

Electronic Supplementary Material

“A new goniopholidid from the Upper Jurassic Morrison Formation, USA: novel insight into aquatic adaptation toward modern crocodylians”

Junki Yoshida et al.

Included in this file

- Trait evolution
- Figures S1, S2, and S3
- Phylogenetic data matrix for *Amphicotylus milesi* (GMNH PV0000229)
- Table. Palatal and hyoid morphologies

(a) Trait evolution

To visualize rates of trait evolution, we used Phytools (Revell 2012) in R to plot a phylogeny in which the x axis is scaled to time and the y axis to two values, the curvature of ceratobranchial and position of posterior margin of internal choana (figure S1–3). Thirty-two taxa are sampled for the former value and 67 taxa for the latter value (Table 1). The two time-calibrated trees for the values are obtained under minimum-branch- and equal-branch-length model simulation.

(b) SUPPLEMENTARY FIGURES

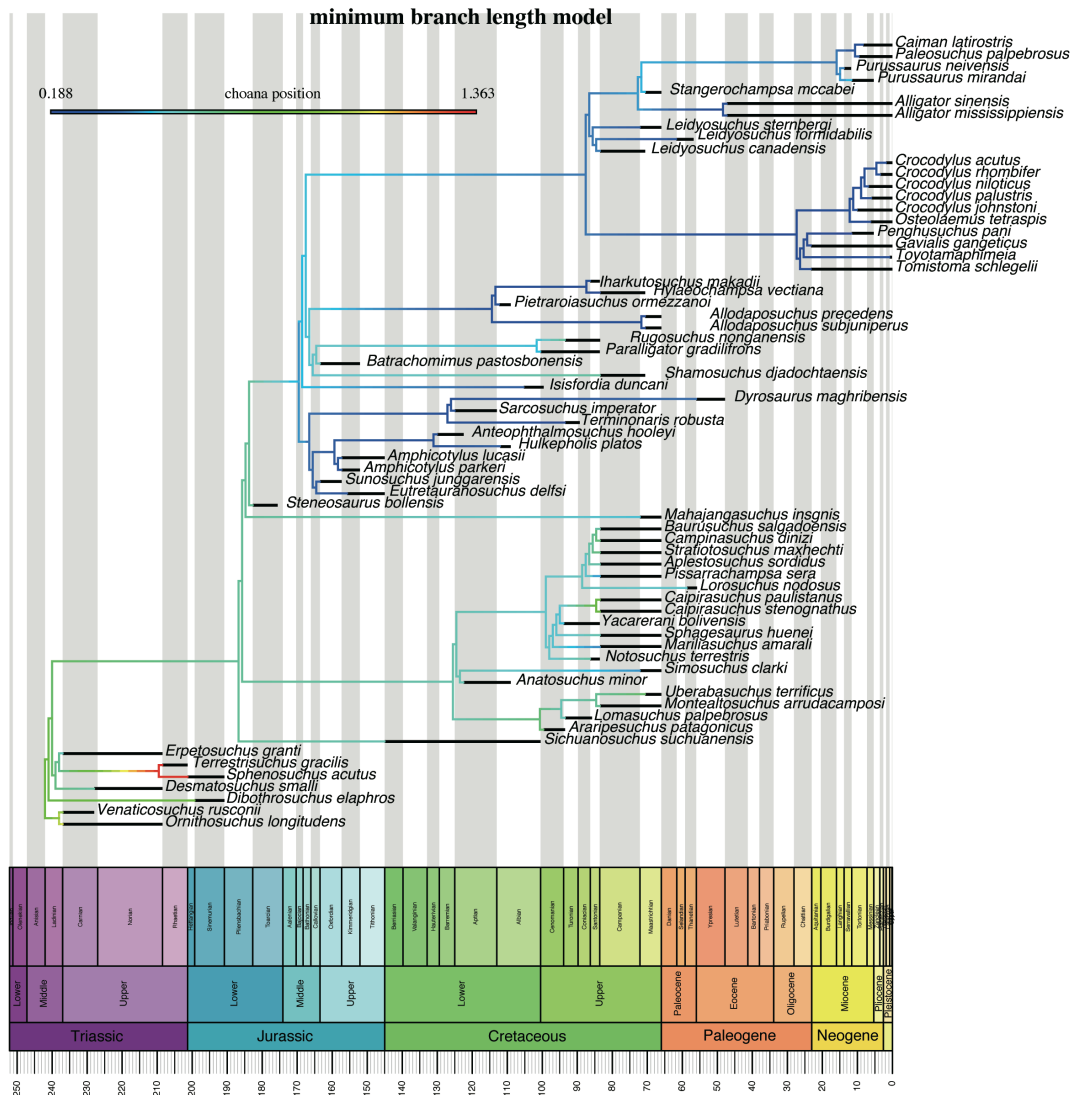


Figure S1. Evolution of posterior end of internal choana on time-scaled crocodyliiform phylogeny (minimum branch length model).

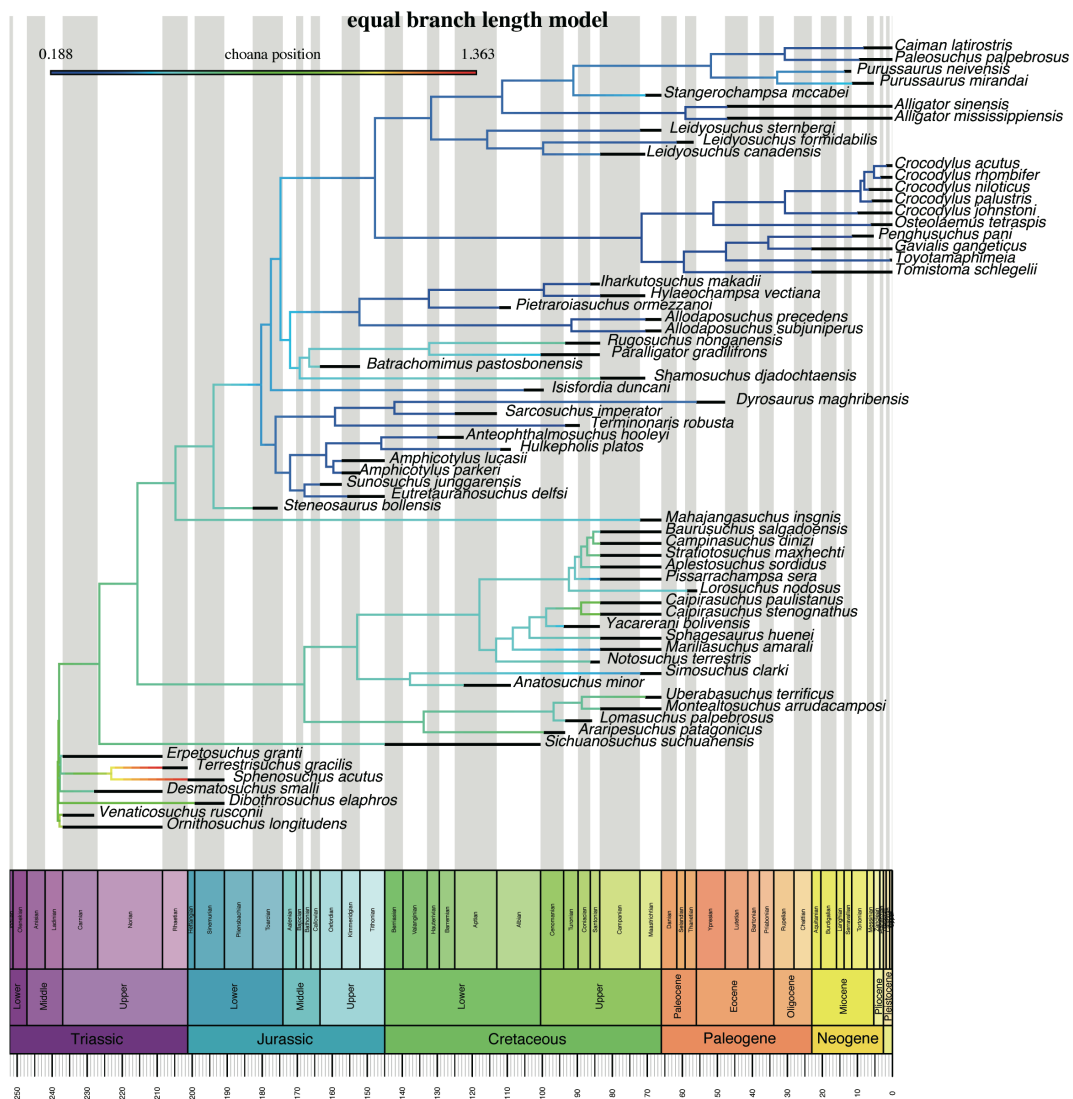


Figure S2. Evolution of posterior end of internal choana on time-scaled crocodyliform phylogeny (equal-branch-length model).

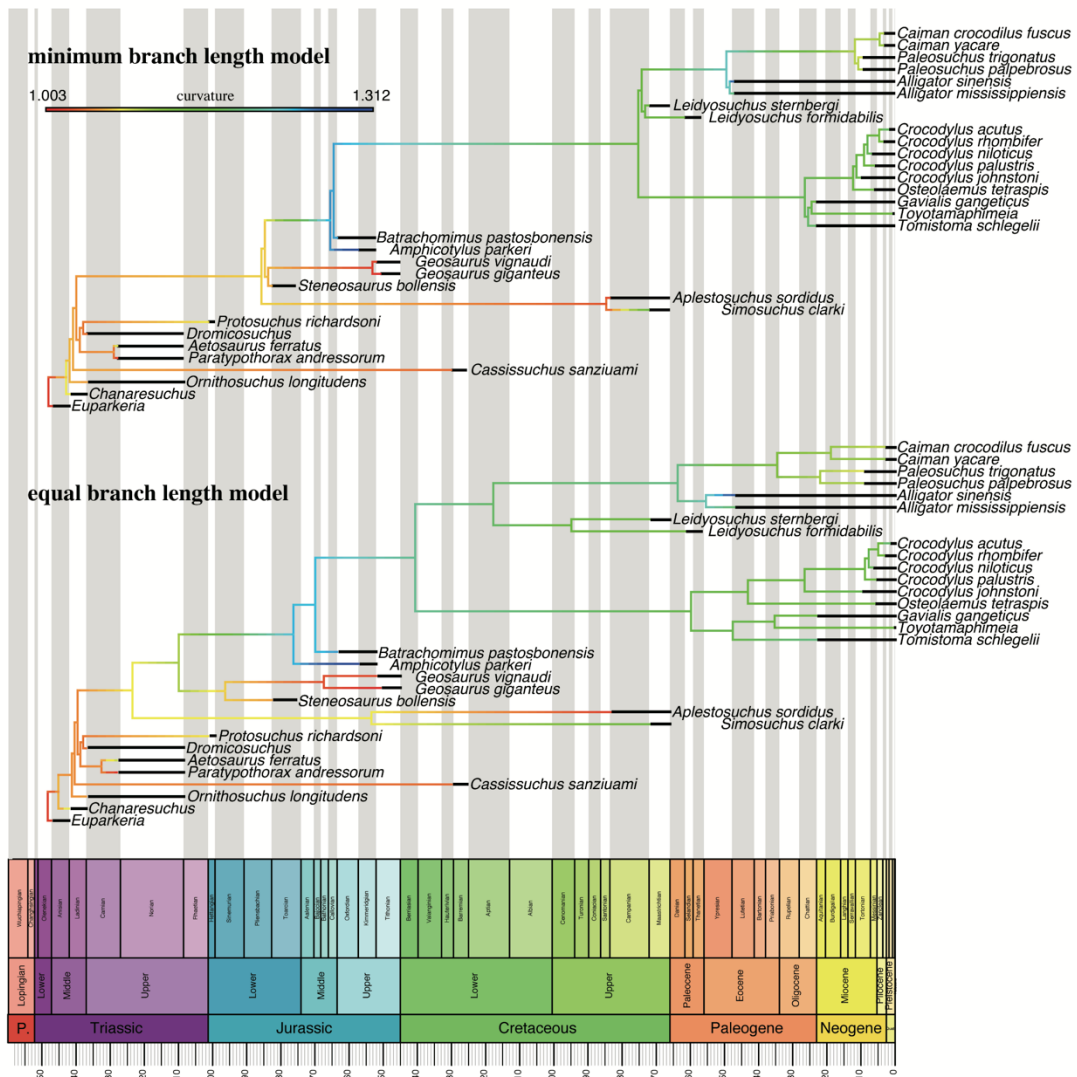


Figure S3. Evolution of ceratobranchial curvature on time-scaled crocodyliform phylogeny (minimum branch length model and equal-branch-length model).

(c) PHYLOGENETIC DATA MATRIX FOR *Amphicotylus milesi* (GMNH PV0000229).

486 characters and 103 taxa comprise the data matrix for the phylogenetic analysis. 24 characters are treated as ordered (Cha. 6, 7, 31, 72, 73, 145, 152, 157, 206, 208, 212, 235, 261, 286, 291, 292, 322, 336, 359, 360, 414, 448, 452, 453). ORD indicates the ordered characters in the list below. GMNH-PV0000229 is the holotype of *Amphicotylus milesi*.

CHARACTERS

1 Skull height, in posterior view: 0, skull higher than wide, or subequal; 1, skull evidently wider than high.

2 Skull geometry, relative position of tooth row, quadrate articular facet and occipital condyle: 0, tooth row and quadrate condyle aligned, both at a lower level than the occipital condyle; 1, tooth row at a lower level than the quadrate condyle, which is aligned to the occipital condyle; 2, tooth row quadrate and occipital condyle all aligned in the same plane; 3, tooth row and occipital condyle aligned, but quadrate condyle at a slightly lower level; 4, tooth row and quadrate condyle unaligned and quadrate at a lower level, but both below the occipital condyle; and 5, tooth row and quadrate condyle unaligned and tooth row at a lower level, but both below the occipital condyle.

3 Skull geometry, relative position of tooth row and occipital condyle: 0, unaligned, tooth row at a lower level than occipital condyle; 1, tooth row and occipital condyle aligned in the same plane.

4 Skull geometry, relative position of quadrate and occipital condyles: 0, unaligned, quadrate condyle at a lower level than the occipital condyle; 1, quadrate and occipital condyles aligned in the same plane.

5 Rostrum, length relative to the total skull length: 0, brevirostrine, rostrum length no more than 55% of the total length; 1, mesorostrine, rostrum length shorter than 67% of the total length; 2, sublongirostrine, rostrum length longer than 66% of the total length, but not longer than 70%; 3, longirostrine, rostrum length longer than 70% of the total length.

6 ORD Rostrum, relation between height and width (state (1) does not imply the rostrum will be tubular, although a tubular rostrum is most likely (1) in proportion); 0, wider than high, platyrostral; 1, height and width subequal; 2, higher than wide,

oreinrostral.

7 ORD Rostrum, relation with the skull at maturity, in dorsal view: 0, rostrum well defined, broadening abruptly at orbits; 1, rostrum poorly defined, smoothly broadening and fitting the skull at orbits; 2, rostrum poorly defined, as broad as skull or slightly wider, smoothly fitting the skull at orbits.

8 Rostrum, relation with the skull at maturity, in lateral view: 0, rostrum smoothly fits the skull, skull roof progressing towards the tip of the snout at about the same level; 1, rostrum smoothly decreases in height from skull, at least towards the mid-rostrum; 2, rostrum and skull with a poor fit.

9 Rostrum, dorsal projection (state (1) is not the hump-like boss seen in *Crocodylus acutus*. Instead, the whole rostrum bulges dorsally/anterodorsally): 0, absent, rostrum straight or low; 1, present and evident, rostrum bulges dorsally, with nasals assuming an arched profile in lateral view.

10 Ornamentation, bony surface sculpted with an anastomosed arrange of wrinkles and ridges, composing a vermiform-dendritic pattern: 0, absent; 1, present,

11 Ornamentation, bony surface sculpted with elliptic to subpolygonal pits and grooves, composing a pitted pattern: 0, absent; 1, present.

12 Ornamentation, proportion between pits and grooves relative to the ornamented area, at late ontogeny: 0, ornamentation dominated by pits, with grooves almost entirely absent; 1, pits and grooves well represented on the skull, with grooves usually present (e.g., maxillo-jugal suture, frontal, dentary) late in ontogeny; 2, ornamentation dominated by grooves.

13 Ornamentation, presence of pitted pattern on the postorbital bar, if skull sculpted: 0, absent; 1, present.

14 Ornamentation, presence of pitted pattern on the jugal: 0, absent; 1, present.

15 Ornamentation, distribution of pitted pattern on the jugal surface: 0, evident ornamentation only occurs at the anterior ramus; 1, evident ornamentation occurs on the anterior and posterior rami.

16 Ornamentation, presence of pitted pattern on the quadratojugal: 0, absent; 1, present, restricted to the distal end.

17 Ornamentation (mandible), presence of strong pitted pattern on surangular-articular: 0, absent; 1, present.

18 Ornamentation (mandible), presence of strong pitted pattern on angular: 0, absent; 1,

present.

19 Ornamentation (dermal armour), type of sculpture: 0, vermiform-dendritic pattern; 1, pitted pattern.

20 Sculpturing, palatal surface of maxilla: 0, absent, palatal surface smooth; 1, present, palatal surface ornamented with ridges.

21 Sculpturing, presence on the palatal surface of pterygoid: (state (1) is present in Protosuchidae): 0, absent, surface smooth; 1, present.

22 Neurovascular foramina, presence of an expanded network of openings on the dorsal surface of the rostrum and ventral-lateral surfaces of the mandible: 0, absent, neurovascular openings limited to a single line, near the ventral margin of the rostrum and dorsal margin of dentary; 1, present at least at the premaxillae, maxillae and dentaries.

23 Neurovascular foramina (premaxilla), overall distance to the alveolar margin and teeth: 0, ventralmost foramina reach area next to the alveolar margin, close to teeth; 1, ventralmost foramina clearly apart from the alveolar margin, distant to the teeth.

24 Neurovascular foramina (anterior maxilla), overall distance to the alveolar margin and teeth (state (0) is putative apomorphy of derived eusuchians, but is also present in other mesoeucrocodylian clades. State (1) is a common condition in Crocodylomorpha, occurring even in basal eusuchians): 0, ventralmost foramina reach area next to the alveolar margin, close to teeth; 1, ventralmost foramina clearly apart from the alveolar margin, distant to the teeth.

25 Neurovascular foramina (mid maxilla) forming a strongly arched line at mid-rostrum, at maturity (state (1) is putative apomorphy of *Araripesuchus*): 0, absent, line of foramina follows the overall outline of the margin; 1, present, ample area of smooth margin ventral to the arched line of foramina.

26 Neurovascular foramina (posterior maxilla), distribution on the alveolar margin (state (1) is putative apomorphy of goniopholidids): 0, ventralmost foramina not high on the maxillary margin, either close or next to the alveoli; 1, ventralmost foramina high on the maxilla (up to twice the distance from other foramina), very distant to the alveoli.

27 Neurovascular foramina (dentary), distribution of neurovascular foramina relative to the alveolar margin, in non-tubular snouted forms: 0, foramina form a simple straight to ventrally-arched line; 1, foramina form a sinusoid line, following the dorsal flutings, when flutings are present.

- 28 Foramen at premaxillo-maxillary suture in lateral view: 0, absent; 1, present.
- 29 Perinarial crests, presence and morphology (state (1) is present within Goniopholididae): 0, absent, surface even or bearing a perinarial fossa; 1, present as well defined and distinct ridges, cornering the lateral to posterior borders of the naris.
- 30 Lachrymal crest anterior to orbit, presence (lachrymal refers to the lachrymal fossa, immediately anterior to the orbit, not the lachrymal bone, and state (1) is a putative apomorphy of Metriorhynchidae): 0, absent; 1, present.
- 31 ORD Naris, orientation in the sagittal plane: 0, not dorsalized, either anterior or lateral, but nasal cavity not visible in dorsal view; 1, antero-dorsal; 2, dorsal.
- 32 Naris, shape of narial opening in anterodorsally or dorsally oriented naris (not considering the internarial bar, when present): 0, subcircular, approximately as long as wide; 1, heart-shaped; 2, keyhole-shaped, subcircular anteriorly, but elongated and subquadratic posteriorly; 3, highly elliptic; 4, wider than long.
- 33 Naris, distance from the anteriormost edge of premaxillae: 0, narial opening is close to the anterior tip of the snout, regardless of the presence of contact between anterior rami of premaxillae, or the orientation of naris; 1, narial opening is distant to the anterior tip of the snout, with anterior rami of premaxillae meeting broadly anterior to naris.
- 34 Naris, presence of an anterior narial notch: 0, absent; 1, present.
- 35 Naris, presence of lateral narial notch: 0, absent; 1, present,
- 36 Naris, composition of dorsal/posterior border: 0, formed mostly by the nasals; 1, formed mostly by premaxilla, or nasal excluded from dorsal/posterior border.
- 37 Naris, presence and morphology of the internarial bar, in late ontogeny: 0, absent, external nares confluent; 1, present, not arched dorsally/anterodorsally and with nasal contribution; 2, present, evidently arched dorsally and with nasal contribution; 3, present, arched dorsally and with no nasal contribution.
- 38 Naris, projection of the internarial bar relative to the main body of premaxilla and narial opening, in late ontogeny: 0, does not project anterior to the main body of premaxilla; 1, strongly projected anteriorly from narial opening, anterior to main body of premaxilla.
- 39 Naris, presence of dorsal projection of anterior rami of premaxillae, and proportional participation in the internarial bar: 0, premaxillae does not project, or projection is incipient and poorly defined, feebly contributing to internarial bar; 1, premaxillae

project from the medial contact of anterior rami, composing at least the base of the internarial bar, or an evident bar-like projection if bar is absent.

40 Perinarial fossa, presence and extent: 0, absent or incipient; 1, present, small, shallow and mostly limited to the ventral part of the naris; 2, present, extremely well-developed and deep, widely extending lateral to the naris.

41 Postnarial fossa, presence (state (1) is putative apomorphy of derived goniopholidids, but still poorly sampled in Neosuchia): 0, absent; 1, present.

42 Intranarial fossa, presence at the lateral walls, inside narial cavity, at the vestibulum): 0, absent; 1, present.

43 Antorbital cavity: 0, absent; 1, present.

44 Antorbital cavity, presence of internal antorbital fenestra: 0, absent; 1, present, connecting with internal sinus.

45 Antorbital cavity, relation between external and internal antorbital fenestrae: 0, external and internal fenestrae subequal or not distinguishable; 1, external fenestra larger than internal fenestra, but no more than twice its area; 2, external fenestra much larger than internal fenestra, or external fenestra present and internal fenestra closed.

46 Antorbital cavity, shape: 0, subcircular to subpolygonal; 1, strongly elliptic, length at least twice its height, and obliquely orientated at approximately 30 degrees with respect to the longitudinal axis.

47 Antorbital cavity, size (area) of external antorbital fenestra, relative to the orbit: 0, small, less than 50% the orbit area, or antorbital cavity absent; 1, large, almost as large as the orbit.

48 Antorbital cavity, size (length) of internal antorbital fenestra relative to the orbit: 0, small, internal fenestra is less than 25% of the length of the orbit, or internal fenestra is absent; 1. medium, internal fenestra is approximately 25-50% of the length of the orbit; 2, large, internal fenestra is more than 50% of the length of the orbit; 3, very large, internal fenestra approximately the same size as the orbit.

49 Antorbital cavity, nasal participation in the internal fenestra: 0, absent, nasals excluded from the internal fenestra by a maxillo-lachrymal contact; 1, present, nasals broadly reach the internal fenestra (or reach deep into the fossa, if then fenestra is closed).

50 Antorbital cavity, jugal participation in the external fenestra: 0, absent, jugal excluded from the external fenestra by a maxillary-lachrymal contact; 1, present, jugal

takes part in the external fenestra.

51 Antorbital cavity, position relative to the rostrum (state (1) is putative apomorphy of *Thalattosuchia*): 0, closer to the orbit than to the alveolar margin; 1, closer to the alveolar margin than to the orbit.

52 Antorbital cavity, position relative to the orbit (state (1) is putative apomorphy of *Neosuchia*): 0, close to the orbit, with lachrymal narrow between orbit and antorbital cavity; 1, distant to the orbit, with lachrymal wide between orbit and antorbital cavity.

53 Lachrymal fossa, presence: 0, absent, bony surface completely plain or convex; 1, present as a small and shallow depression at the anteriormost corner of the orbit, but with most bony surface plain or convex; 2, present and fully developed, with most bony surface anterior to orbit concave.

54 Rostrum, orientation of external surface of premaxillae and maxillae: 0, premaxillae and maxillae face laterally; 1, rostrum with ventral region facing laterally to ventrolaterally, and dorsal region facing dorsolaterally.

55 Rostrum, morphology of the external surface of premaxilla and maxilla: 0, rostrum with a continuous surface, either convex or plain; 1, rostrum with distinct ventral and dorsal surfaces, plain and separated by a somewhat distinct anteroposterior ridge or edge.

56 Rostrum, presence of constriction at the premaxillae-maxillae suture, in dorsal view, either forming a notch, a shallow concavity or a narrow slit: 0, absent; 1, present.

57 Rostrum, type of constriction at the premaxilla-maxilla suture: 0, narrow slit; 1, wide, poorly-defined concavity, or not constricted at all; 2, well-defined notch.

58 Rostrum, morphology of notch at the premaxillae-maxillae suture: 0, notch absent, or poorly encasing the tooth (< 50% of crown perimeter), usually only part of the lingual surface of the crown; 1, notch closely encasing tooth (c. 50%-60%), at least the lingual surface of the crown; 2, notch strongly encase tooth in a scabbard-like notch (c. 70%), including most of lingual/labial surfaces of the crown.

59 Rostrum, presence of a posterodorsal process of premaxilla, at contact with maxilla and nasal: 0, absent; 1, present, extending posteriorly, wedging between maxilla and nasals.

60 Rostrum, morphology of contact at premaxillae-maxillae suture, in dorsal/lateral views: 0, simple, suture not interdigitating; 1, complex, with an anteriorly directed process from maxilla fitting the premaxilla.

- 61 Rostrum, presence of wedge-like process of maxilla to the premaxilla, at premaxilla-maxilla suture: 0, absent; 1, present, wedge-like, anteriorly directed and fitting the premaxilla.
- 62 Premaxillae anterior to naris, morphology (state (0) is putative apomorphy of Notosuchidae + Sphagesauridae; (1) of *Araripesuchus* + *Libycosuchus*): 0, anterior rami of premaxillae do not meet medially, anterior/ventral to naris, with both premaxillae in contact only through palatine rami; 1, anterior rami of premaxillae meet anterior to naris, through a very narrow band, but not projecting vertically; 2, anterior rami of premaxillae broadly meet anterior to naris, forming a vertical wall, which may be straight or slightly convex.
- 63 Premaxilla, type of contact with maxilla (state (1) is a putative apomorphy of Crocodyliformes): 0, premaxilla loosely overlies maxilla on face; 1, premaxilla and maxilla suture together along butt joint.
- 64 Premaxillae, lateral projection relative to maxillae: 0, absent, premaxillae subequal or narrower than maxillae at anterior to mid rostrum; 1, present, premaxillae clearly wider than maxillae at anterior to mid rostrum.
- 65 Premaxillae, general profile in dorsal view (state (1) is putative apomorphy of Metriorhynchidae; (2) of Sphagesauridae; (4) of derived goniopholidids): 0, round to triangle-shaped, premaxillae smoothly fitting the rostrum; 1, lanceolate, premaxillae smoothly fitting the rostrum; 2, subquadratic, premaxillae smoothly fitting the rostrum; 3, paddle-shaped, expanded laterally; 4, axe-shaped, expanded laterally.
- 66 Premaxillae, presence of a sub-elliptic naso-oral fossa (=incisive foramen, fossa premaxillaris) at medial contact of ventral rami: 0, absent, premaxillae fully in contact medially along the palate; 1, present as a discrete fossa or foramen, less than half the greatest width of premaxillae; 2, large, more than half the greatest width of premaxillae.
- 67 Premaxillae, position of the naso-oral fossa in the palatine rami, relative to the alveolar margin: 0, completely situated far from premaxillary tooth row, at the level of the second or third alveolus, or posterior; 1, abuts premaxillary tooth row; 2, projects between first premaxillary teeth.
68. Premaxillae, contribution of maxillae to the naso-oral fossa at medial contact of ventral rami: 0, absent, premaxillae contact medially, posterior to the naso-oral foramen; 1, present, maxillae take part at least on the posterior border of the foramen.
- 69 Premaxillae, shape of naso-oral fossa: 0, oblong, leaf-like ;1, teardrop-shaped to

slit-like; 2, complex, triangular, arrow-headed or fleur-de-lys; 3, diamond-shaped; 4, elliptic and elongated; 5, subcircular.

70. Premaxillae, shape of naso-oral fenestra: 0, both anterior and posterior ends tapering to an acute end; 1, tapering anteriorly only, with round or complex distal end 2. anterior and posterior ends rounded, not tapering.

71 Premaxilla, presence of foramen in the perinarial depression: 0, absent; 1, present.

72 ORD Nasals, length: 0, poorly elongated, anteriorly limited by the maxillae only; 1, elongated, contacting the maxillae and premaxillae, but not reaching the naris; 2, evidently elongated, taking part in the naris.

73 ORD Nasals, morphology in dorsal view (state (2) is present in *Simosuchus*): 0, triangular, lateral margins strongly confluent anteriorly; 1, rectangular or subrectangular, lateral margins mostly parallel or lateral margins poorly confluent anteriorly; 2, triangular, lateral margins diverging anteriorly.

74 Nasals, general structure: 0, flattened; 1, dome-like.

75 Nasals, dorsal surface close to the posterior end (state (2) is shared by *Hsisosuchus* and *Calsoyasuchus*): 0, continuous, lacking a medial groove or trench; 1, slightly concave, forming a shallow and poorly defined depression, anteroposteriorly oriented; 2, deeply trenched, with a steep longitudinal depression at midline.

76 Nasals, morphology of lateral border, posterior to external nares, in dorsal view: 0, laterally concave; 1, straight or convex.

77 Nasals, fusion at maturity (state (1) is putative apomorphy of Dyrosauridae, but is also present in Mahajangasuchidae): 0, absent, nasals unfused; 1, present, nasals at least partially fused.

78 Maxilla, participation in the orbit: 0, absent, excluded from the orbit by lachrymal-jugal contact; 1, present, maxilla takes part in the orbit.

79 Maxilla, morphology of ventral margin: 0, not distinct from the remaining surface of maxilla, slightly convex; 1, maxillae with a distinct ventral surface alongside the alveolar margin, smooth and mostly plane.

80 Maxilla, projection of ventral margin in lateral view: 0, ventral maxillary margin is straight; 1, ventral maxillary margin festooned, being convex and concave at locations, assuming a sinusoidal profile; 2, ventral maxillary margin is overall convex, from contact with premaxilla to contact with jugal.

81 Maxilla, projection of ventral margin in dorsal view: 0, maxilla does not project

laterally at all, and is narrow throughout; 1, maxilla expands laterally in locations (coincident with festooning waves, when present), with maxilla sinusoidal in dorsal view; 2, maxilla is wide throughout, with no fluting prominent in dorsal view.

82 Maxilla, number of waves, when festooning present: 0, a single clearly identifiable wave is present, at the anterior section of the maxilla, with ventral maxillary margin poorly sinusoidal; 1, two major waves clearly identifiable, separated by an evident concave area, with ventral maxillary margin strongly sinusoidal and a corresponding dorsally directed wave on the dorsal edge of the dentary.

83 Maxilla, lateral exposure of occlusal pit for the 11th dentary tooth, at maturity: 0, not exposed laterally, dentitions may overbite or interlock, but lateral wall of occlusal pit is closed; 1, laterally open, with occlusal surface exposed as a shallow notch.

84 Maxilla, position of largest alveolus: 0, largest alveolus is the third or anterior; 1, largest alveolus is the fourth or posterior.

85 Maxilla, presence of multiple caecal recesses at the surface within narial canal: 0, absent, surface imperforate; 1, present.

86 Maxilla, presence of lateral fossa/fossae next to the alveolar margin: 0, absent, maxillary bony surface convex or flat; 1, present.

87 Maxilla, presence of multiple fossae along most of its lateral face: 0, absent; 1, present.

88 Maxilla, presence of a shallow fossa at maxilla-jugal contact: 0, absent; 1, present.

89 Maxilla, presence of a maxillary depression, next to the maxilla-jugal contact: 0, absent; 1, present.

90 Maxilla, morphology of anterior border of maxillary depressions: 0, shallow, anterior edge of depression usually poorly defined, or maxillary depression is absent; 1, deep, anterior border always well-defined relative to dermal surface of maxilla.

91 Maxilla, extent of contact with nasal: 0, small sutural contact; 1, extensive contact.

92 . Maxilla, presence of an evident posteromedial process between lachrymal and nasal: 0, absent, maxillary posteromedial process no more than feeble; 1, present, maxilla sends an evident posteromedial process within lachrymal.

93 Maxilla, presence of broad contact with prefrontal: 0, maxilla and prefrontal do not contact at all, or with a feeble contact; 1, present and evident, maxilla extensively contacts prefrontal.

94 Lachrymal, relative proportions at maturity: 0, subquadratic, or shorter than wide; 1,

longer than wide.

95 Lachrymal, proportional length (AP/ML (= anteroposterior/medial-lateral) should be taken anterior to orbit (i.e., does not consider posteromedial section, dorsal to the orbit): 0, short to poorly elongated, AP/ML index closer to 2, or smaller; 1, proportionally long, AP/ML index closer to 3, or higher.

96 Lachrymal, exposure in dorsal aspect: 0, absent, lachrymal is vertically oriented and only exposed in lateral aspect; 1, present, either vertical or horizontal.

97 Lachrymal, presence of a posteroventral process: 0, absent, lachrymal does not progress below orbit, or barely projects through a broad and short wedge; 1, present, progress below orbit as an acute process; 2, present, progress below orbit as a truncated process.

98 Lachrymal, extent of contact with nasal: 0, nasal and lachrymal do not contact at all, or with a feeble contact; 1, present and evident, lachrymal extensively contacts nasal.

99 Prefrontal-lachrymal crest dorsal to orbit, presence and morphology: 0, absent, or incipient and laterally directed, as a simple edge; 1, present and evident, projecting dorsally and short, only slightly progressing anterior to the orbit; 2, present and evident, projecting dorsally and long, broadly progressing on the rostrum as very prominent divergent crests.

100 Transverse rostral crest, presence: 0, absent; 1, present.

101 Transverse frontal crest anteromedial to the orbits, presence: 0, absent, dorsal skull surface plain or bearing a sagittal crest; 1, present, crescent-shaped (facing anteriorly), and transecting the skull from orbit to orbit.

102 Frontal sagittal crest, presence: 0, absent; 1, present.

103 Parietal sagittal crest, presence (must not be mistaken for a narrow parietal between the supratemporal fossae): 0, absent; 1, present.

104 Crests margining the border of the supratemporal fossae, dorsally projected: 0, absent, or present only in part of the perimeter; 1, present around the full perimeter.

105 Supratemporal fenestra, presence of a shallow fossa at its anteromedial corner: 0, absent, anteromedial corner of supratemporal fenestra smooth; 1, present.

106 Supratemporal fenestra, size proportional to the orbit at maturity: Size refers to fenestra only, not fossa; based on major axis of the fenestra and antero- posterior axis of orbit: 0, clearly smaller than the orbit; 1, fenestra subequal to the orbit; 2, supratemporal fenestra larger than orbit.

107 Supratemporal fossa, size proportional to the orbit at maturity: 0, clearly smaller than the orbit, or fossa closed by skull table elements; 1, fossa subequal to the orbit; 2, supratemporal fossa larger than orbit.

108 Supratemporal fossa, relation with surrounding dermal bones of skull roof: 0, dermal bones of skull roof do not overhang rim at maturity, or slightly overhang rim at part of the external fenestra; 1, dermal bones of skull roof consistently overhang rim of supratemporal fenestra around the entire edge, near maturity; 2, dermal bones of skull roof overhang rim of supratemporal fenestra near maturity, closing or nearly closing the fenestra during ontogeny.

109 Supratemporal fossa, presence of a main axis: 0, main axis indistinct, or poorly distinct; 1, main axis evident and much longer than secondary axis.

110 Supratemporal fossae, orientation of the main axis at late ontogeny: 0, both axis diverge anteriorly; 1, both axis parallel; 2, both axis converge anteriorly.

111 Supratemporal fossae, overall shape: 0, elliptic; 1, square-shaped to subrectangular; 2, triangle-shaped, axis converging medially; 3, circular; 4, triangle-shaped, axis converging anteromedially.

112 Supratemporal fossae, angle between posterolateral process of the frontal and the intertemporal bar: 0, angle of c. 90 degrees, with anteromedial corner of the supratemporal fossae mostly rounded; 1, angle of c. 50 degrees, with anteromedial corner of the supratemporal fossae acute, wedge-like.

113 Supratemporal fossae, shape of medial borders: 0, convex, so the intertemporal bar has a double-concave profile; 1, borders straight, parallel; 2, straight, either convergent or divergent.

114 Supratemporal fossa, presence of foramina on the medial parietal wall: 0, absent, wall imperforate; 1, present, wall bearing foramina.

115 Skull roof at orbits, general morphology of periorbital elements (frontal, postorbital, palpebral): 0, overall level with each other and with the remaining skull table; 1, lateral processes of frontal arched laterodorsally, with palpebral and postorbital curved dorsally.

116 Skull roof, alignment of parietal, frontal and nasals in a steep angle: 0, absent; 1, present.

117 Supratemporal skull roof (posterior to orbit), general proportions. For the purposes of scoring this character, skull roof limits are set as follows: postorbitals (anterior,

lateral); parietal/supraoccipital (posterior). Always considered dorsal margin only, not anterior/lateral/posterior: 0, about as long as wide; 1, clearly longer than wide (at least 1.5x).

118 Supratemporal skull roof, dorsal surface: 0, surface complex; 1, flat skull table present, formed by flattened and levelled surfaces of frontal, postorbital, squamosal and parietal.

119 Supratemporal skull roof, dorsal curvature and elongation of squamosal prongs, at maturity: 0, with broad curvature and short squamosal prongs; 1, with nearly horizontal sides and significant squamosal prongs.

120 Supratemporal skull roof, morphology of frontoparietal suture: 0, concave anteriorly, `V` or `U-shaped`; 1, transverse to the skull, either straight or complex; 2, concave posteriorly, `V` or `U-shaped`.

121 Supratemporal skull roof, position of frontoparietal suture at medial line of skull, relative to the orbit: 0, frontoparietal suture is evidently posterior to orbits; 1, frontoparietal suture is at a very anterior position, almost medial to posterior most border of the orbits, always as a straight line transecting most of the skull roof, and frontal-postorbital contact is extremely reduced.

122 Supratemporal skull roof, position of frontoparietal suture at medial line of skull, relative to the postorbital bars: 0, distal margin of frontal is medial to the (dorsal end of) postorbital bars, or slightly anterior; 1, distal margin of frontal is posterior to the postorbital bars, but not reaching the mid skull roof; 2, distal margin of frontal is posterior to the postorbital bars, frankly reaching into the intertemporal bar and mid skull roof.

123 Supratemporal skull roof, morphology of the postorbital (=anterolateral) corner of skull roof, in dorsal view: 0, distinct anterior (or anterolateral) and lateral edges, separated by a round to acute anterolateral corner, or a projecting process; 1, anterior and lateral edges, separated by a distinct anterolaterally facing edge; 2, anterior to lateral edges continuous, curved, without an anterolaterally projecting edge, corner or process.

124 Supratemporal skull roof (parietal and squamosals), posterior extension of its posterior margin over the occipital surface: 0, absent or feeble; 1, present and evident,

125 Prefrontal, lateral projection: 0, small to medium, not overhanging the orbit; 1, extremely enlarged, overhanging the orbit.

126 Prefrontals, extension of posterior end: 0, short, limited to the anteromedial border of the orbit, with frontal reaching the medial to posteromedial border of the orbit; 1, long, composing the anteromedial and medial borders of the orbit, with frontal reaching orbit medially and posteromedially; 2, very long, reaching the posteromedial borders of the orbit, with frontal reaching orbit posteromedially only.

127 Prefrontal pillar, presence of contact between prefrontal descending process and palatine ascending process: 0, absent; 1, present.

128 Prefrontal pillar, structure at contact between prefrontal and palatine processes: 0, small contact area; 1, robust contact suture.

129 Prefrontal pillar, morphology of descending process of prefrontal: 0, descending process transversely expanded, with the lateromedial lamina well developed and anteroposterior lamina small or absent; 1, descending process longitudinally expanded, with the anteroposterior lamina well developed and lateromedial lamina small or absent.

130 Prefrontal pillar, morphology of ascending process of palatine, when pillar complete: 0, ascending process transversely expanded; 1, ascending process columnar, or anteroposteriorly elongated.

131 Prefrontal pillar, morphology of medial process: 0, expanded dorsoventrally; 1, expanded anteroposteriorly.

132 Frontals, fusion of main body at maturity: 0, not fused, and a medial suture fully persists in late ontogeny, with frontals paired; 1, frontals are completely fused into a single element, or at least the main body is completely fused.

133 Frontal, width relative to the total skull width, at maturity: 0, narrow, c. 1/5th of skull width, or narrower; 1, wide, c. 1/3rd of skull width, or more.

134 Frontal, proportional width of main body (between orbits) relative to width of the supratemporal skull roof, at maturity: 0, narrow, usually 20-30% of the width of the skull roof; 1, wide, usually 40-50% of the width of skull roof.

135 Frontal, general geometry: 0, essentially flat, lateral margins flush with skull surface; 1, concave, medial borders of the orbit upturned, forming ridged orbital margins.

136 Frontal, morphology of anterior process: 0, wide throughout; 1, wide posteriorly and tapering anteriorly, wedge-like to triangle-shaped; 2, narrow throughout, as a distinct projection.

137 Frontal, morphology of anteriormost border of anterior process: 0, truncated; 1,

wedge-like, either broad or acute.

138 Frontal, medial surface: 0, frontal is continuous, from anterior margin to posterior end; 1, frontal is divided into two plain surfaces, being the anterior at a slightly more ventral level than the posterior.

139 Frontal, presence of a tuberos projection on the medial line, between the orbits: 0, absent; 1. present, well defined.

140 Frontal, extension of anterior margin at late ontogeny: 0, short, does not progress anterior to the orbits; 1, long, progress anterior to the orbits.

141 Frontal, participation in the primary medial border of orbit, at dorsal skull roof: 0, extensive participation in the orbit; 1, excluded from the orbit by prefrontal-postorbital contact, or participation is very restricted.

142 Frontal (anterior process), position relative to tip of prefrontal: 0, ends evidently posterior to tip of prefrontals; 1, reach or barely surpass the anteriormost tip of prefrontals.

143 Frontal, presence of wedge-like processes projecting posterolaterally from the distal margin: 0, absent; 1, present, wedging between postorbital and parietal, and frankly projecting towards or inside the supratemporal fossae.

144 Parietals, fusion in adults: 0, absent, parietals are paired elements; 1, present, parietal is a single element.

145 ORD Parietal, morphology of the medial surface at maturity: 0, broad throughout, with a wide sculpted region separating fossae; 1, narrow, but with a flattened surface separating fossae, which may be sculpted or not; 2, narrow, forming a sagittal crest.

146 Parietal, dorsal projection of the medial surface, relative to the skull roof: 0, does not project dorsally; 1, projects dorsally.

147 Postparietal (=dermosupraoccipital), presence as a distinct element: 0, absent or fused with parietal; 1, present.

148 Upper (=postorbital-squamosal) temporal bars, orientation in dorsal view: 0, temporal bars mostly parallel, giving the skull roof a rectangular outline in dorsal view; 1, temporal bars oblique and anteriorly convergent, giving the skull roof a trapezoidal outline in dorsal view.

149 Upper temporal bars, outline of lateral margins in dorsal view: 0, margin mostly straight or slightly convex; 1, margin strongly sinusoidal.

150 Upper temporal bar, position relative to intertemporal bar: 0, upper temporal bar is

leveled with intertemporal bar; 1, upper temporal bar is ventrally displaced relative to the intertemporal bar, coincident with the horizontal plane, and rotated, with dorsal surface exposed laterally and ventral surface medially; 2, upper temporal bar is diagonally displaced relative to the intertemporal bar (posterior end more ventrally displaced than anterior end), but not rotated.

151 Upper temporal bar, relative participation of postorbital (state (1) is putative apomorphy of Thalattosuchia): 0, small, postorbital represents c. 30% of the bar; 1, extensive, postorbital represents c. 50% (or more) of the bar.

152 ORD Postorbital, presence and elongation of a robust anterolateral process projecting from its dorsal surface and postorbital bar: 0, absent or poorly developed; 1, present and short, but evident; 2, present and very long, reaching the lateral corner of the orbit.

153 Postorbital, relation of anterolateral process and its lamina (when present) to the orbit and anterior jugal ramus; 0, orbit not shielded laterally by a postorbital process and its lamina; 1, postorbital process almost reaching or reaching the dorsal edge of the anterior jugal ramus, with process and lamina shielding the posterolateral-lateral sections of the orbit.

154 Squamosals, presence of horn-like flanges projecting dorsolaterally from the lateral edge: 0, absent, lateral surface of squamosal level with frontal or at a lower plane; 1, absent, but edges buttressed and evidently enlarged; 2, present.

155 Squamosal, presence of an extra lobe, unsculpted, at the posterodorsal corner (state (1) is putative apomorphy of Atoposauridae): 0, absent, posterodorsal border of squamosal squared off; 1, present, unsculpted lobe projecting posterolaterally.

156 Squamosal, orientation of the posterior face at the occipital surface, at maturity: 0, mostly vertical, facing posteriorly; 1, inclined, facing posterodorsally.

157 ORD Orbits, orientation in dorsal view (not considering palpebrals): 0, orbits fully lateral; 1, orbits face dorsolaterally; 2, orbits with a strong dorsal component.

158 Orbits, orientation in lateral view (must not consider palpebrals to determine orientation): 0, orbits are lateral-dorsal, with a small anterior component, frontal horizontal or poorly inclined; 1, orbits have a strong anterior component, frontal steep and facing anterodorsally.

159 Orbits, presence of sclerotic ring: 0, absent; 1, present.

160 Orbit, composition of anterior (lachrymal) border: 0, lachrymal, but with extensive

participation of jugal; 1, lachrymal only, neither prefrontal nor jugal reach the lachrymal area; 2, lachrymal, but with extensive participation of prefrontal.

161 Orbit, morphology of medial (primary) border: 0, medial and distal borders at a broad angle (>90 degrees), primary orbit is circular to polygonal; 1, medial and distal borders at an acute angle (<90 degrees) and forming a posteromedial corner, with primary orbit triangular.

162 Laterotemporal fenestra, size proportional to orbit in late ontogeny: 0, small to absent, no more than 20% the area of the orbit; 1, large, area is usually no less than 50% of the area of the orbit.

163 Laterotemporal fenestra, proportions: 0, longer than high or subequal, usually half the height of the orbit; 1, higher than long, and usually as high as the orbit.

164 Laterotemporal fenestra, shape: 0, elliptic to subpolygonal; 1, clearly triangular.

165. Laterotemporal fenestra, orientation: 0, faces laterally; 1, faces laterodorsally.

166 Laterotemporal fenestra, position of jugal-quadratojugal suture relative to the posteroventral corner: 0, jugal-quadratojugal suture lies at ventral edge of the fenestra, with quadratojugal taking part in the lower temporal bar; 1, jugal-quadratojugal suture lies at posterior angle of the fenestra, with quadratojugal barely reaching the distal end of the lower temporal bar; 2, jugal-quadratojugal suture at posterodorsal edge of the fenestra, with quadratojugal excluded from the lower temporal bar.

167 Laterotemporal fenestra (spina quadratojugalis), presence of a quadratojugal spine in the distal border of the fenestra: 0, absent; 1, present.

168 Laterotemporal fenestra (spina quadratojugalis), position of spine on the quadratojugal border, when present: 0, low. near distal corner of infratemporal fenestra; 1, high, between distal and upper corners of infratemporal fenestra.

169 Laterotemporal fenestra (spina quadratojugalis), orientation of spine, when present: 0, anteriorly-anterodorsally oriented; 1, dorsally-anterodorsally oriented.

170 Laterotemporal fenestra (spina quadratojugalis), elongation of quadratojugal spine, when present and fully preserved: 0, short; 1, long.

171 Jugal, participation in the ventral border of the orbit: 0, reduced participation, or excluded from the orbit by a lachrymal-postorbital contact, ventral to the orbit; 1, jugal forms large part or all of the ventral margin of the orbit.

172 Jugal, cross-section of anterior ramus, beneath orbit: 0, subcircular to subpolygonal, ramus rod-like; 1, elliptic to laminar, lateral surface of ramus evidently flattened.

- 173 Jugal, cross-section of posterior ramus, beneath laterotemporal fenestra (state (1) is putative apomorphy of Sphagesauridae): 0, subcircular to subpolygonal, ramus rod-like; 1, elliptic, lateral surface of ramus evidently flattened, blade-like.
- 174 Jugal, height of anterior ramus relative to the height of posterior ramus: 0, anterior ramus approximately as broad as posterior ramus; 1, anterior ramus approximately twice as broad as posterior ramus.
- 175 Jugal (anterior ramus), height below orbit at maturity: 0, low, jugal only forms a narrow band of bone; 1, high, broadly separates orbit from ventral plane of cranium.
- 176 Jugal, alignment of anterior and posterior processes (state (1) is putative apomorphy of *Kaprosuchus* + *Mahajangasuchus*): 0, inline dorsoventrally; 1, anterior and posterior processes at a sharp angle to one another, with both processes sloping ventrally to form a strongly arched jugal.
- 177 Jugal, presence of fossa at ventrolateral surface near ectopterygoid contact (the jugal ventral fossa is a putative apomorphy of *Mahajangasuchus* and *Kaprosuchus*): 0, absent, jugal-ectopterygoid contact is inset from lateral surface of jugal, or at ventral surface of jugal; 1, present as a smooth but evident depression, below orbit.
- 178 Jugal (anterior ramus), projection of ventral margin at maturity: 0, absent, ventral margin of anterior jugal ramus level with the ventral margin of posterior ramus; 1, present and poor, jugal gradually flares ventrally at a low angle, and ventral projection is modest; 2, present and deep, jugal flares anteriorly at a steep angle, and ventral projection is conspicuous.
- 179 Jugal (anterior ramus), presence of a ridge at dorsal edge, and relation with postorbital bar: 0, ridge absent, postorbital bar becomes flush with dorsal surface of jugal; 1, ridge present, separating postorbital bar from lateral surface of jugal, but neither conspicuous, nor projecting dorsally; 2, ridge present and conspicuous, projecting dorsally and separating postorbital bar from lateral surface of jugal.
- 180 Jugal (anterior ramus), presence and number of neurovascular foramina: 0, single enlarged foramen anteriorly directed; 1, absent; 2, multiple (2-5) small foramina, usually ventrally oriented.
- 181 Jugal (anterior ramus), participation in the rostrum: 0, ramus short, does not progress anterior to the anteriormost border of the orbit, and does not take part in the rostrum; 1, at least moderately elongated, clearly surpassing the anteriormost border of the orbit.

182 Jugal (anterior ramus), length: 0, short to moderately elongated, but does not reach beneath the antorbital fenestra, poorly contributing to rostrum; 1, long, progress below antorbital fenestra and extensively takes part in the rostrum.

183 Jugal, morphology of anterior end at maturity: 0, rounded or wedging dorsally/medially; 1, truncated; 2, wedging ventrally/distally.

184 Jugal fit to maxilla: 0, ventral border of jugal continuous with ventral border of maxilla, with outline in lateral view straight or smoothly curved; 1, ventral borders of jugal and maxilla not leveled and with a poor fit, as the maxilla is at a lower level relative to the jugal.

185 Jugal, presence of a blade-like prong, laterally projecting from midbody: 0, absent; 1, present.

186 Palpebrals, presence and number: 0, absent, or (anterior) palpebral is deeply fused with prefrontal; 1, one large (anterior) palpebral present; 2, two large palpebrals (anterior and posterior) present.

187 Palpebrals, overall structure and size: 0, palpebrals are small and gracile; 1, palpebrals are robust and large; 2, palpebrals are robust, but small.

188 Palpebral (anterior), shape: 0, elongated, sickle-like; 1, elongated, delta-like; 2, rectangular.

189 Palpebral (anterior), attachment to the skull: 0, reduced contact, palpebral sutured to skull only closer to its anterior edge, or not sutured at all; 1, long contact, palpebrals well sutured to the skull by at least anterior and medial edges; 2, extensive contact, palpebral fully sutured to the skull by anterior, medial and posterior edges (including lateral end of posterior edge).

190 Palpebrals, contact between anterior and posterior elements, when both are present: 0, no sutural contact; 1, small, posterior palpebral only contacts the anterior palpebral by the lateralmost end of posterior edge; 2, extensive, posterior palpebral contacts the anterior palpebral by most or all the posterior edge.

191 Postorbital bar, general structure at maturity: 0, slender, gracile; 1, massive and robust.

192 Postorbital bar, cross-section: 0, subcircular, bar cylindrical; 1, elliptical, bar transversely flattened.

193 Postorbital bar, relation to dermis: 0, subdermic, distinct, originating mesially from the jugal ramus; 1, dermic, gradually narrowing.

- 194 Postorbital bar, inclination in lateral view: 0, vertical; 1, inclined, with dorsal end distal to the ventral end.
- 195 Postorbital bar, inclination in anterior view: 0, vertical; 1, inclined, with dorsal end medial to the ventral end.
- 196 Postorbital bar, presence and number of projections: 0, no projection; 1, single projection, generally not prominent; 2, two prominent projections.
- 197 Postorbital bar, contribution from ectopterygoid: 0, absent, bar does not receive contribution from ectopterygoid; 1, present, bar receives contribution from ectopterygoid.
- 198 Postorbital bar, presence of ectopterygoid-postorbital contact: 0, absent; 1, present.
- 199 Postorbital bar, composition of lateral surface (state (1) is putative apomorphy of Thalattosuchia): 0, lateral surface formed by postorbital and jugal; 1, lateral surface formed by postorbital only, with jugal only exposed at the medial face of the bar.
- 200 Postorbital bar, morphology of postorbital-jugal contact: 0, postorbital anterior to jugal; 1, postorbital medial to jugal, or slightly posterior to; 2, postorbital lateral to jugal.
- 201 Postorbital bar (postorbital), relation with dorsal part of the postorbital: 0, bar broadens dorsally, continuous with dorsal part of postorbital; 1, dorsal part of the postorbital bar constricted, with clear limits from the main body of the postorbital.
- 202 Postorbital bar (postorbital), presence of a vascular opening at the lateral edge of the bar, close to the dorsal surface of the postorbital: 0, absent; 1, present.
- 203 Quadratojugal, morphology of dorsal process at posterodorsal angle of laterotemporal fenestra: 0, narrow relative to main body, contacting only a small part of postorbital; 1, dorsal end expanded as a broad sheet, extensively contacting the postorbital.
- 204 Quadratojugal, extension of anterodorsal ramus: 0, quadratojugal reaches dorsal angle of infratemporal fenestra; 1, quadratojugal does not extend to dorsal angle of infratemporal fenestra, and quadrate participates in laterotemporal fenestra.
- 205 Maxillo-palatine fenestrae (= the primary choanae of goniopholidids): 0, absent; 1, present, subcircular; 2, present, anteroposteriorly elongated.
- 206 ORD Suborbital fenestrae, presence and size: 0, absent; 1, present, much smaller than orbits; 2, present, subequal or larger than orbits.
- 207 Suborbital fenestrae, shape of anterior border (state (1) is present in

Thalattosuchia): 0, rounded, smooth; 1, in sharp angle, forming a notch, fissure-like.

208 ORD Anterochoanal fossae: 0, absent, bony surface flat; 1, present as shallow fossa; 2, present as deep fossae,

209 Parachoanal fossae, presence: 0, absent; 1, present.

210 Palate, palatine rami of premaxillae: 0, absent; 1, present, in contact at the medial line and forming the anteriormost section of the secondary bony palate.

211 Palate, presence of contact between ventral rami of the maxillae: 0, absent, ventral rami are poorly developed and do not meet at medial line, with secondary palate not formed; 1, present, ventral rami meet each other at medial line, or meet vomer, and secondary bony palate formed.

212 ORD Palate, presence of palatal shelves of palatines, and their relation with the narial passage: 0, palatal shelves of palatine absent, narial passage only bounded dorsally, by the pterygoid; 1, narial passage at least partially bounded by palatal shelves of the palatine, laterally, creating the choanal groove; 2, narial passage at least mostly bounded by palatal shelves of the palatine, laterally and ventrally, forming the nasopharyngeal duct.

213 Palate, relation between palatal shelves of the palatine : 0, palatal shelves of palatine absent or not fully in contact at medial line; 1, palatal shelves of palatine fully developed, bounding the narial passage ventrally and in contact at medial line, creating fully formed nasopharyngeal duct, with secondary palate complete.

214 Palate, participation of maxilla in the suborbital fenestra: 0, takes part in the suborbital fenestra; 1, fully excluded from the suborbital fenestra by a palatine-ectopterygoid contact, anterior to suborbital fenestra.

215 Palate, composition of anteromedial border of suborbital fenestrae: 0, entirely composed of palatines, which expand laterally and reach the anteriormost border of the fenestra; 1, palatal ramus of maxilla takes part in the anteromedial border of the fenestra.

216 Palate, presence of maxillary process to palatine, next to the anterior border of antorbital fenestra: 0, absent; 1, present, palatines composing a three-radiated blade anteriorly.

217 Palate, direction of the sutural contact of premaxilla-maxilla, at the palate: 0, curved posteriorly, premaxillary palate projects over maxillary palate; 1, straight, poorly arched or complex; 2, curved anteriorly, maxillary palate projects over premaxillary

palate.

218 Palate, presence of maxilla-pterygoid contact medial to suborbital fenestra, in ventral view (state (1) is putative autapomorphy of *Kaprosuchus*): 0, absent, palatines take part in the suborbital fenestra; 1, present, excluding palatines from suborbital fenestra.

219 Palate, relative position of the distalmost suture of palatine, at the border suborbital fenestra: 0, suture is at distal end of suborbital fenestra, or lateral to it, but very close; 1, suture is located medial to posterior angle of suborbital fenestra, and far from it.

220 Palate canals, presence: 0, absent; 1, present.

221 Vomer, ventral exposure on palate: 0, not exposed on palate, hidden by palatal branch of maxillae; 1, exposed on palate between premaxillae and maxillae.

222 Palatines, progression of the palatine process through the palate (if palatines meet in the midline of palate): 0, short, anterior border medial to the anteriormost margin of the suborbital fenestrae, or barely anterior to them; 1, long, anterior border of palatines clearly surpassing the anteriormost border of the suborbital fenestrae.

223 Palatines, proportional length of anterior process, projecting at maxillary palate: 0, anterior process of palatines short, with length subequal to width; 1, evidently longer than wide.

224 Palatines, overall morphology of palatine process: 0, wide, fan-like; 1, wide posteriorly and tapering anteriorly, wedging between palatine rami of maxilla; 2, lateral margins parallel or flaring anteriorly.

225 Palatines, morphology of anterior face of palatine process near medial line: 0, rounded or pointed anteriorly, either U-shaped or V-shaped; 1, truncated, maxillo-palatine suture transversally oriented relative to the skull; 2, invaginated by at least a broad and short maxillary wedge, maxillo-palatine suture M-shaped.

226 Palatines, presence of a long medial process of the maxilla, posteriorly directed and dividing the anterior face of palatine process: 0, absent, anterior face of palatine process U-shaped, V-shaped or broad M-shaped; 1, present, anterior face of palatine process clearly bifid, narrow M-shaped.

227 Palatines, heart-shaped anterior face of palatine process: 0, absent, maxillo-palatine suture U-shaped, V-shaped, or M-shaped; 1, present, anterior palatine process invaginated close to the medial line by maxilla, with maxillo-palatine suture assuming a heart-shaped profile.

228 Palatine bar, presence: 0, absent; 1, present, gracile; 2, present as distinctively robust bars.

229 Nasopharyngeal duct, width at its narrowest section relative to the skull width: 0, narrow in proportion to skull width, no more than 25%; 1, wide in proportion to skull width, no less than 30%.

230 . Nasopharyngeal duct, presence of a deep sulcation on the ventral surface, where the medial contact of palatine occurs: 0, absent; 1, present,

231 . Nasopharyngeal duct, cross-section: 0, width is subequal to height, or greater; 1, evidently higher than wide.

232 . Anterochoanal sagittal crest, presence: 0, absent, bony surface is smooth to concave; 1, present, pterygoid surface at medial line projects ventrally anterior to the internal naris, forming a discrete and short acute crest; 2, present, bony surface of palatines projects ventrally at medial line, anterior to the internal naris, forming a discrete and short acute crest.

233 . Choanae, size (area) relative to skull: 0, very small; 1, ample,

234 . Choanae and perichoanal fossa, width relative to the width of the nasopharyngeal duct: 0, narrow, width evidently smaller than the narrowest section of the nasopharyngeal duct; 1, subequal, wider than the narrowest section of the nasopharyngeal duct, but not wider than the widest section; 2, proportionally wide, clearly wider than the widest section of the nasopharyngeal duct,

235 . ORD Choanae, position of anterior border of the internal naris relative to nasopharyngeal duct and suborbital fenestra: 0, anterior border situated anterior to the suborbital fenestra; 1, anterior border situated at mid-nasopharyngeal duct; 2, anterior border close to the posterior end of the nasopharyngeal duct, or posterior to it.

236 Choanae, position of anterior border of the internal naris relative to pterygoid surface at medial line: 0, close to anterior end of pterygoid, or anterior to it; 1, at mid/posterior pterygoid surface.

237 Choanae, position of posterior border relative to pterygoid ventral surface: 0, posterior border situated near the anterior edge of the pterygoids, or anterior to pterygoids; 1, posterior border situated approximately at mid-ptyergoid; 2, posterior border at posterior pterygoid surface.

238 . Choanae, shape of anterior border in palatal view: 0, rounded, straight, or invaginated; 1, choanal opening wedges between bony lamina as an acute V-shape,

internal nares assuming a lanceolate profile.

239 . Choanae, shape in palatal view: 0, subcircular, elliptic or lanceolated; 1, triangle-like; 2, rectangular; 3. V-shaped or reversed triangle; 4. butterfly-shaped.

240 Choanae, general morphology: 0, choanae wider than long; 1, length and width subequal; 2, choanae longer than wide.

241 Choanae, orientation: 0, ventrally oriented; 1, posteroventrally oriented.

242 Choanae, participation of pterygoid in the choanal border: 0, pterygoid only bounds the posterior border of the choanae; 1, pterygoid forms at least the posterior and lateral choanal borders; 2, anterolateral rami of pterygoid embrace most of the choanae, but do not meet medially, at the anterior choanal border (either by the presence of palatine or ventral exposure and expansion of interchoanal septum); 3, anterolateral rami of pterygoid completely embrace the choanae, meeting medially at its anterior border (eusuchian choanae).

243 Choanae, presence of extensive contact between converging perichoanal pterygoid laminae, anterior to choanae: 0, absent, anterior pterygoid laminae narrow anterior to choanae, or not in contact at all; 1, present, anterior pterygoid laminae widely meet anterior to choanae.

244 Interchoanal septum, exposure at internal naris: 0, nasopharyngeal septum absent or receded, not dividing the internal narial opening; 1, present, nasopharyngeal septum of pterygoid fully dividing the choanal opening, or evidently projecting from ventral surface of pterygoid, if choanal groove is not enclosed by palatines.

245 Interchoanal (nasopharyngeal) septum, exposure at the ventral surface of the nasopharyngeal duct, anterior to the choanae: 0, absent, or nasopharyngeal septum receded and not exposed ventrally at all; 1, present, interchoanal septum projects anteriorly between palatines, and expands ventrally, creating a wide surface at the anterior choanal border.

246 Interchoanal septum, presence of an acute groove on its ventral surface: 0, absent, ventral surface smooth to slightly depressed; 1, present and evident, well marked.

247 Interchoanal septum, shape: 0, narrow vertical bony sheet; 1, narrow vertical bony sheet, expanded ventrally, T-shaped in cross-section; 2, narrow vertical bony sheet, inflated ventrally and forming a robust bar, semicircular in cross-section.

248 Interchoanal septum, morphology of ventralmost surface, as septum approaches choanal opening: 0, parallel sided; 1, tapers anteriorly; 2, expanding both anteriorly and

posteriorly, hourglass-shaped; 3, tapers both anteriorly and posteriorly.

249 Perichoanal ridge, presence at anterolateral edge of internal naris, late in ontogeny: 0, absent, all anterolateral edge of choanae flush with remaining bony surface; 1, present as a well defined wall, bounding at least the anterolateral border of the internal naris.

250 Perichoanal ridge, presence at posterolateral edge of choana, late in ontogeny: 0, absent, all posterolateral edge of choanae flush with remaining bony surface; 1, present as a well defined wall, bounding at least the posterolateral border of the internal naris.

251 Perichoanal ridge, presence of a continuous wall around the internal naris, early in ontogeny: 0, absent or incomplete, at least part of the choanal margin flush with bony surface; 1, present, continuous.

252 Ectopterygoid, relation with maxilla and tooth row: 0, ectopterygoid abuts maxillary tooth row at medial wall of distal alveoli; 1, ectopterygoid broadly separated from last teeth in the tooth row by palatal ramus of maxilla, or barely contacting maxilla.

253 Ectopterygoid, presence of broad contact with palatine ramus of maxilla: 0, absent, ectopterygoid does not contact maxilla, or barely contacts its caudal end, medial to jugal; 1, present.

254 Ectopterygoid, morphology of medial process: 0, single; 1, forked.

255 Ectopterygoid, development of the medial ramus: 0, small, do not take part in the internal naris; 1, well-developed, taking part in the internal naris.

256 Ectopterygoid, morphology of the distal ramus: 0, laminar, extending as a flattened sheet over the pterygoid wing; 1, robust, extending as a rod over most of the pterygoid wing, with subcircular cross- section through most of its length.

257 Ectopterygoid, length of posterior ramus, at maturity: 0, reaches posterior tip of lateral pterygoid flange; 1, pinched off anterior to posterior tip of lateral pterygoid flange.

258 Pterygoids, fusion posterior to choanae (state (1) is putative apomorphy of Mesoeucrocodylia): 0, not fused; 1, fused.

259 Pterygoid, participation in the suborbital fenestra: 0, pterygoid takes part in the suborbital fenestra; 1, pterygoid excluded from the suborbital fenestra by a palatine-ectopterygoid contact.

260 Pterygoid, presence of depression on primary pterygoidean palate posterior to

choanae (state (1) is present in several derived notosuchians): 0, absent or moderate in size, being narrower than palatine bar; 1, wider than palatine bar.

261 ORD Pterygoid ventral rami (wings), size: 0, very small or vestigial; 1, well-developed; 2, extremely well-developed.

262 Pterygoid ventral rami (wings), ventral surface at distal end: 0, plain surface; 1, evident transverse ridge on ventral surface, forming a vertically oriented post-choanal wall, or a buttressed bar.

263 Pterygoid ventral rami (wings), structure: 0, laminar; 1, robust.

264 Pterygoid ventral rami (wings), orientation in lateral view: 0, poorly to mildly inclined, no more than 45 degrees; 1, strongly vertical, 50 degrees or more relative to the horizontal plane.

265 Pterygoid ventral rami (wings), extension of posterior border of ventral wings, in ventral view: 0, relatively anterior, not covering the anteromedial end of quadrates; 1, relatively posterior, covering the anteromedial end of quadrate.

266 Supraoccipital, presence and development of tuberos prominences: 0, absent; 1, present, modest but evident; 2, present and extremely developed.

267 Supraoccipital, morphology of posterior wall: 0, essentially flat, or projecting distally; 1, strongly concave.

268 Exoccipitals, overall morphology: 0, terminate dorsal to basioccipital tubera; 1, send robust process ventrally and participate in basioccipital tubera; 2, send slender process ventrally to basioccipital tubera.

269 Exoccipitals, presence of a large ventrolateral part ventral to paroccipital process: 0, absent; 1, present.

270 Exoccipitals, presence of medial contact between both elements (Clark 1994, ch62; Ortega et al. 2000, ch63): can also be defined as the participation of supraoccipital in the foramen magnum. 0, do not meet in midline; 1, meet on the midline, dorsal to the basioccipital, excluding the supraoccipital from the foramen magnum,

271 Exoccipitals, presence of a pronounced transverse ridge dorsal to foramen magnum (state (1) is putative apomorphy of Hsisosuchidae): 0, absent or incipient; 1, present.

272 Exoccipitals, participation in the occipital condyle: 0, absent or incipient, neither reaching the articular surface nor meeting medially; 1, present and evident, reaching the articular surface and meeting medially.

273 Exoccipital, presence of descending flange ventral to subcapsular process (state (1)

is putative apomorphy of protosuchids, but also present at least in *Araripesuchus tsangatsangana*): 0, absent; 1, present, laterally concave.

274 Exoccipital, extent of contact with the quadrate: 0, absent or narrow; 1, broad contact present, stabilizing the quadrate.

275 Exoccipital, presence of ventrolateral contact with the ventromedial part of quadrate: 0, absent, quadrate does not contact exoccipital; 1, present, exoccipital and quadrate enclosing carotid artery and forming passage for cranial nerves IX-XI.

276 Exoccipital, presence of individualized passage (metopic foramen) for cranial nerve IX: 0, absent, cranial nerves IX-XI pass through a common large foramen; 1, metopic foramen present, medial to cranial passage for nerves X-XI.

277 Exoccipitals, presence of an evident boss on lateral edge of paroccipital process: 0, absent, exoccipital with small or no boss on paroccipital process; 1, present, paroccipital process with a proportionally robust, thickened lateral/ventrolateral edge.

278 Exoccipitals, elongation of lateral end (= paraoccipital process) relative to the skull roof: 0, relatively short, does not progress lateral to the skull roof; 1, relatively long, clearly progress lateral to the skull roof.

279 Exoccipital, projection of the lower margin of paraoccipital process (state (0) is putative apomorphy of Mesoeucrocodylia, but with reversion in Dyrosauridae): 0, absent or feeble, ventral border usually level with foramen magnum; 1, present and evident, lower margin reaching ventrally at least as far as the same level as the occipital condyle.

280 Exoccipital, morphology of ventral border of paraoccipital process (state (1) is putative apomorphy of Dyrosauridae): 0, either projects as a wide blade, or projection is feeble/absent; 1, projects ventrally as a narrow bar, rod-like.

281 Crista interfenestralis between fenestrae pseudorotunda and ovalis, orientation: 0, nearly vertical; 1, horizontal.

282 Mastoid antrum, extension into supraoccipital: 0, absent, does not extend into supraoccipital; 1, present, extends through transverse canal in supraoccipital to connect middle ear regions.

283 Lateral carotid foramen, position relative to basisphenoid (lateral exposure), at maturity: 0, opens lateral to basisphenoid lateral exposure; 1, opens dorsal to basisphenoid lateral exposure.

284 Anterior foramen for palatine ramus of cranial nerve VII, position relative to

basisphenoid rostrum: 0, ventrolateral to basisphenoid rostrum; 1, ventral to basisphenoid rostrum.

285 Laterosphenoid, orientation of capitate process: 0, capitate process oriented laterally towards midline; 1, capitate process oriented anteroposteriorly towards midline.

286 ORD Basisphenoid, ventral exposure in adults and young individuals, but not immature or hatchlings: 0, extremely reduced surface, exposed as a transversal slit, almost obliterated ventrally by the basioccipital and the pterygoids; 1, well-exposed, although basisphenoid surface clearly smaller than basioccipital surface; 2, ample surface exposed ventrally, basisphenoid at least as long as the basioccipital, or longer.

287 Basioccipital, cross-section of occipital condyle (Andrade et al., 2011): State (1) is putative apomorphy of Dyrosauridae: 0, subcircular, condyle not compressed; 1, strongly elliptic, condyle dorsoventrally flattened.

288 Basioccipital, presence of basal tubera: 0, absent; 1, tubera present, large and pendulous.

289 Basipterygoid process, development: 0, small or absent; 1, prominent, forming a movable joint with pterygoid, and with basisphenoid joint suturally closed.

290 Eustachian tubes, relation to basioccipital and basisphenoid (state (0) occurs also in *Dibothrosuchus* and *Postosuchus*): 0, not enclosed between basioccipital and basisphenoid; 1, entirely enclosed between the basioccipital and basisphenoid.

291 ORD Quadrate, orientation of main body in lateral view: 0, poorly inclined, subvertical; 1, slightly inclined posteriorly, approximately 45 degrees; 2, strongly inclined, with quadrate almost horizontal.

292 ORD Quadrate, orientation in dorsal view: 0, does not project laterally to the skull, with the lateral surface of the quadrate covered by the squamosal; 1, slightly projected laterally to the skull, with most of the laterodistal end of the quadrate covered by the squamosals; 2, strongly projected laterally to the skull, exposing most of the distal end of the quadrate.

293 Quadrate, orientation of distal end and condylar head: 0, directed posteroventrally; 1, directed mostly ventrally, or anteroventrally.

294 Quadrate, presence of preotic siphonial foramen on medial surface, close to tympanum: 0, absent; 1, present.

295 Quadrate, presence of fenestrae on the dorsolateral-posteromedial surfaces: 0,

fenestrae absent or limited to one opening (preotic siphonial foramen); 1, two or more fenestrae additional to siphonial foramen (if siphonial foramen present).

296 Quadrate, structure: 0, non-pneumatic; 1, highly pneumatic.

297 Quadrate, morphology of posterior edge: 0, broad medial to tympanum, gently concave; 1, posterior edge narrow dorsal to exoccipital contact, strongly concave.

298 Quadrate, articulation of primary head: 0, prootic, squamosal, and exoccipital; 1, prootic and laterosphenoid.

299 Quadrate, position of foramen aerum, next to the articular condyle: 0, foramen aerum single, on mediodorsal angle of the quadrate, close to the condyle; 1, foramen aerum single, on dorsal surface of the quadrate, close to the condyle; 2, foramen aerum double, being the medial foramen on the mediodorsal angle of the quadrate and distant to the condyle, and the lateral foramen on the dorsal surface and close to the condyle.

300 Quadrate condyle, size of medial hemicondyle relative to lateral hemicondyle, and presence of intercondylar groove: 0, medial hemicondyle smaller or subequal to lateral one, poorly curved, and with intercondylar groove incipient at best; 1, medial hemicondyle evidently larger than the lateral one, round and projecting ventrally, with intercondylar groove evident.

301 Quadrate condyle, expansion of medial hemicondyle: 0, absent; 1, present, medial hemicondyle is expanded.

302 External auditory meatus, general morphology (state (1) is putative apomorphy of crown eusuchians): 0, subpolygonal to elliptic; 1, triangle-shaped, with apex directed dorsally.

303 External auditory meatus, size: 0, very small, poorly visible (even in lateral view); 1, medium to large, conspicuous.

304 External auditory meatus, position of squamosal-quadrate suture at distal edge: 0, squamosal-quadrate suture extends dorsally along posterior margin of external auditory meatus, directed anterodorsally; 1, squamosal-quadrate suture extends only to posteroventral corner of external auditory meatus, directed anteroventrally or horizontal,

305 . Otic aperture, morphology of distal margin: 0, posterior margin not defined and gradually merging into the exoccipital, or smooth and continuous with the paraoccipital process, but never invaginated; 1, distal margin inset or invaginate.

306 Cranioquadrate canal, presence and position: 0, absent; 1, at least partially enclosed by quadrate, exoccipital and squamosal, with distal end near lateral edge of skull; 2, at

least partially enclosed by quadrate, exoccipital and squamosal, with distal end located ventral to paraoccipital process.

307 Cranioquadrate canal, general structure: 0, canal laterally open or not formed, and cranioquadrate passage absent; 1, passage fully formed, with canal enclosed at least distally by the exoccipital and squamosal, regardless of the participation of the quadrate; 2, passage fully formed, with canal laterally enclosed by quadrate and squamosal, and exoccipital only bounding the canal medially; 3, passage fully formed, with canal laterally enclosed by quadrate and exoccipital, regardless of the participation of the squamosal.

308 Cranioquadrate canal, lateral contact between quadrate and exoccipital: 0, narrow or absent; 1, broad.

309 Cranioquadrate passage, exposure in occipital view: 0, exposed on occipital surface; 1, shielded posteriorly by the ventral border of paraoccipital process, with passage not exposed in occipital view.

310 Oral symphyseal fossa, presence: 0, absent; 1, present as a small depressed area, anteroposteriorly elongated, located at the medial line of symphysis, in the oral cavity.

311 Posteroventral symphyseal fossa, presence of a single depressed area at the posterior end of symphysis, in ventral view: 0, absent or feeble; 1, evident, deep, longer than wide.

312 External mandibular fenestra, presence: 0, absent; 1, present as a diminutive passage; 2, present as an evident fenestra.

313 External mandibular fenestra, size relative to the orbit: 0, extremely reduced or absent, less than 50% of the length of the orbit, with surangular and angular sutured along most of (or all) their length; 1, small, approximately with the same length of the orbit; 2, large, evidently longer than the orbit.

314 External mandibular fenestra, orientation of main axis: 0, horizontal; 1, main axis inclined, directed anteroventrally-posterodorsally.

315 External mandibular fenestra, shape: 0, subcircular to poorly elliptic; 1, highly elliptic, anteroposterior axis much longer than dorso-ventral axis, three times or more, but both ends rounded; 2, slit-like, proportionally very long and both ends acute; 3, broad teardrop-like; 4, narrow teardrop-like; 5, triangle.

316 External mandibular fenestra, morphology of anterior margin: 0, curved, with a broad arched margin anteriorly; 1, anterodorsal and anteroventral margins poorly arched,

meeting at an acute angle anteriorly, anterior end is wedge-like.

317 Mandible, presence of evident festooning at anterior mandible: 0, absent, margin straight, in lateral view; 1, present, projecting dorsally at the premaxilla-maxilla suture.

318 Mandible, presence of evident festooning at mid mandible: 0, absent, margin straight in lateral view, or moderately concave; 1, present and incipient, with dorsal edge of dentary weakly sinusoidal in lateral view; 2, present and evident, with dorsal edge of dentary strongly sinusoidal in lateral view.

319 Mandible, overall morphology in dorsal view: 0, mandible is narrow, hemimandibles are confluent, with left and right alveolar margins running alongside each other; 1, mandible is broad, hemimandibles are mostly parallel, but alveolar margins meet medially at first alveolus forming a wide arched line, giving the mandible a broad-U shape.

320 Mandible, orientation of hemimandibles at their medial contact: 0, evidently acute angle, hemimandibles meet at c. 45 degrees of each other, or less; 1, broad angle, hemimandibles meet at c. 70 degrees of each other, or more.

321 Mandible, morphology of distal rami in dorsal/ventral views: 0, distal rami mostly straight or poorly curved; 1, distal rami strongly curved medially at mid-mandible, giving the mandible a broad-Y shape.

322 ORD Mandible, ventral border at angular, in lateral view: 0, angular straight and mostly horizontal, or poorly curved, from the anterior to the posterior end; 1, angular evidently (but gently) curved; 2, angular abruptly curved, always below glenoid fossa, with mid-posterior sections of angular sub-vertical, facing posteriorly.

323 Mandible, morphology of ventral margin, in lateral view: 0, mandible is curved ventrally, with maximum curvature at anterior section of angular, below the mandibular fenestra (when present), or not curved at all; 1, mandible is curved posteroventrally, with maximum curvature at posterior section of angular, below (or almost below) the mandibular glenoid fossa, usually posterior to mandibular fenestra (when present).

324 Mandible, dorsal border at dentary-surangular contact, in lateral view: 0, mostly straight; 1, gently arched dorsally; 2, strongly arched dorsally.

325 Mandible, presence of an evident coronoid process, projecting dorsally or anterodorsally: 0, absent; 1, present.

326 Mandible, relation between surangular and articular: 0, truncated, sulcus present between surangular and articular; 1, continuous, articular flush against surangular.

- 327 Mandible, position of caudal end of surangular-angular suture relative to articular: 0, lingually meets articular at ventral tip; 1, meets articular dorsal to ventral tip.
- 328 Mandible, morphology of angular-surangular suture and relation with external mandibular fenestra, at late ontogeny: 0, angular-surangular suture mostly horizontal, contacting fenestra at posterior angle (when fenestra is present); 1, angular-surangular suture curves ventrally at anterior end, passing broadly along ventral margin of fenestra (when fenestra is present).
- 329 Mandible, presence of a splenial crest: 0, absent; 1, present as a long, laminar and horizontal blade, next to the alveolar margin, projecting medially.
- 330 Mandible, presence of a conspicuous and robust surangular crest on the lateral surface of the mandible, next to the glenoid fossa: 0, absent; 1, present.
- 331 Symphysis, orientation relative to the horizontal plane: 0, horizontal or slightly inclined; 1, inclined dorsally.
- 332 Symphysis, length relative to width: 0, short, length and width subequal or shorter than wide, and mandible "U" or "V- shaped"; 1, proportionally long, longer than wide, and mandible "V" or "Y-shaped"; 2, extremely long, length at least five times its width, and mandible "Y-shaped".
- 333 Symphysis, morphology of anterior end: 0, symphysis tapers anteriorly, with no constriction at mid-posterior sections; 1, symphysis clearly constricted at fifth-sixth alveoli; 2, symphysis flares anteriorly, with anterior region bearing teeth 1-4 at anterior margin and posterior region narrower (but constriction poorly defined); 3, symphysis flares anteriorly, with anterior region bearing teeth 1-2 at anterior margin and posterior region narrower (but constriction poorly defined).
- 334 Symphysis, morphology of dorsal surface: 0, flat or slightly concave; 1, strongly concave and narrow, trough shaped.
- 335 Symphysis, presence of posterior splenial peg: 0, absent; 1, present.
- 336 ORD Symphysis, shape of anterior end in dorsal view: 0, anterior end expanded, fan-like; 1, anterior end expanded, rounded to sub-quadratic; 2, not expanded.
- 337 Dentary, presence of an occlusal pit or strong concavity for the reception of an enlarged maxillary caniniform: 0, absent; 1, present, occlusal concavity lateral to the 5th-7th alveoli; 2, present, occlusal concavity lateral to the 8th-9th alveoli.
- 338 Dentary, morphology of distal end: 0, dentary tappers posterodorsally into a single ramus, usually acute, extending only dorsal to the mandibular fenestra; 1, dentary

extends dorsally to the mandibular fenestra, and almost vertically ventral to the anterior margin of the fenestra (posteroventral ramus incipient); 2, dentary distal end bifurcated, usually extending both dorsally and ventrally to the mandibular fenestra (if fenestra present and not reduced), with posteroventral ramus evidently present and well developed.

339 Dentary, morphology of dorsal ramus at distal end, next (dorsal) to mandibular fenestra: 0, dentary ramus dorsal to fenestra follows dorsal edge of fenestra; 1, dentary ramus dorsal to fenestra projects posteroventrally as a laminar blade, partially shielding the fenestra laterally and creating a secondary, straight to slightly convex anterodorsal border.

340 Dentary distal end, extension relative to the distal margin of the orbit: 0, relatively short, do not reach posterior to the orbit; 1, relatively long, reaches posterior to the orbit.

341 Splenials, general structure: 0, thin posterior to symphysis; 1, robust dorsally, posterior to symphysis.

342 Splenials, involvement in symphysis, in ventral view: 0, absent, splenials do not take part in the symphysis; 1, present, splenials are visible at the distal end of symphysis, in ventral view.

343 Splenials, extent of involvement in symphysis: 0, marginal, or none at all; 1, modest but evident, with length of splenials at symphysis approximately the same as the width of the symphysis; 2, extensive participation, length of splenials at symphysis much longer than width of symphysis.

344 Splenials, morphology at their contact in the symphysis, in ventral view: 0, V-shaped; 1, U-shaped.

345 Splenial, participation in the medial wall of the posterior mandibular alveoli: 0, does not take part, splenial may reach the alveolar margin, but alveoli are delimited solely by the dentary; 1, participates in the distalmost alveoli, supporting teeth.

346 Surangular, extension of the anterior lateral ramus: 0, short, does not extend beyond the orbit; 1, long, extends at least to the same relative position as the anterior border of the orbit, nor reaches beyond the orbit.

347 Surangular, proportional development of lateral and medial rami, at anterior end: 0, medial ramus absent or incipient, with lateral ramus well developed; 1, medial ramus well developed, subequal to lateral ramus, and dentary-surangular suture evidently

complex.

348 Surangular, morphology of lateral anterior process: 0, single; 1, forked, with a dorsal and a ventral process evident.

349 Surangular, relative length of the anterior processes of the lateral anterior ramus: 0, unequal, dorsal process much longer, or ventral process absent; 1, subequal to equal; 2, unequal, ventral process longer.

350 Surangular, presence of extension to the retroarticular process: 0, absent, pinched off anterior to tip of retroarticular process, or surangular excluded from process; 1, present, extends to posterior end of retroarticular process.

351 Coronoid, relation with foramen intermandibularis medius: 0, limited, coronoid only bounds posterior half of the foramen; 1, extensive, completely surrounds foramen; 2, extensive, obliterates foramen.

352 Coronoid, morphology of dorsal edge: 0, slopes strongly anteriorly; 1, almost horizontal.

353 Angular, presence of insertion area for M pterygoideus posterior onto its lateral surface: 0, absent, M pterygoideus posterior limited to the posterior/ventral surfaces of angular; 1, present and evident.

354 Prearticular, presence: 0, absent; 1, present.

355 Mandibular glenoid fossa, length relative to width: 0, short, length smaller than width, matching the dimensions of the quadrate condyle; 1, length at least equal to width, or longer, and evidently longer than the quadrate condyle.

356 Mandibular glenoid fossa, development of posterior margin: 0, posterior margin smoothly progressing to the retroarticular process, with glenoid fossa poorly defined; 1, posterior margin delimited by a corner, and the glenoid fossa clearly delimited; 2, posterior margin well developed, evidently high.

357 Mandibular glenoid fossa, participation of surangular in the articulation: 0, does not take part, or barely takes part on the lateral wall of the fossa; 1, broadly participates in the glenoid fossa, forming approximately one third of its surface, with quadratojugal also broadly contributing to the quadrate condyle.

358 Retroarticular process, development: 0, absent or poorly developed; 1, present and evidently projecting posterior to glenoid fossa.

359 ORD Retroarticular process, length of the attachment surface for the adductor muscles relative to its width: 0, short, subequal; 1, moderately elongated, evidently

longer than wide; 2, extremely elongate, more than twice its width.

360 ORD Retroarticular process, orientation in lateral view: 0, posteroventrally oriented; 1, posteriorly oriented; 2, posterodorsally oriented.

361 Retroarticular process, position of distalmost tip relative to the mandibular glenoid fossa: 0, tip at the same level or below; 1, tip clearly in a more dorsal plane than the glenoid fossa.

362 Retroarticular process, morphology and orientation in dorsal/posterior view: 0, surface poorly concave and facing dorsally, or at least lateral surface facing dorsally-laterodorsally and medial surface facing mediodorsally (if surface divided); 1, surface strongly concave, facing dorsomedially.

363 Retroarticular process, morphology of the surface for the attachment of adductor muscles: 0, triangle shaped; 1, ellipsoid, rectangular or spoon shaped; 2, shovel shaped,

364 Retroarticular process, presence of a longitudinal anteroposteriorly oriented crest or ridge dividing the attachment surface for the adductor muscles: 0, absent; 1, present, dividing the surface into medial and lateral portions.

365 Retroarticular process, position of the posteromedial wing: 0, posteromedial wing dorsally situated, or at mid height on the retroarticular process; 1, posteromedial wing ventrally situated on the retroarticular process.

366 Retroarticular process, position and orientation of the foramen aerum: 0, foramen aerum medially oriented, opening at the medial margin of retroarticular process lamina; 1, foramen aerum dorsally oriented, lateral from the medial margin of retroarticular process.

367 Dentition, relation between tooth rows on both sides of the skull: 0, forming one continuous set of teeth, both in the cranium and mandible; 1, forming two distinct sets, tooth rows at posterior set convergent rostrally and almost in touch each other, at mid-palate and mandible.

368 Posterior maxillary teeth, transverse section: 0, evident lateral compression affecting both edges of the crown, making both edges evident regardless of the presence/absence of carinae/keel; 1, transverse section circular to subcircular, without significant lateral compression; 2, transverse section teardrop-like (=triangular), with asymmetric lateral compression occurring on the distal margin only.

369 Mid to posterior mandibular teeth, transverse section: 0, evident lateral compression affecting the entire crown, making evident both mesial and distal edges,

regardless of the presence/absence of carinae/keel; 1, transverse section circular to subcircular, without significant lateral compression; 2, transverse section teardrop-like (=triangular), with asymmetric lateral compression occurring on the mesial margin only.

370 Dentition, presence of faceted teeth: 0, absent; 1, present, most crowns with at least the labial surface with three facets.

371 Dentition, presence of laminar teeth (for practical purposes, laminar tooth is here considered as tooth with cross-section highly elliptical at the base of crown, with mesial-distal axis approximately twice the labial-lingual axis, or greater): 0, absent; 1, present, laminar teeth dominate dentition.

372 Dentition, presence of spatulated teeth: 0, absent; 1, present.

373 Anterior to mid dentition, general crown robustness: 0, teeth slender, sharpening apically; 1, teeth robust, "inflated", or bulbous apically.

374 Mid to posterior dentition, presence of pebbled ornamentation on tooth crown surface: 0, absent; 1, present, enamel ornamented with a pebbled pattern.

375 Mid to posterior dentition, presence and morphology of ridged ornamentation on enamel surface of teeth: 0, enamel ornamentation absent or incipient; 1, present, composed of basi-apical well-defined ridges, conspicuous and set apart to each other, never anastomosed; 2, present, composed of numerous basi-apical well-defined ridges, conspicuous and set close to each other, rarely anastomosed, with anastomosis stronger apically; 3, present, composed of numerous basi-apical low ridges, feeble and set close to each other, poorly anastomosed, with anastomosis stronger apically; 4, present, composed of numerous basi-apical low ridges, feeble and set close to each other, anastomosed into a fabric of ridges distributed through most of the crown.

376 Mid to posterior dentition, presence of accessory ridges on labial-lingual surfaces of crown: 0, absent; 1, present, basi-apical, evident and well-spaced, formed by enamel and dentine.

377 Mid to posterior dentition, number of cusps per tooth: 0, each crown has single apical cusp, regardless of presence of accessory cusps in cingula; 1, each crown has one main cusp aligned with smaller cusps, arranged in a single row; 2, several cusps, unequal in size, arranged in more than one row; 3, multiple small cusps, subequal in size, along edges of occlusal surface.

378 Carinae, presence of keel at the edge of tooth crown: 0, absent; 1, present.

379 Carinae (mid-posterior dentition), presence and morphology of denticles at crown

edges: 0, homogenous carina, serrated with cuneiform to ripple-like true denticles (ziphodont); 1, true denticles absent, crowns either with a smooth edge (non-ziphodont), or an homogenous carina where crenulations may appear as a result of superficial ornamentation (false-ziphodont); 2, heterogeneous carina, composed by tubercle-like true denticles (ziphomorph).

380 Carinae (maxillae), distribution of denticles at crown edges: 0, mesial and distal crown edges with the same morphology, either with or without true denticles; 1, mesial carina absent and distal carina present.

381 Carinae (mid-posterior mandible), distribution of denticles at crown edges (state (1) is putative apomorphy of *Sphagesaurus*, but unknown in *Armadillosuchus*): 0, mesial and distal crown edges with the same morphology, either with or without true denticles; 1, mesial carina present and distal carina absent, with mid-posterior teeth occluding as opposing blades.

382 Occlusion, relation between premaxillary and mandibular dentitions: 0, either match the mandible or slightly cover it, as upper teeth overbite the dentary teeth; 1, premaxilla widely overhangs the mandible, with premaxillary ventral margin covering the alveolar margin at anterior mandible.

383 Occlusion, relation between maxillary and mandibular series at mid dentition: 0, in-line or interlocked; 1, maxillary dentition overbites mandibular dentition.

384 Occlusion, relation between maxillary and mandibular series at the posterior dentition: 0, in-line or interlocked; 1, maxillary dentition overbites mandibular dentition.

385 Premaxillary teeth, presence of an hypertrophied tooth at penultimate or last alveolus: 0, all teeth subequal in size; 1, one enlarged tooth, longer than the other premaxillary elements, usually not higher than the symphyseal depth; 2, one fully hypertrophied tooth, much longer than the other premaxillary elements and at least as high as the symphyseal depth, also with a much larger cross-sectional area at crown base.

386 Premaxillary enlarged tooth, size relative to largest teeth at maxillae and mandible: 0, premaxillary tooth smaller, with shorter crown and shorter-narrower alveoli, or subequal; 1, premaxillary tooth larger than any given tooth at maxilla or mandible, with higher crown and longer-wider alveolus.

387 Premaxillary alveolar margin, orientation: 0, vertical, dentition is procumbent or

not; 1, inturned, dentition is not procumbent.

388 Premaxillary alveolar margin, projection relative to the maxillary alveolar border: 0, absent, alveolar margin of premaxillae and maxillae continuous, usually in the same plane; 1, present, premaxillary alveolar margin is ventrally offset.

389 Premaxillary alveolar margin, distinction relative to the maxillary alveolar border, in lateral view: 0, alveolar margin is continuous, and maxillary dentition is no more than slightly offset ventrally; 1, premaxillary and maxillary alveolar margins are separated by a extremely deep notch, with maxillary dentition distinctly offset ventrally.

390 Premaxillary alveoli, disposition in ventral view: 0, alveoli set in the alveolar margin to form an arched row, curved posteriorly from midline and poorly diverging from medial line, usually angled laterally at c. 90 degrees or less; 1, alveoli set in the alveolar margin to form a straight to poorly arched row, strongly diverging from medial line and angled laterally at c. 120 degrees.

391 Last premaxillary tooth, relative position in the horizontal plane: 0, strongly anteromedial to first maxillary tooth; 1, anterior to first maxillary tooth, or slightly altered relative to it; 2, evidently anterolateral to first maxillary tooth.

392 Maxillary dentition at anterior maxillae, presence of an hypertrophied caniniform tooth: 0, absent, no enlarged caniniform is present, with maxillary dentition usually isometric to sub-isometric; 1, present as an enlarged tooth slightly larger than (but not contrasting with) neighboring teeth, with maxillary dentition anisometric; 2, one hypertrophied tooth, much larger than neighboring teeth and contrasting in size with them, with maxillary dentition strongly anisometric.

393 Maxillary dentition, morphology: 0, all maxillary teeth caniniform, or last teeth lanceolate (isomorphic or sub-isomorphic); 1, acute caniniforms anteriorly, followed by blunter caniniform teeth; 2, caniniform teeth anteriorly, followed by molariform teeth; 3, most or all teeth molariform, but teeth 1-2 eventually weakly caniniform to conical.

394 Maxillary tooth row, extension relative to anterior border of suborbital fenestra: 0, does not reach the anteriormost border of the suborbital fenestra; 1, reaches the anteriormost border of the suborbital fenestra; 2, extends posterior to the anteriormost border of the suborbital fenestra.

395 Maxillary tooth row, position of last maxillary tooth relative to posterior border of suborbital fenestra: 0, far anterior to the posteriormost end of the suborbital fenestra; 1, at the same relative position of the posterior border of the suborbital fenestra, or very

close.

396 Maxillary/dentary teeth, implantation of anterior to middle elements, at maturity: 0, teeth set in fully isolated alveoli; 1, at least part of the teeth set in a groove, not separated by septa.

397 Maxillary/dentary teeth waves, in non-tubular-snouted forms: 0, absent, no tooth size variation; 1, one wave of teeth enlarged, at mid snout; 2, enlarged teeth in two waves; 3, one wave of teeth greatly enlarged, at the end of maxilla/dentary.

398 Symphyseal dentition, alignment of anteriormost alveoli relative to the medial line: 0, alveoli 1-4 not transversally aligned at anterolateral margin; 1, alveoli 1-2 transversally aligned, and following alveoli set posteriorly to them; 2, alveoli 1-4 transversally aligned, so the fourth alveolus is lateral (or lateral and slightly posterior) to first alveolus, and following alveoli are posterior to them.

399 Symphyseal dentition, position of fifth alveoli in dorsal (buccal) view: 0, distant, or at least both alveoli moderately apart; 1, close to each other, next to the medial line of symphysis.

400 Symphyseal dentition, presence of a complete symphyseal tooth battery: 0, absent; 1, present, teeth from each pair closer to each other than to other teeth in the same hemimandible.

401 Symphyseal dentition, presence of highly procumbent teeth: 0, non-procumbent to mildly procumbent; 1, first symphyseal pair highly procumbent, crowns nearly horizontal; 2, pairs 1-2 highly procumbent, crowns nearly horizontal.

402 Symphyseal alveoli 1-2, confluence: 0, well-separated, usually as much distant from each other as from other mandibular teeth; 1, alveoli 1-2 confluent, separated by a thin alveolar wall, and clearly apart from neighboring alveoli.

403 Symphyseal alveoli 3-4, confluence: 0, well-separated, usually as much distant from each other as from other mandibular teeth; 1, alveoli 3-4 confluent, separated by a thin alveolar wall, and clearly apart from neighboring alveoli.

404 Symphyseal alveoli 3-4, relative size: 0, nearly same size, or third alveolus larger; 1, fourth alveolus larger than third.

405 Symphyseal alveoli 3-4, relative position: 0, tooth 3 medial to tooth 4; 1, tooth 3 anteromedial to tooth 4; 2, teeth 3-4 set in tandem.

406 Symphyseal alveolus 1, relative position: 0, not in line with alveoli 3-4, closer to the medial line of symphysis; 1, in line with alveoli 3-4.

407 Symphyseal alveolus 2, relative position: 0, not in line with alveoli 3-4 and closer to the medial line; 1, in line with alveoli 3-4, as close as these to the medial line; 2, not in line with alveoli 3-4, at a more lateral position.

408 Dentary tooth opposite to premaxilla-maxilla contact, isometry: 0, subequal to other neighboring teeth; 1, tooth is at least evidently enlarged, anisometric relative to other neighboring teeth.

409 Dentary tooth opposite to premaxilla-maxilla contact, length: 0, small to medium sized, but length is no more than twice the length of other neighboring teeth; 1, hypertrophied, at least twice longer than neighboring teeth.

410 Dentary tooth opposite to premaxillary-maxillary suture, occlusion: 0, occludes either in notch at premaxilla and maxilla early in ontogeny, or lateral to premaxilla-maxilla suture, when the notch is absent or poorly defined; 1, occludes in a pit between premaxilla and maxilla; no notch early in ontogeny; 2, occludes medial to premaxilla-maxilla suture, but not in a pit or a notch.

411 Dentary tooth occluding against premaxillary-maxillary suture: 0, third, or anterior; 1, fourth; 2, fifth, or posterior.

412 Maxillary dentition, area occupied by teeth and alveolar margin of maxilla, in palatal view: 0, proportionally small teeth set in a narrow alveolar margin, marginal to palate/oral cavity; 1, proportionally large teeth set in a wide alveolar margin, occupying large area at the maxillary ventral ramus/oral cavity.

413 Mandibular teeth 7-8, relation with the neighboring teeth: 0, not particularly distinct; 1, forming a distinct set, with alveoli closer to each other than to other teeth, and crown from tooth 7 much smaller than crown 8; 2, teeth 7-8 are distant from each other, but alveoli 6-7 and 8-9 forming isolated sets, and alveoli 7-8 smaller than other alveoli.

414 ORD Maxillary teeth, occurrence of bilateral paramesial rotation: 0, absent; 1, bilateral paramesial rotation up to 30 degrees from the original plane; 2, bilateral paramesial rotation clearly over 30 degrees from the original plane.

415 Middle and posterior mandibular teeth, occurrence of bilateral paramesial rotation: 0, not oblique or slightly altered; 1, oblique (more than 30 degrees).

416 Middle and posterior teeth, occurrence of bilateral paradistal rotation: 0, absent; 1, bilateral paradistal rotation present, teeth obliquely implanted, with rotation of at least 30-40 degrees from the original plane.

- 417 Middle and posterior teeth, presence of cingula with accessory cusps: 0, absent; 1, present, cingulum bearing a series small of cusps, set labial/lingual to the main body of crown.
- 418 Posterior teeth, presence of rings of undulating enamel on crown surface: 0, absent; 1, present.
- 419 Vertebrae, presence of strong procoelly: 0, absent, vertebrae no more than feebly procoelic; 1, present in all cervical, dorsal and proximal caudals, with degree of procoely progressively decreasing in distal caudals.
- 420 Presacral vertebrae, morphology of articular surfaces: 0, all amphiplatic or amphicoelic; 1, presacral series includes at least gently procoelic vertebrae.
- 421 Presacral vertebrae, presence of a ventrally projecting laminar process (hypapophysis) ventral to the centrum: 0, absent or incipient, but neither laminar nor projecting ventrally, no more than a sagittal ridge; 1, present as fully projecting laminae,
- 422 Caudal vertebrae, morphology of articular surfaces of proximal elements: 0, amphiplatic or amphicoelic; 1, all at least gently procoelic, only with first caudal eventually biconvex.
- 423 Axis, proportional length of the main body of the centrum relative to its height: 0, short, length and height of centrum subequal; 1, long, centrum evidently longer than high.
- 424 Axis, development of neural spine laminae: 0, poorly developed, limited to the posterior half of the neural arch; 1, well developed, occupying the dorsal surface of the neural arch and projecting anteriorly and posteriorly to it, due to the presence of prespinal and postspinal laminae.
- 425 Axis, morphology of posterior half of neural spine: 0, wide; 1, narrow.
- 426 Axial hypapophysis, presence of deep fork: 0, present; 1, absent or feeble.
- 427 Third cervical vertebra (CIII), development of prezygapophysis: 0, poorly developed, slightly projecting anterior to the vertebral centrum; 1, well developed, clearly projecting anteriorly, beyond the vertebral centrum.
- 428 Anterior (postaxial) cervical vertebrae, development of neural spine laminae: 0, laminae absent or poorly developed, with neural spine rod-shaped or poorly flattened laterally; 1, prespinal and postspinal laminae well developed, with neural spine occupying at least most of the dorsal surface of the neural arch.
- 429 Posterior cervical vertebrae, development of neural spine laminae: 0, laminae

absent or poorly developed, with neural spine rod-shaped or only slightly flattened laterally; 1, well developed, laminar, occupying at least most of the dorsal surface of the neural arch.

430 Anterior cervical vertebrae, structure of the base of neural spine: 0, gracile base, with neural spine clearly distinct from the neural arch; 1, robust base, with the development of spinozygapophyseal ridges.

431 Posterior cervical vertebrae, structure of the base of neural spine: 0, gracile base, with neural spine clearly distinct from the neural arch; 1, robust base, with the development of spinozygapophyseal ridges.

432 Sacral vertebrae, number: 0, two; 1, three, being the third the first caudal.

433 Sacral vertebrae, orientation of the transverse processes: 0, horizontal; 1, arched ventrally, at least in the first sacral.

434 Sacral vertebrae, relative position of lateral end of transverse process: 0, level with the vertebral centrum; 1, ventral relative to the vertebral centrum, transverse processes of both sacrals lateroventrally directed.

435 Caudal vertebrae, relative height of neural spine: 0, larger spines are up to 2.5 times the height of vertebral body; 1, average spines are 2.5-4 times the height of vertebral body.

436 Tail, vertebrae morphology near distal end (state (1) is putative apomorphy of *Metriorhynchidae*): 0, non-hypocercal, distal vertebrae isomorphic to poorly heteromorphic; 1, hypocercal, caudal series clearly heteromorphic, with a section of the distal vertebrae defining the lower lobe of a tail fin.

437 Atlantal ribs, presence of very thin medial laminae at anterior end: 0, absent; 1, present.

438 Scapulocoracoid synchondrosis, precocious closure during ontogeny: 0, absent, synchondrosis closes very late in ontogeny; 1, present, synchondrosis closes relatively early in ontogeny.

439 Scapula, symmetry: 0, symmetrical, anterior and posterior edges similar in lateral view, with dorsal end poorly flared; 1, asymmetrical, anterior edge strongly concave relative to posterior edge, with distal end strongly flared.

440 Coracoid, length relative to the length of scapula: 0, smaller, approximately half the length of the scapula; 1, subequal.

441 Ilium, relative length of anterior and posterior processes: 0, subequal, anterior and

posterior processes similar in length; 1, unequal, with anterior process relatively small, one quarter or less than the length of the posterior process.

442 Ilium, presence of indentation at the dorsal margin of iliac blade: 0, absent, dorsal edge convex or straight in lateral view; 1, present as a shallow or modest dorsal indentation; 2, present as a strong dorsal indentation ("wasp-waisted").

443 Ilium, morphology of anterior process of iliac blade, in lateral view: 0, very narrow relative the main body of the iliac blade; 1, rounded and moderately broad relative the main body of the iliac blade; 2, very broad and deep, at least half the height of the main body of the iliac blade.

444 Ischium, presence of pubic process: 0, pubic process absent, or incipient and small, not restricting the participation of the pubis to the acetabulum; 1, anterior process well developed, robust and with a round head, at least partially restricting the participation of pubis in the acetabulum.

445 Pubis, exclusion from acetabulum: 0, pubis not excluded, participating at least marginally of the anteroventral rim of acetabulum; 1, pubis excluded, acetabulum composed exclusively by ischium and ilium.

446 Pubis, presence of exclusive proximal contact with ischium: 0, absent, pubis supported by both ilium and ischium; 1, present, proximal head of pubis contacts only the ischium.

447 Pubis, expansion of distal end: 0, absent, pubis rod-like; 1, present, paddle-like.

448 ORD Limb bones, length relative to trunk, at maturity: 0, limb bones relatively short; 1, limb bones moderately long; 2, limb bones very long.

449 Limb bones, general structure: 0, limb bones robust; 1, limb bones overall slender, but not weak; 2, gracile.

450 Limb bones, relative length of forelimbs/hindlimbs: 0, forelimb much shorter than hindlimb at maturity; 1, forelimb slightly shorter than hindlimb at maturity; 2, forelimb and hindlimb subequal in length at maturity.

451 Limb bones, general morphology of manus and pes: 0, plantigrade or digitigrade; 1, paddles.

452 ORD Limb bones (forelimbs), proportional length of ulna relative to the humerus (state (2) is putative apomorphy of Teleosauridae, where humerus is almost twice the size of ulna): 0, ulna clearly longer than humerus; 1, ulna subequal to humerus (distal/proximal = 75-125%); 2, ulna clearly shorter than the humerus.

- 453 ORD Limb bones (hindlimbs), proportional length of tibia relative to the femur: 0, tibia subequal to femur, or only slightly shorter (distal/proximal >74%); 1, length uneven, tibia evidently shorter than the femur (distal/proximal c. 50-74%); 2, length uneven, tibia much shorter than femur (distal/proximal < 50%).
- 454 Humerus, relative orientation between the proximal and distal heads: 0, unaligned, each turned more than 30 degrees; 1, mostly aligned, each turned no more than 30 degrees.
- 455 Femur, relative orientation between the proximal and distal heads: 0, femur with light torsion, proximal and distal articulation facets approximately at 30 degrees or less from each other; 1, femur with evident torsion, proximal and distal articulation facets approximately at 60 degrees from each other.
- 456 Humerus, presence of common insertion for *M. teres major* and *M. dorsalis*: 0, absent, separate scars can be distinguished dorsal to deltopectoral crest; 1, present, insert with common tendon, with a single insertion scar.
- 457 Ulna, morphology of olecranon process: 0, narrow and subangular; 1, wide and rounded.
- 458 Proximal carpals, general morphology of radiale and ulnare: 0, radiale and ulnare short, almost spherical; 1, radiale and ulnare at least poorly elongated.
- 459 Proximal carpals, relative proportions of radiale: 0, slender, much longer than wide; 1, broad, proximal width subequal to length.
- 460 Proximal carpals, length of radiale relative to length of metacarpals: 0, radiale is shorter than metacarpals, or subequal; 1, radiale is evidently longer than metacarpals.
- 461 Proximal carpals, relative length of radiale and ulnare: 0, radiale and ulnare subequal in length; 1, radiale evidently longer than ulnare.
- 462 Proximal carpals, relative expansion of proximal and distal heads of radiale: 0, almost equally expanded; 1, proximal head wider than distal one.
- 463 Proximal carpals, presence of a facet of articulation in the radiale, for reception of the ulnare: 0, absent; 1, present, facet evident, near its proximal end,
- 464 Femur, general shape (state (1) is putative apomorphy of *Thalattosuchia*): 0, poorly sigmoid; 1, strongly sigmoid.
- 465 . Pes, relative length of digits III and IV: 0, digit III is longer than digit IV; 1, digit IV is longer than digit III.
- 466 Calcaneum tuber, presence: 0, absent or vestigial; 1, present.

- 467 Metatarsal I, morphology of proximal end: 0, proximal end not enlarged; 1, proximal end moderately enlarged; 2, proximal end greatly enlarged.
- 468 Dermal armor, presence and distribution: 0, absent; 1, dorsal osteoderms present, but ventral osteoderms absent; 2, dorsal and ventral osteoderms present.
- 469 Presacral nuchal armor, relation of nuchal osteoderms with the remaining dorsal armor and skull: 0, large nuchal shields continuous from postoccipital region to trunk armour, with any given osteoderm contacting the anterior and posterior elements (except for the first postoccipital shield); 1, large nuchal shields continuous with trunk armour, but not reaching the postoccipital region; 2, large nuchal shields discontinuous with dorsal trunk armour and absent from postoccipital region.
- 470 Presacral nuchal armor, number and arrange of nuchal shields): 0, four paramedian nuchal shields, sided by two accessory shields, all enlarged relative to the remaining neck dermal armour; 1, four paramedian nuchal shields enlarged relative to remaining neck shields, and no accessory shield enlarged; 2, eight (or more) shields, arranged in two paramedian rows, enlarged relative to remaining neck shields, with no accessory shield enlarged; 3, ten or more median osteoderms, combined with several lateral osteoderms, composing a distinct cervical shield.
- 471 Presacral nuchal armor, morphology of nuchal shields relative to the remaining trunk dermal armour: 0, nuchal and dorsal trunk shields undifferentiated, morphology grading continuously; 1, nuchal shields clearly differentiated from dorsal trunk shields by size and general morphology (regardless of contact between nuchal and trunk series).
- 472 Presacral dorsal armor, number of contiguous longitudinal rows of paravertebral osteoderms: 0, two paravertebral medial rows; 1, four continuous rows, two paramedian and two lateral.
- 473 Presacral dorsal armor, presence and number of accessory ranges of osteoderms in addition to the dorsal rows of osteoderms: 0, absent (total of up to four dorsal rows); 1, present, two accessory rows (total of 4-6 dorsal rows); 2, present, no less than four accessory rows (total number dorsal rows usually eight or more).
- 474 Presacral dorsal armor, type of contact between elements in a row: 0, imbricated, any given anterior trunk osteoderm partially overlays its following element; 1, sutured, osteoderms do not cover adjacent dermal elements, and are sutured if in contact.
- 475 . Presacral dorsal armor, general proportions of medial elements: 0, at least as long as wide; 1, evidently wider than long.

- 476 Presacral dorsal armor, surface of paravertebral osteoderms: 0, mostly straight, forming a plain flat scute, either keeled or not; 1, scutes strongly curved, with convex surface, partially embracing the vertebrae from side to side.
- 477 Presacral dorsal armor, presence of an anterior process to articulate with the anterior adjacent scute, in medial dorsal elements: 0, absent; 1, present.
- 478 Presacral dorsal armor, presence of an anteroposteriorly directed keel on the dorsal surface of paramedial elements: 0, absent; 1, present.
- 479 Presacral ventral armor, presence of ventral collar scales: 0, absent, no shield enlarged relative to other ventral scales; 1, present, forming a single row of enlarged scales; 2, present, forming two parallel rows of enlarged scales.
- 480 Presacral ventral armor, presence of paired ossifications: 0, single or absent; 1, present, pairs sutured together.
- 481 Postsacral armor, distribution when present: 0, a pair of rows, covering the vertebral column; 1, several rows, enclosing the tail surface.
- 482 Postsacral armor, presence of an anteroposteriorly directed keel on the dorsal surface of paramedial elements: 0, absent; 1, present.
- 483 Tongue, presence of keratinized surface (state (1) is putative apomorphy of Alligatoridae/Alligatoroidea, but unknown in all fossil taxa): 0, absent; 1, presence.
- 484 Functional lingual salt glands, presence: 0, absent; 1, present.
- 485 Internal hypertrophied salt glands, presence: 0, absent; 1, present.
- 486 M. caudofemoralis, morphology: 0, with single head; 1, with double head (longus and brevis). ;

MATRIX

Gracilisuchus

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Protosuchus

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Hsisosuchus_chungkingensis

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Platysuchus

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Steneosaurus_herberti

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Steneosaurus_bollensis

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Pelagosaurus

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Cricosaurus_araucanensis

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Cricosaurus_suevicus

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Rhacheosaurus

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Metriorhynchus

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100001100000001201000?0---1000000001110000?---11100?1?12000?021001121000?
0010111210??0?01?20???1010?0?000001?0???1?00000000?110001111000?????201?1
200?0?00?0?????11000?00---000001011?00002000200-0012001012???01020102000

10?011000000001100000000000100200-000000020000010000100000011???1100011
01?011000110100111201??01000011100-----0--??1?

Dakosaurus_carpenteri

????11?0000-----0???00?00?1300010-000111?1001?112100101002101????00012
100100-0-?00000100?00??000000?22012012?000001022010?????11011001010110??
?1100??00?20?????????????00??????00?---???????12????0????11?0-????0????
?????????0?????0????????????????????????1??0????????????????????????????
??0??00---??0??0??0??0??????-??????????0?02?112?0010?01?00000200110?
000000000100?00?????????????0?01000000?????1100011?1???????1??0011??01?
???????1??0-----0--???

Dakosaurus_maximus

?3101200000-----0?11100000?1300010-0001112100111?2100101002101?????001
2100100-?-?000001?????000?0?22012?1??0???????1???????101100101?????
???????00?2??0?0?0---?????????11?0?0?---??0?0???????0??011???????0?1?????
??1????????????????????????????????
??0?00---?00001011?00?00100?200-0?120?0?11??0?020??00???000000000001000
0???00000100(01)00000000002?000?10000101????????????????????????????????
??????????????0-----0--???

Dakosaurus_andiniensis

03101200000-----00?110100001300010-000?11210011102100101002101????0001
?100100-0-?0000010010001000000?22012012?00000?022010?????11011001010110
000110000000120100020---1000000001110000?---111000??12000?0?001121?0?00
??11????000?01120200101000-??000??0?00000?0000?11000111?000?????201?00
000?0?0?0?????1100?000---000001011?0?0010??200-0?????0?110?0?02?102000??0
000000000010000?000000100(0
1)00000000002?000?10000?01??
??????????0?????

Geosaurus_giganteus

????1?00000-----0?111000??1??????-?0??11210011112101201???????????001210
0100-0-?00000100000010000?0?220?2?1??00?0?????2?1?????1101100101?1?????1?
00??00012010?0?0---1000000001110000?---11100???12000?02???????000?0???11??
??0?0?0?0?????0?????000?????????????00?????????????????????????0?????????
??????00---000001????00?00????200-0?????1?12??????0???0???00011000000100

Geosaurus_grandis

Notosuchus

Mariliasuchus

Yacararani

56

??

Adamantinasuchus

0??01?1110-0----0??0110001000-00100-010000--00----2110101000102??????201?0
01100-00?0000000000?01000100??0?000?00?1??001000?????1110100010?0?????
0?0000?1?01010?110---111000000000010??(01)?(01)0001100?0?1?0??0??1?21?????
????00000?00?0??101????10?0??000??????????0?0?00??0??11?????????????0?11??
??11??????2??002110000011(01)020??0010??20100?1(01)?10100??0?0?0?????
??02?0000?0000200000210000103?0110??1??211002?002100000?????????????00
??????????11?0??????????00????????????????????

Armadillosuchus

0??0101?10-0----0???????1000-00100-0?0000--00----211010?000?02??????20111?
0?00-0??0??01?000?0?000000?12012000?0001?1000?00?????11101100?0?01100100
000001100?01011?0---110100010?000?02111?0011??0?1??????????????(12)?????
??0??????1????111?0?1?????
??2??????????000??????????0100?2?????1????????????????????????02?00?0101??2
1?00?210000103???1011100021100201?21000?????????????????????????????????0??
?????????????(1 2)0310001?00???????

Sphagesaurus_huenei

0(04)000111110-0----?0?01100?1000-001?0-010000--00----21101010001020---0201
?1?0100-00?000001?000?0?000?????????00?00001????00?????1110?00?0?1?????
0?00??110010101110---110100010010010?????00011??0?1?0?02001112101020?010
00000100101?01????10100?????11?0??11?0?0?10??1?0?1110?????????1?01111?0?
110?????2??1?????000??????????0100?20?????????????????0?????????0220000
101002110002100001031001011000021100201?2100000??10?????1??????????????
??

Sphagesaurus_montealtensis

0(04)000111110-0----?100110001000-00100-010011000000002110101000102?-???02
011000100-00?0000010000101000100?01011000?000100000000??0??111011001000
111000000000110010101110---10000000001001021(01)??0011?0?0?0?020011121
010(12)010?000000100?0121010111101002?00011000111?1010100?11??1110000??
???1?00111?0111??01?02200?02(12)?0000011?020??0?010002000?110110112??
?0??0?????????0220000??10021100021000010310?101100002?100201021000?????
??

Comahuesuchus

04000111010-?------?000??0?0??00-00100-?10000--00----210010100(01)100??????201
1000?10000?000000000010000000000(01)00-000?0001?10(01)?000?????1000000000
0010000?0?00001100101011?0---11?(01)100??010000?????0011?0?0?1???0200?112
1010?0?000000001000012101011110?0??000110001?111010?00??100?11?0000????
?10?0?11110?11?1?????2200002(12)?0001110?02?????0??000120?0??10111?0?0?????
?0?????????000000000000100011000000010000?(12)00000010000-?0000?00????????
??

Baurusuchus

040022?0010-0-----0100110001000-001020110000--00----20012210021000----121111
??110000?000001000000000010001201240??00010000100??????11101000100011001
00100000000010101110---1111100201?12002111110011??01101?0200?11210102000
00000002?010121010111101000000011110?1112011000?0100?1110000?1???100010
1110011?1?01?02?000021100100000020??00011110100001110?01111??1012010001
20??000000000001000011200000120000100000011001101000000000??10??0???10
000???????111?11201000??1101110010(1 2)????????????????

Stratiosuchus

040022?0010-0-----0100110000000-001020110000--00----210122100210010142?2111
1???10000?000001000000000010001201240??00010000100??????1110110010001100
10010000000010101110---1111100??1?12002111210011?0?0?101?020011121010200
000000002?010121010111101001000011110?1112011000?0100?1110000?????10001
011?0?11???01?02?0000211??100000?20????0?1???10?????????0?11???1?120?????????
?00?0000000010000112000001200001?000?????1101000000000?????????????00??
?????111?11201?00??1101110010(1 2)????????????????

Malawisuchus

000001110????0????0?00?100?1000-0??02?1(12)0011010000002100101??1100?????0
21??101110000?000001000?101000000000010000?00010100?001?????111?200010?0
10000000000?110010101110---110100010?00000211(01)?00011???0?100?02?001121
000?0000112000??0?0??100?0?110?0??000?000?1?0010?0?0??100?1110000?????1
000?(12)1?10?1??1?????220??02203?0?000002???0?0010?120201?110?0?000??1?100
10001200?00?001000010100111(12)01000?22?01100?????????02?000001000?0?????
???????0???1????????11?0????????????0010(1 2)?????0??01????????

Candidodon

000011211012011????0001100?1000-0?100-?10011000000002100101001100?????02
110?000?0-00?000001???110?000000?00010000?00010???100??????1110110000?010
00000?0000010010101110---11010001011?000?000011???0?10?02?00112100020
0001???0000?0121010(01)(12)1101000000011?01?10?1010000??100?11?0000?????1
0001111?0?11?0?????2200?0??????000?????????010??20????110????????????0?????
????00?0010?000100???10000012220110?0????111???0?0?010?????????????????
?????????11?0????????????0??? (1 2)?????????????????

Uruguaysuchus

0000112110120111??1000110001000-0?100-0?001100010?0021001010011001?0??02
110101010000?000001??01100000000000010000?00010100100??????111020001000
1000000000000100101011?0---110100000100000(12)1???00011???0?1???020001121
000(12)0000100100010?01210100211010000000?001?10?10(01)00?0?0100?11?0??
?????1000?11110????0?????2??0021000010001000???0010?1?0?0??11010?0???10
110100012???000001000000100?1110000012220?1000000?1??1021000000000000????
?????00000????1??111?11101??????????0???1???000000?-0??????

Araripesuchus_patagonicus

10001111001201000?1000??001?00-0??02?1(1
2)001100010000210100100?100??????21000000?1?0??00000100001?1000000000010
000?000101001000?????1000000010001000000?0000010010101100---11110001111?(
01)002101(01)000110?011?01020001121000?0000100000000?011101022110101110
00?100111001000000?0100?11?00???????1000111110?1??0001?02?00?0210310?000
1010??0?0?10?1?02?10110?0?100??1?11010101100?01?000000000????11100000012
20?100?????????0(12)?0?0?00000????????????0???1????????111?1001????????0???
10200001100-0??????

Araripesuchus_gomesii

1000111100120110011000101001000-0000211200110001000021010010011000----?2
100000011000?0000010000121000000000010000?0001010010001101?100000001000
1000000?0000010010101100---11111001211110021010000110??01110102000112100
010000100000010001110102211010111000?100?11001000000?0100011?0000?1???1
000111110?11?0001?02(03)000021031010001010??000010102021??11010?100??101
1010101100?01?000000000000111000000012?011000000010010(12)100000000010??
???00??10000??111??11111101001?0?????001010200001101-00?????

Araripesuchus_wegeneri

1000111100120110?11000101001000-0000211200110001000021010010011000---12
100000011000?000001000012000010000000-300?0000010010001101?10000001000
100000000000010010100100---111110011(12)11100210??00011?0?011?01020001121
000200001000000100011101002110100110001100111001000000?0100?1110000?1??
?1000111111?1??0001?02300002(12)???01000??????0?00000102???11010??0?????
??????????00000000(01)00000011110000001220120000001100102100000000000???
?????????00??????????11101?0???10110?0101?????????-011??0?

Araripesuchus_buitreraensis

1???11110??0?????00?????0000-0?0?0?120011?00100002??100100?10?????????
10??1100??000001??????0000000(01)(01)00-3?0?0000?1001?00?????100001001000
100?000?000??100?01?01?????1??1000?(01)???00(12)1???0011???0?1???02000112
1000?000010?000010?01110100211010110000?1001?10010000???0???1???0??????
1?0??11?1??????01?0?????0?????01000?????????010?120??00111?0?????????????
?????0?00000000?????????0100001?(12)01?00?0???0010(12)10?0?00?????????????
??

Araripesuchus_tsangatsangana

00001112001?01100??000?10000000-0?00?12001100010?002??100100?10?????0??
??10??1000??00000101001?00000000(01)(01)00-3?0?000001001?001111?100000001
000100000010000010010100100---11110001(12)10?0002101(01)0001100?011101020
0011210???0?00??000??0011(01)0(01)00211010000000?10???10?(01)0???00?0100
11110000?1???1000?11110111?0001?023000011100010001?10??0000100120001011
0100??0??1011?1110?0?0?0000000000001000??10100001220110000000100101(12)0
00000000000??1?11?00000??1?1(01)01111?11010???101101????????????????????
0?

CratoForm (=cf. Araripesuchus SMNK PAL6404; Frey & Salisbury, 2007)

?000111100120110001000110001000-000021120011000100002100101001100?????
2100000111000?000001000011?000100?0000-301?000101001000?????11101?0010?0
1100000?00000?0?????????--11???00??1???00?????????????????????0200011210???00
00??????0?0?0121010011?01?000000?1?01?10?10000???0?????????????????1000?1???
??1?????????????0?????0?00010??????010???0(12)???110?1?????1???0?00?????00
?000000000?0?111000000012(01)011?00???????02?0?0?0000000?????????????00????
????????11?01??????0?0??????1020000?000-?01????

Libycosuchus

0000111100120111??00011000?000-00102112001??00?00002100101001100101???2
1?0100100000?000001?00010?000000000011000?000101??100?????1110??00?0??1
000000?0000010010101100---11?110001111000?????11011?0???1?0?0200?1121?000
0?00100000?10001?10?00(12)110?????00001001110?1000000?0100?11?0000?????10
001111?0?1100??1??2?0000210310001010?0??001000120?01?111?11100??1001010
001200?0??????????10?111?0000101?1011?0000001000?0000?-???00?0??????????
??

Lomasuchus

000011100010?111??000?000??00-0?????20?11?0010?00210122111210??????21
10100010100?0000010100100000000001012000?0?01010020001?01?1110100010001
000100000000100101011?0---1111100011??002111210011(12)?011?0?02000?1210
0020000100200010001(12)1010011101000000011?0??1001001?00?010001110000??
??1000111?10?1????01?0?0????????10?0??(12)????????????????1110????????
?????????000000000001000?11??0???1(12)120?1????????110?0?00000??????????
????????????????????0????????????????????????????????????

Montealtosuchus

000011100010011111100?100001000-00?02112001100010000210122111210010152?
2110100010100?0000010100100000000001012000?0001010020001????11101000100
0100010000000010010101100---11111000?1111002111210011(12)0?0?100?0200011
21000200001002000100012101001110100000001100111001001000?010001110000??
???1000111110?1100?01?023000021131110001020?001011?110210?110111100?00
020112001000000000000000100011110001012120?100000011001101000000000????
??????????0??11??????11?01?0???110111???2????0??????????

Uberabasuchus

04001111001(12)0111111000100000000-000021120011000100002101221112100????
?02110100011000?000001010010000000000101240?0001010(12)2?0(01)?????11?02
00?100?100010000000010010101110---11111000(01)?112002111210011(12)1?0?1?0
?02000112100??0?001????????0????????????????????????????00?0100????0?
?????(12)00??11010?11????????0?0211311?0002120??0?1011?1102111111?11110
??0??2?11210??01100010?00?00111200010?212001?000??1???11010?0000000?0?
??????????0????11???1?111(1 2)01?????1101110???2(0 1)20?(0 1)01001???????

cf. *Hamadasuchus*

0500221100100111??000000000000-00012112001100000001210122110210310052?

2110100010100?0000010010101000000?01012000?000101002?00?????11101000100
0100010000000010010101100---111110021?11000(12)111?100110?01100?02000112
1000100011002000?00010202002010100000001100?11002?01100?0100?11?0100?1?
??100?1120?0?1110?01?02300??????11?????????0????????????110?????????????
??????01?000000001000???(12)0000012120?2000000110011010?0?000??????????
??

Caririsuchus

????2111001?0111??1??????????100001201?000---00---(12)?01211002100??????21
10100010100?0000010010101?00000?0001?0?000101001?00?????11101?00100010
001000000001001010110?????11111001??100002111?100110?0?1??????????1?????
??0????????????????????121?0?1
????01?02?????2(12)1(03)?110001100?0?01???12)?(02)?1????????????0??(12)?1?2
?0???00?01000000100?0?(01)00000?11(12)001?000?????110(12)0?0?000?????????
???????00?????1?????111020?????0???0???20200001000??11????

Sebecus

0500121?1012011111?0?0000000001000?1(12)0100??????????2101211??21?30---?
21?0100020-00?00000100?0?01?0100?010????0?00?10100?000?????1110210010?01
00010?00000(01)001010110?????111110021?10000(12)111?10011?1?0?1?0?02??011
210?0100001000000?000?1101???110?0???0001100?01??2?????????100?11?0000?1??
?100?11(12)110?1110?01?0?30000201??1000011?????01011?020?????1?01???????00
21112?0(01)?0?000010000001000011(01)00000110(12)0?10000000211110100000000
0??

Anatosuchus

1???102100110110111000110001000-0?00211200110101000021?0101002100?????12
(12)?0100111000?000001011?1000001000000(01)000000001010010001??1?1010100
01000100000010000010010001100---111110011?100002???00011???0?1000020001
121000?000010(02)(01)000100010202002?(12)0110?000?100011001100000?0100?1
1?00???????1000111010?1100?01?0200?0020131???110001???0?01000020?11?101?0?
100??1002111001?0?011000000001100111000001010(12)0?1?000000?000011000?0
00000????-?00?????????11???????11?02?????11011?????(1 2)100000(0 1)001???????

Kaprosuchus

0??030210??1011000?00011000010240100100100110101010121012110021000---02
110010011100?000001011?100(01)0010000200?0000000111002101?????1011200010

00110000010000010010101100---110111121211100????10011?????1?0?0200011210
1011000102000010001020202001011113000110011100210000????????????1???1
????120?0??00????????20??011100010??1?110??0201?1??0?110??10?201100
1?0??000000000001(01)000012000011202002?000000???11000000000?????????
??

Mahajangasuchus

1??0?0210??011001100??10001?0(12)??0??????11010100012100101???00?????
?(12)?0?1001?000?000001011?10020000000201240100001110011011?01?101021001
000110010000020010010101110---110111121?11200????10011(12)?02100?02000?
12101??000?1?2??0010?011202?1112011012000110010100210000??0100011101001
1???1000?12000?1100?01?02300??20131011100010??0?11000021011100-00??0??10
0211(01)101?0?00?00000??00?0000??0000??1(01)1001?000000(12)0011(01)000000
000000????1110000000??111??1111112010?1??1101110???(12)(01)?0000001?????
??

Theriosuchus_pusillus

1(12)?100110011011?1?1001?10000001?00002010001???0?00001101211002100?????
?2100100011101000000100001010001111000110?0?000101010?001001?10011?00?0
0010000?0?000101001010110????11100000(01)10000011???0011???01110?0200011
21010?00001000000000011102102010?10000001100011001000000?0????11??0???1?
?01000122?10011?0?????230(01)0000-??1200011???0?0000??10??0110?00?????00
0?????????0?000000000000100011100000112200(12)0000000??100?00000000?????
??????????00??1???????(0 1)010??1?010010?00102(01)?000010??011????

Theriosuchus_guimarotae

1???001?0011?11?11?00??100?0001?0??02010?0110001000011?121?00?10??????21
00?01011101?000001000010000011??000??0?0???1?1010000????10011?00100010
00?0??00?1?1001010110????11100000(01)1000?011???0011?00?111?02?00??210??
?0?0?1?????00??1110???(12)0?01???00??1?0?01??10000?????????????????????0?
22??0?????????????????0200?012???1?00??0?001???10201?????0?00?????????(12)??
???0000000??0?100???10?000?122?01000?0001??100?0?0?0001?????????????????
??

Stolokrosuchus

12113?11001?0?????0??????100100011201(12)0011?1020001210120100211012111
?11??100?010?1?000001001110100000000100-300?0001010100001?01?100?1000100

0110010000000010010101100---111110?2(12)?11000????00011011011000020??112
100120?0011100000?00??0?????0??????011?0??10??00100?0100?1110000????0
000122000??1?0??1??2301????????????????????????????1?0?????????????????
???01??00????0?100???1?000011?1001??????????0?0?0?00?????????????????
??

Calsoyasuchus

1???3011001101?????0??1101?0001000010-0000111102110101012010021030---011
1210010100101001010010101000000000012000?0001?1000?00?????110011?010001
00?0?0100???100101???????11??10?0?0?11000??(01)(01)?10011?110111??2????112?
???1???0101??0?????????????????11000?0?????????????????????????????????
????????????1??01??
00?02?0?0?0???10000011?2001????????????00?????????????????????????????
??0?

Eutretauranosuchus

1???101?0010011111?001?10?0?0?0?????????0?000--00---110120????10??????11001
00?10001?100101001?1?1??000100011001?00010100000011???11001100100010000
00?00000100?010110????1111100?(12)?1?0?0?(01)1?0011??011?0?220001120001
(12)000010210000000111021020101000000011?00?1001000100?0100?11?00?????
00001220?0?1??0?????2???0?21100110001100??0?00110?10?0?111????1???0?02?10
100000?0???0?02?01??0???0?0?1(01)2001000001020110?100?????????????????
????????????????????????0?????????????????????????????????

Sunosuchus_junggarensis

1???201?00100111??100??10?0002000010-00?000--00---?101201002103101??0110
0100110001?100101001?1??000100?00011000?000101000000?????110011001000100
0000?000001??1010110????1111100?(12)?110?0101(12)-?0011??01110?220001?2?0
??200001021000000011102?020101000000011000?10010001?0?0100011?00???1???0
000122010011?0?????2?01002(12)?001?0001100???001100102?1?110?0100??0002
010100000?011000002001?0?0??(01)0000011020?10000????01100?0000?000000??11
?????????0?????1?????1(0 1)010???1??1101110???2?00001010?0?1????

Sunosuchus_miaoi

1211(12)00(12)001?011111?00?????????0????????????00--00---?????????????????(1
2)?0?00?????-?100101??????000000?0000-000?0001010?0000?????1100100010??1
000000?00000100?010110????11111001(12)????0?(01)(12)?10011??0?1???22000?

1210???00??10???000?01110200201010000000?1000?10010?0100?01???11??0?????
??0000?220?0?11?0??1??2??1?021141??0001100??0?00(12)?????01?1?0?1?00??000
2010100000?01??0000200??0??1????????20??0??????????0?0?00??????????
??

Sunosuchus_thailandicus

????(12)?????1?????11??
??0????????????????????????????????????
??
??2(
12)?41???01100????00??????01?1???1?0???0??20101000?0?????????0?????????
????????????????????????????????0??
????????????????????

Siamosuchus_phuphokensis

1(12)?1101?0010011????10???0?010200?010-00?00-----?1?1211002103?????0210
0100?11101?1001?100101?1100100?(01)(01)0??(03)?0?0010?0?000?????1110???0?
0??10000?01?00?0??1?1???????11?1?????1?????????0011?????10?0???1121??
????01????????????(12)0????????????????????????????00?0100?11?10??????000?1
220?0011?0?????2?0???01
?000102001100?00(01)000002112?02?000?????1?0?0?0?0?001011??11100???0???
?1??111?00??10?1???????0???2?0?0?01011???1???

Amphicotylus_lucasii

12111011001?0111???001110?0010200?010-001000--00---1101211002104111??0110
0000?11101?1001010010101101000?0100-300?00010110?10(01)1????1110111010?0
10000101100001001010111????111110012?11000??12-10011???0?1?0?02000112101
120?001000000000??? (12)0?????0?????????1?00?00?000100?0100?11??000?????0
001220?0?11?0??1??2001?????????????????????0????????????????????????????
??01?0001020011000?0101?002112002?0?0?????1?0?0?0?10????????????????????
??

Amphicotylus_stovalli

---1101100-00111????011101?0-02001010-00-000-----10121100210410032-11001
001-1-01-1001010---1--0-000--100-100-0-0101--1-----1110--101-0010000101--000
1-0-01011-????---110--2----01----1-0-1--0-1--0-0??112000-20?0-100000000-?1?0??
1020????????????????????????0-0100-11--0-----00-?220--01--0-----??????????

??011000102001100-00-000--211200-
????????????????00-?-00??
??????????

GMNH-PV0000229

1???10-?001001111110011101-01-2-011?0-0010-----1101211002104100--011000
00111-01-10010100101011010001-100-100-000101021-0-----1110?01011001000010-
1000010010101100---111110012-110001-12-10011---011---020011120001-0?0-10(0
2)(12)00000-?1200110201011--000?--00011001-00100-0100-11--0-----0001220100
1--0-01--200100101-11-0001100---100(01)10-10-0-1110(01)-----0002010100000-011
000102001100-00-000--21120020000010(12)00100100---00000011101110000000001
11001111(0 1)02010-1111001110(0 1)11(1 2)-{0 1}-0-01011-----

Nannosuchus

12111011001?0111??1??1?101?0002001010-00?000--00----110121100210(34)?????01
100000111101?0000010000101101001?0000-000?00010?021101?????110211010101
000010110000100(01)0101101???111?000?(12)1100?01112-10001???0?1?????????
??100??00??100?11?1000?????0??
?220?????0????2??1?0?????11000?????????00??10?????110?????????????????????0?
?1?000002001100??????0??10?????0?????????1?????????00????????????????????????
??

Goniopholis_simus

1211101100100111111001110100102101010-001000--00----110121100210410132011
000001111010100111001010110100011100-101?0001020211011?01?11102(01)11111
01000010110000100011011011?1111110012?110?01112-10011(12)??011?0?0200011
21001200?0102100000001110210201010000000?00??1001000100?0100?1111000??
??000001220?0011?0?01-020010010110110001100??0?00010010201111?010100??00
02010100000?01100010200110000010000021120021000110200100100001000?????
??????00000??1?1?????00101011?????????0???2(01)?00001010???????

Goniopholis_kiplingi

1211201100100111??10??1101?0102101010-001000--00----110121100210410132011
0000011110101001110011101101000?1100-100?000102021101?????1110201111101
0000101100001000110110?????111110012?110001112-10011(12)1?0?110??20??11210
??2000?????????00001??02102??0?????000??????0?100?100?0100?11?1000?????00?
?220?00??20?????20?1?????????????????????0?????????????????????????????????0

1?00010200110000?1000002112002?0?0?????1?0?0?0?100?????????????????????
?111???

Goniopholis_baryglyphaeus

1???101100100111111001?10100?0?????10-?01000--00----110121100?1?????????1100
0001111010100111001010110100010100-100?00010102?101110??111020101110100
00101?00001000110110?????11?11001221?000??12-10011?100?110?02000112100??0
???1?????00?00111020020?01000000011?00??00100?100?0100111?1000?????000??2
20?00?1?0???020010?00---110002100??0?00010?10?-1?1?000100??0?02010100?00
?011000?020011000?010?0002112002100011020010010000?00001??????????00????
????????????????????????????2??0?01010????????

Hooleygoniopholidid

1211101100100111111001?10100?0?????1?????00--00----11012??00???(34)??????11
00000111001?100111001010100000011200-300?1?0101020102?????11102110101010
00010121000200001011?1???110100002?110001222?10000??0?1?0?02000?121011?
00?011210000100111020020101000000?11000?10?1000100?0100?11?1000?????0000?
1220?0??1?0??1-?20010000---1?0002100????0001?010?-1?11100000??0?02010100?
?0?011000102001100?0?????0??112002200011000010?100001000??????????????0??
??????????0????????????????????2??00010?0????????

Dollo_goniopholidid

12111011001001111110?111010010200?010-00?000--00----1101211002104?????0110
0000111101?100111001?10100000011200-300?10010?020102?????1110210000?0100
0010?210002000010110?????110100002?110001222-10000??0?1?0?020?011210???0
0??1?????001001?10?0020?01?????????1000??0?1000100?0100?11?1000?????00000?22
0?0??00?01-02001?000---110001100??01?00100102-1?1?00?0???0?020101000000
011000102?01100?0?10??0?211200220??11000010??0000??0000011??1110000000??
111??1111(0 1)01010?1??1001000??2??0001010??01????

Hulke_goniopholidid

12113011001001111??001?101?0102001010-001000--00----1101211002104(12)00??0
1100000111001?1001110011101000000?1200-101?10010102010111?1?11101100101
011000001100001000110110110?1101100022110001112-10001(12)1101110?0200??1
21011200001111000000011102002010?100000011?00?10?10001?0?0100?11?1000???
??00001220?00?1?0?01-02001??????????????????0?????????????????????????
??????01?000102001100?001000002112002?0?????????1?0?0?0?00????????????????

??

Pholidosaurus_schaumburgensis

1000300200110111??100??00-0?02?????-?0?00--00----1101101????(3 4)1????(0
1)100100?0--0-?0000010010101000000?1200-100?000100021101????111011001010
11001001100001001010?101101110100002211000??12-10000?1?01110?02?00?1210-
??0001111000000?01110200201010000000110001100?000100?0100?1111000?0???0
000122000?11?0?010020010?????010000111?????00210010?0?012?000?0?0?002011
200100?011000102001100?00?0?0?0(01)200-0000010202???1?000100011?????????
?????0???11?????????0???1?????????????(0 1)???0???1?????????

Sarcosuchus_imperator

1211201200110111111001?0?00001000010-000000--00----01011010021131001001(
01)0010000--0-?00000100101?10?000001100-300?1001020001001?00?110111001011
1000100?210002001010?100---1111?0012?10000??(01)1-11000?1?01100?020001121
001001001110000000011102001110100000001100?11001000100?0100011?1000?0??
?0000122000?11?0?010023010010100000001110?00?002200000011120010101???002
010100000?0110001030011000001111012001000200211000000020000100000001???
00??000?0???1?100111100?010?1?????????0???21200001011?00?????

Elosuchus

1211211200110111??1001?0?00002000010-000000--00----11011010021131(0
1)04201100100011011?0000010010101000000?2200-200?10010101010?0?????110111
0010?01000100111000210(01)010?100---111110022111000??(01)1-11011?1?0111?0?
20001121001200001120000000011202001?20100(12)100011000110?1000100?0100?
11?1000?????00001220?0?11?0?01002301?22100?????11???????02?01?0?0?1?01?
?0???????0?200?????01?00010(23)?01100000(01)0000021(01)2001?000???????0?0?
0?10?00?0??2???00010?1?????????

Vectisuchus

1(12)?121020011011111?01?10?-000?????-??0000--00----110110100?11(34)?????
1100?00000-?-??0??01????10?000000?2200-201?10010?0(12)0?0?????1101??0010?0
10001?0111000210?010?1?????11111001211?000????-11000?1?0?????02000?1210??
?0?0???????0000011202001020100?0000?1?00?10?1000100?0100?11?0000?????0000
1220?0?11?0???????0100?20101000011?0?????002??010001?120?0?10???1?02011100
100?011000102001100?00???????0(01)(12)00-(01)00???????00010?0010000?0?1????
????????????????????11?0???????????0???2???0?01011?0??????

Dyrosaurus_maghribensis

13102112001101110010010000-0002000010-000000--00---010110100211311010011
00110000-1-?00000010010101000000022012000?000101010000????110?1100101011
0010011100?200101011011011111000221000010(01)?-11000?1?0?100?0200011210
01200001110000000011202001?20100000001100011001000121?0101?1111011?0???
01101220?0?11?0?010023010110?00000001110??000023001020?0120000000??1002
112210111?011000002001100?00000000100200-0000000212100101001000010?????
???00010??1???0???00?0?011??11011100102???11010??????????

Dyrosaurus_phosphaticus

1??0(2

3)1120011?111??10?10000-0002000010-000000--00---0101101002113???100110011
0000-1-?00000010010101000000?220?2?0?00?1???000?1100?110?11001?1?1?001?0
???00?(12)0010?????????11??100??21000010????10??(12)???1???0200?1121?01???0
01110000000????0????????????????11???????1????????????????11?11?????????220????
????????????101?????0000001?????????30????????120??0????????????12?1?1?1?0110000
02001100?00000000100??0-000?00021210010100100?0????????????????1????????????
??

Congosaurus

1??? (2

3)1120011?1??1110?10000-0002000010-0?0?00--00---01011010021131?0100110011
0000-1-?0000001001?101000?0?0?????????00?0????????????????1??11????1??????0???
??? (12)0010?????????1???100??2100?0?????????????????020??1121001?0000011100
0???0???0????????????????11????????????????????????????????0?????????????
???00?????000011?????1???0???????120???0?0?1???112?1?11?01100000200110
0?0?000000100??0-00?00021210010100?0?0010?????????00010??1???111?00?01?1
1??11011100??????11??????????????

Guarinisuchus

1310111100110111??10010000-0??2000010-000000--00---0101101002113?????0110
0110000-1-?00000010010101000000?22012001?001?0?0(12)0000?????10?110010101
21010011100?2001010110????111110002?10000??(01)0-11000???01100?0200011210
012000011100000000112020010201000000011000?1001000121?0101?11?1011?????
11101220???11?0?0100230100???0?0000??1???????2?0010?0??1200???0???0???12
???1???01100000200?100?00000000100200-?0????????1001010010?00?0????????????
????????????????????0??????????????2????????????????

Rugosuchus

1(12)?1200?0011011111100??00?000(12)?0?0020?0000---00---(01)1012(01)100(12)
 10(03)1????02100100010101?11000100101(01)1000111?00011000??010101?00??
 ??1001010010?010001?0??0000(12)00(12)010110????1111100(12)2?11000??(01)?10
 011???0???0?020001121010?0?0?1120000000011102102020????000???0???100?1
 00?01000110?00?????0000?(12)2??0?1100????2??00000---??00011?????0001?010(
 01)?1?110? ??????0?0201(01)(12)?0100?0(01)(01)00000?00?100?1110000011-2002?0
 00?????????0?0?00??0? ?????????0000????????????????????????????2??010??
 ???11???

Bernissartia

1101001100110111111001?10000002000010-000000--00---0101211002103?1???011
 00100011101?0000010010100000000?0(01)01(01)00000001010(12)20001?01?100111
 00?0001000010?000001001010110100?111110012211000??(0
 1)0-0001121?011?00020001121010001001?100000000?020(12)0?(12)020?0???00011
 000010?100?10000100011?1000????000?122000?110000?0023010000---1200011101
 ?01000000100-0?10?000?00?00002010100000000000000(13)000100?1110000011121
 02000?00110010010000000000?1??10?????000?0?01?10111110010101100?????0010
 21200101001?001???

Susisuchus

1101202100110111001??1?100-0002200010-000000--00---0100101002100?????0210
 0101002-0-?0000010010101000000000010000?00010??0000?????10012000100?100
 000000000?10010001111001111?100??00000??(01)(01)-000?11??0?1?0??????????
 ???00???????1?00???????0???220
 ?0?????0000230????????????1??0???0?????1???1????0?????????01??000?????0
 ?????????????????00?10?????????????????0?????0?010?????????000?????1???????0
 0?01?????110110????20211100001???????

Isisfordia

1101201100110111??100???0?-0002200010-000000--00---0100101002100100420210
 0100?02-0-?0000010010101000000000012000?000101010000?????100120001000100
 000000000010010101101001111110012?11000??(01)(01)-0001111?0(12)1?0?020001
 12101100100112100000001120200103010-??00011000110?10001?0?0100?11?0000??
 ???00001220?0?11?0000002300?02(12)?(01)0???????0????0?????1?20?????00010???
 ???0?????????0000000000001100?1100000010020?0?????????????0?0?000000101????
 ??????????0?1?1?????001010?1??1?0???0???222?1100001??1?????

Allodaposuchus

1??1101?00110111??00???0?0002000010-000000--00----0100101002100100420210
0100?12101?0000010010101000000100012402?000101012000????10012100100010
001001000001001010110????111110012?11000?(01)(01)-00011?110(12)1?0?020001
12101?10100100000000?000212???031?0???00001????10??0??00?0100?11?1000??
?10000?22000?1?0000?-02000??
??????0110000010011000001000001112102?0??????????1?0?00000????????????
??

Iharkutosuchus

1??001(0

1)00110?????00???0?0002000010-000000--00----01001010021001004202100101?0
2-010000000110010000000--002-----?000101012000????10010000100010000000
00(12)001010110?????1111001?00?00?(01)(01)-11011?1?0?110?011001121010001
00100000000?00021200103100-??00001000110000100?0?0100?11110?0????0000?2
2100???00????2?0?0000---000102111?0?000000201-1?00-10000???0?0201??????
011000100020100000000000110221030000000010000?10000000????????????
??

Hylaeochampsia

1?0???1?0?110?????100??1?0??0?????1?????000--00----0?????00?????????(1
2)00?00?????01?00000?110010000000100001100000001010120001?010100100000000
1000000100000100101011?????1???100??210000?(01)(01)-11011211011?002100?1
21010?010?100000000000021200103100-??00001000?100?0?011000100?11?1000??0
?10000122?00???000-02000??
??????0?????0??????????????00??221?3?????????????0?????11????????????
??

Gavialis

11013102001101000110010000-0002210010-000000--00----010110100211310010001
00100000-1-00000010011101000000011012?0?0000111010000111101111110010101
1000001000002001010110100111011001221100010??-1101121101110002000112100
100100111000000000021200013100-0000001000010000001001010001110100110000
01012200001100010002310002110000000110000000023001000101200001000?1002
0112100100011000001001100000000000100200-000000020200010000100111111111
11010000000111011111000010110111011000101110101000100110?00

Piscogavialis

1101311200110100??10010000-0002210010-000000--00---010110100211310010001
00100000-1-?000001001110100000001101220000001100100001111?1000110010101
1001001000002001010110100?110110012211000????-1101121101110?02000112101
100100111000000000021200113100-00000010001100100010010100?1110100??000
0001220?0011?00100023100022??000000?100???0023?010?0?01200?01???0???0??
???????011000001001100000000000100200-00000002020001000010011?1?????????
?0???????????100?0?0?1???????0010?????101000?????????

Eosuchus

1101301100110101?110010000-0002210010-000000--00---010110100210310022011
00100000-11?000001001110100000000001000000001100120001111?1000210010001
1000000000002001010110100?111110012211000?(01)1-01011?1101110?020001121
01100100112000000000021200113110-??000010001100100010010100?1110100???1
?00001220?0?11000100023100022?00000001110???0?0200020?0?0110????????1???
112?????011000001001100000100000100200-000000020100010(01)0010011111111
11100?????????????????0?????????????????????1101?10001?????????

Tomistoma

11013012001101100110010000-0002210010-000000--00---010110100210311021011
0010001101100000010010101000000000010000000011101210011111100121001000
1000100000000100101011010011111100122110001001-000111110111000201011210
1100100110000000000021200103100-00000010001100100111000100011?0100??111
0000122010011001100123100021100100001111001000230020201011000010000100
2011210010001100000100110000000000011020010000000212100100001001111111
01110?0000001111111110010??1111110110001011(1 2)1111000110110101

Crocodylus_niloticus

1101201100110111111001000010002210010-000000--00---010121100210311021021
0010001111110000010010101000000000012000001011000(02)100111111011210010
001000100000100100101011210001111100122110001000-0001111101110102020112
101100100112000000000021200113100-0000001000110010011000010001110100111
110000122010011001100123100021100120001110101110010012201000-0001010110
0201121001000110000000011000001000001102102000000110010010000000111111
10111010000000011211111001010111111011000101201111000110110101

Crocodylus_porosus

1101301100110111111001000010002210010-000000--00---0101211002103110210??

00100011111100000100101011000000??012000001011000(0
2)10011111101121001000100010000010020010101121110111110012?110001000-00
01111101110102020112101(01)00100112100000000021200113100-00100010001100
100110000100011101001111100001??0100110011001231000211001200011101011?0
010012201000-0001010110020112100100011000000001100000100000110210200000
01100100100000001111??10?11??0000000112111110010??11111101100010120111
1000110110101

Osteolaemus

11011011001101111110010000100020100110100000--00----?1012110021031100002
100?00011111000000100?010110000000011000000?0111010100111111?0121001000
1000000000000100101011211101111100122110001000-000111110111000202011210
1100100011000000010021200003100-??10101000?10010011(01)00010001110100?11
110000122010011001100123100021100120001110101?10000010201?00-0001010110
0201120001000110000000011000011000001102102000000110010010000000111111
1011101000000001111111100101011111101100010(1 2)211111000110110101

Voay

1101101100110111111001000010002010?10-000000--00----?101211002103110000(1
2)100?000111110000001001010110000100011200000?011001010011??11?01210010
0010000?000020010010101120---111110012211000??(01)0-000111110111010202011
2101110100112000000010021200103100-??11101000?10010011?000100?11?0100??1
1?0000122010011001100123100021100120001110100?1000001020??00-0001010110
0201120001000110000000011000011000001102102000000110010010000000111111
?01110?00000??111111111001010111111011000??(1 2)???101000?????????

Brachychampsia

1101101?00110111111001000010002200010-000000--00----010010100210021152021
00100012101000000111?0100??00000100120000000110012001?????1001210010001
00000000000010010101101110111110012211000??(01)0-0?011111011100020?01121
001?000010210001??00021200103110-??010?1?00110010011(01)?00100?1110100??0
?10?00122010011100101123100?2(12)?00121100110100?00000010201?00-?0?1100?
100201120001010110000?00?100011?0100011021020000001?0010110000?001?????
0??????????00?????????0????0??1?????????????1112????1?0?????

Diplocynodon

1101101100110111111001000010002010010-000000--00----010121100210011000011

0010001210100000010010101000000000010000000011001000011???1001200010011
0000000000001001010110111011110012211000???-0001111101110002000112101
1?0000112100000000021204113110-??01011000110010011000010001110100??0110
000122010?1110010012310002(12)?00120001110100100000010201000-0001100?10?
20112?00?0101100000000110000010000011021020000010100101100000001?????0
??????????0???02????0???0??1?????????????????????1?1????0?

Alligator_mississippiensis

11011012001101111110010000100020100110100000--00---01001010021001100002
1001000121010000001111010010000000001000000001100100001111110012100100
0100000000000010010101100---1111100122110001000-000111110111000200011210
1110000112100000000021203103110-000101100011001001100001000111010011011
000012201001110010(01)123100021100121101110100100000010201000-000110011
0020112000101011000000001100011100000110210200000011001011000000011111
100111010000000011111111001010111111011000101111121000110111001

Caimancrocodilus

1101101200110111111001000010002010010-000000--00---010010100210012000021
001000121010000001000010111000000010-0001000110000000111111001210010001
0000000000001001010110(01)1101111100122110001000-0001111101110102000112
101110000112100000000021203003110-000101100011(01)010011002010001110100
110110000122010011100101123100021100121101110111?00000010201000-0001111
0100201120001010110000000011000111000001102102000000110010110000000111
11100111010000011011111111001010111111011000102101111000111111001

Caimanlatirostris

1101101200110111111001000010002010010-000000--00---010010100210012000021
001000121010000001000010121000000010-0001000111000000111111001210010001
00000000000010010101100---1111100122110001000-00011111011101020001121011
10000112100000000021203003110-00010110001100100110020100011101001101100
00122010011100101123100021100121101110?11100000010201000-00011110100201
1200010101100000000110001110000011021020000001100101100000001111110011
101000001?011111111001010111111011000102101111000121111001

Melanosuchus

1101101200110111111001000010002010010-000000--00---010010100210012000021
001000121010000001000010121000000010-000100011100000011(01)111001210010

00100000000000010010101100---1111100122110001000-00011111011101020001121
01110001112100000000021203003110-00110110001100100110020100011101001101
10000122010011100101123100021100121101110111100000010201000-00011110100
2011200010101100000000110001110000011021020000001100101100000001111110
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(d) Table. Palatal and hyoid morphologies

Group I	Group 2	Genus, species	Specimen	Reference	Curvature (=length/data nce)	CB length/skull width	Posterior margin of internal choana (Distance between posterior end of internal choanae to skull posterior end / Skull Width)	Anterior margin of internal choana (Distance between anterior end of internal choanae to skull posterior end / skull width)	FAD	LAD
Non-Neosuchia	Non-Neosuchia	<i>Chamaesuchus</i>	MCZ 4038	Yoshida pers. obs.	1.08	0.58			242	237
Non-Neosuchia	Non-Neosuchia	<i>Euparkeria capensis</i>	SAM-PK 5887	Yoshida pers. obs. (MCZ VPR8176, cast).	1.01	0.88	2.18	2.86	247.2	242
Non-Neosuchia	Non-Neosuchia	<i>Eretmosuchus granti</i>	NHMUK R3139	Walker 2002			0.53	0.56	237.00	208.50
Non-Neosuchia	Non-Neosuchia	<i>Ornithosuchus longitudo</i>		3143 Walker 1864 Huxley 1877	1.05		1.08	1.15	237.00	208.50
Non-Neosuchia	Non-Neosuchia	<i>Venaticosuchus ruscconi</i>	PVL2378	Von Baczko et al., 2014				0.86	237.00	228.00
Non-Neosuchia	Non-Neosuchia	<i>Desmatosuchus smalli</i>	TTUP9024	Parker 2005			0.59	0.81	228.00	208.50
Non-Neosuchia	Non-Neosuchia	<i>Aetosauros ferratus</i>	MCZ 9479	Yoshida pers. obs.	1.09				228	208.5
Non-Neosuchia	Non-Neosuchia	<i>Aetosauros ferratus</i>	SMNS 5710	Yoshida pers. obs.	1.01				228	208.5
Non-Neosuchia	Non-Neosuchia	<i>Parataphoxys andersonum</i>	SMNS 19003	Schoch & Desojo 2016	1.01				228	208.5
Non-Neosuchia	Non-Neosuchia	<i>Dromicosuchus</i>	UNG 15574	Sues et al., 2003	1.04	0.38			237	208.5
Non-Neosuchia	Non-Neosuchia	<i>Dibothrosuchus elaphros</i>	IVPP V7907	Wu & Chatterjee, 1993			0.85	0.99	199.30	190.80
Non-Neosuchia	Non-Neosuchia	<i>Sphenosuchus acutus</i>	SAM3014	Walker 1980			1.33	1.34	201.30	190.80
Non-Neosuchia	Non-Neosuchia	<i>Terrestriusuchus gracilis</i>	NHMUK R7557 (formely P47/21, 4)	Crush 1984	1.38		1.36	1.75	208.50	201.30
Non-Neosuchia	Non-Neosuchia	<i>Protosuchus haughtoni</i>	BP 14770	Gow 2000				1.03		
Non-Neosuchia	Non-Neosuchia	<i>Protosuchus richardsoni</i>	AMNH 3024	Colbert & Mook 1951	1.07	0.29			201.3	199.3
Non-Neosuchia	Non-Neosuchia	<i>Schizosuchus suchuanensis</i>	IVPP V10594	Wu et al., 1997			0.58	0.81	145.00	100.50
Non-Neosuchia	Non-Neosuchia	<i>Zaniasuchus shepardi</i>	IGM100132	Poi & Noroi, 2004				1.29		
Non-Neosuchia	Non-Neosuchia	<i>Heisosuchus dashangensis</i>	ZDM 3405	Gao 2001				1.10		
Non-Neosuchia	Non-Neosuchia	<i>Mahajangsuchus insignis</i>	FMNH PR 2389	Turner & Buckley, 2008			0.49	0.56	72.10	66.00
Non-Neosuchia	Non-Neosuchia	<i>Notosuchus terrestris</i>	MLP-94-VI16-5	Andrade & Bertini, 2008			0.58	0.86	86.30	83.80
Non-Neosuchia	Non-Neosuchia	<i>Anotosuchus minor</i>	MNN GDF603	Sereno et al., 2003			0.56	0.62	122.46	109.00
Non-Neosuchia	Non-Neosuchia	<i>Arapesuchus patagonicus</i>	MUCPV 269	Turner 2006			0.68	0.81	99.60	83.50
Non-Neosuchia	Non-Neosuchia	<i>Arapesuchus tsangatsangana</i>	FMNH PR2297	Turner 2006					72.10	66.00
Non-Neosuchia	Non-Neosuchia	<i>Merisuchus amari</i>	MZSP-PV 50	Zaher et al., 2006			0.42	0.51	63.50	66.00
Non-Neosuchia	Non-Neosuchia	<i>Simosuchus clarki</i>	UA9879	Koy et al., 2010	1.14	0.37	0.43	0.44	72.10	66.00
Non-Neosuchia	Non-Neosuchia	<i>Yacarerani boliviensis</i>	MNK-PAL5063	Novas et al., 2009			0.45	0.54	93.90	83.80
Non-Neosuchia	Non-Neosuchia	<i>Apletosuchus bordinus</i>	LPRP/USP 0229a	Godoy et al., 2014	1.02	0.50	0.57	0.60	83.50	66.00
Non-Neosuchia	Non-Neosuchia	<i>Calprasuchus palliatus</i>	MPMA 67-0001/00	Iori & Carvalho, 2011			0.75	0.85	83.50	66.00
Non-Neosuchia	Non-Neosuchia	<i>Calprasuchus stenognathus</i>	MZSP-PV 139	Poi et al., 2011			0.79	0.86	83.50	66.00
Non-Neosuchia	Non-Neosuchia	<i>Sphagesaurus humei</i>	RGL-100	Poi 2003			0.56	0.68	83.50	66.00
Non-Neosuchia	Non-Neosuchia	<i>Cassisuchus sanzui</i>	MCMLH 1791a	Buscalloni 2017	1.04	0.45			130	125.45
Non-Neosuchia	Non-Neosuchia	<i>Gobiosuchus kielanae</i>	ZPAL MgR-2	Osmolska et al., 1997				1.12		
Non-Neosuchia	Non-Neosuchia	<i>Lomasuchus palpebrosus</i>	MCZ4064PV	Gasparini et al., 1993			0.54	0.67	93.50	85.80
Non-Neosuchia	Non-Neosuchia	<i>Montealtosuchus arrudacampoi</i>	MPMA-16-0007-04	Carvalho et al., 2007, Tavares et al., 2017			0.80	0.61	83.50	66.00
Non-Neosuchia	Non-Neosuchia	<i>Uberabosuchus terrificus</i>	GPLLP No.630	Carvalho et al., 2004			0.89	0.82	70.60	66.00
Non-Neosuchia	Non-Neosuchia	<i>Baurusuchus saigadensis</i>	MPMA 62-0001-02	Carvalho et al., 2005			0.55	0.63	83.50	66.00
Non-Neosuchia	Non-Neosuchia	<i>Bretosuchus bonapartei</i>	PVL 4735	Gasparini et al., 1993				0.47		
Non-Neosuchia	Non-Neosuchia	<i>Campinasuchus ditini</i>	CPP 1235	Carvalho et al., 2011			0.70	0.78	83.50	66.00
Non-Neosuchia	Non-Neosuchia	<i>Lorosuchus nodosus</i>	PVL 6218	Poi et al., 2011			0.51	0.54	56.70	55.80
Non-Neosuchia	Non-Neosuchia	<i>Pisarrarchampsia sera</i>	LPRP/USP 0019	Montefeltro et al., 2011			0.42	0.45	83.50	66.00
Non-Neosuchia	Non-Neosuchia	<i>Saltisuchus fumens</i>	MCT 1130-R	Kellner et al., 2004			0.60			
Non-Neosuchia	Non-Neosuchia	<i>Sebecus caenophius</i>	MCT-DNPM-RJ	Colbert 1946				0.69		
Non-Neosuchia	Non-Neosuchia	<i>Stratiotosuchus maxhechti</i>	DGM 1477-R	Riff & Kellner, 2011			0.66	0.67	83.50	66.00
Pholidosauridae	Neosuchia	<i>Terminonaris robusta</i>	SMNH P2411.1	Wu et al., 2001			0.19	0.37	93.50	88.30
Pholidosauridae	Neosuchia	<i>Sarcosuchus imperator</i>	MNN 604	Sereno et al., 2001			0.30	0.31	125.00	113.00
Thalattosuchia	Non-Neosuchia	<i>Stenosauros bollensis</i>	SMNS 20281	Mueller-Towe 2006	1.05	0.31			182.70	175.80
Thalattosuchia	Non-Neosuchia	<i>Stenosauros bollensis</i>	USNM 11320 (cast)	Yoshida pers. obs.	1.01	0.50			182.70	175.80
Thalattosuchia	Non-Neosuchia	<i>Stenosauros bollensis</i>	GPT/PE/210	Yoshida pers. obs.	1.06	0.37	0.61	0.68	182.70	175.80
Thalattosuchia	Non-Neosuchia	<i>Stenosauros sp.</i>	AMNH FR10049	Yoshida pers. obs.	1.01	0.42			182.70	175.80
Thalattosuchia	Non-Neosuchia	<i>Gossaurus vignaudi</i>	UJALN-FGT-R1	Frey et al., 2002	1.02				192.1	145
Thalattosuchia	Non-Neosuchia	<i>Gossaurus giganteus</i>	NHM 37020	Young et al., 2009	1.00				190.8	145
Thalattosuchia	Non-Neosuchia	<i>Dyrosaurus maghribensis</i>	OCP DEK-GE 253	Jouve et al., 2006			0.39	0.43	56.00	47.80
Goniopholidae	Neosuchia	<i>Simosuchus jungarensis**</i>	IVPP V10606	Wu et al., 1996			0.34	0.35	163.50	157.30
Goniopholidae	Neosuchia	<i>Simosuchus jungarensis**</i>	IVPP V10606	Wu et al., 1996			0.99	1.10		
Goniopholidae	Neosuchia	<i>Simosuchus jungarensis***</i>	IVPP V10606	Wu et al., 1996			0.34	1.10		
Goniopholidae	Neosuchia	<i>Eudretraurosuchus defisi</i>	BYU 17628	Smith et al., 2010			0.39	1.22	195.70	145.00
Goniopholidae	Neosuchia	<i>Eudretraurosuchus defisi</i>	CMNH 8028	Pritchard et al., 2013			0.30	1.22	197.30	152.10
Goniopholidae	Neosuchia	<i>Amphictylus lucasii</i>	AMNH FARB5782	Mook 1942			0.36		197.3	145
Goniopholidae	Neosuchia	<i>Amphictylus lucasii</i>	GMNH PV0000229	This study	1.31	0.35	0.30	0.82	197.30	152.10
Goniopholidae	Neosuchia	<i>Goniopholis sp.</i>	SMNH P2003.20.1	Erickson 2016	1.32	0.36				
Goniopholidae	Neosuchia	<i>Anteophthalmosuchus hooley</i>	NHMUK R3876	Salisbury & Nalén, 2011; Martin et al., 2016			0.28	0.42	130.00	122.46
Goniopholidae	Neosuchia	<i>Hulkapholis platos</i>	ARI-2045	Photo			0.36	0.51	112.03	109
Paralligatoridae	Neosuchia	<i>Batrachomimus pastozobonensis</i>	LPRP/USP 0617	Montefeltro et al., 2014	1.25	0.56	0.54	0.89	163.5	152.1
Paralligatoridae	Neosuchia	<i>Paralligator gradifrons</i>	PIN3459/501	Turner 2015			0.46	0.58	100.50	83.80
Paralligatoridae	Neosuchia	<i>Rugosuchus nongrenensis</i>	IGV 33	Wu et al., 2001			0.60	0.77	93.50	83.50
Paralligatoridae	Neosuchia	<i>Shamosuchus gladiolotaensis</i>	IGM 100/1195	Poi et al., 2009			0.59	0.69	83.50	70.60
Hylaeosuchia	Neosuchia	<i>Hylaeosuchia vectiana</i>	BMNH R 177	Owen 1874			0.19	0.28	83.50	70.60
Hylaeosuchia	Neosuchia	<i>Pietrarsiusuchus ormezzanoi</i>	PG-1	Buscalloni et al., 2011			0.31	0.37	112.30	109.00
Eusuchia	Neosuchia	<i>Iherarkosuchus makadii</i>	MTM 2006.52.1	Osi et al., 2007			0.28	0.28	86.30	83.80
Eusuchia	Neosuchia	<i>Isisfordia duncani</i>	QM F44310	Salisbury et al., 2006			0.36	0.37	105.30	99.60
Eusuchia	Neosuchia	<i>Alligator mississippiensis</i>	AMNH R07134	Yoshida pers. obs.	1.10	0.33	0.28	0.42	47.25	0.00
Eusuchia	Neosuchia	<i>Alligator mississippiensis</i>	AMNH 46642	Yoshida pers. obs.	1.16	0.31	0.30	0.40	47.25	0.00
Eusuchia	Neosuchia	<i>Alligator mississippiensis</i>	AMNH 43314	Yoshida pers. obs.	1.18	0.30	0.31	0.38	47.25	0.00
Eusuchia	Neosuchia	<i>Alligator mississippiensis</i>	AMNH 43315	Yoshida pers. obs.	1.17	0.28	0.29	0.36	47.25	0.00
Eusuchia	Neosuchia	<i>Alligator mississippiensis</i>	AMNH 43316	Yoshida pers. obs.	1.20	0.31	0.34	0.40	47.25	0.00
Eusuchia	Neosuchia	<i>Alligator mississippiensis</i>	ROM R8039	Yoshida pers. obs.	1.17	0.36			47.25	0.00
Eusuchia	Neosuchia	<i>Alligator sinensis</i>	AMNH R13973	Yoshida pers. obs.	1.27	0.31	0.21	0.33	47.25	0.00
Eusuchia	Neosuchia	<i>Paleosuchus palpebrosus</i>	NSM unnumbered	Yoshida pers. obs.			0.34	0.34	9.53	0
Eusuchia	Neosuchia	<i>Paleosuchus palpebrosus</i>	AMNH 137161	Yoshida pers. obs.	1.10	0.32			9.53	0
Eusuchia	Neosuchia	<i>Paleosuchus trigonatus</i>	AMNH 137175	Yoshida pers. obs.	1.08				9.53	0
Eusuchia	Neosuchia	<i>Allodaposuchus precedens</i>	UPJAM A1	Buscalloni et al., 2001			0.44	0.46	70.60	66.00
Eusuchia	Neosuchia	<i>Allodaposuchus precedens</i>	PSMUB9 Y438	Deflino et al., 2008			0.30	0.46	70.60	66.00
Eusuchia	Neosuchia	<i>Allodaposuchus sp.</i>	AM3-15	Pascual et al., 2012			0.21	0.25		
Eusuchia	Neosuchia	<i>Allodaposuchus subjuniperus</i>	MPZ 2012/288	Pascual et al., 2014			0.21	0.21	70.60	66.00
Eusuchia	Neosuchia	<i>Leldyosuchus sternbergi</i>	USNM 6553	Brochu 1997	1.15		0.33	0.35	72.10	66.00
Eusuchia	Neosuchia	<i>Leldyosuchus formidabilis</i>	SMM P71.16.26	Erickson 1976	1.14		0.32	0.46	61.70	56.80
Eusuchia	Neosuchia	<i>Borealosuchus griffithi</i>	UALVP 40955	Wu et al., 2001					66.00	61.70
Eusuchia	Neosuchia	<i>Caiman crocodilus fuscus</i>	ZSM 81.1937	Yoshida pers. obs.	1.09	0.34	0.38	0.41	3.28	0.00
Eusuchia	Neosuchia	<i>Caiman yacare</i>	ZSM 10.1933	Yoshida pers. obs.	1.11	0.33		0.33	3.28	0.00
Eusuchia	Neosuchia	<i>Caiman yacare</i>	AMNH R73622	Yoshida pers. obs.	1.09	0.28			3.28	0
Eusuchia	Neosuchia	<i>Caiman latirostris</i>	NSM PO 432	Yoshida pers. obs.			0.25	0.26	8.34	0.00
Eusuchia	Neosuchia	<i>Gavialis gangeticus</i>	ZSM 29.1912	Yoshida pers. obs.	1.16		0.20	0.24	23.23	0.00
Eusuchia	Neosuchia	<i>Gavialis gangeticus</i>	AMNH 110145	Yoshida pers. obs.	1.13	0.29	0.20	0.30	23.23	0.00
Eusuchia	Neosuchia	<i>Gavialis gangeticus</i>	AMNH R173632	Yoshida pers. obs.	1.12	0.27			23.23	0.00
Eusuchia	Neosuchia	<i>Toyotamaphimele machikanensis</i>	MOUF00001	Kobayashi et al., 2006	1.14	0.31	0.32	0.33	0.781	0.13
Eusuchia	Neosuchia	<i>Penghusuchus pani</i>	NMNS-005645	Shan et al., 2009			0.19	0.28	11.61	5.33
Eusuchia	Neosuchia	<i>Leldyosuchus canadensis</i>	NMC 8942	Brochu 1997			0.41	0.42	83.50	70.60
Eusuchia	Neosuchia	<i>Tomistoma schlegelii</i>	NSM-PO 18	Yoshida pers. obs.	1.14	0.31	0.23	0.29	23.23	0.00
Eusuchia	Neosuchia	<i>Tomistoma schlegelii</i>	AMNH 113078	Yoshida pers. obs.	1.19	0.28			23.23	0.00
Eusuchia	Neosuchia	<i>Osteolemus tetraspis</i>	AMNH 69057	Yoshida pers. obs.	1.14	0.35	0.20	0.25	6.21	0.00
Eusuchia	Neosuchia	<i>Crocodylus johnstoni</i>	R28550	Yoshida pers. obs.	1.17		0.30	0.32	10.06	0.00
Eusuchia	Neosuchia	<i>Crocodylus johnstoni</i>	R28887	Yoshida pers. obs.	1.15	0.38	0.30		10.06	0.00
Eusuchia	Neosuchia	<i>Crocodylus niloticus</i>	NSM PO 19	Yoshida pers. obs.			0.26	0.27	6.82	0.00
Eusuchia	Neosuchia	<i>Crocodylus niloticus</i>	AMNH 73047	Yoshida pers. obs.	1.10	0.36	0.29	0.38	6.82	0.00
Eusuchia	Neosuchia	<i>Crocodylus niloticus</i>	AMNH 118718	Yoshida pers. obs.	1.18	0.35	0.28	0.41	6.82	0.00
Eusuchia	Neosuchia	<i>Crocodylus rhombifer</i>	AMNH 57713	Yoshida pers. obs.	1.09	0.36	0.30	0.41	3.42	0.00
Eusuchia	Neosuchia	<i>Crocodylus rhombifer</i>	AMNH 77595	Yoshida pers. obs.	1.12	0.31			3.42	0.00
Eusuchia	Neosuchia	<i>Crocodylus acutus</i>	AMNH 7121	Yoshida pers. obs.	1.19	0.35	0.30	0.38	1.79	0.00
Eusuchia	Neosuchia	<i>Crocodylus palustris</i>	AMNH 77632	Yoshida pers. obs.	1.13	0.33	0.20	0.27	5.95	0.00
Eusuchia	Neosuchia	<i>Purussaurus mirandai</i>	UNEFM-GIAAP1369	Aguilera et al., 2006			0.47			

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Institutional abbreviations

AMNH, American Museum of Natural History, New York, USA; BYU, Brigham Young University, Utah, USA; CMNH, Cleveland Museum of Natural History, Cleveland, USA; CPP, Centro de Pesquisas Paleontológicas L. I. Price, Peirópolis, Brazil; DGM, Departamento de Produção Mineral, Rio de Janeiro, Brazil; GPIT, Institut und Museum für Geologie und Paläontologie, Universität Tübingen, Tübingen, Germany; GMNH, Gunma Museum of Natural History, Gunma, Japan; IGM, Mongolian Institute of Geology, Ulaanbaatar Mongolia; IG, the Geological Institute of the Chinese Academy of Geological Sciences, Beijing, People's Republic of China;

IVPP, Institute of Vertebrate Paleontology and Paleoanthropology, Beijing, People's Republic of China; LPRP, Laboratório de Paleontologia, Universidade de São Paulo, Ribeirão Preto, Brazil; MLP, Museo de La Plata, La Plata, Argentina; MNK, Museo Noel Kempff Mercado, Santa Cruz de la Sierra, Bolivia; MNN, Musée National du Niger, Niamey, Niger Republic; MOU, Museum of Osaka University, Osaka, Japan; MOZ, Museo Profesor J. Olsacher, Zapala, Argentina; MPMA, Museu de Paleontologia de Monte Alto, Monte Alto, Brazil; MPZ, Museo Paleontológico de la Universidad de Zaragoza, Zaragoza, Spain; MTM, the Hungarian Natural History Museum, Budapest, Hungary; MUCPV, Museo de Geología y Paleontología, Universidad Nacional del Comahue, Comahue, Argentina; MZSP, Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil; NHMUK, the Natural History Museum, London, UK; NMC, Canadian Museum of Nature, Ottawa, Canada; NMNS, National Museum of Natural Science, Taiwan; NSM, National Science Museum, Tsukuba, Japan; OCP, Office Chérifien des Phosphates, Khouribga, Morocco; PC, ; PIN, Paleontological Institute, Moscow, Russia; PVL, Paleontología de Vertebrados, Instituto Miguel Lillo, Tucumán, Argentina; QM, the Queensland Museum, Brisbane, Australia; RCL, Museo de Ciencias Naturales, Pontificia Universidade Catolica de Minas Gerais, Belo Horizonte, Brazil; SAM, South African Museum, Cape Town, South Africa; SMM, Science Museum of Minnesota, Minnesota, USA; SMNH, Royal Saskatchewan Museum, Regina, Canada; SMNS, State museum of Natural History Stuttgart, Stuttgart, Germany; TTUP, Paleontology Collections, Museum of Texas Tech University, Lubbock, Texas, USA; UA, University of Antananarivo, Antananarivo, Madagascar; UC, University College, London, UK; UNEFM, Universidad Nacional Experimental Francisco de Miranda, Coro, Venezuela; UPUAM, Unidad de Paleontología de la Universidad Autónoma de Madrid, Spain; USNM, Smithsonian Museum of Natural History, Washington D.C., USA.