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Supplementary Data

for

A new metriorhynchoid (Crocodylomorpha, Thalattosuchia) from the Middle Jurassic of Oregon and the evolutionary timing of marine adaptations in thalattosuchian crocodylomorphs

ERIC W. WILBERG

Department of Geoscience, University of Iowa, Iowa City, Iowa 52242, U.S.A., eric-wilberg@uiowa.edu

ADDITIONAL ANATOMICAL FIGURES

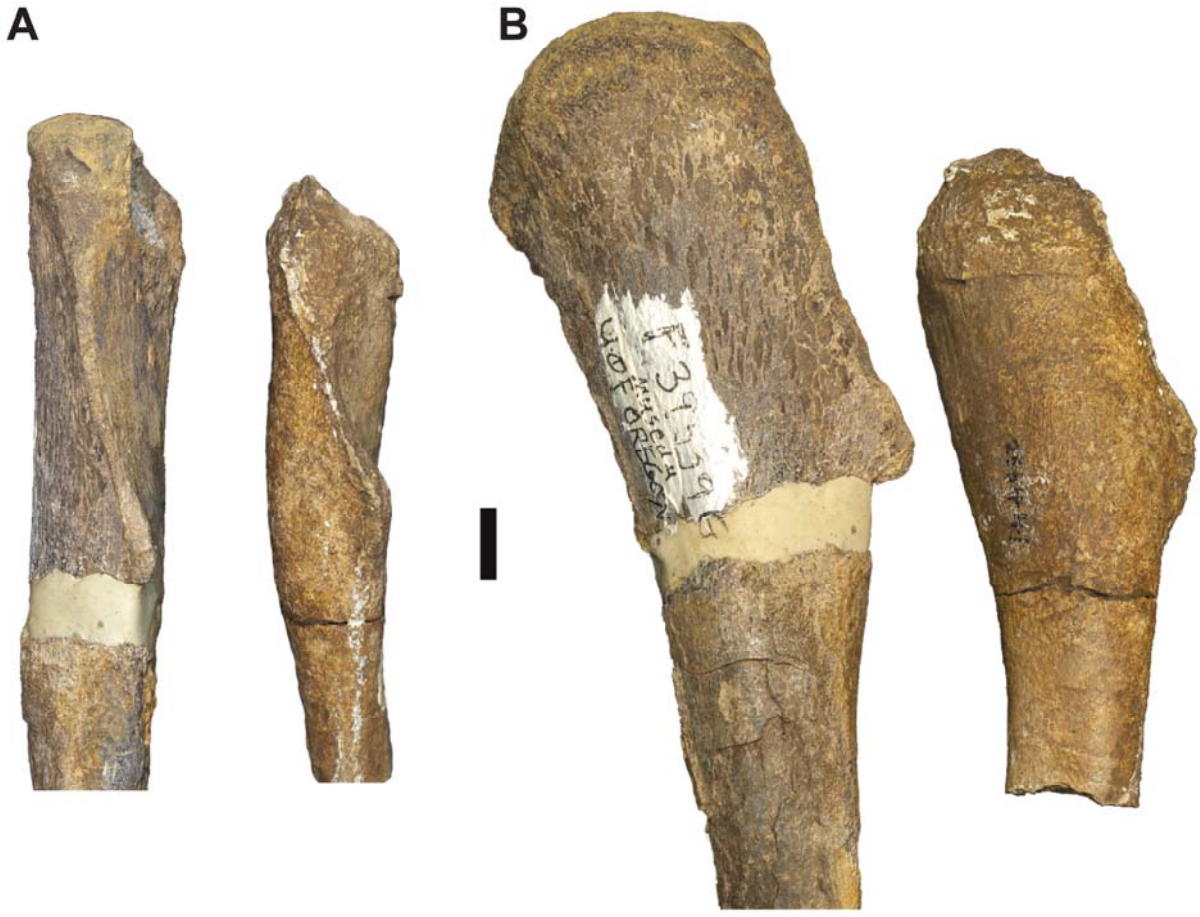

FIGURE S1. Proximal portions of holotype (left; MNCH F39539) and referred (right; USNM 25644) humeri. **A**, anterior view showing orientation of deltopectoral crest; **B**, dorsal view. Scale bar equals 1 cm.

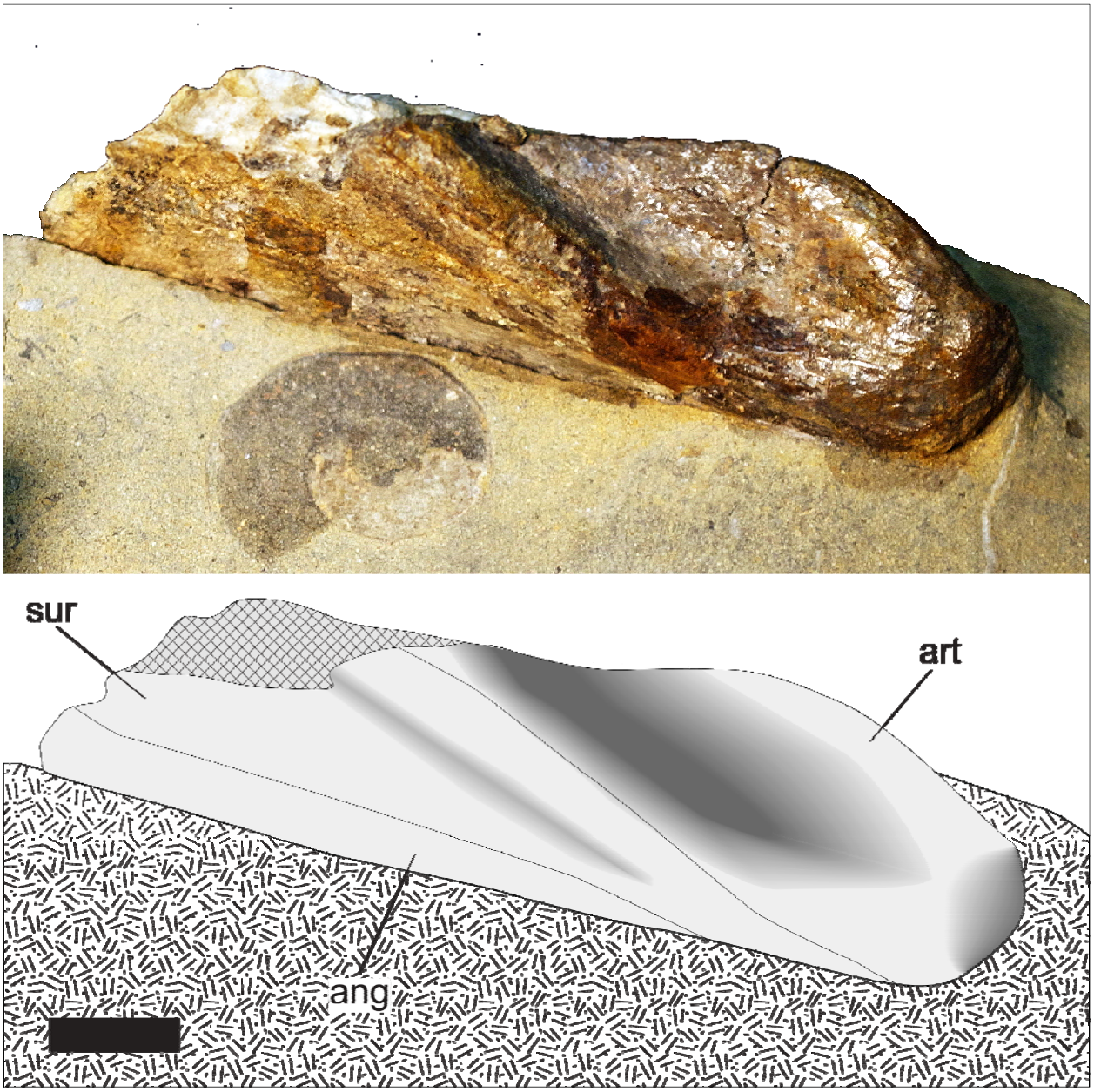

FIGURE S2. Left retroarticular process of *Zoneait nargorum* gen. et sp. nov. (MNCH F39539) and line interpretation in dorsolateral view. Gray hatched regions represent fractured and missing bone. Scale bar equals 1 cm.

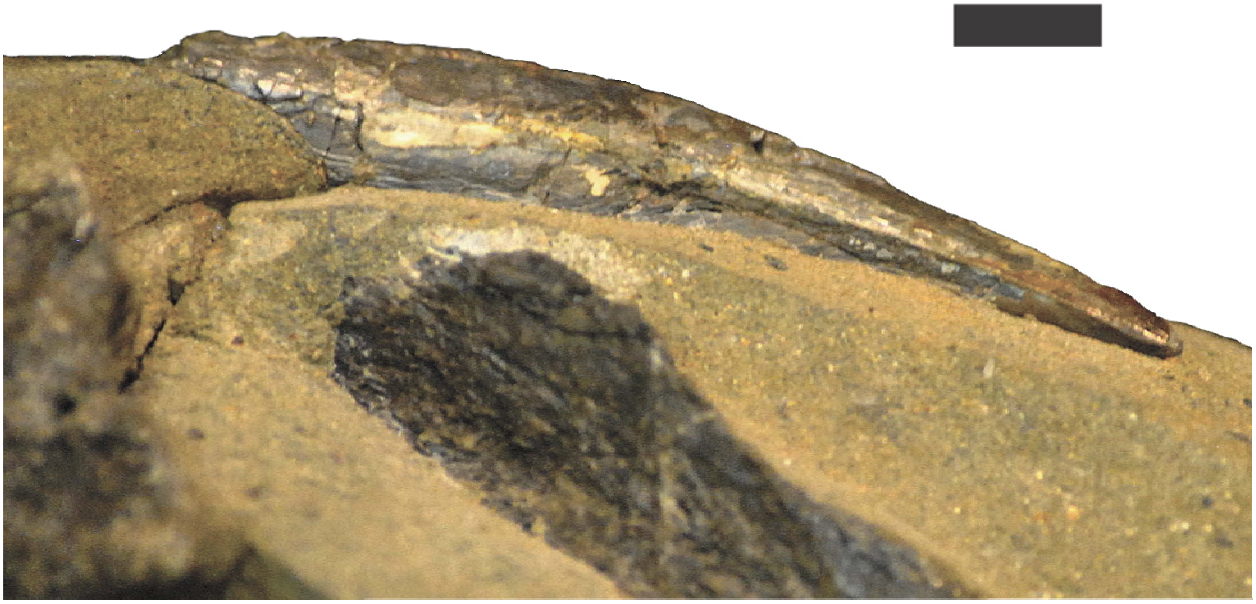

FIGURE S3. Elongate tooth of *Zoneait nargorum* gen. et sp. nov. (MNCH F39539) in posterior view. Scale bar equals 1 cm.

FIGURE S4. Conical (posterior?) tooth crown of *Zoneait nargorum* gen. et sp. nov. (MNCH F39539) in two views. Scale bar equals 1 cm.

MATERIALS

Materials studied and references used for character coding.

Institutional Abbreviations—**AMNH**, American Museum of Natural History, New York, U.S.A.; **BSPG**, Bayerische Staatssammlung für Paläontologie und Geologie, Munich, Germany; **CNRST-SUNY,** Centre National de Recherche Scientifique et Technologique du Mali–Stony Brook University, Stony Brook, U.S.A.; **FMNH**, Field Museum of Natural History, Chicago, Illinois, U.S.A.; **GPIT**, Geologisches-Paläontologisches Institut der Universität Tübingen, Tübingen, Germany; **IRSNB**, Royal Belgium Institute of Natural Sciences, Brussels, Belgium; **IVPP**, Institute of Vertebrate Paleontology and Paleoanthropology, Beijing, China; **MCZ**, Museum of Comparative Zoology, Harvard, U.S.A.; **MNHN**, Muséum National d'Histoire Naturelle, Paris, France; **NHMUK**, Natural History Museum, London, U.K.; **OXFUM**, Oxford University Museum, Oxford, U.K.; **SMNH**, Saskatchewan Museum of Natural History, Saskatchewan, Canada; **SMNS**, Staatliches Museum für Naturkunde, Stuttgart, Germany; **SUI**, University of Iowa Paleontology Repository, Iowa City, U.S.A.; **UH**, Urweltmuseum Hauff, Holzmaden, Germany; **UOMNH**, University of Oregon Museum of Natural and Cultural History, Eugene, U.S.A.

Postosuchus kirkpatricki–Weinbaum, 2002
Sphenosuchus acutus–Walker, 1990
Dibothrosuchus elaphros–Wu and Chatterjee, 1993
Zaraasuchus shepardi–Pol and Norell, 2004a
Gobiosuchus kielanae–Osmólska et al., 1997
Orthosuchus stormbergi–Nash, 1975
Protosuchus richardsoni–Colbert and Mook, 1951; MCZ 6727; AMNH 3024 (holotype)
Shantungosuchus hangjinensis–Wu et al., 1994
Sichuanosuchus shuhanensis–Wu et al., 1997; IVPP V10594 (holotype); IVPP V12088
Zossuchus davidsoni–Pol and Norell, 2004b
Kayenta Form–Clark, 1986
Edentosuchus tienshanensis–Pol et al., 2004; IVPP V3236
Hsisosuchus chunkingensis–Li et al., 1994
Simosuchus clarki–Buckley et al., 2000; Kley et al., 2010
Libycosuchus brevirostris–BSPG 1012 VIII 574 (holotype); MNHN MRS 3101; MNHN MRS 3102
Araripesuchus gomesii–AMNH 24450 (holotype)
Araripesuchus patagonicus–Ortega et al., 2000
Malawisuchus mwakayasyungutiensis–Gomani, 1997
Uruguaysuchus aznarezi–Gasparini, 1971
Notosuchus terrestris–NHMUK R14105 (cast); Pol, 2005; Fiorelli and Calvo, 2008
Mariliasuchus amarali–Zaher et al., 2006
Comahuesuchus brachybuccalis–Martinelli, 2003
Chimaerasuchus paradoxus–Wu and Sues, 1996; IVPP V8274 (holotype)
Sphagesaurus heuni–Pol, 2003
Lomasuchus palpebrosus–Gasparini et al., 1991
Uberabasuchus terrificus–Carvalho et al. 2004
Peirosaurus torminni–Gasparini et al., 1991

Mahajangasuchus insignis–Buckley and Brochu, 1999; Turner and Buckley, 2008; FMNH PR 2389; FMNH PR 2449
Stolokrosuchus lapparenti–Larsson and Gado, 2000
Montsecosuchus depereti–Buscalioni and Sanz, 1990
Theriosuchus guimarotae–Schwarz and Salisbury, 2005
Theriosuchus pusillus–NHMUK OR48330 (holotype); NHMUK OR48216; NHMUK OR48318; NHMUK OR48328; NHMUK OR48244; NHMUK OR48266
Hylaeochampsa vectiana–Clark and Norell, 1992; NHMUK R177 (holotype)
Bernissartia fagesii–Norell and Clark, 1990; IRSNB n° R 46
Shamosuchus djadochtaensis–Pol et al., 2009
Borealosuchus formidabilis–Erickson, 1976; Brochu, 1997a
Allodaposuchus precedens–Buscalioni et al., 2001
Gavialis gangeticus–Jouve, 2009; Brochu, 1997b; NHMUK RR 61.4.1.2
Alligator mississippiensis–Jouve, 2009; Brochu, 1999
Crocodylus niloticus–Jouve, 2009, unnumbered SUI specimen
Susisuchus anatoceps–Salisbury et al., 2003
Eutretauranosuchus delfsi–Mook, 1967; Smith et al., 2010
Goniopholis simus–NHMUK OR41098; NHMUK R5814; NHMUK R14155; NHMUK R3876; NHMUK OR48310; NHMUK OR43598; NHMUK R1956; NHMUK R5138; NHMUK R214; NHMUK R3220; NHMUK OR48307; NHMUK OR48307; NHMUK R3876; Salisbury et al., 1999
Vectisuchus leptognathus–SMNS 50984 (holotype); Buffetaut and Hutt, 1980
Calsoyasuchus valliceps–Tykoski et al., 2002
Sunosuchus junggarensis–Wu et al., 1996
Elosuchus cherifiensis–MNHN SAM 129; Lapparent de Broin, 2002
Chenanisuchus lateroculi–Jouve et al., 2005; CNRST-SUNY 280; BSPG 2001 I 40
Rhabdognathus aslerensis–Brochu et al., 2002; Jouve, 2007; CNRST-SUNY 190
Dyrosaurus phosphaticus–Jouve, 2005; MNHN ALG 1; MNHN ALG 2; MNHN ALG 3; MNHN 1901-11 (holotype); MNHN APH 27; BSPG 2001 I 38
Sarcosuchus imperator–Sereno et al., 2001; MNHN GDF 662
Pholidosaurus purbeckensis–Salisbury, 2002; NHMUK OR28432; NHMUK R3414; NHMUK R3956
Terminonaris browni–Mook, 1933; AMNH 5851 (holotype); AMNH 5844
Terminonaris robusta–Wu et al., 2001; SMNH P2411.1; AMNH 5849
Steneosaurus brevior–Mueller-Töwe, 2006; NHMUK OR14781 (holotype); NHMUK R756
Steneosaurus brevidens–NHMUK R8576
Steneosaurus bollensis–Mueller-Töwe, 2006; MCZ 1063; SMNS 20280; SMNS 4554; SMNS 4168; SMNS 15951b; SMNS 52034; GPIT Re 1193/1; GPIT Re 1193/2; GPIT Re 1193/3; GPIT Re 1193/10; GPIT Re 1193/13
Steneosaurus durobrivensis–NHMUK R2073; NHMUK R2865; NHMUK R3701
'Steneosaurus' larteti–Eudes-Deslongchamps, 1869; NHMUK OR33125; OXFUM J.29850; OXFUM J.1407
Pelagosaurus typus–Mueller-Töwe, 2006; UH 4; UH 8; UH 9; UH 10; BSPG 1973 VII 592; BSPG 1925 I 34; NHMUK OR32599
Peipehsuchus teleorhinus–IVPP V48001 (holotype); IVPP V10098
Teleosaurus cadomensis–Jouve, 2009; NHMUK R880

Teleidosaurus calvadosii–NHMUK R2681 (plastotype)
Teleidosaurus bathonicus–Mercier, 1933
Teleidosaurus gaudryi–NHMUK OR3353 (holotype)
Zoneait nargorum–UOMNH F39539
Metriorhynchus leedsi–Andrews, 1913; NHMUK R3540 (holotype); NHMUK R3899;
Metriorhynchus casamiquelai–Gasparini and Chong Díaz, 1977
Metriorhynchus durobrivensis–Andrews, 1913; NHMUK R2039; NHMUK R2618
Metriorhynchus superciliosus–NHMUK R2030; NHMUK R2036; NHMUK R2041; NHMUK R2051; NHMUK R6859; MNHN 1908-6; MNHN 8925; MNHN 8922
Cricosaurus suevicus–SMNS 9808; SMNS 90513
Enaliosuchus macrospondylus–Hua et al., 2000
Dakosaurus andiniensis–Pol and Gasparini, 2009
Dakosaurus maximus–SMNS 8203 (neotype); NHMUK OR40103a
Steneosaurus leedsi–NHMUK R3320 (holotype); NHMUK R3806
Platysuchus multiscrobiculatus– Mueller-Töwe, 2006; SMNS 9930 (holotype); UH 1

MORPHOLOGICAL CHARACTER DESCRIPTIONS

Character list and state descriptions for the phylogenetic analysis. The character list is largely modified from Jouve (2009) with the addition of numerous characters from other published character lists and new characters. Character numbers from prior publications are noted in brackets at the end of the description. Characters new for this analysis denoted with 'NEW'. All characters were treated as unordered.

A nexus file of the phylogenetic dataset is available at the Journal of Vertebrate Paleontology website.

Cranial characters

General shape:

(1) Ornamentation of external surface of frontal and parietal: smooth (0); formed by grooves and ridges (1); or with circular or subpolygonal pits (2). [Modified from Wu et al., 2001 (1), Ortega et al., 2000 (1), and Jouve, 2004, 2009 (1)].

(2) Snout narrow or wide, broadening gradually at orbits (0), or narrow, broadening abruptly at orbits (1). [Wu et al., 2001 (2), and Jouve, 2009 (2).]

(3) Anterodorsal margin of the external nares without premaxillary dorsal projection (0), or with small dorsal projection at the level of the suture between right and left premaxillae (1). [Jouve, 2004, 2009 (3).]

(4) Rostral length: distance from anterior orbital edge to anterior contour of rostrum equal or longer than remainder of skull (0); distance from anterior orbital edge to anterior contour of rostrum shorter than remainder of skull (1). [Modified from Ortega et al., 2000 (3), by Jouve, 2009 (6).]

(5) Rostral length: distance from anterior orbital edge to anterior contour of rostrum shorter, equal or slightly longer than distance from anterior orbital edge to posterior parietal contour (0); distance from anterior orbital edge to anterior contour of rostrum at least twice the

distance from anterior orbital edge to posterior parietal contour (1). [Modified from Ortega et al., 2000 (4), by Jouve, 2009 (7).]

Cranial openings

(6) External nares divided (0), or confluent (1). [Wu et al., 2001 (65) and Jouve, 2009 (8).]

(7) Position of external nares with respect to anterior rostral contour in dorsal view: concealed (0); a premaxillary bar separates external nares and anterior rostral contour (1). [Ortega et al., 2000 (17), and Jouve, 2009 (9).]

(8) Antorbital fenestra as large as orbit (0), or about half the diameter of orbit (1), or much smaller than orbit (2), or absent (3). [Wu et al., 2001 (66), and Jouve, 2009 (10).]

(9) Lateral border of orbits located lateral (0) or medial (1) to level of lateral margin of supratemporal fenestra. [Wu et al., 2001 (130), and Jouve, 2009 (11).]

(10) Supratemporal fenestrae equal in length or shorter than orbits (0), or much longer than orbits (1). [Wu et al., 2001 (67), and Jouve, 2009 (12).]

(11) Supratemporal fenestrae: cover most of surface of skull roof (surrounded by narrow ridges with no extended flat surface) (0); surrounded by flat skull table (regardless of size) (1). [Modified from Ortega et al., 2000 (41), Wu et al., 2001 (24), and Jouve, 2009 (13).]

(12) Infratemporal fenestra: large (0) or very small (1). [Wu et al., 2001 (107) and Jouve, 2009 (14).]

(13) Infratemporal fenestra: shorter than it is deep or at least as long as deep (0); very elongated, much longer than deep (twice) (1). [Modified from Ortega et al., 2000 (74) by Jouve, 2009 (15).]

(14) Infratemporal fenestrae: facing laterally (0); facing laterodorsally (1). [Ortega et al., 2000 (46) and Jouve, 2009 (16).]

(15) Choanae opening ventrally from palate (0), or opening posteriorly into midline depression (1). [Wu et al., 2001 (39) and Jouve, 2009 (17).]

(16) Choanae of moderate size (0), or extremely large, nearly half of maximal skull width (1), or very narrow, elongate, more than three times longer than wide (2). [Modified from Wu et al., 2001 (42), Tykoski et al., 2002 (42), by Jouve, 2009 (18).]

(17) Anterior margin of choanae bordered by vomers and maxillae (0), or by maxillae only (1), or by palatines only (2), or by palatine and pterygoid with small participation of palatine (3), or by pterygoids only (4). [Modified from Wu et al., 2001 (44) by Jouve, 2009 (19).]

(18) Choanae confluent (0), or divided by septum from vomer (1), or from pterygoid (2). [Modified from Wu et al., 2001 (68) by Jouve, 2009 (20).]

(19) Oral cavity communicates with nasal cavity through palatal perforations (naso-oral fenestrae), besides internal nares: no (0); yes (1). [Ortega et al., 2000 (11) and Jouve, 2009 (21).]

(20) Caudal edge of internal nares: cranial to rear edge of palatine fenestra (0), caudal to rear edge of palatine fenestra (1). [Wu et al., 2001 (143) and Jouve, 2009 (22).]

(21) Anterior margin of choanae anterior to posterior margin of suborbital fenestra (0), or posterior to posterior margin of suborbital fenestra (1). [Jouve, 2004, 2009 (23).]

Premaxilla

(22) Posterior margin of the external nares formed by the premaxilla gently curved (0) or presence of a posterior notch in the premaxilla (premax w/ anterior projection?) (1). [Modified from Pol, 1999, 2003 (135 and 123 respectively) by Jouve, 2009 (24)].

(23) Dorsal part of premaxilla vertical, nares laterally orientated (0), or dorsal part of premaxilla nearly horizontal, nares dorsolaterally or dorsally orientated (1), or anterodorsal part of premaxilla ventral in position, nares facing directly forward (2). [Wu et al., 2001 (6) and Jouve, 2009 (25).]
(24) Palatal part of premaxillae not in contact posterior to incisive foramen (0), or in contact posteriorly along contact with maxillae (1), or in contact along entire length due to lack of incisive foramen (2). [Wu et al., 2001 (7) and Jouve, 2009 (26).]
(25) Foramen at premaxillo-maxillary suture in lateral surface (not for large mandibular teeth): absent (0); present (1). [Pol and Norell, 2004a (135) modified from Ortega et al., 2000 (13) by Jouve, 2009 (27).]
(26) Premaxilla loosely overlying maxilla on face (0), or premaxilla and maxilla sutured together along butt joint (1). [Wu et al., 2001 (8) and Jouve, 2009 (28).]
(27) Premaxilla forming at least ventral half of internarial bar (0), or little, if any, of internarial bar (1). [Wu et al., 2001 (125) and Jouve, 2009 (29).]
(28) Premaxilla and maxilla with broad contact on face and snout not constricted at contact (0), or broad, laterally open notch between maxilla and premaxilla (1), or snout constricted, with premaxilla and maxilla forming narrow slit (2), or snout constricted at contact with premaxilla and maxilla, forming broad, laterally directed concavity (3), or snout broad at contact with premaxilla and maxilla, forming lateral fenestra (4). [Wu et al., 2001 (9) and Jouve, 2009 (30).]
(29) Premaxillo-maxillary suture in lateral view: vertical (0); caudodorsally directed (1). [Ortega et al., 2000 (6) and Jouve, 2009 (32).]
(30) Premaxillo-maxillary suture in lateral view: straight (0); zigzag shaped (1). [Ortega et al., 2000 (8) and Jouve, 2009 (33).]
(31) Direction of premaxillo-maxillary suture in palatal view: cranially directed (0), sinusoidal, posteromedially directed on its lateral half and anteromedially directed along its medial region (1), caudally directed (2), or perpendicular to the longitudinal axis of the skull (3). (Direction of suture is evaluated with respect to a theoretical line that passes between the lateral contact of both bones). [Modified from Ortega et al., 2000 (9) and Pol and Norell, 2004a (126), by Jouve, 2009 (34)].
(32) Ventral edge of premaxilla with respect to ventral edge of maxilla in lateral view: placed almost at same height or premaxilla ventrally offset (0); ventral margin of rostrum strongly dorsally convex at the level of the premaxillary-maxillary suture (ventral-most margin of premaxilla at same height as the ventral-most margin of the maxilla), and anterior dorsal contour of dentary is also strongly concave (1). [Modified from Ortega et al., 2000 (10) and Jouve, 2009 (35)].

Maxilla

(33) Maxillae not in contact in palate (0), or posterior ends of maxillae not in contact on palate at sutures with palatines (1), or in contact posteriorly (2). [Wu et al., 2001 (10) and Jouve, 2009 (36).]
(34) Sculpturing of palatal surface: maxillary palatal surface smooth (0); maxillary palatal surface ornamented with ridges (1). [Ortega et al., 2000 (2) and Jouve, 2009 (37).]
(35) Maxilla terminating behind anterior margin of orbit (0), or anterior to orbit (1). [Wu et al., 2001 (114) and Jouve, 2009 (38).]

(36) Maxilla–lacrimal contact partially included in antorbital fossa (0), or completely included (1). [Pol, 1999, 2003 (145 and 131, respectively) and Jouve, 2009 (39).]
(37) Depression on posterolateral surface of maxilla absent (0), or present (1). [Wu et al., 2001 (127) and Jouve, 2009 (40).]
(38) Ventral edge of maxilla in lateral view: straight or convex (0); sinusoidal (1). [Ortega et al., 2000 (21) and Jouve, 2009 (42).]
(39) Position of anterior portion of maxillary tooth row: adjacent to (0), or offset labially and ventrally from (1), dentary tooth row. [Sereno et al., 2003 (75) and Jouve, 2009 (43).]
(40) Maxillary alveoli set along lateral margin of maxilla (0), or maxillary alveoli displaced medially by expansion of maxillary lateral margin (1). [Rogers, 2003 (112) and Jouve, 2009 (44).]

Nasal
(41) Nasal contact with lacrimals: nasal extensively contacts lacrimal (0); lacrimo-nasal contact excluded (or very nearly) by prefrontal (1) or excluded by posterior projection of maxilla (2). [Modified from Ortega et al., 2000 (165) and Wu et al., 2001 (11) by Jouve, 2009 (45).]
(42) Dorsal border of external nares formed mostly by nasals (0), both the nasals and premaxilla (1), or premaxilla only (2). [Modified from Wu et al., 2001 (13) and Pol, 1999, 2003 (136 and 124, respectively) by Jouve, 2009 (46)]
(43) Nasal contacting premaxilla (0), not (1). [Wu et al., 2001 (14) and Jouve, 2009 (47).]
(44) Nasal sends a small anterolateral process between maxilla and premaxilla (0) or premaxilla-maxilla suture straight, continuous with the nasal-maxilla suture (1). [Modified from Pol, 1999, 2003 (140 and 127 respectively) by Jouve, 2009 (48)]
(45) Caudal tip of nasals: caudally nasals converge at sagittal plane (0); nasals caudally separated by an anterior sagittal projection of frontal (1). [Ortega et al., 2000 (24) and Jouve, 2009 (49)]

Lacrimal
(46) Lacrimal contacting nasal along medial edge only (0), or along medial and anterior edges (1). [Wu et al., 2001 (12) and Jouve, 2009 (50)]
(47) Lacrimal orbital contour: facing laterally (0); facing laterodorsally (1). [Ortega et al., 2000 (172) and Jouve, 2009 (51)]

Prefrontal
(48) Prefrontal with two anterior processes, one anterodorsal and one anteroventral, separated by posterodorsal process of lacrimal (0), single short anterior process (shorter or as long as the orbit) (1), or single long anterior process (much longer than the orbit) (2). [Modified from Gomani, 1997 (4) by Jouve, 2009 (52)]
(49) Prefrontal pillars: do not reach palate (0); reach palate and solid integrated (1). [Wu et al., 2001 (15), Ortega et al., 2000 (29), and Jouve, 2009 (53)]
(50) Prefrontal pillars when integrated in palate: pillars transversely expanded (0); pillars transversely expanded in their dorsal half and columnar ventrally (1); pillars longitudinally expanded in their dorsal part and columnar ventrally (2). [Ortega et al., 2000 (30) and Jouve, 2009 (54)]

(51) Prefrontal–maxillary contact in the inner anteromedial region of orbit: absent (0); present (1). [Pol, 1999, 2003 (162 and 146, respectively) and Jouve, 2009 (55)]

Postorbital

(52) Ectopterygoid–postorbital suture: ectopterygoid does not contact postorbital (0); ectopterygoid contacts postorbital on medial side of postorbital bar (1). [Ortega et al., 2000 (36) and Jouve, 2009 (56)]

(53) Vascular opening on lateral edge of dorsal part of postorbital bar: absent (0); present (1). [Wu et al., 2001 (27) and Jouve, 2009 (57)].

(54) Postorbital anterior to jugal on postorbital bar (0), or postorbital medial or posterior to jugal (1), or postorbital lateral to jugal (2). [Modified from Wu et al., 2001 (16) by Jouve, 2009 (59)]

(55) Postorbital bar weak (0), or postorbital bar robust (1). [Modified from Wu et al., 2001 (25) by Jouve, 2009 (60)]

(56) Postorbital bar transversely flattened (0), or postorbital bar columnar (1). [Modified from Wu et al., 2001 (26) and Jouve, 2009 (61)]

(57) Postorbital entirely excluded from infratemporal fenestra (0), or bordering infratemporal fenestra (1). [Modified from Wu et al., 2001a (108) and Jouve, 2009 (62)]

(58) Postorbital does not participate, or slightly participates (0), or participates largely (1), to the dorsal margin of the infratemporal fenestra. [Modified from Jouve, 2004 (59) and Jouve, 2009 (63)]

(59) Relative length between postorbital and squamosal: squamosal is longer (0); postorbital is longer (1). [Ortega et al., 2000 (33) and Jouve, 2009 (64)]

Jugal

(60) Jugal does not exceed the anterior margin of the orbit (0), exceeds slightly (1), or exceeds strongly, such as the anterior process of jugal, from its anterior-most participation to the orbit to its anterior tip, is nearly as long as or longer than the orbital length (2). [Modified from Pol, 1999, 2003 (134 and 122 respectively) by Jouve, 2009 (65)]

(61) Anterior process of jugal as broad as posterior process (0), or about twice as broad as posterior process (1). [Wu et al., 2001 (17) and Jouve, 2009 (66)]

(62) Jugal participation in antorbital fenestra: yes (0); no (1). [Ortega et al., 2000 (71) and Jouve, 2009 (67)]

(63) Jugal transversely flattened (0), or rod-like (1), beneath infratemporal fenestra. [Wu et al., 2001 (18) and Jouve, 2009 (68)]

(64) Lateral surface of jugal in ventral view: exposed lateral to maxilla, jugal outwardly bowed (0); not visible in ventral view, jugal straight (1). [Ortega et al., 2000 (174), Wu et al., 2001 (101), and Jouve, 2009 (69)]

(65) Posterior process of jugal equal or longer (0), shorter (1), or much shorter (two-fold shorter) (2) than anterior process. [Modified from Wu et al., 2001 (102) by Jouve, 2009 (70)]

(66) Jugal posterior process exceeding posteriorly the infratemporal fenestrae (0), or not (1). [Pol, 1999, 2003 (150 and 136, respectively) and Jouve, 2009 (71)]

(67) Ventral portion of postorbital bar: flush with lateral surface of jugal (0); slightly medially displaced (1); medially displaced and a ridge separates postorbital bar from lateral surface of jugal (2). [Modified from Ortega et al., 2000 (34) by Jouve, 2009 (72)]

(68) Base of postorbital process of jugal directed posterodorsally (0), dorsally (1), or anterodorsally (2). [Pol, 1999, 2003 (156 and 142 respectively) and Jouve, 2009 (73)]
(69) Lateral surface of anterior branch of jugal: smooth, plane, or concave (0); with a pronounced triangular depression (1). [Ortega et al., 2000 (145) and Jouve, 2009 (74)]
(70) Ventral lamina of jugal extends far anterior to the ectopterygoid (0), or ends at the level of the ectopterygoid (1). [Jouve, 2004 (68) and Jouve, 2009 (75)]

Quadratojugal
(71) Quadratojugal contacts postorbital: yes (0); no (1). [Ortega et al., 2000 (49), Wu et al., 2001 (19), and Jouve, 2009 (76)]
(72) Jugal and quadratojugal in lateral view: quadratojugal visible beneath jugal (0); quadratojugal is not exposed (1). [Ortega et al., 2000 (38) and Jouve, 2009 (77)]
(73) Corner of infratemporal fenestra in lateral view: jugal–quadratojugal suture lies at posteroventral corner (0); quadratojugal extends anteriorly forming part of ventral edge of infratemporal bar (1). [Modified from Ortega et al., 2000 (39) and Jouve, 2009 (78)]
(74) Posteroventral corner of quadratojugal reaching the quadrate condyles (0), or not reaching the quadrate condyles (1). [Pol, 1999, 2003 (155 and 141, respectively) and Jouve, 2009 (79)]
(75) Lateroventral margin of quadratojugal: smooth (0); strongly ornamented (1). [Jouve, 2004 (72) and Jouve, 2009 (80)]
(76) Quadratojugal spine at caudal margin of infratemporal fenestrae: absent (0); present (1). [Ortega et al., 2000 (47) and Jouve, 2009 (81)]
(77) Surangular and quadratojugal taking part in craniomandibular joint: no (0); yes (1). [Ortega et al., 2000 (99) and Jouve, 2009 (82)]

Frontal
(78) Interorbital space narrow, less wide than the minimal width of snout (at the level of premaxillary–maxillary suture) (0), or broad, wider than minimal width of snout (1). [Modified from Wu et al., 2001 (20) and Jouve, 2009 (83)]
(79) Frontals: paired (0); fused (1). [Wu et al., 2001a(21) and Jouve, 2009 (84)]
(80) Dorsal surface of frontal and parietal flat (0), or with narrow median ridge (1). [Wu et al., 2001 (22) and Jouve, 2009 (85)]
(81) Frontal not or almost not extending into supratemporal fossa (0), or extending well into supratemporal fossa (1). [Wu et al., 2001 (23) and Jouve, 2009 (86)]
(82) Frontal anterior to orbit much shorter than lacrimal (0), or longer than prefrontal, approaching the level of anterior tip of lacrimal anteriorly (1). [Wu et al., 2001 (129) and Jouve, 2009 (87)]

Parietal
(83) Parietal without broad occipital portion (0), or with broad parietal occipital portion as or nearly as high as the supraoccipital exposure (1). [Modified from Wu et al., 2001 (32) by Jouve, 2009 (88)]
(84) Supraoccipital exposure on cranial roof: no, parietals contact on occiput avoiding dorsal exposure of supraoccipital (0); supraoccipital connects parietal at posterior edge of skull roof or is clearly exposed on dorsal surface of cranial roof (1). [Ortega et al., 2000 (62) and Jouve, 2009 (89)]

(85) Parietal with broad, sculptured region separating supratemporal fossae (0), or with sagittal crest between supratemporal fossae (1). [Wu et al., 2001 (33) and Jouve, 2009 (90)]
(86) Parieto-postorbital suture: absent (0), present but not on dorsal surface of skull roof (1); present on dorsal surface of skull roof (2). [Modified from Ortega et al., 2000 (27) by Jouve, 2009 (91)]
(87) Postparietal: distinct bone (0); not distinct (fused with parietal?) (1). [Wu et al., 2001 (34) and Jouve, 2009 (92)]

Squamosal
(88) Paraoccipital process in loose contact with squamosal laterally (0), or paroccipital process laterally narrow and sutured to squamosal (1), or paroccipital process very deep dorsoventrally, interlocked with squamosal (2). [Wu et al., 2001 (115) and Jouve, 2009 (93)]
(89) Anterior opening of temporo-orbital (temporal canal): exposed in dorsal view (0); hidden in dorsal view, and overlapped by squamosal rim of supratemporal fossa (1). [Ortega et al., 2000 (75) and Jouve, 2009 (94)]
(90) Posterior edge of squamosal nearly flat, no posterior squamosal prongs (0), or posterolateral edge of squamosal extending posteriorly as a long process, squamosal prongs developed (1). [Modified from Wu et al., 2001 (36) by Jouve, 2009 (95)]
(91) Posterodorsal corner of squamosal squared off, lacking extra 'lobe' (0), or with 'lobe' (1). [Modified from Wu et al., 2001 (35) and Jouve, 2009 (96)]
(92) Squamosal with descending process (0), or without descending process (1). [Wu et al., 2001 (103) and Jouve, 2009 (97)]
(93) Squamosal remains anterior to the quadrate condyle (0) or reaches the level (1), or extends far posterior to the quadrate condyle (2) in lateral view. [Jouve, 2004 (90) and Jouve, 2009 (98)]
(94) Unsculpted ventral projection of the squamosal enclosing the dorsal half of the paroccipital process: absent (0), present (1). [Jouve, 2009 (99)]

Supraoccipital
(95) Supraoccipital forming part of dorsal edge of foramen magnum (0), or otoccipitals in broad contact dorsal to foramen magnum, separating supraoccipital from foramen (1). [Modified from Wu et al., 2001 (61) by Jouve, 2009 (100)]
(96) Supraoccipital more or less triangular (0), or pentagonal (1). [Wu et al., 2001 (117) and Jouve, 2009 (101)]
(97) Mastoid antrum not entering supraoccipital (0), or extending through transverse canal in supraoccipital to connect middle ear regions (1). [Wu et al., 2001 (62) and Jouve, 2009 (102)]

Exoccipital
(98) Posterior surface of exoccipitals flat (0), or with bilateral posterior prominence (1). [Modified from Wu et al., 2001 (63) by Jouve, 2009 (103)]
(99) Exoccipital contributes slightly (0) or largely (1) to the occipital condyle. [Jouve, 2004 (96) and Jouve, 2009 (104)]
(100) Otoccipital without laterally concave descending flange ventral to subcapsular process (0), or with flange (1). [Wu et al., 2001 (58) and Jouve, 2009 (105)]

(101) Cranial nerves IX–XI exiting through common large foramen vagi in otoccipital (0), or cranial nerve IX exiting medial to nerves X and XI through separate passage (1). [Wu et al., 2001 (59) and Jouve, 2009 (106)]
(102) Crista interfenestralis (between fenestra ovalis and fenestra pseudorotunda) nearly vertical (0), or horizontal (1). [Wu et al., 2001 (126) and Jouve, 2009 (107)]

Cranial table
(103) Cranial table nearly as wide as ventral portion of skull (0), or narrower than ventral portion (1). [Wu et al., 2001 (123) and Jouve, 2009 (108)]
(104) Supratemporal fenestra smaller or nearly same size as orbit, wider or as wide as long (0), larger than orbit, but less than twice longer than wide (1), or larger than orbit, but nearly twice longer than wide (2). [Modified from Wu et al., 2001 (131) by Jouve, 2009 (109)]
(105) Posterodorsal margin of the skull roof sigmoidal (0), dorsally convex (1), or almost horizontal (2) in occipital view. [Modified from Ortega et al., 2000 (40) by Jouve, 2009 (110)]

Palatine
(106) Palatines not in contact on palate below narial passage (0), or form palatal shelves that do not meet (1), or in contact ventral to narial passage, forming part of secondary palate (2). [Wu et al., 2001 (37) and Jouve, 2009 (111)]
(107) Absence (0) or presence (1) of a palatomaxillary foramina or ventral maxillary groove. [Jouve, 2004 (104) and Jouve, 2009 (112)]
(108) Palatine anteromedial process extends further than the anterior margin of the palatal fenestrae between the maxillae (0), or does not extend further (1). [Pol, 1999, 2003 (143 and 129, respectively) and Jouve, 2009 (113)]
(109) Palatine bordering suborbital fenestra (0), or entirely excluded from suborbital fenestra (1). [Wu et al., 2001 (109) and Jouve, 2009 (114)]
(110) Width between suborbital fenestra narrower (0) or largely wider (1) than minimal width of snout at premaxilla–maxillary suture. [Jouve, 2004 (106) and Jouve, 2009 (115)]
(111) Paired anterior palatal fenestra: absent (0); present (1). [modified from Wu et al., 2001 (128) and Jouve, 2009 (116)]

Pterygoid
(112) Pterygoid restricted to palate and suspensorium, joints with quadrate and basisphenoid overlapping (0), or quadrate ramus of pterygoid extending dorsally to laterosphenoid, joints with quadrate and basisphenoid extensively overlapping (1), or pterygoid extending dorsally to contact laterosphenoid and forming ventrolateral edge of trigeminal foramen, strongly sutured to quadrate and laterosphenoid (2). [Wu et al., 2001 (38) and Jouve, 2009 (117)]
(113) Pterygoids separate posterior to choana (0), or fused (1). [Wu et al., 2001 (41) and Jouve, 2009 (118)]
(114) Palatal surface of pterygoid smooth (0), or sculptured (1). [Wu et al., 2001 (40) and Jouve, 2009 (119)]
(115) Pterygoid not in contact anterior to contact with basisphenoid on palate (0), or contact (1). [Wu et al., 2001 (121) and Jouve, 2009 (120)]

(116) Pterygoid thin, sheet-like (0), or with large pneumatic space within body (1). [Wu et al., 2001 (106) and Jouve, 2009 (121)]
(117) Posteromedial process of pterygoid anterior to the level of the medial eustachian foramen (0), or at the same level as the medial eustachian foramen (1). [Jouve, 2004 (113) and Jouve, 2009 (122)]
(118) In ventral view, posterolateral margin of the pterygoid (torus transiliens) far anterior to the medial eustachian foramen (0), nearly at the level of the medial eustachian foramen (1), far posterior to the medial eustachian foramen (2), or medial-most part of the posterior margin of the pterygoid nearly at the level of the medial eustachian foramen, and the posterior margin is anterolaterally orientated, posterolateral margin of the pterygoid (torus transiliens) being anterior to the medial eustachian foramen (3). [Jouve, 2004 (114) and Jouve, 2009 (123)]
(119) Quadrate ramus of pterygoid narrow and elongate in ventral view (0), or broad in ventral view (1), or narrow and very short in ventral view (2). [Wu et al., 2001 (119) and Jouve, 2009 (124)]
(120) Long anterior process of pterygoids that contact the maxillae anteromedial to primary choanae: absent (0); present (1). [Tykoski et al., 2002 (119) and Jouve, 2009 (125)]
(121) Absence (0) or presence (1) of a posterolateral pterygoid–basisphenoid wing. [Jouve, 2004 (117) and Jouve, 2009 (126)]

Ectopterygoid
(122) Ectopterygoid–maxilla contact: ectopterygoid does not connect to palatal branch of maxilla (0); ectopterygoid makes contact with maxillary palatal branch (1). [Ortega et al., 2000 (61) and Jouve, 2009 (127)]

Quadrate
(123) Quadrate without fenestra (0), or with single fenestra (1), or with three or more fenestrae on dorsal and posteromedial surfaces (2). [Wu et al., 2001a(45) and Jouve, 2009 (129)]
(124) Dorsal primary head of quadrate not articulating with laterosphenoid (0), or articulating with laterosphenoid (1). [Wu et al., 2001 (47) and Jouve, 2009 (130)]
(125) Dorsal margin of the external otic aperture formed by the quadrate, the squamosal does not participate (0), or formed by squamosal (1). [Jouve, 2009 (131)]
(126) Ventrolateral contact of otoccipital with quadrate very narrow (0), or broad (1). [Wu et al., 2001 (48) and Jouve, 2009 (132)]
(127) Cranio-quadrate canal: laterally open (0); closed off by a thin lamina formed by squamosal, quadrate, and exoccipital (1); closed off by a thick lamina formed by squamosal, quadrate, and exoccipital (2). [Ortega et al., 2000 (76), Wu et al., 2001 (49), and Jouve, 2009 (133)]
(128) Anterior opening of cranio-quadrate passage in otic area (when cranio-quadrate canal is closed off): not expanded (otic aperture oval in shape) (0); opening expanded forming a caudal notch (1). [Ortega et al., 2000 (159) and Jouve, 2009 (134)]
(129) Pterygoid ramus of quadrate with flat ventral edge (0), or with deep groove along ventral edge (1). [Wu et al., 2001 (50) and Jouve, 2009 (135)]
(130) Ventromedial part of quadrate not in contact with otoccipital on occiput (0), or contacting otoccipital to enclose internal carotid artery and form passage for cranial nerves IX–XI (1), or further contacting basisphenoid (2). [Wu et al., 2001 (51) and Jouve, 2009 (136)]

(131) Quadrate not in contact with basisphenoid (0), or in contact with basisphenoid (1) in ventral view. [Modified from Wu et al., 2001 (104) and Jouve, 2009 (137)]
(132) Distal part of quadrate body distinct (0) or indistinct due to ventromedial contact of quadrate body with otoccipital (1). [Wu et al., 2001 (105) and Jouve, 2009 (138)]
(133) Ventral surface of quadrate slightly concave (0), or very concave, with strong, obliquely orientated crest (1). [Wu et al., 2001a(120) and Jouve, 2009 (139)]
(134) Mandibular condyle of quadrate positioned ventral to occipital condyle but about level of the lower tooth row (0), ventral to occipital condyle but below level of the lower tooth row (1), or placed at level with occipital condyle (2). [Modified from Wu et al., 2001 (124) and Pol and Norell, 2004a (104) by Jouve, 2009 (140)]
(135) Quadrate condyles: almost aligned (0); medial condyle expanded ventrally (1). [Ortega et al., 2000 (53) and Jouve, 2009 (141)]
(136) Dorsal surface of caudal branch of quadrate: concave or flat and smooth (0); with a longitudinal ridge from base of paraoccipital process to articular end (1). [Ortega et al., 2000 (55) and Jouve, 2009 (142)]
(137) Dorsal surface of caudal branch of quadrate: with a triangular depression (0); without depression (1). [Ortega et al., 2000 (154) and Jouve, 2009 (143)]

Basisphenoid
(138) Eustachian tubes not enclosed between basisphenoid and basioccipital (0), or entirely enclosed (1). [Wu et al., 2001 (52) and Jouve, 2009 (144)]
(139) Lateral eustachian foramen at the level of medial eustachian foramen (0), or dorsolateral to medial eustachian foramen (on lateral surface of braincase), largely hidden from occipital view by the basioccipital (1), or (slightly) dorsolateral to medial opening, not completely hidden by basioccipital (thalattosuchians?) [Modified from Jouve, 2004 (135), Jouve, 2009 (145)]
(140) Basisphenoid rostrum (cultriform process): slender (0); dorsoventrally expanded (1). [Modified from Wu et al., 2001 (53) by Jouve, 2009 (146)]
(141) Relative length of basisphenoid and basioccipital: basisphenoid shorter or equal to basioccipital (0); basisphenoid longer and transversely wider than basioccipital (1). [Ortega et al., 2000 (68), Wu et al., 2001 (55), and Jouve, 2009 (147)]
(142) Basisphenoid in ventral view: widely exposed (0); almost excluded from ventral view and hidden by pterygoid and basioccipital (1). [Ortega et al., 2000 (67), Wu et al., 2001 (56), and Jouve, 2009 (148)]
(143) Basisphenoid smooth (0), bears a strong anteroposterior medial crest (1), bears two crests (2), or three crests (3). [Modified from Jouve, 2004 (139) and Pol and Norell, 2004a (179) by Jouve, 2009 (149)]

Basioccipital, Basipterygoid
(144) Ventral portion of basioccipital thin, without well-developed bilateral tuberosities (0) or ventral portion anteroposteriorly thick, rugose, with pendulous tubera formed primarily from basioccipital (1), or pendulous tubera with large contribution from exoccipitals. [Modified from Wu et al., 2001 (57), by Jouve, 2009 (150)]
(145) Basioccipital with lateral knobs: absent or slightly developed (0); strongly developed (1). [Gasparini et al., 1991 (15) and Jouve, 2009 (151)]

(146) Ventral projection of the basioccipital ventrally indistinct (0) or distinct (1) from the exoccipital in occipital view. [Modified from Jouve, 2004 (142) and Jouve, 2009 (152)]
(147) Occipital condyle: caudally directed (0); ventrocaudally directed (1). [Ortega et al., 2000 (176) and Jouve, 2009 (153)]
(148) Basipterygoid process prominent, forming potentially movable joint with pterygoid (0), or small or absent, with basisphenoid joint closed suturally (1). [Wu et al., 2001 (54) and Jouve, 2009 (154)]

Vomer
(149) Vomer: exposed on palate between palate and maxillae (0); hidden by palatal branch of maxillae (1). [Ortega et al., 2000 (59) and Jouve, 2009 (155)]

Palpebral
(150) One small palpebral present in orbit (0), or two large palpebrals present (1), or one large palpebral present (2), or palpebrals absent (3). [Wu et al., 2001 (64) and Jouve, 2009 (156), Modified from Clark, 1994)]

Mandibular characters

(151) External mandibular fenestra absent (0), or reduced to a thin slot (1), or present and relatively large (2). [modified from Jouve, 2004 (148), Jouve, 2009 (158)]
(152) Posteroventral edge of mandibular ramus straight or convex (0), or strongly deflected (1). [Wu et al., 2001 (112) and Jouve, 2009 (159)]
(153) Shape of dentary symphysis in ventral view: hourglass-shaped anteriorly (0); extremely elongated and lateral margins straight anteriorly (1); moderately elongated and anteriorly pointed (2); rounded, wide, 'horseshoe'-shaped (3); anteriorly rounded but not wide (4). [Modified from Pol, 1999, 2003 (212 and 155, respectively) by Jouve, 2009 (160)]
(154) Mandibular symphysis: short (0); long, dentary symphysis prolongs caudal to fourth alveoli (1). [Ortega et al., 2000 (151) and Jouve, 2009 (161)]
(155) Dentary extending posteriorly beneath mandibular fenestra (0), or not extending beneath fenestra (1). [Wu et al., 2001 (69), Jouve, 2009 (162), and Clark, 1994 (70)]
(156) Dentary smooth lateral to seventh alveolus (0), or dentary with large occlusion pit lateral to seventh alveolus (1). [Buckley and Brochu, 1999 (105) and Jouve, 2009 (163)]
(157) Seventh mandibular tooth about as large as the others (0), or small and close to the eighth (1). [Jouve, 2004 (153) and Jouve, 2009 (164)]
(158) Prearticular: present (0); absent (1). [Wu et al., 2001 (71) and Jouve, 2009 (165)]
(159) Articular without medial process medial to articular fossa (0), or with medial process (1), or with medial process articulating with otoccipital and basisphenoid (2). [Wu et al., 2001 (72), Jouve, 2009 (166), and Clark, 1994 (73)]
(160) Glenoid fossa of articular: craniocaudally similar to articular surface of quadrate (0); slightly longer than articular surface of quadrate (1), much longer (~3X) (2). [modified from Wu and Sues, 1996 (23)]
(161) Dorsal edge of surangular flat (0) or arched dorsally (1) anterior to glenoid fossa. [Modified from Wu et al., 2001 (73) and Jouve, 2009 (168)]
(162) Posterior-most part of angular visible in lateral view (0), or ventrally orientated, not visible laterally but ventrally (1). [Modified from Wu et al., 2001 (110) by Jouve, 2009 (170)]

(163) Sharp ridge along the ventral surface of angular: absent (0), or present (1). [Pol and Norell, 2004b (186) and Jouve, 2009 (171)]
(164) Splenial not involved in symphysis (0), or slightly involved in symphysis (1), or extensively involved in symphysis (2). [Wu et al., 2001 (76) and Jouve, 2009 (172)]
(165) Retroarticular process very short and robust (0), or very reduced or absent (1), or short, high, and quadrangular (2), or posterodorsally curving and elongate (3), or posteriorly projecting from ventral part of mandible and attenuating (4). [Modified from Wu et al., 2001 (70) by Jouve, 2009 (173)]
(166) Retroarticular process short, does not ascend to the articular glenoid cavity (0), or ascends surpassing the articular glenoid cavity (1) or extremely dorsally curved, ascends surpassing largely the articular glenoid cavity (2). [Modified from Ortega et al., 2000 (93) and Jouve, 2004 (163) by Jouve, 2009 (174)]
(167) Retroarticular process absent or present but without posteromedial process (0), or present and with pronounced posteromedial process (1). [Wu et al., 2001 (116) and Jouve, 2009 (175)]
(168) Retroarticular process: without a medial shelf (0); with a medial shelf (1). [Ortega et al., 2000 (141) and Jouve, 2009 (176)]
(169) Medial shelf of retroarticular process: vertical and facing medially (0); facing dorsally (1). [Ortega et al., 2000 (147) and Jouve, 2009 (177)]
(170) Medial wing of retroarticular process: dorsal in position (0); deflected (1). [Jouve, 2004 (167) and Jouve, 2009 (178)]
(171) Posteromedial wing of retroarticular process, when exists, dorsally situated or at mid-height (0), or ventral (1). [Jouve, 2004 (168) and Jouve, 2009 (179)]
(172) Coronoid: short (0), long, anteriorly extended (1), or absent (2). [Modified from Ortega et al., 2000 (98) and Jouve, 2004 (170) by Jouve, 2009 (180)]

Dentition

(173) Premaxillary tooth row orientation: arched laterally (0), angled, teeth lined posterolaterally (1), or angled, tooth lined laterally (2). [Modified from Sereno et al., 2001 (69) by Jouve, 2009 (181)]
(174) Number of premaxillary teeth: five (0), four (1), three (2), or two (3). [Wu and Sues, 1996 (27), Ortega et al., 2000 (133), Pol and Norell, 2004a (105), and Jouve, 2009 (182)]
(175) Number of maxillary teeth: more than 20 (0), 8–20 (1), seven (2), six (3), five (4), or four or fewer teeth (5). [Modified from Pol and Norell, 2004a (107), Wu and Sues, 1996 (30), and Ortega et al., 2000 (164) by Jouve, 2009 (183)]
(176) Last premaxillary alveolus the largest of premaxillary tooth row: no (0); yes (1). [Ortega et al., 2000 (15), Wu et al., 2001 (77), and Jouve, 2009 (184)]
(177) Compressed crown of maxillary teeth orientated parallel to the longitudinal axis of skull (0), or obliquely disposed (1). [Pol, 1999, 2003 (151 and 137, respectively) and Jouve, 2009 (185)]
(178) Size of maxillary teeth: all maxillary teeth similar in size or with the largest alveolus placed at middle of maxillary row (0); tooth row with waves of size variation (1). [Ortega et al., 2000 (20), Wu et al., 2001 (78), and Jouve, 2009 (186)]
(179) Teeth at anterior part of maxilla: no prominent tooth (0); second or third alveoli enlarged (1); fourth or fifth alveoli enlarged (2). [Ortega et al., 2000 (156) and Jouve, 2009 (187)]

(180) Relative position of last maxillary tooth with anterior edge of palatine fenestra: last maxillary tooth caudal to anterior edge of palatine fenestra (0); last maxillary tooth cranial to anterior edge of palatine fenestra (1). [Ortega et al., 2000 (18) and Jouve, 2009 (188)]
(181) Heterondonty of maxilla and dentary teeth: homodonty (0); with different dental morphologies (heterodonty) (1). [Ortega et al., 2000 (132) and Jouve, 2009 (189)]
(182) Maxillary and dentary teeth transverse section: labiolingually compressed (0); subcircular (1). [Ortega et al., 2000 (104) and Jouve, 2009 (190)]
(183) Mid- to posterior maxillary teeth, crown-root junction: unconstricted (0); constricted (1). [Modified by Sereno et al., 2001 (50) from Buckley et al., 2000 (117) and Jouve, 2009 (191)]
(184) Premaxillary teeth 1 and 2, position: separated like adjacent teeth (0); nearly confluent (1). [Modified by Sereno et al., 2001 (56) and Jouve, 2009 (192)]
(185) Last premaxillary tooth, position: anterior (0), anterolateral (1), or anteromedial (2) to first maxillary tooth. [Modified from Sereno et al., 2001 (70) by Jouve, 2009 (193)]
(186) Premaxillary tooth row, position relative to maxillary row: level (0); ventrally offset (1). [Sereno et al., 2001 (71) and Jouve, 2009 (194)]
(187) Posterior cheek of teeth not multicusped (0), multicusped (1). [Gomani, 1997 (46) and Jouve, 2009 (195)]
(188) Number of maxillary teeth multicusped: none (0); less than four (1); more than four (2). [Modified from Gomani, 1997 (47) and Jouve, 2009 (196)]
(189) Number of cusps: one (0); three (1); more than three (2). [Modified from Gomani, 1997 (49) and Jouve, 2009 (197)]
(190) Anterior dentary teeth opposite premaxilla–maxilla contact no more than twice length of other dentary teeth (0), or more than twice the length (1). [Wu et al., 2001 (79) and Jouve, 2009 (198)]
(191) Dentary teeth, posterior tooth opposite premaxilla–maxilla contact homodont (0), or enlarged opposite smaller teeth on maxillary tooth row (1). [Wu et al., 2001 (80) and Jouve, 2009 (199)]
(192) Serrated (0) or not serrated (1) teeth. [Modified from Gasparini et al., 1993 (31) and Jouve, 2009 (200)]

Postcranial characters

Scapula
(193) Anterior and posterior margins of scapula symmetrical in lateral view (0), or anterior edge more strongly concave than posterior edge (1). [Wu et al., 2001 (81) and Jouve, 2009 (201)]
(194) Scapular blade with anterior and posterior margin nearly parallel (0), or scapular blade very broad dorsally (1). [Modified from Buckley and Brochu, 1999 (106) by Jouve, 2009 (202)]

Coracoid
(195) Relative length of coracoid and scapula: scapula is at least one-third longer than coracoid (0); scapula as long as coracoid (1). [Ortega et al., 2000 (121), Wu et al., 2001 (82), and Jouve, 2009 (203)]

(196) Coracoid with knob-like posteromedial process (0), or with elongate posteromedial process (1), or with distally expanded ventromedial process (2). [Wu et al., 2001 (113) and Jouve, 2009 (204)]
(197) Coracoid shaft: short (0); long shaft extending ventrally (1). [Wu et al., 2001 (116) and Jouve, 2009 (205)]
(198) Olecranon well developed (0) or absent (1). [Wu et al., 2001 (122) and Jouve, 2009 (206)]
(199) Glenoid surface of coracoid: extended on a subhorizontal plane (0); extended on a vertical plane (1); extended on a oblique plane, and the glenoid lip facing outwards and posteroventrally (2). [Ortega et al., 2000 (122) and Jouve, 2009 (207)]

Ilium
(200) Anterior process of ilium similar in length or slightly shorter than posterior process (0), or one-quarter or less the length of posterior process (1). [Modified from Wu et al., 2001 (83) and Jouve, 2009 (208)]
(201) Iliac blade: with posterior lamina as high as anterior one (0); with posterior lamina higher than anterior one (1). [Ortega et al., 2000 (77) and Jouve, 2009 (209)]

Pubis
(202) Pubis rod-like, without expanded distal end (0), or with expanded distal end (1). [Wu et al., 2001 (84) and Jouve, 2009 (210)]
(203) Pubis forming anterior half of ventral edge of acetabulum (0), or pubis at least partially excluded from acetabulum by anterior process of ischium (1). [Wu et al., 2001 (85) and Jouve, 2009 (211)]

Limbs
(204) Radiale: longer than wide (0); as long as wide (considering its proximal width as reference) (1). [Ortega et al., 2000 (127) and Jouve, 2009 (212)]
(205) Radiale and ulnare short (0) or elongate (1). [Wu et al., 2001 (118) and Jouve, 2009 (213)]
(206) Proximal and distal ends of radiale: almost equally expanded (0); proximal head wider than distal one (1). [Ortega et al., 2000 (150) and Jouve, 2009 (214)]
(207) Length from proximal articular facet of femur to distal end of fourth trochanter: more than one-third of total femoral length (0); one-third or less of total femoral length (1). [Ortega et al., 2000 (161) and Jouve, 2009 (215)]
(208) Humeral shaft: straight (0); sigmoidal, with a pronounced posterior curvature of shaft on proximal area of humerus (1). [Ortega et al., 2000 (180) and Jouve, 2009 (216)]
(209) Distal end of femur with large lateral facet for fibula (0), or with very small facet (1). [Wu et al., 2001 (86) and Jouve, 2009 (217)]
(210) Fifth pedal digit with (0) or without (1) phalanges. [Wu et al., 2001 (87) and Jouve, 2009 (218)]

Vertebrae
(211) Atlas intercentrum broader than long (0), or as long as broad (1). [Wu et al., 2001 (88) and Jouve, 2009 (219)]
(212) Neural spine on cervical vertebrae as broad as those on anterior cervical vertebrae (0), or posterior spines anteroposteriorly narrow, rod-like (1), or all spines rod-like. [Modified from Wu et al., 2001 (89) and Jouve, 2009 (220), modified from Clark, 1994 (90)]

(213) Cervical vertebrae without well-developed hypapophyses (0), or with well-developed hypapophyses (1). [Wu et al., 2001 (90) and Jouve, 2009 (221)]
(214) Cervical vertebrae amphicoelous or amphiplatyan (0), or semi-procoelous (1), or procoelous (2). [Wu et al., 2001 (91), modified by Rogers, 2003 and Jouve, 2009 (222)]
(215) Trunk vertebrae amphicoelous or amphiplatyan (0), or semi-procoelous (1), or procoelous (2). [Wu et al., 2001 (92), modified by Rogers, 2003 (93) and Jouve, 2009 (223)]
(216) All caudal vertebrae amphicoelous or amphiplatyan (0), or first caudal vertebra biconvex, with other caudal vertebrae procoelous (1), or first caudal vertebra biconvex, with other caudal vertebrae semi-procoelous, amphicoelous, or amphiplatyan (2), or all caudal vertebrae procoelous (3). [Wu et al., 2001 (93), modified by Rogers, 2003 (94) and Jouve, 2009 (224)]

Osteoderms
(217) Cervical osteoderms not fused into cervical shield (0), or multiple cervical osteoderms fused into shield (1). [Rogers, 2003 (111) and Jouve, 2009 (225)]
(218) Dorsal osteoderms rounded, ovate (0), or rectangular, wider than long (1), square (2), or rectangular, much wider than long (~2X) (3). [Modified from Wu et al., 2001 (94) and Jouve, 2009 (226)]
(219) Dorsal osteoderms with straight anterior edge (0), or with anterolateral process on anterior edge (1). [Wu et al., 2001 (95) and Jouve, 2009 (227)]
(220) Dorsal osteoderms arranged in two parallel, longitudinal rows (0), or in more than two longitudinal rows (1). [Wu et al., 2001 (96) and Jouve, 2009 (228)]
(221) Tail with dorsal osteoderms only (0), or completely surrounded by osteoderms (1). [Wu et al., 2001 (98) and Jouve, 2009 (229)]
(222) Osteoderms absent (0) or present (1) on ventral part of trunk. [Wu et al., 2001 (99) and Jouve, 2009 (230)]
(223) Osteoderms with longitudinal keels on dorsal surface (0), or without keels (1). [Wu et al., 2001 (100) and Jouve, 2009 (231)]
(224) Lateral margin of the osteoderm horizontal (0), or thick and vertical (1). [Jouve, 2004 (220) and Jouve, 2009 (232)]
(225) Continuity of dorsal armor: dorsal amour continues from neck to tail (0); dorsal armor shows a narrowing or gap at the cervico-thoracic junction (1). [Ortega et al., 2000 (109) and Jouve, 2009 (233)]
(226) Number of keels on transverse bands of presacral dorsal armour: none or one (0); more than one (1). [Modified from Ortega et al., 2000 (115) and Jouve, 2009 (234)]

Miscellaneous characters

(227) Posterior margin of the orbit located anteriorly to the posterior margin of the suborbital fenestra (0), or posteriorly or at the same level as the posterior margin of the suborbital fenestra (1). [Jouve, 2004 (195) and Jouve, 2009 (235)]
(228) Posterior edge of the supratemporal fenestra thin (with fossa extending to posterior limit – thin ridge) (0), or thin, but not a narrow ridge (no posterior extension of fossa) (1), or thick (2). [Modified from Jouve, 2004 (184) and Jouve, 2009 (236)]
(229) Supratemporal fenestra: present (0), or absent (1). [Ortega et al., 2000 (72) and Jouve, 2009 (237)]

(230) Dorsal margin of the lateral edge of the supratemporal fenestra (postorbital and squamosal) nearly horizontal or slightly laterally deflected (0), or strongly laterally deflected (1). [Jouve, 2009 (238)]
(231) Dorsal margin of the lateral edge of the supratemporal fenestra (postorbital and squamosal) ornamented (0), or smooth (1). [Jouve, 2009 (239)]
(232) Infratemporal fenestra largely hidden from ventral view by the pterygoid flange (0), or largely visible in ventral view, laterally to the pterygoid flange (1). [Modified from Jouve, 2004 (189) by Jouve, 2009 (240)]
(233) Infratemporal fenestra widely opened and nearly much shorter than supratemporal fenestra (0), as long as supratemporal fenestra (1), longer than supratemporal fenestra (2). [Modified from Jouve, 2009 (241)]
(234) Anterior margin of the choanal opening: gently rounded (0), or tapers anteriorly between the palatines (1), or 'w'-shaped (2). [Modified from Jouve, 2009 (241)]
(235) Choanal opening: opened posteriorly and continuous with pterygoid surface (0), or closed posteriorly by an elevated wall formed by the pterygoids (1). [Pol and Norell, 2004a (183) and Jouve, 2009 (243)]
(236) Choanal septum shape: narrow vertical bony sheet (0), or 'T'-shaped bar expanded ventrally (1). [Pol and Apesteguia, 2005 (186) and Jouve, 2009 (244)]
(237) Flat ventral surface of internal nares septum: anteriorly broad (0), or tapering anteriorly (1). [Pol and Apesteguia, 2005 (220) and Jouve, 2009 (245)]
(238) Posterior margin of the otic aperture smooth (0), or invaginate (1). [Brochu, 1999 (102) and Jouve, 2009 (246)]
(239) Distance between the tip of the snout and the anterior-most position of the premaxilla-maxilla suture in dorsal view is larger (0), or smaller (1) than the distance between the anterior-most position of premaxilla-maxilla suture in dorsal view and the posterodorsal extremity of the premaxilla. [Jouve, 2004 (205) and Jouve, 2009 (247)]
(240) Absence (0) or presence (1) of two foramina in the palatal surface in the premaxillae-maxillae suture (no pits for dentary teeth). [Jouve, 2009 (248)]
(241) Edge of the maxillary tooth alveoli lower or at the same level than the space between toothrow (0), or edge of the maxillary tooth alveoli higher than the space between toothrow (toothrow underline) (1). [Hua and Jouve, 2004 (165) and Jouve, 2009 (249)]
(242) Posterior process of ventral lamina of maxilla without tooth short (0), or long (1). (Jouve, 2009 (250))
(243) Nasal participation in antorbital fenestra: yes (0), or no (1). [Ortega et al., 2000 (70) and Jouve, 2009 (251)]
(244) Nasal lateral edges from its posterior-most contact with the maxilla to the posterior-most contact with the external nares if exists, or the anterior tip of nasal: nearly parallel (0), parallel but the anterior end oblique to each other (1), or entirely oblique to each other (2). [Modified from Pol, 1999 (141) and Pol and Norell, 2004a (128) by Jouve, 2009 (252)]
(245) Posterolateral region of nasals: flat surface facing dorsally (0), or lateral region deflected ventrally, forming part of the lateral surface of the snout (1). [Pol and Apesteguia, 2005 (223) and Jouve, 2009 (253)]
(246) Prefrontal contact nasal along medial edge only (0), or penetrates the nasal anteriorly, separating the nasal in a posteromedial and a posteroventral process (1). [Jouve, 2009 (254)]

(247) Lateral margin of prefrontal continuous with the laterodorsal margin of the orbit formed by the frontal (0), or laterally expended, forming a lateral 'lobe' over the orbit (1). [Jouve, 2009 (255)]
(248) Dorsal margin of orbit in dorsal view rounded or forms widely opened and gently rounded 'V' (0), or forms acute and narrow 'V' (1). [Jouve, 2009 (256)]
(249) Anterolateral postorbital process absent (0), or small (1), or contacts the dorsal margin of the jugal (2). [Modified from Jouve, 2004, 2005, 2009 (9, 4, and 257 respectively)]
(250) Postorbital bar: distinctive from the dorsolateral margin of the postorbital (0), or dorsolateral margin of postorbital and postorbital bar not distinctive (1). [Jouve, 2009 (258)]
(251) Postorbital bar visible in dorsal view (0), or vertical and not visible in dorsal view (1). [Modified from Jouve, 2004 (192) and Jouve, 2009 (259)]
(252) Dorsoventral height of jugal antorbital region with respect to infraorbital region: equal or lower (0), or jugal antorbital region 1.5 times more expanded than minimal height of the jugal below the orbit (1). [Modified from Pol and Norell, 2004a (130) by Jouve, 2009 (260)]
(253) External surface of ascending process of jugal: exposed laterally (0), or exposed posterolaterally (1). [Pol and Norell, 2004b (182) and Jouve, 2009 (261)]
(254) Ventral margin of jugal between ventral contact with maxilla and quadratojugal: straight (0), or strongly arched dorsally (1). [Modified from Pol and Norell, 2004b (179) by Jouve, 2009 (262)]
(255) Longitudinal ridge on lateral surface of jugal below infratemporal fenestra: absent (0), or present (1). [Pol and Norell, 2004b (183) and Jouve, 2009 (263)]
(256) Posterolateral end of quadratojugal: acute or rounded, tightly overlapping the quadrate (0), or with sinusoidal ventral edge and wide and rounded posterior edge slightly overhanging the lateral surface of the quadrate (1). [Pol and Norell, 2004a (180) and Jouve, 2009 (264)]
(257) Anterior process of the frontal extending far anteriorly (0), or slightly anteriorly, at the same level or posteriorly (1) to the anterior margin of the orbits. [Jouve, 2004 (178) and Jouve, 2009 (265)]
(258) Width does not differ abruptly along interfenestral bar (0), or anterior portion (frontal) much wider than posterior portion (parietal) (1). [Jouve, 2009 (266)]
(259) Angle between posteromedial process (interfenestral bar) and lateral process of frontal (posterodorsal margin of orbit) in dorsal view: nearly 90° (0), or much less than 90° (1). [Jouve, 2009 (267)]
(260) Frontal-postorbital suture in the skull table (anterior to the supratemporal fenestra), straight (0), 'V'-shaped, frontal tapers laterally, sending a lateral process within the postorbital on the skull table (1). [Jouve, 2009 (268)]
(261) Parietal with (0), or without (1) broad parietal occipital portion separated in two part by supraoccipital. [Modified from Wu et al., 2001 (32) by Jouve, 2009 (269)]
(262) Parietal does not extend well into supratemporal fenestra, or when it extends, parietal does not form a long and thin anterior process between the frontal and laterosphenoid (0), or parietal extends anterolaterally, forms a long and thin anterior process between the frontal and laterosphenoid, and participates to the anteroventral margin of the supratemporal fenestra, below the frontal within the fenestra (1). [Jouve, 2009 (270)]

(263) Dorsal surface of posterolateral region of squamosal: without ridges (0), or with three curved ridges oriented longitudinaly (1). [Pol and Norell, 2004b (184) and Jouve, 2009 (271)]
(264) Posterolateral edge of squamosal: without descending ornamented process (0), or with descending ornamented process (1). [Pol and Norell, 2004a (163) and Jouve, 2009 (272)]
(265) Exoccipital visible in lateral view between squamosal and quadrate, or participates to the posterior margin of the external otic aperture (0), or quadrate and squamosal sutured posterior to the external ear, and exoccipital excluded from posterior margin (1). [Modified from Jouve, 2004 (121) by Jouve, 2009 (273)]
(266) Lateral edge of the skull table at the level of the postorbital-squamosal suture situated laterally at the same level (0), or medially (1) to the quadrate condyle for the jaw articulation in dorsal view. [Jouve, 2004 (170) and Jouve, 2009 (274)]
(267) Maxilla-palatine suture tapers anteriorly (0), palatine anteromedially straight, perpendicular to the longitudinal axis of the skull (1), or palatine invaginated (2). [Modified from Turner and Calvo, 2005 (122) by Jouve, 2009 (275)]
(268) Palatine-pterygoid contact on palate: palatines overlie pterygoids (0), or palatines firmly sutured to pterygoids (1). [Pol and Norell, 2004a (165) and Jouve, 2009 (276)]
(269) Posteriorly facing notch between the base of the pterygoid wings: absent (0), present (1). [Pol, 1999 (164), Pol and Norell, 2004a (148), and Jouve, 2009 (277)]
(270) Ectopterygoid medial process: single (0), or forked (1). [Ortega et al., 2000 (146) and Jouve, 2009 (278)]
(271) Ectopterygoid does not connect or connect slightly the palatal branch of maxilla (0), ectopterygoid extensively connects the maxilla, but suture lateromedialy oriented (1), or anterior process of ectopterygoid long, and extensively connects the palatal branch of maxilla (2). [Jouve, 2009 (279)]
(272) Anterior process of pterygoid ramus of quadrate is not sutured (0) or is sutured to the pterygoid (1). [Jouve, 2009 (280)]
(273) Quadrate major axis directed: posteroventrally (0), ventrally or anteroventrally (1). [Modified from Pol, 1999 (166), Pol and Norell, 2004a (150), and Ortega et al., 2000 (44) by Jouve, 2009 (281)]
(274) Orientation of quadrate body distal to otoccipital-quadrate contact in posterior view: ventrally (0), or ventrolaterally (1). [Pol and Norell, 2004a (181) and Jouve, 2009 (282)]
(275) Cross section of distal end of quadrate: mediolaterally wide and anteroposteriorly thin (0), or subquadrangular (1). [Pol and Norell, 2004a (164) and Jouve, 2009 (283)]
(276) Basisphenoid rostrum short (0), or extremely long anteriorly (1). [Jouve, 2005 (2) and Jouve, 2009 (284)]
(277) Basisphenoid-pterygoid suture nearly straight transversely (0), or basisphenoid tapers anteriorly between the two pterygoids (1). [Jouve, 2009 (285)]
(278) Absence (0) or presence (1) of a medial crest on the posterior surface of the ventral process of the basioccipital. [Modified from Jouve, 2004 (185) by Jouve, 2009 (286)]
(279) Posterior surface of basioccipital ventral to the occipital condyle short and gently curved, lower than the occipital condyle (0), or long, flat and nearly vertical, at least as high as occipital condyle (1). [Modified from Jouve, 2004 (197) by Jouve, 2009 (287)]
(280) Absence (0) or presence (1) of a deep medial depression ventral to the basioccipital and posterior to the medial eustachian foramen. [Jouve, 2004 (198) and Jouve, 2009 (288)]

(281) Palpebrals: separated from the lateral edge of the frontals (0), or extensively sutured to each other and to the lateral margin of the frontals (1). [Pol and Norell, 2004b (181) and Jouve, 2009 (289)]
(282) Dorsal surface of mandibular symphysis: flat or slightly concave (0), or strongly concave and narrow, trough shaped (1). [Pol and Apesteguia, 2005 (184) and Jouve, 2009 (290)]
(283) Dorsal edge of dentary: straight (0), or showing a single concave arch behind the caniniform tooth (1), edge sinusoidal, with two concave waves (2). [Modified from Ortega et al., 1996 (1) and Jouve, 2009 (291)]
(284) Ventral exposure of splenials: absent (0), or present (1). [Ortega et al., 1996 (9) and Jouve, 2009 (292)]
(285) Splenial: thin posterior to symphysis (0), or splenial robust dorsally posterior to symphysis (1). [Ortega et al., 1996 (7) and Jouve, 2009 (293)]
(286) Posterior peg at symphysis: absent (0), or present (1). [Pol and Apesteguia, 2005 (181) and Jouve, 2009 (294)]
(287) Lateral surface of the anterior region of surangular and posterior region of dentary: without a longitudinal depression (0), or with a longitudinal depression (1). [Ortega et al., 1996 (5) and Jouve, 2009 (295)]
(288) Longitudinal ridge along the dorsolateral surface of surangular: absent (0), or present (1). [Pol and Norell, 2004b (187) and Jouve, 2009 (296)]
(289) Distal portion of humeral shaft rounded (0), or flattened (1) in cross-section. [Jouve, 2009 (298)]
(290) Ilium: large, longer than high (0), small, higher than long (1). [Jouve, 2009 (299)]
(291) Anteroposterior development of neural spine in axis: well developed covering all the neural arch length (0), or poorly developed, located over the posterior half of the neural arch (1). [Pol, 1999 (168), Pol and Norell, 2004a (152), and Jouve, 2009 (300)]
(292) Prezygapophyses of axis: not exceeding anterior edge of neural arch (0), or exceeding the anterior margin of the neural arch (1). [Pol, 1999 (169); Pol and Norell, 2004a (153) and Jouve, 2009 (301)]
(293) Sacral ribs short, robust, and slightly bent lateroventrally (0), or long, gracile, and strongly bent ventrally (1). [Jouve, 2009 (302)]
(294) Height of neural arch of caudal vertebrae: less than two times length of centrum (0), or more than two times the length of the centrum (1). [Jouve, 2009 (303)]
(295) Posterior portion of tail straight (0), or bent ventrally, tail being ‘fish-shaped’. [Jouve, 2009 (304)]
(296) Cervical region surrounded by lateral and ventral osteoderms sutured to the dorsal elements: absent (0), or present (1). [Pol and Norell, 2004b (189) and Jouve, 2009 (305)]
(297) Appendicular osteoderms: absent (0), or present (1). [Pol and Norell, 2004b (190) and Jouve, 2009 (306)]
(298) Dorsal surface of osteoderms ornamented with anterolaterally and anteromedially directed ridges (fleur de lys pattern of Osmolska et al., 1997): absent (0), or present (1). [Pol and Norell, 2004b (188) and Jouve, 2009 (307)]
(299) External nares in dorsal view: much wider than long (0), nearly as wide as long (1), or much longer than wide (2). [Modified from Vignaud, 1995 by Jouve, 2009 (309)]
(300) Orbit more circular in lateral aspect (0), or in dorsal aspect (1). [Jouve, 2009 (310)]
(301) Maximal width of the nasal less or nearly as wide as (0), wider than (1), or more than twice as wide as (2) the minimal width of the snout. [Jouve, 2009 (311)]

(302) Distance between the posterior processes of nasals shorter (0) or nearly as long as the distance from posterior process of nasal to the anterior margin of the supratemporal fenestra (1). [Jouve, 2009 (312)]
(303) Lacrimal participates in the dorsal margin of the antorbital fenestra (0), participates in the posterior margin only (1). [Jouve, 2009 (313)]
(304) Lacrimal does not exceed (0), or exceeds the anterior margin of the antorbital fenestra (1). [Jouve, 2009 (314)]
(305) Lacrimal visible (0) or not visible (1) in dorsal view. [Jouve, 2009 (315)]
(306) Posterior process of prefrontal does not reach (0) or reaches (1) the level of the anterior margin of the supratemporal fossa. [Modified from Jouve, 2009 (316)]
(307) Anterior tip of the prefrontal reaches or exceeds (0), or remains posterior (1) to the posterior margin of the antorbital fenestra. [Jouve, 2009 (317)]
(308) Jugal does not exceed (0) or exceeds (1) the lacrimal anteriorly. [Jouve, 2009 (318)]
(309) Absence (0) or presence (1) of a transverse frontal ridge. [Jouve, 2009 (319)]
(310) Absence (0) or presence (1) of a wide frontal plate in the anteromedial corner of the supratemporal fossa. [Modified from Jouve, 2009 (320)]
(311) Parietal widely exposed, much wider than the supraoccipital (0), or without broad occipital portion, or nearly as wide as the supraoccipital (1). [Jouve, 2009 (321)]
(312) Short ventrolateral extension of the exoccipital (0), or exoccipital covers strongly the dorsal surface of caudal branch of quadrate (1). [Jouve, 2009 (322)]
(313) Posterodorsal margin of the skull roof not strongly ‘W’-shaped (0), or sigmoidal, strongly ‘W’-shaped, and the dorsal margin of the supraoccipital is much higher than the dorsal margin of the squamosal in posterior view (1), ‘W’-shaped with supraoccipital below dorsal margin of squamosal (2). [Modified from Jouve, 2009 (323)]
(314) Absence (0) or presence of a pterygoid-ectopterygoid fenestra (1). [Jouve, 2009 (324)]
(315) Ventrally exposed part of basisphenoid: wider than long (0), longer than wide (1). [Jouve, 2009 (325)]
(316) Medial margin of the orbit in dorsal view: formed mostly by the frontal (0), or mostly by the prefrontal, the frontal is excluded or participates only slightly (1). [Jouve, 2009 (326)]
(317) Third dentary tooth smaller than the fourth, and alveoli separated (0), third and fourth dentary alveoli nearly equal in size, and nearly confluent (1). [Jouve, 2009 (327)]
(318) Length of the humerus more than two-thirds (0), nearly two-thirds (1), or nearly one-third (2) the length of the femur. [Jouve, 2009 (328)]
(319) Humerus much longer than scapula (0), or shorter or nearly as long as scapula (1). [Jouve, 2009 (329)]
(320) Ulna nearly as long as humerus (0), or more than one-quarter shorter than humerus (1). [Jouve, 2009 (330)]
(321) Basisphenoid not or slightly visible (0), or widely exposed (1) below the basioccipital in occipital view. [Jouve, 2009 (331)]
(322) Ventral half of the lacrymal: extending ventroposteriorly widely contacting the jugal (0), or tapering ventroposteriorly, does not contact or contacts the jugal only slightly (1). [Pol and Apesteguia, 2005 (224) and Jouve, 2009 (332)]
(323) Ectopterygoid projecting medially on ventral surface of pterygoid flanges: barely extended (0), or widely extended covering approximately the lateral half of the ventral surface of the pterygoid flanges (1). [Pol and Apesteguia, 2005 (230) and Jouve, 2009 (333)]

(324) Posterior teeth with rings of ondulated enamel: absent (0), or present (1). [Gasparini et al., 2006 (250) and Jouve, 2009 (334)]
(325) Enlarged foramen at anterior end of surangular groove: absent (0), or present (1). [Gasparini et al., 2006 (245) and Jouve, 2009 (335)]
(326) Foramen for the internal carotid artery: reduced, similar in size to the openings for cranial nerves IX-XI (0), or extremely enlarged (1). [Gasparini et al., 2006 (248) and Jouve, 2009 (336)]
(327) Sculpture of external surface of rostrum: absent (0), or present (1). [Gasparini et al., 2006 (252) and Jouve, 2009 (337)]
(328) Prefrontal and lacrimal around orbits: forming flat rims (0), or evaginated, forming elevated rims (1). [Gasparini et al., 2006 (256) and Jouve, 2009 (338)]
(329) Nasal bones: paired (0), or partially or completely fused (1). [Gasparini et al., 2006 (257) and Jouve, 2009 (339)]
(330) Medioventral projection of exoccipital remains far (0), or nearly reaches (1) the ventral projection of the basioccipital. [Jouve, 2009 (340)]
(331) Maximal width of premaxillae less (0), or more (1) expended than the maximal width of the rostrum at the level of the 4th or 5th alveoli. [Jouve, 2009 (341)]
(332) Upper tooth row: forms waves in ventral view (0), or nearly straight, oriented posterolaterally, each tooth being more lateral than the immediately anterior one (1). [Jouve, 2009 (342)]
(333) When the cranioquadrate canal is closed off anteriorly by a thin lamina: dorsal lamina of exoccipital (anterior to the cranioquadrate canal) does not suture (0), or sutures (1) the quadrate or squamosal dorsally. [Jouve, 2009 (343)]
(334) Lateral rim of supratemporal fenestra with respect to interfenestral bar in lateral view – at same level (flat skull table) (0), or slightly deflected ventrally (1), or strongly deflected ventrally (2). NEW
(335) Suborbital fenestrae end anteriorly at level of anterior border of orbit (0), extend further anteriorly (1), or terminate posterior to the anterior border of the orbit (2). NEW
(336) Groove along lateral margin of maxilla dorsal to toothrow (separates sculptured region from unscluptured region) – absent (0), or present (1). NEW
(337) Lacrimal contacts maxilla (0), excluded from maxilla by anterior process of jugal (1), or excluded by antorbital fenestra (2). NEW
(338) Anterior process of prefrontal – shorter than anterior process of lacrimal (0), or longer (1) NEW
(339) Palatomaxillary grooves are restricted to maxillae (0), or extend caudally onto surface of palatines (1). NEW
(340) Palatal surface of palatines smooth (0), or sculptured (pitted) (1). NEW
(341) Pterygoid participates in posterior border of suborbital fenestrae (0), or is excluded by posterolateral processes of palatines or medial expansion of ectopterygoids (1). NEW
(342) Basisphenoid rostrum fused dorsally with laterosphenoid (0), or separate (1) NEW
(343) Prootic widely exposed on braincase (0), or prootic mostly obscured by expansion of quadrate and laterosphenoid (1). NEW
(344) Lateral mandibular groove on dentary and surangular (surangular groove of Gasparini et al., 2006) – very poorly developed or absent (0), or well developed with foramen at posterior end (1). NEW

(345) Glenoid fossa formed exclusively by articular (0), or with large contribution from surangular (1). NEW
(346) Groove along lateral margin of dentary ventral to toothrow separating sculpted region (below) from unsculpted region (above) – absent (0), or present (1). NEW
(347) Deltopectoral crest of humerus – present and robust (0), or very reduced/absent (1). NEW
(348) Radius and ulna elongate bones (much longer than wide) (0), or flattened plate-like elements (1). NEW
(349) Sclerotic ossicles – absent (0), or present (1) [Young and Andrade, 2009 (19)]
(350) Anteroposterior directed ridge along prefrontal/lacrimal suture – absent (0), or present (1). [Modified from Young and Andrade, 2009 (150)]
(351) Prefrontal 'overhang' over orbit – very slight ~5–10% of its width (0), or greatly enlarged > 10% (1) [Modified from Young and Andrade, 2009 (12)]
(352) Lateral margin of prefrontal overhang – gently curved (obtuse angle) with posterior margin anterolaterally directed (0), or gently curved with posterior margin directed laterally at nearly 90º to midline of skull (1), or with distinct point formed with posterior margin directed anterolaterally (2), or with distinct point and posterior margin directed laterally nearly 90º from midline of skull (3) [Modified from Young and Andrade, 2009 (14)]
(353) Dorsal and ventral rims of squamosal groove for external ear-flap musculature: absent, (0), ventral placed lateral to dorsal (1), or ventral directly beneath dorsal (2) [Young and Andrade, 2009 (112)]
(354) Mandibular groove on dentary and surangular - shallow, far longer on the dentary than on the surangular (0), shallow and equally long on dentary and surangular (1), deep and strongly developed on both elements, or with a large foramen at both ends (2). [Young and Andrade, 2009 (46)]
(355) Calcaneum tuber: well developed – with long neck (subequal in length to main body of calcaneum ± 5%), distal end wider than main body of calcaneum and projects inwards the body at >80° (0), poorly developed – short neck (< half length of calcaneum main body), distal end < half the width of calcaneum main body width & projects out straight from calcaneum (1), or absent/vestigial – no defined tuber, the posterior edge of calcaneum one smooth, gentle curve (2) [Young and Andrade, 2009 (74)]
(356) Forelimb vs. hind limb length – forelimb and hind limb subequal (0), or forelimb much reduced (1) [Young and Andrade, 2009 (109)]
(357) Dorsoventrally oriented ridge on braincase at parietal/prootic/laterosphenoid intersection (directly above foramen for cranial nerve V) – absent (0), present (1). NEW
(358) Elongate groove on jugal beneath orbit – absent (0), present (1). NEW
(359) Posterolaterally directed facet on posterolateral margin of squamosal – absent (0), present (1). NEW
(360) Number of sacral vertebrae: two (0), more than two (1) [Buscalioni and Sanz, 1990 (44)]
(361) Posterior process of ectopterygoid: developed (0), or absent (1) [Pol, 1999 (148)]
(362) Large and aligned neurovascular foramina on lateral maxillary surface; absent (0), or present (1) [Pol, 1999 (152)]
(363) Quadrate distal end: with only one plane facing posteriorly (0), or with two distinct faces in posterior view, a posterior one and a medial one (separated by a ridge?) bearing the foramen aereum (1) [Pol, 1999 (167)]
(364) Anterior margin of femur linear (0), or bears a flange for coccygeofemoralis musculature (1) [Buckley and Brochu, 1999 (102)]

(365) Maxillary dental implantation: teeth in isolated alveoli (0), or located on a dental groove (1) Modified from Oretga et al., 2000 (19)]
(366) Lateral contour of snout in dorsal view: straight (0); or sinusoidal (1) [Ortega et al., 2000 (130)]
(367) Posterior ridge on glenoid fossa of articular: present (0), or absent (1) [Pol and Apesteguia, 2005 (183)]
(368) Palatines run parasagittaly along midline (0), or palatines diverge laterally becoming rodlike caudally forming palatine bars (1) [modified from Martinelli, 2003 (36) by Zaher et al., 2006]
(369) Posterior edge of quadrate: broad medial to tympanum, gently concave (0), or posterior edge narrow dorsal to otoccipital contact, strongly concave (1). [Clark, 1994 (46)]
(370) Ridge along dorsal section of quadrate-quadratojugal contact: absent (0), or present (1). [Pol and Norell, 2004b (185)]
(371) Ulna shape in cross-section – ovate/round as in other long bones (0), or flattened (1). NEW
(372) Sacral osteoderms (if present) – larger than dorsal osteoderms immediately preceding sacrum (0), or similar in size or smaller (1). NEW
(373) Sculpturing on skull roof restricted to frontal and parietal (0), or extends onto postorbital and squamosal (1). NEW
(374) Sagittal crest (when present) – narrow, but dorsoventrally flat as in *Steneosaurus bollensis* (0), narrow, but of uniform width with distinct medial groove as in *Metriorhynchus superciliosus* (1), or narrows abruptly posteriorly at frontal parietal suture and is dorsoventrally expanded as in *Suchodus brachyrhynchus* (2). NEW
(375) Surangular in dorsal view: does not extend beyond the orbit along the dorsal surface of the mandible (0), or does (1). [Young and Andrade 2009 (47)]

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