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Marcos Vinicius Lopes Queiroz

A new Peirosauridae (Crocodyliformes Notosuchia) from the Adamantina Formation (Bauru Group, Late Cretaceous), and a new phylogenetic analysis of notosuchians

São José do Rio Preto

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To all these my most sincere thanks.

“The crocodile cannot turn its head. Like all science, it must always go forward with all-devouring jaws.”

Pyotr Kapitsa (JUNGK, 1958, p. 56)

RESUMO

Dentro da diversidade de fauna encontrada nos depósitos da Bacia Bauru estão os Peirosauridae. Este grupo de Notosuchia se espalha por Gondwana e possui importantes formas descritas para o Brasil. Neste trabalho descrevemos uma nova espécie de Peirosauridae com rostro de proporções platirostral ou aproximadamente tubular, encontrado na Formação Adamantina (Bacia Bauru, Cretaceo Superior). O espécime consiste em um crânio parcialmente preservado com teto craniano, região interorbital do cranio e fragmentos da porção posterior do rostro, incluindo pré-frontal e lacrimal; hemimandíbula esquerda, com 14 alvéolos e 12 dentes; e um fragmento de costela cervical. O espécime pode ser atribuida à Peirosauridae graças à existência de uma abertura ótica fechada posteriormente e em forma de triângulo, com ápice direcionado dorsalmente; à ausência de bordas supratemporais elevadas e hipertrofiadas; por possuir a superfície lateral do flanco descendente pós-orbital côncava; e um dentário com concavidade lateral para recepção de dente maxilar alargado. O espécime foi reconhecido como uma nova espécie de Peirosauridae baseando-se em uma série de autapomorfias que o distingue de seus táxons mais proximos, tais como dentes com carenas lisas; a sua borda póstero-ventral do quadratojugal que não atinge os côndilos quadrados; as bordas distais do quadrado possuem apenas um plano voltado posteriormente; e o processo paraoccipital que em vista occipital apresenta orientação horizontal. Afim de esclarecer o posicionamento do novo espécime dentro de Peirosauridae, bem como para elucidar a topologia do grupo com a inserção de vários possíveis membros, foi realizada uma análise filogenética que contaneou dados importantes de três matrizes independentes com alta representatividade de Notosuchia, em especial os Peirosauridae. Nossos resultados indicaram para a monofilia de Peirosauridae, formado por suas grandes linhagens de Pepesuchinae e Peirosaurinae, conforme o proposto anteriormente. Paralelo a este resultado encontramos o argentino *Colhuehuapisuchus lunai*, descrito originalmente como um Peirosauridae, aninhado junto aos Mahajangasuchidae, ampliando assim a distribuição espacial do grupo e o consagrando como mais um grupo de Notosuchia com representatividade Gondwanica.

Palavras–chave: Sistemática filogenética. Notosuchia. Peirosauridae. Pepesuchinae. Peirosaurinae. Formação Adamantina. Bacia Bauru.

ABSTRACT

Peirosauridae is one of the fossil crocodyliform groups found in the Bauru Basin deposits. The fossil record of this group of Notosuchia spans across Gondwana, with important forms described for Brazil. In this work, we describe a new species of Peirosauridae that possesses a rostrum of platyrostral or nearly tubular proportions, found in the Adamantina Formation (Bauru Basin, Late Cretaceous). The specimen consists of a partially preserved skull with a cranial table, interorbital region and fragments of the posterior portion of the rostrum, including the prefrontal and lacrimal; left hemimandible, with 14 alveoli and 12 teeth; and a single cervical rib fragment. The specimen can be attributed to the Peirosauridae clade by the presence of a posteriorly closed optical opening in the form of a triangle, with a dorsally directed apex; the absence of elevated and hypertrophied supratemporal borders; for having a concave post-orbital descending process lateral surface; and a dentary with lateral concavity to receive an enlarged maxillary tooth. The new specimen was assigned to a new taxon based on a series of autapomorphies that distinguish it from its imediate sister taxa, such as teeth with smooth canines; its posteroventral border of the quadratojugal that does not reach the square condyles; the distal edges of the square have only a posteriorly facing plane; and the paraoccipital process that, in the occipital view, presents a horizontal orientation. To clarify the position of the new Peirosauridae, as well as to elucidate the topology of the group with the inclusion of several possible members, a phylogenetic analysis was performed including data from three independent matrices with increased representation of Notosuchia, especially the Peirosauridae. Our results indicated the monophyly of Peirosauridae, formed by two main lineages of Pepesuchinae and Peirosaurinae, as previously proposed. Parallel to this result, we find the Argentinian *Colhuehuapisuchus lunai*, originally described as a Peirosauridae, nested within the Mahajangasuchidae, thus expanding the spatial distribution of the group as another Notosuchia clade widespread in Gondwana.

Keywords: Phylogenetic systematics. Notosuchia. Peirosauridae. Pepesuchinae. Peirosaurinae. Adamantina formation. Bauru Basin.

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

char. character
CPPLIP Centro de Pesquisas Paleontológicas L. I. Price, Uberaba, Brazil
D1-D14 dentary tooth number (varies from 1 to 14)
DGM Diretoria de Geologia e Recursos Minerais, Rio de Janeiro, Brazil
DNPM Departamento Nacional de Produção Mineral, Rio de Janeiro, Brazil
Fm. Formation
gen. genus
LAPEISA Laboratório de Paleontologia de Ilha Solteira, Ilha Solteira, Brazil
MCT Museu de Ciências da Terra, Rio de Janeiro, Brazil
MN Museu Nacional, Rio de Janeiro, Brazil
MNN Musée National du Niger, Niamey, Niger
MPMA Museu de Paleontologia de Monte Alto, Monte Alto, Brazil
ROM Royal Ontario Museum, Toronto, Canada
RRBP Rukwa Rift Basin Project, Tanzanian Antiquities Unit, Dar es Salaam, Tanzania
sp. nov. specie novae
st. state
TBR Tree-Bisection-Reconnection
UFRJ-DG Coleção de Paleontologia de Vertebrados da Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil

SUMMARY

1 INTRODUCTION

Notosuchia (sensu RUIZ *et al*., 2021, TURNER; SERTICH, 2010; POL *et al*., 2012; POL; LEARDI, 2015) is diverse and rich group of a crocodyliforms that is abundant among the very rich Cretaceous paleofauna of Gondwana. This group is composed by diverse forms both in morphology and, possibly, in paleoecology, including individuals from different habitats and feeding habits, that was previously compared to the diversity of biology among extant mammals (O'CONNOR *et al*., 2010; ÖSI, 2014; GODOY *et al*., 2014; BRONZATI; MONTEFELTRO; LANGER, 2015; MELSTROM; IRMIS, 2019; MONTEFELTRO *et al*., 2020).

Although notosuchian representatives are present in most all the landmasses that formed Gondwana (BUFFETAUT, 1994; GOMANI, 1997; LARSSON; SIDOR, 1999; SERENO *et al*., 2003; SERENO; LARSSON, 2009; O'CONNOR *et al*., 2010; BUCKLEY; BROCHU, 1999; BUCKELY *et al*., 2000; WILSON *et al*., 2001), it is in the Cretaceous deposits of South America that the group shows their greatest diversity (BONAPARTE *et al*., 1991; BRONZATI; MONTEFELTRO; LANGER, 2015, POL; LEARDI, 2015). The Bauru Basin is one of these deposits in which a plethora of notosuchians had been recovered from, being a stratigraphic unit that outcrops in much of Southern Brazil (FERNANDES; RIBEIRO, 2014). The Adamantine Formation (Upper Cretaceous, Bauru Basin) has one of the most important continental fossiliferous deposits of this period and has a unique ecosystem (BRONZATI; MONTEFELTRO; LANGER, 2015; POL; LEARDI, 2015, MONTEFELTRO *et al*., 2020, BANDEIRA *et al*., 2018). This formation is bears an important fossil vertebrate record, with several species described of various lineages of Notosuchia (RIFF *et al*., 2012; GODOY *et al*., 2014; PINHEIRO *et al*., 2018). These species represent the most diverse paleofauna of this group during the Cretaceous (RIFF *et al*., 2012; CANDEIRO *et al.*, 2006) and demonstrate the existence of an ecosystem dominated by Crocodyliformes unparalleled in the geological history of Earth (GODOY *et al*., 2014; MONTEFELTRO *et al*., 2020). In some localities, the fossil record of Notosuchia rivals and or overcome the coeval diversity of Theropoda (MONTEFELTRO *et al*., 2020, contra BANDEIRA *et al*., 2018).

One of the diverse notosuchian groups present in the Adamantina Formation is the Peirosauridae (CARVALHO; RIBEIRO; AVILA, 2004; CARVALHO; VASCONCELLOS; TAVARES, 2007; CAMPOS *et al*., 2011; IORI; GARCIA, 2012; PINHEIRO *et al*., 2018). Since the initial description of *Peirosaurus tormini* (PRICE, 1955), this group has been recognized as unique. However, from the 1990s onward, a greater diversity of species was described and associated to the group from Cretaceous deposits in South America (CARVALHO; RIBEIRO; AVILA, 2004; CARVALHO; VASCONCELLOS; TAVARES, 2007; CAMPOS *et al*., 2011; IORI; GARCIA, 2012; MARTINELLI *et al*., 2012; BARRIOS *et al*., 2016; CORIA *et al*., 2018; PINHEIRO *et al*., 2018; GEROTTO; BERTINI, 2018; FILIPPI; BARRIOS; GARRIDO, 2018), continental Africa (LARSSON; GADO, 2000; LARSSON; SUES, 2007; SERTICH; O'CONNOR, 2014; NICHOLL *et al*., 2021) and Madagascar (SIMONS;BUCKLEY, 2009). Most of the known peirosaurids are characterized by a broad oreinorostral rostrum (e.g. *Montealtosuchus arrudacamposi* Carvalho; Vasconcellos; Tavares, 2007 and *Hamadasuchus rebouli* Larsson; Sues, 2007). At the same time, a smaller number of forms putatively attributed to the group have a playtrostral or nearly tubular rostrum (e.g. *Itasuchus jesuinoi* Price, 1955 and *Pepesuchus deiseae* Campos *et al*., 2011).

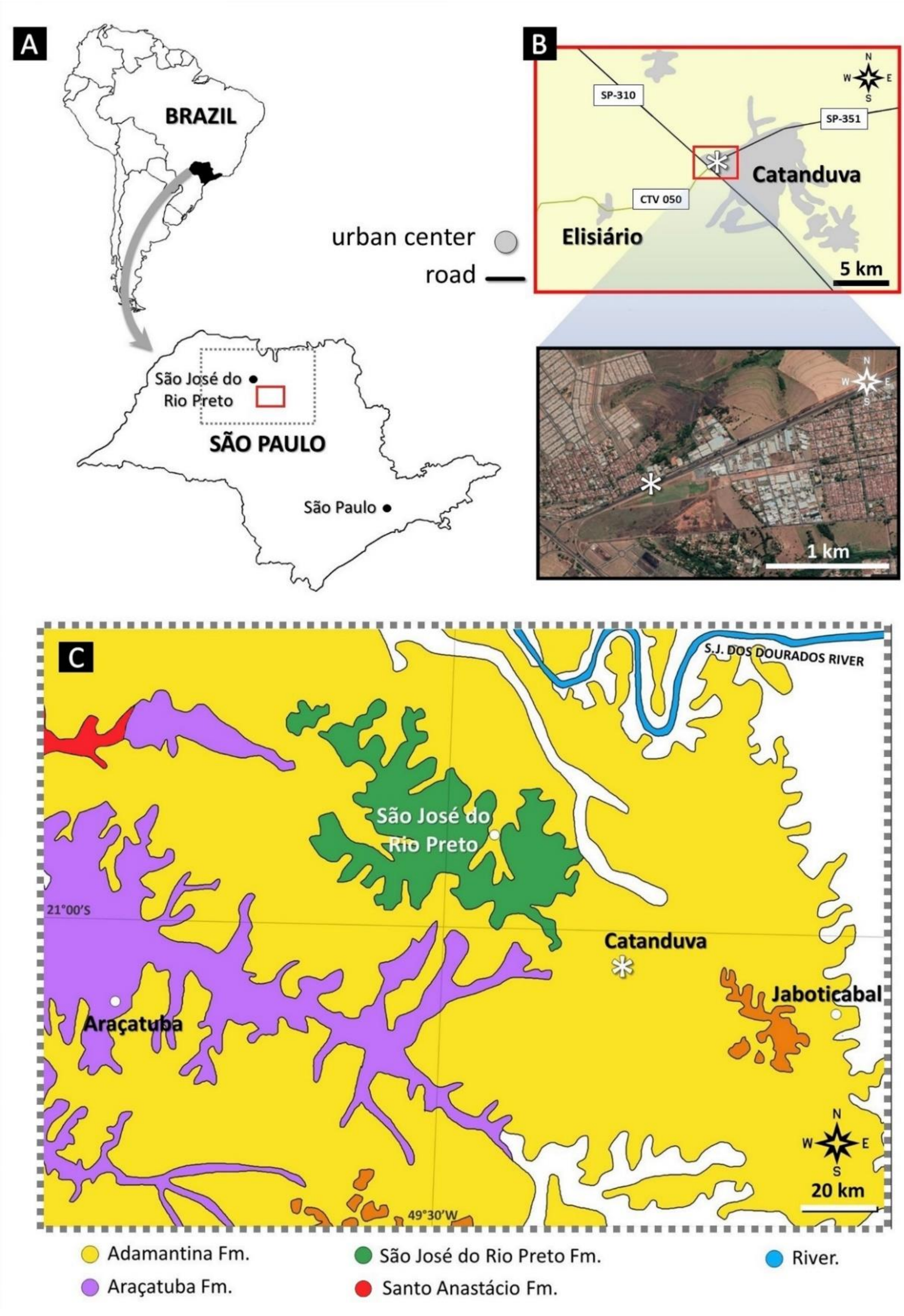
Despite the description of several species of Peirosauridae in the last 25 years, the unique traits and the morphological diversity of the group, peirosaurids have been historically neglected, and only a fraction of the species are, in general, included in phylogenetic analyzes. This situation changed in 2018, when two matrices constructed relatively independently of each other included a greater diversity of Peirosauridae diversity (PINHEIRO *et al*., 2018, GEROTTO; BERTINI, 2018). These matrices point to conflicting results regarding the internal phylogeny of the group. Gerotto and Bertini (2018) recognize the Peirosauridae as a monophyletic group composed of two clades: the Peirosaurinae (Peirosauridae characterized by the oreinorostral shape) and the Pepesuchinae (Peirosauridae characterized bythe nearly tubular or platyrostral rostral shape). On the other side, Pinheiro *et al* (2018) recognize Peirosauridae, as previously understood, as a paraphyletic group. In this work, the nearly tubular and platyrostral rostrum taxa are proposed as belonging to a different clades, named Itasuchidae, while the remaining Peirosauridae form a homonymous clade, as a sister group of Sebecidae (SIMPSON, 1937).

In 2011, an outcrop of the Adamantina Formation in Catanduva (figure 1) revealed several fossils, including a specimen identified as a Peirosauridae with a long, nearly tubular face (MPMA 68-0001-11). This specimen is the focus this new study, and represents one of the few known long-snouted Peirosauridae specimens, and one of the most complete in Brazil.

The taxonomy, description and phylogenetic positioning of this new specimen became even more relevant after the fire in the Museu Nacional, in Rio de Janeiro, Brazil in 2018. During this tragedy, the holotype and the complete referred materials of the one main Brazilian long-snouted Peirosauridae specie were lost (*Pepesuchus deiseae* Campos *et al*.). In addition to this incident, there is the disappearance in the 1990s of two specimens, including the almost complete holotype of *Caririsuchus camposi* (KELLNER, 1987), another Peirosauridae, which could help in the task of elucidating the internal relationships of this diverse group.

In the present work, a specimen of Peirosauridae from the Adamantina Formation (Bauru Basin) in Catanduva-SP is described, possibly representing a new species with a nearly tubular rostrum. In addition to the description of the material, we performed a new phylogeny of Crocodyliformes to adequately test the monophyly of Peirosauridae, and to elucidate the inner phylogenetic relationships of the clade.

Figure 1. Type locality of MPMA 68-0001-11. **A,** maps of South America, Brazil and São Paulo, showing the provenance of the fossil; **B,** the provenance of the fossil and the outcrop of the Adamantina Formation where the MPMA 68-0001-11 was found; **C,** surface exposure of Bauru Basin rocks around the locality where MPMA 68-0001-11 was found (marked with an asterisk).



(Source: Modified from Fernandes & Ribeiro, 2014).

2 MATERIAL AND METHODS

2.1 Collection and preparation

The specimen MPMA 68-0001-11 was identified in 2011, during construction on the highway SP-351 at the km 16, in the municipality of Catanduva, São Paulo, Brazil. The constructions revealed an outcrop of the Adamantina Formation in which several fossils were revealed and rescued, including the specimen MPMA 68-0001-11, atributed peirosaurid crocodyliform (IORI *et al*., 2011). In 2019, the specimen, was analyzed in the LAPEISA.

2.2 Phylogenetic analysis

To investigate the phylogenetic relationships of MPMA 68-0001-11 within Crocodyliformes, the specimen was included in the most recent version of the phylogenetic dataset of the Crocodyliformes published by Ruiz *et al*. (2021). This matrix encompasses a great part of the known diversity of Gondwanan Cretaceous Crocodyliformes with 98 taxa. The original matrix included nine peirosaurids (*Barreirosuchus franciscoi* Iori; Garcia, 2012; *Gasparinisuchus peirosauroides* Martinelli *et al*., 2012; *Hamadasuchus rebouli* Larsson; Sues, 2007; *Itasuchus jesuinoi* Price, 1955; *Lomasuchus palpebrosus* Gasparini; Chiappe; Fernandez, 1991; *Montealtosuchus arrudacamposi* Carvalho; Vasconcellos; Tavares, 2007; *Pepesuchus deiseae* Campos *et al*. 2011; *Stolokrosuchus lapparenti* Larsson; Gado, 2000; and *Uberabasuchus terrifichus* Carvalho; Ribeiro; Avila, 2004). We expanded the taxonomic sampling with the addition of 12 taxa associated related to Peirosauridae (MPMA 68-0001-11; *Amargasuchus minor* Chiappe, 1988; *Ayllusuchus fernandezi* Gasparini, 1984; *Rukwasuchus yajabalijekunduis* Sertich; O'Connor, 2014; *Caririsuchus camposi* Kellner, 1987; *Roxochampsa paulistanus* Roxo, 1936; *Kinesuchus overoi* Filippi; Barrios; Garrido, 2018; *Colhuehuapisuchus lunai* Lamanna *et al*., 2019; *Bayomesasuchus hernandezi* Barrios; Carabajal; Bona, 2016; *Barrosasuchus neuquenianus* Coria *et al*., 2018; *Ogresuchus furatus* Sélles *et al*., 2020 and *Antaeusuchus taouzensis* Nicholl *et al*., 2021).

We also expanded the character sampling for anatomical phylogenetic relevant traits in peirosaurids with the addition and redefinition of 13 characters (see Supplementary Material for details) proposed or modified by newly published papers of Gerotto and Bertini (2018) and Pinheiro *et al*. (2018) (see Supplementary Material for details). In addition, two characters already in the character list were rewritten (333 and 354), and four were modified to add new character states (521-524, see Supplementary Material).

The final matrix is 110 taxa and 524 characters (see supplementary material). The defined ingroup is the Mesoeucrocodylia clade, with "Protosuchia" and Thalattosuchia as outgroups.

For phylogenetic analysis, search for the most parsimonious trees was developed in the software TNT v. 1.5 (GOLOBOFF; CATALANO 2016) with a heuristic search with random seed as ‘0’, performed 10,000 replicates, TBR (Tree bisection and reconnection) as the rearrangement algorithm, and saving 20 cladograms per round. The MPTs were collapsed after each repetition, and the most parsimonious trees were summarized in a strict consensus tree.

3 RESULTS

3.1 Systematic Palaeontology

Crocodylomorpha Walker, 1970

Crocodyliformes Hay, 1930 (sensu CLARK in BENTON; CLARK 1988)

Mesoeucrocodylia Whetstone and Whybrow, 1988

Notosuchia Ruiz *et al*. 2021

Sebecia Larsson and Sues 2006

Peirosauridae Gasparine, 1982

Pepesuchinae Geroto and Bertini, 2018

Holotype. MPMA 68-0001-11 is a partial skull composed of cranial table, interorbital region, and fragments of the posterior portion of the rostrum, including prefrontal and lacrimal; left hemimandible, with 14 alveoli and 12 teeth; and an isolated cervical rib fragment

Stratigraphic horizon. Adamantina formation, Bauru Group, Bauru Basin. Late Cretaceous (Campanian to Maastrichtian).

Type locality. Outcrop on the side of the SP highway 351, between km 16 and 17, municipality of Catanduva, north center of São Paulo state, Brazil (21°07'54.8"S 49°00'58.8"W).

Diagnosis. The new taxon is a peirosaurid with an nearly tubular rostrum that differs from the other peirosaurids due to a set of unique characters (autapomorphies marked with an asterisk): dentary not compressed and lateroventral surface anterior to mandibular fenestra convex; dentary with lateral concavity for reception of enlarged maxillary tooth; distance at the anterior margin of the orbit to posterior margin of the antorbital fossa longer than the height of the antorbital fossa at the posterior margin; elongated symphysis; fourteen teeth per hemimandible; 7th and 8th teeth of the dentary apart from each other and closer to 6th and 9th; teeth with smooth carinae*; lateral insertion of the post-orbital over the jugal in the post-orbital bar*; supratemporal rims at the level of the cranial table; squamosal post-lateral process without ornamentation and projected upwards*; posteroventral edge of the quadratojugal does not reach the quadrate condyles*; distal edges of the quadrate with only one plane facing posteriorly*; quadratojugal dorsal extent in medial surface ending at the same level the dorsal tip of laterotemporal fenestrae*; horizontal orientation of the paraoccipital process in occipital view*.

3.2 Description

MPMA 68-0001-11 is composed of the cranial table (figure 2), the left hemimandible (figure 3), with almost complete dentary, and a single isolated cervical rib. The cranial table, although fragmented, includes the posterior region (parietal, squamosal, post-orbital and frontal), the anterior margin of the orbits is marked by incomplete pieces of the lacrimal and prefrontal, but their lateroventral limits have been lost. It is possible to identify the posterior limits of the nasal and left maxilla, as well their sutures to the lacrimal. The right lateral cranial elements (jugal, quadratojugal and square) are also preserved. In the occipital view, the supraoccipital and exoccipital are present with poorly preserved limits. The ventral part of the skull including the neurocranium is heavly fragmented and covered by rocky matrix.

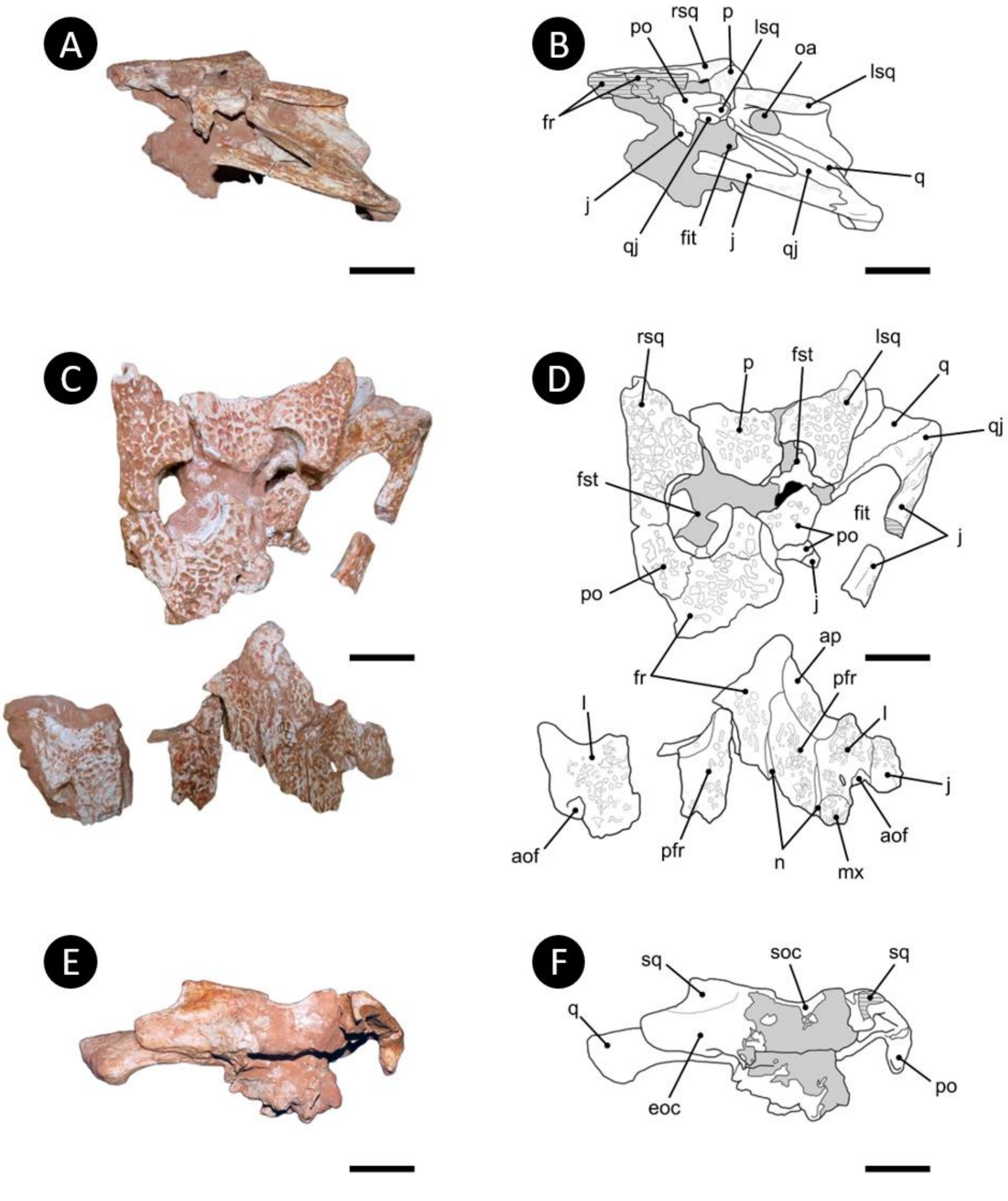
The dentary of MPMA 68-0001-11 extends from the distal end to almost the margins of the external mandibular fenestra and the suture with the surangular. The size and shape of the dentary indicate a longirostral shape. Among the 14 preserved alveoli of the left dentary, only teeth D2 and D12 are absent. The surface and details of the splenial are covered by rocky matrix.

The outer surface of the preserved portion is well-preserved, allowing visualization of the sutures. However, MPMA 68-0001-11 shows taphonomic deformations, slightly distorting the longitudinal axis, and most of the structures are incomplete or fragmented.

Lacrimal: The lacrimal extends from the anterior margin of the orbit and the contact with the prefrontal to its anterior limits, contacting the maxilla and nasal in a notched suture. It also has a short and straight lateral extension, forming the posterior border of the antorbital fenestra and contacting the anterior ramus of the jugal.

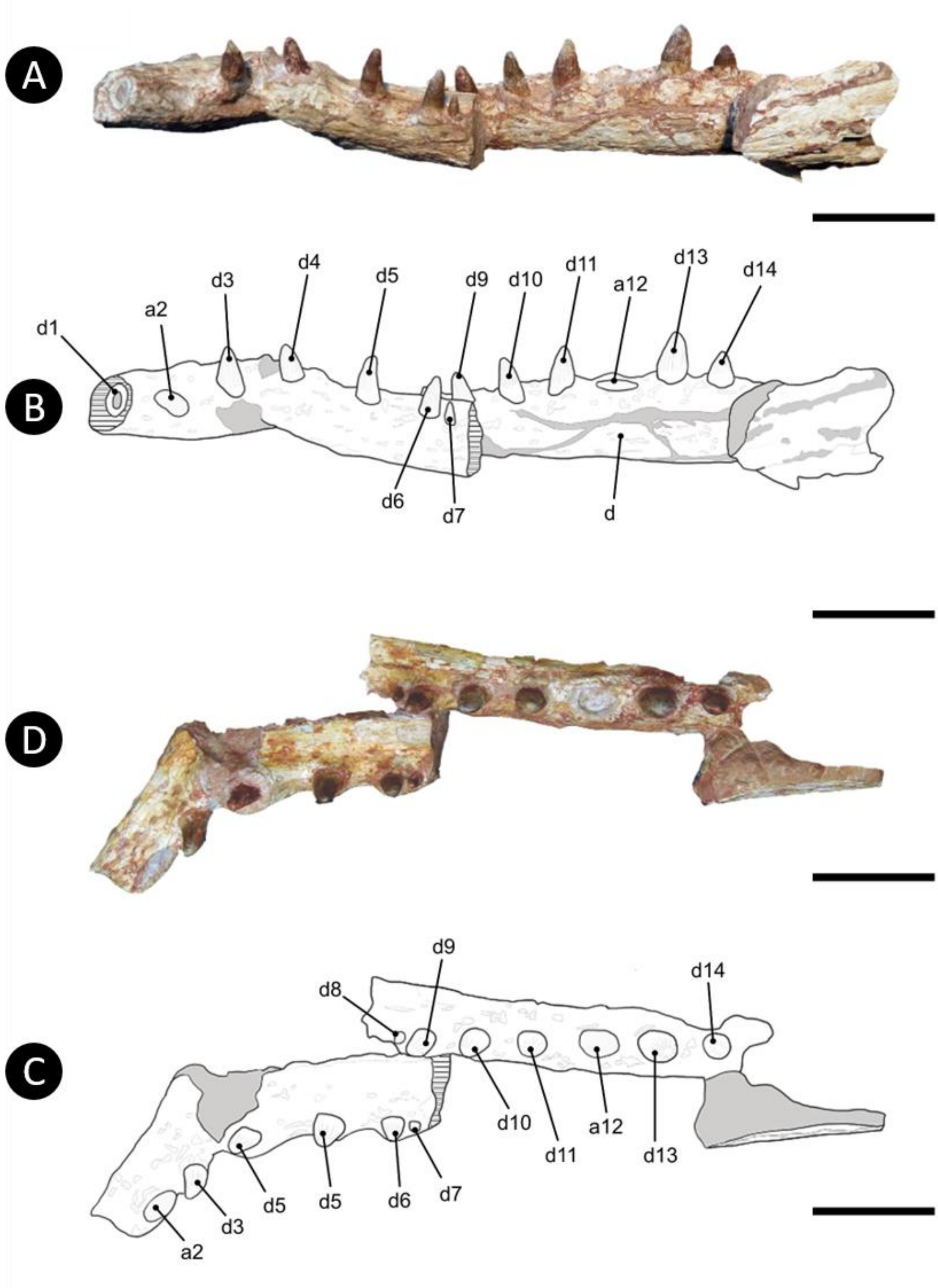
The lacrimal presents a slight lateral concavity next to the suture with the jugal and its surface has an increased ornamentation, as well as the structures that limit it. Both lacrimals are incomplete and it is not possible to trace their most anterior limits and their real extent.

Figure 2. Skull of the new species (MPMA 68-0001-11) and interpretative drawings. **A** and **B**, left lateral view; **C** and **D**, dorsal view; **E** and **F**, occipital view of skull. The grey and hatched areas indicate the presence of rock matrix and broken surfaces, respectively. **Abbreviations**: **oa**, optical aperture; **aof**, antorbital fenestra; **ap**, anterior palpebral; **eoc**, exoccipital; **fit**, infratemporal fenestra; **fr**, frontal; **fst**, supratemporal fenestra; **j**, jugal; **1**, lacrimal; **lsq**, left squamosal; **mx**, maxilla; **n,** nasal; **p,** parietal; **pfr**, prefrontal; **po**, postorbital; **q**, quadrate; **qj**, quadratojugal; **rsq**, right squamosal; **soc**, supraoccipital; **sq**, squamosal. Scale bar: 5cm.



(Source: the author).

Figure 3. Left hemimandible of the new species (MPMA 68-0001-11) and interpretative drawings. **A** and **B**, left lateral view; **C** and **D**, oclusal view of hemimandible. **Abbreviations**: a2-12, alveoli; d, dentary; d1-14; dentary teeth. Scale bar: 5cm.



(Source: the author).

The lacrimal presents a slight lateral concavity next to the suture with the jugal and its surface has an increased ornamentation, as well as the structures that limit it. Both lacrimals are incomplete and it is not possible to trace their most anterior limits and their real extent.

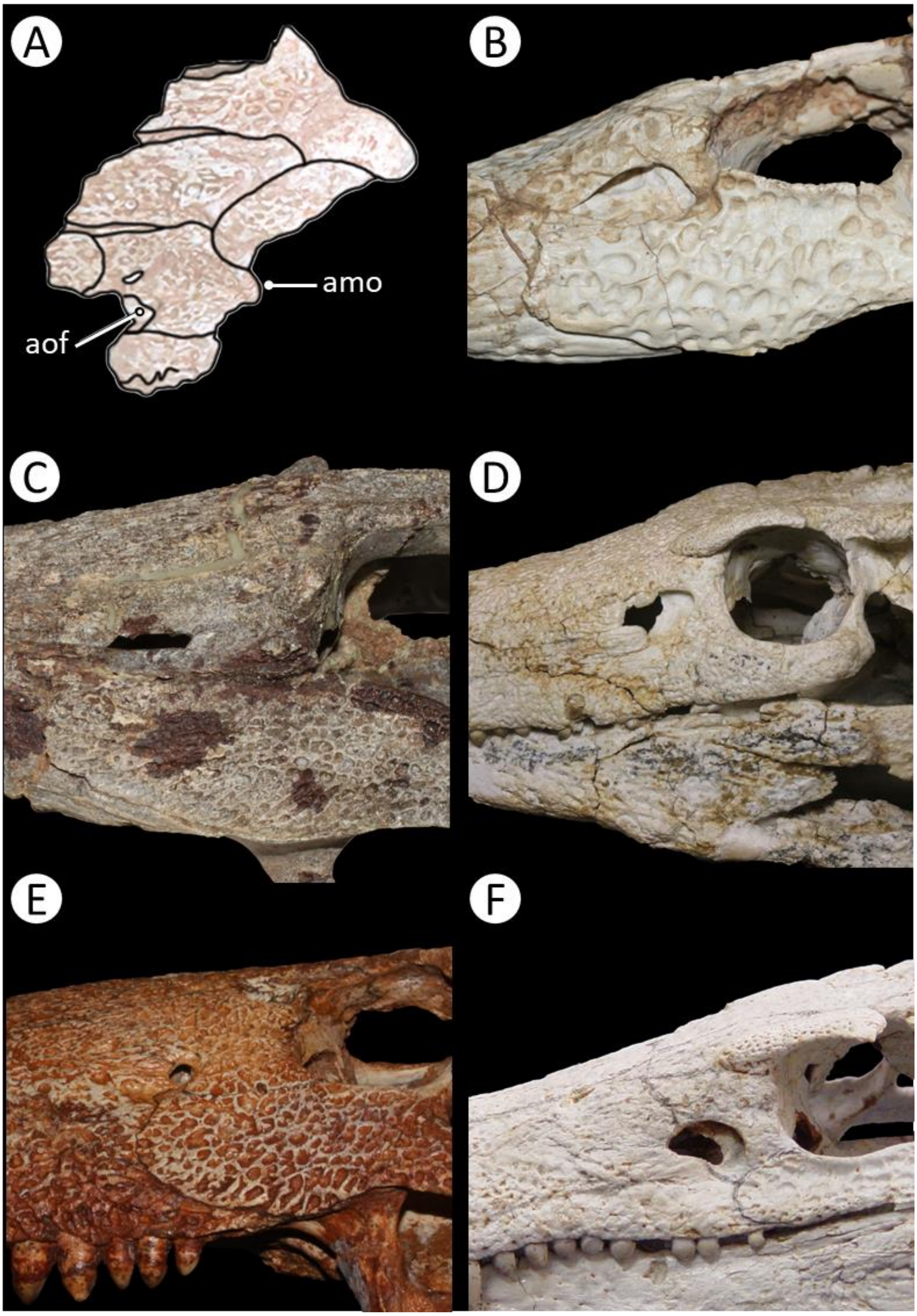
Only the posterior limit of the antorbital fenestra is preserved, where it presents an elliptical-shaped fossa. As in other peirosaurids platyrostral or nearly-tubular rostrum, the antorbital fenestra is low and elongated, slit-shaped. In MPMA 68-0001-11, the distance between the posterior margin of the antorbital fenestra and the anterior margin of the orbit is porportionally greater than in most Peirosauridae, being similar only to *Stolokrosuchus* and *Hamadasuchus* (figure 4).

Nasal: Only two posterior wedge-shaped processes of the left nasal are preserved in MPMA 68-0001-11. Both processes present smooth sculpture ornate with pits and grooves. The most medial of the processes wedges laterally to the frontal and medially to the left prefrontal. The medial process inserts medially to the prefrontal and laterally to the lacrimal, separating these two at their most anterior limits.

A similar nasal shape (i. e. with two posteriorly extending wedge-shaped processes separating anteriorly frontal-prefrontal and prefrontal-lacrimal) is observed in other Peirosauridae, such as *Pepesuchus*, *Caririsuchus* and *Barreirosuchus*. However, a similar shape is found in *Cricosaurus* and *Metriorhynchus casamiquela*, also crocodyliforms of aquatic habits and long-snouted (GASPARINI, 2000; FREY et al., 2002)

Prefrontal: The prefrontal is elongated and wedges between the frontal and lacrimal, being separated by the posterior processes of the nasal, as in other Peirosauridae (*Pepesuchus*, *Caririsuchus* and *Barreirosuchus*). The anterior limits of the prefrontals is at the same level as the boundary of the frontal, as in *Pepesuchus, Rukwasuchus, Caririsuchus* and *Barreirosuchus*. Anteriorly, the prefrontals have a process that contacts lateraly the frontal and anteromedialy to the orbital margin. This process has a dorsal concavity for the reception of the anterior palpebral.

Figure 4: The antorbital region of peirosaurids. **A,** MPMA 68-0001-11; **B,** *Pepesuchus deiseae* (MN 7005-V); **C,** *Stolokrosuchus lapparenti* (MNN GDF600)*;* **D,** *Uberabasuchus terrificus* (CPPLIP-630)*;* **E,** *Hamadasuchus rebouli* (ROM 52620)*;* **F,** *Montealtosuchus arrudacamposi* (MPMA-16-0007-04). The dotted line in A indicates sutures. **Abbreviations**: **aof**, antorbital fenestra; **amo**, anterior orbital margin.



(Source: the author).

Palpebral: Only the left anterior palpebral is preserved in MPMA 68-0001-11. It is composed of a robust element with a slightly convex and heavily ornamented dorsal surface. The elliptical anterior palpebral is anterolaterally inclined to the dorsal surface of the skull and has and articulates in the posterior projections of the prefrontal and lacrimal, fitting on a notch present on the posterior edge of these structures. Its posteromedial portion also fits into a small lateral facet of the frontal. The surface of the articulation of the anterior palpebral to the frontal and prefrontal is convex.

Frontal: The frontal is fully fused at midline and presents a strong outer ornamentation. Anterior to the orbits, the frontal is laterally limited by the prefrontals and nasals, and extends to its posterior limit, contacting the postorbitals laterally and the most anterior limit of the parietal. Between the orbits, the frontal is lateraly notched for insertion of the anterior palpebral. As in other peirosaurids, the orbital margins of frontal are moderately elevated, producing a gently concave dorsal surface. Lateroposteriorly, the frontal also touches the supratemporal fenestra, thus participating in its anterior margin.

In MPMA 68-0001-11, the frontal tapers anteriorly past the orbits, and although not preserved, its most anterior edge would likely form the wedge-shaped process between the nasals.

Postorbital: The postorbital is formed by three processes that radiate from its central body, two dorsal processes and a descending one.

The dorsal process extends anteromedially and contacts the frontal which separates the orbit from the supratemporal fenestra, in which it contributes to the edge of both apertures. The posterodorsal process curves posteriorly, and meets the squamosal on the dorsal surface of the cranial table, lateraly to the supratemporal fenestra. These two dorsal processes form a surface ornamented with pits and grooves located at the anterolateral corner of the cranial table.

The descending process of the postorbital is directed lateroventrally, and is concave in its most dorsal limit. It is the descending process that contacts the ascending process of the jugal and forms the dorsal portion of the postorbital bar. In this contact, the postorbital is positioned lateral to the jugal differently from all other Peirosauridae (*Barreirosuchus, Pepesuchus, Stolokrosuchus, Hamadasuchus, Gasparinisuchus, Barrosasuchus, Montealtosuchus* and *Uberabasuchus*).

The outer surface of the postorbital bar is unsculpted, and its lateral surface is medially inclined. There is the presence of a vascular opening on the dorsal surface of the postorbital bar positioned posterolaterally. Although this vascular opening can also be found in other taxa, as some Neosuchia, in *Araripesuchus*, and in other Peirosauridae (*Pepesuchus, Rukwasuchus,* *Hamadasuchus*, *Montealtosuchus* and *Uberabasuchus*), the posterolateral position of this foramen is only shared by *Pepesuchus* and *Rukwasuchus*.

Parietal: The parietal forms a single midline bone with a horizontally oriented dorsal surface ornamented with an irregular pattern rounded pits.

The dorsal surface of the parietal is located anteriorly between the supratemporal fenestrae, forming the entire medial margin of these apertures. At its most anterior limit, it expands to meet the frontal in a transversely oriented suture.

Posteriorly, the dorsal surface of the parietal is broad, completely covering the supraoccipital, and markedly depressed at its center. This parietal anatomy is shared with other Pepesuchinae of the Adamantina formation (*Pepesuchus* and *Barreirosuchus*). The dorsal surface of the parietal extends laterally, reaching the medial processes of the squamosals. The dorsal surface of the parietal extends laterally, reaching the medial processes of the squamosals and forming the posteromedial margins of the supratemporal fenestrae.

Although it is fragmented and covered by the rocky matrix, the descending portion of the parietal formed a large part of the margins of the fossa of the supratemporal fenestrae.

Squamosal: In MPMA 68-0001-11, the squamosals are well-preserved with a dorsal surface ornamented with grooves and irregular pits. The squamosals consist of three processes that form a triradiate structure, the medial process, anterior process, and posterior process, all processes project ventrally.

The dorsal surface of the three processes covers much of the posterolateral corner of the cranial table and forms part of the porterior and lateral margins of the supratemporal fenestrae.

The anterior process of squamosal extends laterally overhanging the supratemporal fenestra. At this portion, the squamosal meets the posterior process of postorbital in a clear transverse suture. This squamosal-postorbital suture extends to the lateral edge of the cranial table and with an anteroventrally inclination. The lateroventral surface of the anterior process of the squamosal extend ventrally towards the orbital margin, overlapping laterally the postorbital and reaching the level of the dorsal tip of the lateral temporal fenestrae. This extension forms a wedge-like suture overlapping the base of the postorbital bar. This feature is shared with other Pepesuchinae as *Pepesuchus*, *Stolokrosuchus* and *Rukwasuchus*.

The anterior process of the squamosal has a large descending surface. Laterally, this surface covers most of the dorsal margins of the bony otic aperture and attaching dorsaly the anterodorsal process of the quadrate.

The medial process of the squamosal is short and robust. This postorbital process extends medially, posteriorly bordering the supratemporal fenestra until it reaches the parietal in a posterolaterally inclined suture.

The posterior squamosal process in MPMA 68-0001-11 is unornamented in its most posterior surface. Its posterior edge presents a notch. The posterior process of the squamosal in MPMA 68-0001-11 projects posteriorly and upwards beyond the limits of the cranial table. The well-developed posterior descending surface of the posterior process of the squamosal projects ventrally from the medial and posterior squamosal processes. This external surface of the occipital portion of the squamosal has a posteriorly inclination in pepesuchines such as *Barreirosuchus, Caririsuchus* and *Pepesuchus*, and unlike Peirosaurinae (*Barrosasuchus, Bayomesasuchus*, *Hamadasuchus, Barrosasuchus, Lomasuchus, Montealtosuchus* and *Uberabasuchus*) and Xenodontosuchia.

Jugal: Only the left jugal is present, but it is incomplete. Its original limits are not preserved, but from its preserved portion, its anterior process extendeds beyond the anterior margins of the orbits. The jugal borders a large infratemporal fenestra lateroventrally and contacts the quadrate jugal forming an interdigitated suture. The dorsal process of the jugal projects at the midpoint of the structureforming the ventral portion of the postorbital bar.

The infratemporal bar of the jugal is rod-shaped, as in the other Pepesuchinae (*Barreirosuchus*, *Caririsuchus*, *Pepesuchus* and *Stolokrosuchus*) and different from the Peirosaurinae (*Barrosasuchus, Hamadasuchus, Barrosasuchus, Lomasuchus, Montealtosuchus* and *Uberabasuchus*) that present this structure laterally flattened. The infratemporal bar surface has ornamentations composed of pits and grooves. The jugal with the quadratojugal and quadrate are displaced in the dorsoventral axis.

Quadrate: As in all Crocodyliformes, the quadrate is a complex bone a with main body and a dorsal and a pterygoid processes as well as an anterodorsal region consisting of a dorsal head and an anterodorsal process, contacting other structures of the cranial table and attached to the neurocranium (IORDANKY; GANS, 1973; SERTICH; O'CONNOR, 2014). In MPMA 68-0001-11 however, it is only visible laterally and occipitally. Due the cranial taphonomic deformation of MPMA 68-0001-11, the quadrate is flattened in its longitudinal axis, and extends more laterally than perhaps it would originally have been.

The large quadrate of MPMA 68-0001-11 forms the jaw joint. The articular facet of the quadrate extends laterally beyond the lateral limit of the cranial table. The medial lateral surface is wide area, and ornamented by several longitudinally oriented straight striae of muscular attachment, representing the broad sutural surface of the quadratojugal just above the laterotemporal fenestra.

The anterodorsal region of the quadrate extends dorsaly and overlapping the quadratojugal at the level of the optic aperture. The bony otic aperture is closed posteriorly by the quadrate and otoccipital, and possess a triangle-shaped outiline, with the apex directed dorsally. In ventral view, the anterodorsal branch of the quadrate is developed and forms more than half of the lateral border of the internal supratemporal fenestra.

The distal portion of the quadrate on the mandibular condyle presents a posteriorly facing plane (figure 5) and its distal body extends posteriorly and lateroventrally (figure 6). Due to this inclination, its distal articular surface is located posterior and ventral to the occipital condyle. More anteriorly, the distal body of the quadrate slopes gently towards the quatratojugal on its lateromedial aspect.

Quadratojugal: The quadratojugal is mostly unesculpted, except for its lateroposterior portion (figure 5). The anterodorsal branch of the quadratojugal is narrow and has a long sutural contact with the quadrate above the infratemporal fenestrae. This branch of the quadratojugal forms the entire posterior margin of the infratemporal fenestrae.

The medial surface of the anterodorsal branch of the quadratojugal ends at the same level as the dorsal tip of the laterotemporal fenestrae, a similar anatomy observed in some Eunotosuchian taxa (e.g. Sphagesauria). In the anterodorsal corner of the laterotemporal fenestrae, the quadratojugal is overlapped by the postorbital, excluding the quadrate and squamosal from the dorsal margin of the infratemporal fenestra.

The posterior corner of the infratemporal fenestra is formed by the quadratojugal posterodorsally and the jugal anteroventrally. A short anteroventral process of the quadratojugal contacts medially to the jugal, forming an interdigitated suture on the infratemporal bar.

Posteriorly, the posteroventral border of the quadratojugal tapers, excluding the quadratojugal from the mandibular articulation (figure 5), as in Mahajangasuchidae and Xenodontosuchia.

Supraoccipital: The supraoccipital in MPMA 68-0001-11 is poorly preserved, with only a thin U-shaped element located centrally in the skull, subjacent to the parietal and exposed only on the occipital surface of the skull (figure 6).

Ottocippital: The ottociptal forms most of the occipital surface of the skull. Dorsally, it presents a poorly marked suture contacting the supraoccipital dorsomedally and dorsolaterally the descending surface of the posterior squamosal process. The paraoccipital process is projected posteriorly and laterally, with a horizontal orientation. The lateral limits of the paraoccipital process extends further laterally the lateral margin of the squamosal (figure 6). This trait is unique among Peirosauridae. Its surface is smooth and forms a concavity on the lateromedial axis.

Dentary: The left dentary is present and mostly completely preserved, missing only its posteriormost end with the possible contact with the surangular and angular. The position and extent of the symphysis is unclear as the medial and splenial margins are covered by rocky matrix. The dentary is fragmented into four pieces with abrubt breakages at the limits of d3, d7 and d14 (figure 3 and 7).

The dentary is elongated, (35 cm preserved length), with almost the same thickness along its entire length, with a gradual increase posteriorly in comparison to its anterior portion. Through the dentary it is possible to affirm that the new specimen MPMA 68-0001-11 is at least 50% larger than other Peirosauridae from the Adamantina Formation (*Itasuchus, Montealtosuchus, Pepesuchus, Roxochampsa*). The dentary is not lateromedially compressed, while the lateroventral surface anterior to mandibular fenestra is convex. The edge of the dentary is straight and subparallel to the longitudinal axis of the skull. The dentary has its entire lateral and ventral surface ornamented with striations and small pits. However, the alveolar surface is relatively smooth. There is a concavity on the side of the dentary, close to d4, possibly for the insertion of a hypertrophied maxillary tooth.

Since it was first proposed by Clark (1994), the rostral formula of crocodilians has been defined by a relationship between the dorsoventral height of the rostrum in lateral view and the lateromedial width of the rostrum in dorsal view.

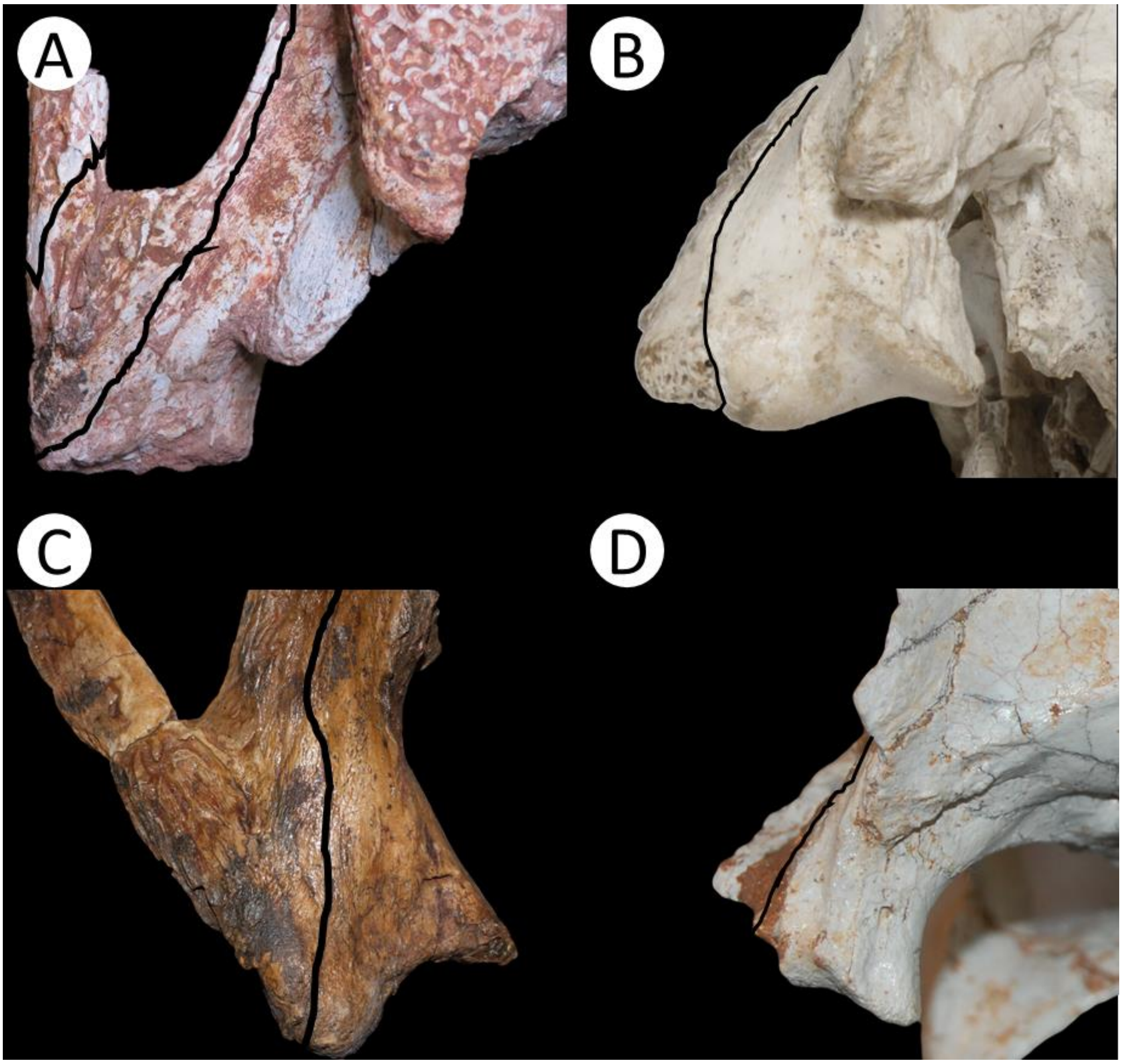
The face shape is not particularly associated with phylogenetic or geographic restrictions (PINHEIRO, 2007), the type of diet and environmental factors, in turn, seem to be more linked (BROCHU, 2001; WALMSLEY *et al*., 2013; DRUMHELLER; WILBERG, 2020). Amphibian animals have mainly platyrostral and nearly tubular formulas, while oreinorostral occurs in terrestrial animals (WALMSLEY *et al*., 2013; DRUMHELLER; WILBERG, 2020).

Even with the absence of structures that are traditionally used to frame specimens within one of the four states analyzed in this work (narrow oreinirostral, broad oreinirostral, nearly tubular and platyrostral), specimen MPMA 68-0001-11 was recognized as an individual of nearly tubular or platyrostral morphology. Such recognition took place through the relationship of the anteroposterior width between other bones, mainly the dentary, as well as by inference due to the long extension of the mandibular symphysis (WALMSLEY *et al*., 2013), all this compared to other related taxa and taxa with morphology nearly tubular or playtrostral.

The presence of 14 alveoli is visible with teeth in place, missing only the 2nd and the 12th teeth. The alveoli are practically all positioned on the same sagittal axis to the dentary. The first alveoli are projected anterodorsally.

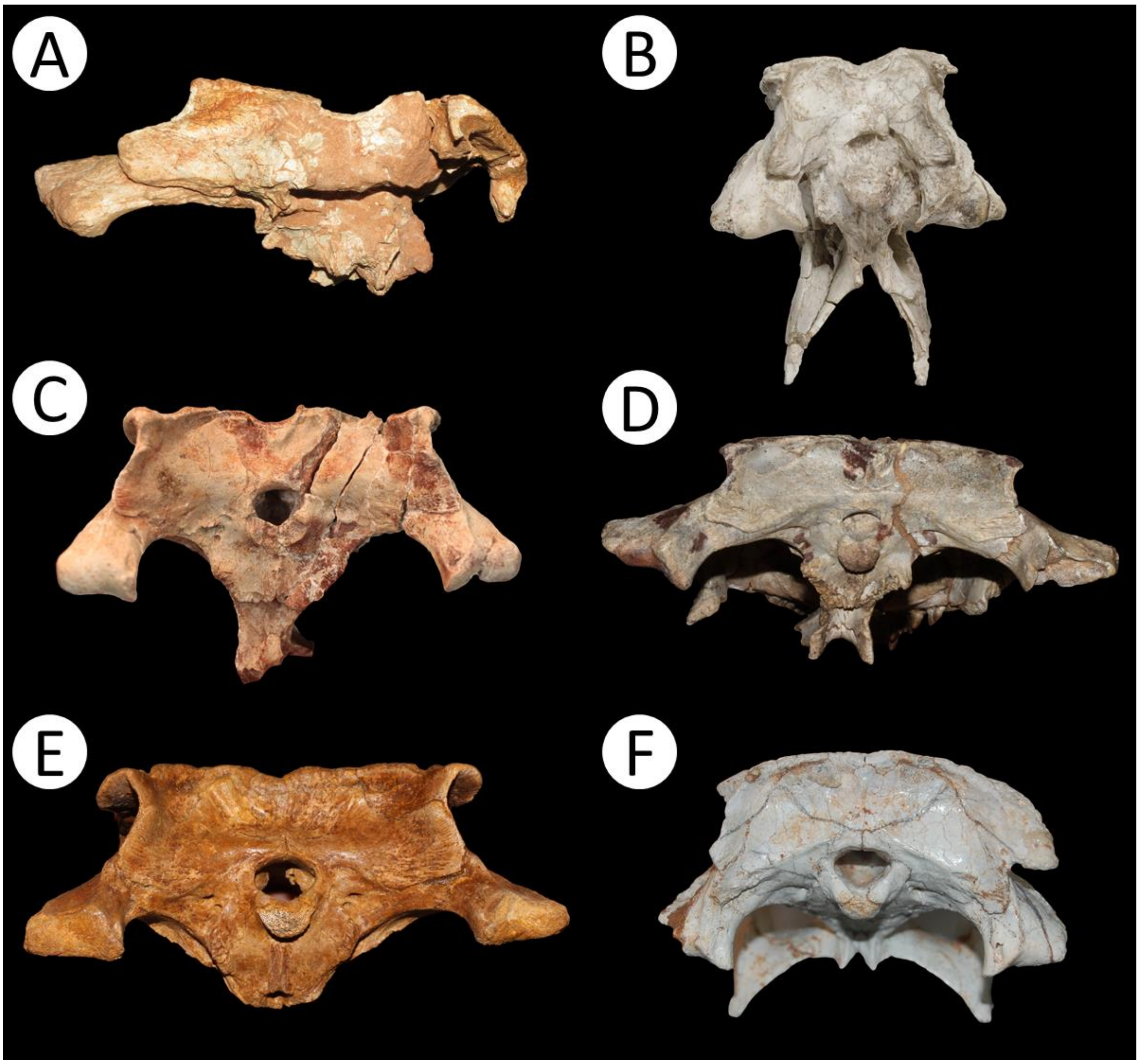
Dentition: MPMA 68-0001-11 had 14 teeth in each hemimandible, varying in size and diameter, in *Roxochampsa* there are at least nineteen teeth per hemimandible, in *Itasuchus* and *Pepesuchus* there are eighteen teeth, and at least twenty-two for *Caririsuchus* (PINHEIRO *et al*., 2018). The dentary alveoli are remarkably separated, probably accommodating the occlusion of the opposing maxillary teeth in these spaces, forming an interlocked dentition. There are in MPMA 68-0001-11 two pairs of alveoli in the mandible (d6/d7 and d8/d9) separated by a diastema (figure 7), this pattern is shared with *Pepesuchus*, *Itasuchus*, *Roxochampsa* and possibly *Caririsuchus*. The dental series forms two waves. The smallest tooth is d8, with approximately 0.8 cm from base to apex, and the largest were d11 and 13, with 2 cm each. The "cheek" teeth have laterally compressed crowns arranged obliquely to the longitudinal axis of the skull. The teeth have smooth grooved ornamentation on the enamel surface of the middle to posterior teeth, which extends from base to apex. The teeth have smooth carina, similar to *Stolokrosuchus*, and different from other Peirosauridae that have Ziphodon or false-ziphodon.

Figure 5. The mandibular articulation of quadrate in peirosaurids and mahajangasuchids. **A,** MPMA 68-0001-11; **B,** *Pepesuchus deiseae* (MN 7005-V); **C,** *Kaprosuchus saharicus* (MNN IGU12)*;* **D,** *Montealtosuchus arrudacamposi* (MPMA-16-0007-04). The dotted line indicates the sutures of quadratojugal.



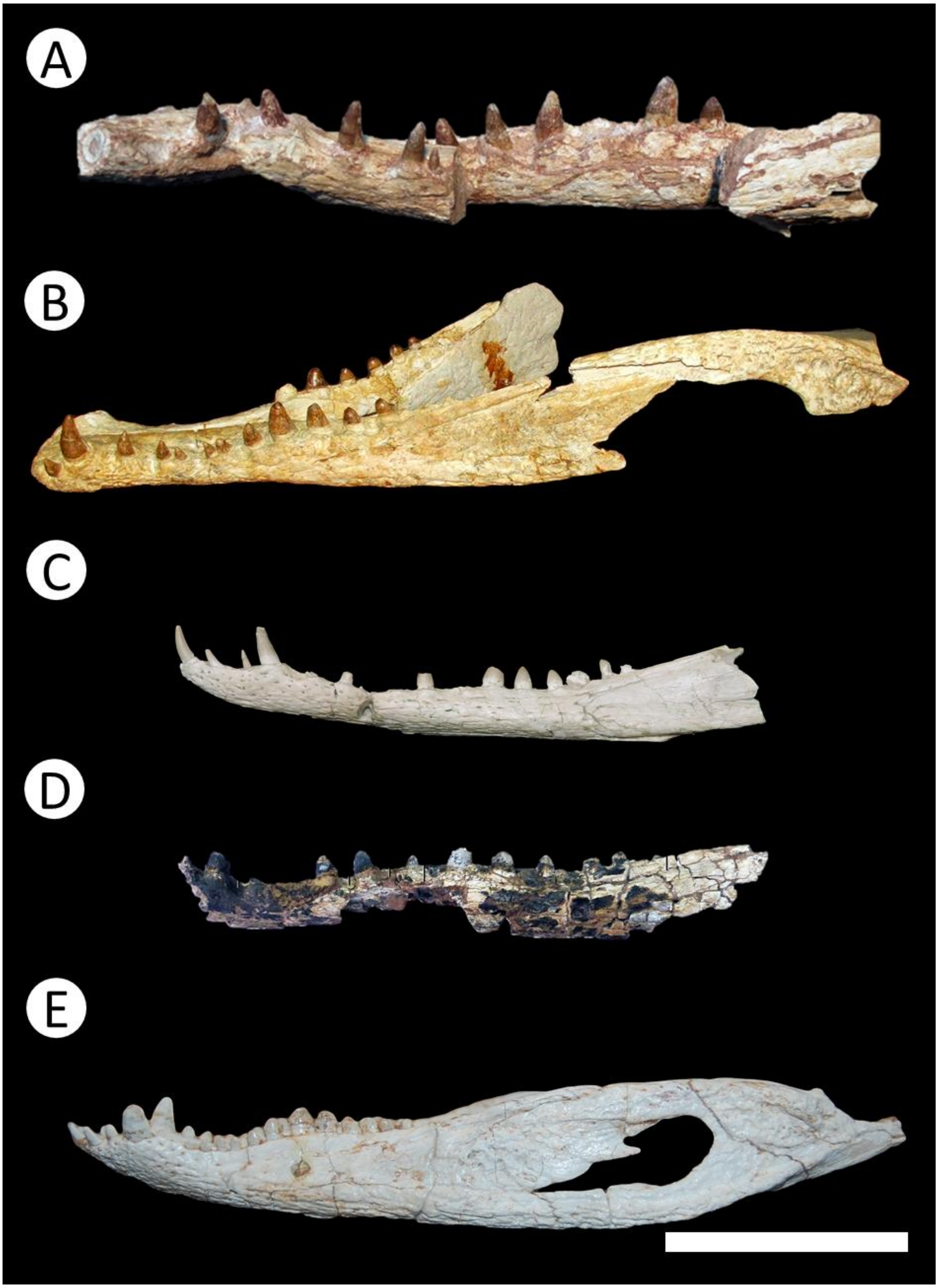
(Source: the author).

Figure 6. Occipital view of peirosairids skull. **A,** MPMA 68-0001-11; **B,** *Pepesuchus deiseae* (MN 7466-V); **C,** *Rukwasuchus yajabalijekundu* (RRBP 08630)*;* **D,** *Stolokrosuchus lapparenti* (MNN GDF600)*;* **E,** *Hamadasuchus rebouli* (ROM 52059)*;* **F,** *Montealtosuchus arrudacamposi* (MPMA-16-0007-04).



(Source: the author).

Figure 7. Lateral view of mandible of peirosaurids. **A,** MPMA 68-0001-11; **B,** *Itasuchus jesuinoi* (DGM 434-R); **C,** *Pepesuchus deiseae* (MCT 1788-R)*;* **D,** *Roxochampsa paulistanus* (UFRJ-DG 501-R); **E,** *Montealtosuchus arrudacamposi* (MPMA-16-0007-04). Scale bar: 10cm.



(Source: Modified from Pinheiro *et al*.,2018).

3.3 Phylogenetic relationships

Only six most parsimonious trees of 2577 steps each were recovered. The new results (Figure X) shed light on the phylogenetic relationships among the Gondwanan notosuchians, especially about the internal relationship within Peirosauridae. Here, we address the main clades recovered within Notosuchia, their internal relationships and differences from previous works. We discuss the main aspects of our results such as the nesting of the new taxon within Pepesuchinae (GEROTO; BERTINI, 2018); the clades Pepesuchinae and Peirosaurinae as sister groups confirming the monophyly of Peirosauridae; and the taxon *Colhuehuapisuchus lunai* (LAMANNA et al., 2019) nested within Mahajangasuchidae (SERENO; LARSSON, 2009).

3.3.1 Notosuchia (sensu RUIZ *et al*., 2021), Eunotosuchia (sensu RUIZ *et al*., 2021) and Xenodontosuchia (sensu RUIZ *et al*., 2021)

This plylogenetic analysis recovered important clades proposed in Ruiz *et al.* (2021), but we highlight some differences about the topology that differs from our analysis.

Our phylogenetic analysis places *Anatosuchus minor* (SERENO *et al*., 2003) as the sister taxon of *Simosuchus clarki* (BUCKLEY *et al*., 2000). This result differs from Ruiz *et al.* (2021) in which *Anatosuchus minor* is in polytomy with Sebecia + Eunotosuchia. Although the phylogenetic positioning of *Anatosuchus minor* is controversial, being related to different clades (SERENO *et al*., 2003; SERTICH; O'CONNOR, 2014; PINHEIRO *et al*. 2018), its positioning with *Simosuchus clarki* is not novel (GEROTO; BERTINI, 2018).

The relationship betwen *Anatosuchus minor* and *Simosuchus clarki* is supported by eight unambiguous synapomorphies (char. 8 st. 3; char. 18 st. 0; char. 33 st. 0; char. 36 st. 0; char. 196 st. 0; char. 239 st. 1; char. 346 st. 1; char. 366 st. 2).

As proposed by Ruiz *et al.* (2021), our phylogenetic analysis also does not recover the clade Sebecosuchia (Sebecidae + Baurusuchidae), instead we recovered Xenodontosuchia (Sphagesauria + Baurusuchia).

In our phylogenetic analysis however, *Malawisuchus mwakasyungutiensis* (GOMANI, 1997) is place as the sister taxon of Xenodontosuchia. This contrasts with analyses using a previous version of the matrix used here (RUIZ et al. 2021), that place *Morrinhosuchus luziae* (IORI; CARVALHO, 2009) as the sister taxon of Xenodontosuchia.

The position of Xenodontosuchia as sister to *Malawisuchus* is the more usual (POL *et al*., 2014; MARTIN; BROIN 2016; PINHEIRO *et al*., 2018, 2021). The clade composed of *Malawisuchus* + Xenodontosuchia in our analysis is supported by two unambiguous synapomorphies: articular facet for quadrate condyle with close to three times length of quadrate condyles (char. 349 st. 2); presence of wear facets in posterior (molariform) teeth (char. 378 st. 1).

Our phylogenetic analysis places *Morrinhosuchus* within Sphangesauridae, as previously proposed (POL *et al*., 2014; FIORELLI *et al*., 2016; IORI *et al*., 2018; MARTINELLI *et al*., 2018). The placement of *Morrinhosuchus* within Sphangesauridae is supported by six synapomorphies: lacrimal length shorter than prefrontal length (char. 63: 1 --> 2); absence of ornamentation on the posterolateral process of squamosal (char. 118 st. 0); distal quadrate body with anterior margin oriented in a right angle in relation to quadratojugal (char. 195 st. 0); participation of maxilla at anterior edge of suborbital fenestra reduced or absent. (char. 211 st. 1); mandibular outer surface sculpture present only in dentary (char. 301 st. 0); foramen in posterior surface of the base of postorbital bar positioned posteromedially (char. 512 st. 1).

The inclusion of *Ogresuchus furatus* in our analysis retrieved divergent results from what was proposed in its original description. In Sellés *et al*. (2020), *Ogresuchus* is recovered as Sebecidae, while our phylogeny finds *Ogresuchus* nested with Baurusuchia.

The clade Baurusuchia is supported in our analysis by six unambiguous synapomorphies: absence of external antorbital fenestrae (char. 12 st. 1); squamosal posterolateral process in level with skull table (char. 117 st. 0); jugal infratemporal bar rod-shaped (char. 160 st. 1); at maturity, the ectopterygoid extents along lateral flange to pterygoid posterior tip (char. 255 st. 0); splenial robust dorsally posterior to symphysis (char. 334 st. 1); postorbital bar inclined medially posteroventrally (char. 515 st. 1).

3.3.2 Peirosauridae (GASPARINE, 1982), Pepesuchinae (GEROTO; BERTINI, 2018) and Peirosaurinae (GEROTO; BERTINI, 2018)

The clade Peirosauridae groups eighteen species of Gondwana notosuchians in two large sub clades (figure 8). The Peirosauridae clade is supported by nine unambiguous synapomorphies: otic aperture closed posteriorly and triangle-shaped, with apex directed dorsally (char. 30 st. 1); absence of supratemporal rims raised and hypertrophied (char. 96 st. 0); lateral surface of postorbital descending flange concave (char. 175 st. 1); ectopterygoid abuted by the maxilla (char. 213 st. 0); anterior half of interfenestral bar between suborbital fenestrae flareds anteriorly (char. 224 st. 1); dentary with lateral concavity for reception of enlarged maxillary tooth (char. 312 st. 1); premaxillary teeth 1 and 2 nearly confluent (char. 368 st. 1); maxillary teeth occur in two waves (festooned) (char. 371 st. 2); robust otic butters (char. 487 st. 1).

Our phylogenetic analysis recovered two main clades within Peirosauridae. One of them is composed of peirosaurids wich are distinguisehed by oreinorostral morphology associated with terrestrial and semi-aquatic habits (SERTICH; O'CONNOR, 2014; PINHEIRO *et al*. 2018). This clade has been found in previous analyses, but only in Geroto and Bertini (2018) it received a phylogenetic definition. The clade Peirosaurinae recovered here, includes eight species of peirosaurids (*Gasparinisuchus peirosauroides; Hamadasuchus rebouli; Lomasuchus palpebrosus; Montealtosuchus arrudacamposi; Uberabasuchus terrifichus*; *Bayomesasuchus hernandezi; Barrosasuchus neuquenianus; Antaeusuchus taouzensis*), supported by nine synapomorphies: presence of foramen in perinarial depression (char. 41 st. 1); opened contact on ventral edge of premaxilla-maxilla contact as large fenestrae encompassing at least partially the opposite dentary tooth (char. 45 st. 1); maxilla with wedge-like process in lateral surface of premaxilla-maxilla contact (char. 135 st. 1); presence of vascular opening in dorsal surface of postorbital bar (char. 172 st. 1); presence of prominent depression on the palate near alveolar margin at the level of the 6th or 7th alveoulus (char. 203 st. 1); intermediary-shaped of splenial-dentary suture at symphysis on ventral surface (char. 333 st. 2); premaxilla with anteroposterior length long in relation to the rostrum (char. 509 st. 1); postorbital bar with a narrow structure (char. 516 st. 0); external surface of the occipital portion of the squamosal with inclination posterodorsally (char. 517 st. 1).

Pepesuchinae, which is sister to Peirosaurinae, is a clade formed by peirosaurids charategorized by a nearly tubular or platyrostral rostrum shape, and with possible aquatic habits (SERTICH; O'CONNOR, 2014; PINHEIRO *et al*. 2018). In this analysis, Pepesuchinae includes ten species (MPMA 68-0001-11; *Barreirosuchus franciscoi; Itasuchus jesuinoi; Pepesuchus deiseae; Stolokrosuchus lapparenti*; *Amargasuchus minor*; *Rukwasuchus yajabalijekunduis; Caririsuchus camposi; Roxochampsa paulistanus and Kinesuchus overoi*) and is supported by one unambiguous mandibular synapomorphie: dentary not compressed and lateroventral surface anterior to mandibular fenestra convex (char. 315 st. 1). This condition is also found in some Neosuchia with aquatic habit, such as *Sarcosuchus imperator*, *Goniopholis simus*, *Susisuchus anatoceps* and the living Crocodyliformes.

3.3.3 MPMA 68-0001-11 within Pepesuchinae (GEROTO; BERTINI, 2018)

All of the most parsimonious trees place the specimen MPMA 68-0001-11 as a sister to the clade (*Barreirosuchus franciscoi (Pepesuchus deiseae (Itasuchus jesuinoi+Amargasuchus minor+Caririsuchus camposi+Roxochampsa paulistanus)*. The sister-clade relationship of MPMA 68-0001-11 and this others platyrostral and nearly tubular Notosuchian is supported by presence of vascular opening in dorsal surface of postorbital bar (char. 172 st. 1); dorsal surface of parietal markedly depressed from skull roof (char. 100 st. 2); and caudal tip of nasals separated by anterior sagittal projection of frontals (char. 61 st. 1).

3.3.4 MPMA 68-0001-11 as a new peirosauridae.

The specimen MPMA 68-0001-11 could be assigned to a new genus and species due to the presence of eight autapomorphies that distinguishes it from the other genus of Peirosauridae: teeth with smooth carinae (char. 354 st. 4); lateral insertion of the post-orbital over the jugal in the post-orbital bar (char. 89 st. 2); squamosal post-lateral process without ornamentation (char. 118 st. 0) and projected upwards (char. 115 st. 2); posteroventral edge of the quadratojugal does not reach the quadrate condyles (char. 167 st. 0); distal edges of the quadrate with only one plane facing posteriorly (char. 196 st. 0); quadratojugal dorsal extent in medial surface ending at the same level the dorsal tip of laterotemporal fenestrae (char. 214 st. 1); horizontal orientation of the paraoccipital process in occipital view (char. 290 st. 0).

3.3.5 *Ayllusuchus fernandezi* (GASPARINI, 1984), Sebecidae (SIMPSON, 1937) and Sebecia (LARSSON; SUES, 2006)

In our phylogeny *Ayllusuchus fernandezi* is recovered within Sebecidae (SIMPSON, 1937), a position supported by six synapomorphies: rostrum with narrow oreinirostral proportion (char. 8 st. 0); absence of external antorbital fenestrae (char. 12 st. 1); rostrum narrower than width of premaxillae at the level of alveoli 4 or 5 (char. 35 st. 1); nasal elevated above dorsal surface of maxillae forming a saggital bar (char. 53 st. 1); posterolateral region of nasal deflected ventrally, forming part of the lateral surface of the snout (char. 56 st. 1); presence os paired foramen located ant anterior region of palatal ventral surface, not homologous to maxilo-palatine fenestrae and palate canals (char. 479 st. 1).

In this phylogeny, Sebecidae represent the only group within Notosuchia (Gasparini, 1971) with representatives that cross the Cretaceous-Paleogene boundary. This result is different from Pinheiro et al. (2018), in which this specimen was recovered as the sister clade of *Barreirosuchus fransciscoi*, therefore considered a Peirosauridae.

In our phylogenetic analysis, the clade Sebecosuchia (Sebecidae + Baurusuchidae) is not recovered, instead we recovered Xenodontosuchia (Sphagesauria + Baurusuchia) and Sebecidae is recover as the sister group of Peirosauridae, as proposed by Ruiz et al. (2021). The clade Sebecidae + Peirosauridae is supported by six unambiguous synapomorphies: presence os perinarial fossa (Char. 127 st. 1); inset jugal portion of postorbital bar anteriorly continuous, but posteriorly inset (Char. 159 st. 0); posterior pterygoid processes well developed projecting posteriorly (Char. 248 st. 1); external mandibular fenestra, shape slit-like, proportionally very long and both ends acute (Char. 306 st. 2); cheek teeth base constricted (Char. 377 st. 1); number of neurovascullary foramen in maxilla surpass in many the number of teeth (Char. 510 st. 1).

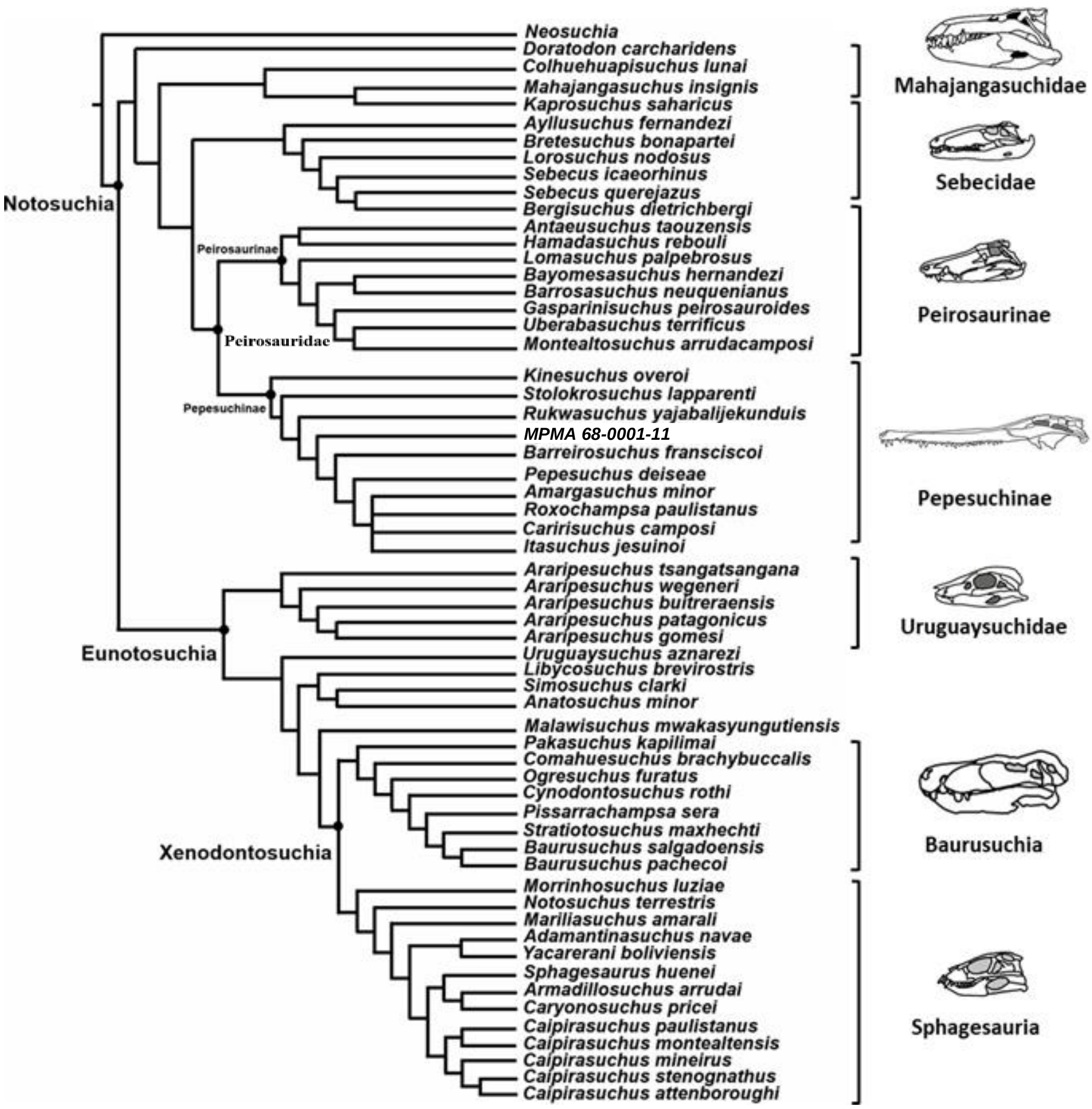
The formation of the clade Sebecidae + Peirosauridae refers to the initial proposition of the clade Sebecia by Hans and Larsson (2006), however, contrary to the first proposition of the clade, in our analysis Sebecia is within Notosuchia and not as a sister group of Neosuchia.

3.3.6 *Colhuehuapisuchus lunai* (LAMANNA et al., 2019) and Mahajangasuchidae (SERENO; LARSSON, 2009)

The taxon *Colhuehuapisuchus lunai* (Lamanna et al., 2019), originally identified as a Peirosauridae, is found in our new phylogenetic analysis as the sister group to the Mahajangasuchidae (Sereno & Larsson, 2009). This newly proposed phylogenetic position is supported by three characters related to the symphysis and one that related to the position of the first teeth of the dentary: dentary with anterior alveoli procumbente (char. 319 st. 1); dentary symphysis in ventral view U-shaped and smoothly curving anteriorly (char. 332 st. 1); splenial-dentary suture at symphysis on ventral surface (char. 333 st. 1) and on occlusal view (char. 521 st. 1) with transversely orientation, with angle betwen hemimandibule main axis of the symphisis more than 70º. In this way, Mahajangasuchidae becomes another group within Notosuchia with a Gondwanan distribution.

Another issue related to the phylogenetic position of Mahajangasuchidae is its relationship with the clades Sebecidae and Peirosauridae. Mahajangasuchidae was once considered a sister group to Sebecidae (PINHEIRO *et al*., 2018, GEROTTO; BERTINI, 2018) and even Peirosauridae (SERTICH; O'CONNOR, 2014; BRAVO; POL, GARCÍA-LÓPEZ, 2021), but here it appears as the sister clade of Sebecidae+Peirosauridae, as in Ruiz *et al.* (2021). This relationship is supported by six unambiguous synapomorphies: posterior extent of maxilla in lateral surface of rostrum anterior to anterior margin of orbit (char. 141 st. 1); absence of unsculpted region in the dentary below the tooth row (char. 316 st. 0); dentary with dorsal edge sinusoidal, with two concave waves (char. 317 st. 3); splenial robust dorsally posterior to symphysis (char. 334 st. 1); dentary teeth opposite to premaxilla-maxilla contact more than twice the length (char. 381 st. 1); tooth row immediately posterior to caniniform (D4) characterized by D5-D9 converging to the main axis of the symphysis and D10-D12 diverging (char. 522 st. 1).

Figure 8. Reduced strict consensus tree depicting the phylogenetic relationship among Notosuchia.



(Source: the author).

4 CONCLUSIONS

The specimen MPMA 68-0001-11 represents a new species of Peirosauridae. The new species is the 9th peirosaurid described for Brazilian Cretaceous deposits and the 8th from rocks of the Bauru Group, expanding the morphological and taxonomic diversity of the group. Peirosauridae has been recovered as a monophyletic group that nests all its forms in two major lineages, both distributed across the lands that formed Gondwana in the past. Peirosaurinae is composed of the taxa *Gasparinisuchus peirosauroides, Hamadasuchus rebouli, Lomasuchus palpebrosus, Montealtosuchus arrudacamposi, Uberabasuchus terrifichus, Bayomesasuchus hernandezi, Barrosasuchus neuquenianus, Antaeusuchus taouzensis*, oreinorostral species with possible terrestrial habits. Pepesuchinae groups the nearly tubular or platyrostral rostrum taxa that possibly had aquatic habits, including MPMA 68-0001-11 (described here), *Barreirosuchus franciscoi, Itasuchus jesuinoi, Pepesuchus deiseae, Stolokrosuchus lapparenti, Amargasuchus minor, Rukwasuchus yajabalijekunduis, Caririsuchus Camposi, Roxochampsa paulistanus and Kinesuchus overoi*. Peirosauridae nests species that spread across Gondwana, from the Aptian to the Maastrichtian, indicating that the separation of taxa and the group's irradiation occurred in the pre-Aptian period. With the nesting of the Argentinian specimen *Colhuehuapisuchus lunai* within Mahajangasuchidae, we have the formation of another group within Notosuchia with a Gondwanan distribution.

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SUPLEMENTARY MATERIAL

1 DETAILS OF THE PHYLOGENETIC ANALYSIS

1.1 Character and taxon sampling

The taxon sampling was based on the previously published analysis, expanded to accommodate MPMA 68-0001-11. The resulting data matrix includes 110 taxa and 524 characters.

1.2 Character list

The original source for each character is indicated after the characters and characters states definitions. The 17 added characters are in the end of the list. Characters proposed by the first time are 521-524; characters adapted from Geroto and Bertini (2018) are 508-518 and adapted from Pinheiro *et al*. (2018) are 519-520.

1. External surface of dorsal cranial bones: smooth (0), ornamented (1) (Clark, 1994).
2. External surface of dorsal cranial bones: slightly grooved (0), heavily ornamented with deep pits and grooves (1) (Clark, 1994).
3. Sculpture in external surface of rostrum: absent (0), present (1) (Gasparini *et al.*, 2006).
4. Rostrum dorsal projection: absent, rostrum straight or low (0), rostrum upturned (1) (Andrade *et al.*, 2011).
5. Skull expansion at orbits: gradual (0), abrupt (1) (Clark, 1994).
6. Lateral contour of snout in dorsal view: straight (0), sinusoidal (1) (Ortega *et al.*, 2000).
7. Snout length (anterior margin of orbits to rostrum) relative to remainder of skull: equal or longer (0), shorter (1) (Wu *et al.*,1997).
8. Rostrum proportions: narrow oreinirostral (0), broad oreinirostral (1), nearly tubular (2), playtrostral (3) (Clark, 1994).
9. External nares orientation: facing anterolaterally (0), facing dorsally (1) (Clark, 1994).
10. External nares: divided by a septum (0), confluent (1) (Clark, 1994).
11. Major orbit orientation: dorsally or laterodorsally (0), fully laterally (1). (Wilkinson *et al.* ,2008).
12. External antorbital fenestrae: present (0), absent (1) (Andrade *et al.*, 2011).
13. External antorbital fenestra size: as large as orbit (0), about half the diameter of the orbit (1), much smaller than the orbit (2) (Clark, 1994).
14. Shape of antorbital fenestra: rounded or dorsoventrally high (0), low and elongated, slit-like (1), triangular shape with apex dorsally directed (2) (Gasparini *et al.*, 2006).
15. External supratemporal fenestra: present (0), absent (1) (Ortega *et al.*, 2000).
16. External supratemporal fenestrae shape: square-shaped to sub rectangular (0), circular to elliptical (1), triangle-shaped converging medially (2) (Andrade *et al.*, 2011).
17. Anteroposterior length of external supratemporal fenestrae: equal to or shorter than orbits (0), much longer than obits (1) (Clark, 1994).

18. Infratemporal fenestrae, size proportional to orbit: small to absent, no more than 20% the area of the orbit (0), large, area is usually no less than 50% of the area of the orbit (1) (Andrade *et al.,* 2011).
19. Infratemporal fenestra, orientation: faces laterally (0), faces laterodorsally (1) (Andrade *et al.,* 2011).
20. Infra temporal fenestrae shape: clearly triangular (0), elliptic to subpolygonal (1) (Ortega *et al.,* 2000).
21. Choanal opening, conformation in palate: continuous with pterygoid ventral surface except for anterior and anterolateral borders (0), or opens into palate through deep midline depression (choanal groove) (1) (Clark, 1994).
22. Choanae, shape in palatal view: subcircular, elliptic or lanceolated (0), triangle-like (1), rectangular (2) (Andrade and Bertini, 2008).
23. Choanal opening size: moderately broad or narrow, equal or less than 30% the width between the lateral margins of the pterygoid wings (0), or extremely broad approximately 50% the width between the lateral margins of the pterygoid wings (1) (Clack, 1994).
24. Choanal groove: undivided (0), partially septated (1), completely septated (2) (Clark, 1994).
25. Choanal opening: opened posteriorly and continuous with pterygoid surface (0), closed posteriorly by an elevated wall formed by the pterygoids (1) (Pol and Norell, 2004a).
26. Suborbital fenestrae: small (0), present and subequal or larger than orbit (1) (Andrade *et al.*, 2011).
27. Suborbital fenestrae, shape of anterior border: rounded, smooth (0), in sharp angle, forming a notch, fissure-like (1) (Andrade and Bertini, 2008).
28. Post-temporal fenestrae: present (0), absent (1) (Montefeltro *et al.,* 2011).
29. Otic aperture (not including additional quadrate fenestrae): opened posteriorly (0), closed posteriorly by quadrate and otoccipital (1) (Clark, 1994).
30. General morphology of otic aperture (including otic aperture of cranio-quadrate passage but not preotic siphonal foramen nor quadrate fenestrae when present): closed posteriorly and subpolygonal to elliptic (0), closed posteriorly and triangle-shaped, with apex directed dorsally (1) (Andrade *et al.*, 2011).
31. External auditory meatus, size (including otic aprture of cranio-quadrate passage but not preotic siphonal foramen and quadrate fenestrae when present): very small, poorly visible (even in lateral view) (0), medium sized (1), conspicuously large (2) (Andrade *et al.,* 2011).
32. Cranio-quadrate canal: completely opened laterally (0), closed thoroughly (1), occipital opening closed but no canal formed (2) (Clark, 1994).
33. Cranio-quadrate canal occipital opening: distal portion near lateral edge of skull (0), distal portion located ventral to paraoccipital process (1) (Clark, 1994).
34. Dorsal surface of rostrum: curves smoothly (0), bears a median boss (1) (Brochu, 1999).
35. Maximal width of premaxillae and maximal width of the rostrum at the level of alveoli 4 or 5: premaxillae narrower (0), rostrum narrower (1) (Jouve, 2009).
36. Premaxillae anterior to nares, morphology: strongly sutured (0), loosely sutured, sometimes not in contact (1) (Andrade *et al.,* 2011).
37. Premaxilla anterior to nares: narrow (0), broad (1) (Clark, 1994).
38. Distance between the tip of the snout and the anteriomost position of the premaxilla-maxilla suture in dorsal view, and the distance between the anteriormost position of premaxilla-maxilla suture in dorsal view and the posterodorsal extremity of the premaxilla: distance between the tip of the snout and the anteriomost position

of the premaxilla-maxilla suture larger (0), distance between the anteriormost position of premaxilla - maxilla suture in dorsal view and the posterodorsal extremity of the premaxilla larger (1) (Jouve, 2004).

39. Nares, projection of the internarial bar relative to the main body of premaxilla and narial opening: does not project anterior to the main body of premaxilla (0), strongly projected anteriorly from narial opening, anterior to main body of premaxilla (1) (Andrade *et al.*, 2011).
40. Premaxilla participation in internarial bar: forming at least the ventral half (0), with little participation (1) (Clark, 1994).
41. Premaxilla, foramen in perinarial depression: absent (0), present (1) (Gasparini *et al.*, 2006).
42. Perinarial crests: absent (0), present as well defined and distinct ridges, cornering the lateral to posterior borders of the naris (1) (Andrade *et al.*, 2011).
43. Postnarial fossa: absent (0), present (1) (Andrade *et al.*, 2011).
44. Premaxilla-maxilla suture ventrally: confluent (0), opened contact on ventral edge of rostrum (1) (Clark, 1994).
45. Opened contact on ventral edge of rostrum at premaxilla-maxilla contact: present ventrally as notch (0), present ventrally as large fenestrae encompassing at least partially the opposite dentary tooth (1), present as a narrow slit along the entire lateral portion of the suture (2) (Clark, 1994).
46. Nasal into external nares: absent, maxillae contact midline (0), absent, premaxillae contact midline (1), participate medially on dorsal/posterior margin of the nares (2), participate medially and laterally on dorsal/posterior margin of the nares (3) (Clark, 1994).
47. Posterodorsal process of premaxilla: absent (0), present extending posteriorly wedging between maxilla and nasals (1) (Pol, 1999).
48. Premaxilla-maxilla contact, nature of contact: premaxilla loosely overlies maxilla (i.e., posterodorsal process of the premaxilla overlaps the anterodorsal surface of the maxilla) (0), sutured together along a butt joint (1) (Clark, 1994).
49. Depression on posterolateral surface of maxilla: absent (0), or present (1) (Wu *et al.*, 1997).
50. Maxilla, extent of contact with nasal: extensive contact (0), small sutural contact (1) (Andrade *et al.*, 2011).
51. Maxillae, participation in the orbit: absent (0), present (1) (Andrade *et al.*, 2011).
52. Nasal bones: paired (0), or partially or completely fused (1) (Gasparini *et al.*, 2006).
53. Nasal elevated above dorsal surface of maxillae forming a sagittal bar: absent (0), present (1) (Montefeltro *et al.*, 2011).
54. Nasal lateral border posterior to external nares: laterally concave(0), straight (1) (Pol, 1999).
55. Nasal lateral edges: nearly parallel (0), oblique to each other converging anteriorly (1) (Pol, 1999).
56. Nasals, shape of posterolateral region: flat surface facing dorsally (0), lateral region deflected ventrally, forming part of the lateral surface of the snout (1) (Pol and Apesteguia, 2005).
57. Posterior portion of dorsal surface of the nasal: round or flat (0), or bearing a rugose broad depression (1) (Montefeltro *et al.*, 2011).
58. Nasal participation in antorbital fenestra: present (0), absent (1) (Ortega *et al.*, 2000).
59. Nasal-lacrimal contact: present (0), absent (1) (Clark, 1994).
60. Lacrimal contacts nasal along medial edge only (0), or medial and anterior edges (1) (Clark, 1994).

61. Caudal tip of nasals: converge at sagittal plane (0), or separated by anterior sagittal projection of frontals (1) (Ortega *et al.,* 2000).
62. Midline longitudinal depression on posterior portion of nasal and anterior portion of frontal: absent (0), present (1) (Montefeltro *et al.,* 2011).
63. Total lacrimal length relative to total prefrontal: longer (0), sub equal (1), shorter (2) (Brochu, 1999).
64. Lacrimal shape: longer than broad (0), as long as broad (1) (Sereno and Larsson, 2009).
65. Support for the anterior palpebral bone: marked depression forming an incipient lateral projection (0), marked depression forming a great lateral projection for the support of anterior palpebral (1) (Sereno and Larsson, 2009).
66. Facet for palpebral articulation, general shape: borders not marked forming an anteroposterior elongated area (0), well-marked borders forming a shallow hemispherical surface (1) (Pol *et al.,* 2009).
67. Prefrontal lateral development: reduced (0), or enlarged, extending laterally over orbit (1) (Gasparini *et al.,* 2006).
68. Paired crests along the prefrontal-frontal sutures: absent (0), or present (1) (Pol and Powell, 2011).
69. Prefrontals anterior to orbits: elongated, oriented parallel to anteroposterior axis of the skull (0), short and broad, oriented posteromedially-anterolaterally (1). (Gomani, 1997).
70. Prefrontal-lacrimal crest dorsal to orbit: absent (0), present (1) (Andrade *et al.,* 2011).
71. Prefrontal and lacrimal around orbits: forming flat rims (0), or evaginated, forming elevated rims (1) (Gasparini *et al.,* 2006).
72. Prefrontals medial contact: absent (0), present (1) (Montefeltro *et al.,* 2011).
73. Prefrontals medial contact: present anteriorly (1), or present along mostly of dorsal medial edge (2) (Montefeltro *et al.,* 2011).
74. Frontals: paired (0), unpaired (1) (Clark, 1994).
75. Frontal width between orbits: narrow, as broad as nasals (0), broad, twice as broad as nasals (1) (Clark, 1994).
76. Frontal, morphology of anteriormost border of anterior process: truncated (0), wedge-like (1) (Andrade *et al.,* 2011).
77. Dorsal surface of frontal: flat (0), with a longitudinal ridge (1) (Clark, 1994).
78. Frontal dorsal longitudinal ridge: restricted to the posterior portion (0), restricted to median portion (1), restricted to anterior portion (2) (Montefeltro *et al.,* 2011).
79. Frontal, extension of anterior margin: long, progress anterior to the orbits (0), short, does not progress anterior to the orbits (1) (Andrade *et al.,* 2011).
80. Transverse ridge crossing the frontal anteromedial to the orbits: absent (0), or present (1) (Pol *et al.,* 2009).
81. Dorsal surface of frontal, posterior to orbits: flat or slightly concave (0) or markedly concave transversally (not considering the elevated orbital rim when it occurs) (1) (Riff and Kellner, 2011).
82. Prefrontal pillar: not contacting palate (0), contacting palate (1) (Clark, 1994).
83. Dorsal region of prefrontal pillars: transversely expanded (0), longitudinally expanded (1) (Ortega *et al.,* 2000).
84. Prefrontal pillar ventral portion, when integrated in palate: transversely expanded (0), columnar (1) (Ortega *et al.,* 2000).

85. Frontal, anterior ramus with respect to the tip of the prefrontal: ending posteriorly (0), ending anteriorly (1) (Sereno *et al.*, 2001).
86. Lateral margins of the frontal, relative to the skull surface: flush with skull surface (0), or elevated, forming ridged orbital margins (1) (Brochu, 1999).
87. Frontal, participation in the primary medial border of orbit, at dorsal skull roof, not considering palpebrals: extensive participation in the orbit (0), excluded from the orbit by prefrontal-postorbital contact, or participation is very reduced (1) (Andrade *et al.*, 2011).
88. Postorbital anterolateral process: absent or poorly developed (0), or well developed, long, and acute (1) (Clark, 1994).
89. Postorbital-jugal contact, configuration of contact: postorbital anterior to jugal (0), postorbital medial to jugal (1), postorbital lateral to jugal (2) (Clark, 1994).
90. Parieto-postorbital suture: absent from dorsal surface of skull roof and supratemporal fossa (0), absent from dorsal surface of skull roof but present at the ventral region of supratemporal fossa (1) absent from dorsal surface of skull roof but broadly present within supratemporal fossa (2), or present within supratemporal fossa and on dorsal surface of skull roof (3) (Clark, 1994).
91. Relative length between squamosal and postorbital: squamosal is longer (0), postorbital is longer (1) (Ortega *et al.*, 2000).
92. Supratemporal roof, conformation of dorsal surface: complex (0), dorsally flat "skull table" developed, with postorbital and squamosal with flat shelves extending laterally beyond quadrate contact (1) (Clark, 1994).
93. Medial borders of supratemporal fenestrae: flat sculptured region (0), forming a low saggital crest (1) (Clark, 1994).
94. Dermal bone overhang about the supratemporal fenestrae: absent (0), present (1) (Norell, 1988).
95. Dermal bone overhang about the supratemporal fenestrae: present only medially and posteriorly (0), present about the entire edge (1) (Norell, 1988).
96. Supratemporal rims raised and hypertrophied: absent (0), present (1) (Montefeltro *et al.*, 2011).
97. Bar between orbit and supratemporal fossa, shape: broad and solid, with broadly sculpted dorsal surface if sculpture is present on skull (0), bar narrow, sculpting restricted to anterior surface (1) (Clark, 1994).
98. Angle between medial and anterior margins of supratemporal fossa: ~90 degrees or greater (0), or ~45 degrees (1) (Gasparini *et al.*, 2006).
99. Shallow fossa at anteromedial corner of supratemporal fenestra: present (0), or absent, corner smooth (1) (Brochu, 1999).
100. Parietal, dorsal surface: same level of squamosal (0), projected dorsally, relative to the skull roof (1), markedly depressed from skull roof (2) (Andrade *et al.*, 2011).
101. Cranial table width with respect to ventral portion of skull: as wide as ventral portion of skull (quadrates covered by squamosal) (0), narrower but still covering most of the lateromedial region of quadrates (1), narrower exposing lateromedial region of quadrate (2) (Wu *et al.*, 1997).
102. Upper temporal bars, outline of lateral margins in dorsal view: margin mostly straight or slightly convex (0), margin strongly sinusoidal (1) (Andrade *et al.*, 2011).
103. Lateral margins of squamosal and postorbital in dorsal view: parallel (0), or diverging posteriorly (1) (Ortega *et al.*, 2000).

104. Palpebrals: absent (0), present (1) (Clark, 1994).
105. Posterior palpebral: absent (0), present (1) (Clark, 1994).
106. Anterior palpebral shape: rounded (0), hook-shaped with a posterolateral process (1) (Clark, 1994).
107. Palpebrals: separated from (or weakly sutured to) lateral edge of frontals (0), extensively sutured to each other and to lateral margin of frontals (1) (Pol and Norell, 2004b).
108. Frontal-postorbital suture at anterior edge of external supratemporal fenestrae: level with the intertemporal bar (0), lower than the intertemporal bar (1) (Wilkinson *et al.*, 2008).
109. Longitudinal groove for attachment of the upper ear lid at squamosal lateral surface: absent (0), present (1) (Clark and Sues, 2002).
110. Dorsal and ventral edges of squamosal groove for upper ear lid: ventral edge is lateral to dorsal (0), ventral edge is directly beneath dorsal (1) (Clark and Sues, 2002).
111. Posteromedial branch of squamosal, orientation: transversely oriented (0), posterolaterally oriented (1) (Gasparini *et al.*, 2006).
112. Squamosal, dorsal margin of occipital flange: straight (0), or dorsally concave (1) (Gasparini *et al.*, 2006).
113. Anterior opening of temporo-orbital canal, in dorsal: present (0), absent (1) (Ortega *et al.*, 2000).
114. Squamosal posterolateral process: absent (0), present (1) (Clark, 1994).
115. Squamosal posterolateral process projection: parallel to skull roof (0), ventrally directed (1), upturned (2) (Ortega *et al.*, 2000).
116. Ventral projection of squamosal posterolateral process: does not closes the auditory meatus posteriorly (0), closes the auditory meatus posteriorly (1) (Ortega *et al.*, 2000).
117. Squamosal posterolateral process: in level with skull table (0), or depressed from skull table (1) (Sereno and Larsson, 2009).
118. Ornamentation on the posterolateral process of squamosal: absent (0), present (1) (Larsson and Sues, 2007).
119. Distal squamosal posterolateral process: tapered (0), broad (1) (Larsson and Sues, 2007).
120. Exposure of supraoccipital in skull roof: absent (0), present (1) (Ortega *et al.*, 2000).
121. Supraoccipital dorsal exposure: exposed in the midline portion of posterior region of skull table (0) restricted to a thin surface attached to posteriormost portion of parietal and squamosal (1) (Montefeltro *et al.*, 2011).
122. Parietal: with broad occipital portion (0), without broad occipital portion (1) (Clark, 1994).
123. Enclave at parietal-squamosal posterior margin in dorsal view: absent (0), present (1) (Wilkinson *et al.*, 2008).
124. Ventral curvature of temporal arch: absent (0), present (1) (Andrade *et al.*, 2011).
125. Ventral edge of premaxilla, location relative to maxilla: at same height as ventral edge of maxilla (0), or lower than ventral edge of maxilla, with dorsal contour of anterior part of dentary strongly concave (1) (Ortega *et al.*, 2000).
126. Notch in premaxilla on lateral edge of external nares: absent (0), present on the dorsal half of the external nares lateral margin (1) (Pol, 1999).
127. Perinarial fossa: absent (0), present (1) (Pol and Apesteguia, 2005).
128. Perinarial fossa: restricted extension (0), reaching the alveolar margin of premaxillae (1) (Pol and Apesteguia, 2005).
129. Perinarial fossa: posterior margin not reaching the level of posterior margin of external nares (0), posterior margin reaching beyond the level of posterior margin of external nares (1) (Pol and Apesteguia, 2005).

130. Neurovascular foramina (maxillae and premaxilla), overall distance to the alveolar margin and teeth ventralmost foramina clearly apart from the alveolar margin, distant to the teeth (0), ventralmost foramina reach area next to the alveolar margin, close to teeth (1) (Andrade and Bertini, 2008).
131. Neurovascular foramina (mid maxilla) forming a strongly arched line at mid-rostrum: absent, line of foramina follows the overall outline of the margin (0), present, ample area of smooth margin ventral to the arched line of foramina (1) (Andrade *et al.*, 2011).
132. Neurovascular foramina (posterior maxilla), distribution on the alveolar margin: ventralmost foramina not high on the maxillary margin, either close or next to the alveoli (0), ventralmost foramina high on the maxilla (up to twice the distance from other foramina), very distant to the alveoli (1) (Andrade and Bertini, 2008).
133. Ventral edge of maxilla in lateral view: straight or convex (0), or sinusoidal (1) (Ortega *et al.*, 2000).
134. Small foramen located in the premaxillo-maxillary suture in lateral surface (not for big mandibular teeth): absent (0), or present (1) (Pol, 1999).
135. Wedge-like process of the maxilla in lateral surface of premaxilla-maxilla: absent (0), or present (1) (Gasparini *et al.*, 1993).
136. External surface of maxilla and premaxilla, general shape: with single plane facing laterally (0), or with ventral region facing laterally and dorsal region facing dorsolaterally (1) (Pol, 1999).
137. Evaginated maxillary alveolar edges: absent (0), present (1) (Gasparini *et al.*, 2006).
138. Evaginated maxillary alveolar edges: as continuous sheet (0), as discrete evaginations at each alveolus (1) (Gasparini *et al.*, 2006).
139. Unsculptured region along alveolar margin on lateral surface of maxilla: absent (0), or present (1) (Wu and Sues, 1996).
140. Large and aligned neurovascular foramina on lateral maxillary surface: forming a continuous row (0), forming anterior and posterior series separated by a gap (1) (Pol, 1999).
141. Posterior extent of maxilla in lateral surface of rostrum: posterior to anterior margin of orbit (0) anterior to anterior margin of orbit (1) (Wu and Chatterjee, 1993).
142. Lacrimal, posterior extent and relationship with jugal: extending posteroventrally, widely contacting jugal (0), or tapering posteroventrally, does not contact jugal or contacts the jugal only slightly (1) (Zaher *et al.*, 2006).
143. Anterior margins of lacrimal and jugal: confluent with no notch at anterior contact (0), jugal edge convex producing an anterior notch at contact (filled by maxilla) (1) (Larsson and Sues, 2007).
144. Jugal, extension below the orbit: does not exceed anterior margin of orbit (0), or exceeds margin (1) (Pol, 1999).
145. Posterior extent of orbital edge of jugal: confluent with postorbital bar (0), displaced laterally and ends anterior to postorbital bar (forming posteroventral notch in orbit) (1) (Brochu, 1999).
146. Jugal outer surface: confluent along the entire length (0), infratemporal portion of jugal laterally displaced anteriorly (1) (Pol, 1999).
147. Infratemporal portion of jugal laterally displaced: does not extend beyond the anterior orbital margin (0), extends beyond the anterior orbital margin (1) (Pol, 1999).
148. Dorsoventral height of jugal antorbital region with respect to infraorbital region: equal or lower (0), or antorbital region more expanded than infraorbital region (1) (Pol, 1999).

149. Dorsoventral depth of the jugal orbital portion in relation to infratemporal portion: almost the same depth (0), orbital portion twice the depth of the infratemporal portion (1) (Clark, 1994).
150. Jugal, large foramen on the lateral surface near the anterior margin: absent (0), or present (1) (Zaher *et al.*, 2006).
151. Anterior process of jugal relative to infratemporal fenestrae anteroposterior length: smaller to sub equal (0), much longer (1) (Larsson and Sues, 2007).
152. Ectopterygoid-jugal suture ridge: absent (0), present (1) (Montefeltro *et al.*, 2011).
153. Ectopterygoid-jugal suture ridge: continuous with ventral ridge of the infratemporal portion of jugal (0), ridges separated by a notch at the posterior region of the ectopterygoid-jugal suture (1) (Montefeltro *et al.*, 2011).
154. Posterior portion of lateral surface of jugal and ectopterygoid: not confluent (0), confluent with lateral jugal margin forming a depression (1) (Sereno and Larsson, 2009).
155. Ventral lamina of jugal: extends far anterior to ectopterygoid (0), or ends at level of ectopterygoid (1) (Jouve, 2004).
156. Base of postorbital process of jugal, orientation: directed posterodorsally (0), dorsally (1), or anterodorsally (2) (Pol, 1999).
157. Postorbital process of jugal, location on jugal: anteriorly placed (0), in middle (1), or posteriorly positioned (2) (Pol, 1999).
158. Jugal portion of postorbital bar, relative to lateral surface of jugal: flush with lateral surface of jugal (0), inset (1) (Ortega *et al.*, 2000).
159. Inset jugal portion of postorbital bar: anteriorly continuous but posteriorly inset (0), or medially displaced along the whole extent (1) (Ortega *et al.*, 2000).
160. Jugal infratemporal bar: laterally flat (0), rod-shaped (1) (Clark, 1994).
161. Postorbital bar, external texture: sculpted (0), or unsculpted (1) (Clark, 1994).
162. Postorbital bar, lateral surface formed by: formed by postorbital and jugal (0), or only by postorbital (1) (Gasparini *et al.*, 2006).
163. Ventral margin of infratemporal bar of jugal: straight or gentle dorsally arched (0), or strongly arched (1) (Pol *et al.*, 2004).
164. Longitudinal ridge on lateral surface of jugal below infratemporal fenestrae: absent (0), present (1) (Pol and Norell, 2004b).
165. Jugal, relationship with antorbital fossa: participating in margin of antorbital fossa (0), or separated from it (1) (Wu and Sues, 1996).
166. Jugal posterior process, extent of process: exceeding posteriorly the infratemporal fenestrae (0), or not (1) (Pol, 1999).
167. Posteroventral corner of quadratojugal: not reaching quadrate condyles (0), reaching quadrate condyles (1) (Pol, 1999).
168. Quadratojugal: reaches but does not participate in quadrate condyles (0), forms lateral extension to the quadrate condyles and participates in mandibular joint (1) (Pol, 1999).
169. Postorbital bar, shape: transversely flattened (0), massive and elliptical cross section (1), slender and cylindrical (2) (Clark, 1994).

170. Dorsal part of postorbital, shape in dorsal view: with anterior and lateral edges only (0), or with anterolaterally facing edge (1) (Clark, 1994).
171. Dorsal end of the postorbital bar, shape nearing skull table: continuous with dorsal part of postorbital (0), or dorsal part of postorbital bar constricted, distinct from the dorsal part of the postorbital (1) (Clark, 1994).
172. Vascular opening in dorsal surface of postorbital bar: absent (0), or present (1) (Clark, 1994).
173. Postorbital posteroventral process: absent or extremely reduced (tip of laterotemporal fenestrae close to dorsal edge of skull) (0), present (tip of laterotemporal fenestrae separated from the dorsal edge of skull) (1) (Larsson and Sues, 2007).
174. Postorbital participation in infratemporal fenestra: almost or entirely excluded (0), or bordering infratemporal fenestra (1) (Buscalioni *et al.,* 1992).
175. Postorbital descending flange lateral surface: flat (0), or concave (1) (Montefeltro *et al.,* 2011).
176. Quadratojugal, ornamentation at base: absent (0), or present (1) (Pol, 1999).
177. Length of anterior process of quadratojugal: either short or absent (0), from long (less than half length of lower temporal bar) to moderate (one third of lower temporal bar) (1), long (greater than half of lower temporal bar) (2) (Larsson and Sues, 2007).
178. Posterolateral end of quadratojugal, shape and relationship with quadrate: acute or rounded, tightly overlapping quadrate (0), or with sinusoidal ventral edge and wide and rounded posterior edge slightly overhanging lateral surface of quadrate (1) (Pol and Norell, 2004a).
179. Postorbital-quadratojugal contact in lateral view: restricted (0), broad contact between quadratojugal and the posterior portion of the postorbital descending flange (1) (Clark, 1994).
180. Ridge along dorsal section of quadrate-quadratojugal contact: absent (0), or present (1) (Pol and Norell, 2004b).
181. Posterior margin of infratemporal fenestrae: straight (0), with an anterior projection (1) (Ortega *et al.,* 2000).
182. Anterior projection of posterior margin of infratemporal fenestrae: crest shaped (0), prominent spina quadratojugalis (1) (Ortega *et al.,* 2000).
183. In lateral view, anterior process of the squamosal extending to the orbital margin, overlapping the postorbital: absent (0), present (1) (Turner and Buckley, 2008).
184. In lateral view, anterior process of the squamosal extending to the orbital margin, overlapping the postorbital: reaching the level of dorsal tip of lateral temporal fenestrae (0), reaching the orbital margin (1) (Turner and Buckley, 2008).
185. Quadrate major axis, direction of orientation: directed posteroventrally (0), directed mostly ventrally, or anteroventrally (1) (Pol, 1999).
186. Dorsal, primary head of quadrate articulates with: squamosal, otoccipital, and prootic (0), or prootic and laterosphenoid (1) (Clark, 1994).
187. Quadrate lateral depression: absent (0), present (1) (Montefeltro *et al.,* 2011).
188. Cranioquadrate otic aperture: not marking a notch at otic aperture (0), or marking a notch at otic aperture (1), marking a posteroventral sulcus (2) (Brochu, 1999).
189. Posterior edge of quadrate: broad medial to tympanum, gently concave (0), or posterior edge narrow dorsal to otoccipital contact, strongly concave (1) (Clark, 1994).

190. External auditory meatus: continuous (0), separated in two region by a ridged on quadrate-quadratojugal (1) (Larsson and Sues, 2007).
191. Quadrate fenestration: absent (0), present (1) (Clark, 1994).
192. Quadrate fenestration: preotic siphonal foramen present anterior to otic aperture (0), quadrate with many additional fenestration (1) (Clark, 1994).
193. Quadrate fenestrae: visible in lateral view (0), or internalized in otic notch (1) (Montefeltro *et al.*, 2011).
194. Squamosal-quadrate contact within the otic aperture: dorsally to cranioquadrate otic aperture (0), within cranioquadrate otic aperture (1) (Brochu, 1999).
195. Distal quadrate body: anterior margin oriented in a right angle in relation to quadratojugal (0), anterior margin gentle slopes to quadratojugal (1) (Montefeltro *et al.*, 2011).
196. Quadrate distal end in posterior view: with only one plane facing posteriorly (0), or with two distinct faces, a posterior one and a medial one bearing foramen aëreum (1) (Pol, 1999).
197. Incisive foramen size: present (0), absent (1) (Larsson and Sues, 2007).
198. Palatal parts of premaxillae, extent of contact: do not meet posterior to incisive foramen (0), meet posteriorly along contact with maxillae (1) (Clark, 1994).
199. Incisive foramen, location relative to premaxillary toothrow: completely situated far from alveolar processes at level of second or third alveolus (0), close to alveolar process (1) (Brochu, 1999).
200. Premaxilla, anterior alveolar margin orientation: vertical (0), or inturned (1) (Sereno *et al.*, 2001).
201. Posterior palatal branches of maxillae anterior to palatines: do not meet (0), meet (1) (Clark, 1994).
202. Premaxillary palate, circular paramedian depressions: absent (0), present (1) (Sereno *et al.*, 2001).
203. Prominent depression on the palate near alveolar margin at the level of the 6th or 7th alveoulus: absent (0), or present (1) (Turner and Buckley, 2008).
204. Premaxilla-maxilla suture in palatal view, medial to alveolar region: anteromedially directed (0), sinusoidal, posteromedially directed on lateral half and anteromedially directed along medial region (1), or posteromedially directed (2), premaxillae-maxillae suture U-shaped (3) (Pol, 1999).
205. Premaxilla-maxilla lateral fossa excavating alveolous of last premaxillary tooth: no (0), or yes (1) (Larsson and Sues, 2007).
206. Large nutrient foramen on palatal surface of premaxilla-maxilla contact: small or absent (0), or present (1) (Larsson and Sues, 2007).
207. Rugose surface on palatal surface of maxilla posterior to last tooth: absent (0), or present (1) (Pol and Powell 2011).
208. Longitudinal depressisons on palatal surface of maxillae and palatines: absent (0), or present (1) (Gasparini *et al.*, 2006).
209. Sculpturing, palatal surface of maxilla: absent, palatal surface smooth (0), present, palatal surface ornamented with ridges (1) (Ortega *et al.*, 2000).
210. Maxillae saggital contact: smooth (0), bearing a longitudianal series of foramina (1) (Montefeltro *et al.*, 2011).
211. Participation of maxilla at anterior edge of suborbital fenestrae: great participation (0), reduced or absent (1) (Andrade and Bertini, 2008).
212. Sagittal torus on maxillary palatal shelves: absent (0), present (1) (Larsson and Sues, 2007).

213. Ectopterygoid - maxilla contact: ectopterygoid only abuts maxilla (0), present and broad and maxilla broadly separetes ectopterygoid from maxillary tooth row (1) (Brochu, 1999).
214. Quadratojugal dorsal extent in medial surface: ending ventrally to the dorsal tip of laterotemporal fenestra (0), ending at the same level, or overcoming the dorsal tip of laterotemporal fenestrae (1) (Montefeltro *et al.*, 2011).
215. Palatines, palatal process: absent (0), present (1) (Clark, 1994).
216. Palatines, palatal process: do not meet on palate below narial passage (0), meet ventral to narial passage, forming part of secondary palate (1) (Clark, 1994).
217. Maxilla-palatine suture (when fused at midline): palatine anteriorly rounded (0), palatine anteriorly pointed (1), palatine invaginated (2), suture transverse to midline axis (3) (Brochu, 1999).
218. Maxillary process to palatine, next to the anterior border of suborbital fenestrae: absent (0), present (1) (Andrade and Bertini, 2008).
219. Nasopharyngeal duct, width at its narrowest section relative to the skull width: narrow in proportion to skull width, no more than 25% (0), wide in proportion to skull width, no less than 30% (1) (Andrade *et al.*, 2011).
220. Palatines anterior extension: overcoming the anterior margin of suborbital fenestrae (0), do not reaching the level of the anterior margin of suborbital fenestrae (1) (Pol, 1999).
221. Paired anterior palatal fenestrae: absent (0), or present (1) (Wu *et al.*, 1997).
222. Medial palatal contact: smooth (0), rougouse (1) (Montefeltro *et al.*, 2011).
223. Row of foramina flanking the medial contact of palatines: absent (0), present (1) (Montefeltro *et al.*, 2011).
224. Anterior half of interfenestral bar between suborbital fenestrae: parallel to subparallel (0), or flared anteriorly (1) (Pol *et al.*, 2009).
225. Posterior half of interfenestral bar between suborbital fenestrae: parallel to subparallel (0), or flared posteriorly (1) (Pol *et al.*, 2009).
226. Ventral face of palatine bar: flat and wide (0), ventral surface restricted and dorsal portion cylindrical (1) (Montefeltro *et al.*, 2011).
227. Cylindrical dorsal portion of palatine bar: with the same wideness through (0) constricted in the posterior portion (1) (Montefeltro *et al.*, 2011).
228. Palatines (anteroposterior axis): run parasagittally along midline (0), diverge laterally, becoming rod-like and forming palatine bars posteriorly (1) (Martinelli, 2003).
229. Palatine-pterygoid contact on palate: palatines overlie pterygoids (0), or palatines firmly sutured to pterygoids (1) (Pol and Norell, 2004a).
230. Vomer, exposure on palate: exposed (0), or not exposed (1) (Buckley *et al.*, 2000).
231. Pterygoid, location: restricted to palate and suspensorium, joints with quadrate and basisphenoid overlapping (0), or extends dorsally to contact laterosphenoid and form ventrolateral edge of trigeminal foramen, strongly sutured to quadrate and laterosphenoid (1) (Clark, 1994).
232. Pterygoids, contact on palate: not in contact anterior to basisphenoid on palate (0), or pterygoids in contact (1) (Wu *et al.*, 1997).
233. Primary pterygoidean palate, role in forming choanal opening: forms posterior half of choanal opening (0), forms posterior, lateral, and part of anterior margin of choana (1), or completely encloses choana (2) (Clark, 1994).

234. Pterygoid, ventral surface of pterygoid flanges, parachoanal fossae: absent (0), or present (1) (Andrade and Bertini, 2008).
235. Pterygoid parachoanal fenestra: absent (0), present (1) (Montefeltro *et al.*, 2011).
236. Pterygoid parachoanal fenestra: open dorsally (0), closed dorsally (1) (Montefeltro *et al.*, 2011).
237. Pterygoid, in ventral view, participation in the suborbital fenestra: pterygoid forms margin of suborbital fenestra (0), or excluded from suborbital fenestra by ectopterygoid-palatine contact (1) (Turner and Sertich, 2010).
238. Anterior edge of choanae, location: situated between suborbital fenestra (or anteriorly) (0), near posterior edge of suborbital fenestra (1), or near posterior edge of pterygoid flange (2) (Clark, 1994).
239. Pterygoid ventral rami, ventral surface at proximal end: smooth (0), evident transverse ridge on ventral surface (1) (Andrade *et al.*, 2011).
240. Transverse ridge on ventral surface of pterygoid: thin (0), robust (1) (Andrade *et al.*, 2011).
241. Quadrate process of pterygoids: well developed (0), or poorly developed (1) (Pol, 1999).
242. Quadrate ramus of pterygoid in ventral view: narrow (0), or broad (1) (Wu *et al.*, 1997).
243. Palatal surface of pterygoids: smooth (0), or sculpted (1) (Clark, 1994).
244. Pterygoidean flanges: laminar and expanded (0), bar-like (1) (Ortega *et al.*, 2000).
245. Bar-like pterygoidean flanges: elongate (0), short and poor developed (1) (Ortega *et al.*, 2000).
246. Pterygoid flanges, size: thin and laminar (0), or dorsoventrally thick, with pneumatic spaces (1) (Wu *et al.*, 1997).
247. Pterygoid flanges: mediolaterally expanded surpassing laterally the quadrate medial condyle (0), or relatively short, and do not reach laterally to the level of quadrate medial condyle (1) (Ösi *et al.*, 2007).
248. Posterior pterygoid processes: absent or reduced (0), well developed projecting posteriorly (1) (Larsson and Sues, 2007).
249. Choanal septum shape: narrow vertical bony sheet (0), T-shaped bar expanded ventrally (1), or massive and blocky (2) (Pol and Apesteguia, 2005).
250. Ventral surface of choanal septum: smooth to slightly depressed (0), marked by an acute groove (1), ridged (2) (Turner, 2006).
251. Postorbital-ectopterygoid contact: present (0), or absent (1) (Pol, 1999).
252. Ectopterygoid, relation to postorbital bar: absent, bar does not receive contribution from ectopterygoid (0), present, bar receives contribution from ectopterygoid (1) (Sereno and Larsson, 2009).
253. Ectopterygoid main axis orientation: laterally or slightly anterolaterally (0), or anteriorly, subparallel to longitudinal axis of skull (1) (Pol *et al.*, 2004).
254. Ectopterygoid, extent of medial projection on the ventral surface of pterygoid flanges: barely extended (0), or widely extended, covering approximately lateral half of ventral surface of pterygoid flanges (1) (Zaher *et al.*, 2006).
255. Ectopterygoid, extent along lateral pterygoid flange, at maturity: extends to posterior tip (0), or does not extend to posterior tip (1) (Norell, 1988).
256. Ectopterygoid, participation in the palatine bar: absent (0), or present (1) (Zaher *et al.*, 2006).
257. Anterior process of ectopterygoid: developed (0), or reduced or absent (1) (Pol, 1999).
258. Ectopterygoid medial process, shape: single (0), or forked (1) (Ortega *et al.*, 2000).

259. Posterior process of ectopterygoid: developed (0), or reduced or absent (1) (Pol, 1999).
260. Ectopterygoid-palatine contact posterior to the suborbital fenestra: not contacting (0), or contacting (1) (Pol and Powell 2011).
261. Ectopterygoid, morphology of the distal ramus: laminar, extending as a flattened sheet over the pterygoid wing (0), robust, extending as a rod over most of the pterygoid wing, with subcircular crosssection through most of its length (1) (Andrade *et al.*, 2011).
262. Basipterygoid process, shape: prominent, forming movable joint with pterygoid (0), or small or absent, with basisphenoid joint suturally closed (1) (Clark, 1994).
263. Basisphenoid, exposure on braincase: exposed on ventral surface of braincase (0), or virtually excluded from ventral surface by pterygoid and basioccipital (1) (Clark, 1994).
264. Basispenoid, lateral exposure on braincase: absent (0), or present (1) (Pol, 1999).
265. Basisphenoid: ventral surface continuous to surrounding bones (0), body ventrally developed and separated from the remaining elements by a posteroventrally step forming by a sulcus separating it from the main occipital plane, forming a postchoanal pterygoid-basisphenoid tuberosity (1) (Montefeltro *et al.*, 2011).
266. Pterygoid ramus of quadrate: with flat ventral edge (0), or with deep groove (1) (Clark, 1994).
267. Paired ridges located medially on the ventral surface of the basisphenoid (originating at the anterior margins of lateral Eustachian foramina): absent (0), present (1) (Pol and Norell, 2004a).
268. Quadrate-basisphenoid contact: dorsolateral contact (0), dorsolateral and anterolateral contact (1) (Wu *et al.*, 1997).
269. Basisphenoid ventral surface, size relative to basioccipital: shorter than basioccipital (0), or wide and similar to, or longer, in length than basioccipital (1) (Clark, 1994).
270. Basioccipital: without well-developed bilateral tuberosities (0), or with large pendulous tubera (1) (Clark, 1994).
271. Basiocciptal, midline crest on basioccipital plate below occipital condyle: absent (0), or present (1) (Turner and Sertich, 2010).
272. Eustachian tubes, relationship with basioccipital and basisphenoid: not enclosed between basioccipital and basisphenoid (0), or entirely enclosed (1) (Clark, 1994).
273. Lateral eustachian tube openings, location: located posterior to medial opening (0), or aligned anteroposteriorly and dorsoventrally (1) (Pol, 1999).
274. Lateral Eustachian foramina anterior wall: present and separating the foramen from the sulcus (0), absent, foramen opens into the sulcus (1) (Montefeltro *et al.*, 2011).
275. Lateral Eustachian foramina: smaller than medial one (0), as larger or larger than medial one (1) (Montefeltro *et al.*, 2011).
276. Anterodorsal ramus of quadrate in ventral view: developed, forming more than 50% of the lateral edge of internal supratemporal fenestra (0), restricted, forming less than 50% of the lateral edge of internal supratemporal fenestra (1) (Montefeltro *et al.*, 2011).
277. Muscle scar in the medial surface of quadrate (ridge A Iordasky 1968): almost straight to curved (0), or sigmoidal (1) (Montefeltro *et al.*, 2011).
278. Ventral surface of the quadrate: smooth or with simple muscle scars (0), with developed multiples ridges (1) (Ösi *et al.*, 2007).

279. Cross section of distal end of quadrate: mediolaterally wide and anteroposteriorly thin (0), or subquadrangular (1) (Pol and Norell, 2004a).
280. Quadrate condyles: Quadrate condyles with poorly developed intercondylar groove (0), or medial condyle expands ventrally, being separated from lateral condyle by deep intercondylar groove (1) (Ortega *et al.*, 2000).
281. Lateral quadrate condyle: almost at the same anteroposterior extention than medial one (0), or lateral quadrate hemispherical (1) (Montefeltro *et al.*, 2011).
282. Laterosphenoid bridge: absent (0), at least partially complete (1) (Brochu, 1999).
283. Laterosphenoid, orientation of capitate process: oriented laterally (0), or anteroposteriorly toward midline (1) (Brochu, 1999).
284. Squamosal posterolateral region, lateral to paroccipital process: narrow (0), or bearing subrounded flat surface (1) (Gasparini *et al.*, 2006).
285. Supraoccipital: forms dorsal edge of foramen magnum (0), otoccipitals broadly meet dorsal to foramen magnum, separating supraoccipital from foramen magnum (1) (Clark, 1994).
286. Posterior surface of supraoccipital: nearly flat (0), or with bilateral posterior prominences (1) (Clark, 1994).
287. Exoccipitals participate in the occipital condyle: no (0), yes (1) (Jouve *et al.*, 2005).
288. Basioccipital and ventral part of otoccipital, orientation: facing posteriorly (0), or posteroventrally (1) (Gomani, 1997).
289. Ventrolateral contact of otoccipital with quadrate: very narrow (0), or broad (1) (Clark, 1994).
290. Orientation of paraoccipital process in occipital view: horizontal (0), dorsal-laterally directed at a 45° angle (1), or medial edge horizontal, then terminal third sharply inclined dorsal-laterally at a 45° angle (2) or curve downwards strongly (3) (Young and Andrade, 2009).
291. Otoccipital: without laterally concave descending flange ventral to subcapsular process (0), or with flange (1) (Clark, 1994).
292. Ventromedial part of quadrate, contact with otoccipital: does not contact otoccipital (0), or contacts otoccipital to enclose carotid artery and form passage for cranial nerves IX-XI (1) (Clark, 1994).
293. Cranial nerves IX-XI, passage through braincase: all pass through common large foramen vagi in otoccipital (0), or cranial nerve IX passes medial to nerves X and XI in separate passage (1) (Clark, 1994).
294. Development of distal quadrate body ventral to otoccipital-quadrate contact: distinct (0), indistinct (1) (Wu *et al.*, 1997).
295. Otoccipital, ventral to paroccipital process: without large ventrolateral part ventral to paroccipital process (0), or with large ventrolateral part (1) (Clark, 1994).
296. Crista interfenestralis between fenestrae pseudorotunda and ovalis, orientation: nearly vertical (0), or horizontal (1) (Clark, 1994).
297. Mastoid antrum, location: does not extend into supraoccipital (0), or extends through transverse canal in supraoccipital to connect middle ear regions (1) (Clark (1994).
298. Quadrate body distal to otoccipital-quadrate, orientation of contact in posterior view: ventrally (0), or ventrolaterally (1) (Pol and Norell, 2004a).
299. Foramen for the internal carotid artery: reduced, similar in size to openings for cranial nerves IX-XI (0), or extremely enlarged (1). (Gasparini *et al.*, 2006).
300. Mandibular outer surface sculpture: absent (0), present (1) (Montefeltro *et al.*, 2011).

301. Mandibular outer surface sculpture: present on dentary (0), present on dentary and splenial (1) (Montefeltro *et al.*, 2011).
302. Strong pitted pattern on angular and posterior surangular: absent (0), present (1) (Andrade *et al.*, 2011).
303. Mandibular fenestra: absent (0), present (1) (Clark, 1994).
304. Mandibular fenestrae size: present as a diminutive passage (0), present as an evident fenestra (1) (Clark, 1994).
305. External mandibular fenestra, orientation of main axis: horizontal (0), main axis inclined, directed anteroventrally-posterodorsally (1) (Andrade *et al.*, 2011).
306. External mandibular fenestra, shape: subcircular to poorly elliptic (0), highly elliptic, anteroposterior axis much longer than dorso-ventral axis, three time or more, but both ends rounded (1), slit-like, proportionally very long and both ends acute (2). teardrop-like (3), triangle (4) (Andrade *et al.*, 2011).
307. Mandible, morphology of distal rami in dorsal/ventral views: distal rami mostly straight or poorly curved (0), distal rami strongly curved medially at mid-mandible, giving the mandible a broad-Y shape (1) (Andrade *et al.*, 2011).
308. Posteroventral edge of mandibular ramus, shape: straight or convex (0), or markedly deflected (1) (Wu *et al.*, 1997).
309. Jaw joint, location: placed level with occipital condyle (0), below occipital condyle (1) (Wu and Sues, 1996).
310. Anterior foramen intramandibularis oralis: small or absent (0), or large and slotlike (1) (Ortega *et al.*, 2000).
311. Foramen intramandibularis caudalis: absent (0), present (1) (Larsson and Sues, 2007).
312. Dentary, lateral surface: smooth lateral to seventh alveolus (0), or with lateral concavity for reception of enlarged maxillary tooth (1) (Buckley and Brochu, 1999).
313. Lateral surface of dentaries below alveolar margin, at mid to posterior region of tooth row: vertically oriented, continuous with rest of lateral surface of dentaries (0), or flat surface exposed dorsolaterally, divided by ridge from rest of lateral surface of dentaries (1) (Pol and Apesteguia, 2005).
314. Dentary, relative to mandibular fenestra: extends posteriorly beneath mandibular fenestra (0), or does not extend beneath fenestra (1) (Clark, 1994).
315. Dentary compression and lateroventral surface anterior to mandibular fenestra: compressed and vertical (0), or not compressed and convex (1) (Ortega *et al.*, 1996).
316. Unsculpted region in the dentary below the tooth row: absent (0), present (1) (Pol, 1999).
317. Dorsal edge of dentary: slightly concave or straight and subparallel to longitudinal axis of skull (0), straight with abrupt dorsal expansion, being straight posteriorly (1), with single dorsal expansion and concave posteriorly (2), or sinusoidal, with two concave waves (3) (Ortega *et al.*, 1996).
318. In lateral view, surangular and dentary suture: simple, with no interdigitation or with little interdigitation (0), or complex, with interlocking well developed prongs from both surangular and dentary, three posterior prongs from dentary and two from surangular (1) (Brochu, 1999).
319. Dentary, projection of anterior alveoli: project anterodorsally (0), procumbent (1) (Brochu, 1999).
320. Coronoid size: short, located below dorsal edge of mandibular ramus (0), or anteriorly extended with posterior region elevated at dorsal margin of mandibular ramus (1) (Ortega *et al.*, 2000).
321. Coronoid participation on the external face of the mandible: no (0), or yes (1) (Young and Andrade, 2009).
322. Posterior peg at symphysis: absent (0), or present (1) (Pol and Apesteguia, 2005).
323. Posteroventral symphyseal depressions: absent (0), present (1) (Montefeltro *et al.*, 2011).

324. Posteroventral symphyseal depressions: facing ventrally (0), facing posteriorly (1) (Montefeltro *et al.*, 2011).
325. Symphysis, length relative to width: short, length and width subequal or shorter than wide (0), proportionally long, longer than wide (1), extremely long, length at least five times its width (2) (Andrade *et al.*, 2011).
326. Splenial involvement in symphysis in ventral view: not involved (0), involved (1) (Clark, 1994).
327. Splenial, participation in the medial wall of the posterior mandibular alveoli: does not take part, splenial may reach the alveolar margin, but alveoli are delimited solely by the dentary (0), participates in the distalmost alveoli, supporting teeth (1) (Andrade *et al.*, 2011).
328. Dorsal surface of mandibular symphysis: flat or slightly concave (0), or strongly concave and narrow, trough shaped (1) (Pol and Apesteguia, 2005).
329. Medial surface of splenials posterior to symphysis: flat or slightly convex (0), markedly concave (1) (Pol and Apesteguia, 2005).
330. Mandibular symphysis in lateral view: shallow and tapering anteriorly (0), deep and tapering anteriorly (1), deep and anteriorly convex (2), or shallow and anteriorly convex (3) (Wu and Sues, 1996).
331. Mandibular symphysis, orientation of anterior part: horizontal or slightly dorsally directed (0), forming an angle of approximately 45 degrees to the main axis of the jaw (1) (Sereno and Larsson, 2009).
332. Shape of dentary symphysis in ventral view: tapering anteriorly forming an angle (0), U-shaped, smoothly curving anteriorly (1), or lateral edges longitudinally oriented with convex anterolateral corner and extensive, transversely oriented anterior edge (2) (Pol, 1999).
333. Splenial-dentary suture at symphysis on ventral surface: V-shaped (<45° betwen hemimandibule main axis of the symphisis) (0), Transversely oriented (>70° betwen hemimandibule main axis of the symphisis) (1), Intermediary-shaped (>45° and <70° betwen hemimandibule main axis of the symphisis) (2) (modified from Pol and Apesteguia, 2005).
334. Splenial posterior to symphysis: thin (0), or robust dorsally (1) (Ortega *et al.*, 1996).
335. Surangular groove, enlarged foramen at anterior end: absent (0), present (1) (Gasparini *et al.*, 2006).
336. Lateral surface of the anterior region of surangular and posterior region of dentary: without longitudinal depression (0), or with longitudinal depression (1) (Ortega *et al.*, 1996).
337. Surangular ventral face in lateral view: angular doesn't extend beyond orbits (0), angular extends beyond the orbits (1) (Wilkinson *et al.*, 2008).
338. Dorsal edge of surangular: mostly straight (0), arched dorsally (1) (Clark, 1994).
339. Longitudinal ridge along the dorsolateral surface of surangular: absent (0), or present (1) (Pol and Norell, 2004b).
340. Lateral expansion of posterodorsal edge of surangular anterior to glenoid fossa: absent (0), or present (1) (Turner and Buckley, 2008).
341. Surangular, contribution to the glenoid fossa: forms only lateral wall of glenoid fossa (0), or forms approximately one-third of glenoid fossa (1) (Buckley and Brochu, 1999).
342. Insertion area for M. pterygoideous posterior: does not extend onto lateral surface of angular (0), or extends onto lateral surface of angular (1) (Clark, 1994).
343. Surangular extension toward posterior end of retroarticular process: along entire length (0), or pinched off anterior to posterior tip (1) (Norell, 1988).

344. Angular, shape of posteroventral margin: straight or gently arched dorsally (0), or strongly arched dorsally (1) (Pol *et al.,* 2009).
345. Angular posterior to mandibular fenestra, location on mandible: widely exposed on lateral surface of mandible (0), or shifted to ventral surface of mandible (1) (Wu *et al.,* 1997).
346. Sharp ridge on the surface of the angular: absent (0), present (1) (Pol and Norell, 2004b).
347. Sharp ridge on the surface of the angular: at ventral-most margin (0), or along lateral surface (1) (Pol and Norell, 2004b).
348. Prearticular: present (0), or absent (1) (Clark, 1994).
349. Articular facet for quadrate condyle, size: equal in length to quadrate condyles (0), slightly longer (1), or close to three times length of quadrate condyles (2) (Wu and Sues, 1996).
350. Posterior ridge on glenoid fossa of articular: posterior margin well developed, evidently high (0), posterior margin poorly delimited, crest absent (1) (Pol and Apesteguia, 2005).
351. Articular, medial process articulating with otoccipital and basisphenoid: absent (0), present (1) (Clark, 1994).
352. Retroarticular process: absent or extremely reduced (0), with an extensive rounded, wide, and flat (or slightly concave) surface projected posteroventrally and facing dorsomedially (1), posteriorly elongated, triangular, and facing dorsally (2), or posteroventrally projecting and paddle-shaped (3) (Clark, 1994).
353. Position of distalmost tip of retroarticular process relative to the mandibular glenoid: tip at the same level or below (0), tip clearly in a more dorsal plane than the glenoid fossa (1) (Andrade *et al.,* 2011).
354. Tooth margin carinae: Without carinae (0), With denticulate carinae (Ziphodont) (1), With tubercular heterogenic denticles (Ziphomorph) (2), With crenulated carinae (False ziphodont) (3), With smooth carinae (4) (modified from Ortega *et al.,* 1996).
355. Mid to posterior elements of the toothrows: crowns not compressed laterally, subcircular in cross section (0), or crowns symmetrically slightly compressed laterally (1), or crowns symmetrically highly compressed laterally (2) (Pol, 1999).
356. Compressed crown of maxillary and dentary teeth, orientation: oriented parallel to longitudinal axis of skull (0), only maxillary teeth obliquely disposed (1), both maxillary and dentary obliquely disposed (2) (Pol, 1999).
357. Asymmetric compression of Mid to posterior tooth rows elements: absent (0), present, occurring only along distal margin giving teeth a teardrop shape (1) (Andrade and Bertini, 2008).
358. Tooth accessory cusps: absent (0), present (1) (Gomani, 1997).
359. Tooth accessory cusps: accessory cusps arranged in one row (0), accessory cusps arranged in more than one row (1) (Gomani, 1997).
360. Posterior teeth with rings of undulated enamel: absent (0), or present (1) (Gasparini *et al.,* 2006).
361. Presence of ridged ornamentation on enamel surface of mid to posterior teeth: absent (0), present (1) (Andrade *et al.,* 2011).
362. Surface of tooth enamel: smooth or slightly crenulated (0), or with ridges at base of crown (often extending apically) (1) (Turner and Sertich, 2010).
363. Accessory ridges on labial-lingual surfaces of mid to posterior teeth: absent (0), present (1) (Andrade *et al.,* 2011).
364. Premaxillary tooth number: six (0), five (1), four (2), three (3), two (4) (Wu and Sues, 1996).
365. Number of maxillary teeth: eight or more (0), seven (1), six (2), five (3), or four (4) (Wu and Sues, 1996).

366. Premaxillary tooth row orientation: arched posteriorly from midline (0), angled posterolaterally, at 120 angle (1), transverse (2), set in a relatively straight posterolateral orientation (3) (Sereno *et al.,* 2001).
367. Procumbent premaxillary alveoli: absent (0), or present (1) (Zaher *et al.,* 2006).
368. Premaxillary teeth 1 and 2, position: separated like adjacent teeth (0), or nearly confluent (1) (Larsson and Gado, 2000).
369. Posterior premaxillary teeth, size: similar in size to anterior teeth (0), or much longer than anterior teeth (1) (Clark, 1994).
370. Last premaxillary tooth position relative to tooth row: anterior or anteromedial (0), or anterolateral (1) (Sereno *et al.,* 2001).
371. Maxillary teeth waves: absent, no tooth size variation (0), one wave of teeth enlarged (1), or enlarged maxillary teeth occur in two waves (festooned) (2) (Clark, 1994).
372. Maxillary tooth row posterior extension: does not extends posteriorly to the anteriormost border of the suborbital fenestra (0), extends posteriorly to the anteriormost border of the suborbital fenestra (1) (Ortega *et al.,* 2000).
373. Maxillary tooth, size relative to maxillary palatal surface in palatal view: proportionally small teeth, occupying only marginal portion of ventral surface of maxilla (0), or proportionally well developed teeth, occupying large area of maxillary palatal surface (1) (Andrade and Bertini, 2008).
374. Size of the 7th and 8th dentary tooth crowns: about the same size (0), 7th much smaller than 8th (1) (Andrade *et al.,* 2011).
375. Maxillary dental implantation: teeth in isolated alveoli (0), or located in dental groove (1) (Ortega *et al.,* 2000).
376. Tooth (with transitional morphology) present at premax-max contact: absent (0), or present (1) (Turner and Sertich, 2010).
377. Cheek teeth base: not constricted (0), or constricted (1) (Ortega *et al.,* 1996).
378. Posterior (molariform) teeth, wear facets: absent (0), or present (1) (Turner and Sertich, 2010).
379. Width of root of teeth with respect to crown: narrower or equal (0), or wider (1) (Ortega *et al.,* 2000).
380. Enlarged maxillary teeth: absent (0), present at second or third alveolus (1), or fourth or fifth (2) (Ortega *et al.,* 2000).
381. Anterior dentary teeth opposite premaxilla-maxilla contact: no more than twice length (0), more than twice the length (1) (Clark, 1994).
382. Vertebral centra, shape: cylindrical (0), or spool-shaped (1) (Buscallioni and Sanz, 1988).
383. Atlas intercentrum, size: broader than long (0), or as long as broad (1) (Clark, 1994).
384. Axial neural spine height: high, subequal to centrum height (0), low, less than half centrum height and nearly horizontal (1) (Larsson and Sues, 2007).
385. Anteroposterior development of neural spine in axis: well developed, covering all of neural arch length (0), or poorly developed, located over the posterior half of the neural arch (1) (Pol, 1999).
386. Axial neural spines, width of posterior half: wide (0), or narrow (1) (Brochu, 1999).
387. Prezygapophyses of axis, development relative to neural arch: not exceeding anterior edge of neural arch (0), or exceeding anterior margin of neural arch (1) (Pol, 1999).
388. Postzygapophyses of axis: well developed, curved laterally (0), or poorly developed (1) (Pol, 1999).
389. Axial hyapophysis, deep fork: present (0), or absent (1) (Brochu, 1999).

390. Cervical rod-like neural spines: absent (0), present (1) (Clark, 1994).
391. Cervical vertebrae: amphicoelous or amphyplatyan (0), or procoelous (1) (Clark, 1994).
392. Anterior cervical vertebrae base of neural spine: gracile base, with neural spine clearly distinct from the neural arch (0), robust base, with the development of spinozygapophyseal ridges (1) (Andrade and Bertini, 2008).
393. Prezygapophyseal process of anterior cervical vertebrae: anterodorsally projected and straight or slightly recurved (0), or dorsally projected and strongly recurved (1) (Pol *et al.,* 2012).
394. Prezygapophyseal process of anterior to middle cervical vertebrae in lateral view: anterior margin straight or evenly convex (0), or anterior margin bearing a distinct bulge at the midpoint of the prezygapophyseal process (1) (Pol *et al.,* 2012).
395. Shape of the articular surface of the parapophysis in the posterior cervicals and anterior dorsals: subcircular/ovoid with the major axis oriented anteroposteriorly (0), or subtriangular/ovoid with major axis oriented dorsoventrally (1) (Pol *et al.,* 2012).
396. Posterior cervical vertebrae base of neural spine: gracile base, with neural spine clearly distinct from the neural arch (0), robust base, with the development of spinozygapophyseal ridges(1) (Andrade and Bertini, 2008).
397. Third cervical vertebra (CIII) prezygapophysis: poorly developed, slightly projecting anterior to the vertebral centrum (0), well developed, clearly projecting anteriorly, beyond the vertebral centrum (1) (Andrade *et al.,* 2011).
398. Hypapophyses in cervicodrsal vertebrae: absent (0), present (1) (Buscallioni and Sanz, 1988).
399. Hypapophyses in cervicodrsal vertebrae: present only in cervical vertebrae (0), present in cervical and dorsal vertebrae (1) (Buscallioni and Sanz, 1988).
400. Trunk vertebrae: amphicoelous or amphyplatyan (0), or procoelous (1) (Clark, 1994).
401. Transverse process of posterior dorsal vertebrae, shape: dorsoventrally low and laminar (0), or dorsoventrally high (1) (Buscallioni and Sanz, 1988).
402. Dorsal migration of parapophysis on the neural arch on middle dorsals: dorsal vertebrae 4 to 9 showing a gradual dorsal migration of parapophysis, with at least two vertebrae bearing the parapophysis on the neural arch pedicles, well below the diapophysis (0), or abrupt change in position of parapophysis, with dorsal 4 bearing the parapophysis at the neurocentral suture and dorsal 5 with parapophysis leveled with diapophysis forming a transverse process (1) (Pol *et al.,* 2012).
403. Medial surface of prezygapophyseal process of anterior to middle cervical vertebrae: flat or slightly convex (0), or with an ovoid or triangular depression close to the neural canal (1) (Pol *et al.,* 2012).
404. Spinopostzygapophyseal lamina in dorsal vertebrae: absent (0), or present as a high and sharp lamina (1) (Pol *et al.,* 2012).
405. Distinct rounded depression on the dorsal surface of the neural arches of the anterior to middle dorsal vertebrae, located between the base of the neural spine and the postzygapophyseal process: absent (0), or present (1) (Pol *et al.,* 2012).
406. Relative position of the transverse process and the postzygapophysis in middle dorsal vertebrae: postzygapophysis located dorsal to the transverse process (0), or postzygapophysis level with the transverse process (1) (Pol *et al.,* 2012).
407. Number of sacral vertebrae: two (0), or more than two (1) (Buscallioni and Sanz, 1988).

408. Sacral vertebrae, direction of transverse processes: laterally (0), or markedly deflected ventrally (1) (Gasparini *et al.*, 2006).

409. Dorsolateral end of first sacral rib: located at the level of the neural canal (0), or dorsoventrally expanded, projecting dorsally above the level of the neural canal (1) (Pol *et al.*, 2012).

410. Biconvex first caudal vertebra: absent (0), present (1) (Clark, 1994).

411. Caudal vertebrae downwards deflection: absent (0), present (1) (Young and Andrade, 2009).

412. Cervical rib shaft, posterior process, posterodorsally projecting spine at the junction with the tubercular process: absent (0), or present (1) (Turner, 2006).

413. Anterior scapular edge: strongly concave (0), posterior edge relatively straight (1) (Clark, 1994).

414. Scapular blade width: no more than twice length of scapulocoracoid articulation (0), or very broad, greater than twice length of scapulocoracoid articulation (1) (Buckley and Brochu, 1999).

415. M. teres major and M. dorsalis scapulae insert separately on humerus: yes (0), no (1) (Brochu, 1999).

416. Insertion mark dorsal to the glenoid facet of the scapula for the attachment of the M. triceps: present as a well-developed ridge or tubercle (0), or absent (1) (Pol *et al.*, 2012).

417. Coracoid, medial process: elongate posteromedial process (0), with distally expanded ventromedial process (1) (Wu and Sues, 1996).

418. Coracoid length: up to two-thirds of scapular length (0), or subequal in length to scapula (1) (Clark, 1994).

419. Distal expansion of the coracoid: larger or equal to the proximal expansion (0), or less expanded than the proximal region (1) (Pol *et al.*, 2012).

420. Recess ventral to the glenoid facet of the coracoid: shallow and smoothly concave surface (0), or deep recess strongly concave in lateral view, overhung by a large ventral projection of the glenoid facet (1) (Pol *et al.*, 2012).

421. Orientation of the area of insertion of M. subscapularis above the internal tuberosity of the humerus: obliquely oriented in anterior view, with the area of insertion facing proximomedially (0), or vertically oriented in anterior view, with the area of insertion facing medially (1) (Pol *et al.*, 2012).

422. Anterior projection and profile of deltopectoral crest in humerus: Well-developed crest bearing a pointed tubercle for the insertion of the supracoracoideus complex (sensu Meers, 2003) (0), or low and anteriorly convex in lateral view, lacking a well-developed tubercle (1) (Pol *et al.*, 2012).

423. Proximal one-third of the deltopectoral crest: originating at the proximolateral corner of the humerus and running distally along the proximal region of the lateral margin of the humerus (0), or proximal origin medially displaced from the proximolateral corner of the humerus and running distally, leaving an anteriorly facing concave surface between the crest and the lateral margin of the anterior surface of the humerus (which probably corresponds to the insertion area of the M. coracobrachialis brevis dorsalis) (1) (Pol *et al.*, 2012).

424. Orientation and extension of the distal half of the deltopectoral crest: running along the lateral edge of the humerus or slightly deflected medially reaching, at the most, the lateromedial midpoint of the humeral shaft (0), or strongly deflected medially, surpassing the lateromedial midpoint of the anterior surface of the humeral shaft (1) (Pol *et al.*, 2012).

425. Circular depression on the posterior surface of the proximal end of the humerus, related to the insertion of the M. scapulohumeralis caudalis: absent (0), or present (1) (Pol *et al.*, 2012).

426. Lateral and medial surface of distal end of humerus: flat and anteroposteriorly broad, similar in anteroposterior length to the lateromedial width of the distal end of humerus (0), or convex and reduced in comparison with the lateromedial width of the distal humerus (1) (Pol *et al.*, 2012).
427. Ulna, width of olecranon process: narrow and subangular (0), or wide and rounded (1) (Brochu, 1999).
428. Articular surface for the ulna on the radiale: facing posterolaterally (0), or facing posteriorly, not visible in lateral view (1) (Pol *et al.*, 2012).
429. Proximodistal development of articular surface for the ulna on the radiale: short and wide, being up to than 30% of the total length of the radiale (0), or proximodistally elongated, being more than 40% of the total length of the radiale (1) (Pol *et al.*, 2012).
430. Proximal end of radiale, shape: expanded symmetrically, similarly to distal end (0), or more expanded proximolaterally than proximomedially (1) (Buscallioni and Sanz, 1988).
431. Proximal carpals, relative proportions of radiale: slender, much longer than wide (0), broad, proximal width subequal to length (1) (Ortega *et al.*, 2000).
432. Distal region of articular surface for the ulnare on the radiale: merging gradually with the posterolateral surface of the radiale shaft (0), or usually triangular, and separated from the shaft of the radiale by a distinct step (1) (Pol *et al.*, 2012).
433. Proximal region of articular surface for the ulnare in the radiale: divided from the articular surface for the ulna by a crest, creating a distinct articular surface for the ulnare (0), or continuous with the articular surface for the ulna (1) (Pol *et al.*, 2012).
434. Anterior surface of radiale: smoothly convex (0), or bearing a proximodistal crest that extends along the shaft dividing the anterior surface of the radiale (1) (Pol *et al.*, 2012).
435. Distolateral expansion of the ulnare: absent, as (or less) expanded as the distomedial corner of the ulnare (0), or distinctly expanded and projecting more distally than the distomedial corner of the ulnare, forming a distinct process (ulnar anterior projection sensu Nascimento and Zaher, 2010) (1) (Pol *et al.*, 2012).
436. Lateromedial width of shaft of metacarpal I: as broad as the shaft of other metacarpals (0), or broader than other metacarpals, being the digit I the most robust element of the metacarpus (1) (Pol *et al.*, 2012).
437. Anterior process of ilium, length relative to posterior process: similar in length to posterior process (0), or one-quarter or less length of posterior process (1) (Clark, 1994).
438. Development of the rugose surface for the insertion of the M. iliotibialis that forms the supracetabular crest: lateromedially narrow (0), lateromedially broad (1) (Buscallioni and Sanz, 1988).
439. Development of the postacetabular process of the ilium: well developed as a distinct process that extends anteroposteriorly at least 60% of the acetabular length (0), or extremely reduced or absent, extending anteroposteriorly not more than 50% of the acetabular length (1) (Pol *et al.*, 2012).
440. Posterior end of the postacetabular process: tapering posteriorly and ending in an acute tip (0), or subrectangular shaped with the posterior end vertically oriented, with its dorsoventral height being at least 60% of the height at the origin of the postacetabular process (1) (Pol *et al.*, 2012).
441. Orientation of the ventral margin of the postacetabular process: posterodorsally directed (0), or horizontally or slightly posteroventrally deflected (1) (Pol *et al.*, 2012).

442. Dorsoventral position of the ventral margin of the postacetabular process (along its posterior-most third): located at the same height or dorsally than the acetabular roof (0), or located at or ventrally than the dorsoventral midpoint of the acetabular height (1) (Pol *et al.,* 2012).
443. Orientation of the rugose surface for the insertion of the M. iliotibialis that forms the supracetabular crest: dorsal or dorsolateral (0), lateral (1) (Buscallioni and Sanz, 1988).
444. Pubis, shape: rod-like without expanded distal end (0), or with expanded distal end (1) (Clark, 1994).
445. Pubis anterior process: absent (0), present (1) (Clark, 1994).
446. Ischium anterior process: does not excludes pubis from acetabulum margin (0), excludes pubis from acetabulum margin (1) (Clark, 1994).
447. Femur, anterior margin: linear (0), or bears flange for PIFI 1 musculature and a marked concavity above this region (1) (Buckley and Brochu, 1999).
448. Development of greater trochanter on proximal femur: prominent, ridge-like lateral border that separates lateral surface of proximal femur from a flat posterior surface of proximal femur reaching down to the level of the fourth trochanter (0), or proximodistally short trochanteric surface lacking a distinct ridge that separates the lateral and posterior surfaces of the proximal femur and ending well above the fourth trochanter (1) (Pol *et al.,* 2012).
449. Lateral supracondylar ridge on anterior surface of distal femur: prominent and broad lateral suprancondylar ridge separating the anterior concave surface of femur from the lateral surface (0), or absence of well developed lateral suprancondylar ridge, anterior surface of femur flat or slightly concave and continuous with the lateral surface of the distal femur (1). (Pol *et al.*, 2012).
450. Proximal-most portion of fibular head: straightsided to weakly developed posteriorly (0), or very sharply projecting posteriorly, forming distinct extension (1) (Turner, 2006).
451. Tibial shaft in anterior or posterior view: straight or only slightly bowed (0), or markedly bowed laterally (1) (Pol *et al.,* 2012).
452. Distal projection of tibial articular surfaces: medial region of distal articular surface of distal tibia extends further distally than the lateral region, forming a strongly oblique distal margin of the tibia (0), or medial and lateral regions subequally extended, with distal margin subhorizontally oriented (1) (Pol *et al.,* 2012).
453. Anterior margin of the tibial facet on the astragalus: forming a well-defined ridge that reaches medially the ball-shaped region for the articulation of metatarsal I-II and closes the proximomedial corner of the anterior hollow of the astragalus (0), or forming a low ridge that is medially separated by a notch from the ball-shaped region for the articulation of the metatarsals I-II, failing to close the proximomedial corner of the anterior hollow (1) (Pol *et al.,* 2012).
454. Planar and proximal calcaneal surfaces on the astragalus: connected to each other forming a continuous articular surface that articulates with the calcaneal condyle, the margin of which forms the distolateral ridge-like margin of the anterior hollow of the astragalus (0), or separated from each other forming two distinct articular surfaces for the planar and proximal articular surfaces of the calcaneum (1) (Pol *et al.,* 2012).
455. Astragalar-tarsal ligament pit on astragalus (sensu Sertich and Groenke, 2010) at the distal end of the anterior hollow: not differentiated from the rest of the anterior hollow of the astragalus (0), or distinct depression separated from the anterior hollow by an obliquely oriented ridge running along the proximolateral margin of the astragalar-tarsal ligament pit (1) (Pol *et al.*, 2012).

456. Development of proximal astragalar depression, located posteriorly to the tibial facet of the astragalus: shallow concave depression (0), or deep depression with sharply delimited medial and anterior margins, forming a true astragalar fossa (1) (Pol *et al.*, 2012).
457. Shape of the fibular facet on the astragalus: subrectangular with subequal anterior and posterior margins (0), or trapezoidal with the proximodistal height of its anterior margin lower that the posterior margin (1) (Pol *et al.*, 2012).
458. Calcaneum with posterior astragalar facet: subtriangular with proximal and lateral margins forming a right-angle and an oblique medioplantar edge (0), or proximal and plantar edges subparallel to each other connected through a broad and rounded medial margin (1) (Pol *et al.*, 2012).
459. Dorsal osteoderms shape: rounded or ovate (0), rectangular, much broader than long (3X, or more) (1), rectangular, broader than long (less than 3X), (2), or square (3) (Clark, 1994).
460. Dorsal osteoderms articular anterior process: absent (0), present (1) (Clark, 1994).
461. Dorsal osteoderms articular anterior process: with discrete convexity on anterior margin (0), or with well-developed process located anterolaterally (1) (Clark, 1994).
462. Longitudinal keels on dorsal surface of osteoderms: absent (0), present (1) (Clark, 1994).
463. Longitudinal keels on dorsal surface of osteoderms: extending to anterior half (0), or restricted to posterior edge of osteoderm (1) (Pol *et al.*, 2009).
464. Osteoderms: some or all imbricated (0), or sutured to one another (1), or not in contact (2) (Clark, 1994).
465. Gap in cervico-thoracic dorsal armor: absent (0), or present (1) (Ortega *et al.*, 2000).
466. Presacral nuchal armor: nuchal and dorsal trunk shields undifferentiated, morphology grading continuously (0), nuchal shields clearly differentiated from dorsal trunk shields by size and general morphology (regardless of contact between nuchal and trunk series) (1) (Andrade *et al.*, 2011).
467. Rows of dorsal primary osteoderms (sensu Frey, 1988): present (1), absent (1) (Clark, 1994).
468. Rows of dorsal primary osteoderms (sensu Frey, 1988): two parallel rows (0), four rows (1), or more than four rows (2) (Clark, 1994).
469. Dorsal osteoderms, accessory ranges of osteoderms (sensu Frey, 1988): absent (0), or present (1) (Turner and Sertich, 2010).
470. Osteoderms on ventral part of trunk: absent (0), or present (1) (Clark, 1994).
471. Tail osteoderms: dorsal surface only has osteoderms (0), completely surrounding tails (1), or lacks any osteoderms (2) (Clark, 1994).
472. Appendicular osteoderms: absent (0), or present (1) (Pol and Norell, 2004b).
473. Constriction at frontal anterior process: absent (0), present, anterior portion of anterior process of frontal constricted (1) (Montefeltro *et al.*, 2013).
474. Dorsal edge of squamosal sulcus for dorsal ear lid: parallel to ventral edge (0), dorsal margin with a medial curvature (1) (Montefeltro *et al.*, 2013).
475. Size of the dorsal aperture of orbitotemporal channel: small, are of foramen less than 30% of internal supratemporal fenestrae area (0), big, larger than 30% of internal supratemporal fenestrae area (1) (Montefeltro *et al.*, 2013).
476. Ornamentation at squamosal postero lateral corner close to external supratemporal fenestrae: non sculpted or with same pattern of skull roof (0), with a peculiar pebbled surface (1) (Montefeltro *et al.*, 2011).

477. Frontal participation in primary orbit border: restricted to the posterior region (0), or forming great part of median and anterior region (1) (Montefeltro *et al.,* 2013).
478. Parietal posterior region dorsal surface: smooth (0), presenting a dorsal ridge (1) (Montefeltro *et al.*, 2013).
479. Paired foramen located ant anterior region of palatal ventral surface (not homologous to maxillo-palatine fenestrae and palate canals): absent (0), preset (1) (Montefeltro *et al.,* 2013).
480. Median pharyngeal tube main orientation: ventral (0), lateral (1), posterior (2) (Montefeltro *et al.*, 2013).
481. Median pharyngeal tube, posterior wall: present (0), absent (1) (Montefeltro *et al.,* 2013).
482. Dorsoventral height of the proximal region of the quadrate body: less than 50% of the skull roof total width (0), more than 50% of the skull roof total width (1) (Montefeltro *et al.*, 2013).
483. Occipital condyle proximal surface: condyle surface gradually slopes onto occipital surface (0), present clearing marking a neck separating occipital condyle and surrounding occipital surface (1) (Montefeltro *et al.*, 2013).
484. Diastema at 7th and 8th teeth positions: absent, 7th and 8th teeth regularly spaced (0), present, 7th and 8th teeth apart from each other and closer to 6th and 9th (1) (Montefeltro *et al.,* 2013).
485. Bony otic aperture: Formed by external auditory meatus (EAM) (0), formed by EAM, dorsal otic incisure (DOI), and incisure of the otic aperture of the cranioquadrate passage (IOC) (1) (sensu Montefeltro *et al.*, 2016).
486. Otic buttress: Absent (0), present (1) (sensu Montefeltro *et al.*, 2016).
487. Otic buttress: Slender (0), Robust (1) (sensu Montefeltro *et al.,* 2016).
488. Coronoid process on the medial surface of the anterior surangular: Absent or poorly developed (0), well developed, forming prominent elongated crests (1) (adapted from Pol *et al.*, 2014).
489. Longitudinal sulcus between the coronoids process of surangular: Shallow (0), deep (1) (Ruiz *et al.,* 2021).
490. Ventral coronoid process: reduced, less developed than ascending medial process of angular (0), well developed ventral extension similar to ascending medial process of angular (1) (Ruiz *et al.,* 2021).
491. Bar between the paracoanal fenestrae, shape: same width along the entire extension (0), tappers in the posterior third (1) (Ruiz *et al.*, 2021).
492. Flat ventral surface of ventral nares septum: Parallel sided (0), tapering anteriorly (1), tapering posteriorly (2) (sensu Pol *et al.*, 2014: char. 225 – modified from Pol and Apesteguía, 2005: char. 220).
493. Pterygoid flanges, length of the base between the posterior edge of parachoanal fenestra and anterior portion of quadrate process of pterygoid: More than half of the dorsoventral length of the posterior edge of the pterygoid flanges (0), less than half of the dorsoventral length of the posterior edge of the pterygoid flanges (1) (Ruiz *et al.*, 2021).
494. Ectoperygoid-palatine contact posterior to the suborbital fenestra: equally formed by ectopterygoid and palatine (0), formed only by the ectopterygoid (1) (Ruiz *et al.,* 2021).
495. Medial pharyngean tube in relationship with the pterygoids: bounded by pterygoid wall anteriorly (0), enlarged and anteriorly continued by the choana (1) (Ruiz *et al.,* 2021).
496. Basisphenoid posterior edge: straight or curved (0), with an anterior reentrance (1) (Ruiz *et al.*, 2021).
497. Outer enamel surface: Smooth (0), rugose (1) (char.392 – modified from Turner and Sertich, 2010: char. 294 sensu Pol *et al.,* 2014).

498. Size of neurovascular foramina on mind to posterior region of aveolar edge of the dentary: Small (0), extremely large, being approximately as anteroposteirorly long as an alveolus (1) (sensu Pol *et al.*, 2014: char.365).
499. Thin enamel ridge (loph) connecting adjacent denticles instead of presenting distinct interdenticular slits: absent (0), present (1) (sensu Pol *et al.*, 2014: char.389).
500. Suture between the postorbital and the squamosal in lateral view: straight or almost straight, vertical or oblique (0), convex anteriorly (1) (sensu Pol *et al.*, 2014: char.411 – modified from Nascimento and Zaher, 2010: char. 258 and Montefeltro *et al.*, 2011: char.16).
501. Quadrate contact with basioccipital: absent (0), located on the ventral surface of the braincase (1), well developed medial crest of quadrate meets the basioccipital surface of the skull, excluding the exoccipital from the margin of the occipital surface (2) (Pol *et al.*, 2014, modified from Andrade and Bertini, 2008a: char. 70).
502. Jugal anteroventral process between maxilla and ectopterygoid: Absent (0), present, jugal extending anteriorly a short triangular process that wedges between the ectopterygoid and maxilla on the lateroventral surface of the skull at the level of the orbits (sickle-like medial process present on the ventral surface of the anterior jugal ramus, sensu Andrade and Bertini, 2008a) (1) (sensu Pol *et al.*, 2014: char. 351).
503. Frontal shape along its suture with the prefrontal: relatively broad and tapering gradually anteriorly (0), broad tabular-shaped with lateral sutures with prefrontals parallel to each other (1) (sensu Pol *et al.*, 2014: char. 353).
504. Quadrate mesoventral crest ventral to occipital contact: absent (0), incipient (1), well developed (2) (Ruiz *et al.*, 2021).
505. Small pedicel of pterygoid supporting the palatine-ectopterygoid contact posterior to the suborbital fenestra: Absent (0), present (1) (Ruiz *et al.*, 2021).
506. Diastema between D5 and D6: Absent or regularly arranged teeth (0), present, clearly separating the alveoli (1) (Ruiz *et al.*, 2021).
507. Maxillopalatal fenestrae: enclosed mostly by the maxilla (0), enclosed by the palatine (1) (Ruiz *et al.*, 2021).
508. Skull height in posterior view: Taller than wide (0); Wider than tall (1) (modified from Geroto and Bertini, 2018: char. 11; Clark, 1994: char. 3;).
509. Anteroposterior length of premaxilla in relation to the rostrum: short (< 30% total length of the rostrum) (0), long (> 30 % total length of the rostrum) (1) (Geroto and Bertini, 2018: char. 12).
510. Proportional number of neurovascullary foramen in maxilla relative to the number of teeth: low number (1-2 for each tooth) (0), great number (larging surpass the number of teeth) (1) (sensu Geroto and Bertini, 2018: char. 39; Andrade and Bertini, 2008: char. 16).
511. Posterolateral process of nasal inserting between prefrontal and lacrimal: absent (0), present (1) (Geroto and Bertini, 2018: char. 55).
512. Foramen in posterior surface of the base of postorbital bar: absent (0), posteromedially (1), posterolaterally (2), laterally (3) (sensu Geroto and Bertini, 2018: char. 68; Montefeltro *et al.*, 2011: char. 483-484).
513. Relative position of the anteriormost margin of the prefrontals: forward to the anteriormost margin of the frontal (0), in the same level of the anteriormost margin of the frontal (1), backward to the anteriormost margin of the frontal (2) (sensu Geroto and Bertini, 2018: char. 71; Andrade and Bertini, 2008: char. 24).

514. Anterior process of the frontal extends between the prefrontals: do not extend (0), extend (1) (Geroto and Bertini, 2018: char. 82).
515. Postorbital bar: straight (0), inclined medially posteroventrally (1) (sensu Geroto and Bertini, 2018: char. 96; Andrade and Bertini, 2008: char. 50).
516. Structure of the postorbital bar: narrow (0), broad (1) (sensu Geroto and Bertini, 2018: char. 97; Clark, 1994: char. 25).
517. External surface of the occipital portion of the squamosal, inclination: faces posteriorly (0), faces posterodorsally (1) (sensu Geroto and Bertini, 2018: char. 111; Andrade 2005: char. 74).
518. Internarinal bar: present as a wide bar (0), slight narrow (1), absent (2) (sensu Geroto and Bertini, 2018: char. 96; Clark, 1994: char. 66).
519. Skull roof in dorsal view: rectangular shape (0), trapezoidal shape (1) (modified from Pinheiro *et al.*, 2018: char. 170; Ortega *et al.,* 2000: char. 157).
520. Anterior extension of the otic recess: restricted to the squamosal (0), extends on the posterior region of the lateral surface of the postorbital (1), extends along the entire length of the postorbital, which has an anterior transverse lamina that separates the otic recess from the orbit (2) (sensu Pinheiro *et al*., 2018: char. 335; Sereno and Larsson, 2009: char. 69).
521. Splenial-dentary suture at symphysis on occlusal view: V-shaped (<45° betwen hemimandibule main axis of the symphisis) (0), Transversely oriented (>70° betwen hemimandibule main axis of the symphisis) (1), Intermediary-shaped (>45° and <70° betwen hemimandibule main axis of the symphisis) (2) **(new)**.
522. Tooth row immediately posterior to caniniform (D4): D5-D12 in a straight line (0), D5-D9 converging to the main axis of the symphysis and D10-D12 diverging (1), D5-D9 in a straight line and D10-D12 converging to the main axis of the symphysis (2), D5-D12 diverging to the main axis of the symphysis (3), D5-D9 in a straight line and D10-D12 diverging to the main axis of the symphysis (4) **(new)**.
523. Distance between anterior margin of the orbit to posterior margin of the antorbital fossa, and height of the antorbital fossa at the posterior margin: Distance at the anterior margin of the orbit to posterior margin of the antorbital fossa longer (0), Distance at the anterior margin of the orbit to posterior margin of the antorbital fossa shorter (1) **(new)**.
524. Ridged ornamentation on enamel surface of mid to posterior teeth: Continuous ridges from base to tooth apex (0), Some ridges are interrupted and not reach to apex (1) **(new)**.

1.3 List of taxa included in the phylogenetic analysis

Taxa used in the phylogenetic analysis are listed below. Collection numbers of first-hand analyzed specimens are added following the complementary literature source. The added taxa are marked with an *.

1. *Adamantinasuchus navae* – Nobre and Carvalho (2006); UFRJ-DG 107-R.
2. *Agaresuchus fontisensis* –Narváez *et al.* (2016); HUE-02502, HUE-03713.
3. *Alligator mississipiensis* – Iordansky (1973), Brochu (1999); RM 2790, RM 2801.
4. *Allodaposuchus precedens* – Buscalioni *et al.* (2001, 2011), Delfino *et al.* (2008).

5. **Amargasuchus minor* – Chiappe (1988); MACN-N-12.
6. *Amphicotilus lucasii* – Mook (1942), Andrade *et al.* (2011); AMNH 5782.
7. *Anatosuchus minor* – Sereno *et al.* (2003), Sereno and Larsson (2009); MNN GAD 17, MNN GAD 18, MNN GAD 603.
8. **Antaeusuchus taouzensis* – Nicholl *et al.* (2021); NHMUK PV R36829, NHMUK PV R36874.
9. *Araripesuchus buitreaensis* – Pol and Apesteguia (2005), Turner (2006).
10. *Araripesuchus gomesi* – Price (1959); AMNH 24450.
11. *Araripesuchus patagonicus* – Ortega *et al.* (2000), Pol and Apesteguia (2005), Turner (2006); MUCPv 267, MUCPv 268, MUCPv 269.
12. *Araripesuchus tsangatsangana* – Turner (2006), Turner and Sertich (2010).
13. *Araripesuchus wegneri* – Sereno and Larsson (2009); MNN GAD19, MNN GAD 20, MNN GAD 23, MNN GAD 26.
14. *Armadillosuchus arrudai* – Marinho and Carvalho (2009); UFRJ DG 303-R, MPMA 64-0001/04.
15. **Ayllusuchus fernandezi* – Gasparini (1984); MLP 72-IV-4-2.
16. *Barreirosuchus fransciscoi* – Iori and Garcia (2012), MPMA 04-0012/00.
17. **Barrosasuchus neuquenianus* – Coria *et al.* (2019); MCF-PVPH-413.
18. *Batrachomimus pastosbonensis* – Montefeltro *et al.* (2013); LPRP/USP-0617.
19. *Baurusuchus pachecoi* – Price (1945), Riff and Kellner (2001).
20. *Baurusuchus salgadoensis* – Carvalho *et al.* (2005); MPMA 62-0001-02.
21. **Bayomesasuchus hernandezi* – Barrios *et al.* (2016); MCF-PVPH-822.
22. *Bergisuchus dietrichbergi* – Rossman *et al.* (2000), Pol and Powell (2011); Me 7003 HLD.
23. *Bernissartia fagesii* – Buscalioni *et al.* (1984), Norell and Clark (1990); CR-82, IRSNB 46.
24. *Bretesuchus bonapartei* – Gasparini *et al.* (1993); Pol and Powell (2011); PVL 4735.
25. *Caipirasuchus attenboroughi* – this paper; LAPEISA/UNESP-0001
26. *Caipirasuchus mineirus* – Martinelli *et al.* (2018)
27. *Caipirasuchus montealtensis* – Iori *et al.* (2013); MPMA 15-0001/90; MPMA 68-0003/12.
28. *Caipirasuchus paulistanus* – Iori and Carvalho (2011); MPMA 67-00001/00.
29. *Caipirasuchus stenognathus* – Pol *et al.* (2014)
30. **Caririsuchus camposi* – Kellner (1987); CD-R-041, DGM-DNPM 1468-R.
31. *Caryonosuchus pricei* – Kellner *et al.* (2011a)
32. **Colhuehuapisuchus lunai* – Lamanna *et al.* (2019); UNPSJB-PV 961.

33. *Comahuesuchus brachybuccalis* – Martinelli (2003); MACN-PV 31, MUCP-PV 202, MOZ 6131.
34. *Cricosaurus araucanensis* – Gasparini and Dellape (1976), Fernández and Gasparini (2000, 2008), Pol and Gasparini (2009), Young and Andrade (2009), Young *et al.* (2010); MACN-N 95.
35. *Cricosaurus schroederi* – Karl *et al.* (2006), Young and Andrade, 2009, Young *et al.* (2010).
36. *Cricosaurus suevicus* – Young and Andrade, 2009, Young *et al.* (2010).
37. *Cricosaurus vignaudi* – Frey *et al.* (2002), Young and Andrade, 2009, Young *et al.* (2010).
38. *Crocodylus* –Iordansky (1973); Brochu (1999); ROM R 934, ROM R 6837, ROM R 6838.
39. *Cynodontosuchus rothi* – Pol and Gasparini (2007), Montefeltro *et al.* (2011); MLP 64-IV-16-25.
40. *Dakosaurus andiniensis* – Gasparini *et al.* (2006), Pol and Gasparini (2009), Young *et al.* (2012); MOZ 6146P.
41. *Dibothrosuchus elaphros* – Wu and Chatterjee (1993), Clark and Sues (2002), Clark *et al.* (2004).
42. *Doratodon carcharidens* – Company *et al.* (2005); IPUW 234952, IPUW 234953, IPUW 234955a-b, IPUW 234957, IPUW 234958, IPUW 234959, IPUW 234960, IPUW 234961.
43. *Dyrosaurus phosphaticus* – Jouve (2005), Brochu *et al.* (2002).
44. MPMA 68-0001-11 – this papper.
45. *Eutretauranosuchus delfisi* –Smith *et al.* (2010).
46. *Fruitachampsa callisoni* –Clark (2011), LACM 120455a.
47. *Gasparinisuchus peirosauroides* – Gasparini *et al.* (1991), Martinelli *et al.* (2012); MOZ 1750.
48. *Gavialis gangeticus* – Iordansky (1973), Brochu (1999); RM 4791.
49. *Gobiosuchus kielanae* – Osmólska *et al.* (1997), Turner and Sertich (2010), Pol *et al.* (2012).
50. *Goniopholis kiplingi* – Andrade *et al.* (2011); DORCM 12154.
51. *Goniopholis simus* – Owen (1878), Andrade *et al.* (2011); NHMUK R 5261.
52. *Guarinisuchus munizi* – Barbosa *et al.* (2008); DG-CTG-UFPE 5723.
53. *Hamadasuchus rebouli* – Larsson and Sues (2007); ROM 4982, ROM 52059, ROM 52620, ROM 54511.
54. *Hemiprotosuchus leali* – Bonaparte (1971), Pol *et al.* (2012); PVL 3829.
55. *Hsisosuchus* – Li *et al.* (1994), Gao (2001), Peng and Shu (2005).
56. *Hylaeochampsa vectiana* – Clark and Norell (1992); NHMUK 177.

57. *Hyposaurus rogersii* – Denton *et al.* (1997), Pol *et al.* (2012).
58. *Iharkutosuchus makadii* – Ösi *et al.* (2007), Ösi (2008), Ösi and Weishampel (2009), Buscalioni *et al.* (2011).
59. *Isisfordia duncani* – Salisbury *et al.* (2006), Pol *et al.* (2009), Sereno and Larsson (2009), Andrade *et al.* (2011).
60. *Itasuchus jesuinoi* – Price (1955); DGM 434-R.
61. *Kaprosuchus saharicus* – Sereno and Larsson (2009); MNN-IGU 12.
62. *Khoratosuchus jintasakuli* – Lauprasert *et al.* (2009).
63. **Kinesuchus overoi* – Filippi *et al.* (2018); MAU-Pv-CO-583.
64. *Libycosuchus brevirostris* – Turner and Sertich (2010), Andrade *et al.* (2011), BSP 1912.VIII.574.
65. *Litargosuchus leptorhynchus* – Gow and Kitching (1988), Clark and Sues (2002); BP/1/5237P.
66. *Lohuecosuchus megadontos* – Narváez *et al.* (2015); HUE-04498
67. *Lomasuchus palpebrosus* – Gasparini *et al.* (1991); MOZ 4084 PV.
68. *Lorosuchus nodosus* – Pol and Powell (2011), Pol *et al.* (2012).
69. *Mahajangasuchus insignis* – Buckley and Brochu (1999), Turner and Buckley (2008).
70. *Malawisuchus mwakasyungutiensis* –Gomani (1997), Turner and Sertich (2010).
71. *Mariliasuchus amarali* – Zaher *et al.* (2006); UFRJ-D-50-R, UFRJ-D-105-R, UFRJ-D-115-R, URC R67, MZSP-PV 50, MZSP-PV 139.
72. *Metriorhynchus casamiquelai* – Gasparini and Díaz (1977), Pol and Gasparini (2007), Young and Andrade, 2009, Young *et al.* (2010).
73. *Metriorhynchus superciliosum* – Young and Andrade (2009), Young *et al.* (2010); AMNH FR 997.
74. *Montealtosuchus arrudacamposi* – Carvalho *et al.* (2007); MPMA-16-007-04.
75. *Morrinhosuchus luziae* – Iori and Carvalho (2009); MPMA 07-0009/01; MPMA 12-0050/07.
76. *Notosuchus terrestris* – Fiorelli and Calvo (2008); MACN-PV-RN 22, MACN-PV-RN 23, MACN-PV-RN 1037, MACN-PV-RN 1039, MACN-PV-RN 1040, MACN-PV-RN 1041, MACN-PV-RN 1048, MACN-PV-RN 1127, MACN-PV-RN 1038, MACN-PV-RN 1045, MLP 64-IV-16-5, MLP 64-IV-16-7, MLP 64-IV-16-8, MLP 64-IV-16-10, MUCP-PV 35, MUCP-PV 137, MUCP-PV 147, MUCP-PV 149, MUCP-PV 198, MUCP-PV 287.
77. **Ogresuchus furatus* – Sellés *et al.* (2020); MCD-7149.

78. *Orthosuchus strombergi* –Nash (1975), Benton and Clark (1988); Sereno and Larsson (2009), Nesbitt (2011), Pol *et al.* (2012); SAM PK K 4639, BP/1/4770.
79. *Pakasuchus kapilimai* – O'Connor *et al.* (2010), RRBP 08631.
80. *Pelagosuchus typus* –Pierce and Benton (2006), Sereno and Larsson (2009), Turner and Sertich (2010), Pol *et al.* (2012), NHMUK R 32599; NHMUK R 32600.
81. *Pepesuchus deiseae* – Campos *et al.* (2011); MN 7005 V; MCT 1723-R; MCT 1788-R.
82. *Pholidosaurus pueberckensis* – Owen (1878), Salisbury (2002); NHMUK R 3956, NHMUK R 28432.
83. *Pietraroiasuchus ormezzanoi* – Buscalioni *et al.* (2011).
84. *Pissarrachampsa sera* – Montefeltro *et al.* (2011); LPRP/USP 0017, LPRP/USP 0018, LPRP/USP 0019.
85. *Protosuchus haughtoni* – Gow (2000), Nesbitt (2011); BP/1/4746, BP/1/4946, BP/1/590, BP/1/4770, SAM PK K 8026.
86. *Protosuchus richardsoni* – Brown (1933), Nesbitt (2011); AMNH FR 3016.
87. *Racheosaurus gracilis* – Young and Andrade (2009), Young *et al.* (2010, 2012).
88. **Roxochampsa paulistanus* – Roxo (1936), Pinheiro *et al.* (2018); DGM 258-R, DGM 259-R, UFRJ-DG 451-R, UFRJ-DG 501-R.
89. *Rugosuchus nonganensis* – Wu *et al.* (2001a), Pol *et al.* (2009).
90. **Rukwasuchus yajabalijekunduis* - Sertich and O'Connor (2014); RRBP 08630.
91. *Sarcosuchus imperator* – Sereno *et al.* (2001), Pol *et al.* (2012); MNN 603, MNN 604, MNN 606.
92. *Sebecus icaeorhynus* – Colbert (1946), Molnar (2010), Pol and Powell (2011), Pol *et al.* (2012); AMNH 3159, AMNH 3160.
93. *Sebecus querejazus* – Buffetaut and Marshall (1991), Pol and Powell (2011), Pol *et al.* (2012); MHCN-P 3701, MHCN-P 13491.
94. *Shamosuchus djadochtaensis* – Pol *et al.* (2009); AMNH 3159, IGM 100/1195.
95. *Shantungosuchus* – Wu *et al.* (1994), Lu and Wu (1996).
96. *Sichuanosuchus* – Wu *et al.* (1997), Peng (1996).
97. *Simosuchus clarki* – Georgi and Krause (2010), Hill (2010), Kley *et al.* (2010), Sertich and Groenke (2010), Turner and Sertich (2010).
98. *Sphagesaurus huenei* – Pol (2003).
99. *Sphenosuchus acutus* –Walker (1990), Clark and Sues (2002), Clark *et al.* (2004); SAM PK K 3014.

100. *Steneosaurus bollensis* –Sereno and Larsson (2009), Turner and Sertich (2010), Andrade *et al.* (2011), Pol *et al.* (2012), NHMUK R 47171, SMNS 15391, SMNS 15951, SMNS 18878.
101. *Stolokrosuchus lapparenti* – Larsson and Gado (2000); MNN GDF 600.
102. *Stratiotosuchus maxhechti* – Campos *et al.* (2001), Montefeltro *et al.* (2011), Riff and Kellner (2011); DGM 1477-R.
103. *Sunosuchus* – Buffetaut and Ingavati (1980), Andrade *et al.* (2011).
104. *Susisuchus anatoceps* – Salisbury *et al.* (2003), Salisbury *et al.* (2006), GP/2E 9267.
105. *Terminonaris robusta* –Wu *et al.* (2001b), Sereno *et al.* (2001).
106. *Theriosuchus* – Owen (1878), Salisbury (2002); NHMUK R 48330.
107. *Uberabasuchus terrificus* – Carvalho *et al.* (2004); CPPLIP-630.
108. *Uruguaysuchus aznarezi* – Rusconi 1933, Soto *et al.* (2011); FC-DPV 2320.
109. *Yacarerani boliviensis* – Novas *et al.* (2009).
110. *Zosuchus davidisoni* – Pol and Norell (2004a).

1.4 Institutional Abbreviations

AMNH, American Museum of Natural History, New York, USA; **BPI**, Bernard Price Institute; Johannesburg, South Africa; **BSP**, Bayerische Staatssammlung für Pal¨aontologie und Geologie,Münich,Germany; **CPPLIP**, Centro de Pesquisas Paleontológicas L. I. Price, Universidade Federal do Triângulo Mineiro (UFTM), Uberaba, Brazil; **CR**, "Cerra Roya" clay pit, Museo Municipal Paleontológico de Galve, Teruel, Spain; **DG-CTG-UFPE**, Centro de Tecnologia e Geociências da UFPE, Recife, Brazil; **DGM**, Diretoria de Geologia e Recursos Minerais, Rio de Janeiro, Brazil; **DORCM**, Dorset County Museum, Dorchester, UK; **FC-DPV**, Colección de Vertebrados Fósiles, Facultad de Ciencias, Montevideo, Uruguay; **GP**, Laboratório de Paleontologia Sistemática, Instituto de Geociências, Universidade de São Paulo, São Paulo, Brazil; **HLMD**, Hessisches Landesmuseum, Darmstadt, Germany; **HUE**, Lo Hueco collection, housed at the Museo de las Ciencias de Castilla-La Mancha, Cuenca, Spain; **IGM**, Mongolian Institute of Geology, Ulaan Bataar, Mongolia; **IPUW**, Institut fur Paläontologie, Universität Wienis, Vienna, Austria; **IRSNB**, Institut Royal des Sciences naturelles de Belgique, Brussels, Belgium; **LACM,** Los Angeles County Museum of Natural History, Los Angeles, USA; **LAPEISA/UNESP:** Laboratório de Paleontologia de Ilha Solteira-UNESP, Brazil **LPRP/USP**, Laboratório de Paleontologia de Ribeirão Preto-USP, Ribeirão Preto, Brazil; **MACN**, Museo Argentino de Ciências Naturales, Buenos Aires, Argentina; **MHCN**, Museo de Historia Natural Alcides d'Orbigny, Cochabamba, Bolivia; **MLP**, Museo de La Plata, La Plata, Argentina; **MN**, Museu Nacional, Rio de Janeiro, Brazil; **MNK-PAL**, Museo 'Noel Kempff Mercado,' Santa Cruz de la Sierra, Bolivia; **MNN**, Musée National du Niger, Niamey, Niger; **MOZ**, Museo Professor J. Olsacher, Zapala, Argentina; **MNHN-F**, Muséum National d'Histoire Naturelle, Paléontologie, Paris, France; **MPMA**, Museu de Paleontologia de Monte Alto "Prof. Antonio Celso de Arruda Campos", Monte Alto, Brazil; **MUCP**, Museo de Geología y Paleontología, Universidad Nacional del Comahue, Neuquén, Argentina; **MZSP PV**, Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil; **NHMUK**, Natural History Museum, London, UK; **PVL**, Instituto Miguel Lillo, Tucumán, Argentina; **RCL**, Museu de Ciências Naturais, Pontificia Universidade Catolica de Minas Gerais, Brazil; **RM**, Redpath Museum, McGill University, Montréal, Canada; **ROM**, Royal Ontario Museum, Toronto, Canada; RRBP, Rukwa Rift Basin Project, Tanzanian Antiquities Unit, Dar es Salaam, Tanzania; **SAM**, Iziko, South African Museum, Cape Town, South Africa; SMNS, Staatliches Museum für Naturkunde Stuttgart, Stuttgart, Germany; **UFRJ**, Coleção de Paleontologia de Vertebrados da Universidade Federal do Rio de Janeiro no Rio de Janeiro, Rio de Janeiro, Brazil. **URC:** Museu de Paleontologia e Estratigrafia "Prof. Dr. Paulo Milton Barbosa Landim", Universidade Estadual Paulista, Rio Claro, Brazil**.**

1.5 Data Matrix

Polimorphisms are under brackets and inapplicable characters are represented by "N".

Litargosuchus leptorhynchus

0N000010000000010???????N??10N???000001??00??2??0000000001001000NN000000N0010N000???000000
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0?0000???0???????0??000000N?0??0?0???0??00??000?0??00?????????????????????0???????????????????
??????0N0000?NN??00N?????????????????????1000000001000031N

Sphenosuchus acutus

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000N?00NNN10???0000?0?0?NNNNN?0NN????NNNNNNN0000000N0N0N?000N000??100??N1?10?0000?000000??????
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000000?100?001001?0000??00N00?????????0?00??00?1100000??????????????????0N????0???????????????
??????0N000NNNN00000N???N?NNNN????????N??001000000100103 1N

Dibothrosuchus elaphros

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Fruitachampsa callisoni

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Gobiosuchus kielanae

101000110010101NN0010NNNN1010N211000000000001020100000100010 0?020??000000N[01]?0[01]?0?0100
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10010?110N??010?01110?10[01]??000?0??0000000?0NNNNNNNNN?NN???11000N0N0N0100N100??1?001N00?0N10
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Hemiprotosuchus leali

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Hsisosuchus

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Orthosuchus strombergi

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Protosuchus haughtoni

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Protosuchus richardsoni

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Shantungosuchus

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Sichuanosuchus

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Zosuchus davidisoni

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????????????????????????0001000?010??????N?NN000???10??N??11?????011?01130N

Amphicotylus lucasii

111101031101NN0101101002110111101000 00N?0111001110000 1100?0010?000000100N1010N010101100010
0101100000210100001100?10N0110N000000NN10?10010N000??100N01000N0?011101001N010201?0101?000??0N
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000???10101001?00??40000N0100100001021
0000?002??
??????00?0000??01?11????N?N???????????0??N1100000010201??N0

Eutretauranosuchus delfsi

11100103?1002N01011010021101 1?101000?0N???1??0?1100001100?001010000?0?00N1010N0101??100010 0101100000200???001100110N0110N000?00NN1??????0N0?0?0100N?100??01??11010?0??1020??0?011000110N 010010??N01?????100????000000?10?100000100N?1011000N000N??00N?0100??00?0????011?00??0011?????? 00??1?100010?1?00??1?111111000????00?1[012]?0?0?0N11?00301?1000000?00000N???03000000N010?1000? 00210000?0?20????????0?????????0????????????00???1????????0??????????????????????????????????2??? ???????????00010000010??????N?N?00?0???0?0??N????????????0?????

Goniopholis kiplingi

111001031001NN0101101002110 1???0100000N?01110011100001100?0010100000000100N1000N010???1010?0 010110000021010??01100110N0110N00000???10110010N00011100N01000N?0?111?1000?0102011???1100?11?? 0?0?????N?10??0[01]????100???0???110100?????0N01?110?0N010N??00N00?00??00000?100?1?000??0?1??? ?0000???01????0???00??????????????????????????????????????0?????????????????????40?00N010010000? 0210?0000?2??? ?????????000000?0?01???????N?NN??????????N??11?001001010103N0

Goniopholis simus

111001031101NN0001101002110?1?10100000N?011100111000?110??001?10??00010??1000N01?101101010 01011?000021010?001100110N0110N000000NN10110010N00001100N0100??0?011101000?110201?01?1?000110N 01??10?????0?1?[01]10?0?0?00?000?1101000??100?011?100???00N?000N0?10???00?000???11??0??00?10?? ???00???010001??1100??1???110110000?00?113???????010003?10100100000?000N10003040000N0100100?0 021000?0?0201??0?01?00?????????00?????0?????00??1?????????????1???????1??????????0?????????????2110N 00?00?1?00??0000??01????????????????????00???N1100?1001020103N0

Sunosuchus

11?00??31101NN??01101002?101????100000N??0?100?1?00?0???0?0??0??00???0?1010[01]0N010????00 010?101100??020?????011???10N011?N000??????0?????????0???0???1?00N01????01???????20111?0?0?0?? ?0N?10?1?10N?1?00??1?0??0??00?0??11??0??00100N??11?000N000N??0???01???????0????011?00??00?1?10 000??1?1?100?1?01??0?1??1111130???????????0????0N?1????0?0???10?0?1?0???1??0304??????100????00 ?1100?0?0??0?0??1????0??????110??????????0?0??????????????1????1?????1?0????110???0?????????2110N 0?000?1???0?01??0?0????????N?N?00????????????1000?00010?0104N0

Allodaposuchus precedens

111000031?0???01011010001100 1?10N00000?????0N111000000100????010000?0000N1010N000101?00012 0101100000211????0110001[01]001110100000NN???1N010N1?[01]???00?????0N0?011101?0?N?10101101?1?? 0?0N??0?00?010NN1001001???N0?000001?110?00000000N01111200N02????00N??1NN?10??0001??1?10?0?00?1 ????01000?10100010?1??0??10???41000N?1??100 00?0?100000????1?? ????????????0??01?0??01?11????N?N???????????0??N01?0100010?00???0

Hylaeochampsa vectiana

0N?00?0???11NN010???10001100?110N0???????????????00000??00?1N00110000?00101000N100101010011 0101100010200????0??0000NNNNN10100????????????????1001?0N01??????0?11???0?N?0N1?1?????????0??0N 0??0?010N??????????????00000??110000?00000N01?11200N020N??00N011??010?100000?11?????0001????01 ????10100011011?0??10???0??00N??0?????????1 0?0??? ??????0?001000001?110???N?NN00????00?0N??1??0100010??0??N?

Iharkutosuchus makadii

111000131111NN1NN111100010011?10N00000NN?0?0N11100000110 0N1N?01100000000N1000N0?0???0000?N01NNNNNNN0101????011?0N0NNNNN10100000NN10?0N010N101N?0???????0N0???11???0?N?10??110?????000N0N0?0??????N0?01001?03N0?000001?110?00000100N01111200N020N??00N011NN010?100000??1?0???0011010?11000??01001?0?1?????1???10NNN00?0?00NN?000??00N0??1?[01]0???00?00????0?0N??????000?1100001000000?1100001[01]00???00?01?000110??????N?NN0?????????0N?N11?010001021024NN

Pietraroiasuchus ormezzanoi

1110001311????01011110021000 1?10N00000NN?000N11100000?100?1N?01100000000N10?0N000???0000?2?10110000?210????0??00?1??01110?0??00NN???0N?10N1?10?000??000????0111?100?N010101????1????????0?00?????N1????01???N???0?????11??0??00?00N01?111???020N??00N011NN????????????????????0?1????01??????????????????????1010NNN00??00NN???0??00N00?0????????????????????????0???????0N?????000????1000??????1????????1????????10?????0??1??30N1001102?1??0??01????010???????????0????????0???11?0?00010210240?

Agaresuchus fontiensis

111001031101NN010111100111001110100000NN000101110000001 00N0010110000000 0N1000N00010?10001101011000102001 0?001100010N11?10100000NN10010010N10000111101010N01111101000N010101100000000 11100?00?010N11001101?03110000001?111100000000N01111200N020N0?00N00100???010000001110?010001???000010??0100010???????101?10NNN00?0100NN03000000N001003011000000 00?00N0N10003041000N?0002000000110000???20???0000100??011110???N?NN00????????0N?N0110?10010201?4NN

Lohuecosuchus megadontos

111000031101NN010111100011001110100000NN0000N111000000100N00??110000000??10?0N?101010010?101011?001020010?001100010N01?0?100000NN10010010N1000?111111000N11001111000N010101100000001?100?00?010N11001101?00010000001?113101000100N01111200N020N0?00N001N?10?0100000011?0?0?0001??????000??0100010???????1?1010NNN00?0100NN0?200000N001002011000?0000?00N0N10003041000N0000[12]000000111000???20??000101??010110???N?NN00????????1N?N10?0?1001020114NN

Isisfordia duncani

111000031101NN010110100211001?11100000N?0000N111000001100?00000000000000N1000N000???0000?10101100010200????01100?10N00110100000NN10000010N0000?110N01010N01021101000N010201?01010000110N010?10????1?010010010?0000001?110100000100N01111100N020N??00N00100?1001000000111000?00?1000?00000??010001001?00??10???10?00?????00?0?0??0??????????????00??????????????????00000N010010000000?000000?0?1?00?11111?????11?00??????0??1???0??????????????0??????????1??????????0??0????????30N1101?02111000001000001???????N?NN00????????0N?N1010100010201?0N0

Susisuchus anatoceps

111000031101NN010???10021???1????00000NN0000N111000001100N1N101000000000N1000N000???0100?00101100010200????01100?10N0?110?00000NN10000010N00101100N01000N0?011101000N0???01?01?00?????0N010????????100??01???00??00?0??11?????0???00N01??1100N020N??00N0?10?????0?0????0??1?0?0?00?1?0??????????0100010???????????0110??00???0??1???0??00N01??0?0100??0?????0?0????1??0??40000N??0?[01]000000010?00???0?1??????1?1????????0??????00?0?00??????????????????1????????????????0????????????30N1101102111000?01000??????????N?NN??????????N?N1010100010201?0N?

Bernissartia fagesi

111001031101NN010110100?110?1?11100000???0010[12]1100000?1001001011000000000N1010N000101?10
01001011000?0210???001100010N001??000000NN1001?01??0????100N?1?00N01??11010001?10201?01010?00?
?0N01001?10N?1?01101?0?????0?001?11?0000?0000?011??100N020N???0N?01?001?000?00?011?????00?1???
??0000??0100?1?01??0??1?1010NNN0000?00NN?30000?0N0100?30100?000100011N0010003040000N0100100000
0210000100200?101??000?0????1100??0?0000100000?????????0?0?????????100000?1110??00???????21011
00001111?000010?0?010??????N?N?0???????????N1010101010201??N1

Batrachomimus pastosbonensis

11100103?001NN010100100211O?1?10?00000???0010[12]1100000?000N1N?01001000000N???????????0??
01??????????????1??0??????????????????0????1011?010N1010110100101 0N0?021?01001N0102?1?0?0100?00
N??0?00?010N?1????01???????0?10??111000000100N01??1100N000N??00N00?00????1???????????????????
????00???????????????????10110??00?????N??00???00N11?????0000?00000?10N0N?00?3040000N0100100?0
0100??00000??[23]1
10N0?0?0????0?????0??0???10???N?N?????????????N1110?1101000100N1

Theriosuchus

111001111000200101101001110?1?1010000001000102110000011001011 0[12]100000000N1010N000100010
013010110100020010000110001 0N110??000000NN10010010N00??0000N00?00N000?11010001?10201101010000?
?0N?10??010N?10?1?01?0????000000?110100000000N01111000N000N0000N001000000100 0?0010??00100010??
????0??10????1??1????1?0101[01]?0?0?10?00?10200??[01]??11???30100?000?0[01]0???1110?03?42000N0
0001000?001100001002010?0????01??????1?10????????[12]0?00??10????????0??1??????1??????1110??0?
???????211110?000?01?000011000??0??????N?NN00?0??0???N?N1????1101?00?031N

Rugosuchus nonganensis

111001031?01NN0101101?00?10?1??0N00?????????0N11100000000 0N???0????0???00N10?12?00????100?0
?10110?0002?0????0??00110N1110N000000NN???1?010N0?001100N01?0?????11101000N?102????1?1?0??????
?10?1?????10???01??????00000??11000000011 0N011111???00???000N00?????????????0??1?????0011000???
000??01000?0010?????01110NNN000??00NN00?0??00N01??03010??00??00001N111000300000 0N0000100000021
0?0010?0?0?????????????????????????00???[23]1010
0?????????0001100001??????????N?0????????N?N1010?110001010?NN

Shamosuchus djadochtaensis

11100113??01NN01011010?011001110N000??????00N?11000001100N1N000101000000N1001200010?010010
0101100000210???001100110N0110N0000????10010010N00001101N0101??01011101000N01020101111000 01?1N
01001110N110??????0?????0??0??11??0??00110N01111100N000N0000N001??1?001000?001110?010011000?00
0???1010001001000?1101010NNN000?000NN??0???00N01??0[03]0?000000000000N1110003000000N000?[123]0
????0110?00?001?[01]0?0000111?0????111???????????0??1?1??????????????????????????????????0??????
??[12]10100?????1?1000011?0001?110100N?NN00?0??000?N??1010?11000?010?NN

Alligator mississipiensis

111001031001NN010110100211001111100010010000N11100000 1000N0010200000010 0N1010N010111010013
01011000102001000011001 10N0000N000000NN10010010N0000110?N01000N010[12]1101000N0102011010100000
N0N01001010N0100?101001N10000001011010000011 0N01111200N020N0000N001000100100010011100010011 0NN
00000011010001001100111010111100000100 01?30000?0N0000030100000000011000010002000000N0000100000
0210000100201100001011000011111001000000100101011 00000???1??01?????10????01110??0????????30N11
11102101000001000001011010 0N?NN00?0?0000?N?N101010111010103NN

Crocodylus

111001031101NN010110100011001111100010N000010[12]11000001100N00100000000100N1010N000111000
0130101100010200100001100110N00010000000NN10010010N00000100N01000N01011101000N0102011010100001
10N01001010N11001101002N00000000011?100000000N01111200N020N0000N0010?01001000100111000100010NN
0000001101000100110011101011110000010001030000?0N0000030?0000[01]0000100000100021000000N0000100
0000210000?00201000101011000?111110??00000010010101100000001100010100110000000111000000100010130
N11111021010000010000010110100N?NN00?0?0000?N?N101010101020003NN

Gavialis gangeticus

111010021101NN010110100011001111100010N?0000N011000001100N00100000000010N1110N000111110012
0101100010200100001100110N00010000000NN10010?10N000?1110N01?00N01011111000N010201101010000110N
0100100NN11001001002N00000000011[12]100000000N01111200N020N0000N001??01001000100111000101?10NN
000000100100?100110011101011110000?1000100000000N2100030?000[01]1000011100010002100000N0100100
0000010000000001010101111000?1?11100100000?100000?110?0????11??01?????100???01110??0????????31
011100011010000010000010110100N?NN00?0?1000?N?N101012101020000N0

Khoratosuchus jintasakuli

11000?????01NN01011?10001101???1?0???????????????00000??00N000000??000000N1010N00010?0?00?0
0101100010?00????0??00110N0110N10??????1??0??1??0?100100N0?0?0N?01?11??1??N???101?????????????
0????????????????1???N??00000??111100000000N01?11100N?[12]0N???????0?????????????????????0011000
?????????100??0?????????0???00?00N0000?0????
??10?0?00??
?????????0??01001001???????N?N?00??????????N00?0?01000?00??NN

Dyrosaurus phosphaticus

110000021101N?0111101?0211011011101010N?0000N0?100010?000??01000000000?0N1010N000100100110
?111000000?001???01100?10N0110N000000NN1000??111000?0?10N?1?00N01200N?1000N?10101?0?00?0?00N??
010?10??N?1?0?001?0??00?000?1?111100000000N01??1100N000N??0???0000?101100010011?00?00111?01???
000?10111013?1100?010???10??001??001??0?0?0???21000?0?00??000?1?1?00N?????100000N0100?0000?001
0100000?0??1??????0?????????0??0?????????????1???????
??????00001001001???????N?NN00????????N?N000001100020000N0

Guarinisuchus munizi

111000021?01N?011110100211011011101010N?0000N1?1000001000?00100000000000N1010N000???100110
01110000012001???01100010N0100N000000NN100000111?0000110N00000N00201101000N00N1010010000000N0N
010?10??N?1001001102?00000011?111?00000000N01111100N000N1000N00000?0010000100111000001110010??
000??01110130??00??1?11?????00?0?0???????0?000N2110000001???0????????????????40000N0100[12]000?0
0010100000?01???????10?????????0??????????0?0??1??0N
0?????????00001001?01??10???N?NN00????????N?N000001100020004N0

Hyposaurus rogersii

111100021101NN0111111????1??1?1??0100?N??0?0N??00?????00????0??0000?000N10?0N000????101??
00????000?200????01100010N0?10N?00000NN??00??1110?0???10N?1000N??101111?01N?0?101001????????0N
0?0?????????0???01??????0??????1?11??0??0???0N???1?????????????0N00????10???0?1??1?????????1???????
000??0?11????1100???0???1???0??0?00???0?0??0??21?00?????????0??????0???????021000?0N???0?0?0?????1
010??????[01]??????????????????1100??
?????????000010???010??04N0

Pholidosaurus purbeckensis

111010?21101NN000111100[12]11??1011101??1N????0N?11000001100???100000000000N1?10N0?0???110
1100101000000210????01100?10N00?0N0000????10?0001???00?000???1?0??????1111?0?N?10101??1??100?1
1??01?210?N???0?1??1????????0????111?00000??0N01?111?????0N?000N???0??100?0?0??011?????0??1???
???00???0100?1??1100?01????????0????0????0???????2100????00??0?????????????00?040000N?10010????
?01000?0?0??????????0?????????0???????????????????????????????????1???????110????????????1110N
00?00????0?0010?[01]?01????????????0???????????N11101110102000 4N0

Sarcosuchus imperator

111000031101NN010111100211 0?1011101011N?00?0N011000001100?00[01]00000000010N1010N000100110
1?00101100010200????01100010N0010N000100NN?0000010N[01]0000110N01000N01101101000N0101011010100
00100N0?011010N?100?011102?00000000?111100000100N0?1?1100N010N0?00N001?0?100100010011?0??100??
?00???000??010001?01?00?01???110100010?00111[012]00000??21000?0101001000001000N?00?2040000N010
0101001100000000211????????0?000????000?1000???000????????????????????????1?0????111??????????
??111[01]?0?000?1??0000100000101101??N?NN0??0?0?00?N?N1100?1101020004N0

Terminonaris robusta

111000021101NN0101?1100[12]1101?????01001N?0000N01100000?100?001000000000?0N1010N000???110
110[01]101100010200????0110??10N0100N000100NN10?000111100001?0N?1?00N00??11???00????101?0?0110
??110N0?0?????N?100??111???0?00000??111000000000N0?1?1[01]00N0111??00N00000?10010?0?0?11?0???0
0?1000???00??10??0????1?00?0??11110??00????11?10?0??00N21??0?010?0010?10?00????0002040000N0100
10100110[01]0?00?00?01010001?00???????0N00?????0????000??11????????????0??????1??????1110??0????
????111110??00?1??00000000001???????N?NN00???0????N?N100000100020004N0

Cricosaurus araucanensis

0N00000210102101110110 00?10?000200001000 0000N01100000N11?0001010NN1?1000N1010N00000?000020
101NN001000000NNN10N1100NNNNN0N0110?0NN00000010N?0100100N0001????020N111000???00000100?0000N??
0??N000NN??00??010?0N0??0?00??1120000??00??0??110???00N??0????0???????0?????10??0??010??NN???
00???110001?01[01]11??11??00NNN0010000NN?0?0110??21000?000011100?00?0N0N?0?02000000N0000300000
001?00?0?0000???????000???0?0N00?????01??1?????????????????????????10???????????????????????????
???1N????1??00N0??0??00N????????????????0???N0?11011010100040N

Cricosaurus schroederi

0N0000?2???1021010101???????1????00????????????0??00000N1100001010NN101000N1010N000???000020
?01NN0?10?0?00NNN10N11?0NNNNN0N011?????0000??10N?0?00100N0001??0?120N111000???000?0?0???0?0N??
0?0??00NN?10??1????????
000??110?01?0???1??11??0?????01???0???0????????????????0??11??????0???00??2000000N000????????0?
0???000?????????????0??
???????????N???040N

Cricosaurus suevicus

0N000?0210102101010 1?????1???????00???00??00N011000??N11?0001??0NN1?100??1010N00????10002?
?01NN00101?0?0NNN10N???0NNNNN?N?110????00?00?1????0??1?0N00?1????0???11?0?0???0?00?????????0N0N
000??????????????????N????????????????????????????????????0N????????????????????????????????1????????
????????0??1?????????????0NNN0??????0NN?????1???21????0?0???10???0?0N??????2000000N?0003000?0?01
00000??00?0????1??00???0???0????????1??1?0????1?0?1000????????????0?1??????????????????????????????
1N??N??????N???0?????????????????????????0011?????????040N

Cricosaurus vignaudi

0N0000021?1021010?01??????????????00??????000N011000?0N110???1120NN101000N1010N000????0002?
?01NN00100?000NNN10N?1?0NNNNN0N?110?0NN???00?1????1??100N0?01?????????1?0?????0000????????0N0N
000???????10????????N??1????????
???????0???1???????1????0NNN0????0?NN?0????????1??????0???1??????0N???????0?000????0?30???0?0?
??0?????0?0???????0???
?????????00N?????????????????????????????0011001010?00040?

Dakosaurus andiniensis

0N000001??102101110110001??1000?0100?0N??000N01100000N1100001020NN101000N1010N000???100020
101NN001000000NNN00N1100NNNNN??0000????00100?1???0000100N0001???0120N01100010N00000100100?0N??
0?0N000NN010???01?0?N???00?0??11??1??00?00N????10?????0N?00???00???????0???????????1?00??NN???
00???11000?201??????1??00NNN001??00NN0020?0???1????11???1110??0000N0N?0?0??12000N10003000?0000
?000000?0???0?01??
??????0??00N???01?00N????????????????0????0??0020010200??0N

Metriorhynchus casamiquelai

0N00?002?1102101110110011110?000?00?01?N??000N01100000N1100001000NN1?1000N1010N0?0???000?2?
10?NN0?001000????00N11?0NNNNN???000?????0?0??10N?00??100N00?0??0???0N?1?0?0???000?0?0??00?????
0?0?000N??1????0????N???0?????11??????00?0N????10????10N??0???100??????0???????????????0??NN???
?0?????0?0?201?1???11???0NNN001???0NN?0???0???2???0?0?0???10???0?0N???0???000000N1????0???000?
0?00?0?00???
??????0??00N??10??????????????????????????10110100102000 4?0

Metriorhynchus superciliosum

0N0?000211102101?10?1?011??10002000010N?0000N01100?00N11000010?0NN101?00N10?0N?00???000020
101NN000010000NNN00N1100NNNNN0N000000NN00?00010N?0?0?1?0N000????0??0N111000???000001?0?0000N??
000N000NN0?001?01000N0?100?0??112??00??????01?110????0????0110??0???00???0???10?000?00010NN0??
000??11000100 1111??11??00N??0010?00NN?00?100??2100000000001100?0000N0N00002?10000N000030000000?
?000000000??0????00??????0N00?????01??1?????11????????????01?????0?1????1100???????????????????
1N?0N????01N???00000N100?????????????0???N1??0??0?1020?04?N

Pelagosaurus typus

1110000211002001110110011111000 20000[01]0N?000??01100000N1101001[01]00NN000000N[01]110N000
0?N00002010[01]NN000000000NNN00N0000NNNNN0N0000????00000?1[01]?00000100N00?00N00010N10100100N0
000010000000N??000N000N??1001?01?0?N?0100001?112000000000N01?11000N000N[01]00110000?100010?00?
010?000101010NN100000001100010 01011?011??0110200 10000??000??00??210?000?0?01100?000000N00?0200
0000N0000200000001000000000?00?????00??????0N0??????01?00?00??11????????????0??????001?0001??0?
??????????2111?00000?10?0??0100?100?00N???N?N?00?0?0000???N1??0010010200040N

Rhacheosaurus gracilis

1000000210102101 0?0????????10??2?00010000000N01100000N110???10?0NN1???00N1010N00?????0????
?0???0?0??0000NNN10N01?0NNNNN0N01?0?0NN???0??10N?01???????0????????0????0?????????0??????00N??
??0N??????1????0????????0?????11?????00??0N????1?????00N??00?0??0????????????????0????0?1??????
???????000?1??????????0N00NNN001??0?NN?0?0?100N21???00000???00????0N0N?0?02000000N0???3000?????
0?000?00?0???????0000000?0N000?00001??1?00??????????????????????1??1???????????????????????????
??????1????N??1?0??????????????????????????10?0???010200040?

Steneosaurus bollensis

1[01]000002110020011101100111 11???20000[01]0N?000??01100000N1101001100NN000000N[01]0?0N00000N000020100NN000000000NNN00N0?00NNNNN0N0000?0NN00000010N?0000100N00?0??001?0N111000???0000010010000N??000N000NN??001101000N?0[01]00000011?000000000N01?11000N000N0[01]0110010??10000?00?010?001101010NN00000000111001001111??10??01101001000001000?1000N21000000000100?0?0000N?0002000000N000020000000100000000 0[01]010?01?00?000??0N000000001 0?0?000?11????????0??00????100100001100??0?????????211[01][01]00000?1000??0100??00000N1??N?N????0??0?0???N????????????0????N

Anatosuchus minor

111001030010210100101002100110110000001000 00N2110000010001 1N101000000000N101110001010000110101001010100 1??001100011011110000000111000 01010N10001100N0101??0?021101000101021101111001 00N0N11011010N010?1?01?0?N??00000?1110000000000N01111000N01100000N0000?1?111000?0010000010011 0000??1????010011301110??101011110001??00101000?000N01??00021000010011000101000100000 0N00000020000100?0000?00?01?????????????????0????????????01???1??0????????01????????????????????????????00N1100100??1?0000100000 1?11?1??N?NN0000?00?00N?N10?0?000112021?0N

Araripesuchus buitreraensis

?[01]?00111??1??0010?1?1202110?101??0???????00???11?0?00?100???10??????00?0N101??00?????000?0?100N?00101001?00????????????????0?0???????1??10N0????10??01????0?020N01?00????211?110???000N???????010N???????1??0N?0?0?0???11?010000000N011?1000N000N?000N10111??00?000?01????????????????????????1?????????????????10?????0??0[01]?0?01[01]?0??10N11?10[01]00200100?0??????????????11000N?000?[0123]?0???1?0??0??010???0???1?0???????????N2NN00?0??????N?N1000200000002241N

Araripesuchus gomesi

1110010100101001011012021100101110010010000122110000001001000010000000 00N1000N0001010000120100N0[01]010?00111001100011000010000000100110110 10N00001100N0101??00021101000101021111100000 00N0N11011010N01111?01??0N1000000??1100100000 00N01111000N000N0000N001111?000000?0110000?10011000???10??1010011301?10?10010111030010[01]00101100?000N11?110000?001000111000N11101011000N00002030?001100101001[01]0??0??0?10?101??11001??1?101001011?110??000100??1?????111011101111001???01?1?20N11000000000000001000001 0110100N1NN??00?0001?N?N10?00000000020?1N

Araripesuchus patagonicus

11100[01]?10?10100101101202100110111 0??0??00????2110000001001000010000000 00N1000N000???0000120100N010101001110 0??00011000010000 0??????00101[01]?000?1100N0[01]01??00021001000100N211?110000000N0N1?011010N0??????1???N?000?????11?000?00000N01??1000N000N0000N00111??0000?0?0110?0?010011000???10???0100113?1??0??0?10011030010?0?1???0??010N?1??00?000?00?00?11000N?11010?1000N000020?0??0110??0?001????????????????????????????0???101???????????????????????11????0??????1????????20N1100000??00000010?000?????1??N1NN000[01]?00010N??1??0?000000??0?1N

Araripesuchus tsangatsangana

111001110010100101101??2100110111?0?00??0001221100?00?100?1N00??000?0000N1000N0001010000130100N0001010011100??000110010??000000NN10011010N0000?100N000????0021101000100N211111?01000000N110?1?10N0?1?1?01?0?N1000?????11??000?0????011110???00N0000N1?0000?00?0000??100?0110011??????1[01]??1010011?01110?10010011100000 1?0101100?010N111[01]000000000000?11001011101011000N0000[12]00[01]?001?0?101001000?0?1?110?111??1100???110?100101??1101?0001??00101000?110111011110?110?????120N??0?????????000?10?0001????100?????000??0??0?0N1000?000000020?1N

Araripesuchus wegeneri

1110010100102001011010021000101110010010000122110000011001 1N001000000000N10011000101000010
0100N000101001100011000110001100000011111011010N0000?100N01010N00021101000101021111010000ON0N
11011010N01111101000N100000?1011001000000 0N01111000N000N0000N001001100100000110000010 01100?000
1100101001130 1110??10??01103001?010101120?0???0110000000000 1001?1?00101??01?11000N0000103000011
001?100100???????10??????1100??????0?00?01??11????0???0???0????????????1?????1????????20N110??
0000100000100000 1011????N?NN0000000000N0N1000[02]00[01]100020?1N

Comahuesuchus brachybuccalis

101000130111NN0[12]??1??11??00???????01?1N?[01]?00N211000000100???[01]0?000001000N10?11100
???000??2010100?010?0????0???0?0??????1100?0110000?1??1[01]?1001??00N0?1?0N000?????0?0????????
????????0N??1???1?10N??1???01?02N1?000000?11000000 1011?111??????100N??????0???1?0100?0?10?????
?1??0????????10?1???0?1????0???0?11?11?000?1?0??01[12]01?010N1110000[12]1??0????????00N??????0
1000N0?01[12]3[12]1?00100000?0010???
??????????????????????????????0?00?00??010?????????0??000???0?00N0000?00??120?1?N?

Libycosuchus brevirostris

1[01]?0001100101001011010?[12]1?0???1110010010 0000N??1000?01?001???0?00000?000N10?0N?001??
?000?[23]0100N00010100????0??000?????0?000001111000 01?1[01]?10?0?100N010?????0[12]100??00??100
11????1?0100N??110110?????101?010??N??00???0?11?01?0???????1?11?0??000N?000N?????10001010?011?
??0??0011???????1???010011?01?00??10???11030010?01?0?0?0??1??0??002?110?01?00010000N100010??0?
??????0000?1000001?????0???????????????????0????11???0???
?????????????????????0000?0?0?0?????101???N0?????????0N?N00???0??1?00?13??

Uruguaysuchus aznarezi

11100001011010??01101[01]1[12]1?0?101???0?0?N?0000N2110??001??01??[01]???????0?00N1?0??000
????00???010??0??1010?1?10?????0110??????000?0NN000?1?100001???0??01?00N0?110N0??0?1????1?????
?????0N0N1?0?1?10N?11?1??1???N?0?0100??110000?000?0N0????0???000N??00N0?0?0????10?0?01????????
0????????????????00????1??0????110111000 1000???000?010N1111?00?2??0?0?011?0???????0?0110010?000
20???0?100010100100???????????10?????00????1???00?????1?????????0???0??????1???????111??1???????
??0N110??????????0???0000??0????????1?N00000??0??N0?0?0????00100?131N

Malawisuchus mwakasyungutiensis

101000110?1010010110100110?1???1100100??000102110010011001000[01]0000000000N100110001???00
0[01]20100N000101001?000??0001101?1??00001[01]??000010100100?N000N01?0????010N01?00100N211011?
0?0000N110?0?1?10N?11???11???N?????????1110?0000?00N01111001N000N0000N?0?00??0010???0?100?00?0
01???????01????1001?3??100??0?11?11??001??01[01]0?000??10N11??01002??00100011000N?[12]10100000
1100002 1?0?100?001011010????????10?1????1000??1?1???0??00?1??????0??0??????????????????????1????
???????00N110??01????00?000?000????????0?1N??00???00?N?N00?0?010010002?0N

Simosuchus clarki

1010001300101001001 01[01]121??0102100001100[01]000N2110N0000N0010000000000000 0N1001001010[
01]0000220100N1000000011000110001101111010001101000 0101[01]?1000?100N00010N01020N0100000100111
111100100N111?011010N00001100002N1000N?N1010NN100NN??NN0101100100010 1000N100101000 10101N?10000
0100010100??110??0100113011000?101011110011000110 1000?010N01100202N00011000100010101010 1200100
000102000000001010[01]?0?0110[01]0010?10???11001???100?0?101001000010010 0011?100010??????1111?
??0001111130N110?1020111000010000010111100121N0001?11010N0N000000000110021?1N

Baurusuchus pachecoi

101000000011NN021110111?111010211?0000??100112110?01?10??N?????????0??0??????????????0?0??
01?0N?1??000011??01100011101?1?100011100000101 0N0010?10111011001020N11000N10N211011100011 0N0N
1111111101111N01?00011111001011200101101111N1110???100N1100N10002100111011101001011 00?1?1??00
111??0?00110?1100?10???0111?001101010020 0001??1111121101?00100010000N10001012000N00002300?1010
000000011????????????????????0??
??????0001?000?0?0???100??????000110?0?0N00000???11???21NN

Baurusuchus salgadoensis

101000000011NN020110111?110010211000000??001121100010100 0N00N0111000100111110101?0?000011
0100N11001001111001100011101111100 0?1100000101 0N001011011110110 01?20N11000N10N211011100011 0N0N
1111111101111N0110?11101?001011200101101111N1110???100N1100N100??1001110111010?10110011010100
111??0100110?1?00??0011011100011010100200001101111 2110?00110?01?000N10001012000N0000230001010
000000011??????????????????????????10??0??20?
000?0?000110000010111100???1000001100000N000000011111221NN

Pissarrachampsa sera

10100?000011NN02111011121101102110000000100111110001 01??1N00N1111000100101011000100N000011
0100N11000101111001100011101?111000?110000000010N00101101101011101020N11000N10N211011100011 0N0N
11111110011?1?01?0???11110011113001011 00101N1110110110N1100N100001001010111010010111011111110
010000100110?1100?10011?111?0?11000??0??0??11011110211 0????1???1????????????12000N000034?001?10
000000011????????????1??????0??0???10??0?0??01?0??????????????????11??????1??100?00110?0??????N??
1?????0001100000101 11???0?1100000[01]10000?N00?0000111?12??NN

Stratiotosuchus maxhechti

101000011001NN0211101??2?1011021100000 0?1001111100010100 0N1NN02110001001111110101???0000?3
0100N1100000111010110001110101110001110000010110001011011010111 01?20N11000N10N211011100011 0N0N
011111110110000100101101100101130010???010??11??1??????1???????0210????0?1??10??0????11??0100
100??0100110?1?00??0011???????11????????????11011??0??????????????????????????12000N?000330001010
0?0????1??????????????????????????10???????????0?01011??11??10111????????????01??0111?1?????????
??????000110???01?111????????0000000000??N00?0000?11012??NN

Bergisuchus dietrichbergi

1110?0?0??1020????????????????????00??????????????00??1?000????0[12]010?1?1?0N??0??0?0?0?0??
?????????????????????????????????????0????10?0??0??00????0????????????????????1????????????????
???1???
????????????????????????????????0????00?00?????????1?0?0?0??1?????????????????????12000N?010?0????
???0000?0??1??
?????????0??????????0??????????????0?????????????????????????00N

Bretesuchus bonapartei

101000?00011N?????????0101[01]0???????10?00?000112?100??1??1???????????????0????????????????
?????????????????????????????????????1?110???0???100?????0111???0N0?0?0N???????????????1???????
?????????10N???11?111??1?00?010??11?01000001 0N111?10010?10N?0?0N0?1????????001??111?????0??????
????????????1????1??????????11??10?1?00?00[23]?0???0N1101020[01]010??[01]00???0???1?0??012000N0
00020000011 00000[01]0011???
????????????????????????????1????0?????????0???00?????0??N00?0?0????0??21NN

Cynodontosuchus rothi

10100??000???N?????????????0???????00?00????11???0???????????????????????????????????0???????
??????????????????????????????????0?100???0??1???
????????????00?0????0??00??0??1130010000?0N??
?????????????????????????????0????????????0??11011???2110?????????????????????1?0?0N000033000001?
???000?10??
????????????0??????????????????0????????N0000?0???????0??N

Ogresuchus furatus

101000?001?1NN??????101???0????????0?000010?10111?????????????????0??????????????????????????
?????????????1?10??????????????????0110?0000?00??00??
????????????00001??0000000[01]0??110??0000??0N0?????????[12]?????????????????????????????????????
??010?0N??102[2
3]000?0100?00?011??
??0?0????????010????????????NN

Lorosuchus nodosus

111000031001NN0101101002110??????0101?0001010?11000011110???00?00???000N10?10000100?10??[
12]?101110?1?2???????????????????????000?0NN???000110001??100N1100??0?1[01]0N00000??1???1???0100
00????0?0?1?10N?1101?010?001001?001?11001000?0?0N?10?101???0????01010?00??001????001???????0??
??????010???1?????01?00??1?11110021011??0?10????0?0N1100030[01]01????001??0?0N?0001001000N?000
1000000100?001010??
???????????????0???0????0?0???1?????N??00???00?N?N10???2111?1?104NN

Sebecus icaeorhinus

11100000??11NN010110101010??101111?00?0??0010??100001??10?00?0100000??00N10110000????00?1[
01]0101[01]10??010?1?00011000110011??000??0NN1000??01000001100N?1000N00111001000?0112?1??1?100
000N??01011010N111???01???110000????1100100000?0N????10???00???00100????01000?00101???00010011
?00?000[01]0??01000100110 0?110???111?001??00?01[02]???0???1100?10[01]??001?0?10?001010001?1200
0N?000[01]00?00?110000101010??0??0?1001110?110010001?01???????1??01?1110?11??101??1100111?1101
1?10111010??????????????000001??0010110??????N00000??000N?N0???????????104NN

Sebecus querejazus

111000?0??11N???????1012101??????0???????????????00001?100????0101001?100N101100?010[01]??0
???????????????????????????????????????1000??01000100100N?10?0N00[01]?10?10??????2?????????
???????????????????????1?0???000?1???11?010000010N01??10111000N?00100?1?0?1?01000001?1?????????
???????????????0??12000N?010?0?
????[01]00????0?0??
???????????????0???0?100????????????N0??????0??N?N00???????????104NN

Doratodon carcharidens

111?0??[01]???0[12]001?????????????????????????????????0?1??????????????????????????????????
???????101[01]1??????????????????????????????????100????0N0?0????????????????????????????????????
???
??????????????????????????????1110NNN00?0?00N01020??00N11100000001?100???1N0N??????12000N0000
?0???????000?000?0???
???????????????????????????0??????????????????????????????????????04NN

Gasparinisuchus peirosauroides

1110010[13]0?01NN01????1??[12]?[01]0??????00000?????1121100?001100N1N10????000000N10???00?
???0??????10??????0???1???????0?????????00?011111001?110N00??????????????0??????????N??????????
?????????????????????00001010???00010??112?000000?0N???1?????????????????????????????????0?0?0?0
0?1????????????0?0?1???????????????????0????00?0?320??00N0110010021???1??1????????00??1?0?0N0000
100011021000???11???
????????????????0?00?0000?10????????????0?00????0??N011??0????0??12NN

Barrosasuchus neuquenianus

111001010?002001011010021 10?1111100000?0100112110000011001??0???00???????10?0N000101?0001?
01????0010101110 1?1100?1???1?????001111???1?110N0?111100N01000N?101100100010??211?111100000N0N
0?011010N01?011010101?000010001120?0000110N01111000N000N0000N00100100010000011000001001 10000??
00???????113011?0??1?111111200100101 00301?00110110010111001 1011?100101?001012000N0000200001021
000?10?11???
??????00001?0000?0???100N?NN??0??010?0N0N01?0?00001002111N

Lomasuchus palpebrosus

11100101??102?0101101?021101111110 00??????011[12]1100?00110011N001000000000N1000N000101000
0100101000010101110101100011 00110N0000????1001?110N001??100N01000N0?01??0100010??211?11110000?
?0N?1?1?010N0??????1?1[01]110000100?11201000010??01111000N000N0000N0?1001100?01?1011000?010011
0000?????11?100113011?0???0??111????????0?00?20????????????????00?00?1??0?????????12000N0000?0?
??00210?0?10011???
????????????000000000?1?111100N?NN00??00?000N?N011??00001?02??1N

Hamadasuchus rebouli

111001010010200101101002110011111100001010011111000001100100101000000000N1000N000101000011
01010000?0201????01100010N0100N00001111001 1110N00101100N11000N00010N01000101121111111 0000100N
01011010N0100100101011000011001120100001 00N01011000N010N0000N001001100000010111000010011000000
0001?010011301100011011?????0?10?10?013?1??0??111001?021??????1?????????????12000N0110200011021
0?0010011???
??????00001[01]00001?111???N?NN00[01]??00000N?N01003000010020100

Antaeusuchus taouzensis

??1?0??[13]???
??
??
????????????????????????111111?00?001000131100111111001002101?10??????0N??????12000N0110??????
????00?10??1??
????????????????????0?????????????100??????0???????????????01?0

Bayomesasuchus hernandezi

111??0??0??
01?????????0111???11???110111??????????????????0N0???
?????????????????1?1?????00?????????????1????????????????????????????0??????????????????????????
??????????????????????111????00?0?10??0??0??01111?00[12]0111???1??1?1??????0???12000N0000??????
??1000?100?1??
??????????????????????????????????0?0??????????????????1??[12]21?N

Montealtosuchus arrudacamposi

1110000100102001011010021[01]0111111000001010011211000000100011N002000000000N1000N000101000
01001010000101011101011000110011100000111110011110N00101100N01000N0101100100010112111111100000
N0N01011010N011001010101100001000112010000110N01111000N000N0000N001001100100000110?00010011000
00000010010011301100??1011111130010010100320?01111110010021001101111001010001012000N0000100011
021000010?11????????????????????????????????????1????????????1????????????????????????????????
???0?????000000000010111100N?NN0000000000N0N0000300001002211N

Uberabasuchus terrificus

11100001001020010110?????10111111100001010011211000000100011N001000000000N1000N000???000010
010100001010111010110001100110N000011111001?110N00111100N0100??0?01100100000112111111100000N0N
01011010N011???01???????0?1?0011???00????????11????????????????????1??????????0????????????000
000??010??130???0??1?111111300???10100320?0111111?010[01]21001101111001010000112000N0000100011
0210?0010011??????????????????????111????????????1????????????1???????????????????????????????
??00[12]????00??0??????0111100N?????00????0??0N01?0300001002211N

Itasuchus jesuinoi

11????0???????????????????????[12]1???
???00N?1??0N0???1011000?0112??1???100?0?
???0?0??0????1???11???????????????????????
????????????????????????1[01]?111?0????10?103???????1101?0000?0??10??????????????32000N0100???
???????1???0??11????????0??????1?00????1??????????1???000??????????????0????01??1???????????[2
3]0N1?0???????????????????1????????????????????????????2???1????01?1

Caririsuchus camposi

1110010[12]000021010110?????????????00000?00??10211000001100100010000000000N1010N000???100
010010???11?1101110101100?10N01110?00?0100???1?01???0001100N1100????01??1100000??211?111?00000
N??0?0???????1????0????1????????0??????0??
0??000????0?????????????1?1111?00???101??3?0??????????0????0??1?????00???00???32000N01002000?0
0210100?01[12]1???
?????????????0??0?0???0?1?????????????????0??0??0?1?11110210??1?

Roxochampsa paulistanus

???????3??
???1??
??????????????????0???
?????????????????????11?????0????10?103?0??00N11?000000111?????????????????30000N0110?0?????2?
?0??101?1???
?????????????????1?????????????100??????0??????????????01?1

Amargasuchus minor

??1?0103???0????????????????????????????????????0???
??
??????????????????1?????0001??
??0?????21
0?0????2??
???1??????????????

Pepesuchus deiseae

1111010[23]00002101011010011101111110??0??0000102??00000??00100110000000000N10112000101000
01[01]0101000112[01]001???01100110N101100000?1001001?010N00001100N01000N010?10110000???2111111
??00010100101100NN?1????01?0?1?0100010?111000000100N01111000N000N0000N000001100?00010111?00?10
0?1000????????01000130???1???011?11??0??0?10?110?0??00N110000001?????????????????0??32000N0100
100011021010?00?20??
?????????0?????0000000000011??????N?NN0?????????N?N10112111021?0010

MPMA 68-0001-11

11??0?0[23]??0021010110???????111110????????????????00??????1??1??000000000N1010N000?0?000
02[01]0101000112200????01100012N1010N000????????????????101100N??0??????1??11000000N2111111100
0010100?01100NN110?????????????????1???0?????1
??0000000??010???0?????????11?1???0?0??10?100?0?????1100000001???????????????????42000N0100???
???????????0??0???
????????????000000?00??11????????????0000??00N0N1??1211110?120000

Barreirosuchus fransciscoi

11??0?????01?N0101101000110111111???????????????00000??00?1N110000000000N1010N00010?000010
0100N001122001???01100110N0100N000???????????10N??101100N01000N00011011000N11?211?01??000010??
0?01100NN?11??????????00??0?0?11?000000100N01?11000N01100?00N001????101000101?1?00??00?1????00
000??010001101?00???1??120?0N0100????????1
0?0??0???1??????????????????0?????00??
??????0000000000??1?????N?NN0?????????0N?N1??1011110?00????

Stolokrosuchus lapparenti

111101020000210101101???1101111?1011001000010211000001110100000000000000N1000N000101000010
0101001010201????01100010N011100000010010000010N00101100N11000N01010N1100010112010111100001010
0101100NN01100101000110000010011100000001?0N0?111[01]???????00?????1??110??00?1??11100010001000
00000011010001301100??1011111??0000??00110?0?00??1100000001?????011?100N??????42000N0100100011
02000001002???
?????????00000000010111???????00?0?0000???N10???010100020000

Rukwasuchus yajabalijekunduis

11??0?????0???010?1?10021??011?11???????????????????????????00??00000000N10?0N00010?000011
010100011010011?001100010N1110N000???????????????????????????????0????10??????2110111????0??10
010110???011????????????????????????????????1?11000N??0N0000N0?000???????????11100010111000000
000110100013011000110??[13]2000N0100??????
???????1?0??
?????????000000?0001?111???????000?00??00???0???211110?02???0

Kinesuchus overoi

??1???
??
??
??????????????????????11?111?00?0?10?103?0??00N1100000001??????????????????[13]2000N0000??????
????0???0???
????????????????????0?????????????000????????????????????01?N

Ayllusuchus fernandezi

111101?000?1NN0??????????[01]???????110001?0001021100?011110?0000??????0?????????????????
?????0??????0????????????0??????100???1111???11?10N00?0??????????????????????0???????????????
??????????????0110100011000?1??1?1??00???
?????????100?????1???[01]0???????200
001011??00???1???
?????????????????01?????????????????????????????01??11????????N?

Colhuehuapisuchus lunai

??1??
???
???
?????????????????????11?????0??0?00??03?1??10N110000011????????????????????12000N0100?????????
?0???0???
??????????????????????????????0?0??????????????????????12??

Kaprosuchus saharicus

1010010310002102011010?2111????11000110101010111000101110011N001000000000N10010001l??0000?1
0101010010201???001100012N0111?000000NN0001?010N0010N100N1101??10010N11010100N2110???110?00N0N
0?0???????1011?11???1??000001?111010000000N01111100N01110000N000101?001000001110?00?00110???00
00???????11??1?0???1?101110000100101001 21?000N01?002011110111111001010002002000N0000301001021
000?00?11??
??????0000000?0??0???1??N[12]NN01?0??1000N?N0000010010 1021?0N

Mahajangasuchus insignis

111000031?00210201101102110 11?21100011??1000N?1100010110011N0?100000000101010N0011?1010022
0101010012201????01100012N0101010000???00011010N0010N100N11010N10011111010100N2110110100000N0N
010?100NN010???01002N1000?0010110110010100N01?11100N01110000N000101?01000000111000010011010???
00?0?0100113011001110??111100010?101001???00??00000201110011111 01?00N10?0?012000N0100[12]00000
011000000111 0???????1001110111011001100 10?101?0?????0001??00111110?1101110111111?1???????010??
0??00????00000?000110???1??N2NN0010??1000N?N10?0000010?1?1100

Pakasuchus kapilimai

101000110?11NN0101101?121?0?1???100??????????????000?0??00N???0????00?00??10?0N000????000??
0100N000?010111100110 0?11001010?00?????0000??00N1110?100N11?00??1010N11000N00N211????100??0N??
0?0???????1????????????????????11?????00??0N01?110???000N??00N10000??0100????010?0????001?????0
?0???01001?3?1?0???0?11011110010?0110100???00N11??01002100010????000N121010010011 0000?3?????2?
001?11[01]11???1?10?10?10?????????1??????????????????????0?????????????0111????1????????????00N10
???00???000?010???010?????????N??00??????N0?1000?10101?02??NN

Morrinhosuchus luziae

1010001101102001011 0????????102??01100N???00N111000000 1001??10210?000000N10111000???0000?0
0100N?00101011 1??01100011010111 0000?1??00001010N1001010?N00000N01010N0???0100N?1???1?000000N0N
1?0?1?110?0100101000N?000010111?1??0????????N111?01?110N0100N1?0???00111000?01000001001 1?????0
1????010011301?00????100111100?0001101000??10N1110010010000100??1000N1???0000000N00??220011000
001011000??
??????00?01100?0001??100???10010???000?0?00?010000120203 01

Notosuchus terrestres

1010001101101001011011111001102110010 0N?1000N2110000000100101100000001000N1011100010000012
0100N0000010[01]111001100011010[01]100000[01]1000000101[01]?10001100N01000N0?110N01000110N2110
[01]10?00000N0N110110110001[01]1?01000N00000101111?000100010N1N1110010100N0000N10000100111010 1
0100001100[01]10000?0110?1010011301100?10?1001101101000110 1000?010N11100100100[01]0100011000N?
2101001110N0111210001000001101 0?00?11010?10110?10[01]0001011110?00?0111?[01]10?11010011111?111
110111111101?100????2101000000???0000010000010 1111??02010000001000[01]000000100001202030 1

Mariliasuchus amarali

10100?110111NN0101?01111?0001021100100N?1000N2110010001?0N00?02000001000N1010N1?010?000012
0100N0100010111100110001101 0[01]10000011??000?[01]010N1011100100 1100N0101??01000N00N2010110000
00????110110110001[01]?001000N0000010011100001000 10N11110010110N0000N100?010?100000101000001[
01]011[01]000N01110?010011301100?10010011101010001101011?010N11100100110001000 01000N12101021[0
1]10N0110230101000001111??0???????????1???10??????11110????01?1???00?0011??0????????101?111?110
??1???????00N1?2??00???0000010000010 11?111021[01]0010001010[01]0100001000012020 3N1

Yacarerani boliviensis

101000110111NN01011010121001101110 0100N?0000N21101000010 0N00102000000000N1000N100???000012
0100N1100010011?0011000110000110000110N00001000N11000101110100N01010N11000N10N2010111?0000??0N
110110110001???01000N00000100011000000011 0N11111001?100N1000N11000??01100001010000011 0111????0
110??010111001?00??0010011001010001101011?010N111001001??00100000000N1?101022110N0000220100010
0011110100??1010?10?111??1100?1001?????0?111?10000101 0?111?10111???????1?1001000011111????????
??????0001110000101 1?1111211001111001210N1000?0001120203NN

Adamantinasuchus navae

??0000110111NN???010??????????????00100N?0000N2110110?01?0N0??210000?000N1?0111?0?0??000??
??????????????????????????????????00110N00001000N1101?001110110N01010N01001N0??211?111?0???????
??????11????????0????N??0??????????????????????????
????0?????????????????????01100?0??01101[12]11?????1?1??100??000100???000N??????22110N0000310 1?0
01?00101001???
?????????0???1??00??0?????1??????111????????000010?00??????NN

Caipirasuchus attenboroughi

????0?????????????????11121?0???
??
???????????????????????????1???111000100010N11?110010100N1000N1?021??0110000101 0000????0???????
?????????1?????????????10?11001??1?0110101??????11100100?1?0?10????????????????01110N0110?????????
?0??1?1?0???
??????????????00?10???1111201 1?11??1??2110??????????????????

Caipirasuchus stenognathus

10100011011020010110111211001011?00100N?0000N11100100110010010110000000 0N1011100010?100012
0100N?000?10011?0011000110000??0?00110?00001010N1101010??111?1101010N010001?0N2110?110?0000N0N
110?1?11??0100001000N00000100?111000[01]00000N1111100101[01]0N1000N10021?0011000010100001110 01
1????0110??0??111?01?00??00100111010100011010 10?N10N1110010011?0?100001000N1?1?1121110N0111220
0010001011110[12]0???
????????????????00?01??00010???111120[01]1011111110110000011010?2020301

Caipirasuchus mineirus

1010001101102001011011112110????1100100N?0000N11100000110010010110000000 0N1011100010?000012
0100N?1001100111001?00011?000110000110?00001010N1001010??01101101010N0100011 0N2110?110000?0N0N
1?0?1?????01???01?0?N?00000000111000100010N111110010100N1000N100211001100001010000111001011??0
100??000?11001?0???0?10011101010001101010?N10N1110010011?0?100001000N1?1?1121110N0111220001001
1011110[12]00????????0????????00??01110?????11??????010?0???????????1101111???001000??????00N10
[12]??00?000000011?00010???1111201001 1?1111010100001001012020???

Caipirasuchus montealtensis

10100011011020010110111211011011100100N?0000N1110000011001001010000000 00N10111000???000012
0100N?00111001110011000 1100[01]01100001100000001010N11000101111101101010N01000110N211?111000000
N0N110?11110??100001?00N0000000[01]?11[01]000000010N11110110100N1000N10020?001100001010?00011
0?1?????011???0?0111001?00??001001110101 10?1101010?0111110010011?001000?1000N1?????21110N0111
2200110001011 11?10????????10??????1??????????????????????0??0?0??????????????????????????????????
?01010[01]??00??00?0?01100?0101??11101010??1?0110111N0000?0001120203??

Caipirasuchus paulistanus

10100011011020010110111211 0??????00100N?0000N0110000011001001010000000 00N101110001??000012
0100N10011100111001100011?0????0000110000001010N11000101111?01101010N01000010N21101110000?0N0N
1?0??1????0100001000N0000000111110000000 10N111110010100N1?00N100201001100001 0????0???????????0
110??0????1?01?00??0?10011101?11001101010?010N1110010011?001000?1????10??0021110N0111220001000
101111110?????????????????????????10??0N1000?
000???00?0110??0?01??1110110???1??110111N0000?00101202 03??

Sphagesaurus huenei

101000110111NN0??1101??2110????????0100N?00?0N01100000110?N?????0?????00????????????????0???
???????????0?????????????????????0011000000 1010N11000101111101101000N11000N10N2??011?1000?0N??
1?????1??0?100001000N000000011110000000 00 10N?11110110?00N1000N???001?0?1?1?1??10000010001111??0
1???????001??1?00??0???????????1??01??1??0?0???1??0?1???????????0?????????????21110N011142000N000
1?00110?0?1?10?0???1??
??????0????00000?0??????0???001???20?2??N00000??00?2??03N?

Caryonosuchus pricei

1110?0?10????????????????????????00????????0N??10???
??????????????????????????????????01???0[01]?00010N1??
???????????????????????N???1??
????????????????????????1??????1????????1??1?????1??0?1???????????????????????[12]2110N01114??
0??0??1??011??0???
???????????????????????0????????????1?????????????0??????????0??1

Armadillosuchus arrudai

101000110?11NN021110????????1011?00??0???0?0N?110001011?0N???0200000?000N1000N000????00012
0100N100011011?1001100011011011000 01???????00?0N1??0?1010???0????000N11000N?0N211?111100000N??
1101111?0001???01?????????????1???????????????????????????1???????????0??????????0?0?011001111110
111?00???01?01?00??0???????????1??????????1??1??1????100????????????????????????22110N01114?01?N0??
1?001?010????????????????????????????0??????????0?1?0?0??1??????0????????????????????????2100N[01
]01010???0?0010?000??11??????????01??12?12???0000000101?12??N1

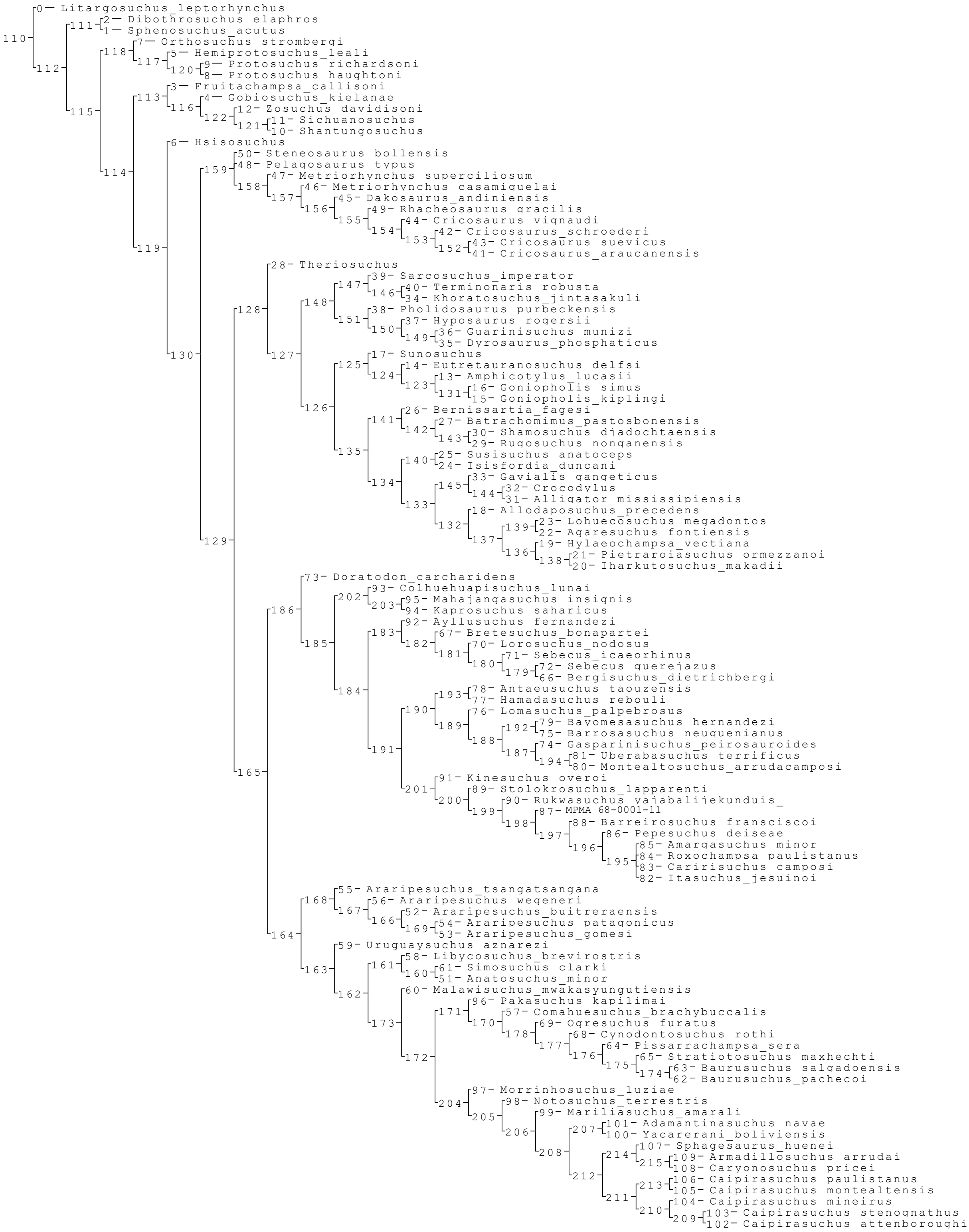
1.6 Tree search strategy

The dataset was analysed using equally weighted parsimony in TNT 1.5 (Goloboff *et al.* 2008), based on a heuristic search ("traditional search) with 10,000 replicates (random seed 0 and hold= 20) followed by TBR branch swapping, saving 20 cladograms per round. The trees were collapsed after each replicate. The strict consensus of which are shown in fig. S1.

1.7 Support measurements

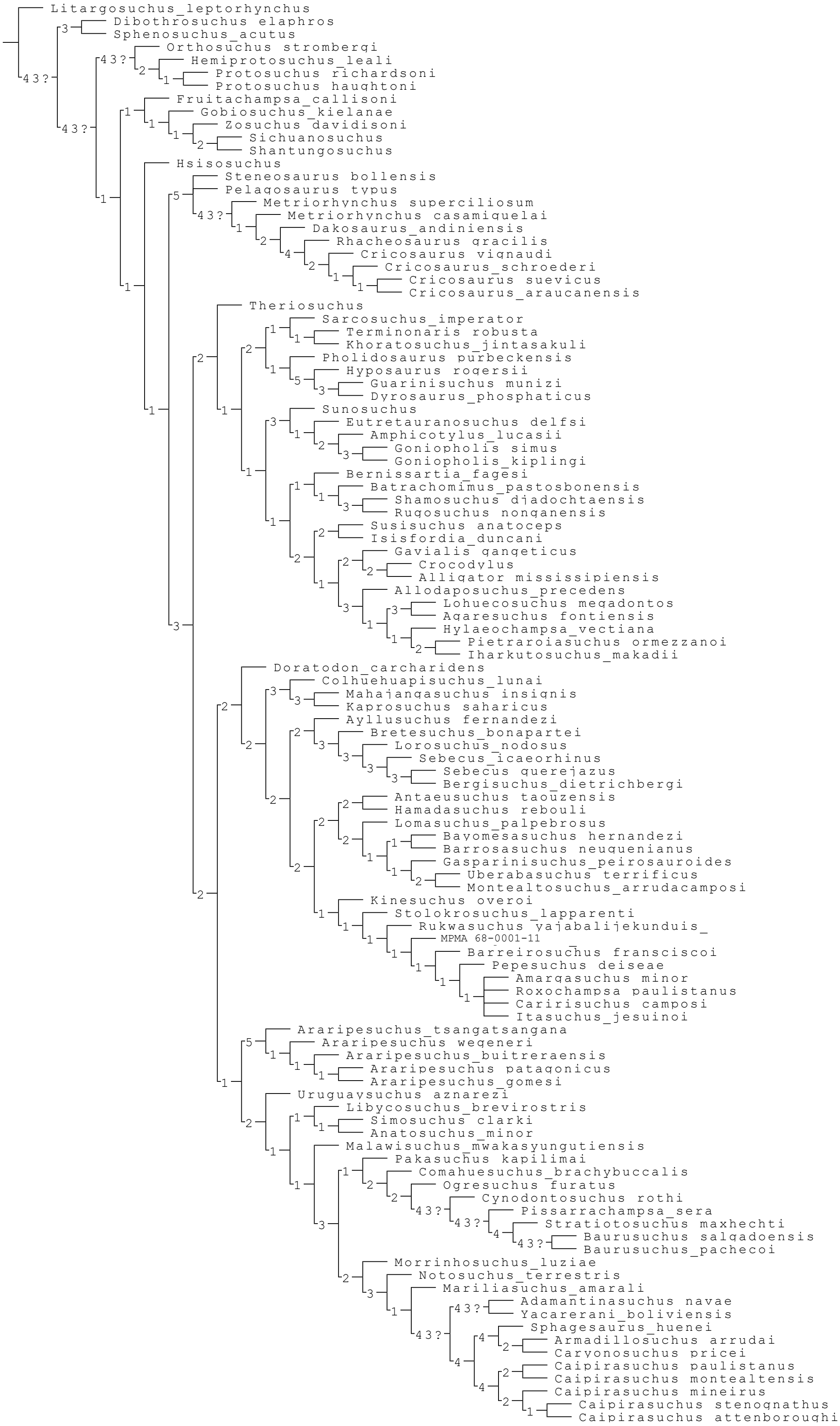
Bootstrap (GC and absolute frequencies >50%) and Bremer support values were calculated for the data in hand using TNT 1.5. Bremer support values (Bremer 1994) were calculated using the TNT script. 1,000 bootstrap pseudoreplicates, followed by TBR branch swapping, were generated for each of the resampling strategy.

Figure S1. Strict consensus tree of the 6 MPTs.



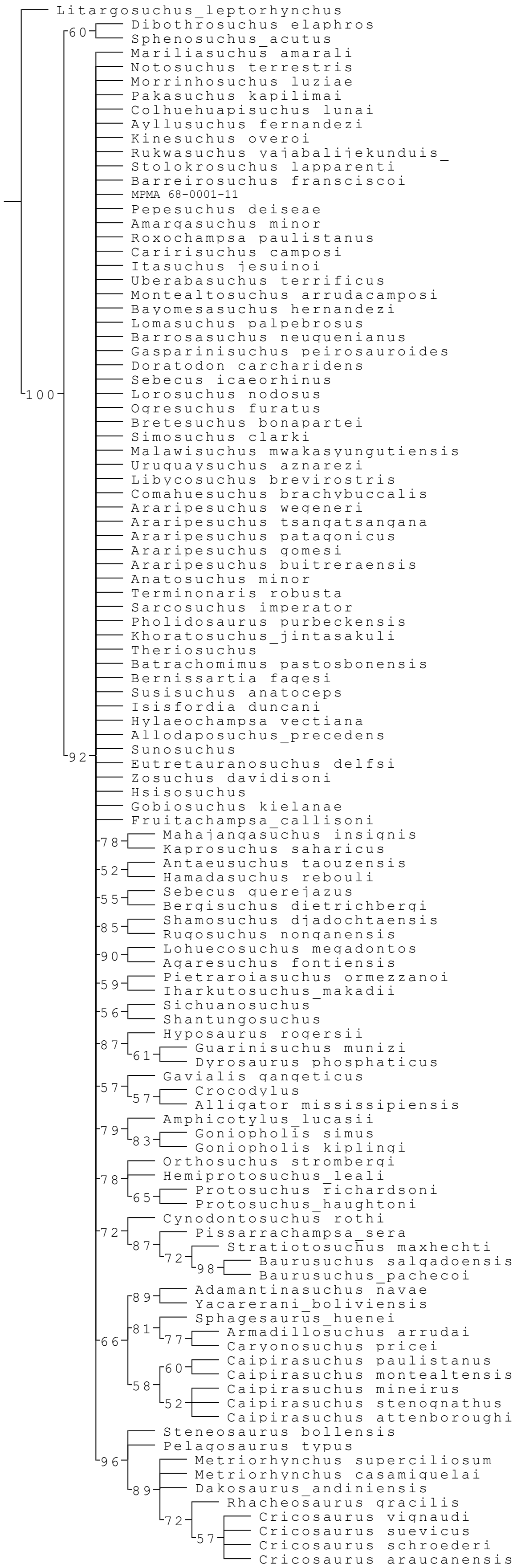
(Source: the author).

Figure S2. "Bremer support" values sequentially indicated on each node.



(Source: the author).

Figure S3. Bootstrap (GC and absolute frequencies >50%).



(Source: the author).

1.8 Synapomorphies list

Node numbers are taken from figure S1. The list was directly exported from TNT.

Litargosuchus leptorhynchus:
All trees:
No autapomorphies.

Sphenosuchus acutus:
All trees:
Char. 44: 1 --> 0
Char. 90: 0 --> 1
Char. 99: 0 --> 1
Char. 164: 1 --> 0
Char. 241: 1 --> 0
Char. 289: 0 --> 1
Char. 296: 1 --> 0
Char. 330: 0 --> 1
Char. 385: 0 --> 1
Char. 419: 0 --> 1
Char. 420: 0 --> 1
Char. 509: 0 --> 1

Dibothrosuchus elaphros:
All trees:
Char. 6: 1 --> 0
Char. 15: 1 --> 2
Char. 53: 0 --> 1
Char. 56: 0 --> 1
Char. 62: 0 --> 1
Char. 81: 0 --> 1
Char. 101: 0 --> 1
Char. 228: 0 --> 1
Char. 286: 0 --> 1
Char. 331: 0 --> 1
Char. 370: 0 --> 1
Char. 482: 0 --> 1

Fruitachampsa callisoni:
All trees:
Char. 11: 0 --> 1
Char. 19: 1 --> 0
Char. 59: 0 --> 1
Char. 68: 0 --> 1
Char. 105: 0 --> 1
Char. 117: 1 --> 0
Char. 155: 1 --> 0
Char. 228: 0 --> 1
Char. 242: 0 --> 1
Char. 337: 0 --> 1
Char. 381: 0 --> 1
Char. 390: 0 --> 1
Char. 399: 0 --> 1
Char. 474: 0 --> 1
Char. 507: 1 --> 0

Gobiosuchus kielanae:
All trees:
Char. 1: 1 --> 0
Char. 14: 0 --> 1
Char. 25: 0 --> 1
Char. 44: 1 --> 0
Char. 46: 1 --> 0
Char. 75: 1 --> 0
Char. 106: 0 --> 1
Char. 109: 1 --> 0
Char. 214: 1 --> 0
Char. 256: 1 --> 0
Char. 301: 1 --> 0
Char. 302: 1 --> 0
Char. 329: 0 --> 3
Char. 350: 0 --> 1
Char. 370: 1 --> 0
Char. 379: 1 --> 0

Hemiprotosuchus leali:
All trees:
Char. 25: 0 --> 1
Char. 43: 1 --> 0
Char. 53: 0 --> 1
Char. 100: 0 --> 1

Hsisosuchus:
All trees:
Char. 17: 1 --> 0
Char. 48: 0 --> 1
Char. 60: 1 --> 0
Char. 61: 0 --> 1
Char. 88: 1 --> 0
Char. 138: 0 --> 1
Char. 142: 0 --> 1
Char. 169: 0 --> 1
Char. 195: 0 --> 1
Char. 236: 0 --> 1
Char. 238: 0 --> 1
Char. 259: 0 --> 1
Char. 286: 0 --> 1
Char. 287: 0 --> 1
Char. 459: 1 --> 0
Char. 476: 1 --> 0
Char. 500: 0 --> 1
Some trees:
Char. 164: 1 --> 0

Orthosuchus strombergi:
All trees:
Char. 19: 1 --> 0
Char. 34: 0 --> 1
Char. 38: 0 --> 1
Char. 105: 0 --> 1
Char. 124: 0 --> 1
Char. 155: 1 --> 0
Char. 326: 0 --> 1
Char. 335: 0 --> 1

Char. 338: 0 --> 1
Char. 339: 0 --> 1
Char. 354: 2 --> 1
Char. 364: 0 --> 34
Char. 461: 1 --> 0
Char. 465: 0 --> 1
Char. 469: 1 --> 0
Char. 512: 0 --> 2
Char. 513: 0 --> 1
Char. 521: 4 --> 1
Char. 522: 1 --> 0
Some trees:
Char. 10: 1 --> 0

Protosuchus haughtoni:
All trees:
Char. 316: 0 --> 1

Protosuchus richardsoni:
All trees:
Char. 60: 1 --> 0
Char. 75: 1 --> 0
Char. 324: 0 --> 1

Shantungosuchus:
All trees:
No autapomorphies.

Sichuanosuchus:
All trees:
Char. 175: 1 --> 0
Char. 413: 0 --> 1
Char. 507: 1 --> 0

Zosuchus davidisoni:
All trees:
Char. 10: 1 --> 0
Char. 100: 0 --> 1
Char. 112: 0 --> 1
Char. 312: 1 --> 0
Char. 314: 0 --> 1
Char. 364: 0 --> 3
Char. 508: 0 --> 1
Char. 520: 0 --> 1
Char. 521: 4 --> 3
Char. 522: 1 --> 0

Amphicotylus lucasii:
All trees:
Char. 3: 0 --> 1
Char. 163: 0 --> 1
Char. 286: 0 --> 1
Char. 368: 0 --> 1

Eutretauranosuchus delfsi:
All trees:
Char. 11: 1 --> 0
Char. 215: 1 --> 0
Char. 229: 1 --> 0
Char. 353: 4 --> 0

Goniopholis kiplingi:
All trees:
Char. 9: 1 --> 0
Char. 141: 0 --> 1
Char. 237: 0 --> 1
Char. 517: 2 --> 1

Goniopholis simus:
All trees:
Char. 15: 1 --> 0
Char. 165: 0 --> 1

Sunosuchus:
All trees:
Char. 71: 0 --> 1
Char. 172: 0 --> 1
Char. 197: 1 --> 0
Char. 280: 0 --> 1
Char. 305: 0 --> 3
Char. 341: 0 --> 1

Allodaposuchus precedens:
All trees:
Char. 98: 1 --> 0
Char. 101: 0 --> 1
Char. 102: 0 --> 1
Char. 507: 1 --> 0

Hylaeochampsa vectiana:
All trees:
Char. 0: 1 --> 0
Char. 71: 0 --> 1
Char. 78: 0 --> 1
Char. 85: 0 --> 1
Char. 166: 1 --> 0
Char. 289: 0 --> 1

Iharkutosuchus makadii:
All trees:
Char. 14: 0 --> 1
Char. 27: 0 --> 1
Char. 100: 2 --> 1
Char. 102: 0 --> 1
Char. 194: 1 --> 0
Char. 276: 0 --> 1
Char. 327: 0 --> 1
Char. 357: 0 --> 1
Char. 372: 0 --> 1
Char. 481: 0 --> 1

Pietraroiasuchus ormezzanoi:
All trees:
Char. 23: 0 --> 2
Char. 101: 0 --> 1
Char. 232: 2 --> 1

Agaresuchus fontiensis:
All trees:

Char. 5: 0 --> 1
Char. 23: 0 --> 1
Char. 43: 0 --> 1
Char. 84: 0 --> 1
Char. 116: 0 --> 1
Char. 150: 0 --> 1
Char. 155: 0 --> 1
Char. 204: 0 --> 1
Char. 279: 0 --> 1
Char. 483: 0 --> 1
Char. 507: 1 --> 0

Lohuecosuchus megadontos:
All trees:
Char. 79: 0 --> 1
Char. 86: 0 --> 1
Char. 119: 1 --> 0
Char. 147: 0 --> 1
Char. 153: 0 --> 1
Char. 156: 1 --> 0
Char. 159: 0 --> 1
Char. 219: 0 --> 1
Char. 223: 0 --> 1
Char. 317: 0 --> 2
Char. 329: 3 --> 2
Char. 372: 0 --> 1
Char. 478: 0 --> 1
Char. 503: 0 --> 1
Char. 508: 1 --> 0

Isisfordia duncani:
All trees:
Char. 60: 1 --> 0
Char. 62: 1 --> 0
Char. 85: 1 --> 0
Char. 89: 0 --> 1
Char. 144: 0 --> 1
Char. 150: 0 --> 1
Char. 156: 1 --> 2
Char. 353: 4 --> 0

Susisuchus anatoceps:
All trees:
Char. 58: 0 --> 1
Char. 140: 0 --> 1
Char. 175: 1 --> 0
Char. 409: 1 --> 0

Bernissartia fagesi:
All trees:
Char. 254: 1 --> 0
Char. 316: 0 --> 3
Char. 338: 0 --> 1
Char. 343: 0 --> 1
Char. 370: 1 --> 2
Char. 388: 1 --> 0
Char. 467: 0 --> 1

Batrachomimus pastosbonensis:
All trees:
Char. 18: 1 --> 0
Char. 131: 0 --> 1
Char. 138: 0 --> 1
Char. 140: 0 --> 1
Char. 156: 1 --> 2
Char. 163: 0 --> 1
Char. 180: 1 --> 0
Char. 210: 0 --> 1
Char. 216: 0 --> 1
Char. 324: 0 --> 1
Char. 331: 1 --> 0
Char. 371: 1 --> 0
Char. 460: 0 --> 1
Char. 461: 1 --> 0
Char. 508: 0 --> 1

Theriosuchus:
All trees:
Char. 6: 0 --> 1
Char. 31: 1 --> 0
Char. 59: 0 --> 1
Char. 63: 0 --> 1
Char. 89: 0 --> 3
Char. 96: 0 --> 1
Char. 116: 0 --> 1
Char. 118: 1 --> 0
Char. 143: 1 --> 0
Char. 300: 1 --> 0
Char. 315: 1 --> 0
Char. 316: 0 --> 2
Char. 345: 0 --> 1
Char. 346: 0 --> 1
Char. 376: 0 --> 1
Char. 390: 0 --> 1
Char. 399: 0 --> 1
Char. 409: 0 --> 12
Char. 417: 1 --> 0
Char. 477: 0 --> 1
Char. 521: 4 --> 3
Char. 522: 0 --> 1

Rugosuchus nonganensis:
All trees:
Char. 53: 1 --> 0
Char. 116: 0 --> 1
Char. 300: 0 --> 1
Char. 343: 0 --> 1
Char. 370: 1 --> 2

Shamosuchus djadochtaensis:
All trees:
Char. 6: 0 --> 1
Char. 379: 0 --> 1

Alligator mississipiensis:
All trees:
Char. 9: 1 --> 0

Char. 23: 0 --> 2
Char. 54: 1 --> 0
Char. 62: 0 --> 2
Char. 79: 0 --> 1
Char. 119: 1 --> 0
Char. 180: 1 --> 0
Char. 193: 1 --> 0
Char. 205: 0 --> 1
Char. 223: 0 --> 1
Char. 224: 0 --> 1
Char. 382: 0 --> 1
Char. 385: 1 --> 0
Char. 514: 0 --> 1
Char. 517: 2 --> 1
Char. 519: 0 --> 1

Crocodylus:
All trees:
Char. 43: 0 --> 1
Char. 85: 1 --> 0
Char. 142: 1 --> 0
Char. 342: 1 --> 0

Gavialis gangeticus:
All trees:
Char. 4: 0 --> 1
Char. 7: 3 --> 2
Char. 45: 1 --> 0
Char. 70: 0 --> 1
Char. 74: 0 --> 1
Char. 84: 0 --> 1
Char. 144: 0 --> 1
Char. 159: 0 --> 1
Char. 190: 1 --> 0
Char. 216: 0 --> 12
Char. 269: 0 --> 1
Char. 282: 1 --> 0
Char. 324: 0 --> 2
Char. 336: 0 --> 1
Char. 343: 0 --> 1
Char. 459: 0 --> 1
Char. 464: 1 --> 0
Char. 465: 1 --> 0
Char. 467: 2 --> 1
Char. 499: 0 --> 1
Char. 512: 0 --> 2

Khoratosuchus jintasakuli:
All trees:
Char. 2: 1 --> 0
Char. 23: 2 --> 0
Char. 60: 1 --> 0
Char. 84: 1 --> 0
Char. 87: 1 --> 0
Char. 121: 0 --> 1
Char. 140: 0 --> 1
Char. 353: 4 --> 0
Char. 360: 1 --> 0
Char. 479: 0 --> 1
Char. 507: 1 --> 0

Dyrosaurus phosphaticus:
All trees:
Char. 2: 1 --> 0
Char. 51: 0 --> 1
Char. 157: 1 --> 0
Char. 521: 4 --> 0

Guarinisuchus munizi:
All trees:
Char. 45: 0 --> 1
Char. 99: 0 --> 1
Char. 118: 1 --> 0
Char. 148: 1 --> 0
Char. 251: 1 --> 0
Char. 254: 1 --> 0
Char. 326: 0 --> 1
Char. 333: 0 --> 1

Hyposaurus rogersii:
All trees:
Char. 3: 0 --> 1
Char. 91: 1 --> 0
Char. 163: 0 --> 1

Pholidosaurus purbeckensis:
All trees:
Char. 4: 0 --> 1
Char. 15: 1 --> 0
Char. 101: 0 --> 1
Char. 117: 1 --> 0
Char. 143: 1 --> 0
Char. 176: 0 --> 1
Char. 508: 0 --> 1
Char. 509: 0 --> 1
Char. 511: 0 --> 1

Sarcosuchus imperator:
All trees:
Char. 36: 0 --> 1
Char. 70: 0 --> 1
Char. 117: 1 --> 0
Char. 144: 0 --> 1
Char. 181: 1 --> 0
Char. 223: 0 --> 1
Char. 371: 1 --> 0
Char. 380: 0 --> 1
Char. 508: 0 --> 1

Terminonaris robusta:
All trees:
Char. 118: 1 --> 0
Char. 138: 0 --> 1
Char. 217: 1 --> 0
Char. 238: 0 --> 1
Char. 476: 1 --> 0

Cricosaurus araucanensis:
All trees:

Char. 16: 0 --> 1

Cricosaurus schroederi:
All trees:
No autapomorphies.

Cricosaurus suevicus:
All trees:
Char. 84: 0 --> 1
Char. 99: 0 --> 1
Char. 140: 1 --> 0

Cricosaurus vignaudi:
All trees:
Char. 61: 0 --> 1
Char. 512: 1 --> 0

Dakosaurus andiniensis:
All trees:
Char. 7: 2 --> 1
Char. 33: 0 --> 1
Char. 84: 0 --> 1
Char. 131: 0 --> 1
Char. 159: 1 --> 0
Char. 218: 0 --> 1
Char. 324: 2 --> 1
Char. 329: 0 --> 1
Char. 330: 0 --> 1
Char. 354: 0 --> 2
Char. 371: 1 --> 0
Char. 482: 0 --> 1
Char. 512: 1 --> 2
Some trees:
Char. 353: 0 --> 1

Metriorhynchus casamiquelai:
All trees:
Char. 237: 0 --> 1
Char. 246: 0 --> 1
Char. 510: 0 --> 1

Metriorhynchus superciliosum:
Some trees:
Char. 353: 0 --> 1

Pelagosaurus typus:
All trees:
Char. 74: 0 --> 1
Char. 160: 1 --> 0
Char. 212: 0 --> 1
Char. 275: 0 --> 1
Char. 292: 1 --> 0
Char. 383: 1 --> 0
Some trees:
Char. 155: 1 --> 0

Rhacheosaurus gracilis:
All trees:
Char. 0: 0 --> 1
Char. 110: 1 --> 0

Steneosaurus bollensis:
All trees:
Char. 247: 0 --> 1
Char. 266: 0 --> 1
Char. 285: 0 --> 1
Some trees:
Char. 61: 0 --> 1
Char. 254: 1 --> 0
Char. 430: 1 --> 0

Anatosuchus minor:
All trees:
Char. 5: 0 --> 1
Char. 6: 1 --> 0
Char. 12: 1 --> 2
Char. 13: 0 --> 1
Char. 58: 0 --> 1
Char. 60: 0 --> 1
Char. 75: 0 --> 1
Char. 89: 2 --> 1
Char. 93: 0 --> 1
Char. 96: 0 --> 1
Char. 125: 1 --> 0
Char. 237: 0 --> 1
Char. 252: 0 --> 1
Char. 253: 0 --> 1
Char. 293: 0 --> 1
Char. 312: 1 --> 0
Char. 321: 1 --> 0
Char. 340: 0 --> 1
Char. 370: 0 --> 1
Char. 374: 1 --> 0
Char. 376: 1 --> 0
Char. 429: 1 --> 0
Char. 507: 0 --> 1
Char. 517: 0 --> 2

Araripesuchus buitreraensis:
All trees:
Char. 6: 0 --> 1
Char. 60: 0 --> 1
Char. 75: 0 --> 1
Char. 157: 1 --> 0
Char. 245: 0 --> 1
Char. 332: 0 --> 2
Char. 335: 0 --> 1
Char. 511: 0 --> 2
Char. 520: 0 --> 2

Araripesuchus gomesi:
All trees:
Char. 301: 0 --> 1
Char. 321: 1 --> 0
Char. 328: 0 --> 1

Araripesuchus patagonicus:
All trees:
Char. 132: 1 --> 0
Char. 158: 1 --> 0
Char. 218: 1 --> 0

Araripesuchus tsangatsangana:
All trees:
Char. 6: 0 --> 1
Char. 89: 0 --> 3
Char. 105: 0 --> 1
Char. 148: 1 --> 0
Char. 176: 0 --> 1
Char. 245: 0 --> 1
Char. 250: 1 --> 0
Char. 266: 0 --> 1
Char. 308: 1 --> 0
Char. 310: 0 --> 1
Char. 393: 0 --> 1

Araripesuchus wegeneri:
All trees:
Char. 12: 1 --> 2
Char. 76: 0 --> 1
Char. 311: 0 --> 1
Char. 317: 0 --> 2
Char. 324: 1 --> 0
Char. 339: 0 --> 1
Char. 363: 2 --> 1
Char. 515: 0 --> 1

Comahuesuchus brachybuccalis:
All trees:
Char. 37: 0 --> 1
Char. 93: 0 --> 1
Char. 132: 0 --> 1
Char. 141: 0 --> 1
Char. 149: 0 --> 1
Char. 154: 1 --> 0
Char. 203: 0 --> 2
Char. 212: 1 --> 0
Char. 222: 0 --> 1
Char. 225: 0 --> 1
Char. 318: 0 --> 1
Char. 362: 0 --> 1
Char. 365: 0 --> 12
Char. 366: 0 --> 1
Char. 493: 1 --> 0

Libycosuchus brevirostris:
All trees:
Char. 158: 1 --> 0
Char. 212: 1 --> 0
Char. 304: 1 --> 0
Char. 305: 0 --> 3
Char. 489: 0 --> 1

Uruguaysuchus aznarezi:
All trees:
Char. 105: 0 --> 1
Char. 140: 0 --> 1
Char. 155: 0 --> 1
Char. 209: 0 --> 1
Char. 327: 0 --> 1
Char. 429: 1 --> 0
Char. 491: 2 --> 1

Malawisuchus mwakasyungutiensis:
All trees:
Char. 43: 0 --> 1
Char. 50: 0 --> 1
Char. 62: 1 --> 0
Char. 143: 1 --> 0
Char. 182: 0 --> 1
Char. 184: 1 --> 0
Char. 199: 0 --> 1
Char. 216: 0 --> 1
Char. 278: 1 --> 0
Char. 413: 1 --> 0
Char. 467: 0 --> 1
Char. 476: 1 --> 0
Char. 513: 0 --> 1
Char. 519: 2 --> 0

Simosuchus clarki:
All trees:
Char. 27: 1 --> 0
Char. 30: 1 --> 2
Char. 36: 0 --> 1
Char. 37: 0 --> 1
Char. 53: 1 --> 0
Char. 62: 1 --> 0
Char. 77: 1 --> 0
Char. 79: 0 --> 1
Char. 88: 1 --> 2
Char. 95: 0 --> 1
Char. 98: 1 --> 0
Char. 100: 1 --> 0
Char. 121: 0 --> 1
Char. 127: 1 --> 0
Char. 148: 1 --> 0
Char. 164: 1 --> 0
Char. 171: 0 --> 1
Char. 182: 0 --> 1
Char. 194: 1 --> 0
Char. 200: 1 --> 0
Char. 215: 1 --> 0
Char. 229: 1 --> 0
Char. 240: 0 --> 1
Char. 248: 0 --> 1
Char. 270: 1 --> 0
Char. 273: 0 --> 1
Char. 307: 0 --> 1
Char. 363: 0 --> 1
Char. 417: 1 --> 0
Char. 458: 0 --> 3

Char. 467: 0 --> 2
Char. 497: 0 --> 1
Char. 499: 0 --> 1
Char. 502: 0 --> 1

Baurusuchus pachecoi:
All trees:
Char. 26: 0 --> 1
Char. 102: 1 --> 0
Char. 207: 0 --> 1

Baurusuchus salgadoensis:
All trees:
Char. 16: 1 --> 0
Char. 99: 0 --> 1
Char. 204: 0 --> 1
Char. 336: 0 --> 1

Pissarrachampsa sera:
All trees:
Char. 56: 0 --> 1
Char. 61: 0 --> 1
Char. 133: 1 --> 0
Char. 207: 0 --> 1
Char. 268: 0 --> 1
Char. 272: 0 --> 1
Char. 274: 0 --> 1
Char. 278: 1 --> 0
Char. 364: 3 --> 4
Char. 454: 1 --> 0
Char. 456: 1 --> 0
Char. 466: 0 --> 1

Stratiotosuchus maxhechti:
All trees:
Char. 7: 0 --> 1
Char. 8: 0 --> 1
Char. 10: 1 --> 0
Char. 58: 0 --> 1
Char. 62: 1 --> 2
Char. 89: 1 --> 3
Char. 105: 1 --> 0
Char. 106: 0 --> 1
Char. 136: 0 --> 1
Char. 184: 1 --> 0
Char. 203: 0 --> 1
Char. 279: 1 --> 0
Char. 500: 1 --> 0

Bergisuchus dietrichbergi:
All trees:
Char. 11: 1 --> 0
Char. 54: 1 --> 0
Char. 521: 4 --> 0

Bretesuchus bonapartei:
All trees:
Char. 1: 1 --> 0
Char. 23: 2 --> 0
Char. 44: 0 --> 1
Char. 124: 0 --> 1
Char. 145: 0 --> 1
Char. 196: 0 --> 1
Char. 199: 0 --> 1
Char. 201: 0 --> 1
Char. 227: 0 --> 1
Char. 257: 0 --> 1
Char. 327: 0 --> 1
Char. 369: 0 --> 1
Char. 520: 0 --> 2

Cynodontosuchus rothi:
All trees:
No autapomorphies.

Ogresuchus furatus:
All trees:
Char. 21: 1 --> 0
Char. 135: 1 --> 0
Char. 205: 1 --> 0
Char. 361: 0 --> 1
Char. 378: 0 --> 1
Char. 508: 0 --> 1

Lorosuchus nodosus:
All trees:
Char. 7: 0 --> 3
Char. 36: 0 --> 1
Char. 41: 0 --> 1
Char. 62: 1 --> 0
Char. 85: 0 --> 1
Char. 160: 1 --> 0
Char. 204: 1 --> 0
Char. 208: 0 --> 1
Char. 229: 1 --> 0
Char. 245: 0 --> 1
Char. 260: 1 --> 0
Char. 303: 1 --> 0
Char. 304: 1 --> 0
Char. 314: 0 --> 1
Char. 353: 1 --> 0
Char. 354: 2 --> 1
Some trees:
Char. 10: 1 --> 0

Sebecus icaeorhinus:
All trees:
Char. 23: 2 --> 0
Char. 33: 0 --> 1
Char. 140: 1 --> 0
Char. 254: 1 --> 0
Char. 315: 0 --> 1
Char. 371: 0 --> 1

Sebecus querejazus:
All trees:
No autapomorphies.

Doratodon carcharidens:
All trees:

Char. 50: 0 --> 1
Char. 302: 1 --> 0
Char. 335: 0 --> 1
Char. 343: 0 --> 1

Gasparinisuchus peirosauroides:
All trees:
Char. 11: 0 --> 1
Char. 60: 0 --> 1
Char. 198: 1 --> 0
Char. 218: 1 --> 0
Char. 223: 1 --> 0
Char. 311: 1 --> 0
Char. 322: 1 --> 0
Char. 324: 1 --> 0
Char. 521: 1 --> 2

Barrosasuchus neuquenianus:
All trees:
Char. 318: 0 --> 1
Char. 324: 1 --> 0

Lomasuchus palpebrosus:
All trees:
Char. 256: 0 --> 1
Char. 337: 1 --> 0
Char. 368: 1 --> 0

Hamadasuchus rebouli:
All trees:
No autapomorphies.

Antaeusuchus taouzensis:
All trees:
Char. 321: 0 --> 1

Bayomesasuchus hernandezi:
All trees:
No autapomorphies.

Montealtosuchus arrudacamposi:
All trees:
Char. 62: 1 --> 2
Char. 119: 0 --> 1
Char. 508: 1 --> 0

Uberabasuchus terrificus:
All trees:
Char. 33: 0 --> 1
Char. 164: 1 --> 0
Char. 351: 1 --> 0
Char. 352: 0 --> 1

Itasuchus jesuinoi:
All trees:
Char. 327: 0 --> 1

Caririsuchus camposi:
All trees:
No autapomorphies.

Roxochampsa paulistanus:
Some trees:
Char. 334: 0 --> 1
Char. 354: 2 --> 0
Char. 361: 0 --> 1
Char. 373: 1 --> 0

Amargasuchus minor:
All trees:
Char. 202: 0 --> 1

Pepesuchus deiseae:
All trees:
Char. 76: 0 --> 1
Char. 117: 1 --> 0
Char. 315: 0 --> 1
Char. 376: 1 --> 0

MPMA 68-0001-11:
All trees:
Char. 88: 1 --> 2
Char. 114: 0 --> 2
Char. 117: 1 --> 0
Char. 166: 1 --> 0
Char. 195: 1 --> 0
Char. 213: 0 --> 1
Char. 289: 3 --> 0
Char. 353: 1 --> 4

Barreirosuchus fransciscoi:
All trees:
Char. 11: 0 --> 1
Char. 58: 0 --> 1
Char. 93: 1 --> 0
Char. 118: 1 --> 0
Char. 165: 0 --> 1
Char. 172: 1 --> 0
Char. 238: 0 --> 1
Char. 252: 0 --> 1
Char. 289: 3 --> 1
Char. 298: 0 --> 1
Char. 511: 2 --> 0

Stolokrosuchus lapparenti:
All trees:
Char. 34: 0 --> 1
Char. 35: 0 --> 1
Char. 55: 0 --> 1
Char. 96: 0 --> 1
Char. 132: 1 --> 0
Char. 169: 1 --> 0
Char. 270: 1 --> 0
Char. 313: 1 --> 0
Char. 315: 0 --> 1
Char. 343: 0 --> 1

Char. 353: 1 --> 4
Char. 371: 1 --> 0

Rukwasuchus yajabalijekunduis:
All trees:
Char. 27: 1 --> 0
Char. 100: 2 --> 1
Char. 269: 0 --> 1

Kinesuchus overoi:
All trees:
No autapomorphies.

Ayllusuchus fernandezi:
All trees:
Char. 3: 0 --> 1
Char. 33: 0 --> 1
Char. 164: 1 --> 0
Char. 354: 2 --> 01
Char. 512: 0 --> 1

Colhuehuapisuchus lunai:
All trees:
Char. 321: 0 --> 1
Char. 521: 1 --> 2

Kaprosuchus saharicus:
All trees:
Char. 1: 1 --> 0
Char. 26: 0 --> 1
Char. 41: 0 --> 1
Char. 76: 0 --> 1
Char. 176: 0 --> 1
Char. 199: 0 --> 1
Char. 304: 1 --> 0
Char. 334: 0 --> 1
Char. 345: 0 --> 1
Char. 353: 1 --> 0
Char. 363: 2 --> 3
Char. 365: 0 --> 1
Char. 370: 1 --> 2
Char. 495: 0 --> 1
Char. 512: 0 --> 1

Mahajangasuchus insignis:
All trees:
Char. 5: 1 --> 0
Char. 21: 0 --> 1
Char. 40: 0 --> 1
Char. 43: 1 --> 0
Char. 71: 0 --> 1
Char. 85: 0 --> 1
Char. 99: 0 --> 2
Char. 118: 1 --> 0
Char. 121: 0 --> 1
Char. 157: 0 --> 1
Char. 217: 0 --> 1
Char. 221: 0 --> 1
Char. 223: 0 --> 1
Char. 253: 0 --> 1
Char. 254: 1 --> 0
Char. 325: 1 --> 0
Char. 518: 0 --> 1

Pakasuchus kapilimai:
All trees:
Char. 76: 1 --> 0
Char. 135: 1 --> 0
Char. 139: 0 --> 1
Char. 147: 0 --> 1
Char. 175: 0 --> 1
Char. 184: 1 --> 0
Char. 279: 1 --> 0
Char. 321: 1 --> 0
Char. 380: 0 --> 1
Char. 507: 0 --> 1
Char. 512: 0 --> 1

Morrinhosuchus luziae:
All trees:
Char. 34: 0 --> 1
Char. 45: 2 --> 1
Char. 63: 0 --> 1
Char. 89: 2 --> 0
Char. 120: 0 --> 1
Char. 141: 0 --> 1
Char. 142: 1 --> 0
Char. 148: 1 --> 0
Char. 216: 0 --> 1
Char. 237: 0 --> 1
Char. 351: 1 --> 0
Char. 367: 0 --> 1
Char. 379: 1 --> 0
Char. 477: 0 --> 1
Char. 482: 1 --> 0

Notosuchus terrestris:
All trees:
Char. 59: 0 --> 1
Char. 62: 2 --> 0
Char. 155: 0 --> 1
Char. 197: 0 --> 1
Char. 257: 0 --> 1
Char. 266: 0 --> 1
Char. 304: 1 --> 0
Char. 362: 0 --> 1
Char. 376: 1 --> 0
Char. 418: 0 --> 1
Char. 458: 0 --> 2
Char. 459: 0 --> 1
Char. 492: 1 --> 0

Mariliasuchus amarali:
All trees:
Char. 27: 1 --> 0
Char. 50: 0 --> 1
Char. 140: 0 --> 1
Char. 141: 0 --> 1
Char. 143: 1 --> 0

Char. 146: 1 --> 0
Char. 169: 1 --> 0
Char. 237: 0 --> 1
Char. 254: 1 --> 0
Char. 280: 0 --> 1
Char. 425: 0 --> 1
Char. 428: 1 --> 0
Char. 463: 0 --> 2

Yacarerani boliviensis:
All trees:
Char. 159: 0 --> 1
Char. 169: 1 --> 0
Char. 507: 0 --> 1
Char. 515: 0 --> 1

Adamantinasuchus navae:
All trees:
Char. 2: 1 --> 0
Char. 17: 1 --> 0
Char. 50: 0 --> 1
Char. 63: 0 --> 1
Char. 141: 0 --> 1
Char. 143: 1 --> 0
Char. 150: 0 --> 1
Char. 163: 0 --> 1
Char. 316: 0 --> 12
Char. 363: 2 --> 3
Char. 375: 1 --> 0
Char. 377: 1 --> 0

Caipirasuchus attenboroughi:
All trees:
Char. 304: 1 --> 0
Char. 309: 0 --> 1
Char. 353: 2 --> 0
Char. 362: 1 --> 0
Char. 378: 0 --> 1

Caipirasuchus stenognathus:
All trees:
Char. 224: 1 --> 0

Caipirasuchus mineirus:
All trees:
Char. 96: 0 --> 1
Char. 139: 1 --> 0
Char. 147: 1 --> 0
Char. 272: 1 --> 0
Char. 279: 1 --> 0
Char. 371: 0 --> 1

Caipirasuchus montealtensis:
All trees:
Char. 233: 0 --> 1
Char. 322: 0 --> 1
Char. 367: 0 --> 1
Char. 459: 0 --> 1
Char. 515: 0 --> 1

Caipirasuchus paulistanus:
All trees:
Char. 164: 1 --> 0
Char. 493: 1 --> 0

Sphagesaurus huenei:
All trees:
Char. 268: 1 --> 0

Caryonosuchus pricei:
All trees:
Char. 1: 0 --> 1

Armadillosuchus arrudai:
All trees:
Char. 366: 0 --> 1

Node 111:
All trees:
Char. 91: 1 --> 0
Char. 92: 0 --> 1
Char. 140: 0 --> 1
Char. 143: 0 --> 1
Char. 507: 1 --> 0

Node 112:
All trees:
No synapomorphies

Node 113:
All trees:
Char. 62: 0 --> 2
Char. 96: 0 --> 1
Char. 332: 0 --> 2
Char. 353: 1 --> 0
Char. 374: 0 --> 1
Char. 380: 0 --> 1

Node 114:
All trees:
Char. 31: 0 --> 1
Char. 135: 0 --> 1
Char. 170: 0 --> 1
Char. 175: 0 --> 1
Char. 214: 0 --> 1
Char. 229: 0 --> 1
Char. 254: 0 --> 1
Char. 284: 0 --> 1
Char. 288: 0 --> 1
Char. 370: 0 --> 1
Char. 383: 0 --> 1

Node 115:
All trees:
Char. 0: 0 --> 1
Char. 2: 0 --> 1
Char. 12: 0 --> 1

Char. 88: 0 --> 1
Char. 108: 0 --> 1
Char. 123: 1 --> 0
Char. 129: 1 --> 0
Char. 299: 0 --> 1
Char. 301: 0 --> 1
Char. 416: 0 --> 1
Char. 476: 0 --> 1
Char. 515: 0 --> 1
Char. 521: 3 --> 4

Node 116:
All trees:
Char. 17: 1 --> 0
Char. 150: 0 --> 1
Char. 156: 1 --> 2
Char. 172: 0 --> 1
Char. 268: 0 --> 1
Char. 354: 2 --> 0
Char. 378: 0 --> 1

Node 117:
All trees:
Char. 13: 0 --> 2
Char. 17: 1 --> 0
Char. 242: 0 --> 1
Char. 337: 0 --> 1
Char. 380: 0 --> 1
Char. 507: 1 --> 0

Node 118:
All trees:
Char. 35: 0 --> 1
Char. 46: 1 --> 0
Char. 58: 0 --> 1
Char. 62: 0 --> 1
Char. 78: 0 --> 1
Char. 138: 0 --> 1
Char. 156: 1 --> 0
Char. 163: 0 --> 1
Char. 265: 0 --> 1
Char. 268: 0 --> 1
Char. 294: 0 --> 1
Char. 379: 1 --> 0
Char. 400: 0 --> 1

Node 119:
All trees:
Char. 6: 1 --> 0
Char. 44: 1 --> 0
Char. 143: 0 --> 1
Char. 256: 1 --> 0
Char. 351: 0 --> 3
Char. 487: 0 --> 1
Char. 522: 1 --> 0

Node 120:
All trees:
Char. 509: 0 --> 1

Node 121:
All trees:
Char. 215: 1 --> 0
Char. 307: 0 --> 1
Char. 374: 1 --> 0

Node 122:
All trees:
Char. 18: 0 --> 1
Char. 195: 0 --> 1
Char. 278: 0 --> 1
Char. 287: 0 --> 1
Char. 500: 0 --> 1

Node 123:
All trees:
Char. 101: 0 --> 1
Char. 476: 1 --> 0

Node 124:
All trees:
Char. 176: 0 --> 1
Char. 370: 1 --> 2

Node 125:
All trees:
Char. 79: 0 --> 1
Char. 85: 1 --> 0
Char. 461: 1 --> 0

Node 126:
All trees:
Char. 29: 0 --> 1
Char. 83: 0 --> 1
Char. 187: 1 --> 0
Char. 308: 1 --> 0
Char. 385: 0 --> 1

Node 127:
All trees:
Char. 9: 0 --> 1
Char. 11: 0 --> 1
Char. 45: 2 --> 0
Char. 262: 0 --> 1
Char. 354: 2 --> 0
Char. 360: 0 --> 1
Char. 517: 0 --> 2

Node 128:
All trees:
Char. 85: 0 --> 1
Char. 104: 1 --> 0
Char. 114: 1 --> 0
Char. 157: 0 --> 1
Char. 171: 0 --> 1
Char. 217: 0 --> 1
Char. 250: 1 --> 0
Char. 331: 0 --> 1
Char. 353: 1 --> 4
Char. 363: 2 --> 1

Char. 379: 1 --> 2
Char. 381: 0 --> 1
Some trees:
Char. 10: 1 --> 0

Node 129:
All trees:
Char. 5: 0 --> 1
Char. 19: 1 --> 0
Char. 28: 0 --> 1
Char. 62: 0 --> 1
Char. 81: 0 --> 1
Char. 129: 0 --> 1
Char. 132: 0 --> 1
Char. 168: 0 --> 2
Char. 188: 0 --> 1
Char. 342: 0 --> 1
Char. 347: 0 --> 1
Char. 397: 0 --> 1
Char. 480: 1 --> 0
Char. 482: 0 --> 1
Char. 484: 0 --> 1
Char. 485: 0 --> 1
Some trees:
Char. 155: 1 --> 0

Node 130:
All trees:
Char. 12: 1 --> 2
Char. 25: 0 --> 1
Char. 200: 0 --> 1
Char. 220: 1 --> 0
Char. 228: 0 --> 1
Char. 237: 1 --> 0
Char. 241: 1 --> 0
Char. 417: 0 --> 1

Node 131:
All trees:
Char. 75: 1 --> 0
Char. 86: 0 --> 1
Char. 512: 0 --> 1

Node 132:
All trees:
Char. 31: 1 --> 0
Char. 85: 1 --> 0
Char. 138: 0 --> 1
Char. 168: 2 --> 1
Char. 508: 0 --> 1

Node 133:
All trees:
Char. 23: 2 --> 0
Char. 89: 0 --> 2
Char. 232: 1 --> 2
Char. 399: 0 --> 1
Char. 519: 1 --> 0

Node 134:
All trees:
Char. 5: 1 --> 0
Char. 43: 1 --> 0
Char. 98: 0 --> 1
Char. 119: 0 --> 1
Char. 458: 2 --> 3
Char. 459: 1 --> 0
Char. 464: 0 --> 1
Char. 465: 0 --> 1
Char. 467: 0 --> 2

Node 135:
All trees:
Char. 27: 1 --> 0
Char. 45: 0 --> 1
Char. 193: 0 --> 1
Char. 212: 0 --> 1
Char. 300: 1 --> 0
Char. 315: 1 --> 0
Char. 409: 0 --> 1
Char. 460: 1 --> 0
Char. 509: 0 --> 1
Char. 511: 0 --> 1
Char. 521: 4 --> 0

Node 136:
All trees:
Char. 10: 0 --> 1
Char. 58: 0 --> 1
Char. 140: 0 --> 1
Char. 246: 0 --> 1
Char. 353: 4 --> 0

Node 137:
All trees:
Char. 19: 0 --> 1
Char. 63: 0 --> 1
Char. 75: 1 --> 0
Char. 360: 1 --> 0

Node 138:
All trees:
Char. 6: 0 --> 1
Char. 25: 1 --> 0
Char. 143: 1 --> 0

Node 139:
All trees:
Char. 144: 0 --> 1
Char. 145: 0 --> 1
Char. 175: 1 --> 0
Char. 182: 0 --> 1
Char. 198: 0 --> 1
Char. 205: 0 --> 1
Char. 512: 0 --> 1
Char. 519: 0 --> 1

Node 140:
All trees:
Char. 75: 1 --> 0

Char. 132: 1 --> 0

Node 141:
All trees:
Char. 101: 0 --> 1
Char. 217: 1 --> 0
Char. 381: 1 --> 0
Char. 523: 0 --> 1

Node 142:
All trees:
Char. 31: 1 --> 0
Char. 58: 0 --> 1
Char. 65: 0 --> 1
Char. 512: 0 --> 1

Node 143:
All trees:
Char. 23: 2 --> 0
Char. 43: 1 --> 0
Char. 224: 0 --> 1
Char. 342: 1 --> 0
Char. 345: 0 --> 1
Char. 353: 4 --> 0
Char. 360: 1 --> 0
Char. 515: 1 --> 0

Node 144:
All trees:
Char. 5: 0 --> 1
Char. 69: 0 --> 1
Char. 89: 2 --> 3
Char. 198: 0 --> 1
Char. 316: 0 --> 3
Char. 360: 1 --> 0
Char. 388: 1 --> 0
Char. 412: 0 --> 1
Char. 521: 0 --> 3

Node 145:
All trees:
Char. 36: 0 --> 1
Char. 62: 1 --> 0
Char. 82: 0 --> 1
Char. 118: 1 --> 0
Char. 351: 3 --> 2
Char. 353: 4 --> 0
Char. 463: 0 --> 1
Char. 469: 1 --> 0

Node 146:
All trees:
Char. 515: 1 --> 0

Node 147:
All trees:
Char. 98: 0 --> 1
Char. 124: 0 --> 1
Char. 199: 0 --> 1
Char. 237: 0 --> 1
Char. 365: 0 --> 1
Char. 368: 0 --> 1
Char. 369: 0 --> 1

Node 148:
All trees:
Char. 5: 1 --> 0
Char. 19: 0 --> 1
Char. 34: 0 --> 1
Char. 43: 1 --> 0
Char. 62: 1 --> 0
Char. 87: 0 --> 1
Char. 132: 1 --> 0
Char. 155: 0 --> 1
Char. 156: 1 --> 0
Char. 168: 2 --> 1
Char. 201: 0 --> 1
Char. 216: 0 --> 1
Char. 296: 1 --> 0
Char. 351: 3 --> 2
Char. 370: 1 --> 0
Char. 458: 2 --> 1

Node 149:
All trees:
Char. 19: 1 --> 0
Char. 36: 0 --> 1
Char. 85: 1 --> 0
Char. 155: 1 --> 2

Node 150:
All trees:
Char. 16: 0 --> 1
Char. 144: 0 --> 1
Char. 285: 0 --> 1
Char. 286: 0 --> 1
Char. 352: 0 --> 1
Char. 373: 0 --> 1

Node 151:
All trees:
Char. 94: 1 --> 0
Char. 461: 1 --> 0

Node 152:
All trees:
Char. 155: 1 --> 0

Node 153:
All trees:
Char. 62: 2 --> 1

Node 154:
All trees:
Char. 269: 0 --> 1
Char. 510: 0 --> 1

Node 155:
All trees:
Char. 16: 1 --> 0

Char. 107: 0 --> 1
Char. 122: 0 --> 1
Char. 140: 0 --> 1
Char. 289: 2 --> 1
Char. 320: 0 --> 1
Char. 472: 0 --> 1

Node 156:
All trees:
Char. 23: 1 --> 0
Char. 62: 0 --> 2
Char. 150: 0 --> 1

Node 157:
All trees:
Char. 289: 0 --> 2
Char. 476: 1 --> 0

Node 158:
All trees:
Char. 0: 1 --> 0
Char. 13: 0 --> 1
Char. 57: 1 --> 0
Char. 66: 0 --> 1
Char. 68: 0 --> 1
Char. 92: 0 --> 1
Char. 110: 0 --> 1
Char. 302: 1 --> 0
Char. 363: 2 --> 3
Char. 410: 0 --> 1
Char. 466: 0 --> 1
Some trees:
Char. 111: 0 --> 1

Node 159:
All trees:
Char. 7: 1 --> 2
Char. 9: 0 --> 1
Char. 16: 0 --> 1
Char. 31: 1 --> 2
Char. 32: 1 --> 0
Char. 45: 2 --> 0
Char. 55: 0 --> 1
Char. 88: 1 --> 2
Char. 90: 0 --> 1
Char. 91: 1 --> 0
Char. 103: 1 --> 0
Char. 108: 1 --> 0
Char. 159: 0 --> 1
Char. 161: 0 --> 1
Char. 170: 1 --> 0
Char. 175: 1 --> 0
Char. 185: 1 --> 0
Char. 190: 1 --> 0
Char. 207: 0 --> 1
Char. 283: 0 --> 1
Char. 294: 0 --> 1
Char. 301: 1 --> 0
Char. 315: 1 --> 0
Char. 324: 1 --> 2
Char. 351: 3 --> 2
Char. 354: 2 --> 0
Char. 370: 1 --> 0
Char. 379: 1 --> 0
Char. 407: 0 --> 1
Char. 429: 1 --> 0
Char. 438: 0 --> 1
Char. 517: 0 --> 2
Some trees:
Char. 243: 0 --> 1
Char. 282: 1 --> 0
Char. 319: 0 --> 1
Char. 353: 1 --> 0
Char. 445: 1 --> 0
Char. 470: 1 --> 0

Node 160:
All trees:
Char. 7: 1 --> 3
Char. 17: 1 --> 0
Char. 32: 1 --> 0
Char. 35: 1 --> 0
Char. 195: 1 --> 0
Char. 238: 0 --> 1
Char. 345: 0 --> 1
Char. 365: 0 --> 2

Node 161:
All trees:
Char. 178: 0 --> 1
Char. 324: 1 --> 0
Char. 342: 1 --> 0
Char. 363: 2 --> 0
Char. 515: 0 --> 1

Node 162:
All trees:
Char. 6: 0 --> 1
Char. 126: 0 --> 1
Char. 138: 0 --> 1
Char. 337: 0 --> 1
Char. 340: 1 --> 0
Char. 370: 1 --> 0

Node 163:
All trees:
Char. 5: 1 --> 0
Char. 43: 1 --> 0
Char. 129: 1 --> 0
Char. 371: 1 --> 0
Char. 516: 0 --> 1
Char. 521: 4 --> 3

Node 164:
All trees:
Char. 12: 2 --> 1
Char. 25: 1 --> 0
Char. 35: 0 --> 1
Char. 100: 2 --> 1
Char. 184: 0 --> 1

Char. 278: 0 --> 1
Char. 301: 1 --> 0
Char. 321: 0 --> 1
Char. 354: 2 --> 1
Char. 374: 0 --> 1
Char. 376: 0 --> 1
Char. 515: 1 --> 0

Node 165:
All trees:
Char. 60: 1 --> 0
Char. 83: 0 --> 1
Char. 98: 0 --> 1
Char. 119: 0 --> 1
Char. 133: 0 --> 1
Char. 142: 0 --> 1
Char. 169: 0 --> 1
Char. 172: 0 --> 1
Char. 205: 0 --> 1
Char. 212: 0 --> 1
Char. 260: 0 --> 1
Char. 287: 0 --> 1
Char. 289: 0 --> 3
Char. 340: 0 --> 1
Char. 351: 3 --> 1
Char. 389: 0 --> 1
Char. 392: 0 --> 1
Char. 394: 0 --> 1
Char. 401: 0 --> 1
Char. 404: 0 --> 1
Char. 405: 0 --> 1
Char. 408: 0 --> 1
Char. 411: 0 --> 1
Char. 413: 0 --> 1
Char. 424: 0 --> 1
Char. 441: 0 --> 1
Char. 446: 0 --> 1
Char. 456: 0 --> 1
Char. 460: 1 --> 0
Char. 519: 01 --> 2

Node 166:
All trees:
Char. 21: 0 --> 2
Char. 248: 0 --> 1
Char. 249: 0 --> 1
Char. 327: 0 --> 1

Node 167:
All trees:
Char. 117: 1 --> 0
Char. 126: 0 --> 1
Char. 130: 0 --> 1
Char. 218: 0 --> 1
Char. 247: 0 --> 1
Char. 304: 1 --> 0
Char. 305: 0 --> 3
Char. 365: 0 --> 3

Node 168:
All trees:
Char. 44: 0 --> 2
Char. 156: 1 --> 2
Char. 157: 0 --> 1
Char. 171: 0 --> 1
Char. 293: 0 --> 1
Char. 300: 1 --> 0
Char. 316: 0 --> 1
Char. 348: 0 --> 1
Char. 430: 1 --> 0

Node 169:
All trees:
Char. 89: 0 --> 2
Char. 105: 0 --> 1
Char. 491: 2 --> 1

Node 170:
All trees:
Char. 120: 0 --> 1
Char. 309: 0 --> 1
Char. 316: 0 --> 2
Char. 331: 0 --> 1
Char. 374: 1 --> 0
Char. 377: 1 --> 0

Node 171:
All trees:
Char. 11: 0 --> 1
Char. 116: 1 --> 0
Char. 159: 0 --> 1
Char. 254: 1 --> 0
Char. 333: 0 --> 1
Char. 514: 0 --> 1

Node 172:
All trees:
Char. 21: 0 --> 1
Char. 40: 0 --> 1
Char. 75: 0 --> 1
Char. 102: 0 --> 1
Char. 105: 0 --> 1
Char. 253: 0 --> 1
Char. 259: 0 --> 1
Char. 462: 1 --> 0

Node 173:
All trees:
Char. 348: 0 --> 2
Char. 377: 0 --> 1

Node 174:
All trees:
Char. 27: 1 --> 0
Char. 45: 1 --> 2
Char. 147: 0 --> 1
Char. 152: 1 --> 0
Char. 196: 0 --> 1
Char. 216: 3 --> 2
Char. 226: 0 --> 1

Char. 280: 0 --> 1
Char. 328: 0 --> 1
Char. 363: 3 --> 2
Char. 499: 0 --> 1

Node 175:
All trees:
Char. 72: 0 --> 1
Char. 74: 0 --> 1
Char. 100: 1 --> 0
Char. 192: 0 --> 1
Char. 249: 0 --> 2

Node 176:
All trees:
Char. 127: 0 --> 1
Char. 208: 0 --> 1
Char. 221: 0 --> 1
Char. 222: 0 --> 1
Char. 225: 0 --> 1
Char. 380: 0 --> 1

Node 177:
All trees:
Char. 9: 1 --> 0
Char. 44: 0 --> 1
Char. 216: 0 --> 3
Char. 219: 0 --> 1
Char. 353: 0 --> 1
Char. 363: 2 --> 3

Node 178:
All trees:
Char. 43: 0 --> 1
Char. 45: 2 --> 1
Char. 138: 1 --> 0

Node 179:
All trees:
Char. 55: 1 --> 0
Char. 64: 0 --> 1
Char. 67: 0 --> 1
Char. 361: 0 --> 1

Node 180:
All trees:
Char. 25: 1 --> 0
Char. 135: 1 --> 0
Char. 157: 0 --> 1

Node 181:
All trees:
Char. 126: 1 --> 0
Char. 155: 0 --> 1
Char. 233: 0 --> 1
Char. 243: 0 --> 1
Char. 363: 2 --> 1
Char. 378: 0 --> 1
Char. 379: 1 --> 0
Char. 521: 1 --> 4

Node 182:
All trees:
Char. 5: 1 --> 0
Char. 132: 1 --> 0
Char. 136: 0 --> 1
Char. 371: 1 --> 0

Node 183:
All trees:
Char. 7: 13 --> 0
Char. 11: 0 --> 1
Char. 34: 0 --> 1
Char. 52: 0 --> 1
Char. 55: 0 --> 1
Char. 478: 0 --> 1

Node 184:
All trees:
Char. 126: 0 --> 1
Char. 158: 1 --> 0
Char. 247: 0 --> 1
Char. 305: 0 --> 2
Char. 376: 0 --> 1
Char. 509: 0 --> 1

Node 185:
All trees:
Char. 140: 0 --> 1
Char. 315: 1 --> 0
Char. 316: 0 --> 3
Char. 333: 0 --> 1
Char. 380: 0 --> 1
Char. 521: 4 --> 1

Node 186:
All trees:
Char. 95: 0 --> 1
Char. 317: 0 --> 2
Char. 337: 0 --> 1

Node 187:
All trees:
Char. 197: 1 --> 0
Char. 363: 2 --> 1

Node 188:
All trees:
Char. 224: 0 --> 1
Char. 258: 1 --> 0

Node 189:
All trees:
Char. 58: 0 --> 1
Char. 100: 2 --> 1
Char. 147: 1 --> 0
Char. 262: 1 --> 0
Char. 522: 0 --> 1

Node 190:

All trees:
Char. 40: 0 --> 1
Char. 44: 0 --> 1
Char. 134: 0 --> 1
Char. 171: 0 --> 1
Char. 202: 0 --> 1
Char. 322: 0 --> 1
Char. 326: 0 --> 1
Char. 332: 0 --> 2
Char. 508: 0 --> 1
Char. 515: 1 --> 0
Char. 516: 0 --> 1

Node 191:
All trees:
Char. 29: 0 --> 1
Char. 95: 1 --> 0
Char. 174: 0 --> 1
Char. 212: 1 --> 0
Char. 223: 0 --> 1
Char. 311: 0 --> 1
Char. 367: 0 --> 1
Char. 370: 1 --> 2
Char. 486: 0 --> 1

Node 192:
All trees:
Char. 331: 0 --> 1
Char. 332: 2 --> 1

Node 193:
All trees:
Char. 315: 0 --> 1
Char. 318: 0 --> 1
Char. 360: 0 --> 1
Char. 361: 0 --> 1

Node 194:
All trees:
Char. 5: 1 --> 0
Char. 54: 1 --> 0
Char. 321: 0 --> 1

Node 195:
All trees:
Char. 316: 0 --> 3
Some trees:
Char. 521: 0 --> 1
Char. 523: 0 --> 1

Node 196:
All trees:
Char. 100: 2 --> 1
Char. 119: 0 --> 1
Char. 140: 1 --> 0
Char. 353: 1 --> 3

Node 197:
All trees:
Char. 112: 0 --> 1
Char. 519: 2 --> 0

Node 198:
All trees:
Char. 60: 0 --> 1
Char. 99: 0 --> 2
Char. 171: 0 --> 1

Node 199:
All trees:
Char. 97: 0 --> 1
Char. 102: 1 --> 0
Char. 512: 0 --> 1
Char. 514: 0 --> 1

Node 200:
All trees:
Char. 316: 3 --> 0
Char. 360: 0 --> 1
Char. 521: 1 --> 0

Node 201:
All trees:
Char. 314: 0 --> 1

Node 202:
All trees:
Char. 318: 0 --> 1
Char. 331: 0 --> 1
Char. 332: 0 --> 1
Char. 520: 0 --> 1

Node 203:
All trees:
Char. 311: 0 --> 1
Char. 316: 3 --> 1
Char. 324: 1 --> 0
Char. 329: 0 --> 2

Node 204:
All trees:
Char. 62: 1 --> 2
Char. 117: 1 --> 0
Char. 194: 1 --> 0
Char. 210: 0 --> 1
Char. 300: 1 --> 0
Char. 511: 0 --> 1

Node 205:
All trees:
Char. 98: 1 --> 0
Char. 306: 0 --> 1
Char. 355: 0 --> 1
Char. 356: 0 --> 1
Char. 360: 0 --> 1
Char. 375: 0 --> 1

Node 206:
All trees:
Char. 11: 0 --> 1

Char. 145: 0 --> 1
Char. 149: 0 --> 1
Char. 317: 0 --> 1
Char. 333: 0 --> 1
Char. 341: 1 --> 0
Char. 353: 0 --> 2
Char. 502: 0 --> 1

Node 207:
All trees:
Char. 49: 0 --> 1
Char. 135: 1 --> 0
Char. 148: 1 --> 0
Char. 304: 1 --> 0
Char. 354: 1 --> 2
Char. 360: 1 --> 0
Char. 361: 1 --> 0
Char. 368: 1 --> 0
Char. 370: 0 --> 1

Node 208:
All trees:
Char. 30: 2 --> 1
Char. 40: 1 --> 0
Char. 95: 0 --> 1
Char. 120: 0 --> 1
Char. 139: 0 --> 1
Char. 142: 1 --> 0
Char. 147: 0 --> 1
Char. 240: 0 --> 1
Char. 289: 3 --> 0
Char. 403: 1 --> 0
Char. 446: 1 --> 0
Char. 497: 0 --> 1
Char. 498: 0 --> 1
Char. 499: 0 --> 1

Node 209:
All trees:
Char. 210: 0 --> 1
Char. 494: 0 --> 1

Node 210:
All trees:
Char. 63: 0 --> 1
Char. 141: 0 --> 1
Char. 220: 0 --> 1
Char. 249: 0 --> 1
Char. 266: 0 --> 1
Char. 352: 0 --> 1
Char. 490: 0 --> 1

Node 211:
All trees:
Char. 11: 1 --> 0
Char. 62: 2 --> 1
Char. 216: 0 --> 1
Char. 248: 0 --> 2
Char. 501: 0 --> 1

Node 212:
All trees:
Char. 25: 0 --> 1
Char. 53: 0 --> 1
Char. 99: 0 --> 1
Char. 151: 0 --> 1
Char. 189: 0 --> 1
Char. 210: 1 --> 0
Char. 270: 1 --> 0
Char. 362: 0 --> 1
Char. 372: 0 --> 1

Node 213:
All trees:
Char. 98: 0 --> 1
Char. 309: 0 --> 1
Char. 491: 2 --> 1
Char. 502: 1 --> 0

Node 214:
All trees:
Char. 156: 1 --> 0
Char. 159: 0 --> 1
Char. 175: 0 --> 1
Char. 287: 1 --> 0
Char. 363: 2 --> 4
Char. 374: 1 --> 0
Char. 375: 1 --> 0
Char. 500: 1 --> 2
Char. 511: 1 --> 0

Node 215:
All trees:
Char. 133: 1 --> 0
Char. 354: 1 --> 2