and more rounded in the posteromedian CV. The vertebral body of the anterior CV is higher than wide, being shorter and proportionally lower than in the presacral vertebrae. The vertebral body of the anterior CV is strongly laterally compressed, but this condition might result from fossil diagenesis.

The vertebral bodies of the posteromedian CV are longer and narrower than in the anterior CV and in the presacral vertebrae (Fig. 3I and J). The ventral margin of the vertebral body of a posteromedian CV is markedly concave (Fig. 3J). The vertebral body of the terminal CV, in turn, are even longer and narrower than in the preceding vertebrae, and their ventral margin are straight, resulting in a somewhat cylindrical shape.

A small pointed projection is present in the dorsal region of the border of the anterior articular facet of the terminal CV of *Campinasuchus*. Such projection was not detected in more anterior CV. The posterior articular facet of terminal CV is also more concave than the condition present in more anterior vertebrae (Fig. 3M and N).

Ribs: The second cervical rib in medial view (Fig. 5A) and five dorsal ribs in lateral view (Fig. 5B–D) of CPPLIP 1237 are exposed and described below. The dorsal ribs were identified as three mid-dorsal ribs (Fig. 5B) and two posterior dorsal ribs (Fig. 5C and D). Those ribs are somewhat fragmented, and some dorsal ribs went through a slight diagenetic compression.

The capitulum and tuberculum of the ribs are preserved in the cervical rib (Fig. 5A), in a mid-dorsal rib (Fig. 5B) and in a posterior dorsal rib (Fig. 5C). Both capitulum and tuberculum of the cervical rib are slightly elongated and medially oriented, although the tuberculum is less elongated than the capitulum. A broken small protuberance is located between the capitulum and the tuberculum of the cervical rib. In the mid-dorsal rib, the capitulum is longer, more elongated, than in the cervical rib, and is oriented anterodorsally (Fig. 5B). The capitulum of the posterior dorsal rib is very fragmented, with only its proximal portion preserved, which is dorsally oriented (Fig. 5C). The tuberculum of the mid-dorsal and posterior dorsal ribs, in turn, are somewhat longer than the one in the cervical rib, being also dorsally oriented. A shallow concavity separates the capitulum and tuberculum in the mid-dorsal rib (Fig. 5B). This concavity is markedly deeper and narrower in the posterior dorsal rib, being somewhat shaped in the form of the letter “U” (Fig. 5C). The distal end of the capitulum and tuberculum in those ribs is expanded. Their facets have a shallow concavity.

All ribs are elongated, arched and narrower in their mediodistal portion. The internal surface of the cervical rib has a subtriangular depression that extends from its proximal surface to its mid surface. The medioproximal region of the external surface of the ribs is mainly depressed, while its lateroposterior surface is moderately bulged. This bulged condition is less marked in posterior dorsal ribs, being totally absent in a posterior dorsal rib (Fig. 5C), which is almost circular in transverse section and has a smooth lateral surface (Fig. 5D).

The cervical and mid-dorsal ribs are slightly arched anteroposteriorly, and this condition is more developed in a posterior dorsal rib (Fig. 5C), which is also more bulged when compared with the somewhat straight aspect of other posterior dorsal rib (Fig. 5D).

The ribs of *C. dinizi* are similar to the general pattern present in *Baurusuchus*, but differ from *Stratiotosuchus maxhechti*, in which the lateral surface of the dorsal ribs has a more marked depression. There is also a small uncinate process in the middle-posterior surface of a posterior rib in those taxa, and both features are not present in *Campinasuchus* and *Baurusuchus*. The uncinate process described above is also reported in *Mariliasuchus amarali* and *Yacarerani boliviensis* (Nobre and Carvalho, 2013; Leardi et al., 2015). The ribs of *C. dinizi*, *Baurusuchus* and *Stratiotosuchus* are also more robust than in non-baurusuchid crocodyliforms such as *Mariliasuchus amarali*, *Mahajangasuchus insignis* and the Crocodylia (Buckley and Brochu, 1999; Nascimento and Zaher, 2010; Vieira, 2011; Nobre and Carvalho, 2013).

Abdominal ribs (Gastralia): fragments of abdominal ribs (gastralia) were preserved in CPPLIP 1237 and CPPLIP 1437.

The abdominal ribs of CPPLIP 1237 consist of small and slender bones scattered in the matrix. Abdominal ribs are larger and thicker in CPPLIP 1437, being approximately straight and flat, and also mostly elongated and wide in that specimen.

Chevrons: Nine highly laterally compressed chevrons articulated with the caudal vertebrae are present in CPPLIP 1435 (Fig. 6A), whereas two disarticulated chevrons partially attached to the matrix are preserved in CPPLIP 1237 (Fig. 6B–D).

Shape of chevrons of *Campinasuchus* is similar to the letter “Y”, as in the typical condition found in the Archosauria (Romer and Parsons, 1977). The structures are slightly flattened anteroposteriorly and lateromedially. The hemal arch portion of the chevrons is elongated dorsally, being wider proximally than distally, forming two proximal articular processes. Those hemal archs are medially separated by the hemal neural channel, which is shaped approximately in the form of the letter “V”. Neural spines of the chevrons are ventrally elongated and elliptical in transverse section, being also slightly more flat lateromedially than the hemal archs.

The chevrons in *C. dinizi*, as well as in *Stratiotosuchus* and *Baurusuchus*, are also more robust than those of *Mariliasuchus amarali*, *Yacarerani boliviensis*, *Mahajangasuchus insignis* and extant taxa (Buckley and Brochu, 1999; Nascimento and Zaher, 2010; Nobre and Carvalho, 2013; Leardi et al., 2015). In addition, the neural channel of the chevrons in *C. dinizi* and other examined fossil crocodyliforms is dorsally open, being distinct of the neural channel of the chevrons of Crocodylia, that is dorsally closed (*sensu* Vieira, 2011).

Osteoderms: Twelve osteoderms are preserved in CPPLIP 1237 and CPPLIP 1437. All osteoderms are fixed in the matrix, with their dorsal region exposed. Two osteoderms are juxtaposed and articulated medially in CPPLIP 1437 (Fig. 6E–H).

Overall shape of the preserved osteoderms is elliptical, but some are shorter and wider (Fig. 6E), while others are narrower and longer (Fig. 7F–H). The medial margin of the osteoderms is straight and the other margins are convex and crenulated, although the anterior and posterior margins are reduced.

One osteoderm of CPPLIP 1437 is markedly wider and shorter than the other osteoderms of *C. dinizi*, resulting in a somewhat rhomboid structure (Fig. 6E). A low medial keel extends longitudinally along the dorsal surface of the osteoderms. The rhomboid osteoderm, in turn, has an almost unperceptible and low medial keel (Fig. 6E).

The dorsal surface of the osteoderms is slightly bulged with some small grooves and striations in the lateral and medial regions.

Grooves and striations are generally absent in the medial keel, but some tiny foramina are present. The ornamentations in dorsal surface of the osteoderms are less developed in CPPLIP 1237 than in CPPLIP 1437. The osteoderms of CPPLIP 1437 are, in turn, slightly bigger than those of CPPLIP 1237.

Osteoderms of *C. dinizi* are similar to the condition present in *Baurusuchus* and *Stratiotosuchus*, but are smaller, more slender, and, overall, delicate. Osteoderms of *C. dinizi* are distinct from the somewhat pentagonal osteoderms with smooth margins of *M. amarali* and *N. terrestris*, being also markedly different from the almost circular osteoderm with slightly crenulated margins present in *Mahajangasuchus insignis* (Buckley and Brochu, 1999; Pol, 2005; Nobre and Carvalho, 2013).

Martin (2015) noted that osteoderms of *Baurusuchus* and of sebecosuchians from the Middle Eocene Karst deposit of Lissieu, France, are highly similar in terms overall morphology, and the same is valid for *C. dinizi* and *Stratiotosuchus*.

5.2. Appendicular skeleton

5.2.1. Pectoral girdle and forelimbs

Scapula: The left scapula of CPPLIP 1437 is exposed in medial view (Fig. 7A), whereas only one posterodorsal fragment of the right scapular lamina is preserved in CPPLIP 1237 (Fig 7C). Therefore, descriptions presented below are based on CPPLIP 1437, unless noted.

The scapular lamina of *C. dinizi* is expanded anteroposteriorly and is lateromedially flat (Fig. 7A). Its dorsal margin is convex, and the structure is more projected posterodorsally than anterodorsally. The anterior margin of the scapular lamina is broken, whereas its posterior margin is straight and slightly oblique. Overall, the scapular lamina of CPPLIP 1437 is slightly fan-shaped in medial view.

The scapular lamina of the scapula of *C. dinizi* is similar to that of *Baurusuchus salgadoensis* and *Baurusuchus albertoi* (Nascimento and Zaher, 2010) in the sense that the structure is strongly expanded anteroposteriorly. In addition, the scapular lamina of *C. dinizi*, *Baurusuchus* and *Stratiotosuchus* is more developed than the relatively thin and anteroposteriorly narrow scapular lamina of other crocodyliforms, such as *Notosuchus terrestris* and *Mariliasuchus amarali* (Pol, 2005; Nobre and Carvalho, 2013). A gradual dorsoventral narrowing of the scapular lamina is also present in all crocodyliforms examined in which the structure is preserved. In the Baurusuchidae, however, the narrowing of the scapular lamina is more gradual than in other crocodyliformes, such as *Mariliasuchus amarali*, *Notosuchus terrestris* and *Simosuchus clarki* (Pol, 2005; Sertich and Groenke, 2010; Nobre and Carvalho, 2013). The same narrowing, in turn, is more marked and abrupted in *Yacarerani boliviensis* and *Mahajangasuchus insignis* than in *Campinasuchus*, *Baurusuchus* and *Stratiotosuchus*.

The medioventral portion of the scapula is constricted, separating the scapular lamina from the ventral portion of the scapula. A moderately deep concavity is present in the medioventral region of the posterior margin of the bone. A similar, albeit less developed, concavity is also present in the scapula of *Mariliasuchus amarali*, *Simosuchus clarki* and *Mahajangasuchus insignis* (Buckley and Brochu, 1999; Sertich and Groenke, 2010; Nobre and Carvalho, 2013). That concavity, in turn, is absent in *Notosuchus terrestris* and *Yacarerani boliviensis*, where the posterior margin of the scapula is approximately straight (Pol, 2005; Leardi et al., 2015). The ventral portion of the scapula of *C. dinizi* is markedly less expanded anteroposteriorly than the scapular lamina, but is more lateromedially robust. In medial view, the ventral surface of the scapula is slightly thicker and expanded than the same region in the scapula of *Mariliasuchus amarali* and *Mahajangasuchus insignis* (Buckley and Brochu, 1999; Nobre and Carvalho, 2013).

A shallow depression is present in the ventromedial surface of the scapula, close to the glenoid cavity. The glenoid cavity, in turn, is shallow, and is located in the ventroposterior region of the scapula. The dorsal edge of the glenoid cavity is slightly pointed. The glenoid cavity is wider and deeper in *C. dinizi* than in *Mariliasuchus amarali* and *Notosuchus terrestris*, and is similar to the condition in *Simosuchus clarki* (Pol, 2005; Sertich and Groenke, 2010; Nobre and Carvalho, 2013). The dorsal edge of the glenoid cavity is also similar in *C. dinizi* and in *Baurusuchus*, being distinct from the more rounded edge of the glenoid cavity present in *Mariliasuchus amarali*, *Notosuchus terrestris*, *Simosuchus clarki*, *Yacarerani boliviensis* and *Mahajangasuchus insignis* (Buckley and Brochu, 1999; Pol, 2005; Sertich and Groenke, 2010; Nobre and Carvalho, 2013; Leardi et al., 2015).

The fragment of the scapular lamina of CPPLIP 1237, in turn, is slightly depressed anterolaterally (Fig. 7C). Its lateroposterior surface is somewhat convex, and small grooves and striae are present in its lateral portion, especially at its dorsolateral margin.

Small grooves and muscle striations are present in the dorsal surface of the scapular lamina and also medially in its mid surface, albeit in smaller quantities. Those muscle scars indicate the origin of the muscles (Mm.) *rhomboideus* and *serratus ventralis cervicis* (Meers, 2003). The posterior margin of the scapular lamina, in turn, bears some mid-dorsal striations that indicate the origin of the muscle (M.) *serratus ventralis thoracis* and the insertion area of the M. *triceps longus caudalis* (Meers, 2003). Somewhat more scattered striations which represent the insertion of the M. *subscapularis* (Meers, 2003) are present in the mid-ventral surface of the scapular lamina. A few striations are also present in the concavity of the scapula, indicating the insertion of the M. *scapulohumeralis caudalis* (Meers, 2003).

Coracoid: A disarticulated left coracoid attached to the matrix and exposed in its lateroventral view is preserved in CPPLIP 1237 (Fig. 7B), whereas a fragment of the distal extremity of the right coracoid, in lateral view, is preserved in CPPLIP 1437 (Fig. 7D). The coracoid of CPPLIP 1237 is overall well preserved, even though their extremities are very fragmented. Overall, the coracoid is elongated dorsoventrally and its extremities are expanded anteroposteriorly. The bone is also narrow in its mid portion and circular in transverse section.

The proximal extremity of the coracoid is more robust, but less expanded, than its distal extremity. The margins of the proximal extremity of the coracoid are also fragmented, but that portion of the bone seems to have a subquadrangular shape. The region of the glenoid cavity in the coracoid is very fragmented, with only a small fragment of the region preserved, in the posterodorsal portion of the proximal third of the coracoid. The coracoid foramen is rounded and located in the posterodorsal region of the proximal extremity, close to the glenoid cavity, being distinct from the more median-located foramen in other crocodyliforms examined, such as *Stratiotosuchus maxhechti*, *Sebecus icaeorhinus*, *Mariliasuchus amarali*, *Simosuchus clarki*, and *Yacarerani boliviensis* (Sertich and Groenke, 2010; Riff and Kellner, 2011; Pol et al., 2012; Nobre and Carvalho, 2013; Leardi et al., 2015) (Fig. 7B).

The median portion of the coracoid is slightly ventrally arched and moderately compressed lateromedially. In *Mariliasuchus amarali* and in the Crocodylia, in turn, the median portion of the coracoid is more arched ventrally (Vieira, 2011; Nobre and Carvalho, 2013). In addition, the median portion of the coracoid of *C. dinizi*, *Baurusuchus* and *Stratiotosuchus* is more elongated than in *Mariliasuchus amarali*, *Simosuchus clarki*, and *Yacarerani boliviensis*.

The distal extremity of the coracoid is more expanded than its proximal extremity, being strongly lateromedially compressed, and its anteroventral and posteroventral portions are pointed. The overall shape of that region of the bone in lateral and medial views is that of an axe blade (Fig. 7D).

The mid-ventral portion of the coracoid of *C. dinizi*, *Baurusuchus* and *Stratiotosuchus* is less compressed lateromedially than the same region of the bone in *Yacarerani boliviensis*, being more similar to the condition observed in *Simosuchus clarki* and *Mariliasuchus amarali*. This portion of the bone is also more robust in Baurusuchidae than in the other aforementioned taxa (Sertich and Groenke, 2010; Nobre and Carvalho, 2013; Leardi et al., 2015).

The dorsoventral groove of the coracoid of *C. dinizi* (*sensu* Nascimento, 2008) is fragmented, but its preserved portion is narrow and shallow (Fig. 7B).

The lateral portion of the anterodorsal surface of the coracoid of CPPLIP 1237 has a discreet striated rugosity, which is related to the insertion of the M. *biceps brachii* (Meers, 2003). Other striations are present in the mid surface and along the distal extremity of the coracoid, which indicate the insertion of the M. *coracobrachialis brevis ventralis* (Meers, 2003).

Humerus: The right (CPPLIP 1237, CPPLIP 1436) and left humeri (CPPLIP 1237, CPPLIP 1436, CPPLIP 1437) are preserved. The humeri are observed in anterior (Fig. 8B), lateroanterior (Fig. 8A) in CPPLIP 1237 and in posterior views (Figs. 8D; 8E) in CPPLIP 1436 and CPPLIP 1437, while their medial surfaces are embedded in the matrix. The humeri of CPPLIP 1436 are articulated to their respective radii (Fig. 8E). The humeri are overall well preserved, although the distal epiphysis of the left humerus of CPPLIP 1237 is fractured and laterally displaced (Fig. 8C).

The proximal epiphysis of the humerus is lateromedially expanded and slightly compressed anteroposteriorly. The dorsal margin of the proximal epiphysis is also convex, its lateral margin is oblique, and the dorsal surface of the medial margin is convex but its ventral surface is concave, forming a slightly pointed medial projection. A shallow somewhat triangular-shaped depression is also present in the anterior surface of the proximal epiphysis (Fig. 8B). The posterior surface of the proximal epiphysis, in turn, is more robust than the anterior surface, and is slightly bulged (Fig. 8D). A small and shallow semicircular depression is present in the mediodorsal region of the posterior surface of the proximal epiphysis, indicating the region where the M. *scapulohumeralis caudalis* was inserted (Meers, 2003) (Fig. 8D). A lateromedian depression in the posterior surface of the humerus corresponds to the insertion of the Mm. *teres major* and *latissimus dorsi* (Meers, 2003). Some muscle scars located in the dorsomedial surface of the proximal epiphysis indicate the insertion of the M. *triceps brevis caudalis* (Meers, 2003). A lateromedian depression in the posterior surface of the humerus, in turn, corresponds to the insertion region of the Mm. *teres major* and *latissimus dorsi* (Meers, 2003). The deltopectoral crest of the humerus is partially missing or partially embedded in the matrix in all examined specimens of *C. dinizi*.

The proximal epiphysis of the humerus of *C. dinizi* is lateromedially expanded as in *Baurusuchus* and *Stratiotosuchus*, but the medial pointed projection present in that region of the bone in *C. dinizi* is distinct of the bulging present in the same region in other baurusuchids (Riff, 2007; Nascimento and Zaher, 2010). The medial pointed projection of the proximal epiphysis of the humerus of *C. dinizi*, in turn, is similar to the condition present in *Simosuchus clarki* (see Sertich and Groenke, 2010). In addition, the proximal epiphysis of the humeri of the Baurusuchidae, with exception of *Pissarrachampsa sera,* in which the humerus is unknown, is more lateromedially expanded than the respective region of the humeri of other crocodyliforms, such as *Mahajangasuchus insignis* and *Yacarerani boliviensis*. However, the proximal epiphysis of the humerus of the aforementioned baurusuchids is markedly less expanded lateromedially than in *Simosuchus clarki* (Buckley and Brochu, 1999; Sertich and Groenke, 2010; Leardi et al., 2015).

The shallow depression present in the anterior surface of the humerus of *C. dinizi*, *Baurusuchus* and *Stratiotosuchus* is somewhat deeper than in *Sebecus icaeorhinus*, *Mahajangasuchus insignis* and *Yacarerani boliviensis* (Buckley and Brochu, 1999; Nascimento and Zaher, 2010; Pol et al., 2012; Leardi et al., 2015), but shallower and narrower when compared with the condition in *Simosuchus clarki* (Sertich and Groenke, 2010). Some muscle scars are present in the anterior depression of the humerus of *C. dinizi*, indicating the origin of the M. *coracobrachialis brevis ventralis* (Meers, 2003).

A semicircular depression located in the posterior surface of the humerus of *C. dinizi* is similar to the condition in *Baurusuchus* and *Stratiotosuchus*, but is distinct from the subtriangular depression located in the same region of the bone in *Mariliasuchus amarali*. In addition, this depression is also deeper in the Baurusuchidae when compared with other crocodyliforms, such as *Mahajangasuchus insignis*, *Sebecus icaeorhinus* and *Yacarerani boliviensis* (Buckley and Brochu, 1999; Pol et al., 2012; Leardi et al., 2015). In *Simosuchus clarki* and in the Crocodylia the posterior surface of the proximal epiphysis of the humerus is practically smooth, and the semicircular depression of the posterior region of the humerus is markedly shallow.

The diaphysis of the humerus of *C. dinizi* is elongated, with the medioproximal region of that portion of the bone narrower than its mediodistal third. The medial and lateral margins of the diaphysis are slightly concave, and the diaphysis is circular in transverse section. Some reduced muscle scars are present in the diaphysis of the humerus of CPPLIP 1237. Those located in the mid-dorsal surface of the structure indicate the origin of the Mm. *brachialis* and *humeroradialis*, whereas scars in the lateromedian and lateroventral indicate the origins of the Mm. *triceps brevis cranialis* and *triceps brevis intermedius*, respectively (Meers, 2003).

The diaphysis of the humerus of *C. dinizi* and *Baurusuchus* are more elongated and slightly thinner than in *Stratiotosuchus* and *Simosuchus*. The diaphysis of the humerus of *C. dinizi*, *Baurusuchus* and *Stratiotosuchus* is also more elongated and thicker when compared with other crocodyliforms, such as *Mariliasuchus amarali* and *Yacarerani boliviensis*.

The distal epiphysis of the humerus of *C. dinizi* is thicker and has a subtriangular shape, but is less expanded when compared with the proximal epiphysis (Fig. 8B and E). The olecranon fossa is shallow, being also subtriangular and located anteriorly in the distal epiphysis. The trochlea, in turn, is robust, prominent and located ventrally to the olecranon fossa (Fig. 8B). Shape of the trochlea is similar to that of a “transverse bar”. The radial and ulnar condyles are slightly rounded and expanded anteroventrally. The radial condyle is more developed than the ulnar. The trochlea of the humerus of *C. dinizi* is developed as in other baurusuchids, but is different from the slightly less developed trochlea of *Mahajangasuchus insignis* and *Yacarerani boliviensis*, and also from the medianally separated radial condyles of the humerus of *Simosuchus clarki* (Buckley and Brochu, 1999; Sertich and Groenke, 2010; Leardi et al., 2015). In addition, the condyles of the humerus of *C. dinizi*, *Baurusuchus* and *Stratiotosuchus* are less rounded when compared with *Simosuchus clarki*.

Small grooves are present in the posterior region of the distal epiphysis of the humerus of CPPLIP 1436. These grooves indicate the origin of the ventral portion of the M. *triceps brevis intermedius* (Meers, 2003).

Radius: Both radii are partially preserved in CPPLIP 1436, articulated with their respective ulnae (Fig. 8F). The proximal epiphysis of the radii, however, were not preserved and fractures are present in their diaphysis and distal epiphysis.

The diaphysis of the radius is thin, its medial margin is moderately concave and the lateral margin is approximately straight, being their shape subcylindrical in transverse section. The anterior torsion of the mid-dorsal portion of the diaphysis of the radius, present in some crocodyliforms such as *Stratiosuchus maxhechti*, *Mariliasuchus amarali* and *Notosuchus terrestris* (Pol, 2005; Riff and Kellner, 2011; Nobre and Carvalho, 2013; Godoy et al., 2016), was not observed in *C. dinizi* CPPLIP 1436. The straighter condition present in the diaphysis of the radius of *C. dinizi* is similar to the one present in other baurusuchids, mainly *Pissarrachampsa sera*, and some non-baurusuchids crocodyliforms, such as *Simosuchus clarki* and *Yacarerani boliviensis* (Nascimento and Zaher, 2010; Sertich and Groenke, 2010; Riff and Kellner, 2011; Leardi et al., 2015; Godoy et al., 2016).

The distal epiphysis of the radius of *C. dinizi* is approximately round, anteroposteriorly depressed, and somewhat lateromedially expanded, being also more expanded ventromedially than ventrolaterally (Fig. 8F). The ventromedial portion of the distal epiphysis of the radius of *C. dinizi* and other baurusuchids is more expanded than in extant crocodyliforms, but is less developed when compared with other fossil species such as *Simosuchus clarki* and *Mahajangasuchus insignis*.

Longitudinal striations are present in the posterior region of the mid to mid-ventral surface of the diaphysis of the radius. These striations indicate the insertion of the tendinous portion of the M. *pronator quadratus* (Meers, 2003). Striations that indicate the origin of part of the M. *pronator teres* (Meers, 2003) are also present in the posterior surface of the distal epiphysis, in this case being more concentrated and developed when compared with other striations in the bone.

Ulna: The ulnae of CPPLIP 1436 are preserved with their posterior and lateral regions exposed, but their epiphyses are severely eroded and partially fractured (Fig. 8F).

The proximal epiphysis of the ulna is expanded anteroposteriorly, compressed lateromedially and slightly arched posteriorly. The posterolateral portion of this epiphysis is high, robust and convex, whereas its anteromedial portion is shorter and concave. A medial V-shaped depression is present medially in the proximal epiphysis (Fig. 8F). In addition, a slightly pointed process is present in the anterodorsal portion of the proximal epiphysis.

Some longitudinal striations extend from the proximal epiphysis to the distal surface of the diaphysis. Those striations indicate the region of origin of a substantial portion of the M. *pronator quadratus* (Meers, 2003). Small grooves and low longitudinal striations are also present in the lateroposterior surface of the proximal epiphysis. Those striations, in turn, indicate the insertion of the M. *triceps brachii* (Meers, 2003).

The midproximal portion of the proximal epiphysis of the ulna of *C. dinizi* is thinner and straighter when compared with other Baurusuchidae, even though similar in general shape to the condition observed in *P. sera* (Nascimento and Zaher, 2010; Riff and Kellner, 2011; Godoy et al., 2016). General features of the proximal epiphysis of the ulna are actually very similar among examined crocodyliforms where the bone is known. However, the proximal epiphyses of the ulnae of *Simosuchus clarki* and *Mariliasuchus amarali* are anteroposteriorly more slender than the structure in the Baurusuchidae. In *Yacarerani boliviensis*, in turn, the anterodorsal portion of the epiphyses of the ulnae has a process that is less acuminated than in other crocodyliforms, being particularly distinct from *C. dinizi* in this respect.

The diaphysis of the ulna is elongated in *C. dinizi*, being also somewhat arched anteriorly and compressed anteroposteriorly. In transverse section, the diaphysis of the ulna is less cylindrical when compared with the radius. The diaphysis of the ulna in the species is also straighter when compared with *Baurusuchus* and *Stratiotosuchus*, and is more similar to the condition in *Pissarrachampsa* and *Yacarerani boliviensis*. Despite those differences, overall the diaphysis of the ulna in the Baurusuchidae is straighter than the condition in some fossil crocodyliforms, such as *Mahajangasuchus insignis* and *Mariliasuchus amarali.* In addition, the ulna of *C. dinizi* and other baurusuchids is markedly straighter than the condition in the Crocodylia (Nascimento, 2008; Vieira, 2011).

A few muscle scars are present in the mid surface of the diaphysis, indicating the origin of the M. *flexor digitorum longus* (Meers, 2003). A few low and elongated striations are also present laterally in the bone. These striations, in turn, indicate the insertion region for the M. *flexor ulnaris* (Meers, 2003).

The distal epiphysis of *C. dinizi* is markedly less expanded anteroposteriorly and lateromedially than the proximal epiphysis, and is also lateromedially compressed. The medial and lateral condyles are located in its posteroventral region. Both condyles are equally developed, subsquare-shaped, and are separated by a narrow and reduced concavity. When compared with *Baurusuchus*, the condyles of the distal epiphysis of the ulna of *C. dinizi* are less developed, being more similar to the condition observed in the ulna of *Pissarrachampsa sera* and *Stratiotosuchus maxhechti*. The condyles of the ulnae of all analyzed crocodyliforms are actually not markedly developed, but in *Mahajangasuchus insignis* and *Simosuchus clarki* they are more ventrally expanded than in the Baurusuchidae and other examined taxa (Buckley and Brochu, 1999; Sertich and Groenke, 2010).

The mediodistal portion of the ulna of *C. dinizi* is mainly straight as in *Pissarrachampsa sera*, while in *Baurusuchus* and *Stratiotosuchus* this region is more pronounced anteriorly, resulting in an overall more sinuous aspect to the structure (Nascimento and Zaher, 2010; Riff and Kellner, 2011). A similar condition is observed in the ulna of *Simosuchus clarki* (Sertich and Groenke, 2010). The mediodistal portion of the ulna of some non-Baurusuchidae crocodyliforms, such as *Mariliasuchus amarali* and *Mahajangasuchus insignis*, is slightly more pronounced anteriorly than in the Baurusuchidae (Buckley and Brochu, 1999; Nobre and Carvalho, 2013).

Carpals: The ulnar, radial, pisiform and a distal carpal are preserved in CPPLIP 1436 (Fig. 8F). An ulnar was also recovered in CPPLIP 1237. The carpals of CPPLIP 1436 are fragmented, but in CPPLIP 1237 they are well preserved. The anterior (CPPLIP 1237), posterior (CPPLIP 1237; CPPLIP 1436) and part of the lateral region (CPPLIP 1436) of the carpals are exposed in the specimens examined.

The radial and ulnar are longer than wide, but the radial is more robust and higher than the ulnar. The proximal tip of the ulnar is more expanded lateromedially than anteroposteriorly, and its lateral portion is higher than its medial portion. The medial and lateral margins of the proximal tip of the ulnar are also slightly concave, while its dorsal margin is convex. The dorsomedial portion of the proximal tip of the ulnar is, in turn, somewhat acuminated.

The mid portion of the ulnar is narrower than its proximal tip, and its lateral and medial margins are concave. This condition is more marked in CPPLIP 1436 than in CPPLIP 1237 (Fig. 8F). In addition, the ulnar of CPPLIP 1237 is slightly compressed anteroposteriorly and thinner than the ulnar of CPPLIP 1436.

The distal tip of the ulnar of CPPLIP 1237 is not preserved, but in CPPLIP 1436 that portion of the bone is expanded, robust and its articular facet is concave (Fig. 8F). The anterior margin of the distal tip of the ulnar is also more projected than its posterior margin. A somewhat flattened and round distal carpal is articulated to the ulnar in a region ventral to the articular facet of the distal end of the bone.

The proximal tip of the radial is mostly embedded in the matrix and its exposed portions are fragmented or overlapped by other bones, with only a small portion of its posteromedial region exposed (Fig. 8F). This portion of the radial is expanded and its articular facet is concave with round margins, as in the case of the distal end of the ulnar. The mid portion of the radial is narrow and its medial margin is concave, whereas the lateral margin is embedded in the matrix and therefore could not be accessed.

The distal tip of the radial, in turn, is more expanded and thicker than its proximal tip, the former being almost twice the size of the later. The articular facet of the distal tip is also concave, as in the case of the proximal tip of the bone.

The pisiform of CPPPLIP 1436 is transversely elongated, being comparatively less expanded dorsoventrally (Fig. 8F). The medial region of the pisiform is concave and its edges are thick, whereas the lateral portion of the bone is small and convex. The mid portion of the pisiform is somewhat constrict, but its dorsal margin is approximately straight. The pisiform articulates with the posterior surface of the proximal tips of both the ulnar and radial.

The carpals of CPPLIP 1436 are more robust and have a denser aspect than the same bones in CPPLIP 1237, but that condition seems to result from differences in development stages among the specimens (see Discussion). Overall, carpals of *C. dinizi* are more slender and their articular facets are less concave than in *Baurusuchus* and *Stratiotosuchus*, being more similar to conditions present in *Pissarrachampsa sera*. Carpals of *C. dinizi* also differ from the condition in *Mahajangasuchus insignis*, where carpals are slightly higher and their articular facets are almost flat than in other crocodyliforms examined in this study (Buckley and Brochu, 1999). The carpals of the Baurusuchidae, including *C. dinizi*, are also proportionally thinner and longer than in *Simosuchus clarki* and *Yacarerani boliviensis* (Sertich and Groenke, 2010; Leardi et al., 2015).

The distal carpal of CPPLIP 1436 is similar in terms of shape to the distal carpal of *Baurusuchus salgadoensis*, *Stratiotosuchus maxhechti* and *Notosuchus terrestris*, but in those species the bone is more rounded and robust (Pol, 2005; Riff and Kellner, 2011). In *Simosuchus clarki* and *Yacarerani boliviensis*, in turn, the distal carpal is more square-shaped than in *C. dinizi* (Sertich and Groenke, 2010; Leardi et al., 2015).

Metacarpals: All metacarpals of CPPLIP 1436 of both hind legs are preserved, articulated with the carpals and their respective proximal phalanges (Fig. 8F).

Metacarpals I to IV are elongate and slightly compressed dorsoventrally. Their tips are expanded, but the proximal tip is smaller and thinner than the distal one. Mid portions of the metacarpals are thin and subcircular in transverse section, resulting in a profile that is concave ventrally and somewhat convex dorsally, a condition that is more pronounced in metacarpal V.

The proximal tips of the metacarpals of *C. dinizi* are closely located in relation to each other. The lateral margin of the proximal tip is expanded, forming a flattened process that overlaps the medial margin of the proximal tip of the next metacarpal in the series. The proximal and distal articular facets of the metacarpals are concave. The lateral and medial surfaces of the distal tips have deep collateral concavities for the attachment of ligaments (*sensu* Meers, 2003; Riff and Kellner, 2011).

Metacarpals vary in general shape, gradually becoming longer and thinner from I to the IV (Fig. 8F). Metacarpal IV is the largest bone of the series, whereas metacarpal V is the less developed, particularly in terms of their mid and distal regions, which are thinner compared to other metacarpals. The proximal region of metacarpal V, however, is more expanded than the same region in other metacarpals. Some muscle scars are present in the distal tips of the metacarpals, indicating the region of insertion of the Mm. *interosseus dorsalis digiti* and *interosseus ventralis digiti* (Meers, 2003).

Metacarpals of *C. dinizi* and of other Baurusuchidae are similar in terms of general shape, especially when compared with *Baurusuchus salgadoensis* and *Pissarrachampsa sera*. The medial process of the proximal tip of the metacarpals of the Baurusuchidae and *Mariliasuchus amarali* is more slender and less projected than conditions in *Yacarerani boliviensis*, in which the same process is more medially projected (Riff, 2007; Nascimento and Zaher, 2010; Nobre and Carvalho, 2013; Leardi et al., 2015). Despite overall similarities of the structures in the Baurusuchidae, the median portion of the metacarpals of *C. dinizi* is slightly longer and more slender than in *Baurusuchus albertoi* and *Stratiotosuchus maxhechti*, being more similar in this respect to the condition in *Pissarrachampsa sera* (Nascimento and Zaher, 2010; Riff and Kellner, 2011; Godoy et al., 2016). In addition, metacarpals of all baurusuchids, including *C. dinizi*, are proportionally thicker and longer than in *Mariliasuchus amarali* and *Simosuchus clarki*.

Manual phalanges: Most manual phalanges are preserved and articulated in their presumed natural position in CPPLIP 1436, whereas in CPPLIP 1237 only five disarticulated phalanges were recovered (Fig. 8F). The distal phalanx (ungueal) of digit II is absent, and the distalmost phalanx of digit IV is similar in general shape to the condition in other baurusuchids, such as *Baurusuchus* (Nascimento and Zaher, 2010), indicating that the manual phalangeal formula of *C. dinizi* is probably 2-3-4-5-3.

Non-ungueal phalanges of digits I to III are slightly elongated, becoming shorter and narrower in a proximal to distal gradient. Tips of all non-ungueal phalanges in those digits are expanded, and their articular facets are moderately concave, with distal tips being more robust and ventroposteriorly expanded than their proximal counterparts. The ventral surface of the non-ungueal phalanges of digits I to III are somewhat concave, whereas the dorsal, lateral and medial surfaces are almost straight, although slightly compressed. Non-ungueal phalanges of digits IV to V, in turn, are thinner, the margins of their articular facets are markedly round, and their distal tips are more lateromedially compressed when compared with the phalanges of other digits.

An approximately round depression is present in the dorsal surface of the distal phalanges, except the ungueal (Fig. 8F). That depression is deeper in the proximal and mid phalanges of digits I to III. The medial and lateral surfaces of manual phalanges, again with the exception of the ungueal, have collateral concavities, as in the case of the same region of the metacarpals (Fig. 8F). In addition, size of phalanges gradually reduces in a proximal to distal direction, up to the distalmost, non-ungueal, phalanges. The non-ungueal distal phalanges of digits IV and V are very small and almost indistinct in terms of general features from each other.

Ventral surface of the ungueal phalanges is markedly concave, their dorsal surface is convex and their distal end is thin and pointed, resulting in an overall falciform aspect to the structure.

A few muscular scars located at the proximal tips of the proximal phalanges in CPPLIP 1436 indicate the insertion of the Mm. *flexor digitorum brevis superficialis digiti* I and III (Meers, 2003).

As mentioned before, manual phalanges of baurusuchids are very similar, but in *C. dinizi* those bones are the thin and gracile when compared with other taxa in the family. In addition, manual phalanges of baurusuchids, included *C. dinizi*, are slightly more elongated than in *Stratiotosuchus* (Nascimento and Zaher, 2010; Riff and Kellner, 2011; Godoy et al., 2016). The manual phalanges in the Baurusuchidae are also more robust than in *Mariliasuchus amarali*, *Notosuchus terrestris* and *Yacarerani boliviensis*, and slightly more elongated than in *Simosuchus clarki* (Pol, 2005; Sertich and Groenke, 2010; Nobre and Carvalho, 2013; Leardi et al., 2015). The proximal and distal tips of the manual phalanges of baurusuchids are slightly more developed than in the other fossil crocodyliforms examined. When compared with the Crocodylia, in turn, manual phalanges of all fossil crocodyliforms are more robust. The ungueal phalanges of the Baurusuchidae also are more curved than in extant taxa, but this condition is more pronounced in *Simosuchus clarki* (Sertich and Groenke, 2010; Vieira, 2011).

5.3. Pelvic girdle and hindlimbs

Ilium: Ilia are partially preserved in CPPLIP 1437 and in CPPLIP 1237, in both cases in lateroventral view (Fig. 9A and B).

The ilium is anteroposteriorly extended, wide in its mid portion, but narrow in the posteroacetabular process. The preacetabular process is prominent, rounded and anteriorly oriented. The posteroacetabular process, in turn, is somewhat bulged laterally, being also anteroposteriorly elongated, slightly lateromedially and ventromedially depressed. A small concavity is present in the posteroventral margin of the ilium, in the region close the acetabulum. Posterior to this concavity, the ventral margin is almost straight along the posteroacetabular process. The acetabulum is concave and moderately deep. The dorsolateral and ventromedial margins of the ilium, located dorsally and ventrally to the acetabulum, respectively, are markedly damaged. Therefore, the supracetabular crest is not preserved in the ilia of CPPLIP 1237 and CPPLIP 1437 (Fig. 9A and B).

The dorsal portion of the ilium, although embedded in the matrix, seems to have the same slightly convex aspect observed in other baurusuchids (*e.g. Baurusuchus albertoi; Pissarrachampsa sera*). A small protuberance is present in the anterodorsal portion of the ilia of *C. dinizi*. That protuberance in CPPLIP 1437 (Fig. 9A) is more proeminent and pointed than in CPPLIP 1237 (Fig. 9B). A similar structure is observed in the ilia of *Baurusuchus salgadoensis* (UFRJ-DG 285-R), being also more proeminent and pointed than in CPPLIP 1237, but more developed than in CPPLIP 1437. A concavity is observed below this protuberance. That concavity is also deeper in CPPLIP 1437 than in CPPLIP 1237. When compared with *Baurusuchus salgadoensis* (UFRJ-DG 285-R), this concavity is also deeper, but has a smaller girth in CPPLIP 1437.

The surface of the ilium between the preacetabular process and the anteroventral region of this bone is markedly striated and rough, indicating the region of insertion of part of the M. *extensor iliotibialis medialis* (Wilhite, 2003). Dorsal to this region and close to the acetabulum, other muscle scars indicate the insertion of the M. *extensor iliotibialis medialis* (Wilhite, 2003). A few rough and elongated striations are also present in the posterior portion of the posteroacetabular process, which correspond to the insertion of the M. *extensor iliotibialis posterior* and part of the M. *flexor tibialis externus* (Wilhite, 2003).

Two somewhat rough and prominent protuberances are located in the anterior and posterior portions of the ventromedial margin of the ilium. They correspond to the anterior articular surface for the ischium and the acetabular antitrocanter of the ilium, respectively (Fig. 9A).

The ilium of CPPLIP 1237 is similar in terms of general shape and features to the ilium of *Baurusuchus albertoi* and *Pissarrachampsa sera* and of a specimen of *Baurusuchus salgadoensis* (UFRJ-DG 288-R), but differ markedly from the ilium of two other specimens of *B. salgadoensis* (UFRJ-DG 285-R and UFRJ-DG 417-R) where this structure is more robust and posteriorly elongated.

The acetabulum of *C. dinizi* is concave and slightly shallower when compared with other baurusuchids, being more similar in this respect to the condition in *Baurusuchus albertoi* and *Pissarrachampsa sera* than in *Baurusuchus salgadoensis* and *Stratiotosuchus maxhechti* (Nascimento and Zaher, 2010; Riff and Kellner, 2011; Godoy et al., 2016). Despite those differences, overall the acetabulum in the Baurusuchidae is markedly deeper than the acetabulum of some non-baurusuchid crocodyliforms such as *Mariliasuchus amarali*, *Notosuchus terrestris*, *Sebecus icaeorhinus* and *Mahajangasuchus insignis* (Buckley and Brochu, 1999; Nascimento and Zaher, 2010; Riff and Kellner, 2011; Pol et al., 2012; Nobre and Carvalho, 2013). In addition, the dorsal surface of the ilium of baurusuchids is slightly convex, in a condition that is clearly distinct from the observed in *Sebecus icaeorhinus* and *Mahajangasuchus insignis*, where the dorsal surface of the ilium is straight and transversally expanded (Buckley and Brochu, 1999; Pol et al., 2012).

Pubis: Pubis of CPPLIP 1437 is well preserved and exposed in dorsal, lateral and medial views.

The proximal tip of the pubis is expanded dorsoventrally and lateromedially, thicker and more robust than other portions of the bone, being also slightly rounded and dorsoposteriorly directed. The medial and lateral margins of the midproximal region of the pubis are straight and narrow, gradually becoming wider towards their distal portions. The general aspect of the mid portion of the pubis is elongated and slightly compressed dorsoventrally. The distal tip of the pubis, in turn, is flat and lateromedially expanded, with the distal margin convex in shape, whereas the medial margin is straight. The lateral margin of the distal tip is not preserved, but overall this portion of the bone is wider than the proximal one, and has a spatulated shape in dorsal or ventral views. Some elongated scars in the distal tip of the pubis indicate the insertion of the M. *pubofemoralis externus* (Wilhite, 2003).

The pubis in the Baurusuchidae, including *C. dinizi*, is relatively longer and its distal region is slightly expanded when compared with other crocodyliforms, such as *Mariliasuchus amarali*, *Mahajangasuchus insignis* and the Crocodylia. In addition, the distal tip of the pubis in *Mariliasuchus amarali* and *Mahajangasuchus insignis* is shaped in the form of an ax (Buckley and Brochu, 1999; Nobre and Carvalho, 2013), a condition that is not present in baurusuchids. The pubis of *C. dinizi* and *Pissarrachampsa* is also small and slender when compared with *Baurusuchus* and *Stratiotosuchus*. The anterior and posterior surface of the pubis of *Stratiotosuchus*, in turn, is slightly more flattened when compared with *C. dinizi*.

Ischium: Two fragments of the anterior proximal articular processes of the ischium (CPPLIP 1437 and CPPLIP 1237; Fig. 9C) and a left ischial lamina in medial view (CPPLIP 1237; Fig. 9D), in addition to two fragments of the anterior proximal articular process in medial and lateral views (CPPLIP 1237 and CPPLIP 1437; Fig. 9D) were preserved. A remnant of the base of a posterior proximal articular process was also preserved in both specimens, but the structure is very fragmented. Ischium of CPPLIP 1237 is smaller and more delicate than that of CPPLIP 1437 (Fig. 9).

The anteroproximal articular process is anterodorsally elongated, anteroposteriorly expanded and slightly lateromedially compressed, with a subround aspect. The mid portion of the anteroproximal articular process is narrower than its proximal and distal portions. The surfaces of the mid portion are also slightly concave, with that condition more pronounced in the ventral surface. The anteroproximal articular processes of the ischium of *C. dinizi* are similar to the condition in *Baurusuchus salgadoensis*, differing from the more truncate shape of the anteroarticular process of the ischium of *Stratiotosuchus maxhechti* and *Yacarerani boliviensis* (Riff and Kellner, 2011; Leardi et al., 2015). The elliptical-shape of the anteroproximal articular process of *Stratiotosuchus maxhechti*, probably resulted from diagenesis, is also distinct from the observed in *C. dinizi* and other baurusuchids. In addition, the anteroproximal articular process in *C. dinizi* is more robust than in *Sebecus icaeorhinus*, which is also dorsoventrally compressed (Pol et al., 2012).

The ventral portion of the acetabular fenestra is preserved in CPPLIP 1237 by a small mid-dorsal concavity that separates the two articular processes of the ischium (Fig. 9C), a disposition of structures that is similar to the condition in other archosaurians (Romer and Parsons, 1977).

The remnant of the posterior proximal articular process of the ischium indicates that this structure was originally posteriorly expanded. The ischial lamina, in turn, is dorsoventrally elongated and its mediodistal portion is more expanded than the proximal one. The anterior and posterior margins of the ischial lamina are mostly straight, whereas the ventral margin is slightly convex and its posterior portion is more expanded (Fig. 9D). Overall, the ischium of *Campinasuchus dinizi* (CPPLIP 1437) is markedly shorter than its pubis.

The mediodistal region of the ischium of *C. dinizi* and other baurusuchids is indeed more expanded than the proximal region of the bone, as in other crocodyliforms. The ischium of *C. dinizi*, *Pissarrachampsa* and *Baurusuchus* is also slightly longer dorsoventrally than that of *Stratiotosuchus maxhechti* (Riff and Kellner, 2011; Godoy et al., 2016).

The straight condition of the posterior margin of the ischial lamina of the Baurusuchidae is similar to the condition in other notosuchians as *Mariliasuchus amarali* and *Yacarerani boliviensis*, but differs from the concave margin of the same region of the bone present in *Sebecus icaeorhinus* and in the Crocodylia (Vieira, 2011; Pol et al., 2012). The slightly convex ventral margin of the ischial lamina of baurusuchids also differs from the oblique profile of that region of the ischium in *Mariliasuchus amarali* (Nobre and Carvalho, 2013). In addition, the posteroventral region of the ischial lamina of the ischium of *C. dinizi* and other baurusuchids is less expanded and pointed than in *Mariliasuchus amarali* and *Mahajangasuchus insignis*. However, the condition observed in the ventral portion of the ischial lamina of *C. dinizi* might derive from taphonomic processes. The lateral surface of the ischial lamina of *C. dinizi* and *Baurusuchus salgadoensis* is slightly bulged, differing from the approximately straight lateral surface of that region of the bone in *Mariliasuchus amarali*, *Mahajangasuchus insignis* and in the Crocodylia (Buckley and Brochu, 1999; Nobre and Carvalho, 2013). The ischial lamina of *C. dinizi* and *Baurusuchus* are similar in terms of general features, but the structure is more slender in the former.

Summing up, the ischium of the Baurusuchidae compared with that of crocodyliforms such as *Mariliasuchus amarali* and *Sebecus icaeorhinus* (Pol et al., 2012; Nobre and Carvalho, 2013) is bigger, more developed, and the articular processes are more expanded.

Femur: The femora of CPPLIP 1237 are preserved, but both are somewhat fragmented, fractured, and their anterior surfaces are partially embedded in the matrix (Figs. 10A; 10B).

The proximal epiphysis of the femur is anteroposteriorly expanded, lateromedially compressed and slightly directed anteromedially. The proximal epiphysis of the left femur of CPPLIP 1237 is fractured and more anteriorly located than the proximal epiphysis of the right femur of the same specimen. The dorsal margin of the epiphysis is convex, while the anterior margin is relatively concave and the posteromedial and lateral margins are almost straight.

The greater trochanter is approximately elliptical in shape and reduced, being posterodorsally located in the proximal epiphysis. The surface of the greater trochanter bears striations that indicate the insertion of part of the M. *puboischiofemoralis internus* (I, II, III) (Romer, 1923). The fourth trochanter is located just ventral to the greater trochanter, being also elliptical in shape and reduced. Some striations in the fourth trochanter indicate the insertion of the M. *caudifemoralis longus* (Romer, 1923). The trochanters of the femur of *C. dinizi* are slightly reduced when compared with *Baurusuchus* and *Pissarrachampsa sera*, being also distinct from the more developed trochanters of *Stratiotosuchus maxhechti* and the great trochanter of *Sebecus icaeorhinus* (Pol et al., 2012). However, the trochanters of *Simosuchus clarki* are more developed when compared with all the aforementioned taxa, including *C. dinizi* (Sertich and Groenke, 2010).

A few small striations in the posterior region of the proximal epiphysis of the femur indicate the insertion area of the tendinous portion of the M. *ischiotrochantericus* and the M. *puboischiofemoralis externus*. Part of the M. *puboischiofemoralis internus* (I) (Romer, 1923), in turn, inserts in the posteromedial region of the proximal epiphysis, as indicated by another set of similar striations located in that portion of the bone (Fig. 10B).

The proximal epiphysis of the femur of *C. dinizi* and *Pissarrachampsa* is more oriented medially when compared with *Baurusuchus*, but in a lesser degree when compared with *Stratiotosuchus maxhechti* and with some non-baurusuchid taxa, as *Yacarerani boliviensis*, where the proximal epiphysis of the femur is more anteromedially located in the bone (Nascimento and Zaher, 2010; Riff and Kellner, 2011; Leardi et al., 2015). However, the epiphysis of the femur in *C. dinizi* and of *Baurusuchus* is less anteriorly oriented than in the Crocodylia.

The diaphysis of the femur is elongated and subcircular in transverse section. The posterior margin of the diaphysis is medioproximally convex and mediodistally concave. The diaphysis of the femur of baurusuchids and *Mariliasuchus* is more elongated and markedly less thick than in *Simosuchus clarki* (Nascimento and Zaher, 2010; Riff and Kellner, 2011; Nobre and Carvalho, 2013).

A striated and anteromedially expanded semicircular protuberance is present in the proximal surface of the diaphysis (Fig. 10B). This region marks the insertion area of part of the *puboischiofemoralis internus* (II) (Romer, 1923). Some small grooves are also present in the posteromedial and anteromedial surfaces of the diaphysis, and indicate the insertion of the M. *femorotibialis externus* and M. *iliofemoralis*, respectively (Romer, 1923).

The posterodorsal margin of the distal epiphysis of the femur is concave, being also posteroventrally expanded in two roughly round fibular and tibial condyles. The fibular condyle is slightly lateroventrally oriented and is also larger and more ventrally expanded than the tibial condyle. The dorsoposterior margins of both condyles are slightly acuminated. A subtriangular and relatively deep intercondylar fossa is located between the fibular and tibial condyles (Fig. 10B). Small grooves and striations are present in the dorsal surface of those condyles and the intercondylar fossa, indicating the insertion of the distal third of Mm. *adductor femoris internus* and *femorotibialis internus* (Romer, 1923). The location of such muscle scars also indicates that the proximal portion of Mm. *adductor femoris internus* and *femorotibialis internus* was possibly inserted in the mid-ventral region of the diaphysis of the femur, as in other extinct basal archosaurs (*sensu*, Tarsitano, 1981). The fibular and tibial condyles of the femur of *C. dinizi* are intermediate in terms of development between the condition in *Mariliasuchus amarali*, *Sebecus icaeorhinus* and *Mahajangasuchus insignis*, where those structures are less developed, and *Simosuchus clarki*, where those condyles are proportionally more developed (Nascimento and Zaher, 2010; Sertich and Groenke, 2010; Riff and Kellner, 2011; Pol et al., 2012; Nobre and Carvalho, 2013). The condyles of the femur of *C. dinizi* are most similar to the ones of *Pissarrachampsa sera* in terms of shape and relative size (Godoy et al., 2016) among the Baurusuchidae where the structure is known.

The femur in the Baurusuchidae, in general, is actually more straight than the femur of *Mahajangasuchus insignis* and *Sebecus icaeorhinus*, but is still somewhat more sinous than the condition present in *Simosuchus clarki* (Buckley and Brochu, 1999; Sertich and Groenke, 2010; Pol et al., 2012). The femur of *C. dinizi* (CPPLIP 1237) in particular is slender and straight, being less sinuous and bearing less muscle scars than in other baurusuchids. In those respects, the bone is similar to the condition present in young crocodilians (Vieira, 2011).

Tibia: Both tibiae of CPPLIP 1237 were preserved (Fig. 10C and D), whereas only the left tibia and the proximal epiphysis of the right tibia were preserved in CPPLIP 1437 (Fig. 10E and F). In CPPLIP 1436, in turn, only the diaphysis and the distal epiphysis of the left tibia, articulated to the tarsals, were preserved (Fig. 10H).

The diaphysis of the tibia of CPPLIP 1436 is free from the matrix, but in CPPLIP 1437 only the anterior and posterolateral regions of the bone are exposed, whereas in CPPLIP 1237 the posterior and lateral regions are exposed. The epiphyses of all tibiae are partially fragmented.

The tibia is robust, but smaller and thinner than the femur. The tibia of CPPLIP 1237 has approximately 2/3 of the size and thickness of the same element in CPPLIP 1437. The proximal epiphysis of the tibia is expanded anteroposteriorly and lateromedially. The medial surface of the tibia is slightly concave, while the lateral surface is slightly convex. The anterolateral and anteromedial surfaces of the proximal epiphysis are slightly depressed, and the margins of their articular facet are thick and somewhat convex. The medial margin of the proximal epiphysis has a small process oriented medially. The lateral articular surface of the proximal epiphysis is higher than the medial articular surface. The articular surface is moderately convex. The posterior surface of the proximal epiphysis has a shallow posterior cleft, as in *Simosuchus clarki* (Sertich and Groenke, 2010). A shallow lateral depression, in turn, is located in the lateral surface, as described for *Sebecus icaeorhinus* (Pol et al., 2012) (Fig. 10C). The proximal epiphysis of the tibia of *C. dinizi* is similar to the condition in other baurusuchids, but is less compressed than in *Stratiotosuchus maxhechti* and less expanded than in some crocodyliforms, as *Simosuchus clarki* (Nascimento and Zaher, 2010; Riff and Kellner, 2011). The proximal epiphysis of the tibia of *Mahajangasuchus insignis* and *Mariliasuchus amarali* is medially displaced when compared with *C. dinizi*.

The diaphysis of the tibia of *C. dinizi* is elongated, thick and slightly curved laterally. Its medial surface is relatively concave, while the lateral and anterior surfaces are almost convex. The diaphysis of the tibia is also subcircular in transverse section, with the shape of its perimeter being more circular than that of the femur. The small nutrient foramen is located in the median portion of the tibia. The diaphysis of CPPLIP 1437 is slightly arched as in *Baurusuchus* and *Stratiotosuchus*, but not as in *Pissarrachampsa sera* and in other crocodyliforms where that condition is even more conspicuous, as in *Mariliasuchus amarali* and *Mahajangasuchus insignis* (Buckley and Brochu, 1999; Nascimento and Zaher, 2010; Riff and Kellner, 2011; Nobre and Carvalho, 2013; Godoy et al., 2016). In CPPLIP 1237, on the other hand, the tibia is approximately straight. In addition, the diaphysis of the tibia of *C. dinizi* is less thick than in other Baurusuchidae, with the condition in *Stratiotosuchus* being the more extreme in terms of relative thickness in the family.

The distal epiphysis of the tibia of *C. dinizi* is expanded, slightly compressed anteroposteriorly, being subtriangular in anterior and posterior views (Fig. 10D and E). Its medial and lateral condyles are ventromedially and ventrolaterally expanded, respectively, but the medial condyle is more expanded ventrally than the lateral condyle, which is, in turn, more laterally expanded (Fig. 10D). Muscle scars in the anterodorsal region of the tibia indicate the origin of MMs. *tibialis anterior* and *extensor digitorum longus* (Tarsitano, 1981). Other muscle scars in the posterior surface of the tibia indicate the insertion of the M. *gastrocnemius* (Tarsitano, 1981).

The distal epiphysis of the tibia is very similar in the Baurusuchidae in terms of overall features, but the condition in *C. dinizi, Stratiotosuchus maxhechti* and *Pissarrachampsa sera* differ from *Baurusuchus salgadoensis*, where the structure is more expanded and robust (Nascimento and Zaher, 2010; Riff and Kellner, 2011; Godoy et al., 2016). In non-Baurusuchidae crocodyliforms, as *Sebecus icaeorhinus*, the distal epiphysis of the tibia is more flat anteroposteriorly (Pol et al., 2012) when compared with the Baurusuchidae. In *C. dinizi*, in particular, the condyles of the distal epiphysis of the tibia in CPPLIP 1237 are more reduced when compared with *Baurusuchus salgadoensis*. In addition, a small and slightly round process is present in the dorsolateral region of the lateral condyle of the tibia of the same specimen of *C. dinizi*. A similar structure is also present in the lateral condyle of the tibia of *Pissarrachampsa sera* (Godoy et al., 2016). In *Baurusuchus salgadoensis*, that process is more round and laterally oriented when compared with the aforementioned taxa.

Fibula: The left fibula of CPPLIP 1437 is preserved and exposed in lateral view (Fig. 10G). The margins of the epiphyses of the fibula are partially fragmented.

Overall, the fibula of *C. dinizi* is lateromedially compressed and the epiphyses are slightly more developed than the diaphysis. The proximal epiphysis of the fibula is more posteriorly expanded, its anterior margin is slightly convex, while the posterior margin is slightly concave. The dorsal margin of the epiphysis is fragmented, but its preserved portion is slightly convex. The proximal epiphysis of the fibula of *C. dinizi* is slightly oriented posteriorly, a condition that is shared with all examined crocodyliforms. However, the anterior margin of the proximal epiphysis of the fibula of *C. dinizi* is less convex and the posterior margin, in turn, is less concave when compared with other baurusuchids, especially *Stratiotosuchus maxhechti*. In addition, the posterior surface of the fibula of all comparative baurusuchids is concave in the proximal epiphysis, but becomes straight abruptly in the diaphysis.

The diaphysis of the fibula of *C. dinizi* is elongated, subcircular in transverse section and its margins are straight, as aforementioned, and narrower than the margins of the proximal epiphysis. All margins of the structure are actually straighter when compared with *Baurusuchus* and *Stratiotosuchus*, even though a more sinuosity is observed in *Pissarrachampsa sera* in relation to the other baurusuchids. The posterior surface of the fibula of extant crocodyliforms, in turn, is roughly straight, whereas in *Yacarerani boliviensis* the posterior surface of the bone is even more convex than in the Baurusuchidae. In addition, the diaphysis of the fibula of *C. dinizi* is more slender than in *Baurusuchus* and *Stratiotosuchus*, being more similar to the condition in *Pissarrachampsa* and non-baurusuchids, as *Yacarerani boliviensis* (Nascimento and Zaher, 2010; Riff and Kellner, 2011; Leardi et al., 2015; Godoy et al., 2016). The diaphyses of the tibia of *C. dinizi*, *Baurusuchus* and *Pissarrachampsa* are less developed than in *Stratiotosuchus maxhechti* (Riff and Kellner, 2011).

The distal epiphysis of the fibula is slightly expanded anteroposteriorly, moderately concave anteriorly, and convex posteriorly, with smooth striae present on its lateral surface. The ventral margin of the epiphysis, in turn, is rounded, but this condition might be due to diagenesis. The distal epiphysis of the ulna of *C. dinizi* is also only slightly expanded and the anterior rounded process present in *Stratiotosuchus* and, in a lesser degree, in *Pissarrachampsa*, is absent, as in *Baurusuchus* (Nascimento and Zaher, 2010; Riff and Kellner, 2011; Leardi et al., 2015; Godoy et al., 2016). Both epiphyses of the fibula of *C. dinizi* are thinner and narrower when compared with other baurusuchids, but the ventral tip of the distal epiphysis of the fibula of *C. dinizi* is more expanded than in remaining taxa of the family. In addition, the distal epiphysis of the fibula of *C. dinizi* is the flattest and less developed in the family, resulting in a structure that is similar in terms of general shape to the condition in *Yacarerani boliviensis*.

Some depressions in the lateral surface of the proximal epiphysis and in the diaphysis indicate to the region of insertion of Mm. *fibularis longus* and *fibularis brevis*. A few striations in the distal epiphysis also indicate the insertion of part of the distal portion of the same muscles (Tarsitano, 1981; Carrano and Hutchinson, 2002).

Tarsals: Only a small fragment of the astragalus is preserved in CPPLIP 1237. The tarsals of CPPLIP 1436 are articulated in the *pes*, but are very fragmented and therefore are not described below.

The fragment of the astragalus is small, subtriangular, bearing a shallow depression in its exposed surface. This depression is very similar to the facet of articulation of the astragalus with the fibula present in other crocodyliforms, and that interpretation is adopted for the structure in *C. dinizi*.

Metatarsals: Four disarticulated (CPPLIP 1237) and four articulated (CPPLIP 1436) metatarsals are preserved in *C. dinizi* (Fig. 10H).

The metatarsals are elongated, almost circular in transverse section and dorsoventrally flat. Metatarsals III is the longest bone in the series, followed by metatarsal II. The proximal tips of the metatarsals are expanded as in metacarpals and also have a flattened process that is articulate in an imbricated way and overlaps the medial margin of the proximal tip of the next metatarsal in the series. The distal tips of the metatarsals are wider than the mid portion of the bones, and their ventrolateral and ventromedial portions have a typically rounded margin. The mid-ventral portion of the metatarsals, in turn, is slightly concave and has a trochlear shape. A reduced and semicircular concavity, related to the insertion of the M. *extensor digitorum longus* (Tarsitano, 1981; Riff and Kellner, 2011), is present in the dorsal surface of the distal tip of the metatarsals (Fig. 10H). As in the case of the metacarpals, collateral concavities are also present in the lateral and medial surface of the distal tips of the metatarsals (Fig. 10H).

The metatarsals of *C. dinizi* and other baurusuchids are similar in terms of general structure but the bones are more slender in the species, being in this respect more similar to the condition in *Pissarrachampsa sera*. In addition, metatarsals of *C. dinizi* are slightly longer and dorsoventrally flattest than in *Stratiotosuchus maxhechti*, in which the perimeter of the mid portion of the bones is also more cylindrical (Riff and Kellner, 2011). Metatarsals of *C. dinizi* are also more elongated and slender in their central segment than in *Simosuchus clarki* (Sertich and Groenke, 2010). The distal tips of the metatarsals of *C. dinizi* are also less expanded when compared with *Yacarerani boliviensis*, which actually shares with all examined baurusuchids the overall slender aspect of the bones (Leardi et al., 2015; Godoy et al., 2016). In spite of differences in the family, metatarsals of the Baurusuchidae are markedly longer and more robust than in *M. amarali* and *N. terrestris* (Pol, 2005; Nascimento and Zaher, 2010; Riff and Kellner, 2011; Nobre and Carvalho, 2013).

Pedal phalanges: The proximal, mid and distal (non-ungueal and ungueal) phalanges are preserved partially articulated on the *pes* of CPPLIP 1436 (Fig. 10H). The phalangeal formula of the *pes* recovered is 2-3-4-5-0. A substantial portion of the mid phalanx of digit II and the non-ungueal distal phalanx of digit IV are embedded in the matrix.

The proximal phalanges are elongated and their tips are expanded, distal tips being wider than proximal tips. Both articular facets of the proximal phalanges are concave, a condition that is more pronounced in the distal tip of the bone. The margins of the proximal tips of the proximal phalanges are subcircular. The distal tips, in turn, have a trochlear shape and bear collateral concavities in the medial and lateral surfaces. The mid portion of the proximal phalanges is slightly compressed dorsoventrally. The ventral outline of that region of the bone is somewhat convex, whereas the dorsal outline is almost straight. The proximal phalanx of digit I is slightly shorter than the proximal falanges of digits II, III, and IV. In addition, the distal tip of digit I is small and narrow when compared with digits II, III and IV, which also have more developed collateral concavities (Fig. 10H). The proximal phalanges of digits II and III are very similar amongst themselves, being the most elongated and developed phalanges of the *pes* (CPPLIP 1436). The mid portion of the proximal phalanx of digit IV is thinner when compared with other digits of the *pes*.

In the second phalangeal series, an ungueal articulates with the proximal phalanx of digit I. This ungueal is less robust and less curved than the preserved ungueal of the *manus*, but both bones have a similar falciform shape (Fig. 10H). The proximal articular facet of the ungueal of the *pes* is concavely shallow. The dorsal portion of this structure is more posteriorly expanded that the ventral portion. The mid phalanges of digits II and III are similar in shape to the proximal phalanges in their respective digits, but are smaller and their ventral surfaces are more concave. The dorsal margins of all non-ungual phalanges are slightly concave. The mid phalanx of digit IV is longer than mid phalanges of other digits, but its distal tip is thinner. The mid phalanx of digit II articulate with a small ungueal phalanx, while mid phalanges of digits III and IV articulate with non-ungueal distal phalanges.

The non-ungueal distal phalanx of digit III is mostly embedded in the matrix. However, two non-ungueal distal phalanges (3rd and 4th phalanges) precede the ungueal in digit IV. The 3rd phalanx of the digit IV is shorter and thinner than other phalanges of the *pes*. The ventral and dorsal margins of that phalanx are markedly more concave than the condition in the mid phalanges. The 4th phalanx of the digit IV, in turn, is extremely reduced and their tips are slightly expanded, the proximal tip being wider than the distal tip. The articular surface of the 4th phalanx of the digit IV is anteriorly convex and smooth. Collateral concavities are absent in both non-ungueal distal phalanges of the digit IV (Fig. 10H). The ungueal of digit III is smaller than ungueals in digits I and II. The ungueal of digit IV is also very reduced and thin.

The phalanges of the *pes* of *C. dinizi* are the most slender among examined baurusuchids. Despite an overall similarity among pedal phalanges in the Baurusuchidae, pedal phalanges of *C. dinizi* are, in terms of shape, more similar with the condition in *Pissarrachapsa sera* (Godoy et al., 2016). In addition, the median portion of the non-ungueal phalanges of *C. dinizi*, *Baurusuchus* and *Pissarrachampsa* are more elongated and thinner than in *Stratiotosuchus*. When compared with *Mariliasuchus amarali*, the phalanges of the *pes* of *C. dinizi* are more elongated and developed, and the articular facets of the proximal ends of the proximal phalanges are deeper (Nobre and Carvalho, 2013). The lateral and medial surfaces of the proximal phalanges of *C. dinizi* are also more straight than in *Mariliasuchus*, with the distal tips of the bones being also more expanded in the former. Ungueal phalanges of *C. dinizi* are the most gracile in the Baurusuchidae, but even in this case those bones are more developed than in *Mariliasuchus*.

The phalanges of the *pes* in the Crocodylia are more slender and less dorsoventrally compressed than in *C. dinizi* and other fossil crocodyliforms. The surface of the phalanges in the Crocodylia are also more smooth than the condition in *C. dinizi* and other extinct crocodyliforms, but the non-ungueal phalanges in the Crocodylia are more elongated than the same structure in *Mariliasuchus amarali*. Ungueal phalanges of the *pes* of *C. dinizi* are also more robust and more lateromedially compressed than phalanges in the Crocodylia.

6. Discussion

Campinasuchus dinizi is peculiar among known baurusuchids, but some elements of its postcranium are relevant to understanding some key aspects of the paleobiology of the species and possibly of the Baurusuchidae as a whole. The postcranium of *C. dinizi* is markedly more robust than that of some non-Baurusuchidae crocodyliforms, as *Mariliasuchus amarali* (Nobre and Carvalho, 2013), but most postcranial features uncovered herein indicate that *C. dinizi* is smaller than other baurusuchids examined in this study. The neural spines of the vertebrae of *C. dinizi*, in particular, are proportionally higher in relation to the condition present in other fossil taxa, as in *M. amarali*, *N. terrestris* and in extant crocodyliforms, such as *Melanosuchus niger* and *Caiman latirostris* (Vieira, 2011; Nobre and Carvalho, 2013). The pectoral and pelvic girdles, as well as the stylopodium and zeugopodium of *C. dinizi*, also include some bone elements which are more developed when compared with *M. amarali*, *N. terrestris* and the Crocodylia, as an expanded and robust scapula, the elongated pubis, and more straight and elongated fore- and hind limbs.

The anatomical features attributed to *C. dinizi* commented above are frequently reported as indicative of terrestrial habits. According to Kardong (2009), the height of the neural spines is proportional to the mechanical forces performed by epaxial muscles during movement and stabilization of the vertebral column, with higher neural spines associated with more developed muscles and to the larger weight bearing of the axial skeleton in terrestrial vertebrates. High neural spines in the cervicals and dorsals are also reported as auxiliary in the support of more robust skulls (Romer and Parsons, 1977; Hidelbrand and Goslow, 2006; Kardong, 2009), and that is generally regarded as the case in the Baurusuchidae. Elongated and straight limbs indicate a more upright posture, a condition that is also reported for other baurusuchids (Nascimento and Zaher, 2010; Riff and Kellner, 2011; Godoy et al., 2016). However, the poorly developed muscle scars observed in the postcranium of all specimens of *C. dinizi* indicate a muscular system that is less developed when compared with other taxa in the Baurusuchidae, but still more developed than in extant crocodyliforms such as *Caiman latirostris* and *Melanosuchus niger*. Using the regression equation proposed by Farlow et al. (2005), the specimen of *C. dinizi* CPPLIP 1237 had a body mass of only about 28.06 to 28.72 kg. When the same inference is applied with other baurusuchids, the results are: *Baurusuchus salgadoensis* (UFRJ-DG 418-R), 87.79 kg; (UFRJ-DG 285-R), 165.62 kg; (UFRJ-DG 288-R), 323.91 kg; (UFRJ-DG 417-R), 338,72 kg; *Baurusuchus albertoi* (MZUSP 140-R), 455.92 kg; *Stratiotosuchus maxhechti* (DGM 1477-R), 539.47 to 582.26 kg; *Pissarrachampsa sera* (LPRP/USP0019; Godoy et al., 2016), 163.36 kg. In addition, the correlation analysis indicates that the increase in body mass is correlated to the increase of the femur of the examined Crocodyliformes (Fig. 11).

Pol et al. (2012) indicated some caution when inferring total weight in fossil crocodyliforms based on skeletal features using the regression equation of Farlow et al. (2005), since proposed values are apparently not accurate in the case of *Pristichampsus* and *Protosuchus* among other fossil taxa. However, a weight of just about 28 kg is consistent with the main known osteological features of *C. dinizi*.

Differences in several elements of the postcranium of CPPLIP 1237 where also noted when compared with other specimens of *C. dinizi*. In CPPLIP 1237, for instance, 1) bones are usually more slender, small and thin, 2) the proatlas is less projected ventrally, 3) the neural spines are slightly more vertically oriented, 4) the fore- and hind limbs are straighter and bear less muscle scars, 5) condyles in all bones of the fore- and hind limbs are typically small and less proeminent, and 6) dorsal surface of osteoderms are comparatively more smooth. Open neurocentral sutures were also observed in the cervical and dorsal vertebrae of CPPLIP 1237. Cranial sutures in the same specimen are also more evident, the skull is less robust (especially the premaxilla), the rostrum is comparatively more developed than other parts of the skull, orbits are larger and more round, the postorbital is slender, the quadratojugal is slightly inclined anterodorsally, and teeth are more numerous (four premaxillar and five maxillar), small and thin, with a reduction in the notch for insertion of the 4th mandibular tooth.

Features present in the skull and postcranium of CPPLIP 1237 are similar to the ones observed in young living crocodyliforms (Mook, 1921b; Vieira, 2011). In addition, neurocentral sutures are ossified in a caudal-to-cranial sequence during growth in extant crocodyliforms, with cervical neurocentral sutures the last ones to close (Brochu, 1996). Even if the pattern and timing of ossification of neurocentral sutures are variable in archosaurs (Irmis, 2007), the aforementioned features observed in the skeleton of CPPLIP 1237 indicate that the specimen is actually a juveline.

As mentioned before, additional evidence supporting that conclusion are the less marked muscle scars present in the skeleton of CPPLIP 1237, that suggest that the muscular system of the specimen was not fully developed when compared with other specimens of *C. dinizi*, and other baurusuchids. This condition also indicates that the skeletal system of the specimen was not subjected to the strong mechanical forces typically present in adults, perhaps enhancing the frequency in which a more upright posture was adopted, as in the case of young living crocodyliforms (*sensu* Organ, 2006; Allen et al., 2010).

Other paleobiological traits are inferred from the postcranial anatomy of *C. dinizi*, and some of them might be relevant to the understanding of the ecomorphology in the Baurusuchidae. Carrano (2000) and Riff (2007), among other authors, proposed that the anteromedial torsion of the proximal epiphysis of the femur is primitive for the Archosauria, and that the more marked condition of this feature is typical of terrestrial basal suchians, where the femur is reported as being located in a more upright position when articulated to the ilium. This torsion is more marked in *C. dinizi* than in *Baurusuchus salgadoensis*, being similar to the condition present in *Pissarrachampsa sera*. *Stratiotosuchus maxhechti*, in turn, has the most extreme degree of anteromedial torsion of the proximal epiphysis of the femur among examined Baurusuchidae (Riff, 2007; Godoy et al., 2016). The degree of the anteromedial torsion of this structure in all baurusuchids, including

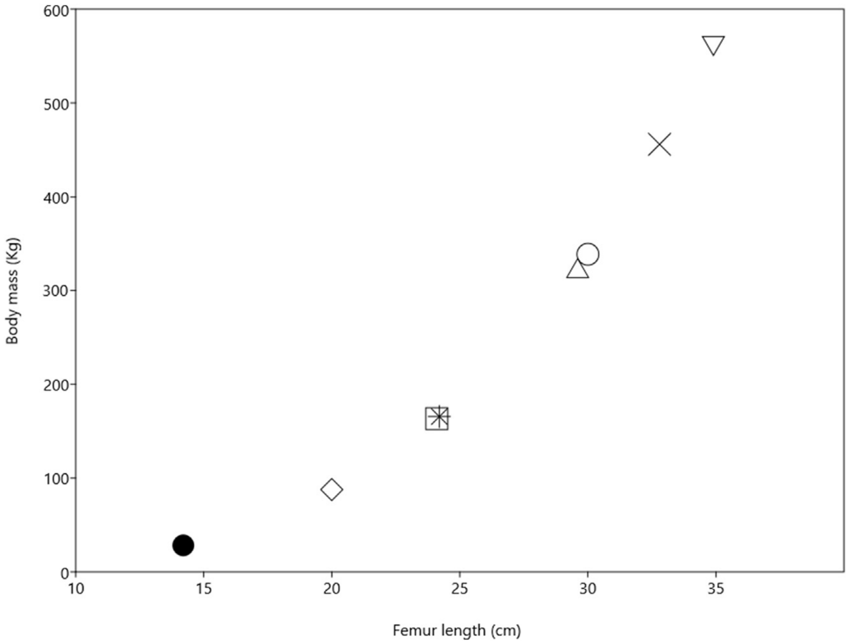

Fig. 11. Analysis of body mass correlation in relation to the femur length of Baurusuchidae.

C. dinizi, is more similar to that present in terrestrial basal suchians than in extant crocodyliforms, indicating a more upright than semi-upright posture. However, the relative position of the humerus and the ulna in *C. dinizi* CPPLIP 1436 is also indicative of a semi-upright position (Fig. 12), a feature that suggests the capacity of changing posture (semi-upright and upright) during life.

Potentially relevant phylogenetic information is also present in the postcranial anatomy of *C. dinizi*. Godoy et al. (2016) hypothesized that the absence of osteoderms in *Pissarrachampsa sera* is a possible synapomorphy of the Pissarrachampsinae Montefeltro, Larsson and Langer, 2011, a subfamily that also includes *C. dinizi*, *Wargosuchus australis* Martinelli and Pais, 2008 and *Gondwanasuchus scabrosus* (Marinho et al., 2013). Godoy et al. (2016) also suggested that if absence of osteoderms was confirmed in other smaller and early-diverging crocodyliforms (*e.g. Cynodontosuchus rothi* Woodward, 1896 and *Gondwanasuchus scabrosus*), this condition could be related to the reduced size. However, as described herein, osteoderms are present in C. *dinizi* and the occurrence of osteoderms is probably not a synapomorphy of the Pissarrachampsinae. In addition, *C. dinizi* is also smallest in relation to other examined baurusuchids, indicating that absence of osteoderms is not necessarily related with reduced sizes in basal crocodyliforms.

The tiny foramina present in the dorsal surface of the osteoderms of *C. dinizi* were probably associated with vascular channels, which in turn might indicate the occurrence of some thermoregulatory ability, as in living crocodyliforms (*sensu* Su and Chen, 2013; De Buffrénil et al., 2015). Occurrence of thermoregulatory ability might be also shared with other baurusuchids in which foramina associated with vascular channels are present in the osteoderms, such as *Baurusuchus salgadoensis* and *Baurusuchus albertoi* (Nascimento and Zaher, 2010).

7. Conclusion

Unique features among the Baurusuchidae were uncovered in the postcranial skeleton of *C. dinizi*, as the straighter limbs and the small body size (Fig. 12). The postcranial anatomy of *C. dinizi* also

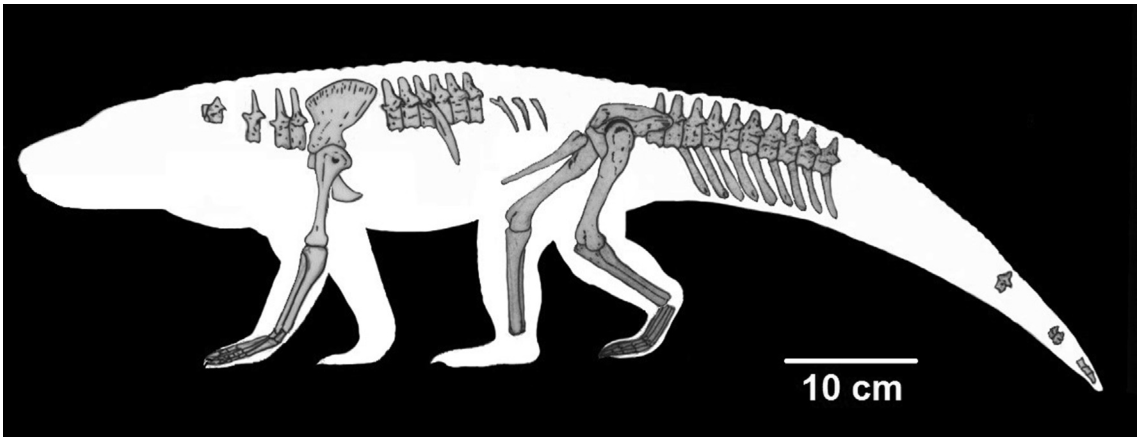

Fig. 12. Illustrated reconstruction of the postcranial skeleton of *Campinasuchus dinizi* (by the first author).

suggests terrestrial habits, with the possibility of modulating posture from a semi-upright to a perhaps fully upright position. The straighter limbs of CPPLIP 1237, which was identified as a juvenile, also probably favored a more cursorial life-style when compared with other specimens of *C. dinizi*, a situation that is highly reminiscent of the changes observed in extant crocodyliforms during growth. The postcranium of *C. dinizi* and other baurusuchids, especially *Pissarrachampsa* and *Baurusuchus*, also share some evident similarities, which might further contribute to the understanding of the phylogenetic relationships within the family in future studies.

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