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A new barusuchid (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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“[…] Man selects only for his own good; Nature only for that of the being which she tends”

Charles Darwin (1859)

RESUMO

Os Baurusuchidae compõem um grupo de notossuquios do Cretáceo Superior da América do Sul. São caracterizados por possuírem rostro curto e alto, número de dentes reduzidos e ziphodontes, e caninos hipertrofiados. Nesse estudo, nós descremos um novo baurusuquídeo da Formação Adamantina (Grupo Bauru), no sudeste brasileiro. O novo táxon consiste de um fragmento da porção direita de um crânio, e elementos do teto craniano, fragmentos do palato secundário e do maxilar inferior, assim como, seis dentes desarticulados. O novo espécime corresponde ao Gênero *Aphaurosuchus*, devido a presença de uma depressão posterior do nasal e a crista infraorbital do jugal voltada para cima. A espécie *Aphaurosuchus kaiju* foi determinada com base em caracteres que a distinguem do *Aphaurosuchus escharafacieis*, assim como uma profunda depressão do frontal, uma depressão longitudinal na linha media do frontal, presença de uma crista contida na depressão do frontal, e um parietal sem projeção posterior sobre a fenestra supratemporal. Para entender a posição filogenética do *Aphaurosuchus kaiju* entre os baurusuquídeos, bem como as afinidades taxonômicas de supostos baurusuquia recém descritos e revisados, realizamos uma análise filogenética atualizada que combinou as informações sobre os Baurusuchia das três matrizes mais atualizadas e independentes disponíveis. Recuperamos as duas principais linhagens de Baurusuchidae, Pissarrachampsinae e Baurusuchinae conforme proposto originalmente. Adicionalmente, recuperamos *Ogresuchus furatus* e *Razanandrongobe sakalavae* como baurusuquia não baurusuquídeos. A nova posição filogenética para esses dois táxons aumenta a distribuição espacial e o alcance temporal de Baurusuchia

Palavras chave: *Aphaurusuchus*. Baurusuchidae. Baurusuchia. Adamantina Formation. Bauru Basin.

ABSTRACT

Baurusuchidae is a group of notosuchian crocodyliforms ubiquitous in the Late Cretaceous deposits in South America. This group is distinguished by dog-faced skulls, with reduced teeth rows, and hypertrophied canines. In this study, we describe a new bauruschid from the Adamantina Formation (Bauru Group), in the southeast Brazil. The new taxon consists of a partial right portion of a skull, and cranial roof elements, fragments of the secondary palate and the lower jaw, as well as, six disarticulated teeth. The new specie is assigned to the Genus *Aphaurosuchus* due to the presence of a posterior depression on the nasal and the upturned infraorbital jugal ridge. The new species *Aphaurosuchus spp.* was erected based on characters that distinguish it from *Aphaurosuchus escharafacies*, such as a large depression on the frontal, a midline longitudinal depression on the frontal, the presence of a crest concealed in the frontal longitudinal depression, and a smooth parietal near the supratemporal fenestrae. To understand the phylogenetic position of *Aphaurosuchus spp.* among baurusuchids, as well as the taxonomical affinities of newly described and recently revised putative baurusuchians, we performed an updated phylogenetic analysis that combined the information about the baurusuchians from three most up to date and independent matrixes available. We recovered the two main lineage of Baurusuchidae, Pissarrachampsinae and Baurusuchinae as originally proposed. Additionally, we recovered *Ogresuchus furatus* and *Razanandrongobe sakalavae* as non-baurusuchids baurusuchians. The novel phylogenetic position for these two taxa increases the spatial distribution and the temporal range of Baurusuchia.

Keywords: *Aphaurusuchus*. Baurusuchidae. Baurusuchia. Adamantina Formation. Bauru Basin.

LIST OF FIGURES

Figure 1 – Map of Bauru Basin. 14

Figure 2 –. Cranial reconstruction of *Aphaurosuchus spp.* 17

Figure 3 – *Aph.* s*pp.* cranial bones. 19

Figure 4 – *Aph. spp.* cranial fragments. 23

Figure 5 – *Aph. spp.* teeth. 27

Figure 6 – The ziphodont teeth of *Aph. spp.* 28

Figure 7 – Frontal of Baurusuchidae. 31

Figure 8 – Jugal of Baurusuchidae. 33

Figure 9 – Parietal of Baurusuchidae. 35

Figure 10 – Nasal of Baurusuchidae. 37

Figure 11 – Cladogram depicting phylogenetic relationships. 43

LIST OF INSTITUTIONAL ABBREVIATIONS

CPP Centro de Pesquisas Paleontológicas L. I. Price, Universidade Federal do Triângulo Mineiro (UFTM), Uberaba, Brazil

DGM Diretoria de Geologia e Recursos Minerais, Rio de Janeiro, Brazil

DNPM Departamento Nacional de Produção Mineral, Rio de Janeiro, Brazil

LPRP-USP Laboratório de Paleontologia de Ribeirão Preto-USP, Ribeirão Preto, Brazil

MOZ-PV Museo Profesor-Dr. Juan Augusto Olsacher, Zapala, Argentina

MPMA Museu de Paleontologia de Monte Alto, Monte Alto, Brazil

MZSP-PV Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil

UFRJ DG Coleção de Paleontologia de Vertebrados da Universidade Federal do Rio de Janeiro no Rio de Janeiro, Rio de Janeiro, Brazil.

SUMMARY

1	**INTRODUCTION**	12
2	**MATERIALS AND METHODS**	15
2.1	**Collection and preparation**	15
2.2	**Phylogenetic analysis**	15
3	**RESULTS**	16
3.1	**Systematic paleontology**	16
3.2	**Description**	18
4	**DISCUSSION**	29
4.1	**Character evolution within Baurusuchidae**	29
4.2	**Phylogenetic relationships**	38
4.2.1	The genus *Aphaurosuchus*	38
4.2.2	Sphagesauria, Baurusuchia and *Pakasuchus*	38
4.2.3	Baurusuchia	39
4.2.4	Baurusuchidae	40
4.2.5	Phylogenetic relationships within Baurusuchidae	41
4.3	**Distribution of Baurusuchia**	44
5	**CONCLUSION**	45
	REFERENCES	46
	SUPPLEMENTARY MATERIAL	51
1	**DETAILS OF THE PHYLOGENETIC ANALYSIS**	51
1.1	**Characters and taxon sampling**	51
1.2	**Character list**	51
1.3	**List of taxa included in the phylogenetic analysis**	84
1.4	**Institutional Abbreviations**	90
1.5	**Data Matrix**	91
1.6	**Tree search strategy**	119
1.7	**Support measurements**	119
1.8	**Synapomorphies list**	123

1. INTRODUCTION

The Cretaceous period in Gondwana is known by the presence of a great diversity of a peculiar group of fossil Crocodyliformes, the Notosuchia (sensu Ruiz et al., 2021, Turner and Sertich, 2010; Pol et al., 2012; Pol and Leardi, 2015). This group presents a wide range of anatomical modifications and potentially paleobiology, that could have rivaled with modern terrestrial mammals (O'Connor et al., 2010; Ösi, 2013; Godoy et al., 2014; Melstrom and Irmis, 2019; Montefeltro et al., 2020). Notosuchians are found in most continental mass that once formed Gondwana, including continental Africa (Buffetaut, 1994; Gomani, 1997; Larsson & Sidor, 1999; Sereno et al., 2003; Sereno & Larsson, 2009; O'Connor et al., 2010), Madagascar (Buckley & Brochu, 1999; Buckely *et al*., 2000) and Pakistan (Wilson et al. 2001). However, the greatest diversity of the group is from Cretaceous deposits from South America (Bonaparte et al., 1991; Bronzati et al., 2015, Pol and Leardi, 2015), mostly from the Bauru Basin, in south-central Brazil, in which more than twenty species of various lineages of notosuchians were formally described, such as Peirosauridae (Carvalho, Ribeiro & Avila 2004; Carvalho, Vasconcellos & Tavares, 2007; Campos et al., 2011; Iori & Garcia, 2012), Sphagesauridae (Price, 1950; Pol, 2003; Nobre & Carvalho, 2006; Andrade & Bertini, 2008; Marinho & Carvalho, 2009; Iori & Carvalho, 2011; Pinheiro et al., 2021, Ruiz et al., 2021) and Baurusuchidae (Price, 1945; Campos et al., 2001; Carvalho et al., 2004; Nascimento & Zaher, 2010; Carvalho et al., 2011; Montefeltro et al., 2011; Marinho et al., 2013; Godoy et al., 2014; Darlim et al., 2021).

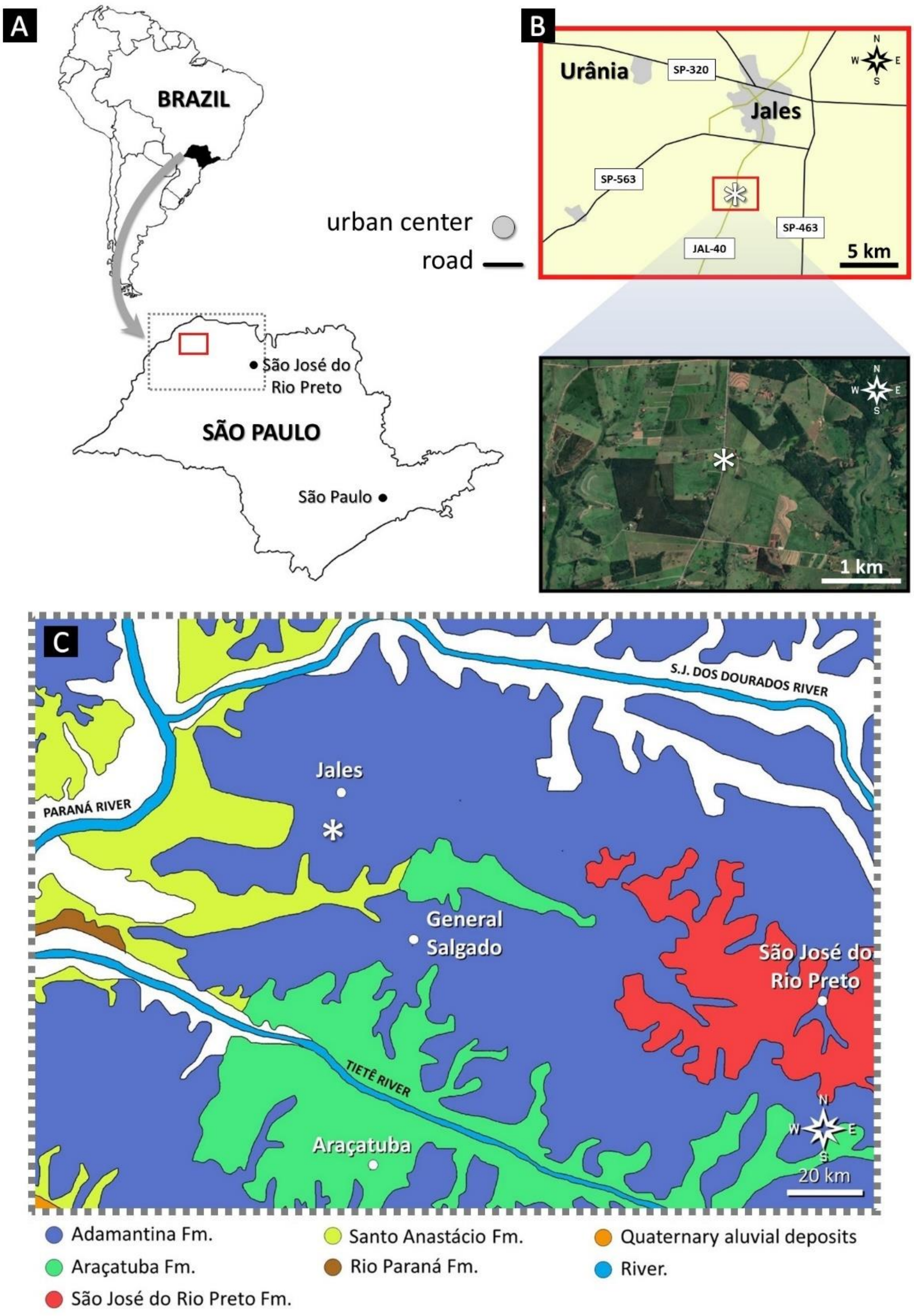
The Adamantina Formation (Late Cretaceous, Bauru Basin) corresponds to one of the most important continental fossiliferous deposits of this period, and shows a unique ecosystem, potentially dominated by Crocodyliformes (Bronzati et al., 2015, Leardi and Pol, 2015, Montefeltro et al., 2020, contra Bandeira et al., 2018). The clade Baurusuchidae (sensu Darlim et al., 2021) corresponds to a major group of notosuchians mostly restricted to this Formation, from which eight out of ten species (Price, 1945; Campos et al., 2001; Carvalho et al., 2004; Nascimento & Zaher, 2010; Carvalho et al., 2011; Montefeltro et al., 2011; Marinho et al., 2013; Godoy et al., 2014; Darlim et al., 2021). The baurusuchids are characterized by having short and deep rostra, reduced dental series with the ziphodont morphotype, and hypertrophied caniniform (Price 1945, Montefeltro et al., 2011, 2020). These characters suggest that this group represented one of the apex predators in this ecosystem (Montefeltro et al., 2011, 2020; Riff and Kellner, 2011; Godoy et al., 2016, 2018), including the direct evidence of predation on others Crocodyliformes (Godoy et al., 2014).

Baurusuchidae is known since the late XIX century (Woodward, 1896), however in the last 20 years the knowledge of the group has greatly increased, with the description of additional taxa, and the investigation of its phylogeny, evolution and paleobiology (Campos et al., 2001; Carvalho et al., 2004; Nascimento & Zaher, 2010; Carvalho et al., 2011; Montefeltro et al., 2011, 2020; Marinho et al., 2013; Godoy et al., 2014, 2016, 2018; Darlim et al., 2021). The past decade witness a significant increase in diversity of Baurusuchidae, and just one phylogenetic matrix was published focusing on the group (Montefeltro et al., 2011, expanded in Godoy et al., 2014 and Darlin et al., 2021). However, despite the reduced number of phylogenetic analyses that included a greater number of baurusuchids, the results are not convergent, in particular, the monophyly and the internal relationships of the putative main lineages of the group (Pissarrachampsinae and Baurusuchinae, Montefeltro et al., 2011, sensu Darlim et al., 2021). The discrepancies among phylogenetic results are clearer comparing the results of large-scale matrixes (Leardi et al., 2018; Pinheiro et al., 2018; Gerotto & Betertini, 2018; Martinelli et al., 2018, Pinheiro et al. 2021, Ruiz et al. 2021), in which the main baurusuchid lineages are recovered encompassing different arrays of taxa.

The core problem with the baurusuchid phylogeny is that the matrices focusing on its internal relationship do not include other relevant notosuchians. On the other hand, the analyses with broader sampling within Crocodyliformes, include fewer of baurusuchids (Leardi et al., 2018; Pinheiro et al., 2018; Gerotto & Betertini, 2018; Martinelli et al., 2018) and a reduced number of characters that are important for its internal relationships.

Here, we describe a fragmentary skull (LPRP/USP 0634) of a new baurusuchid collected in an outcrop of the Adamantina Formation, Bauru Group, in Northwestern São Paulo (Figure 1), and review the relationships of baurusuchids in a large-scale notosuchian phylogeny.

Figure 1. Type locality of LPRP/USP 0634. **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 LPRP/USP 0634 was found; **C,** surface exposure of Bauru Basin rocks around the locality where LPRP/USP 0634 was found (marked with an asterisk).



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

2. MATERIAL AND METHODS

2.1. Collection and preparation

The specimen described here (LPRP/USP 0634) is housed at the collection of the Laboratório de Paleontologia de Ribeirão Preto-USP (LPRP/USP), Ribeirão Preto, São Paulo, Brazil. The field work that resulted in its collection was carried out in accordance with Agência Nacional de Mineiração – ANM, as required by the Brazilian legislation (ordinance number 4.146 from March 4th, 1942). The fossil was mechanically prepared using pin vice and pneumatic tolls at the LPRP/USP.

2.2. Phylogenetic analysis

The new specimen was included in the dataset of Ruiz et al. (2021), which encompasses a great diversity of mesoucrocodylians, including most notosuchian taxa, and a vast sample of cranial and postcranial characters. This matrix was expanded with the inclusion of eight taxa, 7 bauruschids: *Aplestosuchus sordidus* (Godoy et al., 2014), *Aphaurosuchus* e*scharafacies* (Darlim et al., 2021), *Baurusuchus albertoi* (Nascimento & Zaher, 2010), *Campinasuchus dinizi* (Carvalho et al., 2011), *Gondwanasuchus scrabrosus* (Marinho et al., 2013), *Pabwehshi pakistanensis* (Wilson et al., 2001) and *Wargosuchus australis* (Martinelli & Pais, 2008), as well as, two taxa with putative close relationships to baurusuchians: *Ogresuchus furatus* (Sélles et al., 2020) and *Razanandrongobe sakalavae* (Maganuco et al., 2006; Dal Sasso et al., 2017). We also expanded the matrix to include 15 characters (508-521, see the supplementary material). Among the included characters, three (515-518) are newly proposed, three (509, 510, 518) are from the dataset of Pol et al. (2014), four (511-514) are from the dataset of Geroto & Bertini (2018), and four (97, 519-521) are from the dataset of Darlim et al. (2021). The final data matrix is composed of 108 taxa and 521 characters, and was analyzed using equally weighted parsimony in TNT 1.5 (Goloboff & Catalano 2016), via a heuristic search (10,000 replicates). Tree Bisection Reconnection (TBR) was applied for branch swapping, saving 20 cladograms per round, and random seed was set as “0”. The trees were collapsed after each replicate, and the Most Parsimonious Trees were combined in a strict consensus tree.

3. RESULTS

3.1. Systematic palaeontology

Crocodyliformes Hay, 1930 (by subsequent designation by Clark, 1986)

Mesoeucrocodylia Whetstone and Whybrow, 1983

Notosuchia Ruiz et al. (2021)

Baurusuchia Darlim et al. (2021)

Baurusuchidae Darlim et al. (2021)

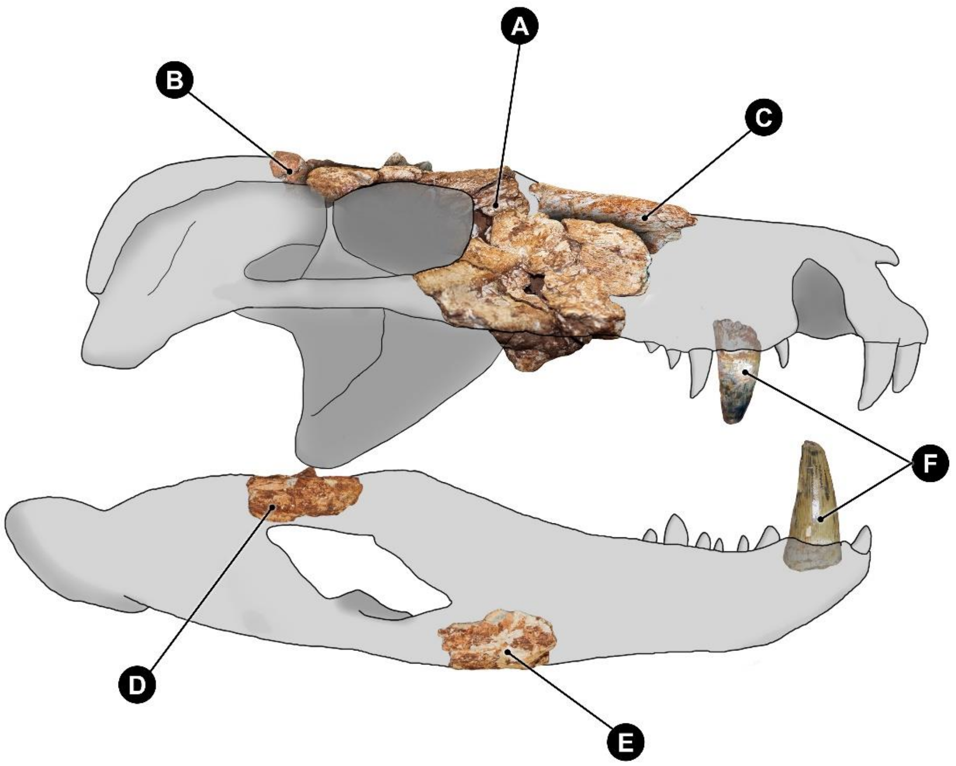
Aphaurosuchus Darlim et al. (2021)

Type-species: *Aphaurosuchus escharafacies*

Diagnosis of the genus: Baurusuchid that differs from other Crocodyliformes by the presence of a depression on the posterior portion of nasal, bearing a distinct longitudinal ridge; the jugal infraorbital ridge (sensu Montefeltro et al., 2011) upturned; and the absence of foramina flanking the medial contact of palatines.

Aphaurosuchus spp.nov. (Figure 2)

Figure 2. Reconstructed skull of *Aphaurosuchus. spp. novae* LPRP/USP 0634. **A,** Portion with maxilla, jugal, lacrimal, anterior and posterior palpebral; **B,** Portion with the frontal and the parietal (the projected structure above the line of the orbit is the result of the fragmentation of the specimen and not a real feature of the taxon); **C,** Fragment with the nasal, the contact between the prefrontals, the anterior projection of the anterior palpebral and; **D,** Fragmentary angular; **E,** Fragment with the triple contact between the dentary, angular and splenial; **F,** The hypertrophied caniniforms.



(Source: the author)

Holotype: LPRP/USP 0624 includes parts of the right portion of a skull, with cranial roof elements, fragments of the secondary palate, fragments of the lower jaw and six disarticulated teeth.

Type locality: A roadside outcrop at 9,6 km south of Jales, north-western São Paulo State, Brazil (20º20'34"S 50º33'57"W).

Stratigraphic horizon: Adamantina Formation, Bauru Group (Fig. 1); Late Cretaceous (ca. Coniacian-Campanian) of the Bauru Basin (Castro et al., 2018).

Diagnosis: Baurusuchid that differs from other Crocodyliformes by the following unique set of traits (autapormorphies marked with asterisks): a longitudinal depression on the anterior portion of the frontal; frontal with a longitudinal depression deeper at its posterior portion*; a robust jugal infraorbital ridge with the same thickness along its preserved length*; presence of a crest on the nasal midline; depression on nasal with a rugose surface; posterior portion of the parietal smooth, without the hypertrophied border overhanging the supratemporal fenestrae *.

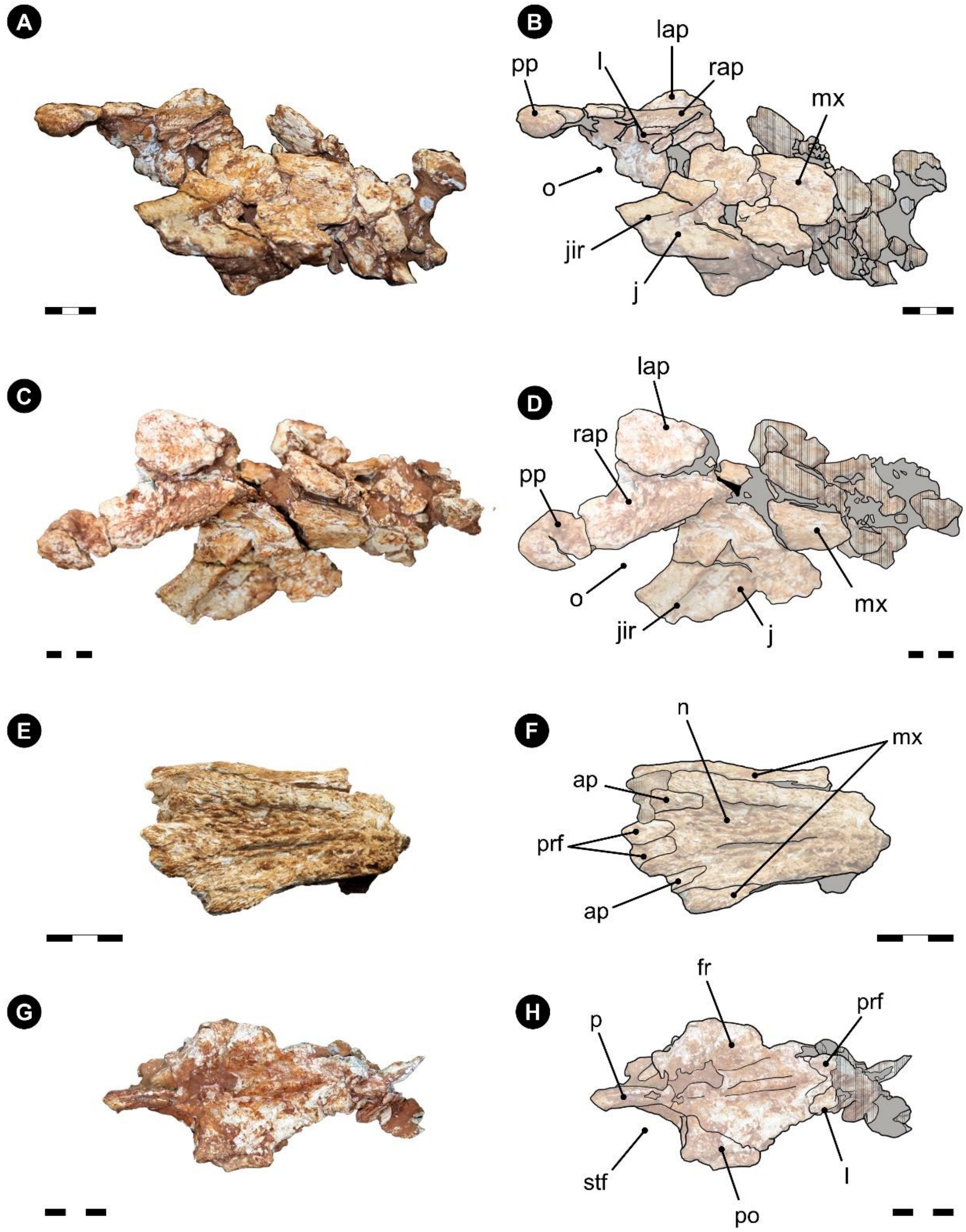
3.2. Description

Cranium

The description is based on the cranial elements LPRP/USP 0634 (Figures 3, 4 and 5). The holotype, and only know specimen, consists mostly of fragments of the right side of the skull, with a portion of the snout and six isolated teeth. The preserved right elements of the cranium consist of the anteriormost portion of the jugal, disarticulated fragments of the maxilla, the lacrimal, as well as the anterior and posterior palpebrals. The specimen also contains an almost complete frontal, several fragments of the prefrontal, the postorbital, the anteriormost and posteriormost portions of the parietal, the posterior portion of the nasal, and a fragment of the lower jaw that contains the triple contact between dentary, splenial and angular, and another fragment of the angular (Figures 3 and 4).

In dorsal view, the preserved portions of the specimen suggest a general shape of the skull similar to other baurusuchids. The external surfaces of most preserved dermal bones are ornamented with ridges and irregular pits. These ornamentations are more evident on the anteriormost portion of the jugal, on the posterior portion of the nasal and on the anterior portion of the frontal.

Figure 3. *Aphaurosuchus spp*. nov. (LPRP/USP 0634, holotype) and interpretative drawings. **A** and **B,** right lateral view; **C, D, E, F, G and H**, dorsal view. The grey and hatched areas indicate the presence of matrix and broken surfaces. **Abbreviations: ap,** anterior palpebral; **fr,** frontal; **j,** jugal; **jir,** jugal infraorbital ridge; **l,** lacrimal; **lap,** left anterior palpebral; **mx,** maxillae; **n,** nasal; **o,** orbit; **p,** parietal; **po,** postorbital; **prf,** prefrontal; **pp,** posterior palpebral; **rap,** right anterior palpebral; **stf,** supratemporal fenestrae. Scale bar: 3cm.



(Source: the author)

Only the anteroventral portion of the right orbit is preserved in LPRP/USP 0634 (Figure 3.A-B). The dorsal portion of the orbit is delimited by the anterior and posterior palpebrals. On the anterior portion, the orbit is delimited by fragments of the lacrimal and the jugal. The jugal also forms the ventral border of orbit. Due to the fragmentation of the specimen is not possible to assess the exact shape for the orbit. However, the preserved portion suggests a similar orbit to other baurusuchids, with an oval to circular shape. The preserved portion of the orbit is anterolaterally oriented, with the ventral border laterally displaced in relation to the dorsal one. The supratemporal fenestrae are not complete. The preserved portion of the fenestrae is restricted to the anteromedial portion on the right side of the cranium, including the contact between the frontal and the parietal. The parietal also delimits the medial margin and the posterior corner of the right supratemporal fenestra. The specimen shows two distinct supratemporal fenestrae (sensu Montefeltro et al., 2011), the external supratemporal fenestra and the internal supratemporal fenestra. Between the right external and internal supratemporal fenestrae there is a well-developed supratemporal fossa (sensu Montefeltro et al., 2011) the same condition present in other baurusuchids (Campos et al., 2001; Carvalho et al., 2004; Montefeltro et al., 2011; Marinho et al., 2013; Godoy et al., 2014; Darlim et al., 2021).

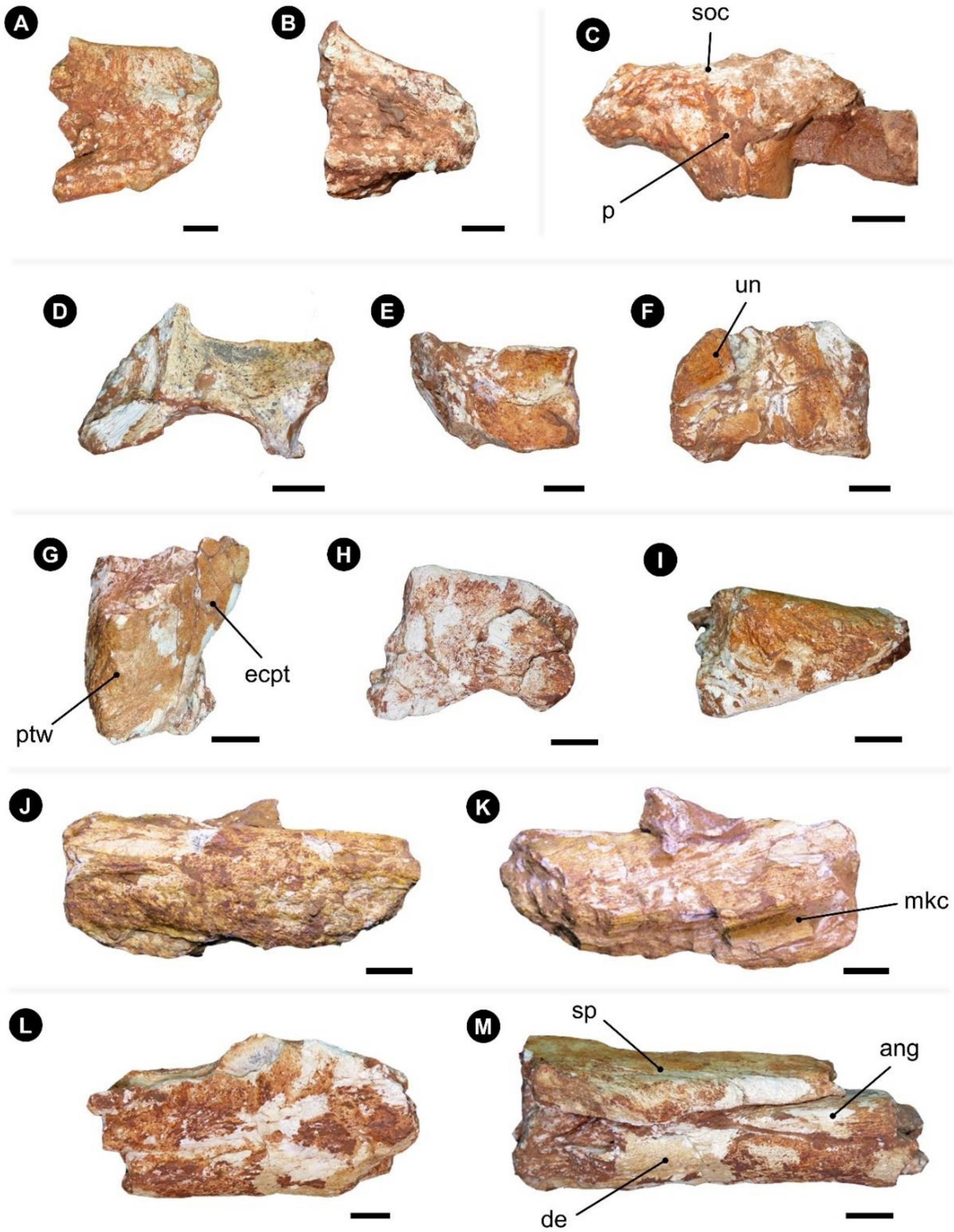
The prefrontals in LPRP/USP 0634 (Figure 3. E-F) are mostly preserved with a distinct medial contact between the prefrontal pair near the posterior portion of the nasal. This contact at medial edge of the prefrontals excludes the contact between nasal and frontal in LPRP/USP 0634. Despite this feature, it is not possible to infer the exact length of the medial contacts between the prefrontals.

The frontals of LPRP/USP 0634 (Figure 3.G-H) are fused into a single element and almost completely preserved. The frontal has a triangular shape, as in other Baurusuchidae (Campos et al., 2001; Carvalho et al., 2004; Montefeltro et al., 2011; Marinho et al., 2013; Godoy et al., 2014; Darlim et al., 2021). The frontal tapers anteriorly and wedges between the posterior margins of the prefrontals, widening the posterior portion posteriorly. The lateral edges of the frontal are medially curved near the contacts with the palpebrals. On its posterior portion, the frontal contacts the parietal in a nearly transverse suture, and contacts the postorbital posterolaterally. The postorbital also forms with the frontal the anterior margin of the internal and external supratemporal fenestrae and fossa.

The outer surface of the frontal is mostly smooth and only few ornaments are present next to the lateral margins on the orbital rim. On the midline portion, the frontals bear a sagittal crest, also present on the frontal midline of *Aplestosuchus sordidus* (Godoy et al., 2014), *Pissarrachampsa sera* (Montefeltro et al., 2011), *Baurusuchus salgadoensis* (Carvalho et al., 2004) and *Stratiotosuchus maxhechti* (Campos et al., 2001). The sagittal crest in LPRP/USP 0634 extends from the level of the posteriormost extension of the prefrontal to the medial portion of the frontal midlenght. Along its extension, the midline frontal crest presents variable width, being tapered at both ends, and being more developed at its midlenght section. LPRP/USP 0634 shows a transversally bowed depression on the dorsal surface of the frontal, similar to *B. salgadoensis* (Carvalho et al., 2004), *S. maxhecthi* (Campos et al., 2001) and *A. escharafacies* (Darlim et al., 2021). However, in LPRP/USP 0634 this dorsal depression, becomes wider and deeper posteriorly. The frontal depression shows a unique condition in LPRP/USP 0634, being much deeper than in other taxa, and three times deeper than the sagittal crest. In this configuration, the frontal sagittal crest is completely contained within the frontal depression. Additionally, the frontal depression in LPRP/USP 0634 is deeper posteriorly, whereas in the others bauruschids, this depression has roughly the same depth thoroughly (Campos et al., 2001; Carvalho et al., 2004; Montefeltro et al., 2011; Marinho et al., 2013; Godoy et al., 2014; Darlim et al., 2021).

Three fragments of the jugal are preserved in LPRP/USP 0634. The largest fragment corresponds to the anteriormost portion of the right jugal (Figure 3.A-B). The jugal is transversally narrow and expands dorsoventrally. The anterior ramus of the jugal, forms the ventral margin of the orbit. Due to the fragmentation and disarticulation of the skull, it is not possible to precisely assess the contact of the jugal with both the maxilla and the lacrimal. However, there are some traits that indicate that the jugal contacts the posterior margin of the maxilla at the anterior margin of the orbit, and contacts the lacrimal on the level of the anterior margin of the orbit. On its outer lateral surface, a hypertrophied longitudinal infraorbital ridge (sensu Montefeltro et al., 2011) is present, which extends posteroventrally from the lacrimal suture to the jugal suborbital portion posteriorly. This condition is also seen in the others baurusuchids (Carvalho et al., 2004; Nascimento & Zaher, 2010; Montefeltro et al., 2011; Marinho et al., 2013; Godoy et al., 2014; Darlim et al., 2021), in which the ridge extends posteroventrally until the infraorbital ramus of the jugal. In the LPRP/USP 0634, the infraorbital ridge is robust and presents the same development on the entire preserved length, from the region next to the lacrimal contact to the ventral portion of the orbit. This condition present in LPRP/USP 0634 differs from other baurusuchids in which the infraorbital ridge is restricted anteriorly (Carvalho et al., 2004; Nascimento & Zaher, 2010; Montefeltro et al., 2011; Marinho et al., 2013; Godoy et al., 2014; Darlim et al., 2021). The infraorbital ridge separates the jugal bone in dorsal and ventral portions. The dorsal one forms the ventral margin of the orbit and it is narrower than the ventral portion. The ventral portion shows a shallow fan-shaped depression (sensu Monfeltro et al., 2011), with a series of three neurovascular foramina at its ventralmost part. Additionally, two other isolated fragments of the jugal are preserved (Figure 4. A-B) and correspond to the infraorbital portion of the left jugal. Due to the fragmentation, it is not possible to assess the details of the anatomy on these fragments. However, it is possible to assess the ventral margin of the left orbit and the presence of the infraorbital ridge on both fragments.

Figure 4. Cranial fragments of *Aphaurosuchus spp*. **A,** fragment of the jugal in lateral view; **B,** fragment of the jugal near the border of the orbit in lateral view; **C,** parietal and supraoccipital in dorsal view; **D,** ectopterygoid posterior view; **E,** ectopterygoid in right lateral view; **F,** ectopterygoid in left lateral view; **G,** pterygoid wing in dorsal view; **H,** pterygoid wing in ventral view; **I,** pterygoid wing in lateral view; **J,** surangular in lateral view; **K,** surangular in ventral view; **L,** dentary in lateral view; **M,** triple contact of dentary, angular and splenial. **Abbreviations**: **ang**, angular; **de**, dentary; **ecpt**, ectopterygoid; **mkc**, meckelian canal; **p**, parietal; **ptw**, pterygoid; **soc**, supraoccipital; **sp**, splenial; **un** unidentified bone fragment. Scale bar: 1 cm.



(Source: the author)

In LPRP/USP 0634, only a small fragment of the lacrimal is preserved on the right side of the cranium, which is restricted to the anterodorsal orbital edge (Figure 3. A-B). The lacrimal contacts the anterior palpebral by a nearly horizontal suture, forming a lateral platform for the support of the anterior palpebral dorsally. Despite its fragmentary nature, it is possible to infer that the lacrimal articulated with the anterior process of the jugal at the anterior border of the orbit, and the posterior edge of the maxilla anterior to the orbit, consistent with the anatomy of other baurusuchids (Campos et al., 2001; Carvalho et al., 2004; Carvalho et al., 2011; Montefeltro et al., 2011; Godoy et al., 2014; Darlim et al., 2021).

The maxillae are highly fragmentated in LPRP/USP 0634, with only the posterior portion of the right bone identified in its original position (Figure 3). This fragment presents a nearly vertical orientation on the lateral surface of the rostrum. The maxillae contact the jugal posteriorly and the lacrimal at the level of the anterior palpebral. Due to the fragmentation, it is not possible to trace the exact articulation between the maxilla and the lacrimal and the jugal. However, we suggest that the maxillae do not participates on the orbital margin, as seen in other baurusuchids (Price 1945; Campos et al., 2001; Carvalho et al., 2004; Carvalho et al., 2011; Montefeltro et al., 2011; Godoy et al., 2014; Darlim et al., 2021). The other maxillary fragments are preserved articulating with the lateral portion of the nasal, comprising the sidewalls of the snout. Thus, the maxillae do not appear to have a great participation on the dorsal surface of the skull, at least on the posterior portion of the rostrum, at the level of the posterior margin of the nasal.

The nasal of the LPRP/USP 0634 is represented by one large fragment (Figure 3. E-F) corresponding to the dorsal surface of the posterior portion of the bone, close to the contact with the prefrontals. The preserved bone is laminar and anteroposteriorly elongated, forming the median section of the dorsal portion of the rostrum. The left lateral edge of the nasal indicates an anterior tapering of this bone, which means that the posterior portion is wider than the anterior one, as in other baurusuchids (Carvalho et al., 2004; Carvalho et al., 2011; Montefeltro et al., 2011; Marinho et al., 2013; Godoy et al., 2014; Darlim et al., 2021). On the lateral edges, the nasal contacts the maxillae, while the posterior portion of the bone contacts an anterior projection of the anterior palpebral, a similar condition to *Stratiotosuchus maxhechti* (Campos et al., 2001). The nasal is limited posteriorly by the prefrontal, which prevents the nasal to contact the frontal anteriorly. On the posteromedial dorsal surface, next to the prefrontal pair, there is a slightly rugose depression. This depression is also present in pissarrachampsines (Montefeltro et al., 2011) and in *Aphaurosuchus escharafacies* (Darlim et al., 2021). In the nasal depression, there is a faint midline crest, which starts at the mid-portion of the nasal and extends posteriorly next to the level of the prefrontals anterior edges. A similar midline crest is also seen in *Aplestosuchus sordidus* (Godoy et al., 2014) and *Aph. escharafacies* (Darlim et al., 2021).

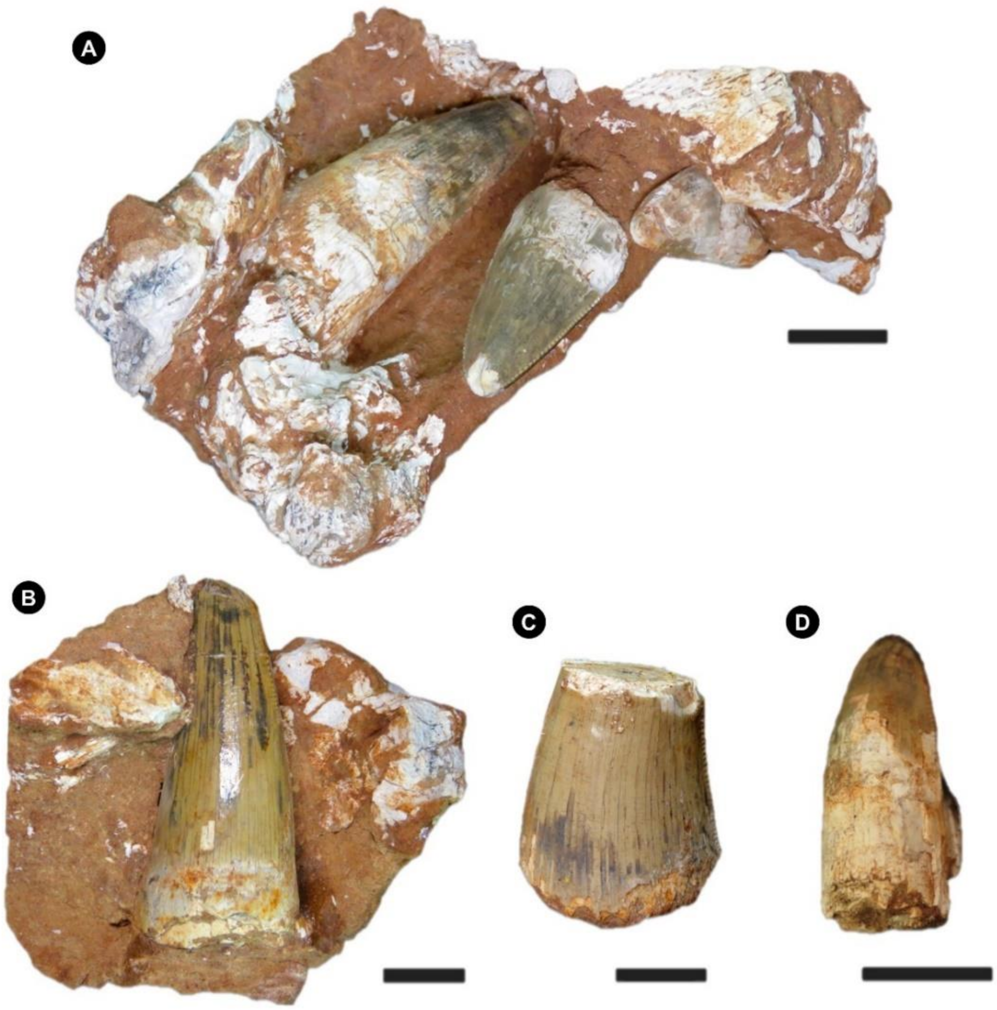
Both right palpebrals are preserved in LPRP/USP 0634 (Figure 3. C-D). The bones are thick and exhibit a strongly sculptured pattern on its dorsal surface. The anterior palpebral is dorsoventrally flattened and larger than the posterior one. The anterior palpebral bone covers the anteromedial portion of the orbit and is hook-shaped. The same condition is also present in the others baurusuchids (Campos et al., 2001; Carvalho et al., 2004; Carvalho et al., 2011; Montefeltro et al., 2011; Marinho et al., 2013; Godoy et al., 2014; Darlim et al., 2021). The anterior palpebral extends onto the lacrimal anterolateral projection, and continues posteriorly to contact the posterior palpebral. The anterior palpebral also present an anterolateral projection that contacts the nasal posteriorly. The posterior palpebral is smaller than the anterior one, and covers the posterior portion of the orbit. This bone is dorsally convex, presenting an almost rounded shape in dorsal view. As in other baurusuchids (Carvalho et al., 2004; Carvalho et al., 2011; Montefeltro et al., 2011; Marinho et al., 2013; Godoy et al., 2014; Darlim et al., 2021), LPRP/USP 0634 presents a supraorbital fenestra formed between the anterior and posterior palpebrals. However, due to fragmentation, it is not possible to define the exact shape of the fenestra. The left anterior palpebral is also preserved, this fragment is displaced from its original position, covering part of the left prefrontal.

There are two preserved fragments of the parietal in LPRP/USP 0634. One larger fragment, corresponds to the anteriormost portion of the bone and forms the interfenestral bar between the supratemporal fenestrae (Figure 3.G-H). The parietal articulates anteriorly to the posterior portion of the frontal, along a nearly transverse suture at the dorsal cranial roof. The other fragment of the parietal corresponds to the posterior limit of the bone, which is firmly attached to the supraoccipital on a transverse suture (Figure 4.C). Additionally, the posterior portion of the parietal is smooth at the level of the supratemporal fenestrae, without a hypertrophied border overhanging the supratemporal fossa. This is a unique condition among baurusuchids, in which the parietal expands over the supratemporal fenestrae (Campos et al., 2001; Carvalho et al., 2004; Carvalho et al., 2011; Montefeltro et al., 2011; Godoy et al., 2014; Darlim et al., 2021).

The dentition of the LPRP/USP 0634 consists of six isolated teeth (Figure 5), without obvious association with specific cranial or mandibular elements. As such it is hard to identify the position along the dental series. Three preserved teeth are hypertrophied, and probably correspond to the caniniforms present in the maxillae and dentaries of baurusuchids (Montefeltro et al., 2011, 2020; Godoy et al., 2014; Darlim et al., 2021). The caniniform teeth are labiolingually compressed, posteriorly curved, with distinct, serrated denticles on mesial and distal cutting edges (true ziphodont teeth, *sensu* Prasad and Broin, 2002, Figure 6). The serrations are placed along most of the crowns distal and mesial edges. However, on the mesial margin, the serrations do not occur near the base of the teeth. The other three preserved teeth are smaller, presenting a triangular-shaped crown, without a well-marked distal curvature. These teeth also present serrated denticles on the mesial and distal cutting edges.

Only a small fragment of the left pterygoid wing is preserved in LPRP/USP 0634 (Figure 4.G). The fragment corresponds to the distal tip of the left wing. The ventral surface of the preserved fragment is slightly convex, while the facet for the articulation with the ectopterygoid is flat. On the lateral portion of the pterygoid wing, a small piece of bone is identified as a fragment of the ectopterygoid.

Figure 5. The isolated teeth of *Aphaurosuchus spp*. **A,** on the right side a hypertrophied caniniform; in the middle and in the left side, smaller teeth; **B** and **C,** hypertrophied caniniforms; **D,** a smaller tooth. Scale: 1cm.



(Source: the author)

The small fragment of the right ectopterygoid preserved in LPRP/USP 0634 (Figure 4) corresponds to the dorsolateral ramus of the bone. The fragment presents a flat articular dorsal surface, which is identified as the facet for the reception of the jugal, following the anatomy of more complete baurusuchid specimens (Price 1945; Carvalho et al., 2004; Carvalho et al., 2011; Montefeltro et al., 2011; Marinho et al., 2013; Godoy et al., 2014; Darlim et al., 2021). On the inner side, the ectopterygoid is concave and presents a small unidentified bone fragment that could be a fragment of the jugal or the palatine.

Figure 6. The serrated denticules of the teeth of *Aphaurosuchus spp.* A hypertrophied caniniform teeth in lateral view. The serrated denticules can be seen along the distal edge.

(Source: the author)

Only two fragments of the right side of the mandible are preserved on LPRP/USP 0634 (Figure 4). One fragment is composed of the region of the triple contact between the dentary, splenial and angular bones, inferred to be located near the lateroventral anterior edge of the mandibular fenestra. The dentary portion of this fragment is the outer surface of mandible, being heavily ornamented with tiny shallow pits. The inner surface is smoother, without ornamentation, and corresponds to the posterior projection of the splenial. In dorsal view, the angular contacts the dentary and the splenial with a short projection wedged between those bones. The other fragment of the lower jaw corresponds to the surangular at the dorsal portion of the mandibular fenestra. The outer surface of this fragment is sculpted with irregular grooves. In ventral view, it is possible to observe the meckelian canal, indicating the presence of the mandibular fenestrae near the level of the surangular.

4. DISCUSSION

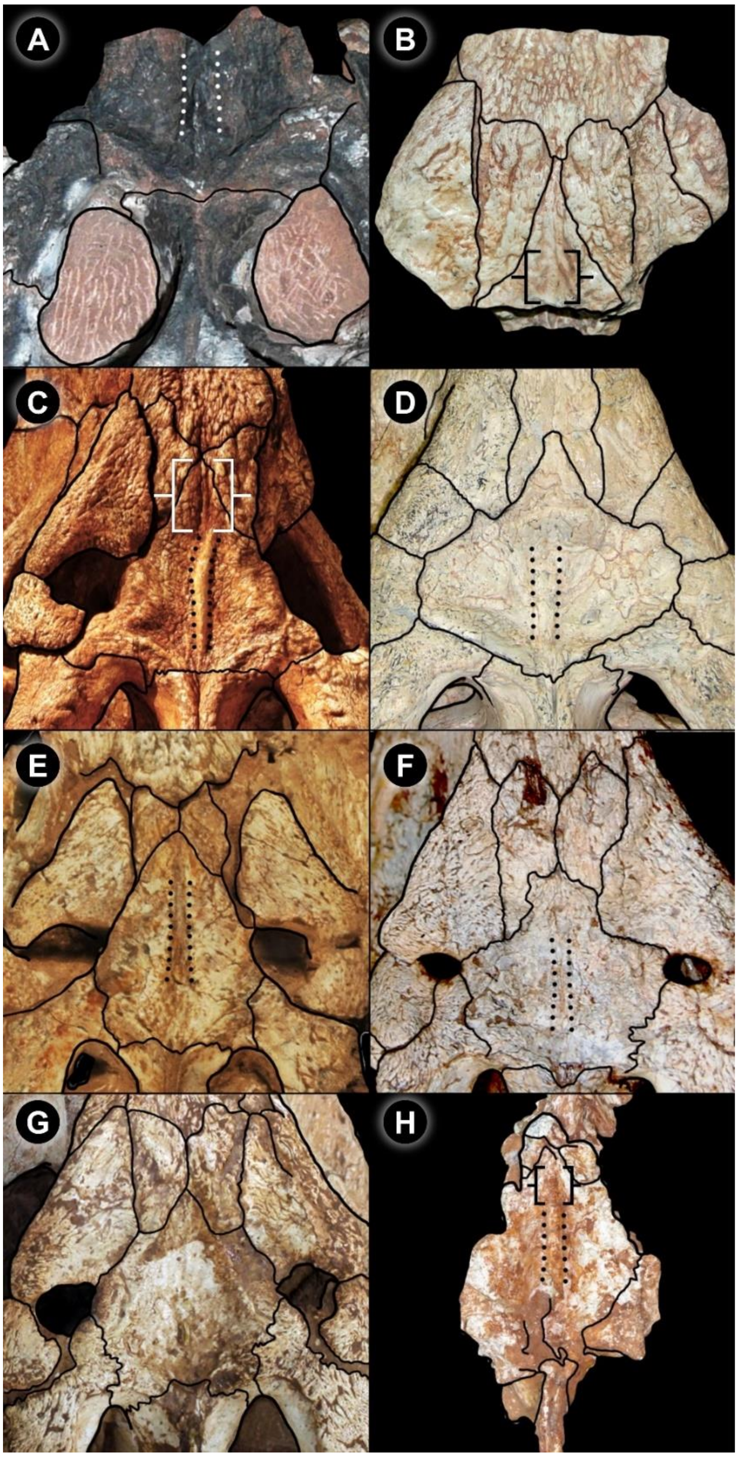
4.1. Character evolution within Baurusuchidae

There are three remarkable traits on the frontal of baurusuchids that are variable among taxa and have been treated as taxonomically relevant: the frontal dorsal depression, the position of the frontal sagittal crest, and the presence of the midline anterior frontal depression. The frontal dorsal depression shows two distinct conditions among baurusuchids: a shallow depression, observed in *Aplestosuchus sordidus* (Godoy et al., 2014), *Pissarrachampsa sera* (Montefeltro et al., 2011) and *Campinasuchus dinizi* (Carvalho et al., 2011), and a strongly transversally bowed dorsal depression, observed in *Baurusuchus salgadoensis* (Carvalho et al., 2004), *Stratiotosuchus maxhechti* (Campos et al., 2001) and *Aphaurosuchus escharafacies* (Darlim et al., 2021). The two states differ in relation to the depth of the depression, even though in both case the anterior and posterior portion are on the same level. LPRP/USP 0634 has a unique condition in which the frontal depression is much more developed. In addition, in LPRP/USP 0634, the depression is much more developed on its posteriormost portion, near the contact with the parietal. This combination of traits related to the frontal in LPRP/USP 0634 is easily distinguishable from all the other baurusuchids. However, the presence of a more developed depression, the major rostro-caudal axis of the frontal LPRP/USP 0634 (approximately 6,4 cm) present a similar size than in the others Baurusuchidae, as *B. salgadoensis* (approximately 6,6 cm), *P. sera* (approximately 6,7 cm), *Aph. escharafacies* (approximately 7,2 cm) and *Apl. sordidus* (approximately 6,9 cm).

The sagittal crest along the dorsal surface of the frontal is present in most baurusuchids with this portion preserved (Campos et al., 2001; Carvalho et al., 2004; Montefeltro et al., 2011; Carvalho et al., 2011; Godoy et al., 2014). The midline crest is absent only in *Wargosuchus australis* (Martinelli & Pais, 2008) and *Aphaurosuchus escharafacies* (Darlim et al., 2021). In *Pissarrachampsa sera* (Montefeltro et al., 2011), *Campinasuchus dinizi* (Carvalho et al., 2011) and *Aplestosuchus sordidus* (Godoy et al., 2014) a sharp saggital crest is seen extending anteriorly to the frontal mid-length. In *Baurusuchus salgadoensis* (Carvalho et al., 2004) and *Stratiotosuchus maxhechti* (Campos et al., 2001), the crest is smoother and restricted to the posterior portion of the frontal. LPRP/USP 0634 presents a condition similar to *P. sera* (Montefeltro et al., 2011), *C. dinizi* (Carvalho et al., 2011) and *Apl. sordidus* (Godoy et al., 2014). However, due to the greater depth of the depression on the frontal of LPRP/USP 0634, this crest is fully contained within de depression. In this configuration, the maximum dorsal extension of the crest stretches below the level of the lateral edges of the frontal.

The midline longitudinal depression of the frontal (sensu Montefeltro et al., 2011) is a modified condition in which a conspicuous depression occurs along the midline on the anterior surface of the frontal. This condition is reported for, *Wargosuchus australis* (Martinelli & Pais, 2008), *Pissarrachampsa sera* (Montefeltro et al., 2011; Godoy et al., 2014; Darlim, et al., 2021) and LPRP/USP 0634 (Figure 7).

Figure 7. The dorsal surface of baurusuchid frontals. **A,** *Campinasuchus dinizi* (CPP 1235); **B,** *Wargosuchus australis* (MOZ-PV 6134); **C,** *Pissarrachampsa sera* (LPRP/USP 0019); **D,** *Stratiotosuchus maxhechti* (DNPM DGM 1477-R)*;* **E,** *Aplestosuchus sordidus* (LPRP/USP 0229a); **F,** *Baurusuchus salgadoensis* (MPMA 62-0001-02)*;* **G,** *Aphaurosuchus escharafacies* (LPRP/USP 0697)*;* **H,** LPRP/USP 0634. The dotted line indicates the saggital crests and the brackets indicates the midline longitudinal depressions.



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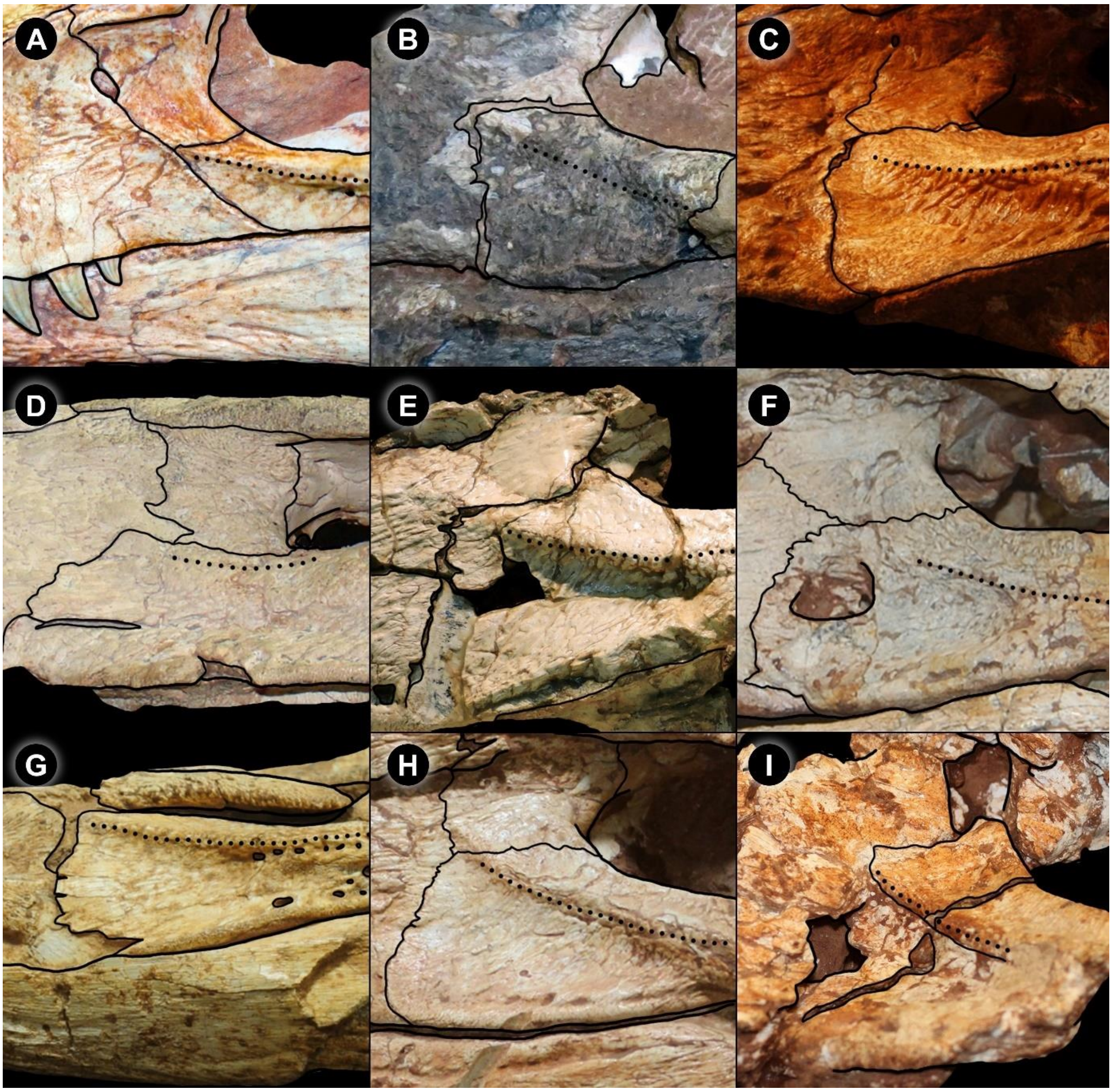
The jugal bone in baurusuchids shows an infraorbital ramus with the presence of a hypertrophied infraorbital ridge (sensu Montefletro et al., 2011), which spans anteriorly from the level of the lacrimal to the midlength of the infratemporal ramus (Figure 8). In *Pissarrachampsa sera* (Montefeltro et al., 2011), *Campinasuchus dinizi* (Carvalho et al., 2011), *Baurusuchus pachecoi* (Price, 1945), *Baurusuchus salgadoensis* (Carvalho et al., 2004) and *Gondwanasuchus scabrosus* (Marinho et al., 2013), the infraorbital ridge becomes confluent with the remaining areas of the jugal near the lacrimal-maxilla contact. In addition, the anterior end of the infraorbital ridge is almost straight, nearly parallel to the ventral edge of the jugal. On the other side, LPRP/USP 0634 presents a similar condition to *Aphaurosuchus escharafacies* (Darlim et al., 2021), in which the anterior end of the infraorbital ridge curves dorsally onto the dorsal surface of the skull, near the contact with the lacrimal. In LPRP/USP 0634, the infraorbital ridge is not fully preserved, but its anterior end does not become gradually confluent with the remaining area of the jugal. In LPRP/USP 0634, the infraorbital ridge terminates abruptly anteriorly, remaining as developed as the more posterior portion of the ridge. Due to the dorsoventrally compression of *Aplestosuchus sordidus* skull (Godoy et al., 2014), it is not possible to assess the real morphology near the lacrimal. In *Stratiotosuchus maxhechti* (Campos et al., 2001), the infraorbital ridge overcomes the anterior orbital border, as in others baurusuchids, even though the ridge is smaller and less prominent than in the other taxa.

Figure 8. The lateral surface of jugal of baurusuchids. **A,** *Gondwanasuchus scrabrosus* (UFRJ DG 408-R); **B,** *Campinasuchus dinizi* (CPP 1235); C**,** *Pissarrachampsa sera* (LPRP/USP 0019); **D,** *Stratiotosuchus maxhechti* (DNPM DGM 1477-R)*;* **E,** *Baurusuchus pachecoi*; **F,** *Baurusuchus salgadoensis* (MPMA 62-0001-02)*;* **G,** *Aplestosuchus sordidus* (LPRP/USP 0229a)*;* **H,** *Aphaurosuchus escharafacies* (LPRP/USP 0697)*;* **I,** LPRP/USP 0634. The dotted line indicates the infraorbital ridge.

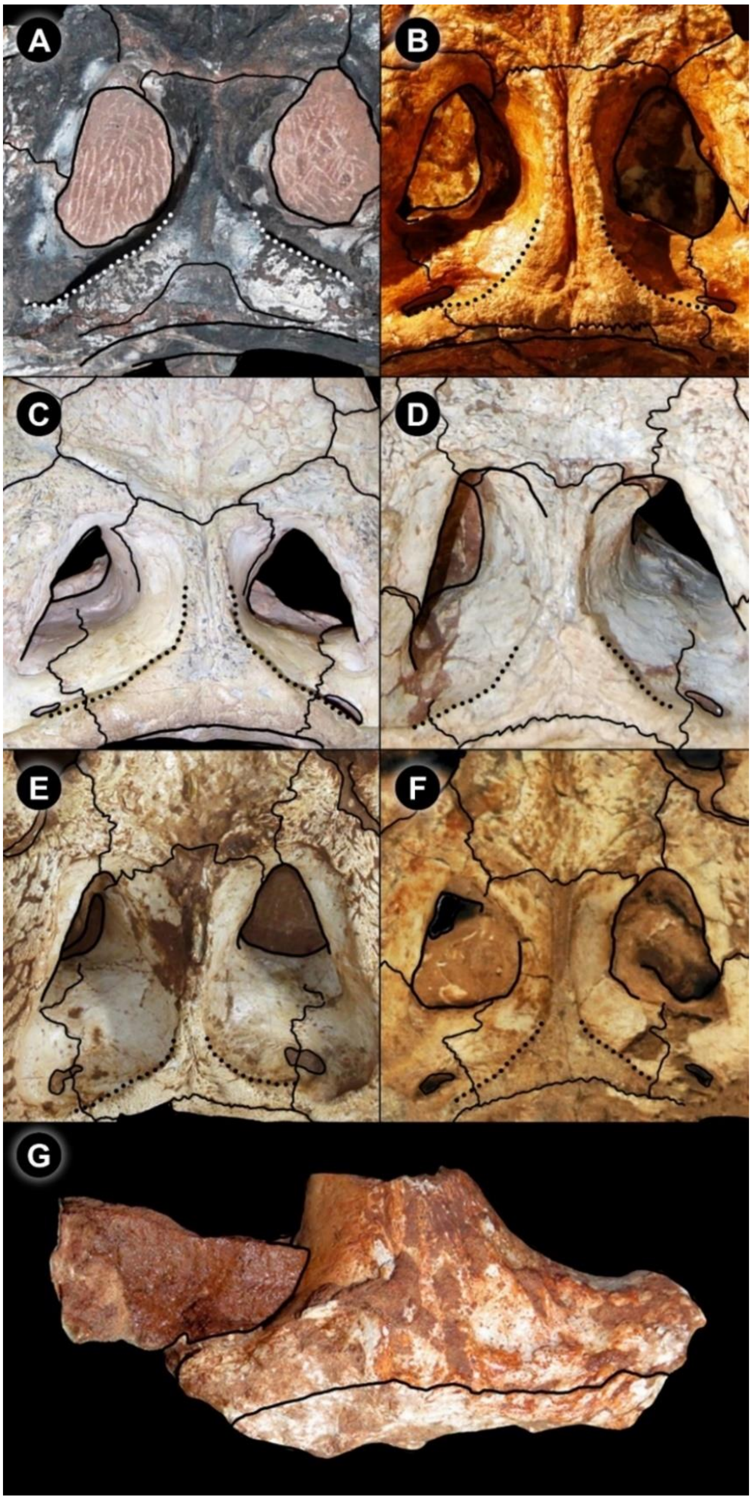


(Source: the author)

In baurusuchids, the parietal is restricted to the medial margin of the supratemporal fenestrae. At the posterior border of the supratemporal fenestrae of most baurusuchids, the parietal projects a short shelf that overhangs the fenestrae (Figure 9, Campos et al., 2001; Carvalho et al., 2004; Carvalho et al., 2011; Montefeltro et al., 2011, Marinho et al., 2013;

Godoy et al., 2014, Darlim et al., 2021). In LPRP/USP 0634, the parietal bone lacks the shelf, and presents a smoother posterior edge near the supratemporal fenestrae (Figure 9).

Figure 9. The dorsal surface of the parietal of baurusuchids. **A,** *Campinasuchus dinizi* (CPP 1235); B**,** *Pissarrachampsa sera* (LPRP/USP 0019); **C,** *Stratiotosuchus maxhechti* (DNPM DGM 1477-R)*;* **D,** *Baurusuchus salgadoensis* (MPMA 62-0001-02)*;* **E,** *Aphaurosuchus escharafacies* (LPRP/USP 0697)*;* **F,** *Aplestosuchus sordidus* (LPRP/USP 0229a)*;* **G,** LPRP/USP 0634. The dotted line indicates the parietal shelf overhanging the supratemporal fenestrae.



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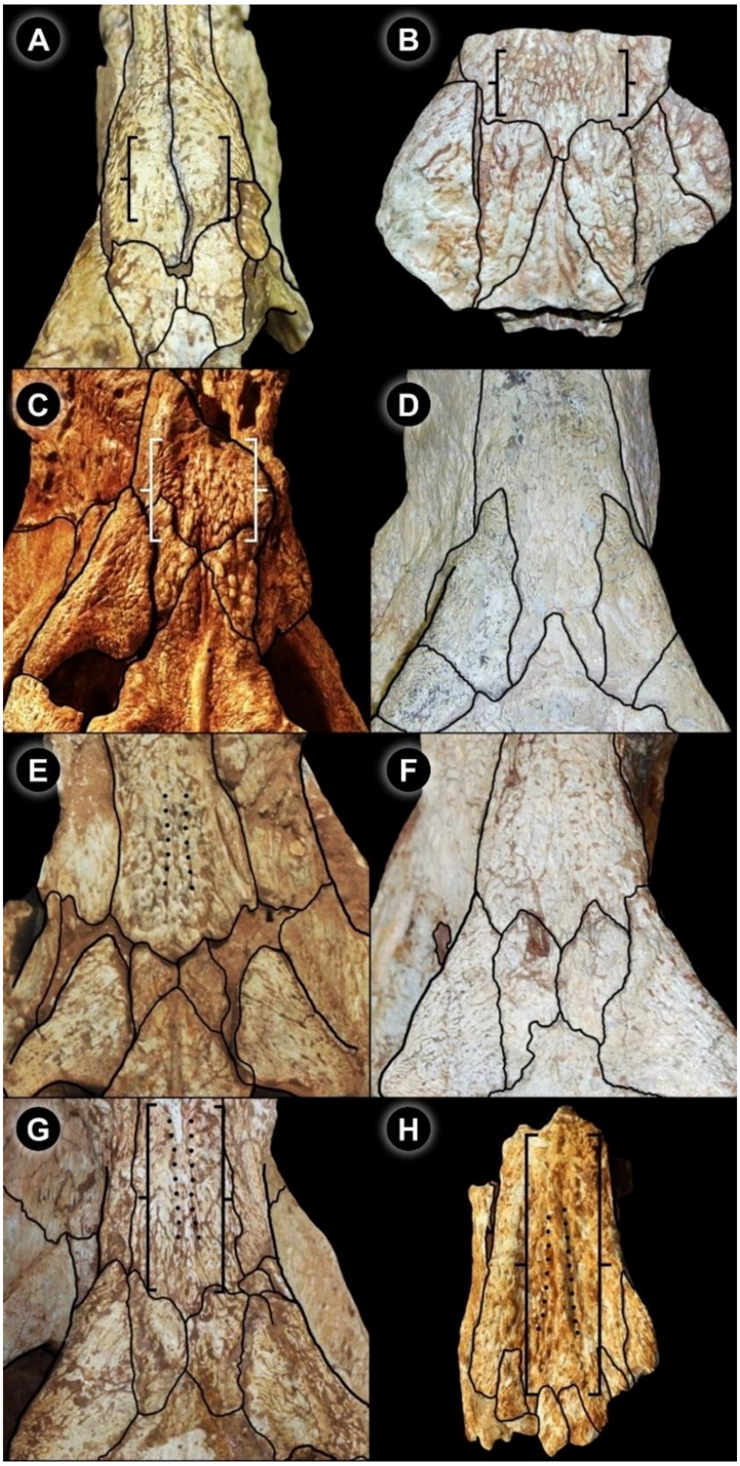
The nasal bone in Baurusuchidae, does not show a greater variation, with all species showing a similar general morphology. The exceptions are the broader nasal bone of *Stratiotosuchus maxhechti* (Campos et al., 2001), and the presence of paired nasal bones in *Gondwanasuchus scabrosus* (Marinho et al., 2013), whereas in all other baurusuchids the nasals are fused into a single element (Campos et al., 2001; Carvalho et al., 2004; Carvalho et al., 2011; Montefeltro et al., 2011; Godoy et al., 2014; Darlim et al., 2021). The posterior portion of the nasal is more variable among baurusuchids. Montefeltro et al. (2011) observed that in pissarrachampsines the nasal presents a longitudinal depression (Figure 10) on the posterior portion of the dorsal surface of the bone. In pissarrachampsines and *G. scabrosus*, the lateral borders of the nasal are above its central portion (Figure 10). The baurusuchines present the central surface at the posterior portion of the nasal at the same level of its lateral borders (e.g., *S. maxhechti* and *Aplestosuchus sordidus*, Godoy et al.2014), or even raised above the lateral borders (e.g. *Baurusuchus salgadoensis* Carvalho et al., 2004). In *Aphaurosuchus escharafacies* (Darlim et al., 2021) and LPRP/USP 0634, the posterior portion of the nasal is similar to the condition in Pissarrachampsinae (Figure 10). Additionally, within the midline depression, it is observed a slender crest in *Apl. sordidus*, *Aph. escharafacies*, and LPRP/USP 0634 (Figure 10), a condition so exclusive, that is unique among notosuchians.

Figure 10. The dorsal surface of the nasal of baurusuchids. **A,** *Gondwanasuchus scrabrosus* (UFRJ DG 408-R); B**,** *Wargosuchus australis* (MOZ-PV 6134); **C,** *Pissarrachampsa sera* (LPRP/USP 0019)*;* **D,** *Stratiotosuchus maxhechti* (DNPM DGM 1477-R)*;* **E,** *Aplestosuchus sordidus* (LPRP/USP 0229a); **F,** *Baurusuchus salgadoensis* (MPMA 62-0001-02)*;* **G,** *Aphaurosuchus escharafacies* (LPRP/USP 0697)*;* **H,** LPRP/USP 0634. The dotted line indicates the nasal crests and the brackets indicates the postero-dorsal depressions.



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4.2. Phylogenetic relationships

Our parsimony analysis resulted in eight most parsimonious trees of 2300 steps. A reduced versionof the strict consensus focusing on Notosuchian is shown in Figure 11, and the complete topology of the strict consensus is presented in the supplementary material. On this work, we highlight four main results: 1. The placement of *Aphaurosuchus spp.* as the sister taxon of *Aphaurosuchus escharafacies*; 2. The sister-group relationship between Baurusuchia and Spaghesauria, forming the clade Xenodontosuchia (sensu Ruiz et al., 2021); 3. The two lineages of Baurusuchidae (Pissarrachampsinae and Baurusuchinae) were recovered with similar taxonomic content to previous works; 4. The placement of *Ogresuchus furatus* and *Razanandrongobe sakalavae* as Baurusuchia (Figure 11).

4.2.1. The Genus *Aphaurosuchus*

LPRP/USP 0624 is included in the genus *Aphaurosuchus* for which we erected the species *Aphaurosuchus spp*. The sister-clade relationship of *Aphaurosuchus spp.* and *Aphaurosuchus escharafacies* is supported by the presence of the postero-dorsal depression on nasal (char. 57 st. 1) and the upturned infraorbital ridge on jugal (char. 517 st.1). Additionally, *Aphaurosuchus spp.* could be assigned to a new specie due to three autapomorphies: 1. a well-developed depression on the dorsal surface of the frontal; 2. a smooth parietal near the supratemporal fenestrae, without the process overhanging upper temporal fenestrae; 3. presence of a sagittal crest within the frontal depression.

4.2.2. Sphagesauria (sensu Ruiz et al., 2021), Baurusuchia, (sensu Darlim et al., 2021), and *Pakasuchus* (O’ Connor et al., 2010)

Our phylogenetic analysis places *Pakasuchus* as the sister taxon of Xenodontosuchia (Sphagesauria + Baurusuchia). A similar position for the taxon was recovered in previous works (Sertich & O’Connor 2014; Meunier & Larsson 2017). This contrasts with its more usual position as sister to *Malawisuchus* (Pol et al., 2014; Martin & Broin 2016; Pinheiro et al., 2018, 2021). *Pakasuchus* as the sister taxon of Xenodontosuchia also differs from analyses using a previous version of the matrix used here (Ruiz et al. 2021), in which *Pakasuchus* was placed within Baurusuchia, as sister clade to all other baurusuchians. The clade composed of

Pakasuchus + Xenodontosuchia is supported by four unambiguous synapomorphies. First, *Pakasuchus*, most of Barusuchia and Spaghesauria, the rostrum lacks the antorbital fenestrae (char.12 st. 1). However, *Gondwanasuchus*, *Campinasuchus*, *Morrinhosuchus*, *Notosuchus* and *Caipirasuchus spp.* possess the antorbital fenestrae, interpreted here as a reversal. The second synapomorphy of *Pakasuchus* + Xenodontosuchia is the lateral margins of squamosal and postorbital diverging posteriorly in dorsal view (char. 104 st. 1). Among the sphagesaurids *Yacarerani*, *Caipirasuchus,* and the Baurusuchia, *Bau. pachecoi* the condition is reversed, with the lateral margins of squamosal and postorbital being parallel.

A hook-shaped anterior palpebral (char. 107 st. 1) is the third synapomorphy of the clade, except in the baurusuchid *Stratiotosuchus,* with a rounded shape. The fourth unambiguous synapomorphy supporting *Pakasuchus* + Xenodontosuchia is the presence of longitudinal keels on the dorsal surface of osteoderms restricted to the posterior edge (char. 464 st. 1, Montefeltro 2019).

Spaghesauria and Baurusuchia formed Xenodontosuchia, which is supported by five unambiguous synapomorphies. The supraoccipital dorsal exposure restricted to a thin surface attached to the posteriormost portion of the parietal and squamosal (char. 122 st. 1). This condition seems to be exclusive within Notosuchia, only present in spaghesaurians and baurusuchians. In Spaghesauria and Baurusuchia, the palatines diverges laterally, becoming rod-like and forming palatines bar posteriorly (char. 229. st. 1). In other notosuchians, such as *Mallawisuchus*, *Simosuchus*, *Libycosuchus*, *Araripesuchus*, *Uruguaysuchus*, sebecids, peirosaurids and mahajangasuchids, the palatines run parasagittally along the midline, a condition also found in *Ogresuchus*, which is interpreted here as a reversal.

The third cranial synapomorphy is the pterygoid excluded from the suborbital fenestrae by the ectopterygoid-palatine contact (char. 238 st. 1). In other notosuchians, the pterygoid forms a margin of the suborbital fenestrae. The fourth unambiguous synapomorphy is the splenial-dentary V-shaped suture (char. 334 st. 0). The absence of tooth accessory cusps (char. 359 st. 0) also supports Xenodontosuchia.

4.1.3 Baurusuchia (sensu Darlim et al., 2021)

Our phylogenetic analysis places *Comahueshucus* within Baurusuchia, as the sister taxon to all other baurusuchians. A similar phylogenetic position of *Comahuesuchus*, sister to Baurusuchidae, was recovered in previous phylogenetic analysis (Montefeltro *et al*. (2013), Pol *et al*. (2014), Martin and De Broin (2016), Martinelli *et al*. (2018), and Ruiz et al. (2021). *Razanandrongobe* was recovered within Baurusuchia for the first time, as the sister-group of *Ogresuchus* + Barusuchidae. The previous analyses that include *Ogresuchus* and *Razanandrongobe* (Sellés et la., 2020; Dal Sasso et al., 2017) have recovered both taxa as sebecosuchians (sensu Martinelli et al. 2018), with *Ogresuchus* within Sebecidae (Sellés et la., 2020). Our phylogenetic analysis does not recover the clade Sebecosuchia (Sebecidae + Baurusuchidae), instead we recovered Xenodontosuchia (Sphagesauria + Baurusuchia), as proposed by Ruiz et al. (2021).

The clade Baurusuchia is supported by seven unambiguous synapomorphies. The prefrontals are short and broad anterior to the orbits (char. 69 st. 1) in Baurusuchia, whereas members of Sphagesauria (except *Notosuchus* and *Mariliasuchus*) exhibit elongated prefrontals, parallel to the anteroposterior axis of the skull. Bauruschians show a large and slot-like foramen *intramandibularis oralis* (char. 311 st. 1), while most sphagesaurians present a small foramen.

Baurusuchians exhibit a dentary dorsal edge with a single dorsal expansion, being concave posteriorly (char. 318 st. 2). Their dentary also presents a U-shape symphysis in ventral view (char. 333 st. 1). Within Notosuchia, the U-shape symphysis is also found in Mahajangasuchidae and in *Libycoshucus*. The sebecids show a similar morphology, however the symphysis not form an evident U-shape. Baurusuchia is mainly composed of species with a short rostrum with hypertrophied caniniforms. This features, lead to the maxilla displaying as a wave of teeth on lateral view (char. 372 st. 1). Among notosuchians, the same morphology appeared homoplastically, in Uruguaysuchidae, Sebecidae, and *Mahajangasuchus*, *Uberabasuchus*, *Anatosuchus*, *Yacarerani* and *Adamantinasuchus*. The other two unambiguous baurusuchian synapomorphies are related to the dentition. Baurusuchia do not present molariforms (char. 379 st. 0), and all the maxillary teeth are isolated in their respective alveolus (char. 376 st. 0). Within Notosuchia, molariform teeth are only present in Spaghesauria, *Malawisuchus* and *Pakasuchus*.

4.1.4 Baurusuchidae

The clade Baurusuchidae (sensu Darlim et al., 2021) includes thirteen species. *Cynodonthosuchus* and *Gondwanasuchus* are successive sister clades of Pissarrachampsinae + Baurusuchinae.

Baurusuchidae is supported by four unambiguous cranial synapomorphies. The presence of a septum dividing the external nares (char. 10 st 1). Within Notosuchia, this condition is homoplastically found in Uruguaysuchidae, Sebecidae, Peirosauridae and Mahajangasuchidae. Baurusuchids exhibit an opened contact on the ventral edge of the rostrum, at the premaxilla-maxilla contact, which results in large fenestrae, encompassing at least partially the opposite dentary tooth (char. 45 st. 1). This condition was also recovered by Montefeltro et al. (2011) as one of the synapomorphies that supports Baurusuchidae. The same condition is also observed in some peirosaurids, such as *Gasparinisuchus*, *Hamadasuchus*, *Lomasuchus*, *Montealtosuchus*, *Uberabasuchus,* as well as in the sebecid *Bretesuchus*.

The third cranial synapomorphy of baurusuchids is the suture between the maxilla and the palatine being transverse to the midline axis (char. 218 st. 3). In *Bau. salgadoensis* and *Bau. pachecoi,* the palatine is evaginated instead. The palatine also presents an anterior extension which does not reach the level of the anterior margin of the suborbital fenestrae (char. 221 st. 1). This condition is unique among notosuchians and one of the most notable features of the clade Baurusuchidae (Montefeltro et al. 2011).

4.1.5 Phylogenetic relationships within Baurusuchidae

Within Baurusuchidae, our phylogenetic analysis recovered *Gondwanasuchus* as the sister clade of Pissarrachampsinae + Baurusuchinae. This group is supported by two synapomorphies. The first one is the presence of a row of foramina flanking the medial contact of the palatines (char. 224 st. 1), which is a unique feature among crocodyliforms. Within Baurusuchidae, *Cynodontosuchus* and *Aph. escharafacies* are the only two species that do not present these foramina. In *Aph. escharafacies*, this condition is interpreted as a reversal. Additionally, the presence of highly laterally compressed teeth (char. 356, st. 2, Figure 11) also supports *Gondwanasuchus* as a sister to Pissarrachampsinae + Baurusuchinae.

Our phylogenetic analysis recovered the two main linages within Baurusuchidae (Pissarrachampsinae and Baurusuchinae) as proposed by Montefeltro et al. (2011), and others subsequent works (Godoy et al., 2014; Geroto & Bertini, 2018; Darlim et al., 2021). The Pissarrachampsinae clade is supported by two synapomorphies. The first is the absence of the incisive foramen (char. 198 st. 1). This condition is also found in some Baurusuchinae, such as *Bau. salgadoensis* and *Bau. pachecoi*. Pissarrachampsines also exhibit the cross section of the distal end of the quadrate mediolaterally wide and anteroposteriorly thin (char. 280 st. 0), while baurusuchines present a subquadrangular cross section (char. 280 st. 1). We also recovered a polytomy within Pissarrachampsinae, composed of the Brazilian *Pissarrachampsa sera*, the Argentinean *Wargosuchus australis* and the Pakistani *Pabwehshi pakistanensis.* Previous works have recovered *Pissarrachampsa* as sister to *Wargosuchus* (e.g. Montefeltro et al., 2011; Godoy et al., 2014; Darlim et al., 2021) and *Pabwehshi* within Baurusuchidae (Turner & Calvo, 2005; Turner, 2006; Nascimento & Zaher, 2010; Pol & Powell, 2011; Dal Sasso et al., 2017; Pinheiro et al., 2018). However, this is the first time *Pabwehshi* is placed within Pissarrachampsinae. The clade composed of *Pissarrachampsa*, *Wargosuchus* and *Pabweshi* is supported by the presence of three premaxillary teeth (char. 365 st. 3), a condition present in *Pissarrachampsa* and *Pabwehshi*, but is unknow for *Wargosuchus*. This condition is also seen in some other non-Pissarrachampsinae baurusuchids, such as *Stratiotosuchus* and *Cynodontosuchus.* But Pissarrachampsines also exhibit the last hypertrophied premaxillary tooth (char. 521 st. 1), which is also seen in *Stratiotosuchus.*

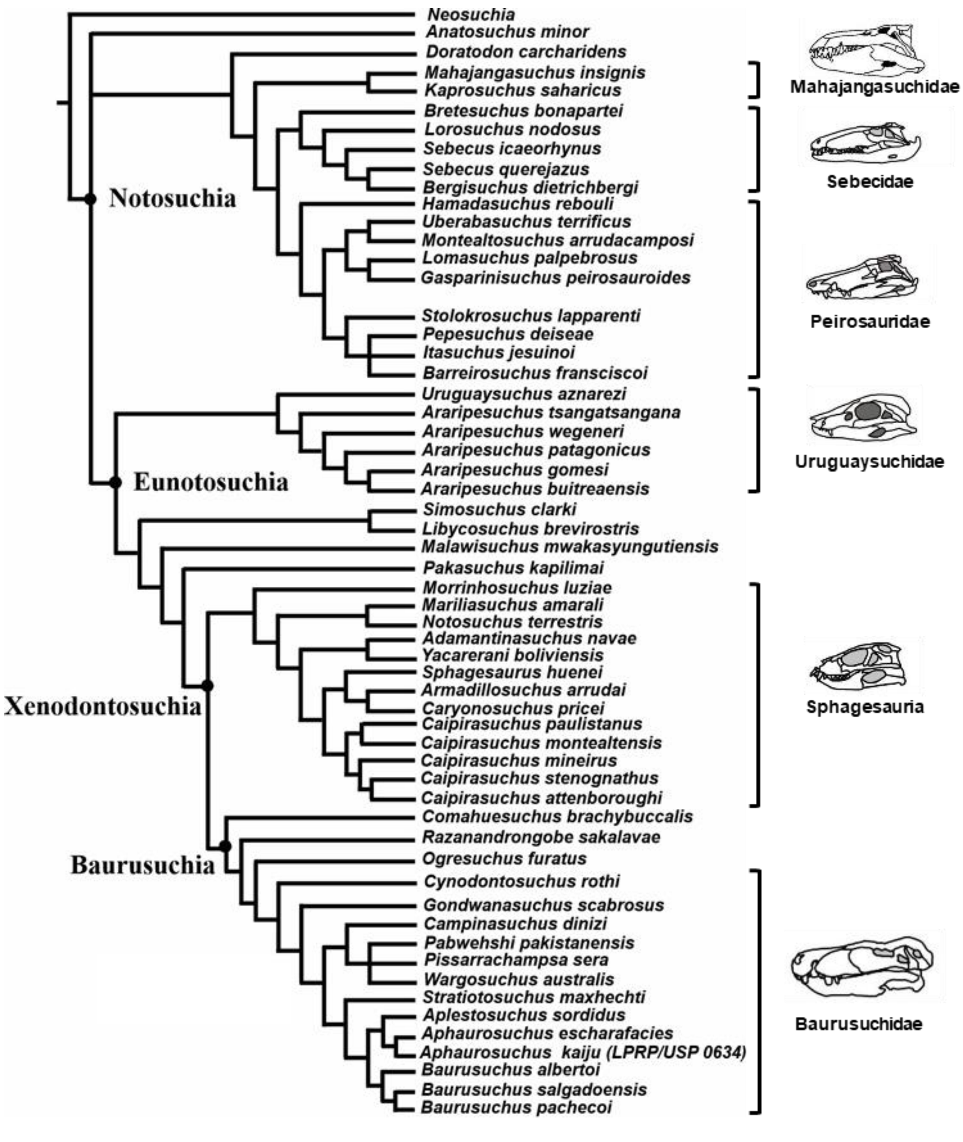
Baurusuchinae is supported by six unambiguous synapomorphies. The medial contact between prefrontals along most of the dorsal medial edge (char. 73 st. 1) is present in *Bau. salgadoensis*, *Stratiotosuchus* and *Aph. spp.* While *Aph. escharafacies* shows a condition similar to the Pissarrachampsinae, with a restricted contact between the prefrontals (char. 73 st. 2). *Aplestosuchus* exhibit a transitional condition between the two states. Another synapomorphy of Baurusuchinae is the frontal with a short anterior extension that does not overcome the level of the anterior edge of the orbits (char. 79 st. 1).

Baurusuchinae present the cranial table as wide as the ventral portion of the skull, so that the quadrates are covered by the squamosal (char. 102 st. 0), while the Pissarrachampsinae show a narrower cranial table. Two other synapomorphies are the presence of multiple subtympanic foramina internalized in a bony otic aperture (char. 194 st. 1) and of a large nutrient foramen on the palatal surface of premaxilla-maxilla (char. 207 st. 1). The presence of a ridged ventral surface of the choanal septum (char. 251 st. 2) is also a synapomorphy of baurusuchines, as in Darlim et al. (2021). Even though in *Aph. escharafacies* the choanal septum is slightly depressed, interpreted here as a reversal.

The clade *Aplestosuchus* + *Aphaurosuchus escharafacies* + *Aphaurosuchus spp.* is supported by two unambiguous synapomorphies. First, the mandibular outer surface sculpture is restricted to the dentary (char. 302 st. 0), a condition is also present in *Gondwanasuchus,* whereas *Pissarrachampsa, Campinasuchus, Stratiotosuchus* and *Bau. salgadoensis* present the sculpture both on the dentary and on splenial outer surface. *Aplestosuchus, Aph. escharafacies* and *Aph. spp.* are the only baurusuchids with a ridge on the posterior portion of the nasal (char. 515 st. 1), a unique condition among notosuchians.

The clade encompassing the three species of the genus *Baurusuchus* is supported by one synapomorphy, the ectopterygoid not extending to the posterior tip of the pterygoid flange at maturity (char. 256 st.1). Other baurusuchids present the plesiomorphic condition, in which the ectopterygoid extends to posterior tip of the flange. *Bau. salgadoensis* as the sister taxon of *Bau. pachecoi* is supported by two synapomorphies. The presence of a post-temporal fenestra (char. 28 st. 0) and the ectopterygoid-jugal ridged suture continuous with the ventral ridge of the infratemporal portion of the jugal (char. 154 st. 0). This condition is also present in *Gondwanasuchus* and *Aph. escharafacies.*

Figure 11. Reduced strict consensus tree depicting the phylogenetic relationship among Notosuchia.



(Source: the author)

4.3 Distribution of Baurusuchia

Baurusuchians have been commonly recognized as a South American clade (Price, 1945; Campos et al., 2001; Carvalho et al., 2004; Martinelli & Pais, 2008; Nascimento & Zaher, 2010; Carvalho et al., 2011; Montefeltro et al., 2011; Marinho et al., 2013; Godoy et al., 2014; Darlim et al., 2021). However, our phylogenetic results indicates that fragmentary taxa from Pakistan, Spain and Madagascar extend the temporal range and spatial distribution of the group. In our parsimony analysis, *Pabwehshi paquistanensis* (Wilson et al., 2001), from the Maastrichtian Pab Formation of Pakistan, was recovered as a Baurusuchidae, similar toseveral previous works (Nascimento & Zaher, 2010; Dal Sasso et al., 2017; Geroto & Bertini, 2018; Pinheiro et al., 2018). If confirmed, *Pabwehshi* would be the only taxon of Baurusuchidae outside South American (Pol & Leardi, 2015), expanding the spatial distribution of the group (Wilson et al., 2001). The Indian Subcontinent was already isolated from other Gondwanan landmasses since the Aptian-Cenomanian (Krause et al., 2019), which suggests that baurusuchids originated previously to that or expanded across oceanic barriers by the end of the Cretaceous.

Additionally, the recovery of *Ogresuchus furatus* (Sellés et al., 2020) and *Razandrongobe sakalavae* (Maganuco et al., 2006) as baurusuchians further expands the spatial distribution of the group to other landmasses. *Ogresuchus*, from the Tremp Formation (Early Maastrichtian) of Catalonia, represents the only baurusuchian in Europe. The enigmatic *Razandrongobe*, which is the oldest putative notosuchian, from the Bathonian (Middle Jurassic) Sakahara Formation of Madagascar (Maganuco et al., 2006; Dal Sasso et al., 2017), radically expands the temporal range of the group. The presence of a notosuchian in the Jurassic reinforces the hypothesis that the radiation, of the group took place before the total fragmentation of Gondwana (Turner & Sertich, 2010, Bronzati et al. 2015, Pol & Leardi, 2015).

5. CONCLUSION

Aphaurosuchus spp. is the 12th described baurusuchid species from the South America, and the 10th from the Bauru Group, expanding the morphological and taxonomic diversity of the clade. Our data support a Baurusuchidae with the two main lineages encompassing the greater diversity of the group. Pissarrachampsinae is composed of the Brazilian taxa *Campinasuchus* and *Pissarrachampsa*, the Argentinean *Wargosuchus,* and the Pakistani *Pabwehshi*. Baurusuchinae is composed of the *Stratiotosuchus*, *Aplestosuchus, Aphaurosuchus escharafacies,* the new taxon *Aphaurosuchus spp.*, *Baurusuchus albertoi*, *Baurusuchus salgadoensis* and *Baurusuchus pachecoi*. *Pabwehshi* was recovered as a Baurusuchidae, and *Ogresuchus* and *Razanandrongobe* as Baurusuchia, which suggests that the group was not limited to South America, and indicates that the group originated much earlier than previous anticipated.

REFERENCES

ANDRADE, M.D.; BERTINI, R.J. A new Sphagesaurus (Mesoeucrocodylia: Notosuchia) from the upper cretaceous of monte alto city (Bauru Group, Brazil), and a revision of the Sphagesauridae. **Historical Biology**, v. 20, n. 2, p. 101-136, 2008a.

ANDRADE, M.D.; BERTINI, R. J. Morphological and anatomical observations about Mariliasuchus amarali and Notosuchus terrestris (Mesoeucrocodylia) and their relationships with other South American notosuchians. **Arquivos do Museu Nacional**, v. 66, n. 1, p. 5-62, 2008b.

BANDEIRA, K. L. M.; BRUM, A.; CIDADE, G. M.; PÊGAS, R. V.; The Baurusuchidae vs Theropoda record in the Bauru Group (Upper Cretaceous, Brazil): a taphonomic perspective. **Journal of Iberian Geology**, p. 1-31, 2018.

BONAPARTE, J.F. et al. Los vertebrados fósiles de la Formación Río Colorado, de la ciudad de Neuquén y cercanías, Cretácico superior, Argentina. 1991.

BRONZATI, M.; MONTEFELTRO, F.C.; LANGER, M.C. Diversification events and the effects of mass extinctions on Crocodyliformes evolutionary history. **Royal Society open science**, v. 2, n. 5, p. 140385, 2015.

BUCKLEY, G.A.; BROCHU, C.A. An enigmatic new crocodile from the Upper Cretaceous of Madagascar. **Cretaceous Fossil Vertebrates**, n. 60, p. 149-175, 1999.

BUCKLEY, G.A. et al. A pug-nosed crocodyliform from the Late Cretaceous of Madagascar. **Nature**, v. 405, n. 6789, p. 941-944, 2000.

BUFFETAUT, E. A new crocodilian from the Cretaceous of southern Morocco. **Comptes rendus de l'Académie des sciences. Série 2. Sciences de la terre et des planètes**, v. 319, n. 12, p. 1563-1568, 1994.

CAMPOS, D.A. Short note on a new Baurusuchidae (Crocodyliformes, Metasuchia) from the Upper Cretaceous of Brazil. 2001.

CARVALHO, I.S.; BERTINI, R.J.; Mariliasuchus: um novo Crocodylomorpha (Notosuchia) do Cretáceo da Bacia Bauru, Brasil. **Geologia Colombiana**, v. 24, p. 83-105, 1999.

CARVALHO, I.S.; CAMPOS, A.C.A.; NOBRE, PH. Baurusuchus salgadoensis, a new crocodylomorpha from the Bauru Basin (Cretaceous), Brazil. **Gondwana Research**, v. 8, n. 1, p. 11-30, 2005.

CARVALHO, S.S.; VASCONCELLOS, F.M.; TAVARES, S.A.S. Montealtosuchus arrudacamposi, a new peirosaurid crocodile (Mesoeucrocodylia) from the Late Cretaceous Adamantina Formation of Brazil. **Zootaxa**, v. 1607, p. 35-46, 2007.

CARVALHO, I.S. et al. Campinasuchus dinizi gen. et sp. nov., a new Late Cretaceous baurusuchid (Crocodyliformes) from the Bauru Basin, Brazil. **Zootaxa**, v. 2871, n. 1, p. 19-42, 2011.

CLARK, J. M. **Phylogenetic relationships of the Crocodylomorph Archosaurs Ph D**. 1986. Tese de Doutorado. Dissertation, Department of Anatomy, University of Chicago, Illinois.

DAL SASSO, C. et al. Razanandrongobe sakalavae, a gigantic mesoeucrocodylian from the Middle Jurassic of Madagascar, is the oldest known notosuchian. **PeerJ**, v. 5, p. e3481, 2017.

DARLIM, G. D.; MONTEFLETRO, F. C.; LANGER, M. C. 3D Skull modeling and description of a new baurusuchid (Crocodyliformes, Mesoeucrocodylia) from the Late Cretaceous (Bauru Basin) of Brazil. **Journal of Anatomy**, p. 1-41, 2021.

DARWIN, C.; On the origin of species by means of natural selection, or, the preservation of favoured races in the struggle for life. Londo, 1859.

FERNANDES, L.A.; RIBEIRO, C.M.M. Evolution and palaeoenvironment of the Bauru Basin (upper Cretaceous, Brazil). **Journal of South American Earth Sciences**, v. 61, p. 71-90, 2014.

GEROTO, C.F.C.; BERTINI, R.J. New material of Pepesuchus (Crocodyliformes; Mesoeucrocodylia) from the Bauru Group: implications about its phylogeny and the age of the Adamantina Formation. **Zoological Journal of the Linnean Society**, v. 185, n. 2, p. 312-334, 2019.

GODOY, P.L. et al. An additional baurusuchid from the Cretaceous of Brazil with evidence of interspecific predation among Crocodyliformes. **PloS one**, v. 9, n. 5, 2014.

GODOY, P. L. et al. Postcranial anatomy of Pissarrachampsa sera (Crocodyliformes, Baurusuchidae) from the Late Cretaceous of Brazil: insights on lifestyle and phylogenetic significance. **PeerJ,** p. 1-56, 2016

GODOY, P. L. et al. Evidence for heterochrony in the cranial evolution of fossil crocodyliforms. **Palaeontology**, p. 1-16 2018

GOLOBOFF, P.A.; FARRIS, J.S.; NIXON, K.C. TNT, a free program for phylogenetic analysis. **Cladistics**, v. 24, n. 5, p. 774-786, 2008.

GOMANI, E.M. A crocodyliform from the Early Cretaceous dinosaur beds, northern Malawi. **Journal of Vertebrate Paleontology**, v. 17, n. 2, p. 280-294, 1997.

HAY, O. P. Second Bibliography and Catalogue of the Fossil Vertebrata of North America: Carnegie Institute Washington. **Washington DC**, v. 2, p. 1094, 1930.

IORI, F.V.; CARVALHO, I.S. Caipirasuchus paulistanus, a new sphagesaurid (Crocodylomorpha, Mesoeucrocodylia) from the Adamantina Formation (Upper Cretaceous, Turonian–Santonian), Bauru Basin, Brazil. **Journal of Vertebrate Paleontology**, v. 31, n. 6, p. 1255-1264, 2011.

IORI, F.V.; GARCIA, K. L.; *Barreirosuchus franciscoi,* um novo Crocodylomorpha Tramatochampsidae da Bacia Bauru, Brasil. **Revista Brasileira de Geociências**, v. 42, n. 2, p. 397-410

KRAUSE, D.W. et al. The Mesozoic Biogeographic History of Gondwanan Terrestrial Vertebrates: Insights from Madagascar's Fossil Record. **Annual Review of Earth and Planetary Sciences**, v. 47, p. 519-553, 2019.

LARSSON, H. C. E.; SIDOR, C. A. Unusual crocodyliform teeth from the Late Cretaceous (Cenomanian) of southeastern Morocco. **Journal of Vertebrate Paleontology**, v. 19, n. 2, p. 398-401, 1999.

LEARDI, J.M.; POL, D.; GASPARINI, Z. New Patagonian baurusuchids (Crocodylomorpha; Notosuchia) from the Bajo de la Carpa Formation (Upper Cretaceous; Neuquén, Argentina): new evidences of the early sebecosuchian diversification in Gondwana. **Comptes Rendus Palevol**, v. 17, n. 8, p. 504-521, 2018.

MAGANUCO, S.; DAL SASSO, C.; PASINI, G. A new large predatory archosaur from the Middle Jurassic (Bathonian) of Madagascar. **Atti Soc. Ital. Sci. Nat. Mus. Civ. St. Nat. Milano**, v. 147, n. 1, p. 19-51, 2006.

MARINHO, T.S.; CARVALHO, I.S. An armadillo-like sphagesaurid crocodyliform from the Late Cretaceous of Brazil. **Journal of South American Earth Sciences**, v. 27, n. 1, p. 36-41, 2009.

MARINHO, T.S. et al. Gondwanasuchus scabrosus gen. et sp. nov., a new terrestrial predatory crocodyliform (Mesoeucrocodylia: Baurusuchidae) from the Late Cretaceous Bauru Basin of Brazil. **Cretaceous Research**, v. 44, p. 104-111, 2013.

MARTIN, J.E.; DE BROIN, F.L. A miniature notosuchian with multicuspid teeth from the Cretaceous of Morocco. **Journal of Vertebrate Paleontology**, v. 36, n. 6, p. e1211534, 2016.

MARTINELLI, A.G. New cranial remains of the bizarre notosuchid Comahuesuchus brachybuccalis (Archosauria, Crocodyliformes) from the Late Cretaceous of Río Negro Province (Argentina). **Ameghiniana**, v. 40, n. 4, p. 559-572, 2003.

MARTINELLI, A.G.; PAIS, D.F. A new baurusuchid crocodyliform (Archosauria) from the Late Cretaceous of Patagonia (Argentina). **Comptes Rendus Palevol**, v. 7, n. 6, p. 371-381, 2008.

MARTINELLI, A.G. et al. The first Caipirasuchus (Mesoeucrocodylia, Notosuchia) from the Late Cretaceous of Minas Gerais, Brazil: new insights on sphagesaurid anatomy and taxonomy. **PeerJ**, v. 6, p. e5594, 2018.

MELSTROM, K.M.; IRMIS, R.B. Repeated evolution of herbivorous crocodyliforms during the age of dinosaurs. **Current Biology**, v. 29, n. 14, p. 2389-2395. e3, 2019.

MEUNIER, L.M.V.; LARSSON, H.C.E. Trematochampsa taqueti as a nomen dubium and the crocodyliform diversity of the Upper Cretaceous In Beceten Formation of Niger. **Zoological Journal of the Linnean Society**, v. 182, n. 3, p. 659-680, 2017.

MONTEFELTRO, F.C. **Revisão filogenética de Mesoeucrocodylia: irradiação basal e principais controvérsias**. 2013. Tese de Doutorado. Universidade de São Paulo.

MONTEFELTRO, F.C.; LARSSON, H.C.E.; LANGER, M.C. A new baurusuchid (Crocodyliformes, Mesoeucrocodylia) from the Late Cretaceous of Brazil and the phylogeny of Baurusuchidae. **PLoS One**, v. 6, n. 7, 2011.

MONTEFELTRO, F.C. et al. A new neosuchian with Asian affinities from the Jurassic of northeastern Brazil. **Naturwissenschaften**, v. 100, n. 9, p. 835-841, 2013.

MONTEFELTRO, F.C.; ANDRADE, D.V.; LARSSON, H.C.E. The evolution of the meatal chamber in crocodyliforms. **Journal of Anatomy**, v. 228, n. 5, p. 838-863, 2016.

MONTEFELTRO, F. C. The osteoderms of baurusuchid crocodyliforms (Mesoeucrocodylia, Notosuchia). **Journal of vertebrate Paleontology**, p. 1-10, 2019.

MONTEFELTRO, F. C.; LAUTENSCHLAGER, S.; GODOY, P. L.; FERREIRA, G. S.; BUTLER, R. J. A unique predator in a unique ecossystem: modelling the apex predator from the Late Cretaceous crocodyliform-dominated fauna in Brazil. **BioRxiv**, 2020.

NASCIMENTO, P.M.; ZAHER, H. A new species of Baurusuchus (Crocodyliformes, Mesoeucrocodylia) from the Upper Cretaceous of Brazil, with the first complete postcranial skeleton described for the family Baurusuchidae. **Papéis avulsos de Zoologia**, v. 50, n. 21, p. 323-361, 2010.

NOBRE, P.H.; CARVALHO, I.S. Adamantinasuchus navae: a new gondwanan Crocodylomorpha (Mesoeucrocodylia) from the Late Cretaceous of Brazil. **Gondwana Research**, v. 10, n. 3-4, p. 370-378, 2006.

O'CONNOR, P.M. et al. The evolution of mammal-like crocodyliforms in the Cretaceous Period of Gondwana. **Nature**, v. 466, n. 7307, p. 748-751, 2010.

ÖSI, A. The evolution of jaw mechanism and dental function in heterodont crocodyliforms. **Historical Biology**, v. 26, n. 3, p. 279-414, 2014.

PINHEIRO, A.E.P. et al. Reassessment of the enigmatic crocodyliform" Goniopholis" paulistanus Roxo, 1936: Historical approach, systematic, and description by new materials. **PloS one**, v. 13, n. 8, 2018.

PINHEIRO, A. E. P. et al. The first notosuchian crocodyliform from the Araçatuba Formation (Group Bauru, Paraná Basin), and diversification of spaghesaurians. **Palaeontology**, v. 93, p. 1-30, 2021.

POL, D. New remains of Sphagesaurus huenei (Crocodylomorpha: Mesoeucrocodylia) from the late Cretaceous of Brazil. **Journal of Vertebrate Paleontology**, v. 23, n. 4, p. 817-831, 2003.

POL, D. et al. Postcranial anatomy of Sebecus icaeorhinus (Crocodyliformes, Sebecidae) from the Eocene of Patagonia. **Journal of Vertebrate Paleontology**, v. 32, n. 2, p. 328-354, 2012.

POL, D. et al. A new notosuchian from the Late Cretaceous of Brazil and the phylogeny of advanced notosuchians. **PLoS One**, v. 9, n. 4, 2014.

POL, D.; LEARDI, J.M. Diversity patterns of Notosuchia (Crocodyliformes, mesoeucrocodylia) during the cretaceous of Gondwana. **Publicación Electrónica de la Asociación Paleontológica Argentina**, v. 15, n. 1, 2015.

PRASAD, G. V. R.; Lapparent de Broin, F. Late Cretaceous crocodile remains from Naskal (India): comparisons and biogeographic affinities. ***Annales de Paléontologie***, v. 82, p. 19-71, 2002.

PRICE, L.I. A new reptile from the Cretaceous of Brazil. **Notas Preliminares e Estudos, Servicio Geologia Mineralogia do Brasil**, v. 25, n. 1, p. 1-8, 1945.

PRICE, L.I. On a new crocodilian, Sphagesaurus, from the Cretaceous of the State of São Paulo, Brazil. **Anais da Academia Brasileira de Ciências**, v. 22, n. 1, p. 77-83, 1950.

RIFF, D.; KELNER, A. W. A. Baurusuchid crocodyliforms as theropod mimics: clues from the skull and appendicular morphology of Stratiotosuchus maxhechti (Upper Cretaceous of Brazil). **Zoological Journal of the Linnean Society**, v. 163, p. 37-56, 2011.

RIFF, D. et al. Crocodilomorfos: a maior diversidade de répteis fósseis do Brasil. **Terræ**, v. 9, n. 1/2, p. 12-40, 2012.

RUIZ, J. V. et al. A new specie of Caipirasuchus (Notosuchia, Sphagesauridae) from the Late Cretaceous of Brazil and the evolutionary history of Sphagesauria. **Journal of Systematic Palaentology**, p. 1-23, 2021.

SÉLLES, A. G. et al. A small Cretaceous crocodyliform in a dinossaur nesting ground and the origin of sebecids. **Scientific Reports,** p. 1-11, 2020.

SERENO, P.C. et al. A new notosuchian from the Early Cretaceous of Niger. **Journal of Vertebrate Paleontology**, v. 23, n. 2, p. 477-482, 2003.

SERENO, P.; LARSSON, H. Cretaceous crocodyliforms from the Sahara. **ZooKeys**, v. 28, p. 1, 2009.

SERTICH, J.J.W.; O'CONNOR, P.M. A new crocodyliform from the middle Cretaceous Galula Formation, southwestern Tanzania. **Journal of Vertebrate Paleontology**, v. 34, n. 3, p. 576-596, 2014.

TURNER, A.; CALVO, J. O. A new sebecosuchian crocodyliform from the Late Cretaceous of Patagonia. **Journal of Vertebrate Paleontology**, v. 25, p. 87-98, 2005

TURNER, A. Osteology and phylogeny of a new specie of Araripesuchus (Crocodyliformes: Mesoeucrocodylia) from the Late Cretaceous of Madagascar. **Historical Biology**, v. 18, p. 255-369, 2006.

TURNER, A.H.; SERTICH, J.J.W. Phylogenetic history of Simosuchus clarki (Crocodyliformes: Notosuchia) from the late cretaceous of madagascar. **Journal of Vertebrate Paleontology**, v. 30, n. sup1, p. 177-236, 2010.

WILSON, J.A.; MALKANI, M.S; GINGERICH, P.D. New crocodyliform (Reptilia, Mesoeucrocodylia) from the Upper Cretaceous Pab Formation of Vitakri, Balochistan (Pakistan). 2001.

WOODWARD, A.W. On two mesozoic crocodilians, Notosuchus (genus novum) and Cynodontosuchus (gen. nov.) from the red sandstones of Territory of Neuquén (Argentina). **Talleres de Publicaciones del Museo**, 1896.

SUPPLEMENTARY MATERIAL

1. DETAILS OF THE PHYLOGENETIC ANALYSIS

1.1. Characters and taxon sampling

The taxon sampling was based on previously published analyses, expanded to accommodate *Aphaurosuchus spp.* (this work), *Aplestosuchus sordidus* (Godoy et al., 2014), *Aphaurosuchus* e*scharafacies* (Darlim et al., 2021), *Baurusuchus albertoi* (Nascimento & Zaher, 2010), *Campinasuchus dinizi* (Carvalho et al., 2011), *Gondwanasuchus scrabrosus* (Marinho et al., 2013), *Pabwehshi pakistanensis* (Wilson et al., 2001); *Wargosuchus australis* (Martinelli & Pais, 2008), *Ogresuchus furatus* (Sélles et al., 2020) and *Razanandrongobe sakalavae* (Maganuco et al., 2006; Dal Sasso et al., 2017).. The resulting data matrix includes 108 taxa and 521 characters.

1.2. Character list

The original source for each character is indicated after the characters definitions. The 15 added characters are in the end of the list, except by one (char. 97). Characters proposed by the first time are indicated with "new". The other added characters are: three characters (509, 510, 518), from Pol et al. (2014), four (511-514) from Geroto & Bertini (2018), and four (97, 519-52) from Darlim et al. (2021).

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 & 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 & Norell (2004a)).

26. Suborbital fenestrae: small (0), present and subequal or larger than orbit (2) (Andrade *et al.* 2011).

27. Suborbital fenestrae, shape of anterior border: rounded, smooth (0), in sharp angle, forming a notch, fissure-like (1) (Andrade & 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: opened laterally (0), closed laterally (1) (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 & 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. Nasa-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 & 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 & 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 & 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 & 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. Supratemporal rims raised and hypertrophied: restricted to the median edge of the external supratemporal fenestra (0), extended to anterior edge of the external supratemporal fenestrae (1) (Montefeltro *et al.* 2011)

98. 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).

99. Angle between medial and anterior margins of supratemporal fossa: ~90 degrees or greater (0), or ~45 degrees (1) (Gasparini *et al.* 2006).

100. Shallow fossa at anteromedial corner of supratemporal fenestra: present (0), or absent, corner smooth (1) (Brochu 1999).

101. 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).

102. 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).

103. 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).

104. Lateral margins of squamosal and postorbital in dorsal view: parallel (0), or diverging posteriorly (1) (Ortega *et al.* 2000).

105. Palpebrals: absent (0), present (1) (Clark 1994).

106. Posterior palpebral: absent (0), present (1) (Clark 1994).

107. Anterior palpebral shape: rounded (0), hook-shaped with a posterolateral process (1) (Clark 1994).

108. 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 & Norell 2004b).

109. 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).

110. Longitudinal groove for attachment of the upper ear lid at squamosal lateral surface: absent (0), present (1) (Clark & Sues 2002).

111. 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 & Sues 2002).

112. Posteromedial branch of squamosal, orientation: transversely oriented (0), posterolaterally oriented (1) (Gasparini *et al.* 2006).

113. Squamosal, dorsal margin of occipital flange: straight (0), or dorsally concave (1) (Gasparini *et al.* 2006).

114. Anterior opening of temporo-orbital canal, in dorsal: present (0), absent (1) (Ortega *et al.* 2000).

115. Squamosal posterolateral process: absent (0), present (1) (Clark 1994).

116. Squamosal posterolateral process projection: parallel to skull roof (0), ventrally directed (1), upturned (2) (Ortega *et al.* 2000).

117. Ventral projection of squamosal posterolateral process: does not closes the auditory meatus posteriorly (0), closes the auditory meatus posteriorly (1) (Ortega *et al.* 2000).

118. Squamosal posterolateral process: in level with skull table (0), or depressed from skull table (1) (Sereno & Larsson 2009).

119. Ornamentation on the posterolateral process of squamosal: absent (0), present (1) (Larsson & Sues 2007).

120. Distal squamosal posterolateral process: tapered (0), broad (1) (Larsson & Sues 2007).

121. Exposure of supraoccipital in skull roof: absent (0), present (1) (Ortega *et al.* 2000).

122. 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).

123. Parietal: with broad occipital portion (0), without broad occipital portion (1) (Clark 1994).

124. Enclave at parietal-squamosal posterior margin in dorsal view: absent (0), present (1) (Wilkinson *et al.* 2008).

125. Ventral curvature of temporal arch: absent (0), present (1) (Andrade *et al.* 2011).

126. 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).

127. 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).

128. Perinarial fossa: absent (0), present (1) (Pol & Apesteguia 2005).

129. Perinarial fossa: restricted extension (0), reaching the alveolar margin of premaxillae (1) (Pol & Apesteguia 2005).

130. 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 & Apesteguia 2005).

131. 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 & Bertini 2008).

132. 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).

133. 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 & Bertini 2008).

134. Ventral edge of maxilla in lateral view: straight or convex (0), or sinusoidal (1) (Ortega *et al.* 2000).

135. Small foramen located in the premaxilla-maxillary suture in lateral surface (not for big mandibular teeth): absent (0), or present (1) (Pol 1999).

136. Wedge-like process of the maxilla in lateral surface of premaxilla-maxilla: absent (0), or present (1) (Gasparini *et al.* 1993).

137. 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).

138. Evaginated maxillary alveolar edges: absent (0), present (1) (Gasparini *et al.* 2006).

139. Evaginated maxillary alveolar edges: as continuous sheet (0), as discrete evaginations at each alveolus (1) (Gasparini *et al.* 2006).

140. Unsculptured region along alveolar margin on lateral surface of maxilla: absent (0), or present (1) (Wu & Sues 1996).

141. 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).

142. Posterior extent of maxilla in lateral surface of rostrum: posterior to anterior margin of orbit (0) anterior to anterior margin of orbit (1) (Wu & Chatterjee 1993).

143. 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).

144. 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 & Sues 2007).

145. Jugal, extension below the orbit: does not exceed anterior margin of orbit (0), or exceeds margin (1) (Pol 1999).

146. 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).

147. Jugal outer surface: confluent along the entire length (0), infratemporal portion of jugal laterally displaced anteriorly (1) (Pol 1999).

148. Infratemporal portion of jugal laterally displaced: does not extend beyond the anterior orbital margin (0), extends beyond the anterior orbital margin (1) (Pol 1999).

149. 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).

150. 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).

151. Jugal, large foramen on the lateral surface near the anterior margin: absent (0), or present (1) (Zaher *et al.* 2006).

152. Anterior process of jugal relative to infratemporal fenestrae anteroposterior length: smaller to sub equal (0), much longer (1) (Larsson & Sues 2007).

153. Ectopterygoid-jugal suture ridge: absent (0), present (1) (Montefeltro *et al.* 2011).

154. 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).

155. Posterior portion of lateral surface of jugal and ectopterygoid: not confluent (0), confluent with lateral jugal margin forming a depression (1) (Sereno & Larsson 2009).

156. Ventral lamina of jugal: extends far anterior to ectopterygoid (0), or ends at level of ectopterygoid (1) (Jouve 2004).

157. Base of postorbital process of jugal, orientation: directed posterodorsally (0), dorsally (1), or anterodorsally (2) (Pol 1999).

158. Postorbital process of jugal, location on jugal: anteriorly placed (0), in middle (1), or posteriorly positioned (2) (Pol 1999).

159. Jugal portion of postorbital bar, relative to lateral surface of jugal: flush with lateral surface of jugal (0), inset (1) (Ortega *et al.* 2000).

160. Inset jugal portion of postorbital bar: anteriorly continuous but posteriorly inset (1), or medially displaced along the whole extent (2) (Ortega *et al.* 2000).

161. Jugal infratemporal bar: laterally flat (0), rod-shaped (1) (Clark 1994).

162. Postorbital bar, external texture: sculpted (0), or unsculpted (1) (Clark 1994).

163. Postorbital bar, lateral surface formed by: formed by postorbital and jugal (0), or only by postorbital (1) (Gasparini *et al.* 2006).

164. Ventral margin of infratemporal bar of jugal: straight or gentle dorsally arched (0), or strongly arched (1) (Pol *et al.* 2004).

165. Longitudinal ridge on lateral surface of jugal below infratemporal fenestrae: absent (0), present (1) (Pol & Norell 2004b).

166. Jugal, relationship with antorbital fossa: participating in margin of antorbital fossa (0), or separated from it (1) (Wu & Sues 1996).

167. Jugal posterior process, extent of process: exceeding posteriorly the infratemporal fenestrae (0), or not (1) (Pol 1999).

168. Posteroventral corner of quadratojugal: not reaching quadrate condyles (0), reaching quadrate condyles (1) (Pol 1999).

169. 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).

170. Postorbital bar, shape: transversely flattened (0), massive and elliptical cross section (1), slender and cylindrical (2) (Clark 1994).

171. Dorsal part of postorbital, shape in dorsal view: with anterior and lateral edges only (0), or with anterolaterally facing edge (1) (Clark 1994).

172. 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).

173. Vascular opening in dorsal surface of postorbital bar: absent (0), or present (1) (Clark 1994).

174. 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 & Sues 2007).

175. Postorbital participation in infratemporal fenestra: almost or entirely excluded (0), or bordering infratemporal fenestra (1) (Buscalioni *et al.* 1992).

176. Postorbital descending flange lateral surface: flat (0), or concave (1) (Montefeltro *et al.* 2011).

177. Quadratojugal, ornamentation at base: absent (0), or present (1) (Pol 1999).

178. 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 & Sues 2007).

179. 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 & Norell (2004a).

180. Postorbital-quadratojugal contact in lateral view: restricted (0), broad contact between quadratojugal and the posterior portion of the postorbital descending flange (1) (Clark 1994).

181. Ridge along dorsal section of quadrate-quadratojugal contact: absent (0), or present (1) (Pol & Norell 2004b).

182. Posterior margin of infratemporal fenestrae: straight (0), with an anterior projection (1) (Ortega *et al.* 2000).

183. Anterior projection of posterior margin of infratemporal fenestrae: crest shaped (0), prominent spina quadratojugalis (1) (Ortega *et al.* 2000).

184. In lateral view, anterior process of the squamosal extending to the orbital margin, overlapping the postorbital: absent (0), present (1) (Turner & Buckley 2008).

185. 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 & Buckley 2008).

186. Quadrate major axis, direction of orientation: directed posteroventrally (0), directed mostly ventrally, or anteroventrally (1) (Pol 1999).

187. Dorsal, primary head of quadrate articulates with: squamosal, otoccipital, and prootic (0), or prootic and laterosphenoid (1) (Clark 1994).

188. Quadrate lateral depression: absent (0), present (1) (Montefeltro *et al.* 2011).

189. 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).

190. Posterior edge of quadrate: broad medial to tympanum, gently concave (0), or posterior edge narrow dorsal to otoccipital contact, strongly concave (1) (Clark 1994).

191. External auditory meatus: continuous (0), separated in two region by a ridged on quadrate-quadratojugal (1) (Larsson & Sues 2007).

192. Quadrate fenestration: absent (0), present (1) (Clark 1994).

193. Quadrate fenestration: preotic siphonal foramen present anterior to otic aperture (0), quadrate with many additional fenestration (1) (Clark 1994).

194. Quadrate fenestrae: visible in lateral view (0), or internalized in otic notch (1) (Montefeltro *et al.* 2011).

195. Squamosal-quadrate contact within the otic aperture: dorsally to cranioquadrate otic aperture (0), within cranioquadrate otic aperture (1) (Brochu 1999).

196. 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).

197. 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).

198. Incisive foramen size: present (0), absent (1) (Larsson & Sues 2007).

199. Palatal parts of premaxillae, extent of contact: do not meet posterior to incisive foramen (0), meet posteriorly along contact with maxillae (1) (Clark 1994).

200. 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).

201. Premaxilla, anterior alveolar margin orientation: vertical (0), or inturned (1) (Sereno *et al.* 2001).

202. Posterior palatal branches of maxillae anterior to palatines: do not meet (0), meet (1) (Clark 1994).

203. Premaxillary palate, circular paramedian depressions: absent (0), present (1) (Sereno *et al.* 2001).

204. Prominent depression on the palate near alveolar margin at the level of the 6th or 7th alveoulus: absent (0), or present (1) (Turner & Buckley 2008).

205. 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).

206. Premaxilla-maxilla lateral fossa excavating alveolous of last premaxillary tooth: no (0), or yes (1) (Larsson & Sues 2007).

207. Large nutrient foramen on palatal surface of premaxilla-maxilla contact: small or absent (0), or present (1) (Larsson & Sues 2007).

208. Rugose surface on palatal surface of maxilla posterior to last tooth: absent (0), or present (1) (Pol & Powell 2011).

209. Longitudinal depressisons on palatal surface of maxillae and palatines: absent (0), or present (1) (Gasparini *et al.* 2006).

210. Sculpturing, palatal surface of maxilla: absent, palatal surface smooth (0), present, palatal surface ornamented with ridges (1) (Ortega *et al.* 2000).

211. Maxillae saggital contact: smooth (0), bearing a longitudianal series of foramina (1) (Montefeltro *et al.* 2011).

212. Participation of maxilla at anterior edge of suborbital fenestrae: great participation (0), reduced or absent (1) (Andrade & Bertini 2008).

213. Sagittal torus on maxillary palatal shelves: absent (0), present (1) (Larsson & Sues 2007).

214. Ectopterygoid N maxilla contact: ectopterygoid only abuts maxilla (0), present and broad and maxilla broadly separates ectopterygoid from maxillary tooth row (1) (Brochu 1999).

215. 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).

216. Palatines, palatal process: absent (0), present (1) (Clark 1994).

217. 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).

218. 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).

219. Maxillary process to palatine, next to the anterior border of suborbital fenestrae: absent (0), present (1) (Andrade & Bertini 2008).

220. 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).

221. 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).

222. Paired anterior palatal fenestrae: absent (0), or present (1) (Wu *et al.* 1997).

223. Medial palatal contact: smooth (0), rugose (1) (Montefeltro *et al.* 2011).

224. Row of foramina flanking the medial contact of palatines: absent (0), present (1) (Montefeltro *et al.* 2011).

225. Anterior half of interfenestral bar between suborbital fenestrae: parallel to subparallel (0), or flared anteriorly (1) (Pol *et al.* 2009).

226. Posterior half of interfenestral bar between suborbital fenestrae: parallel to subparallel (0), or flared posteriorly (1) (Pol *et al.* 2009).

227. Ventral face of palatine bar: flat and wide (0), ventral surface restricted and dorsal portion cylindrical (1) (Montefeltro *et al.* 2011).

228. Cylindrical dorsal portion of palatine bar: with the same wideness through (0) constricted in the posterior portion (1) (Montefeltro *et al.* 2011).

229. Palatines (anteroposterior axis): run parasagittally along midline (0), diverge laterally, becoming rod-like and forming palatine bars posteriorly (1) (Martinelli 2003).

230. Palatine-pterygoid contact on palate: palatines overlie pterygoids (0), or palatines firmly sutured to pterygoids (1) (Pol & Norell 2004a).

231. Vomer, exposure on palate: exposed (0), or not exposed (1) (Buckley *et al.* 2000).

232. 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).

233. Pterygoids, contact on palate: not in contact anterior to basisphenoid on palate (0), or pterygoids in contact (1) (Wu *et al.* 1997).

234. 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).

235. Pterygoid, ventral surface of pterygoid flanges, parachoanal fossae: absent (0), or present (1) (Andrade & Bertini 2008).

236. Pterygoid parachoanal fenestra: absent (0), present (1) (Montefeltro *et al.* 2011).

237. Pterygoid parachoanal fenestra: open dorsally (0), closed dorsally (1) (Montefeltro *et al.* 2011).

238. 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 & Sertich 2010).

239. 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).

240. Pterygoid ventral rami, ventral surface at proximal end: smooth (0), evident transverse ridge on ventral surface (1) (Andrade *et al.* 2011).

241. Transverse ridge on ventral surface of pterygoid: thin (0), robust (1) (Andrade *et al.* 2011).

242. Quadrate process of pterygoids: well developed (0), or poorly developed (1) (Pol 1999).

243. Quadrate ramus of pterygoid in ventral view: narrow (0), or broad (1) (Wu *et al.* 1997).

244. Palatal surface of pterygoids: smooth (0), or sculpted (1) (Clark 1994).

245. Pterygoidean flanges: laminar and expanded (0), bar-like (1) (Ortega *et al.* 2000).

246. Bar-like pterygoidean flanges: elongate (0), short and poor developed (1) (Ortega *et al.* 2000).

247. Pterygoid flanges, size: thin and laminar (0), or dorsoventrally thick, with pneumatic spaces (1) (Wu *et al.* 1997).

248. 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).

249. Posterior pterygoid processes: absent or reduced (0), well developed projecting posteriorly (1) (Larsson & Sues 2007).

250. Choanal septum shape: narrow vertical bony sheet (0), T-shaped bar expanded ventrally (1), or massive and blocky (2) (Pol & Apesteguia 2005).

251. Ventral surface of choanal septum: smooth to slightly depressed (0), marked by an acute groove (1), ridged (2) (Turner 2006).

252. Postorbital-ectopterygoid contact: present (0), or absent (1) (Pol 1999).

253. Ectopterygoid, relation to postorbital bar: absent, bar does not receive contribution from ectopterygoid (0), present, bar receives contribution from ectopterygoid (1) (Sereno & Larsson 2009).

254. Ectopterygoid main axis orientation: laterally or slightly anterolaterally (0), or anteriorly, subparallel to longitudinal axis of skull (1) (Pol *et al.* 2004).

255. 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).

256. Ectopterygoid, extent along lateral pterygoid flange, at maturity: extends to posterior tip (0), or does not extend to posterior tip (1) (Norell 1988).

257. Ectopterygoid, participation in the palatine bar: absent (0), or present (1) (Zaher *et al.* 2006).

258. Anterior process of ectopterygoid: developed (0), or reduced or absent (1) (Pol 1999).

259. Ectopterygoid medial process, shape: single (0), or forked (1) (Ortega *et al.* 2000).

260. Posterior process of ectopterygoid: developed (0), or reduced or absent (1) (Pol 1999).

261. Ectopterygoid-palatine contact posterior to the suborbital fenestra: not contacting (0), or contacting (1) (Pol & Powell 2011).

262. 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).

263. Basipterygoid process, shape: prominent, forming movable joint with pterygoid (0), or small or absent, with basisphenoid joint suturally closed (1) (Clark 1994).

264. Basisphenoid, exposure on braincase: exposed on ventral surface of braincase (0), or virtually excluded from ventral surface by pterygoid and basioccipital (1) (Clark 1994).

265. Basisphenoids, lateral exposure on braincase: absent (0), or present (1) (Pol 1999).

266. 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).

267. Pterygoid ramus of quadrate: with flat ventral edge (0), or with deep groove (1) (Clark 1994).

268. 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 & Norell 2004a).

269. Quadrate-basisphenoid contact: dorsolateral contact (0), dorsolateral and anterolateral contact (1) (Wu *et al.* 1997).

270. 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).

271. Basioccipital: without well-developed bilateral tuberosities (0), or with large pendulous tuberosities (1) (Clark 1994).

272. Basioccipital, midline crest on basioccipital plate below occipital condyle: absent (0), or present (1) (Turner & Sertich 2010).

273. Eustachian tubes, relationship with basioccipital and basisphenoid: not enclosed between basioccipital and basisphenoid (0), or entirely enclosed (1) (Clark 1994).

274. Lateral eustachian tube openings, location: located posterior to medial opening (0), or aligned anteroposteriorly and dorsoventrally (1) (Pol 1999).

275. 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).

276. Lateral Eustachian foramina: smaller than medial one (0), as larger or larger than medial one (1) (Montefeltro *et al.* 2011).

277. 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).

278. Muscle scar in the medial surface of quadrate (ridge A Iordasky 1968): almost straight to curved (0), or sigmoidal (1) (Montefeltro *et al.* 2011).

279. Ventral surface of the quadrate: smooth or with simple muscle scars (0), with developed multiples ridges (1) (Ösi *et al.* 2007).

280. Cross section of distal end of quadrate: mediolaterally wide and anteroposteriorly thin (0), or subquadrangular (1) (Pol & Norell 2004a).

281. 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).

282. Lateral quadrate condyle: almost at the same anteroposterior extention than medial one (0), or lateral quadrate hemispherical (1) (Montefeltro *et al.* 2011).

283. Laterosphenoid bridge: absent (0), at least partially complete (1) (Brochu 1999).

284. Laterosphenoid, orientation of capitate process: oriented laterally (0), or anteroposteriorly toward midline (1) (Brochu 1999).

285. Squamosal posterolateral region, lateral to paroccipital process: narrow (0), or bearing subrounded flat surface (1) (Gasparini *et al.* 2006).

286. Supraoccipital: forms dorsal edge of foramen magnum (0), otoccipitals broadly meet dorsal to foramen magnum, separating supraoccipital from foramen magnum (1) (Clark 1994).

287. Posterior surface of supraoccipital: nearly flat (0), or with bilateral posterior prominences (1) (Clark 1994).

288. Exoccipitals participate in the occipital condyle: no (0), yes (1) (Jouve *et al.* 2005).

289. Basioccipital and ventral part of otoccipital, orientation: facing posteriorly (0), or posteroventrally (1) (Gomani 1997).

290. Ventrolateral contact of otoccipital with quadrate: very narrow (0), or broad (1) (Clark 1994).

291. Orientation of paraocciptial 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 & Andrade 2009).

292. Otoccipital: without laterally concave descending flange ventral to subcapsular process (0), or with flange (1) (Clark 1994).

293. 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 IXNXI (1) (Clark 1994).

294. Cranial nerves IXNXI, 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).

295. Development of distal quadrate body ventral to otoccipital-quadrate contact: distinct (0), indistinct (1) (Wu *et al.* 1997).

296. Otoccipital, ventral to paraoccipital process: without large ventrolateral part ventral to paroccipital process (0), or with large ventrolateral part (1) (Clark 1994).

297. Crista interfenestralis between fenestrae pseudorotunda and ovalis, orientation: nearly vertical (0), or horizontal (1) (Clark 1994).

298. Mastoid antrum, location: does not extend into supraoccipital (0), or extends through transverse canal in supraoccipital to connect middle ear regions (1) (Clark (1994).

299. Quadrate body distal to otoccipital-quadrate, orientation of contact in posterior view: ventrally (0), or ventrolaterally (1) (Pol & Norell 2004a).

300. Foramen for the internal carotid artery: reduced, similar in size to openings for cranial nerves IXNXI (0), or extremely enlarged (1). (Gasparini *et al.* 2006).

301. Mandibular outer surface sculpture: absent (0), present (1) (Montefeltro *et al.* 2011).

302. Mandibular outer surface sculpture: present on dentary (0), present on dentary and splenial (1) (Montefeltro *et al.* 2011).

303. Strong pitted pattern on angular and posterior surangular: absent (0), present (1) (Andrade *et al.* 2011).

304. Mandibular fenestra: absent (0), present (1) (Clark 1994).

305. Mandibular fenestrae size: present as a diminutive passage (0), present as an evident fenestra (1) (Clark 1994).

306. External mandibular fenestra, orientation of main axis: horizontal (0), main axis inclined, directed anteroventrally-posterodorsally (1) (Andrade *et al.* 2011).

307. 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).

308. 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).

309. Posteroventral edge of mandibular ramus, shape: straight or convex (0), or markedly deflected (1) (Wu *et al.* 1997).

310. Jaw joint, location: placed level with occipital condyle (0), below occipital condyle (1) (Wu & Sues 1996).

311. Anterior foramen intramandibularis oralis: small or absent (0), or large and slotlike (1) (Ortega *et al.* 2000).

312. Foramen intramandibularis caudalis: absent (0), present (1) (Larsson & Sues 2007).

313. Dentary, lateral surface: smooth lateral to seventh alveolus (0), or with lateral concavity for reception of enlarged maxillary tooth (1) (Buckley & Brochu 1999).

314. 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 & Apesteguia 2005).

315. Dentary, relative to mandibular fenestra: extends posteriorly beneath mandibular fenestra (0), or does not extend beneath fenestra (1) (Clark 1994).

316. Dentary compression and lateroventral surface anterior to mandibular fenestra: compressed and vertical (0), or not compressed and convex (1) (Ortega *et al.* 1996).

317. Unsculpted region in the dentary below the tooth row: absent (0), present (1) (Pol 1999).

318. 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).

319. 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).

320. Dentary, projection of anterior alveoli: project anterodorsally (0), procumbent (1) (Brochu 1999).

321. 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).

322. Coronoid participation on the external face of the mandible: no (0), or yes (1) (Young & Andrade 2009).

323. Posterior peg at symphysis: absent (0), or present (1) (Pol & Apesteguia 2005).

324. Posteroventral symphyseal depressions: absent (0), present (1) (Montefeltro *et al.* 2011).

325. Posteroventral symphyseal depressions: facing ventrally (0), facing posteriorly (1) (Montefeltro *et al.* 2011).

326. 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).

327. Splenial involvement in symphysis in ventral view: not involved (0), involved (1) (Clark 1994).

328. 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).

329. Dorsal surface of mandibular symphysis: flat or slightly concave (0), or strongly concave and narrow, trough shaped (1) (Pol & Apesteguia 2005).

330. Medial surface of splenials posterior to symphysis: flat or slightly convex (0), markedly concave (1) (Pol & Apesteguia 2005).

331. 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 & Sues 1996).

332. 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 & Larsson 2009).

333. 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).

334. Splenial-dentary suture at symphysis on ventral surface: V-shaped (0), or transversely oriented (1) (Pol & Apesteguia 2005).

335. Splenial posterior to symphysis: thin (0), or robust dorsally (1) (Ortega *et al.* 1996).

336. Surangular groove, enlarged foramen at anterior end: absent (0), present (1) (Gasparini *et al.* 2006).

337. 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).

338. Surangular ventral face in lateral view: angular doesn't extend beyond orbits (0), angular extends beyond the orbits (1) (Wilkinson *et al.* 2008).

339. Dorsal edge of surangular: mostly straight (0), arched dorsally (1) (Clark 1994).

340. Longitudinal ridge along the dorsolateral surface of surangular: absent (0), or present (1) (Pol & Norell 2004b).

341. Lateral expansion of posterodorsal edge of surangular anterior to glenoid fossa: absent (0), or present (1) (Turner & Buckley 2008).

342. Surangular, contribution to the glenoid fossa: forms only lateral wall of glenoid fossa (0), or forms approximately one-third of glenoid fossa (1) (Buckley & Brochu 1999).

343. 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).

344. Surangular extension toward posterior end of retroarticular process: along entire length (0), or pinched off anterior to posterior tip (1) (Norell 1988).

345. Angular, shape of posteroventral margin: straight or gently arched dorsally (0), or strongly arched dorsally (1) (Pol *et al.* 2009).

346. 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).

347. Sharp ridge on the surface of the angular: absent (0), present (1) (Pol & Norell 2004b).

348. Sharp ridge on the surface of the angular: at ventral-most margin (0), or along lateral surface (1) (Pol & Norell 2004b).

349. Prearticular: present (0), or absent (1) (Clark 1994).

350. 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 & Sues 1996).

351. Posterior ridge on glenoid fossa of articular: posterior margin well developed, evidently high (0), posterior margin poorly delimited, crest absent (1) (Pol & Apesteguia 2005).

352. Articular, medial process articulating with otoccipital and basisphenoid: absent (0), present (1) (Clark 1994).

353. 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).

354. 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).

355. Tooth margin carinae: without carinae or with smooth or crenulated carinae (0), with denticulate carinae (1), with tubercular heterogenic denticles (2) (Ortega *et al.* 1996).

356. 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).

357. 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).

358. Asymmetric compression of Mid to posterior tooth rows elements: absent (0), present, occurring only along distal margin giving teeth a teardrop shape (1) (Andrade & Bertini 2008).

359. Tooth accessory cusps: absent (0), present (1) (Gomani 1997).

360. Tooth accessory cusps: accessory cusps arranged in one row (0), accessory cusps arranged in more than one row (1) (Gomani 1997).

361. Posterior teeth with rings of undulated enamel: absent (0), or present (1) (Gasparini *et al.* 2006).

362. Presence of ridged ornamentation on enamel surface of mid to posterior teeth: absent (0), present (1) (Andrade *et al.* 2011).

363. Surface of tooth enamel: smooth or slightly crenulated (0), or with ridges at base of crown (often extending apically) (1) (Turner & Sertich 2010).

364. Accessory ridges on labial-lingual surfaces of mid to posterior teeth: absent (0), present (1) (Andrade *et al.* 2011).

365. Premaxillary tooth number: six (0), five (1), four (2), three (3), two (4) (Wu & Sues 1996).

366. Number of maxillary teeth: eight or more (0), seven (1), six (2), five (3), or four (4) (Wu & Sues 1996).

367. 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).

368. Procumbent premaxillary alveoli: absent (0), or present (1) (Zaher *et al.* 2006).

369. Premaxillary teeth 1 and 2, position: separated like adjacent teeth (0), or nearly confluent (1) (Larsson & Gado 2000).

370. Posterior premaxillary teeth, size: similar in size to anterior teeth (0), or much longer than anterior teeth (1) (Clark 1994).

371. Last premaxillary tooth position relative to tooth row: anterior or anteromedial (0), or anterolateral (1) (Sereno *et al.* 2001).

372. 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).

373. 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).

374. 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 & Bertini 2008).

375. Size of the 7th and 8th dentary tooth crowns: about the same size (0), 7th much smaller than 8th (1) (Andrade *et al.* 2011).

376. Maxillary dental implantation: teeth in isolated alveoli (0), or located in dental groove (1) (Ortega *et al.* 2000).

377. Tooth (with transitional morphology) present at premax-max contact: absent (0), or present (1) (Turner & Sertich 2010).

378. Cheek teeth base: not constricted (0), or constricted (1) (Ortega *et al.* 1996).

379. Posterior (molariform) teeth, wear facets: absent (0), or present (1) (Turner & Sertich 2010).

380. Width of root of teeth with respect to crown: narrower or equal (0), or wider (1) (Ortega *et al.* 2000).

381. Enlarged maxillary teeth: absent (0), present at second or third alveolus (1), or fourth or fifth (2) (Ortega *et al.* 2000).

382. Anterior dentary teeth opposite premaxilla-maxilla contact: no more than twice length (0), more than twice the length (1) (Clark 1994).

383. Vertebral centra, shape: cylindrical (0), or spool-shaped (1) (Buscallioni & Sanz 1988).

384. Atlas intercentrum, size: broader than long (0), or as long as broad (1) (Clark 1994).

385. Axial neural spine height: high, subequal to centrum height (0), low, less than half centrum height and nearly horizontal (1) (Larsson & Sues 2007).

386. 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).

387. Axial neural spines, width of posterior half: wide (0), or narrow (1) (Brochu 1999).

388. 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).

389. Postzygapophyses of axis: well developed, curved laterally (0), or poorly developed (1) (Pol 1999).

390. Axial hyapophysis, deep fork: present (0), or absent (1) (Brochu 1999).

391. Cervical rod-like neural spines: absent (0), present (1) (Clark 1994).

392. Cervical vertebrae: amphicoelous or amphyplatyan (0), or procoelous (1) (Clark 1994).

393. 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 & Bertini 2008).

394. 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).

395. 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).

396. 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).

397. 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 & Bertini 2008).

398. 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).

399. Hypapophyses in cervicodrsal vertebrae: absent (0), present (1) (Buscallioni & Sanz 1988).

400. Hypapophyses in cervicodrsal vertebrae: present only in cervical vertebrae (0), present in cervical and dorsal vertebrae (1) (Buscallioni & Sanz 1988).

401. Trunk vertebrae: amphicoelous or amphyplatyan (0), or procoelous (1) (Clark 1994).

402. Transverse process of posterior dorsal vertebrae, shape: dorsoventrally low and laminar (0), or dorsoventrally high (1) (Buscalioni & Sanz 1988).

403. 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).

404. 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).

405. Spinopostzygapophyseal lamina in dorsal vertebrae: absent (0), or present as a high and sharp lamina (1) (Pol *et al.* 2012).

406. 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).

407. 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).

408. Number of sacral vertebrae: two (0), or more than two (1) (Buscalioni & Sanz 1988).

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

410. 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).

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

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

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

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

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

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

417. 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).

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

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

420. 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).

421. 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).

422. 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).

423. 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).

424. 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).

425. 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).

426. 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).

427. 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).

428. Ulna, width of olecranon process: narrow and subangular (0), or wide and rounded (1) (Brochu 1999).

429. Articular surface for the ulna on the radiale: facing posterolaterally (0), or facing posteriorly, not visible in lateral view (1) (Pol *et al.* 2012).

430. 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).

431. Proximal end of radiale, shape: expanded symmetrically, similarly to distal end (0), or more expanded proximolaterally than proximomedially (1) (Buscallioni & Sanz 1988).

432. Proximal carpals, relative proportions of radiale: slender, much longer than wide (0), broad, proximal width subequal to length (1) (Ortega *et al.* 2000).

433. 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).

434. 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).

435. 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).

436. 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 & Zaher, 2010) (1) (Pol *et al.* 2012).

437. 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).

438. 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).

439. Development of the rugose surface for the insertion of the M. iliotibialis that forms the supracetabular crest: lateromedially narrow (0), lateromedially broad (1) (Buscallioni & Sanz 1988).

440. 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).

441. 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).

442. Orientation of the ventral margin of the postacetabular process: posterodorsally directed (0), or horizontally or slightly posteroventrally deflected (1) (Pol *et al.* 2012).

443. Dorsoventral position of the ventral margin of the postacetabular process (along its posteriorNmost 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).

444. Orientation of the rugose surface for the insertion of the M. iliotibialis that forms the supracetabular crest: dorsal or dorsolateral (0), lateral (1) (Buscallioni & Sanz 1988).

445. Pubis, shape: rod-like without expanded distal end (0), or with expanded distal end (1) (Clark 1994).

446. Pubis anterior process: absent (0), present (1) (Clark 1994).

447. Ischium anterior process: does not excludes pubis from acetabulum margin (0), excludes pubis from acetabulum margin (1) (Clark 1994).

448. Femur, anterior margin: linear (0), or bears flange for PIFI 1 musculature and a marked concavity above this region (1) (Buckley & Brochu 1999).

449. 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).

450. 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).

451. Proximal-most portion of fibular head: straight sided to weakly developed posteriorly (0), or very sharply projecting posteriorly, forming distinct extension (1) (Turner 2006).

452. Tibial shaft in anterior or posterior view: straight or only slightly bowed (0), or markedly bowed laterally (1) (Pol *et al.* 2012).

453. 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).

454. 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 INII 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 INII, failing to close the proximomedial corner of the anterior hollow (1) (Pol *et al.* 2012).

455. 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).

456. Astragalar-tarsal ligament pit on astragalus (sensu Sertich & 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).

457. 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).

458. 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).

459. 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).

460. 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).

461. Dorsal osteoderms articular anterior process: absent (0), present (1) (Clark 1994).

462. Dorsal osteoderms articular anterior process: with discrete convexity on anterior margin (0), or with well-developed process located anterolaterally (1) (Clark 1994).

463. Longitudinal keels on dorsal surface of osteoderms: absent (0), present (1) (Clark 1994).

464. Longitudinal keels on dorsal surface of osteoderms: extending to anterior half (0), or restricted to posterior edge of osteoderm (1) (Pol *et al.* 2009).

465. Osteoderms: some or all imbricated (0), or sutured to one another (1), or not in contact (2) (Clark 1994).

466. Gap in cervico-thoracic dorsal armor: absent (0), or present (1) (Ortega *et al.* 2000).

467. 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).

468. Rows of dorsal primary osteoderms (sensu Frey, 1988): present (1), absent (1) (Clark 1994).

469. Rows of dorsal primary osteoderms (sensu Frey, 1988): two parallel rows (0), four rows (1), or more than four rows (2) (Clark 1994).

470. Dorsal osteoderms, accessory ranges of osteoderms (sensu Frey, 1988): absent (0), or present (1) (Turner & Sertich 2010).

471. Osteoderms on ventral part of trunk: absent (0), or present (1) (Clark 1994).

472. Tail osteoderms: dorsal surface only has osteoderms (0), completely surrounding tails (1), or lacks any osteoderms (2) (Clark 1994).

473. Appendicular osteoderms: absent (0), or present (1) (Pol & Norell 2004b).

474. Constriction at frontal anterior process: absent (0), present, anterior portion of anterior process of frontal constricted (1) (Montefeltro *et al.* 2013).

475. 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).

476. 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).

477. 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).

478. 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).

479. Parietal posterior region dorsal surface: smooth (0), presenting a dorsal ridge (1) (Montefeltro *et al.* 2013).

480. Paired foramen located ant anterior region of palatal ventral surface (not homologous to maxilla-palatine fenestrae and palate canals): absent (0), preset (1) (Montefeltro *et al.* 2013).

481. Median pharyngeal tube main orientation: ventral (0), lateral (1), posterior (2) (Montefeltro *et al*. 2013).

482. Median pharyngeal tube, posterior wall: present (0), absent (1) (Montefeltro *et al*. 2013).

483. 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).

484. 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).

485. 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).

486. 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)**.**

487. Otic buttress: Absent (0), present (1) (sensu Montefeltro et al. 2016).

488. Otic buttress: Slender (0), Robust (1) (sensu Montefeltro et al. 2016).

489. 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).

490. Longitudinal sulcus between the coronoids process of surangular: Shallow (0), deep (1).

491. 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).

492. Bar between the paracoanal fenestrae, shape: same width along the entire extension (0), tappers in the posterior third (1).

493. 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).

494. 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).

495. Ectoperygoid-palatine contact posterior to the suborbital fenestra: equally formed by ectopterygoid and palatine (0), formed only by the ectopterygoid (1).

496. Medial pharyngean tube in relationship with the pterygoids: bounded by pterygoid wall anteriorly (0), enlarged and anteriorly continued by the choana (1).

497. Basisphenoid posterior edge: straight or curved (0), with an anterior reentrance (1).

498. Outer enamel surface: Smooth (0), rugose (1): char.392 – modified from Turner and Sertich, 2010: char. 294 (sensu Pol et al. 2014).

499. 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).

500. Thin enamel ridge (loph) connecting adjacent denticles instead of presenting distinct interdenticular slits: absent (0), present (1) (sensu Pol et al. 2014: char.389).

501. 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).

502. 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).

503. 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).

504. 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).

505. Quadrate mesoventral crest ventral to occipital contact: absent (0), incipient (1), well developed (2) (Ruiz *et al.* 2021).

506. Small pedicel of pterygoid supporting the palatine-ectopterygoid contact posterior to the suborbital fenestra: Absent (0), present (1) (Ruiz *et al.* 2021).

507. Diastema between D5 and D6: Absent or regularly arranged teeth (0), present, clearly separating the alveoli (1) (Ruiz *et al.* 2021).

508. Maxillopalatal fenestrae: enclosed mostly by the maxilla (0), enclosed by the palatine (1) (Ruiz *et al.* 2021).

509. Single or paired large neurovascular foramina on lateral surface of premaxilla, at its posterolateral corner: absent (0), present (1) (Sereno & Larsson, 2009).

510. Temporo-orbital foramen: enclosed between the parietal and squamosal (0), or completely enclosed within squamosal (1) (Pol *et al*. 2014).

511. Premaxillary exposure in palatal view: large, < 0,5 (0); short, = 0,5 (1); very short, > 0,5 (2) (Gasparini *et al.* 1991).

512. Dorsal edge of the rostrum starting on the anterior border of the orbit in lateral view: straight downward or slight convex, pointing to the external nares (0), horizontal straight (1), concave (2) (Geroto & Bertini, 2018; modified from Pinheiro, 2007).

513. Main axis of pterygoids: oriented ventrally (0), oriented lateroventrally (1) (Montefeltro *et al.* 2011).

514. Contribution of ectopterygoid to suborbital fenestrae: do not participating in formation of suborbital fenestra, excluded by pterygoid (0), forming less than 50% of lateral margin of suborbital fenestrae (1), forming 50% or more of the lateral margin of suborbital fenestrae (2) (Geroto & Bertini, 2018)**.**

515. Ridge on the nasals: absent (0), present (1) **(new).**

516. Size of the depression on the frontal: shallow, the frontal ridge almost in the same level of the the frontal edges (0), deep, the frontal ridge all contained within the depression (1), Very deep, the frontal ridge contained twice of the length inside of the depression (2) (**new).**

517. Jugal infraobital ridge: confluent with the rest of jugal (0), uptuned (1) **(new).**

518. Groove located on premaxillary lateral surface, running anteroventrally from the dorsoventral midpoint of its posterior margin: absent (0), present (1) (Pol *et al*. 2014).

519. Longitudinal sulcus in intertemporal bar: absent (0), present (1) (Godoy *et al.* 2014).

520. Row of foramina dorsal to ectopterygoid-jugal suture: absent or small foramina (0), foramina well developed (1) (Godoy *et al.* 2014).

521. Last premaxillary tooth hypertrophy: absent (0), present (1) (Montefeltro *et al.* 2011).

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 taxa added in this work are marked with an *.

1. *Adamantinasuchus navae* – Nobre & Carvalho (2006); UFRJNDG 107NR.
2. *Agaresuchus fontisensis* –Narváez *et al.* (2016); HUEN02502, HUEN03713.
3. *Alligator mississipiensis* – Iordansky (1973), Brochu (1999); RM 2790, RM 2801.
4. *Allodaposuchus precedens* – Buscalioni *et al.* (2001, 2011), Delfino *et al.* (2008).
5. *Amphicotilus lucasii* – Mook (1942), Andrade *et al.* (2011); AMNH 5782.
6. *Anatosuchus minor* – Sereno *et al.* (2003), Sereno & Larsson (2009); MNN GAD 17, MNN GAD 18, MNN GAD 603.
7. **Aphaurosuchus escharafacies* – Darlim *et al.* (2021).
8. **Aphaurosuchus spp.* – this paper; LPRP/USP 0634.
9. **Aplestosuchus sordidus* – Godoy *et al.* (2014).
10. *Araripesuchus buitreaensis* – Pol & Apesteguia (2005), Turner (2006).
11. *Araripesuchus gomesi* – Price (1959); AMNH 24450.
12. *Araripesuchus patagonicus* – Ortega *et al.* (2000), Pol & Apesteguia (2005), Turner (2006); MUCPv 267, MUCPv 268, MUCPv 269.
13. *Araripesuchus tsangatsangana* – Turner (2006), Turner & Sertich (2010).
14. *Araripesuchus wegneri* – Sereno & Larsson (2009); MNN GAD19, MNN GAD 20, MNN GAD 23, MNN GAD 26.
15. *Armadillosuchus arrudai* – Marinho & Carvalho (2009); UFRJ DG 303NR, MPMA 64N0001/04.
16. *Barreirosuchus fransciscoi* – Iori & Garcia (2012), MPMA 04N0012/00.
17. *Batrachomimus pastosbonensis* – Montefeltro *et al*. (2013); LPRP/USPN0617.

18. **Baurusuchus albertoi* – Nascimento & Zaher (2010).
19. *Baurusuchus pachecoi* – Price (1945), Riff & Kellner (2001).
20. *Baurusuchus salgadoensis* – Carvalho *et al.* (2005); MPMA 62N0001N02.
21. *Bergisuchus dietrichbergi* – Rossman *et al.* (2000), Pol & Powell (2011); Me 7003 HLD.
22. *Bernissartia fagesii* – Buscalioni *et al.* (1984), Norell & Clark (1990); CRN82, IRSNB 46.
23. *Bretesuchus bonapartei* – Gasparini *et al.* (1993); Pol & Powell (2011); PVL 4735.
24. *Caipirasuchus attenboroughi* – this paper; LAPEISA/UNESPN0001
25. *Caipirasuchus mineirus* – Martinelli *et al*. (2018)
26. *Caipirasuchus montealtensis* – Iori *et al*. (2013); MPMA 15N0001/90; MPMA 68N0003/12.
27. *Caipirasuchus paulistanus* – Iori & Carvalho (2011); MPMA 67N00001/00.
28. *Caipirasuchus stenognathus* – Pol *et al*. (2014)
29. **Campinasuchus dinizi* – Carvalho *et al.* (2011); CPP 1235; CPP 1234; CPP 1236; CPP 1237.
30. *Caryonosuchus pricei* – Kellner *et al*. (2011a)
31. *Comahuesuchus brachybuccalis* – Martinelli (2003); MACNNPV 31, MUCPNPV 202, MOZ 6131.
32. *Cricosaurus araucanensis* – Gasparini & Dellape (1976), Fernández & Gasparini (2000, 2008), Pol & Gasparini (2009), Young & Andrade (2009), Young *et al.* (2010); MACNNN 95.
33. *Cricosaurus schroederi* – Karl *et al.* (2006), Young & Andrade 2009, Young *et al.* (2010).
34. *Cricosaurus suevicus* – Young & Andrade 2009, Young *et al.* (2010).
35. *Cricosaurus vignaudi* – Frey *et al.* (2002), Young & Andrade 2009, Young *et al.* (2010).
36. *Crocodylus* –Iordansky (1973); Brochu (1999); ROM R 934, ROM R 6837, ROM R 6838.
37. *Cynodontosuchus rothi* – Pol & Gasparini (2007), Montefeltro *et al.* (2011); MLP 64NIVN16N25.

38. *Dakosaurus andiniensis* – Gasparini *et al.* (2006), Pol & Gasparini (2009), Young *et al.* (2012); MOZ 6146P.
39. *Dibothrosuchus elaphros* – Wu & Chatterjee (1993), Clark & Sues (2002), Clark *et al.* (2004).
40. *Doratodon carcharidens* – Company *et al.* (2005); IPUW 234952, IPUW 234953, IPUW 234955aNb, IPUW 234957, IPUW 234958, IPUW 234959, IPUW 234960, IPUW 234961.
41. *Dyrosaurus phosphaticus* – Jouve (2005), Brochu *et al.* (2002).
42. *Eutretauranosuchus delfisi* –Smith *et al.* (2010).
43. *Fruitachampsa callisoni* –Clark (2011), LACM 120455a.
44. *Gasparinisuchus peirosauroides* – Gasparini *et al.* (1991), Martinelli *et al.* (2012); MOZ 1750.
45. *Gavialis gangeticus* – Iordansky (1973), Brochu (1999); RM 4791.
46. *Gobiosuchus kielanae* – Osmólska *et al.* (1997), Turner & Sertich (2010), Pol *et al.* (2012).
47. **Gondwanasuchus scabrosus* – Marinho *et al.* (2013).
48. *Goniopholis kiplingi* – Andrade *et al.* (2011); DORCM 12154.
49. *Goniopholis simus* – Owen (1878), Andrade *et al.* (2011); NHMUK R 5261.
50. *Guarinisuchus munizi* – Barbosa *et al.* (2008); DGNCTGNUFPE 5723.
51. *Hamadasuchus rebouli* – Larsson & Sues (2007); ROM 4982, ROM 52059, ROM 52620, ROM 54511.
52. *Hemiprotosuchus leali* – Bonaparte (1971), Pol *et al.* (2012); PVL 3829.
53. *Hsisosuchus* – Li *et al.* (1994), Gao (2001), Peng & Shu (2005).
54. *Hylaeochampsa vectiana* – Clark & Norell (1992); NHMUK 177.
55. *Hyposaurus rogersii* – Denton *et al.* (1997), Pol *et al.* (2012).
56. *Iharkutosuchus makadii* – Ösi *et al.* (2007), Ösi (2008), Ösi & Weishampel (2009), Buscalioni *et al.* (2011).

57. *Isisfordia duncani* – Salisbury *et al.* (2006), Pol *et al.* (2009), Sereno & Larsson (2009), Andrade *et al.* (2011).

58. *Itasuchus jesuinoi* – Price (1955); DGM 434NR.

59. *Kaprosuchus saharicus* – Sereno & Larsson (2009); MNNNIGU 12.

60. *Khoratosuchus jintasakuli* – Lauprasert *et al.* (2009).

61. *Labidiosuchus amicum* – Kellner *et al*. (2011b).

62. Lavocatchampsa sigogneaurusselae – Martin & de Lapparent de Broin (2016).

63. *Libycosuchus brevirostris* – Turner & Sertich (2010), Andrade *et al.* (2011), BSP 1912.VIII.574.

64. *Litargosuchus leptorhynchus* – Gow & Kitching (1988), Clark & Sues (2002); BP/1/5237P.

65. Lohuecosuchus megadontos – Narváez *et al.* (2015); HUEN04498

66. *Lomasuchus palpebrosus* – Gasparini *et al.* (1991); MOZ 4084 PV.

67. *Lorosuchus nodosus* – Pol & Powell (2011), Pol *et al.* (2012).

68. *Mahajangasuchus insignis* – Buckley & Brochu (1999), Turner & Buckley (2008).

69. *Malawisuchus mwakasyungutiensis* –Gomani (1997), Turner & Sertich (2010).

70. *Mariliasuchus amarali* – Zaher *et al.* (2006); UFRJNDN50NR, UFRJNDN105NR, UFRJNDN115NR, URC R67, MZSPNPV 50, MZSPNPV 139.

71. *Metriorhynchus casamiquelai* – Gasparini & Díaz (1977), Pol & Gasparini (2007), Young & Andrade 2009, Young *et al.* (2010).

72. *Metriorhynchus superciliosum* – Young & Andrade (2009), Young *et al.* (2010); AMNH FR 997.

73. *Montealtosuchus arrudacamposi* – Carvalho *et al.* (2007); MPMAN16N007N04.

74. *Morrinhosuchus luziae* – Iori & Carvalho (2009); MPMA 07N0009/01; MPMA 12N0050/07.

75. *Notosuchus terrestris* – Fiorelli & Calvo (2008); MACNNPVNRN 22, MACNNPVNRN 23, MACNNPVNRN 1037, MACNNPVNRN 1039, MACNNPVNRN 1040, MACNNPVNRN 1041, MACNNPVNRN 1048, MACNNPVNRN 1127,

MACNNPVNRN 1038, MACNNPVNRN 1045, MLP 64NIVN16N5, MLP 64NIVN16N7, MLP 64NIVN16N8, MLP 64NIVN16N10, MUCPNPV 35, MUCPNPV 137, MUCPNPV 147, MUCPNPV 149, MUCPNPV 198, MUCPNPV 287.

76. **Ogresuchus furatus* – Sélles *et al.* 2020
77. *Orthosuchus strombergi* –Nash (1975), Benton & Clark (1988); Sereno & Larsson (2009), Nesbitt (2011), Pol *et al.* (2012); SAM PK K 4639, BP/1/4770.
78. **Pabwehshi pakistanensis* – Wilson *et al.* 2005, (GSPNUM 2000).
79. *Pakasuchus kapilimai* – O'Connor *et al*. (2010), RRBP 08631.
80. *Pelagosuchus typus* –Pierce & Benton (2006), Sereno & Larsson (2009), Turner & Sertich (2010), Pol *et al.* (2012), NHMUK R 32599; NHMUK R 32600.
81. *Pepesuchus deiseae* – Campos *et al.* (2011); MN 7005 V; MCT 1723NR; MCT 1788NR.
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 & Andrade (2009), Young *et al.* (2010, 2012).
88. **Razanandrongobe sakalavae* – Maganuco, Dal Sasso & Pasini (2006); Dal Sasso *et al.* (2017).
89. *Rugosuchus nonganensis* – Wu *et al.* (2001a), Pol *et al.* (2009).
90. *Sarcosuchus imperator* – Sereno *et al.* (2001), Pol *et al.* (2012); MNN 603, MNN 604, MNN 606.
91. *Sebecus icaeorhynus* – Colbert (1946), Molnar (2010), Pol & Powell (2011), Pol *et al.* (2012); AMNH 3159, AMNH 3160.

92. *Sebecus querejazus* – Buffetaut & Marshall (1991), Pol & Powell (2011), Pol *et al.* (2012); MHCNNP 3701, MHCNNP 13491.

93. *Shamosuchus djadochtaensis* – Pol *et al.* (2009); AMNH 3159, IGM 100/1195.

94. *Shantungosuchus* – Wu *et al.* (1994), Lu & Wu (1996).

95. *Sichuanosuchus* – Wu *et al.* (1997), Peng (1996).

96. *Simosuchus clarki* – Georgi & Krause (2010), Hill (2010), Kley *et al.* (2010), Sertich & Groenke (2010), Turner & Sertich (2010).

97. *Sphagesaurus huenei* – Pol (2003).

98. *Sphenosuchus acutus* –Walker (1990), Clark & Sues (2002), Clark *et al.* (2004); SAM PK K 3014.

99. *Steneosaurus bollensis* –Sereno & Larsson (2009), Turner & Sertich (2010), Andrade *et al.* (2011), Pol *et al.* (2012), NHMUK R 47171, SMNS 15391, SMNS 15951, SMNS 18878.

100. *Stolokrosuchus lapparenti* – Larsson & Gado (2000); MNN GDF 600.

101. *Stratiotosuchus maxhechti* – Campos *et al.* (2001), Montefeltro *et al.* (2011), Riff & Kellner (2011); DGM 1477NR.

102. *Sunosuchus* – Buffetaut & Ingavati (1980), Andrade *et al.* (2011).

103. *Susisuchus anatoceps* – Salisbury *et al.* (2003), Salisbury *et al.* (2006), GP/2E 9267.

104. *Terminonaris robusta* –Wu *et al.* (2001b), Sereno *et al.* (2001).

105. *Theriosuchus* – Owen (1878), Salisbury (2002); NHMUK R 48330.

106. *Uberabasuchus terrificus* – Carvalho *et al.* (2004).

107. *Uruguaysuchus aznarezi* – Rusconi 1933, Soto *et al.* (2011); FCNDPV 2320.

108. **Wargosuchus australis* – Martinelli & Pais (2008).

109. *Yacarerani boliviensis* – Novas *et al.* (2009).

110. *Zosuchus davidisoni* – Pol & 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; **DGNCTGNUFPE**, 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; **FCNDPV**, 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 CastillaNLa 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:** Laboratório de Paleontologia e Evolução de Ilha Solteira, Ilha Solteira, Brazil **LPRP/USP**, Laboratório de Paleontologia de Ribeirão PretoNUSP, Ribeirão Preto, Brazil; **MACN**, Museo Argentino de Ciências Naturales, Buenos Aires, Argentina; **MCD:** Museu de la Conca Dellà, Lleida, Spain; **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; **MNKNPAL**, Museo ‘Noel Kempff Mercado,’ Santa Cruz de la Sierra, Bolivia; **MNN**, Musée National du Niger, Niamey, Niger; **MOZ**, Museo Professor J. Olsacher, Zapala, Argentina; **MNHNNF**, Muséum National d’Histoire Naturelle, Paléontologie, Paris, France; **MPMA**, Museu de Paleontologia de Monte Alto "Prof. Antonio Celso de Arruda Campos", Monte Alto, Brazil; **MHT**, Muséum d’Histoire Naturelle de Toulouse; **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. **U-M LSA:** University of Michigan Museum of Paleontology**.**

1.5. Data Matrix

Polimorphism is under brackets and inapplicable characters are represented by "N".

Adamantinasuchus navae

??0000110111NN???010?????????????00100N?0000N2110110?01?0N0??0210000?000N1?0111?0?0??000????????????????????????????????????00110N00001000N1101?001110110N01010N01001N0??211?111?0??????????????11???????0????N??0??????????????????????????????0??????????????????01100?0???01101[1&2]11?????1?1??100??000100???000N??????22110N00003101?001?00101001???0???1??00??0?????1??????111????????0??10???10?00

Agaresuchus fontiensis

111001031101NN010111100111001110100000NN000101110000001 00N00101100000000N1000N00010?100011010110N001020010?001100010N11?10100000NN10010010N100001111010 10N01111101000N0101011000000001 1100?00?010N11001101?03110000001?111100000000N01111200N020N0?00N00100???010000001110?010001???000010??0100010???????101?10NNN00?0100NN03000000N00100301000000000?00N0N10003001000N?0002000000110000???20??0000100??011110???N?NN00???????0N?N?022?[1&2]0NN000?

Alligator mississipiensis

111001031001NN010110100211001111100010010000N111000001000N00102000000100N1010N0101110100130101 10N00102001000011 00110N0000N000000NN10010010N0000110?N01000N010[1&2]1101000N010201101010000 0N0N01001010N0100?101001N10000001011010000011 0N01111200N020N0000N001000100100010011100010011 0NN0000001101000100110011101011110000010001?30000?0N00000301?000000001100001000200000 0N0000100000021000010020110000101100001111100100000010010101100000???1?

?01????10????01110??0????????30N11111021010000010000010110100N?NN00?0?0000?
N?N?0020200N0000

Allodaposuchus precedens

111000031?0???01011010001100 1?10N00000?????0N11100000100????010000?00
00N1010N000101?00012010110N0000211????0110001[0&1]001110100000NN???1N010N
1?[0&1]???00?????0N0?011101?0?N?10101101?1??0?0N??0?00?010NN1001001???N0?00
0001?110?00000000N01111200N02????00N??1NN?10??0001??1?10?0?00?1????01000?10
100010?1??0??10??01000N????100
00?0?100000????1??
???????????????????????0??01?0??01?11????N?N??????????0??N?0????????0??

Amphicotilus lucasii

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00??100N01000N0?011101001N010201?0101?000??0N0?00?0????100101100010?00000?0
110?00000100N01?11000N000N??0???0?00????????1??11?0??10??????000000???1010100
1?00??00000N0100100001021
0000?002??
????????????????00?0000??01?11????N?N??????????0??N?012??0N?0000

Anatosuchus minor

11100103001021010010100210011011000000100000N2110000010001 1N10100000
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01100N0101??0?0211010001010211011110 0100N0N11011010N010?1?01?0?N??00000?11
10000000000N01111000N01100000N0000?1?111000?0010000010011000 0??1????0100113
01110??101011110001??00101000?000N01??00021000010011000101000100 0000N000000
20000100?0000?00?01?????????????????0???????????01???1??0????????01????????????????
???????????00N1100100??1?00001000001?11?1??N?NN0000?00?00N?N10?0010NN0000

Aphaurusuchus escharafacies

1010000000 11NN020110111211111021100000 00?0011111000111001N00N0111000
100101010N1011010000110100N101001001111001100011101111100011100000 1010N001
0110111101100 1020N11000N10N2110111000100N0N1?11111110110 1001?00??111?0010
11300101000111N11101??110N1100N100001001010111010010110011010100 1111001001
1001100?1001001110001101010020000110111112110100010001 1000N10001012000N000

0230001010000000011??
????????????????????????????0001100000101111OO???1000001100000N1011121111110

Aphaurusuchus spp.

101???????1?NN0???????????????????????????????????0?1????1????1???00????111?
111?01??????????????11???????11100???????????11???????????????????1???????????????
???
?0N1???1??????????????????????????
???????????????????????????12??0N??0??????????????0?0?????????????????????????????
???0?????????????????????
??0?0??????????????121?11?

Aplestosuchus sordidus

101000000011NN02????1112110??????0000000100111110001?1000N??N0???0001
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0N001?11?1111011101????1??00N????1?????????????0N??1?????[0&1]????1?01??????0??0
?1?1130?101100101N111011?110N1100N100021001010111010010111O?1????00?????0?0
01???????????10011?000110101002000011011111211010O?10001100101?001012000N000
0230001010000000011???
????????????????????????????00?1?0???010??????0?11000000100000N10??1[1&2]110101
0

Araripesuchus buitreaensis

?[0&1]?00111??1??0010?1?1202110?101??0???????00???11?0?00?100???10??????0
0?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?0100000
00N011?1000N000N?000N10111??00?000?01??????????????????????1?????????????????10?
????0??0[0&1]?0?01[0&1]?0??10N11?10[0&1]00[0&1]00100?0??????????????1000N?000?
[0&1&2&3]?0???1?0??0??010??
??????????????????????????????????0???1?0???????????N2NN00?0??????N?N???0???N???
00

Araripesuchus gomesi

1110010100101001011012021100101110010010000122110000000100100001000000
000N1000N0001010000120100N0N[0&1]010?0011100110001100001000000010011011010
N00001100N0101??00021101000101021111100000000N0N11011010N01111?01??0N10000
00??110010000000N01111000N000N0000N001111?000000?0110000?10011000???10??10

10011301?10?10010111030010[0&1]00101100?000N11?110000?001000111000N11101011
000N00002030?001100101001[0&1]0??0??0?10?101??11001??1?101001011?110??000100?
?1?????11101110111100 1???01?1?20N11000000000000010000010110100N1NN??00?0001
?N?N1?2001?N?00??

Araripesuchus patagonicus

11100[0&1]?10?10100101101202100110111 0??0??00????211000000100100001000
000000N1000N000???0000120100N0N101010011100??00011000010 0000??????00101[0&
1]?000?1100N0[0&1]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?1000
N000020?0??0110??0?001?????????????????????????????0???101????????????????????????11?
???0??????1????????20N1100000??00000010?000?????1??N1NN000[0&1]?00010N???0?00
1?N??0?0

Araripesuchus tsangatsangana

1110011100101001011 01??2100110111?0?00??0001221100?00?100?1N00??000?00
00N1000N00010100001 30100N0N001010011100??000110010??000000NN10011010N000
0?100N000????0021101000100N211111?01000000N110?1?10N0?1?1?01?0?N1000?????11
??000?0????011110????00N0000N1?0000?00?0000??100?0110011??????1[0&1]??1010011
?01110?1001001110000 01?0101100?010N111[0&1]000000000000?11001011101011000N0
000[1&2]00[0&1]?001?0?101001000?0?1?110?111??1100???110?100101??1101?0001??00
101000?11011101111 0?110?????120N??0????????000?10?0001????100?????000??0??0?0N
?????????????

Araripesuchus wegeneri

1110010100102001011010021000101110010010000122110000011 0011N001000000
000N100110001010000100100N0N001010011000110001100011000000111110110 10N000
0?100N01010N000211010001010211111010000 0N0N11011010N01111101000N100000?10
110010000000N01111000N000N0000N001001100100000110000010 01100?000110010100
11301110??10??01103001?010101120?0???0110000000000 1001?1?00101??01?11000N0000
103000011001?100100???????10??????1100??????0?00?01??11????0???0???0????????????
1?????1????????20N110??00001000001000001011????N?NN0000000000N0N102001???00
??

Armadillosuchus arrudai

101000110?11NN021110????????1011?00??0???0?0N?110001011?0N???0200000?0
00N1000N000????000120100N1000011011?100110001101101100001???????00?0N1??0?1
010???0????000N11000N?0N211?111100000N??1101111?0001???01?????????????1???????
???????????????????1??????????0??????????0?0?0110011111 0111?00???01?01?00??0????
??????1?????????1??1??1????100??????????????????????22110N01114?01?N0??1?001?010?
???????????????????????????0??????????0?1?0?0??1??????0???????????????????????2100N[0
&1]01010???0?0010?000??11?????????01??12?12???01?10?00N0000

Barreirosuchus fransciscoi

11??0?????0???01011010001101111111???????????????00000??00?1N101000000000
N1010N00010?0000100100N0N00122001???01100110N0100N000???????????10N??10110
0N01000N00011011000N11?211?01??000010??0?01100NN?11??????????00??0?0?11?000
000000N01?11000N01100?00N001????101000101?1?00??00?1????00000??010011101?00?
??1??0?0N0000????????10?0??0?
??1????????????????????0?????00??
?????????0000000000??1?????N?NN0?????????0N?N???002?0??00?

Batrachomimus pastosbonensis

11100103?001NN010100100 2110?1?10?00000???0010[1&2]1100000?000N1N?0100
1000000N????????????0??01????????????????1??0??????????????????0????1011?010N101011
01001010N0?021?01001N0102?1?0?0100?00N??0?00?010N?1????01???????0?10??111000
000100N01??1100N000N??00N00?00????1?????????????????????????00??????????????????
10110??00?????N??00???00N11?????0?00?00000?10N0N?00?3000000N01001000?00100??
00000??[
2&3]110N0?0?0????0?????0??0???10???N?N?????????????N???20?0?N???0

Baurusuchus albertoi

101?0?????????????110???????110211??????????????????????????????????????1???????
???????????01?01????????????111???1100?11101111????????????????????1??101111011101
020N1?000N10N211011100000??0N1?1?11??1011??????????????????0??????????????????
?????0N???0N1????10??1????????????????????10??11??0?????0???????????01110001????1
0??0?00?????????????000100011000N10??10????????????????????????????0011?10?10?00
1??1000101001????101?01101?1111?101111011111101111???10?10??110??00N1?2??00???
??0?1?????0?????1????????????1?0?????????1??????1?

Baurusuchus pachecoi

101000000011NN021110111?111010211?0000??100112110?01?10??N?????????0?? 0??????????????0?0??01?0N??1??000011??01100011101?1?1000111000001010N0010?101 111011001020N11000N10N2110111000?00N0N11111111101111N01?00011111001011200 101101111N1110???100N1100N10002100111011101001011100?1?1??00111??0?00110?110 0?10???0111?0011010100200001??1111121101?00100010000N10001012000N00002300?1 010000000011???????????????????0?? ????????????????????0001?000?0?0???100??????000110?0?0N??2111??01?00

Baurusuchus salgadoensis

101000000011NN020110111?110010211000000?10011211000111000N00N0111000 1001111110101?0?0000110100N1010010011110011000111011111000111000001010N001 01101111011001?20N11000N10N2110111000100N0N11111111101111N0110011101?0010 11200101101111N1110???100N1100N100??1001110111010?10110011010100111??010011 0?1?00??001101110001101010020000110111112110?00110?01?000N10001012000N00002 3000101000000000011??????????????????????????10??0??????????????????????????????????? ?????????????????20?000?0?000110000010111100???1000001100000N1111110101010

Bergisuchus dietrichbergi

1110?0?0??1020???????????????????00??????????????00??1?000????0[1&2]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????????????????????0?

Bernissartia fagesi

111001031101NN010110100?110?1?11100000???0010[1&2]1100000?10010010110 0000000N1010N000101?10010010110N00?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?0 1??0??1?1010NNN0000?00NN?30000?0N0100?30100?000100011N0010003000000N01001 000000210000100200?101??000?0????1100??0?0000100000?????????0?0?????????100000? 1110??00???????2101100001111?000010?0?010??????N?N?0???????????N??220??0??0??

Bretesuchus bonapartei

101000?00011N????????0101[0&1]0???????10?00?000112?100??1??1?????????????
?0???1?110???0???100?????0111???
0N0?0?0N??????????????1????????????????10N???11?111??1?00?010??11?010000010N11
1?10010?10N?0?0N0?1???????001??111?????0??????????????????1????1?????????11??10?
1?00?00[2&3]?0???0N1101020[0&1]?10??[0&1]00???0???1?0??012000N000020000011000
00[0&1]0011??
?????????????????????????1????0????????0???00?????0??N??2101???0?01

Caipirasuchus attenboroughi

????0????????????????11121?0???
??
???1???111000100010N11?110010100N1
000N1?021??01100001010000????0????????????????1???????????10?11001??1?0110101??
????11100100?1?0?10??????????????01110N0110??????????0??1?1?0????????????????????
???00?10?
??11112011?11??1??2110?????????????

Caipirasuchus mineirus

1010001101102001011011112110????1100100N?0000N111000001100100101100000
000N1011100010?0000120100N??1001100111001?00011?000110000110?00001010N1001
010??01101101010N01000110N2110?110000?0N0N1?0?1?????01???01?0?N?00000000111
000100010N111110010100N1000N10021100110000101000011100101l??0100??000?1100
1?0???0?10011101010001101010?N10N1110010011?0?100001000N1?1?1121110N011122
00010011011110[1&2]00????????0????????00??01110?????11??????010?0??????????11011
11???001000??????00N10[1&2]??00?000000011?00010???11112010011?11110101?1????0
00?1?0

Caipirasuchus montealtensis

10100011011020010110111211011011100100N?0000N11100000110010010100000
0000N10111000???0000120100N??0011100111001100011 00[0&1]01100001100000001010
N1100010111110110101 0N01000110N211?111000000N0N110?11110??100001?00N00000
00[0&1]?11[0&1]000000010N111110110100N1000N10020?001100001010?000110?1?????
011???0?0111001?00??0010011101011 0?1101010?0111111001001 1?001000?1000N1?????
21110N01112200110001011 11?10????????10??????1????????????????????0??0?0?????????
????????????????????????01010[0&1]??00??00?0?01100?0101??11101010??1?0110111N0
??1020000100

Caipirasuchus paulistanus

101000110110200101101112110??????00100N?0000N011000001100100101000000
000N101110001??0000120100N1000111001110011000 11?0????000011000000 1010N11000
101111?01101010N01000010N21101110000?0N0N1?0??1????0100001000N000000011111
000000010N111110010100N1?00N100201001100001 0????0???????????0110??0????1?01?
00??0?10011101?11001101010?010N1110010011?001000?1????10??0021110N0111220001
000101111110?????????????????????????10???
???????0N1000?000???00?0110??0?01??1110110???1??110111N0?2002000000?

Caipirasuchus stenognathus

101000110110200101101112110010 11?00100N?0000N111001001100100101100000
000N1011100010?1000120100N??000?10011?0011000110000??0?00110?00001010N11010
10??111?1101010N010001?0N2110?110?0000N0N110?1?11??0100001000N00000100?111
000[0&1]00000N1111100101[0&1]0N1000N10021?0011000010100001110011????0110??0
??111?01?00??0010011101010001101010?N10N1110010011?0?100001000N1?1?1121110N
01112200010001011110[1&2]0??
????????????????????????????????????00?01??00010???111120[0&1]101111111101101?0002
0000?01

Campinasuchus dinizi

1010000000102002011011121101102?100000001001111100011100?100???11?0?10
0101??11?01????000110100N111001101????011000111011111000111000000010N001011
0110101110 1020N11000110N2110111000100?0N1?111111001111N011?100101?001?1130
?101100101N111011?110N?100N10000100101011101 00?0?1?0?1?1???0010??0100110?1?
00??0?11011100011000100[0&2]0000110111102110100010001 0000N10002012000N00002
30001010000000011???
??????????????????????????001100??010111??????10?000110?000N100002?101100

Caryonosuchus pricei

1110?0?10??????????????????????????00?????????0N??10?????????????????????????????
??01???0[0&1]?00010N1??????????????
??N???1?????????????????????????????
??1??????1?????????1??1??
???1??0?1???????????????????????[1&2]2110N01114??0??0??1??011??0?????????????????
??
0?????????????1???????????0????????????

Comahuesuchus brachybuccalis

101000130111NN0[1&2]??1??11??00???????01?1N?[0&1]?00N211000000100???[0
&1]0?000001000N10?11100???000??2010100N?010?0????0???0?0??????1100?0110000?1?
?1[0&1]?1001??00N0?1?0N000?????0?0????????????????0N??1???1?10N??1???01?02N1?0
00000?110000001011?111??????100N??????0???1?0100?0?10??????1??0????????10?1???0
?1????0???0?11?11?000?1?0??01[1&2]01?010N1110000[1&2]1??0????????00N??????0100
0N0?01[1&2]3[1&2]1?00100000?0010??
??0?00?00??010?????????0??000???0?00N0?21?
2???0???

Cricosaurus araucanensis

0N00000210102101110110000?10?0002000010000000N01100000N11?0001010NN1
?1000N1010N00000?000020101NN0N01000000NNN10N1100NNNNN0N0110?0NN00000
010N?0100100N0001????020N111000???00000100?0000N??0??N000NN??00??010?0N0??
0?00??1120000??00??0??110????00N??0????0???????0?????10??0??010??NN???00???1100
01?01[0&1]11??11??00NNN0010000NN?0?0110??21000?000011100?00?0N0N?0?0200000
0N0000300000001?00?0?0000???????000???0?0N00?????01??1?????????????????????????1
0?????????????????????????????1N????1??00N0??0??00N???????????????0???N???1??0N?
00??

Cricosaurus schroederi

0N0000?2??1021010101???????1????00???????????0??00000N1100001010NN1010
00N1010N000???000020?01NN0N?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??????????????????11??????0???00??2000000N000????????0?0???000?
??????????0??
????????????N??

Cricosaurus suevicus

0N000?02101021010101?????1???????00???00??00N011000??N11?0001??0NN1?10
0??1010N00????10002??01NN0N0101?0?0NNN10N???0NNNNN?N?110????00?00?1????0
??1?0N00?1????0???11?0?0???0?00????????0N0N000?????????????????N????????????????
?????????????????0N?????????????????????????????1????????????????0??1????????????0N
NN0?????0NN?????1???21????0?????10???0?0N??????2000000N?0003000?0?0100000??00

?0????1??00???0???0???????1??1?0????1?0?1000??????????0?1???????????????????????????
??1N??N??????N???0????????????????????????????1??0??0000

Cricosaurus vignaudi

0N0000021?1021010?01?????????????00??????000N011000?0N110???1120NN1010
00N1010N000????0002??01NN0N0100?000NNN10N?1?0NNNNN0N?110?0NN???00?1???
?1??100N0?01?????????1?0?????0000????????0N0N000???????10????????N?????????????
???1???????????????0???1???????1????0
NNN0????0?NN?0????????1??????????1??????0N???????0?000????0?30???0?0???0?????0?
0???????0??
?????????00N??

Crocodylus

111001031101NN0101101000110011111100010N000010[1&2]11000001100N001000
00000100N1010N000111000013010110N001020010000110011 0N00010000000NN100100
10N00000100N01000N01011101000N0102011010100001 10N01001010N11001101002N00
000000011?100000000N01111200N020N0000N0010?0100100010011100010001 0NN00000
01101000100110011101011110000010001030000?0N0000030??000[0&1]00001000001000
2100000N0000100000021 0000?0020100010101 1000?111110??0000001001010110000000 1
100010100110000000111000001000101 30N11111021010000010000010110100N?NN00?0?0
000?N?N00020200N0000

Cynodontosuchus rothi

10100??000???N?????????????0???????00000????11???0??????????????????????????
???????0???0?100???0??1??????????????????????
??????????????????????????????????????00?0????0??00??0??1130010000?0N?????????????
???0???????????0??110
11???2110????????????????????110?0N000033000001????000?10????????????????????????
??0???????????
???????0????????N???1?????1??N

Dakosaurus andiniensis

0N000001??10210111 0110001??1000?0100?0N??000N01100000N1100001020NN1
01000N1010N000???100020101NN0N01000000NNN00N1100NNNNN??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??12000N10003

000?0000?000000?0???0?01??
?????????????????????????0??00N???01?00N???????????????0????0??1??0?N0???

Dibothrosuchus elaphros

0N000000001000020101 0NNNN1010N20N000000?0001121000000010011??1010NN000000N0010N000100000??0001NN0N0010?1?100000N0?00NNNNN0N001000NN?0?0000???0100100N0?00??00110N??000100N????0100000?0N0N000N000NNN100?100?0?000?NNNN0N0NNNN?NNNNNNNN1000000N0N0N?100N000??1?0?0N10?0?00?00000000??????000010001??000?00?10?0N01100001010000??0000?0N00??0301??000000??0000N00000N12000N00001000000 1000?0?00100??0000110?0????0N0??00?0????000?000?00000000??00???000?0010????0????????????0??11?00????00N000NNNN01000N???N?NNNN?0?0000?N??00?001??N0000

Doratodon carcharidens

111?0??[0&1]???0[1&2]001????????????????????????????????0?1?????????????????
???????????????????????101[0&1]1?????????????????????????????????100????0N0?0????
??
??1110NNN00?0?0
0N01020??00N111000000001?100???1N0N??????12000N0000?0???????000?000?0???????
??
??????????0???????????????????????????????????

Dyrosaurus phosphaticus

110000021101N?0111101?021101101110101 0N?0000N0?100010?000??01000000000?0N1010N000100100110?11100N0000?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??0??000?1?1?00N?????100000N0100?0000?0010100000?0??1??????0????????0???0??????
?????1?????????????00001001001???????N?NN00????????N?N??01??0?N?000

Eutretauranosuchus delfisi

11100103?1002N010110100211011?101000?0N???1??0?1100001100?001010000?0?00N1010N0101??100010010110N0000200???001100110N0110N000?00NN1??????0N0?0?0100N?100??01??11010?0??1020??0?011000110N010010??N01?????100????000000?10?100000100N?1011000N000N??00N?0100??00?0????011?00??0011??????00??1?100010?1?00??1?111111000????00?1[0&1&2]?0?0?0N11?00301?1000000?00000N???03000000N010?

1000?00210000?0?20????????0?????????0????????????00???1????????0?????????????????
?????????????2??????????????00010000010??????N?N?00?0???0?0??N1???0[1&2]0N??0??

Fruitachampsa callisoni

111000110?11NN010100?0???00?0N2??00???????01121100?000100?01?02000??1?
00N10?0N00000N?000100100N0N1010??011100110??110001??0000???????01010N000??
00??00?0???0010N00??0????00100001000?0N0N010?0?110????0??0000???01???N?11??00
100100N0111?000N01????10N?0???1?001010?00???????00??????????????????1??1??0?1??
111??????10??1??1?000??0N11???0?????0010000?000N??????02000N0000[1&2]0???1?1?0
?100001110???00?01??????0N10?????0??1??0????0??????????????????1??????1??????????
????211??0????????001010????????????N?NNN??0????0?N?0?????1?0N?000

Gasparinisuchus peirosauroides

1110000[1&3]0?01NN01????1??[1&2]?[0&1]0??????00000?????1121100?001100N
1N10????000000N10???00????0??????10???????0???1???????0?????????00?0?1111001?11
0N00??????????????0??????????N???????????????????????????????00001010???00010??110
?000000?0N???1????????????????????????????????0?0?0?00?1???????????0?0?????????????
???????0????00?0?320??00N0110010001???1???????????00??1?0?0N????1000110210000??
?11??
??????????0?00?0000?10???????????0?00????0??N??0???0????00

Gavialis gangeticus

111010021101NN010110100011001111100010N?0000N011000001100N001000000
00010N1110N00011111001201011 0N00102001000011001 10N00010000000NN10010?10N
000?1110N01?00N01011111000N01020110101000011 0N0100100NN11001001002N00000
000011[1&2]100000000N01111200N020N0000N001??010010001001110 00101?10NN0000
00100100?10011001110101111 0000?1000100000000N2100030??00[0&1]10000111000100
02100000N010010000000100000000010101011 11000?1?11100100000?100000?110?0????1
1??01?????100???01110??0????????3101110001101000001000001011 0100N?NN00?0?100
0?N?N00020200N0000

Gobiosuchus kielanae

101000110010101NN0010NNNN1010N211000000000010201000001000100?020??0
00000N[0&1]?0[0&1]?0?010000?01N010NNN?N??00001101N1000N1100110N100000NN
?0?00010N00000[0&1]00N00010N00120N0?001[0&1]00N001010010?110N??010?01110?1
0[0&1]??000?0??0000000?0NNNNNNNNN?NN???11000N0N0N0100N100??1?001N00?0
N100000110?10?0???000??0??001001?10??0???00NNN0010?01N010?00??0N?0??0301?00

0001?00?0N10?0010000000N00003000?[0&1]001??10001010?1??????????????00??000??
??0?????100???0?0??????????????????1??0???????????20N1100?01?11100N010N0100????
0NNN?NNN?00??00??N??0?2001???00??

Gondwanasuchus scabrosus

10100000001020???010?????10??????00000001001111000011101100N?01100010
010101??0??1??00001????????1????0?1110?????????????????011?10000?010N0010110110
10110?1020N?100011??211011?00?1?0N?????????????????01???????0?00??1130?10010?0
0??1?????????????00N???100111000
11?0010020000110111102110100010?????00N1?????12000N0000230000010000000?10???
??
?000???1??????0????????????000??00??0N1??0??0?01?00

Goniopholis kiplingi

111001031001NN01011010021101???0100000N?0111001110000110?0010100000
0100N1000N010???1010?0010110N000021010??01100110N0110N00000???10110010N00
011100N01000N?0?111?1000?0102011???1100?11??0?0?????N?10??0[0&1]????100???0??
?110100?????0N01?110?0N010N??00N00?00??00000?100?1?000??0?1????0000???01????0
???00??00?00N010010000?021
0?0000?2??
???????????????000000?0?01???????N?NN??????????N????02??0NN?0?0

Goniopholis simus

111001031101NN0001101002110?1?10100000N?011100111000?110??001?10??000
10??1000N01?10110101001011??000021010?001100110N0110N000000NN10110010N000
01100N0100??0?011101000?110201?01?1?000110N01??10?????0?1?[0&1]10?0?0?00?000?
1101000??100?011?100???00N?000N0?10???00?000???11??0??00?10?????00???010001??1
100??1???110110000?00?113???????010003?1?100100000?000N10003000000N01001000?
0021000?0?0201??0?01?00????????00?????0?????00??1????????????1??????1?????????0??
?????????2110N00?00?1?00??0000??01??????????????????00???N??020?0N?10?0

Guarinisuchus munizi

111000021?01N?01111010021101101110101010N?0000N1?1000001000?0010000000
0000N1010N000???100110011100N00012001???01100010N0100N000000NN100000111?0
000110N00000N00201101000N00N1010010000000N0N010?10??N?1001001102?00000011
?111?00000000N01111100N000N1000N00000?0010000100111000001110010??000??0111
0130??00??1?11?????00?0?0??????0?000N2110000001???0???????????????00000N0100[1

&2]000?00010100000?01???????10????????0?????????0?0??????????????????????????????
????????????????1??0N0????????00001001?01??10???N?NN00????????N?N?0????0NN?00
0

Hamadasuchus rebouli

1110010100102001011010021100111111000010100111110000011001001010000000
000N1000N00010100001101010 0N00?0201????01100010N0100N000011111001111 0N001
01100N11000N00010N01000001 1211?11110000100N01011010N0100100100011 00001100
112010000000N01011000N010N0000N00100110000001011100001001100000000 01?0100
113011000110???????0?1???0?003?0??0??1??001?001???????????????????12000N0100200
0010210?0010011??
??????????????????????00001[0&1]00001?111???N?NN00???00000N?N10000200??000

Hemiprotosuchus leali

???000100?10120100010NNNN1010N20N0??0?0??000N2?1000001000????0?000?0
?000N?0?0N1??????0001?0?00N0N0?101?011???1000?0NNNNN???0000????0?0000???00
??000N00??0N00100N00?0110??000001?0??1?0N??0??N01110?10??????????????NN?????
NN?NNNN?NN?????0????N0N?110N?00?????0?N?0???10?????10?1??????0?????0?0?0?11
011?10????????001??0??0???0?0???0?????0???00010???1000N?0?1001?0?0N?000?00???00
????0??001????????0????????????????????????0??????000??????????????????????????????????
???211??0??00?1?????0??N?1?0?00N???????N?????????????????0?0?N?000

Hsisosuchus

1110[0&1]001??[0&1]0100100111N011001???11[0&1]000?[0&1]??0010???10000?0
001??01000000?000N00[0&1]0N0000?N0000000100N0N00002001?00011000[0&1]NNNN
N0N00?[0&1]0???00?00????10?01100N00000N?0110N01?0000100110[0&1]001?01?0N0N
0?0???110?11???[0&1]0?0?????00?N??11??N?1?????N00??1000N11100100N0000????010
0??1010?0?1000?1000000???0?010111001?00??[0&1]?111[0&1]???001???1101?00?000N1
1??0?0?0?001000000000N?0003012000N0000?0?????100??0?0?1??????????00???0?0N0??
??????????00??10????????????11???????????????????????????20N1100000?1??000000?0100
????1??N?N1N?00??100?0?????00?0NN?00?

Hylaeochampsa vectiana

0N?00?0???11NN010???10001100?110N0??????????????00000??00?1N00110000?0
0101000N1001010100110101 10N0010200????0??0000NNNNN10100????????????????100
1?0N01??????0?11???0?N?0N1?1????????0??0N0??0?010N??????????????00000??110000?
00000N01?11200N020N??00N011??010?100000?11?????0001????01????10100011011?0??

10???0??00N??0?????????10?0?????
??
???????0?001000001?110???N?NN00????00?0N?????202????0??

Hyposaurus rogersii

111100021101NN0111111????1??1?1??0100?N??0?0N???00?????00????0??0000?00
0N10?0N000????101??00?????000?200????01100010N0?10N?00000NN??00??1110?0???1
0N?1000N??101111?01N?0?101001????????0N0?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????1010??????[0&
1]???????????????1100??
????????000010???010???????????????????????????????N?000

Iharkutosuchus makadii

111000131111NN1NN111100010011?10N00000NN?0?0N111000001100N1N?0110
0000000N1000N0?0???0000?N01NNNN?NNN0101????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?[0&1]0???00?00????0?0N??????
000?1100001000000?1100001[0&1]00??
??00?01?000110??????N?NN0????????0N?N??2
?120?N?0??

Isisfordia duncani

111000031101NN010110100211001?11100000N?0000N111000001100?0000000000
0000N1000N000???0000?1010110N0010200????01100?10N00110100000NN10000010N00
00?110N01010N01021101000N010201?01010000110N010?10????1?010010010?0000001?
110100000100N01111100N020N??00N00100?1001000000111000?00?1000?00000??01000
1001?00??10???10?00?????00?0?0??0?????????????00?????????????????00000N010010000
000?000000?0?1?00?11111?????11?00?????0??1???0????????????0?????????1?????????0??
0????????30N1101?021110000001000001???????N?NN00???????0N?N?????????????

Itasuchus jesuinoi

11????0???????????????????????[1&2]1??
???00N?1??0N0?
??1011000?0112??????100?0????0?0??0????1???
?????????????11???1[0&1]?111?0????10?10

3???????1101?000??0??10??????????????02000N0100??????????1???0??11????????0??????1?00????1??????????1???000??????????????0????01??1???????????[2&3]0N1?0????????????????????1?????????????????????????????????????0?

Kaprosuchus saharicus

10100103100021020110 10?2111????1100011010101011100010110011N001000000000N100100011??0000?101010110010201???001100012N0111?000000NN0001?010N0010N100N1101??10010N11010100N2110???110?00N0N0?0???????1011?11???1??000001?111010000000N01111100N01110000N000101?001000001110?00?00110???0000???????11??1?0???1?1011100001001010012 0?000N01?002011110111111001010002002000N0000301001021000?00?11??0000000?0??0???1??N[1&2]NN01?0??1000N?N01200201?1101

Khoratosuchus jintasakuli

11000????01NN01011?10001101???1?0??????????????00000??00N000000??000000N1010N00010?0?00?0010110N0010?00????0??00110N0110N10??????1??0??1??0?100100N0?0?0N?01?11??1??N???101?????????????0????????????????1???N??00000??111100000000N01?11100N?[1&2]0N???????0????????????????????0011000?????????100??0????????0???00?00N0000?0??????10?0?00??0??01001001???????N?N?00??????????N???1??0???0??

Libycosuchus brevirostris

1[0&1]?00011001010010110 10?[1&2]1?0???11100100100000N??1000?01?001???0?00000?000N10?0N?001???000?[2&3]0100N0N0010100????0??000?????0?00000111100001?1[0&1]?10?0?100N010?????0[1&2]100??00??10011????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?1?0?01?00010000N100010??0???????0000?1000001?????0???????????????????0????11???0??0000?0?0?0?????101???N0????????0N?N?000010N??0??

Litargosuchus leptorhynchus

0N000010000000010???????N??10N???000001??00??2??0000000001001000NN000000N0010N000???0000000100N0N00000000NN?00N0000NNNNN??001000NN1000??00N00000000N0??00N??1?0N??000?????000??????????0N??????????????????????????????0NN????NNNNNNN?0???????0N???????00????????N????????????????????????????0?0???0????0????0N0110000???00?0?0????00N10???000?0???0?????00?????000?2000N0000?000?00

0?0?0000???0???????0??000000N?0??0?0???0??00??000?0??00????????????????????0????
?????????????????????0N0000?NN???00N?????????????????????????00N??00

Lohuecosuchus megadontos

111000031101NN0101111000110011101000000NN0000N111000000100N00??11000
0000??10?0N?101010010?101011??001020010?001100010N01?0?100000NN10010010N10
00?111111000N11001111000N010101100000001?100?00?010N11001101?00010000001?
113101000100N01111200N020N0?00N001N?10?0100000011?0?0?0001??????000??01000
10???????1?1010NNN00?0100NN0?200000N001002010000?0000?00N0N10003001000N0
000[1&2]000000111000???20??
???????????????????????????????????000101??010110???N?NN00???????1N?N?022020NN
000?

Lomasuchus palpebrosus

11100001??10200101101?02110111111000??????011[1&2]1100?00110011N001000
000000N1000N000101000010010100N00101011101011000110011 0N0000????1001?110N
001??100N01000N0?01??0100010??211?11110000??0N?1?1?010N0??????1?1[0&1]110000
100?11001000000??01111000N000N0000N0?1001100?01?1011000?0100110000?????11?1
00113011?0???0??111????????0?00?20???????????????00?00????0?????????12000N0000?0
???00[1&2]10?0?10011???
????????????????????????????000000000?1?111100N?NN00??00?000N?N?0?0020N??00?

Lorosuchus nodosus

111000031001NN010110100211 0??????0101?0001010?11000011110????00?00???0
00N10?10000100?10??[1&2]?10111?0?1?2??????????????????????000?0NN???000110001??
100N1100??0?1[0&1]0N00000??1???1???010000????0?0?1?10N?1101?010?001001?001?1
1001000?0?0N?10?101???0????01010?00??001????001???????0????????010???1?????01?0
0??1?11110021011??0?10????0?0N1100030[0&1]?1????001??0?0N?0001001000N?000100
0000100?001010???
???????????????????????0???0????0?0???1?????N??00???00?N?N0?????0N?0??0

Mahajangasuchus insignis

111000031?002102011011021101 1?21100011??1000N?1100010110001N0?1000000
00101010N0011?10100220101011001 2201????01100012N0101010000???00011010N0010
N100N11010N10011111010100N2110110100000N0N010?100NN010???01002N1000?0010
110110010100N01?11100N01110000N000101?010000001110000100110 10???00?0?010011
3011001110??111100010?101001???00??00000201?1001111101?00N10?0?012000N0?00[1

&2]00000011000000111O???????100111011101100110010?101?0?????0001??00111110?11
01110111111?1???????010??0??00????00000?000110???1??N2NN0010??1000N?N012102?
1??10?

Malawisuchus mwakasyungutiensis

101000110?1010010110100110?1???1100100??000102110010011001000[0&1]0000
000000N100110001???000[0&1]20100N0N00101001?000??0001101?1??00001[0&1]??000
010100100?N000N01?0????010N01?00100N211011?0?0000N110?0?1?10N?11???11???N?
????????1110?0000?00N01111001N000N0000N?0?00??0010???0?100?00?001???????01???
?1001?3??100??0?11?11??001??01[0&1]0?000??10N11??01000??00100011000N?[1&2]101
0000011000021?0?100?001011010????????10?1????1000??1?1???0??00?1??????0??0?????
???????????????1???????????00N110??01????00?000?000????????0?1N??00???00?N?N0??
0??0??00?0

Mariliasuchus amarali

10100?110111NN0101?01111?0001021100100N?1000N2110010001?0N00?0200000
1000N1010N1?010?0000120100N0N10001011110011000110 10[0&1]10000011??000?[0&1
]010N10111001001100N0101??01000N00N201011000000????110110110001[0&1]?001000
N000001001110000100010N111110010110N0000N100?010?100000101000001[0&1]011[0
&1]000N01110?010011301100?10010011101010001101011?010N111001001100010000 10
00N12101021[0&1]10N011023010100000 1111??0???????????1???10??????11110????01?1?
??00?0011??0????????101?111?110??1???????00N1?2??00???000001000001011?111021[0
&1]0010001010[0&1]010?21020?N0?00

Metriorhynchus casamiquelai

0N00?002?1102101110110011 10?000?00?01?N??000N01100000N1100001000NN1?
1000N1010N0?0???000?2?10?NN0N?001000????00N11?0NNNNN???000?????0?0??10N?0
0??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??????????????????????????????????N0000

Metriorhynchus superciliosum

0N0?000211102101?10?1?011??10002000010N?0000N01100?00N11000010?0NN10
1?00N10?0N?00???000020101NN0N00010000NNN00N1100NNNNN0N000000NN00?000
10N?0?0?1?0N000????0??0N111000???000001?0?0000N??000N000NN0?001?01000N0?10

0?0??112??00??????01?110????0????0110??0???00???0???10?000?00010NN0??000??1100
01001111??11??00N??0010?00NN?00?100??21000000001100?0000N0N00002?10000N00
0030000000??000000000??0????00??????0N00?????01??1?????11???????????01?????0?1??
??1100???????????????????1N?0N????01N???00000N100????????????0???N???1??0N?00?
?

Montealtosuchus arrudacamposi

1110000100102001011010021[0&1]01111110000010?0011211000001000011N00100
0000000N1000N0001010000?0010100N00?0101110101100011001110000?11110011110N
00101100N01000N0101??010001011211?111100000N0N01011010N01100101000110?001
000112010000010N01111000N000N?000N00100?100100000110?0?01001100000000001001
0011301100??101111113001?010100320?01111110?10001?0110111100101000101 2000N0
00010001102100 0010?11?????????????????????????????????????1?????????????1???????????
????????????????????????0?????0000000000101??100N?NN0000000000N0N1010020N?00
00

Morrinhosuchus luziae

1010001101102001011 0????????102??01100N???00N111000000 1001??10210?0000
00N10111000???0000?00100N??001010111??011000110101110000?1??00001010N100101
0?N00000N01010N0???0100N?1???1?000000N0N1?0?1?110?0100101000N?000010111?1?
?0????????N111?01?110N0100N1?0???00111000?010000010011?????01????010011301?00
????100111100?0001101000??10N11100100[0&1]0000100??1000N1???0000000N0???2200
11000001011000??
??????????????????????00?01100?0001??100???10010???000?0?0??0??00?01??

Notosuchus terrestris

1010001101101001011011111001102110 0100N?1000N211000000100101 10000000
1000N101110001000000120100N0N000010[0&1]111001100011010[0&1]100000[0&1]100
0000101[0&1]?10001100N01000N0?110N01000110N2110[0&1]10?00000N0N1101101100
01[0&1]1?01000N00000101111?000100010N1N1110010100N0000N10000100111010101 0
0001100[0&1]10000?0110?1010011301100?10?1001101101000110 1000?010N1110010010
0[0&1]0100011000N?2101001110N01112100010000011010?00?11010?10110?10[0&1]000
1011110?00?0111?[0&1]10?1101001 1111?1111101111111101?100?????2101000000???000
0010000010111 1??02010000001000[0&1]0000200200N0?01

Ogresuchus furatus

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

Orthosuchus strombergi

11101011000010010100NNNN0010N20N011001000011201000000000011N101000
000000N0010N1000??0000100100N0N0010000111001000000NNNNN0N000100NN000010
00N10000000N01?00N00000N00001100N0000010000100N0N010N01110?N00?00000000
000NNNN10NNNN?NNNNNNNNN0011000N?N0N0?00N000??10000N1010N10001101001
1001?????0?0000000?1??1??1?10111000010[0&1]00001000??00N00100300?001?01100100
0N?0??0001000N00002[3&4]00010000?00000000000?0??0000????0N0100???00?00000?0?
?0?0??000??010?00?101001000110??00???????2??0N0010000?001?010N0100000N???N?N
NN??0?0000?N??002???0?N?00?

Pabwehshi pakistanensis

101?????00?????????????????????????00000100?111100?1?1?????????????????????
??0?111?????01??0???????????????????
???????????????????????????????????????11?0??????????????????????????????0????????????
???1??????????????00??0???????
????????????????????????????12000N??0?3?00010????000??11????????????????????????????
??
???0?0?????????0?????????0??1

Pakasuchus kapilimai

101000110?11NN0101101?121?0?1???100?????????????000?0??00N???0????00?00
??10?0N000????000??0100N0N00?0101111001100?11001010?00?????0000??00N1111?100
N11?00??1010N11000N00N211????100??0N??0?0???????1???????????????????11?????00?
?0N01?110???000N??00N10000??0100????010?0????001?????0?0???01001?3?1?0???0?110
11110010?0110100???00N11??01000100010????000N12101001001100000?3?????2?001?11
111???1?10?10?10?????????1?????????????????????0????????????0111????1???????????00
N10???00???000?010???010?????????N??00??????N0??????????????

Pelagosaurus typus

1110000211002001110110011111000200000[0&1]0N?000??01100000N1101001[0&1]00NN000000N[0&1]110N0000?N00002010[0&1]NN0N00000000NNN00N0000NNNNN0N0000????00000?1[0&1]?00000100N00?00N00010N10100100N0000010000000N??000N000N??1001?01?0?N?0100001?112000000000N01?11000N000N[0&1]00110000?100010?00?010?000101010NN1000000011000100 1011?011??011020010000??000??00??210?000???01100?000000N00?02000000N0000200000001000000000?00?????00??????0N0??????01?00?00??11???????????0??????001?0001??0???????????2111?00000?10?0??0100?100?00N???N?N?00?0?0000???N00?1??00N0000

Pepesuchus deiseae

1111000[2&3]0000210101101001110111111 0??0??0000102??00000??00100110000000000N1011200010100001[0&1]010100N0012[0&1]001???01100110N101100000?1001001??10N00001100N01000N010?10110000???2111111??00010100101100NN?1????01?0?1?0100110?112000000000N01111000N000N0000N000001100?00010111?00?100?1000????????01001130???1???011?11??0??0?10?110?0??00N1100000001????????????????0??02000N0100100011021010?00?20??0?????000000000011??????N?NN0?????????N?N???2020????0?

Pholidosaurus purbeckensis

111010?21101NN000111100[1&2]11??1011101??1N????0N?11000001100???100000000000N1?10N0?0???110110010100N0000210????01100?10N00?0N0000????10?0001???00?000???1?0??????1111?0?N?10101??1??100?11??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?????0??0????????????00?000000N?10010?????01000?0?0???????????0?????????0?????????????????????????????????????1???????110???????????1110N00?00????0?0010?[0&1]?01???????????0???????????N??21??00N00?0

Pietraroiasuchus ormezzanoi

1110001311????010111100210001?10N00000NN?000N11100000?100?1N?01100000000N10?0N000???0000?2?10110N000?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???????????N?0?0

Pissarrachampsa sera

10100?000011NN021110111211011021100000001001111100011 1??1N00N1111000
100101011100100N0000110100N11100110111100110001110 1?111000?11000000010N001
01101101011101020N11000N10N2110111000100N0N111111110011?1?01?0???101100111
1300101100101N1110110110N1100N10000100101011101001011101111111001000010011
0?1100?10011?111?0?11000??0??0??110111102110????1???????????????12000N000034?0
01?10000000011???????????1??????0??0???10??0?0??01?0????????????????11??????1??10
0?00110?0??????N??1?????00011000001011 1???0?1100000[0&1]10000?N10?0020101101

Protosuchus haughtoni

11101010001012010001 0NNNN0010N20N001000000011?010000000011N101000
000000N0010N100???0000100100N0N0010000110001 00000NNNNN0N000000NN000010
00N10000000N01000N0?100N00001100N000001100011 0N0N0?0N01110?10???0????????
1?????0NN????NNNNNNN00?1000N0N0N0110N000?????00N???0N?00011010011001??0
??0??0000001101?????10110040010?01101100??00N00??0200?0000100?0?000N0??10012
000N00002000?100?0?0000?010000???1??00????11?10?0?0?????0???????????????????????
?????????????????????????110000001100110 10N2100?00N0NNN?NNN?00???00?N?????
00?0NN0000

Protosuchus richardsoni

11101010001012010?0?0NNNN???0N20N00?0?000001120100000 0??01??00?00000
0000N0000N1000??0000100100N0N00100?0110001000?0NNNNN0N000000NN00001000
N10?0?000N?1000N??100N0000?10??00?00??000110N0N010N01110??0?0?00?0???001?N
N??0NNNN?N???????0011000N0N0N0110N0????1?0??N?0???100?1??10011?????00???0?
00?0?110110110???10040010?011010000????100?0?00?00001?0101000N0001001[0&2]00
0N000020000100?0?000000100??????000?0???1?01?????00??0000??1000??0000???00???0
0010010000N0000??0010002111100000011 0?110?0?2????0?????N?N?N??00?000???????0
???NN000?

Racheosaurus gracilis

10000002101021010?0????????10??2?00010000000N01100000N110???10?0NN1???
00N1010N00?????0?????0???0N?0??0000NNN10N01?0NNNNN0N01?0?0NN???0??10N?0
1???????0?????????0????0??????????0??????00N????0N??????1????0????????0?????11?????0
0??0N????1?????00N??00?0??0????????????????0????0?1?????????????000?1?????????0N0
0NNN001??0?NN?0?0?100N21???00000???00????0N0N?0?02000000N0???3000?????0?00
0?00?0???????0000000?0N000?00001??1?00??????????????????????1??1??????????????????
???????????????1????N??1?0?????????????????????????????1??0NN?000

Razanandrongobe sakalavae

??1????101???????????????????????????0?NN00?0N111???????????????????????????
???00110???00110N??????????????????
???????????????????????????????????????0000011000??0??0????????????????????????????
???1??????0????00??12?0??1??
?1?0?21?????????????????????10000N0?101000000[1&2]???0000100???????????????????
??
???????????000????????0????????1???

Rugosuchus nonganensis

111001031?01NN0101101?00?10?1??0N00????????0N111000000000N???0????0???
00N10?12?00????100?0?10110N?0002?0????0??00110N1110N000000NN???1?010N0?001
100N01?0?????11101000N?102????1?1?0???????10?1?????10???01??????00000??1100000
00110N011111???00???000N00?????????????0??1?????0011000???000??01000?0010?????0
1110NNN000??00NN00?0??00N01??03010??00??00001N1110003000000N0000100000021
0?0010?0?0?????????????????????????00???
??[2&3]10100?????????0001100001??????????N?0????????N?N?0???[1&2]??N00??

Sarcosuchus imperator

111000031101NN0101111002110?1011101011N?00?0N011000001100?00[0&1]000
00000010N1010N0001001101?0010110N0010200????01100010N0010N000100NN?000001
0N[0&1]0000110N01000N01101101000N0101011010100000100N0?011010N?100?011102?
00000000?111100000100N0?1?1100N010N0?00N001?0?100100010011?0??100???00???00
0??010001?01?00?01???110100010?00111[0&1&2]00000??21000?0101001000001000N?00
?2000000N010010100110000000000211????????0?000????000?1000???000???????????????
????????1?0????111?????????????111[0&1]?0?000?1??0000100000101101??N?NN0??0?0?0
0?N?N0?210200N00?0

Sebecus icaeorhynus

11100000??*11NN010110101010*??101111?00?0??0010??100001??10?00?0100000??
00N10110000????00?1[0&1]0101[0&1]100??010?1?00011000110011??000??0NN1000??01
000001100N?1000N00111001000?0112?1??1?100000N??01011010N111???01???110000??
??1100100000?0N????10???00???00100????01000?00101???00010011?00?000[0&1]0??010
001001100?110???111?001??00?01[0&2]???0???1100?10[0&1]??001?0?10?001010001?120
00N?000[0&1]00?00?110000101010??0??0?1001110?110010001?01???????1??01?1110?11

??101??1100111?11011?10111010??????????????000001??0010110??????N00000??000N?N0????????????

Sebecus querejazus

111000?0??11N???????1012101??????0??????????????00001?100????0101001?100N101100?010[0&1]??0???1000??01000100100N?10?0N00[0&1]?10?10??????2????????????????????????????????1?0???000?1???11?010000010N01??10111000N?00100?1?0?1?01000001?1????????????????????????0???02000N?010?0?????[0&1]00????0?0???0???0?100????????????N0??????0??N?N??010??0?0???

Shamosuchus djadochtaensis

11100113??01NN01011010?011001110N000??????00N?11000001100N1N000101000000N1001200010?010010010110N0000210???001100110N0110N0000????10010010N00001101N0101??01011101000N0102010111100001?1N01001110N110??????0?????0??0??11??0??00110N01111100N000N0000N001??1?001000?001110?010011000?000???1010001001000?1101010NNN000?000NN??0???00N01??0[0&3]0?000000000000N1110003000000N000?[1&2&3]0????0110?00?001?[0&1]0?0000111?0????111???????????0??1?1?????????????????????????????0????????[1&2]10100?????1?1000011?0001?110100N?NN00?0??000?N??00?20200?????

Shantungosuchus

11?0??11??1??0???0111?010[0&1]0?0N2????0??0??0?????10?0??????1????????????0?????????????????1??1????????????????????????????????0?0????00?0??????????000N0??10N00120N?1?0??00N?????0?1?11?????0?0?0?110??10???0??????0100N??10?NNNN????NN????1000N0N0N01[0&1]0N100??1?0???100?010?001110?1?00????????????11??11?0??0???11100011??0?00?00??0?0N100??00??0?0???0?00?110???00?0?0?0N?000????0????000?00111?0????????????????????????????0??0?????????????????????????????????0???????????????0?????????????0010?0??????N?N?N???????0?????????????????

Sichuanosuchus

1[0&1]1000110?1010010011100?000????1?000?00??0011?1100000?10010[0&1]1020000??000N[0&1]0111000???000?1?0100N0N???000011000110001100001??0000????01?0?01???00?0000N?001??00120N01?0110[0&1]?0?1?10?0?1100N??0?0?0111??N?????0???????1?0N??10?NNNN???????0??1000N0N0N0100N1000?1??0???????10?001110?1?000??10????????1??1?1???0?1011100011??01?01000?0?0N10??000????00?1??0001?????0?00?0?0N0

0002000?0011??00?0?11?????????0??????0N00??????????01????????000????1?????1?????
??1?????0??????????????0???????00?010?010?????0NNN?N?N000??100?????????????????

Simosuchus clarki

101000130010100100101[0&1]121??0102100001100[0&1]000N2110N0000N00100
000000000000N1001001010[0&1]0000220100N11000000011000110001101111010001101
0000101[0&1]?1000?100N00010N01020N0100000100111111100100N111?011010N00001
100002N1000N?N1010NN100NN??NN01011001000101000N10010100010101N?10000010
0010100??110??0100113011000?1010111100110001101000?010N01100202N00011000100
0101010101200100000102000000001010[0&1]?0?0110[0&1]0010?10???11001???100?0?10
10010000100100011?100010??????1111???0001111130N110?102011100001000001011110
0121N0001?11010N0N01200100??0?0

Sphagesaurus huenei

101000110111NN0??1101??2110???????0100N?00?0N01100000110?N?????0?????0
0????????????????0????????????????0?????????????????????00110000001010N11000101111
101101000N11000N10N2??011?1000?0N??1?????1??0?100001000N000000011110000000
010N?11110110?00N1000N???001?0?1?1?1??10000010001111??01???????001??1?00??0??
????????1??01??1??0?0???1??0?1??????????0????????????21110N011142000N0001?00110
?0?1?10?0???1??
?????????0????00000?0??????0???001???20?2??N0?01????00?0?

Sphenosuchus acutus

0N0000100010000101010NNNN1010N20N0000000?00102100000000001001000N
N000000N0010N0000??000000101NN0N00010000NN000N0000NNNNN0N001000NN100
01000N00100100N00000N00110N0?000000N0000010000000N0N000N?00NNN10???0000
?0?0?NNNNN?0NN????NNNNNNN0000000N0N0N?000N000??100??N1?10?0000?00000
0??????000??000000100?00?0??0N01100?010?00000000??00N000003100??0?0001?100??0
?000012000N0000?000?0000000000?100?001001?0000??00N00?????????0?00??00?110000
0??????????????????0N????0????????????????????0N000NNNN00000N???N?NNNN?????
???N???1?0000?N?000

Steneosaurus bollensis

1[0&1]00000211002001110110011111???20000[0&1]0N?000??01100000N1101001
100NN000000N[0&1]0?0N00000N000020100NN0N00000000NNN00N0?00NNNNN0N00
00?0NN00000010N?0000100N00?0??001?0N111000???0000010010000N??000N000NN??0
01101000N?0[0&1]00000011?000000000N01?11000N000N0[0&1]0110010??10000?00?01

0?001101010NN00000000111001001111??10??01101001000001000?1000N210000000000
100?0?0000N?0002000000N00002000000001000000000[0&1]010?01?00?000??0N00000000
10?0?000?11????????0??00????100100001100??0????????211[0&1][0&1]00000?1000??010
0??00000N1??N?N????0??0?0???N??010?00N?0??

Stolokrosuchus lapparenti

111100020000210101101???1101111?10110010000102110000011101000000000000
00N1000N000101000010010100N1010201????01100010N011100000010010000110N0010
1100N11000N01010N11000101120101111000010100101100NN0110010100011000011001
120000000?0N0?111[0&1]???????00?????1??110??00?1??11100010001000000000110100[
0&1]1301100??1011111??0000??00110?0?00??1100000001?????0?1?100N??????02000N01
001000110[1&2]000001002??
?????????????????????????????????000000000010111???????00?0?0000???N0010020N?01
00

Stratiotosuchus maxhechti

101000011001NN0211101??2?10110211000000?10011111000101000N1NN021100
010011111101011010000?30100N10100100111010110001110101110001110000010110001
01101101011101[0&1]20N11000N10N2110111000100N0N01111111101100001001011011
001011300101??010??11??1??????1???????0210????0?1??10??0????11??0100100??010011
0?1?00??0011???????11????????????11011??0?????????????????????????12000N?000330001
0100?0????1???????????????????????????10???????????0?01011??11??10111????????????01??
0111?1???????????????000110???01?111???????0000000000??N?121?20101101

Sunosuchus

11?00??31101NN??01101002?101????100000N??0?100?1?00?0???0?0??0??00???0?
1010[0&1]0N010????00010?10110N0??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?10000??1?1?100?1?01??0?1??
11111130??????????0????0N?1????0?????10?0?1?0???1??030???????100????00?1100?0?0?
?0?0??1????0??????110?????????0?0??????????????1????1?????1?0????110???0????????211
0N0?000?1???0?01??0?0????????N?N?00???????????????2????N?00?

Susisuchus anatoceps

111000031101NN010???10021???1????00000NN0000N111000001100N1N1010000
00000N1000N000???0100?0010110N0010200????01100?10N0?110?00000NN10000010N0
0101100N01000N0?011101000N0???01?01?00?????0N010???????100??01???00??00?0??1

1????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??00000N??0?[0&1]0000
00010?00???0?1??????1?1????????0??????00?0?00?????????????????1????????????????0???
????????30N1101102111000?01000??????????N?NN??????????N?N???????0N?0?0

Terminonaris robusta

111000021101NN0101?1100[1&2]1101????01001N?0000N01100000?100?0010000
00000?0N1010N000???110110[0&1]10110N0010200????0110??10N0100N000100NN10?0
00111100001?0N?1?00N00??11???00????101?0?0110??110N0?0?????N?100??111???0?000
00??111000000000N0?1?1[0&1]00N0111??00N00000?10010?0?0?11?0???00?1000???00??
10??0????1?00?0??11110??00????11?10?0??00N21??0?010?0010?10?00????0002000000N0
10010100110[0&1]0?00?00?01010001?00??????0N00?????0????000??11???????????0?????
?1??????1110??0????????111110??00?1??00000000001???????N?NN00???0????N?N???1?[
1&2]0?N0000

Theriosuchus

111001111000200101101001110?1?101000000100010211000001100101110[1&2]100
000000N1010N0001000100130101110N1000200100001100010N110??000000NN10010010
N00??0000N00?00N000?11010001?10201101010000??0N?10??010N?10?1?01?0????00000
0?110100000000N01111000N000N0000N001000000100?0010??00100010??????0??10???
?1??1????1?0101[0&1]?0?0?10?00?10200??[0&1]??11???30100?000?0[0&1]0???1110?03?
02000N00001000?001100001002010?0????01??????1?10????????[1&2]0?00??10????????0
??1??????1??????1110??0????????211110?000?01?000011000??0??????N?NN00?0??0???N
?N???2??00N0??0

Uberabasuchus terrificus

1110000100102001O110?????[0&1]0??????10000100001121100000010?011N00?000
000?00N1000N000???0000?0010100N00101011101011000110011 0N00?001111000?110N0
0?0?100N0100??0?[0&1]10N0100010??211?11?10000??0N01011?10??1????01???????0???
??11???00????????11????????????????????1??????????????????????????????0????????????
???111111300???1?100?2??011111??0?0[0&1]01001101??100101??001[0&1]2000N000010
0?110110?0010011??????????????????????111????????????1????????????1????????????????
??????????????????00[1&2]????0???0???????1??1????????00????0???N00?00?0N?0000

Uruguaysuchus aznarezi

11100001011010??01101[0&1]0[1&2]1?0?101???0?0?N?0000N2110??001??01??[0
&1]???????0?00N1?0??000????00???010??0N??1010?1?10?????0110??????000?0NN000?1

?100001???0??01?00N0?1[1&2]0N0??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???????????????0
0????1??0????1101110001000????000?010N1111?00?0??0?0?011?0??????0?0[0&1]10010?
00020???0?110010100100??????????10?????00????1???00?????1????????0???0??????1????
???111??1?????????0N110?????????0???0000??0???????1?N00000??0??N0?????????????0

Wargosuchus australis

101?????????????????????????????????????1??????????1???01?00N1??1?0010?101?
1??????0?0???????????????????1??????????????????????11??????0???????????????????????
??
??
?????????????????????????1??00N0000[2&3]?0??1???????0?????????????????????????????
??
?????0????????????1?????????1

Yacarerani boliviensis

101000110111NN01011010121001101110010 0N?0000N211010000100N001020000
00000N1000N100???0000120100N10100010011?0011000110000110000110N00001000N1
1000101110100N01010N11000N10N2010111?0000??0N110110110001???01000N0000010
0011000000110N11111001?100N1000N11000??0110000101000001101111????0110??0101
11001?00??0010011001010001101011?010N111001001??00100000000N1?101022110N000
0220100010001111010 0??1010?10?111??1100?1001?????0?111?100001010?111?10111???
????1?1001000011111??????????????0001110000101 1?1111211001111001210N010002000
01?0

Zosuchus davidisoni

1110001101001001001110010??1???1??0??00?0?0111110N0001100100[0&1]0?000
00??00N10?0N??0???00?0?[0&1]0100N0N101010011?0???00111001[0&1]1?100000NN?1
000010N?00??000N000?0N??120N010001?0N001????[0&1]?111??0N010???110?11???000
000?00??????11??N?100??0N00?11000N010N010??1???0??00?01??0?100001110010?????1
[0&1]???01001??01?10??0????110?001??0001?000???0N10000000?000??000??010N?????0
00000N00003300?1?1?0?1000?11??
??????????????????????????????????????0001000?010??????N?NN000???10??N??0??????0
??????

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, with Bootsrap indicated in fig. S2 and “Bremer support” indicated in fig. S3.

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 8 MPTs.

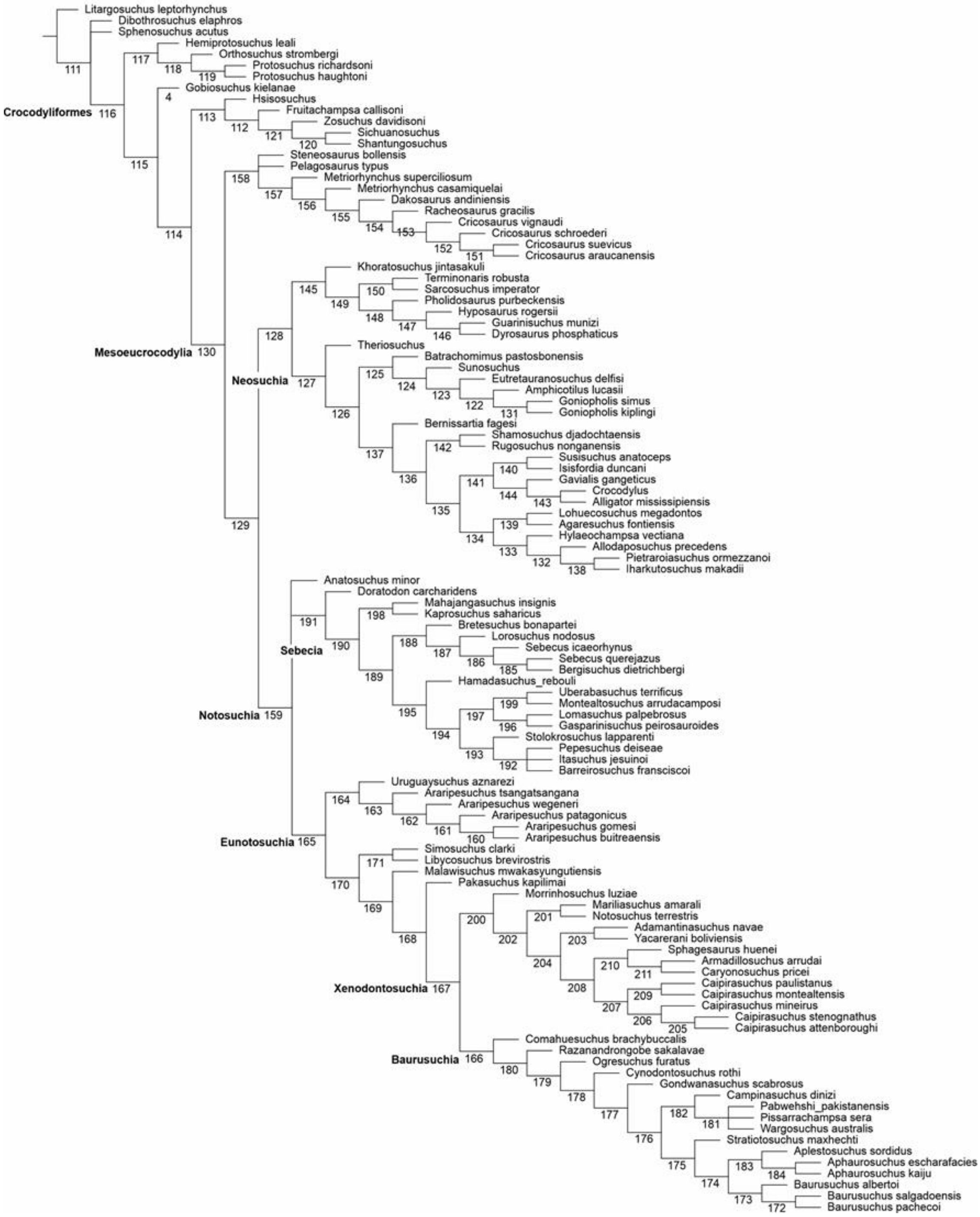


Figure S2. Bootstrap (GC and absolute frequencies >50%).

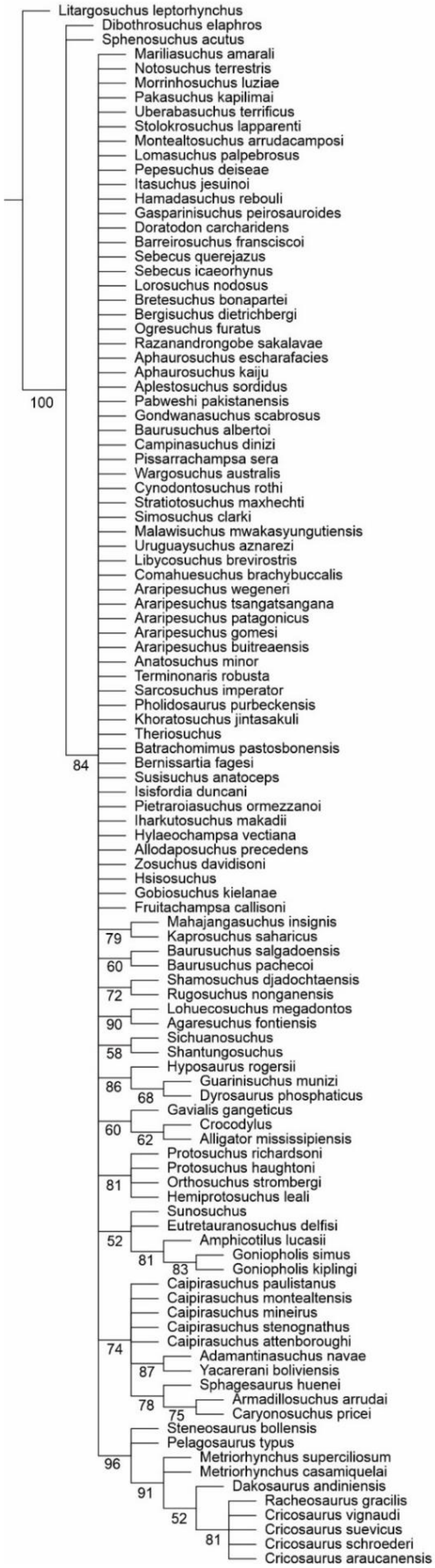
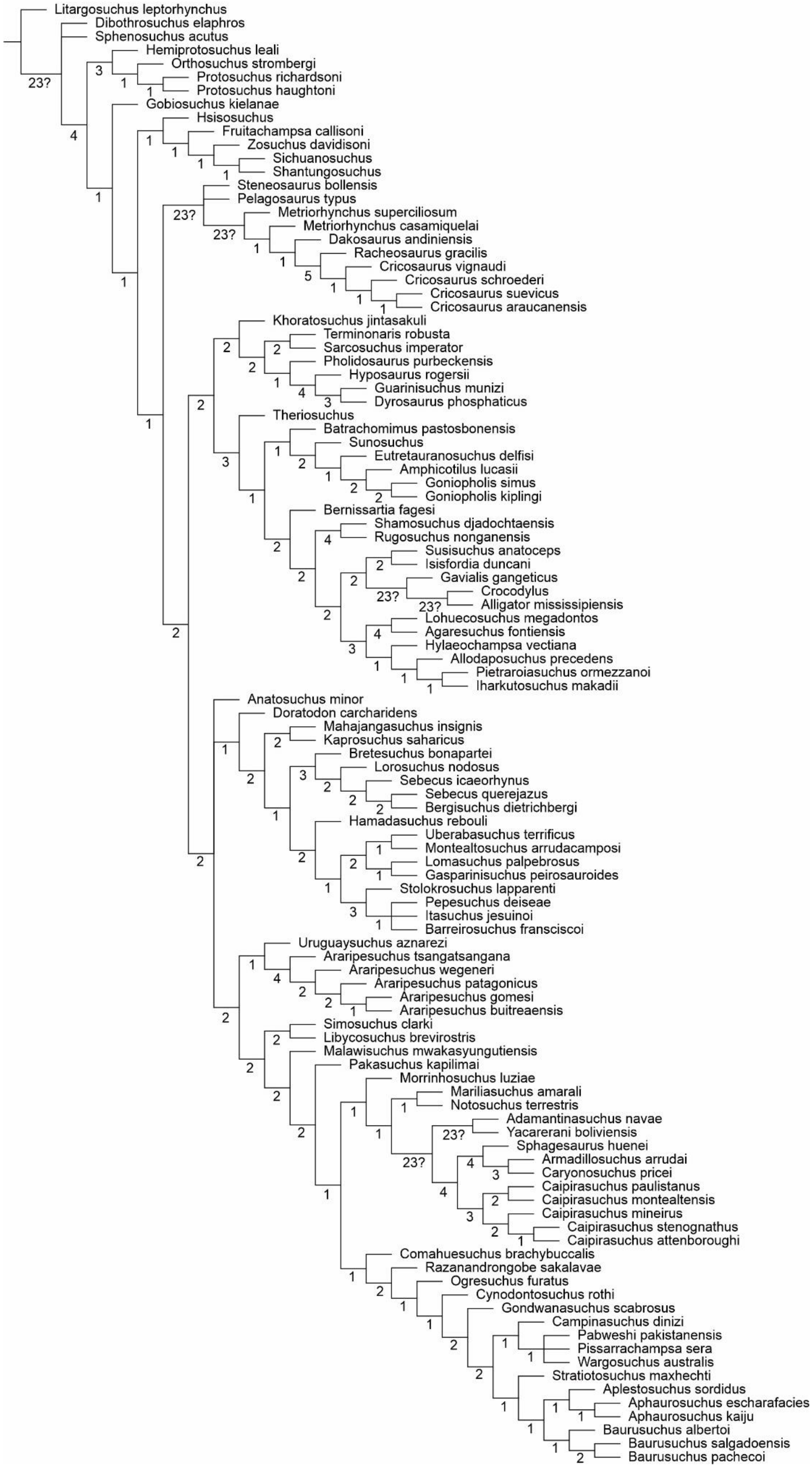


Figure S3. "Bremer support" values sequentially indicated on each node.



1.8. Synapomorphies list

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

Node 111:

All trees:

No synapomorphies

Node 112:

All trees:

Char. 44: 0 --> 1

Char. 97: 0 --> 1

Char. 209: 0 --> 1

Char. 257: 0 --> 1

Some trees:

Char. 62: 0 --> 2

Char. 144: 1 --> 0

Node 113:

All trees:

Char. 25: 1 --> 0

Char. 196: 0 --> 1

Char. 267: 0 --> 1

Char. 288: 0 --> 1

Char. 501: 0 --> 1

Some trees:

Char. 380: 0 --> 1

Char. 430: 0 --> 1

Node 114:

All trees:

Char. 9: 0 --> 1

Char. 20: 0 --> 1

Char. 110: 0 --> 1

Char. 215: 0 --> 1

Char. 326: 0 --> 1

Char. 330: 3 --> 0

Node 115:

All trees:

Char. 7: 0 --> 1

Char. 31: 0 --> 1

Char. 114: 0 --> 1

Char. 136: 0 --> 1

Char. 171: 0 --> 1

Char. 176: 0 --> 1

Char. 255: 0 --> 1

Char. 257: 1 --> 0

Char. 268: 0 --> 1

Char. 289: 0 --> 1

Char. 354: 1 --> 0

Char. 372: 0 --> 1

Char. 384: 0 --> 1

Node 116:

All trees:

Char. 0: 0 --> 1

Char. 2: 0 --> 1

Char. 12: 0 --> 1

Char. 109: 0 --> 1

Char. 124: 1 --> 0

Char. 300: 0 --> 1

Char. 417: 0 --> 1

Char. 477: 0 --> 1

Some trees:

Char. 17: 1 --> 0

Char. 47: 0 --> 1

Char. 88: 0 --> 1

Char. 130: 1 --> 0

Char. 179: 0 --> 1

Char. 186: 0 --> 1

Char. 190: 0 --> 1

Char. 191: 0 --> 1

Char. 231: 0 --> 1

Char. 232: 0 --> 1

Char. 262: 0 --> 1

Char. 272: 0 --> 1

Char. 292: 0 --> 1

Char. 294: 0 --> 1

Char. 380: 1 --> 0

Char. 381: 0 --> 1

Node 117:

All trees:

Char. 78: 0 --> 1

Char. 157: 1 --> 0

Char. 291: 0 --> 1

Char. 295: 0 --> 1

Some trees:

Char. 144: 1 --> 0

Node 118:

All trees:

Char. 4: 0 --> 1

Char. 25: 1 --> 0

Char. 134: 0 --> 1

Char. 149: 0 --> 1

Char. 298: 0 --> 1

Some trees:

Char. 53: 1 --> 0

Node 119:

All trees:

Char. 180: 0 --> 1

Char. 209: 0 --> 1

Char. 304: 1 --> 0

Char. 306: 0 --> 4

Char. 314: 0 --> 1

Char. 398: 0 --> 1

Char. 480: 0 --> 2

Node 120:

All trees:

Char. 216: 1 --> 0

Char. 308: 0 --> 1

Node 121:

All trees:

Char. 157: 1 --> 2

Char. 178: 0 --> 1

Char. 269: 0 --> 1

Char. 326: 1 --> 0

Char. 345: 0 --> 1

Node 122:

All trees:

Char. 102: 0 --> 1
Char. 477: 1 --> 0
Node 123:
All trees:
Char. 177: 0 --> 1
Char. 371: 1 --> 2
Node 124:
All trees:
Char. 45: 12 --> 0
Char. 301: 0 --> 1
Node 125:
All trees:
Char. 132: 0 --> 1
Char. 224: 0 --> 1
Char. 462: 1 --> 0
Node 126:
All trees:
Char. 7: 1 --> 3
Char. 83: 0 --> 1
Char. 143: 0 --> 1
Char. 155: 0 --> 1
Char. 309: 1 --> 0
Node 127:
All trees:
Char. 5: 0 --> 1
Char. 31: 1 --> 0
Char. 133: 0 --> 1
Char. 238: 1 --> 0
Char. 248: 0 --> 1
Char. 330: 0 --> 3
Char. 352: 2 --> 3
Some trees:
Char. 43: 0 --> 1
Char. 99: 1 --> 0
Node 128:
All trees:
Char. 85: 0 --> 1
Char. 115: 1 --> 0
Char. 181: 0 --> 1
Char. 199: 1 --> 0
Char. 264: 0 --> 1
Char. 364: 2 --> 1
Char. 382: 0 --> 1
Some trees:
Char. 10: 1 --> 0
Char. 130: 0 --> 1
Char. 158: 0 --> 1
Char. 380: 0 --> 2
Char. 513: 1 --> 2
Node 129:
All trees:
Char. 23: 1 --> 2
Char. 28: 0 --> 1
Char. 81: 0 --> 1
Char. 149: 0 --> 1
Char. 167: 0 --> 1
Char. 169: 0 --> 2
Char. 189: 0 --> 1
Char. 271: 0 --> 1
Char. 305: 0 --> 1
Char. 348: 0 --> 1
Char. 398: 0 --> 1
Char. 481: 1 --> 0
Char. 483: 0 --> 1
Char. 485: 0 --> 1
Char. 486: 0 --> 1
Some trees:
Char. 101: 0 --> 2
Node 130:
All trees:
Char. 12: 1 --> 2
Char. 17: 0 --> 1
Char. 179: 1 --> 0
Char. 190: 1 --> 0
Char. 198: 0 --> 1
Char. 201: 0 --> 1
Char. 229: 0 --> 1
Char. 242: 1 --> 0
Char. 298: 0 --> 1
Char. 352: 0 --> 2
Char. 381: 1 --> 0
Char. 418: 0 --> 1
Some trees:
Char. 43: 1 --> 0
Node 131:
All trees:
Char. 75: 1 --> 0
Char. 86: 0 --> 1
Node 132:
All trees:
Char. 89: 1 --> 2
Char. 99: 1 --> 0
Node 133:
All trees:
Char. 58: 0 --> 1
Char. 141: 0 --> 1
Char. 247: 0 --> 1
Char. 278: 0 --> 1
Node 134:
All trees:
Char. 139: 0 --> 1
Char. 143: 1 --> 0
Char. 169: 2 --> 1
Char. 326: 1 --> 0
Node 135:
All trees:
Char. 5: 1 --> 0
Char. 99: 0 --> 1
Char. 120: 0 --> 1
Char. 311: 0 --> 1
Char. 459: 2 --> 3
Char. 460: 1 --> 0
Node 136:
All trees:
Char. 43: 1 --> 0
Char. 75: 1 --> 0
Char. 380: 2 --> 0
Char. 390: 0 --> 1
Char. 391: 0 --> 1
Char. 400: 0 --> 1

Node 137:
All trees:
Char. 213: 0 --> 1
Char. 303: 1 --> 0
Char. 325: 1 --> 0
Char. 461: 1 --> 0
Node 138:
All trees:
Char. 6: 0 --> 1
Char. 25: 1 --> 0
Char. 133: 1 --> 0
Node 139:
All trees:
Char. 145: 0 --> 1
Char. 146: 0 --> 1
Char. 174: 1 --> 0
Char. 176: 1 --> 0
Char. 183: 0 --> 1
Char. 199: 0 --> 1
Char. 206: 0 --> 1
Char. 380: 0 --> 2
Node 140:
All trees:
Char. 23: 0 --> 2
Char. 133: 1 --> 0
Char. 400: 1 --> 0
Node 141:
All trees:
Char. 31: 0 --> 1
Char. 63: 1 --> 0
Char. 118: 1 --> 0
Char. 303: 0 --> 1
Char. 371: 1 --> 0
Node 142:
All trees:
Char. 76: 0 --> 1
Char. 224: 0 --> 1
Char. 225: 0 --> 1
Char. 293: 1 --> 0
Char. 346: 0 --> 1
Char. 347: 0 --> 1
Char. 478: 0 --> 1
Node 143:
All trees:
Char. 5: 0 --> 1
Char. 69: 0 --> 1
Char. 199: 0 --> 1
Char. 317: 0 --> 3
Char. 326: 1 --> 0
Char. 371: 0 --> 2
Char. 380: 0 --> 2
Char. 389: 1 --> 0
Char. 413: 0 --> 1
Node 144:
All trees:
Char. 36: 0 --> 1
Char. 75: 0 --> 1
Char. 119: 1 --> 0
Char. 259: 0 --> 1
Char. 342: 0 --> 1
Char. 427: 0 --> 1
Char. 464: 0 --> 1
Char. 470: 1 --> 0
Node 145:
All trees:
Char. 169: 2 --> 1
Char. 217: 0 --> 1
Node 146:
All trees:
Char. 19: 1 --> 0
Char. 36: 0 --> 1
Char. 85: 1 --> 0
Char. 156: 1 --> 2
Node 147:
All trees:
Char. 16: 0 --> 1
Char. 286: 0 --> 1
Char. 287: 0 --> 1
Char. 353: 0 --> 1
Char. 374: 0 --> 1
Node 148:
All trees:
Char. 94: 1 --> 0
Char. 462: 1 --> 0
Some trees:
Char. 99: 1 --> 0
Node 149:
All trees:
Char. 84: 0 --> 1
Char. 87: 0 --> 1
Char. 361: 0 --> 1
Node 150:
All trees:
Char. 125: 0 --> 1
Char. 200: 0 --> 1
Char. 337: 0 --> 1
Char. 366: 0 --> 1
Char. 369: 0 --> 1
Char. 370: 0 --> 1
Node 151:
All trees:
Char. 156: 1 --> 0
Node 152:
All trees:
Char. 62: 2 --> 1
Node 153:
All trees:
Char. 270: 0 --> 1
Node 154:
All trees:
Char. 16: 1 --> 0
Char. 108: 0 --> 1
Char. 123: 0 --> 1
Char. 141: 0 --> 1
Char. 290: 2 --> 1
Char. 321: 0 --> 1
Char. 473: 0 --> 1
Node 155:
All trees:
Char. 23: 1 --> 0

Char. 151: 0 --> 1
Some trees:
Char. 62: 0 --> 2
Node 156:
All trees:
Char. 290: 0 --> 2
Char. 477: 1 --> 0
Node 157:
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. 111: 0 --> 1
Char. 303: 1 --> 0
Char. 364: 2 --> 3
Char. 411: 0 --> 1
Char. 467: 0 --> 1
Some trees:
Char. 112: 0 --> 1
Node 158:
All trees:
Char. 7: 1 --> 2
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. 104: 1 --> 0
Char. 109: 1 --> 0
Char. 114: 1 --> 0
Char. 160: 0 --> 1
Char. 162: 0 --> 1
Char. 171: 1 --> 0
Char. 176: 1 --> 0
Char. 186: 1 --> 0
Char. 191: 1 --> 0
Char. 208: 0 --> 1
Char. 238: 1 --> 0
Char. 284: 0 --> 1
Char. 295: 0 --> 1
Char. 316: 1 --> 0
Char. 325: 1 --> 2
Char. 337: 0 --> 1
Char. 408: 0 --> 1
Char. 439: 0 --> 1
Some trees:
Char. 99: 1 --> 0
Char. 244: 0 --> 1
Char. 283: 1 --> 0
Char. 320: 0 --> 1
Char. 446: 1 --> 0
Char. 471: 1 --> 0
Node 159:
All trees:
Char. 9: 1 --> 0
Char. 83: 0 --> 1
Char. 89: 0 --> 1
Char. 134: 0 --> 1
Char. 143: 0 --> 1
Char. 170: 0 --> 1
Char. 173: 0 --> 1
Char. 288: 0 --> 1
Char. 290: 0 --> 3
Char. 338: 0 --> 1
Char. 341: 0 --> 1
Char. 414: 0 --> 1
Some trees:
Char. 120: 0 --> 1
Char. 206: 0 --> 1
Char. 213: 0 --> 1
Char. 342: 0 --> 1
Char. 352: 2 --> 1
Char. 390: 0 --> 1
Char. 393: 0 --> 1
Char. 395: 0 --> 1
Char. 402: 0 --> 1
Char. 405: 0 --> 1
Char. 406: 0 --> 1
Char. 409: 0 --> 1
Char. 412: 0 --> 1
Char. 425: 0 --> 1
Char. 442: 0 --> 1
Char. 447: 0 --> 1
Char. 457: 0 --> 1
Char. 460: 1 --> 0
Char. 461: 1 --> 0
Node 160:
All trees:
Char. 25: 0 --> 1
Node 161:
All trees:
Char. 21: 0 --> 2
Char. 53: 1 --> 0
Char. 249: 0 --> 1
Char. 250: 0 --> 1
Char. 255: 1 --> 0
Char. 471: 1 --> 0
Char. 503: 0 --> 1
Node 162:
All trees:
Char. 118: 1 --> 0
Char. 131: 0 --> 1
Char. 248: 0 --> 1
Char. 305: 1 --> 0
Char. 306: 0 --> 3
Char. 366: 0 --> 3
Node 163:
All trees:
Char. 5: 0 --> 1
Char. 43: 0 --> 1
Char. 130: 0 --> 1
Char. 158: 0 --> 1
Char. 317: 0 --> 1
Node 164:

All trees:

Char. 106: 0 --> 1

Char. 338: 1 --> 0

Char. 492: 2 --> 1

Node 165:

All trees:

Char. 12: 2 --> 1

Char. 35: 0 --> 1

Char. 89: 1 --> 2

Char. 93: 1 --> 0

Char. 238: 1 --> 0

Char. 322: 0 --> 1

Char. 350: 0 --> 1

Char. 375: 0 --> 1

Char. 377: 0 --> 1

Some trees:

Char. 75: 1 --> 0

Char. 196: 0 --> 1

Node 166:

All trees:

Char. 68: 0 --> 1

Char. 310: 0 --> 1

Char. 317: 0 --> 2

Char. 332: 0 --> 1

Char. 371: 0 --> 1

Char. 375: 1 --> 0

Char. 378: 1 --> 0

Node 167:

All trees:

Char. 121: 0 --> 1

Char. 228: 0 --> 1

Char. 237: 0 --> 1

Char. 358: 1 --> 0

Node 168:

All trees:

Char. 11: 0 --> 1

Char. 103: 0 --> 1

Char. 106: 0 --> 1

Char. 254: 0 --> 1

Char. 463: 1 --> 0

Node 169:

All trees:

Char. 167: 1 --> 0

Char. 378: 0 --> 1

Char. 399: 1 --> 0

Some trees:

Char. 157: 2 --> 1

Char. 354: 1 --> 0

Node 170:

All trees:

Char. 1: 1 --> 0

Char. 6: 0 --> 1

Char. 62: 1 --> 0

Char. 126: 0 --> 1

Char. 155: 0 --> 1

Char. 235: 0 --> 1

Char. 246: 0 --> 1

Char. 252: 1 --> 0

Char. 274: 0 --> 1

Char. 313: 0 --> 1

Char. 341: 1 --> 0

Char. 371: 1 --> 0

Char. 385: 0 --> 1

Char. 422: 0 --> 1

Char. 429: 0 --> 1

Char. 487: 0 --> 1

Char. 500: 0 --> 1

Char. 501: 0 --> 1

Some trees:

Char. 139: 0 --> 1

Char. 175: 0 --> 1

Char. 372: 1 --> 0

Node 171:

All trees:

Char. 169: 2 --> 0

Char. 179: 0 --> 1

Char. 219: 0 --> 1

Char. 257: 0 --> 1

Char. 325: 1 --> 0

Char. 337: 0 --> 1

Char. 343: 1 --> 0

Node 172:

All trees:

Char. 27: 1 --> 0

Char. 153: 1 --> 0

Node 173:

All trees:

Char. 255: 0 --> 1

Node 174:

All trees:

Char. 148: 0 --> 1

Char. 281: 0 --> 1

Char. 329: 0 --> 1

Char. 519: 0 --> 1

Node 175:

All trees:

Char. 72: 0 --> 1

Char. 78: 0 --> 1

Char. 101: 1 --> 0

Char. 193: 0 --> 1

Char. 206: 0 --> 1

Char. 250: 0 --> 2

Node 176:

All trees:

Char. 51: 0 --> 1

Char. 54: 1 --> 0

Char. 62: 0 --> 1

Char. 209: 0 --> 1

Char. 222: 0 --> 1

Char. 226: 0 --> 1

Char. 369: 0 --> 1

Char. 381: 0 --> 1

Node 177:

All trees:

Char. 223: 0 --> 1

Char. 355: 1 --> 2

Node 178:

All trees:

Char. 9: 1 --> 0

Char. 44: 0 --> 1

Char. 217: 0 --> 3
Char. 220: 0 --> 1
Node 179:
All trees:
Char. 7: 1 --> 0
Char. 40: 0 --> 1
Char. 43: 0 --> 1
Node 180:
All trees:
Char. 45: 2 --> 1
Char. 331: 0 --> 1
Node 181:
All trees:
Char. 364: 2 --> 3
Char. 520: 0 --> 1
Node 182:
All trees:
Char. 197: 0 --> 1
Char. 279: 1 --> 0
Node 183:
All trees:
Char. 301: 1 --> 0
Char. 514: 0 --> 1
Node 184:
All trees:
Char. 56: 0 --> 1
Char. 516: 0 --> 1
Node 185:
All trees:
Char. 55: 1 --> 0
Char. 64: 0 --> 1
Char. 67: 0 --> 1
Char. 362: 0 --> 1
Node 186:
All trees:
Char. 25: 1 --> 0
Char. 136: 1 --> 0
Char. 158: 0 --> 1
Node 187:
All trees:
Char. 156: 0 --> 1
Char. 234: 0 --> 1
Char. 238: 1 --> 0
Char. 244: 0 --> 1
Char. 364: 2 --> 1
Char. 379: 0 --> 1
Char. 380: 1 --> 0
Node 188:
All trees:
Char. 7: 1 --> 0
Char. 11: 0 --> 1
Char. 52: 0 --> 1
Char. 55: 0 --> 1
Char. 137: 0 --> 1
Char. 225: 0 --> 1
Char. 235: 0 --> 1
Char. 310: 0 --> 1
Char. 372: 1 --> 0
Char. 479: 0 --> 1
Some trees:
Char. 511: 0 --> 1
Node 189:
All trees:
Char. 159: 1 --> 0
Char. 211: 0 --> 1
Char. 248: 0 --> 1
Char. 377: 0 --> 1
Node 190:
All trees:
Char. 141: 0 --> 1
Char. 316: 1 --> 0
Char. 334: 0 --> 1
Char. 381: 0 --> 1
Node 191:
All trees:
Char. 95: 0 --> 1
Char. 318: 0 --> 2
Some trees:
Char. 355: 0 --> 2
Node 192:
All trees:
Char. 75: 0 --> 1
Char. 100: 0 --> 2
Char. 103: 1 --> 0
Char. 113: 0 --> 1
Char. 158: 0 --> 1
Char. 374: 0 --> 1
Char. 484: 0 --> 1
Some trees:
Char. 60: 0 --> 1
Node 193:
All trees:
Char. 3: 0 --> 1
Char. 7: 1 --> 2
Char. 10: 1 --> 0
Char. 13: 0 --> 1
Char. 128: 1 --> 0
Char. 129: 1 --> 0
Char. 160: 0 --> 1
Char. 183: 0 --> 1
Char. 191: 1 --> 0
Char. 219: 1 --> 0
Char. 315: 0 --> 1
Char. 330: 1 --> 0
Char. 354: 1 --> 0
Char. 380: 1 --> 2
Node 194:
All trees:
Char. 89: 1 --> 0
Char. 155: 0 --> 1
Char. 198: 1 --> 0
Char. 364: 2 --> 1
Char. 368: 0 --> 1
Node 195:
All trees:
Char. 29: 0 --> 1
Char. 38: 0 --> 1
Char. 95: 1 --> 0
Char. 135: 0 --> 1
Char. 175: 0 --> 1

Char. 213: 1 --> 0
Char. 217: 0 --> 2
Char. 369: 0 --> 1
Char. 371: 1 --> 2
Char. 487: 0 --> 1
Some trees:
Char. 75: 1 --> 0
Node 196:
All trees:
Char. 203: 0 --> 1
Char. 217: 2 --> 0
Node 197:
All trees:
Char. 58: 0 --> 1
Char. 101: 2 --> 1
Char. 263: 1 --> 0
Char. 327: 0 --> 1
Node 198:
All trees:
Char. 7: 1 --> 3
Char. 13: 0 --> 1
Char. 15: 1 --> 2
Char. 36: 0 --> 1
Char. 37: 0 --> 1
Char. 51: 0 --> 1
Char. 80: 0 --> 1
Char. 115: 1 --> 2
Char. 154: 0 --> 1
Char. 160: 0 --> 1
Char. 163: 0 --> 1
Char. 167: 1 --> 0
Char. 233: 0 --> 1
Char. 239: 0 --> 1
Char. 240: 0 --> 1
Char. 249: 0 --> 1
Char. 325: 1 --> 0
Char. 332: 0 --> 1
Char. 339: 0 --> 1
Char. 340: 0 --> 1
Char. 501: 0 --> 1
Char. 509: 0 --> 1
Char. 515: 0 --> 1
Char. 518: 0 --> 1
Some trees:
Char. 8: 0 --> 1
Char. 10: 1 --> 0
Node 199:
All trees:
Char. 54: 1 --> 0
Char. 322: 0 --> 1
Char. 323: 0 --> 1
Node 200:
All trees:
Char. 62: 0 --> 2
Char. 118: 1 --> 0
Char. 195: 1 --> 0
Char. 211: 0 --> 1
Char. 301: 1 --> 0
Char. 497: 0 --> 1
Node 201:
All trees:
Char. 23: 2 --> 1
Char. 40: 0 --> 1
Char. 68: 0 --> 1
Char. 121: 1 --> 0
Char. 175: 1 --> 0
Char. 221: 0 --> 1
Char. 274: 1 --> 0
Char. 451: 0 --> 1
Char. 500: 1 --> 0
Node 202:
All trees:
Char. 99: 1 --> 0
Char. 307: 0 --> 1
Char. 356: 0 --> 1
Char. 357: 0 --> 1
Char. 489: 0 --> 1
Char. 490: 0 --> 1
Node 203:
All trees:
Char. 49: 0 --> 1
Char. 78: 0 --> 1
Char. 136: 1 --> 0
Char. 149: 1 --> 0
Char. 305: 1 --> 0
Char. 319: 0 --> 1
Char. 355: 1 --> 2
Char. 367: 0 --> 1
Char. 369: 1 --> 0
Char. 371: 0 --> 1
Node 204:
All trees:
Char. 30: 2 --> 1
Char. 95: 0 --> 1
Char. 140: 0 --> 1
Char. 148: 0 --> 1
Char. 241: 0 --> 1
Char. 269: 0 --> 1
Char. 273: 0 --> 1
Char. 283: 1 --> 0
Char. 290: 3 --> 0
Char. 404: 1 --> 0
Char. 447: 1 --> 0
Char. 498: 0 --> 1
Char. 499: 0 --> 1
Char. 509: 0 --> 1
Char. 510: 2 --> 0
Node 205:
All trees:
Char. 211: 0 --> 1
Char. 495: 0 --> 1
Node 206:
All trees:
Char. 63: 0 --> 1
Char. 213: 1 --> 0
Char. 221: 0 --> 1
Char. 250: 0 --> 1
Char. 267: 0 --> 1
Char. 353: 0 --> 1
Char. 491: 0 --> 1

Node 207:

All trees:

Char. 11: 1 --> 0

Char. 62: 2 --> 1

Char. 217: 0 --> 1

Char. 249: 0 --> 2

Char. 502: 0 --> 1

Node 208:

All trees:

Char. 25: 0 --> 1

Char. 53: 0 --> 1

Char. 100: 0 --> 1

Char. 152: 0 --> 1

Char. 190: 0 --> 1

Char. 211: 1 --> 0

Char. 271: 1 --> 0

Char. 363: 0 --> 1

Char. 373: 0 --> 1

Node 209:

All trees:

Char. 99: 0 --> 1

Char. 310: 0 --> 1

Char. 492: 2 --> 1

Char. 503: 1 --> 0

Node 210:

All trees:

Char. 157: 1 --> 0

Char. 160: 0 --> 1

Char. 176: 0 --> 1

Char. 288: 1 --> 0

Char. 364: 2 --> 4

Char. 375: 1 --> 0

Char. 501: 1 --> 2

Char. 511: 0 --> 1

Node 211:

All trees:

Char. 134: 1 --> 0

Char. 319: 0 --> 1

Char. 355: 1 --> 2