SUPPLEMENTARY ONLINE MATERIAL FOR

A new basal eusauropod from the Middle Jurassic of Yunnan Province, China, and faunal compositions and transitions of Asian sauropodomorph dinosaurs

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SOM_1. Character list for the maximum parsimony analysis.

SOM_2. Character matrix used for a maximum parsimony analysis in nexus format.

References
SOM_1
Character list for the maximum parsimony analysis. Characters 1-331 follow Harris (2006), except for characters 38 and 76 modified by the authors. Characters 332-344 are added by the authors. U followed by number indicates character originally derived from Upchurch et al. (2004). W followed by number indicates character originally derived from Wilson (2002).

(1) Morphology of rostralmost ends of jaws in dorsal view (W65, U1): triangular, with acute tip (0); broadly rounded rostrally with linear, roughly parallel lateral margins (U-shaped or parabolic) (1); platalean (broadly rounded and convex rostrally but with lateral margins that are sinuous, convex rostrally but becoming concave, producing spoon-shape caudally) (2); rectangular, especially lower jaw (rostral margin linear and at abrupt angle to lateral margins) (3).

(2) Configuration of caudolateral processes of premaxilla and lateral processes of maxilla (W1, U15): lacking midline contact (0); possessing midline contact and forming marked narial depression (1).

(3) Angle between lateral and medial margins of premaxilla as seen in dorsal view (U12-14): >20° (0); ≤ 20° (1).

(4) Morphology of rostral margin of premaxilla (= region rostral to nasal process) in lateral view (W2, U10): without ‘step’ (0); with marked ‘step;’ rostral margin of skull thus sharply demarcated (= muzzle-like area present).

(5) Free portion of nasal process of premaxilla in lateral view (U11): majority projects caudally and divides external nares into right and left halves (0); majority projects dorsally and divides external nares into right and left halves (1); is greatly reduced, reducing or eliminating internarial bar and creating single, confluent external narial opening (2).

(6) Thin, plate-like process (flange) directed rostromedially from edge of maxillary ascending process (U17-18, C14): absent (0); present but lacking midline contact (1); present and contacting each other at midline (2).

(7) Direction in which subnarial foramen faces (U6): lateral (0); dorsal (1).

(8) Proportions and size of subnarial foramen (U7): small and subcircular (0); elongate (at least 2x longer than wide in direction of premaxilla-maxilla suture) (1).

(9) Position of subnarial foramen with respect to narial fossa (U8): outside (0); within (1).

(10) Relative positions of subnarial foramen and rostral maxillary foramen (W5): well distanced from one another (0); separated only by narrow bony isthmus (1).

(11) External nares face (U4): laterally or rostrolaterally (0); dorsally or rostrodorsally (1).

(12) Shelf-like area or fossa (narial fossa) on premaxilla and maxilla lateral to external nares (W1, U19): absent (0); present (1).

(13) Length of border of external naris formed by maxilla (W3): short (less than 1/4 narial perimeter) (0); long (more than 1/3 narial perimeter) (1).

(14) Position of mid-point of osteological external nares (W8, U2-3, C7, S7): rostral to antorbital fenestra (0); dorsal to antorbital fenestra (1); caudal to antorbital fenestra (2).

(15) Ratio of maximum diameter of osteological external nares:maximum diameter of orbit (W9, U5): <1.0 (nares shorter) (0); ≥ 1.0 (nares longer) (1).

(16) Preantorbital fenestra (W4, U20, S24): absent (0); present (1).

(17) Antorbital fossa (W7, U21): present (0); absent (1).

(18) Ratio of maximum diameter of antorbital fenestra:maximum diameter of orbit (W6): <0.85 (orbit significantly larger) (0); ≥ 0.85 (diameters subequal) (1).

(19) Angle subtended by rostral and ventral margins of orbit (W10): obtuse or roughly 90 degrees (0); markedly acute (1).

(20) Rostral extent of maxillary process of lacrimal (W11, U16): dorsal to midpoint of antorbital fenestra (0); caudodorsal to midpoint of antorbital fenestra but rostral to
caudodorsal corner of antorbital fenestra (1); process absent; maxilla-lacrimal contact at caudodorsal corner of antorbital fenestra (2).

(21) Element contacting ectopterygoid laterally (W12, U65): jugal (0); maxilla (1).

(22) Contribution by jugal to antorbital fenestra (W13, U22): reduced or absent (0); large (occupying most of caudoventral margin) (1).

(23) Size of frontal (= caudal) process of prefrontal (W14): small (does not project far beyond frontal-nasal suture) (0); elongate (approaches parietal) (1).

(24) Morphology of frontal process of prefrontal in dorsal view (W15, U33): flat, broadly rounded or square (0); hooked or acute and subtriangular (1).

(25) Morphology of jugal (= ventral) process of postorbital (W16, U28): mediolaterally narrow (0); broader mediolaterally than rostrocaudally (1). 10

(26) Jugal (= ventral) process of postorbital (U31): does not contact lacrimal (jugal intervenes) (0); contacts lacrimal (excludes jugal from margin of orbit) (1).

(27) Squamosal (= caudal) process of postorbital (W17): present (0); absent (1).

(28) Frontal-parietal suture in dorsal view (W18, U34): between supratemporal fenestrae/fossae (frontals contribute to rostral margin of fenestrae/fossae) (0); rostral to supratemporal fenestrae/fossae (frontals excluded from rostral margin of fenestrae/fossae) (1).

(29) Midline contact (symphysis) between frontals in adults (W19, U36, C13, S31): sutured (0); fused (1).

(30) Ratio of rostrocaudal length:minimum mediolateral width of frontal (W20, U35): ≥ 1.0 (equal or longer than wide) (0); <1.0 (wider than long) (1).

(31) Dorsoventral height of occipital process of parietal (W21): short (less than diameter of foramen magnum) (0); deep (nearly twice the diameter of the foramen magnum) (1)

(32) Contribution to posttemporal fenestra by parietal (W22, U42): present (0); absent (1).

(33) Postparietal foramen (W23, U43, S26): absent (0); present (1).

(34) Morphology of infratemporal fenestra (C9, S6): subrectangular (0); subtriangular (1); linear (slit-like, crescentic) (2).

(35) Position of rostralmost or rostroventralmost end of infratemporal fenestra (W30, U29-30, C8, S32): caudal to orbit (0); rostral to caudal margin of but caudal to or equal with midpoint of orbit (1); rostral to midpoint of orbit (2).

(36) Ratio of intraparietal distance separating supratemporal fenestrae:length of long axis of supratemporal fenestrae (W24): ≤2.0 (0); ≥2.0 (1).

(37) Supratemporal fossa surrounds supratemporal fenestra (U37): present (0); absent (1).

(38) Orientation of long axis of external supratemporal fenestra (W25-26, U40): rostrocaudal (0); mediolateral (1) (Modified after Harris 2006; the state 2 (axis dorsoventral) correlates with reduction in lateromedial width of the fenestra (character 36)).

(39) Contribution by squamosal to dorsal (dorsomedial) margin of supratemporal fenestra (U44): present (0); absent (excluded by parietal-postorbital contact) (1).

(40) Ratio of maximum diameter of supratemporal fenestra:diameter of foramen magnum (W27, U41, C10, S30): ≥1.0 (0); ≤1.0 (subequal) (1).

(41) Ratio of rostrocaudal:mediolateral dimension of temporal bar (supratemporal region) (W28): ≥1.0 (longer rostrocaudally) (0); <1.0 (longer mediolaterally) (1).

(42) Lateral visibility of supratemporal fenestra (W29, U38-39): not visible (obscured by temporal bar) (0); visible (temporal bar shifted ventrally) (1).

(43) Maxilla-quadratojugal contact (U24, C11, S2): absent (0); present (1).

(44) Squamosal-quadratojugal contact (W31, U45): present (0); absent (1).

(45) Ratio of length of rostral (= jugal or maxillary) process of quadratojugal:length of squamosal (= dorsal) process (W32, U23): ≤1.0 (0); ≥1.0 (1).

(46) Rostral process of quadratojugal (U25): tapers to acute tip (0); expands dorsoventrally at tip (0).
(47) Orientation of rostral process of quadratojugal in lateral view (U26): straight or curves slightly dorsally at tip (0); angles ventrally at tip (1).
(48) Angle between rostral and dorsal processes of the quadratojugal (U27): roughly 90º (0); >>90º (1).
(49) Orientation of long axis of quadrate with respect to long axis of skull (U68, C5, S5): perpendicular (0); angled caudodorsally-rostroventrally (1).
(50) Quadratojugal fossa (W33-34, U66-67, C1): absent (0); shallow (1); deeply invaginated (2).
(51) Orientation of rostral end of maxillary process of palatine (U57): poorly developed and unexpanded (0); mediolaterally expanded (1).
(52) Composition of palatine (= rostral) process of pterygoid (U61): formed from two sheets of bone that project laterally and ventrally (0); formed from single, flat plate (1).
(53) Ratio of dorsoventral height of supraoccipital:height of foramen magnum (W43): ≥2 (0); 1.01-1.99 (1); ≤1 (2).
(54) Rostral end of maxillary process of palatine (U57): poorly developed and unexpanded (0); mediolaterally expanded (1).
(55) Ratio of length:maximum basal diameter of basipterygoid processes (W46, U52-53, S27): ≤2 (0); 2.01-3.99 (1); ≥4.0 (2).
(56) Angle of divergence between basipterygoid processes (W47, U54, S28): ≥30º (0); <30º (1).
(57) Morphology of contact surface on pterygoid for basipterygoid articulation (W36, U63-64): small facet (0); dorsomedially-oriented hook (1); rocker-like surface (2).
(58) Ratio of rostrocaudal depth:dorsoventral height of basal tubercula (W48, U48): ≥0.25 (0); <0.25 (sheet-like) (1).
(72) Ratio of mediolateral width of paired basal tubercula: mediolateral width of occipital condyle (W49): <1.0 (0); 1.0-1.2 (1); >1.2 (2).

(73) (Note: craniopharyngeal foramen) Basisphenoid fossa/foramen between foramen magnum and basal tubercula (W50): absent (0); present (1).

(74) Region between basipectyroid processes (W51, U55): shallowly concave (0); deep pit (1).

(75) Basisphenoid-quadrate contact (W52): absent (0); present (1).

(76) Orientation of basipectyroid processes: roughly perpendicular to skull roof (0), extending anteriorly (1), or extending posteriorly (2), forming markedly acute angle to skull roof. Unordered. Note: the last state is newly added to describe the morphology in *Atlasaurus*, *Jobaria*, and *Spinophorosaurus*.

(77) Cross-sectional morphology of basipectyroid processes (U51): elliptical or subtriangular (0); subcircular (1).

(78) Morphology of parasphenoid rostrum (U56): broadly triangular in lateral view and with groove on dorsal margin (0); slender, spike-like, and lacking dorsal groove (1).

(79) Depth of rostral end of dentary ramus (W55, U69): decreases or maintains dorsoventral height rostrally (0); increases in dorsoventral height and robustness rostrally (1).

(80) Morphology of rostroventral margin of dentary (W56, U70): gently rounded (0); sharply projecting triangular process (‘chin’) (1).

(81) Angle between dentary symphysis and long axis of jaw ramus (W57, U71): <75° (0); >75° (close to perpendicular) (1).

(82) Ratio of length of external mandibular fenestra:length of mandible (W58, U76-77): ≥0.10 (0); <0.10 (1); absent (2).

(83) Ratio of surangular dorsoventral depth:maximum depth of angular (W59, U75): <2.0 (0); ≥2.0 (1).

(84) Ridge on surangular separating adductor and articular fossae (W60): absent (0); present (1).

(85) Depth of medial wall of adductor fossa (W61): shallow (0); deep, with prearticular expanded dorsoventrally (1).

(86) Position of rostral end of splenial relative to mandibular symphysis (U72): caudal to (0); participates in symphysis (1).

(87) Position of caudal process of splenial (W62, U74): overlaps angular (0); separating rostral portions of prearticular and angular (1). 16

(88) Caudodorsal process of splenial (W63, U73): present, approaching margin of adductor chamber (0); absent (1).

(89) Size of coronoid (W64): extends to dorsal margin of jaw (0); reduced, does not extend to splenial (1); absent (2).

(90) Plate of bone lying lateral to teeth on premaxilla, maxilla, and dentary (U9): absent (0); present (1).

(91) Position in tooth row of largest teeth (U78): mid-length along maxilla (0); rostral end of jaws (1).

(92) Number of dentary teeth (W73, U91): ≥18 (0); ≤17 (1).

(93) Length of tooth rows (W66, U94-95): extends to orbit (0); rostral to orbit but caudal to subnarial foramen (1); restricted rostral to subnarial foramen (2).

(94) Occlusal pattern (W67-68): absent (0); interlocking (creating V-shaped facets) (1); planar facets at markedly acute angle to long axis of tooth (high-angled) (2); planar facets at roughly 90° angle to long axis of tooth (low-angled) (3).

(95) Orientation of tooth crowns (W69, U80): aligned along jaw axis (crowns do not overlap) (0); aligned slightly rostrolingually (tooth crowns overlap) (1).

(96) Contact between adjacent tooth crowns (U81): present (0); absent (1).
(97) Ratio of length of worn tooth crown:width of lingual face (= ‘slenderness index’) (U87-89): \( \leq 3.0 \) (crowns expanded; teeth spatulate) (0); 3.01-3.99 (1); \( \geq 4.0 \) (2).

(98) Cross-sectional shape of worn tooth crowns at mid-crown (W70, U84-85, U92, C2, S1): elliptical (convex both labially and lingually) (0); D-shaped (convex labially, flat or concave lingually) (1); circular (spatulate crown wears away leaving facet on root = ‘pencil-’ or ‘peg-like’ tooth morphology) (2).

(99) Enamel surface texture (W71, U79): smooth (0); wrinkled (1).

(100) Marginal tooth denticles (W72, U82-83, C3): present (0); absent on distal margin only (1); absent on both mesial and distal margins (2).

(101) Number of replacement teeth per alveolus (W74, U90): \( \leq 2 \) (0); \( \geq 3 \) (1).

(102) Orientation of teeth (W75, U93): perpendicular to jaw margin (0); oriented rostrally with respect to jaw margin (procumbent) (1).

(103) Longitudinal grooves on lingual face of tooth (W76): absent (0); present (1).

(104) Prominent grooves near mesial and distal margins of labial surface of tooth crowns (U86): absent (0); present (1).

(105) Number of cervical vertebrae (W80, U96-100, S25): \( \leq 9 \) (0); 10 (1); 11 (2); 12 (3); 13 (4); 14 (5); \( \geq 15 \) (6).

(106) Shape of occipital facet of atlantal intercentrum (W79, U101): rectangular in lateral view (dorsal and ventral lengths subequal) (0); wedge-shaped (craniocaudal length of ventral margin greater than that of dorsal margin) (1).

(107) Morphology of articular facets of cervical vertebral bodies (W82, U103): amphicoelous/amphiplatyan (0); opisthocoelous (1).

(108) Morphology of cervical lateral pneumatic fossae (W78, W83, U110, C15, S33): absent (0); simple, undivided (1); simple and undivided in cranial cervicals but becoming complex (divided by bony septa) in caudal cervicals, producing numerous, laterally visible foramina (2); complex (with numerous, laterally visible foramina) in all (post-axial) cervicals (3).

(109) Morphology of ventral surface of cervical vertebral bodies (U106-107): with prominent sagittal keels (0); flat or mildly convex ventrally (1); concave ventrally (longitudinal sulcus present) (2).

(110) Fossae on dorsal surface of costolateral eminences of cervical vertebrae (U109): absent (0); present and confluent with lateral pneumatic fossa (1); present but separated from lateral pneumatic fossa by ridge (2).

(111) Lamination (especially corporodiapophyseal) of cervical vertebral arches (W81, U115-116): well developed with well defined lamina and fossae (0); rudimentary; diapophyseal laminae only feebly developed or absent (1).

(112) Ratio of caudal articular surface height:width of cranial cervical vertebral bodies (W84, U108): <1.25 (0); \( \geq 1.25 \) (1).

(113) Angulation of spinous process on cranial cervical vertebrae (C18): dorsal (vertical) or craniocaudal (0); caudodorsal (1).

(114) Ratio of craniocaudal vertebral body length:dorsoventral height of caudal face of middle cervical vertebral bodies (W86, U102): <4.0 (0); \( \geq 4.0 \) (1).

(115) Ratio of dorsoventral height of middle cervical vertebral arches:dorsoventral height of caudal articular facet of vertebral body (W87, U111-112, C16): <1.0 (0); \( \geq 1.0 \) (1).

(116) Morphology of cranial corporozygapophyseal lamina on middle and caudal cervical vertebral arches (W88, U113): single (0); divided (= cranial infrazygapophyseal fossae present) (1); consists of two parallel laminae (2).

(117) Morphology of articular surfaces of cranial zygapophyses on middle and caudal cervical vertebrae (U114): flat (0); transversely convex (1).
(118) Cervical spinous process height (U117): low (height of vertebra subequal to or less than length of vertebral body) (0); high (height of vertebra greater than length of vertebral body) (1).
(119) Bifurcation of cervical vertebral spines (W85, C17, S34): absent (0); present only on caudal cervicals (1); present on middle cervicals (to C6) (2); present on cranial cervicals (cranial to C6) (3).
(120) Morphology of caudal cervical and cranial thoracic spinous processes (W89-90, U118, C17): single (0); bifid but lacking pseudospinous tuberculum (1); bifid with sagittal pseudospinous tuberculum (2).
(121) Orientation of caudal margin of spinous processes on caudal cervical vertebrae with respect to craniocaudal axis of vertebral body (U119): nearly vertical (0); slopes craniodorsally-caudoventrally (1).
(122) Number of thoracic vertebrae (W91, U122-125): 15 (0); 14 (1); 13 (2); 12 (3); 11 (4); ≤ 10 (5).
(123) Lateral pneumatic fossae in majority of thoracic vertebral bodies (W78, U128-129, C22): absent (0); present as deep but simple pits (1); present as deep excavations that ramify into vertebral body and into base of vertebral arch (leaving only thin septum in body midline) (2).
(124) Lateral position of lateral pneumatic foramina on thoracic vertebral bodies (U130): absent (0); flush with lateral surface (no lateral pneumatic fossa) (1); set within lateral pneumatic fossa (2).
(125) Cranial face of thoracic vertebral arches (U136): flat or shallowly excavated (0); deeply excavated (1).
(126) Hypantrum-hyposphene articulations on thoracic vertebrae (W106, U145, C23, S15): absent (0); present on middle and/or caudal thoracics only (1); present on cranial-caudal thoracics (2).
(127) Single midline lamina extending ventrally from hyposphene in thoracic vertebrae (U146): absent (0); present (1).
(128) Thoracic vertebrae with spinodiapophyseal lamina (W99, U156-157): none (0); on caudal thoracics only (1); on middle and caudal thoracics (2).
(129) Accessory spinodiapophyseal lamina on thoracic vertebrae with non-bifid spinous processes (U151): absent (0); present (1).
(130) Postspinal lamina on thoracic vertebrae with non-bifid spinous processes (U149, C27): absent (0); present (1).
(131) Orientation of transverse processes on thoracic vertebrae (U138, S35): lateral or slightly dorsal (0); strongly dorsolateral (approximately 45º to horizontal) (1).
(132) Morphology of articular face of cranial thoracic vertebral bodies (W94, U104): amphicoelous (0); opisthocoelous (1).
(133) Morphology of caudal margins of lateral pneumatic fossae on cranial thoracic vertebrae (U127, C29): rounded (0); acute (1).
(134) Morphology of ventral surfaces of cranial thoracic vertebral bodies (U126): ventrally convex (0); flat (1); with sagittal crest (creating two ventrolaterally-facing surfaces) (2); ventrally concave with sagittal crest in resultant sulcus (3).
(135) Cranial corporozygapophyseal lamina on cranial thoracic vertebrae (U134): consists of single lamina (0); bifurcate toward upper end (= cranial infrazygapophyseal fossa present) (1).
(136) Orientation of spinous processes of cranial thoracic vertebrae (U158): dorsal or caudodorsal (0); craniodorsal (1).
(137) Ratio of dorsoventral height of vertebral arch:dorsoventral height of thoracic vertebral body (W93, U132, C20, C24, C28, S9): ≤ 1.0 (0); >1.0 (1).
Morphology of cranial corporozygapophyseal lamina on middle and caudal thoracic vertebral arches (U135): single (0); bifurcate toward upper end (= cranial infrazygapophyseal fossa present) (1).

Cranial corpororaparapophyseal lamina on middle and caudal thoracic vertebral arches (W96, U133): absent (0); present (1).

Cranial zygaparapophyseal lamina on middle and caudal thoracic vertebral arches (W97): absent (0); present (1).

Caudal corpororaparapophyseal lamina on middle and caudal thoracic vertebral arches (W98, U137): absent (0); present (1).

Morphology of the distal ends of the transverse processes in thoracic vertebrae (U140): transitions smoothly and uninterrupted onto dorsal surface of transverse process (0); possesses distinctive, elevated area with its own dorsally-facing surface that is connected to the dorsal surface of the remaining process only by a sloping region (1).

Lamination on cranial face of (non-bifid) spinous process of middle and caudal thoracic vertebrae (U148, C26): none (0); prespinal lamina present, cranial spinozygapophyseal laminae absent (1); prespinal lamina absent, cranial spinozygapophyseal laminae present (2); both prespinal and cranial spinozygapophyseal laminae present and connected to each other either directly (merging) or via accessory laminae (3); both prespinal and cranial spinozygapophyseal laminae present but unconnected to each other (4).

Caudal zygapophyses of middle and caudal thoracic vertebrae supported dorsally by (W100, W101, U147, U150): caudal margin of alaminar spinous process only or no dorsal support (0); separate caudal spinozygapophyseal laminae unconnected to postspinal lamina via accessory laminae (1); separate caudal spinozygapophyseal laminae connected to postspinal lamina at proximal end either directly or via accessory laminae (2).

Infradiapophyseal fossa on thoracic vertebral arches (W103, U144): absent (0); present (1).

Spinodiapophyseal and caudal spinozygapophyseal laminae on middle and caudal thoracic vertebrae contact each other (W101): absent (0); present (1).

Supraneural pneumatic cavity within some or all thoracic vertebral arches (U141): absent (0); present but not open externally (1); present and open externally via foramen (2).

Triangular, aliform processes projecting laterally from distal ends of middle and caudal (= non-bifurcate) thoracic spinous processes (W102, U153-154): absent (0); present but do not project far laterally (not as far as caudal zygapophyses) (1); present and project far laterally (as far as caudal zygapophyses) (2).

Orientation of middle and caudal thoracic spinous processes (W104): vertical (0); caudal (distal end approaches level of diapophyses) (1).

Morphology of articular face of caudal thoracic vertebral bodies (W105, U105, C25): amphicoelous/amphiplatyan (0); opisthocoelous (1).

Cross-sectional morphology of caudal thoracic vertebral bodies (U131): subcircular (0); dorsoventrally compressed (1).

Ventral end of caudal corporodiapophyseal lamina of caudal thoracic vertebrae (U142): unexpanded (0); expands and may bifurcate (1).

Position of transverse process on caudal thoracic vertebrae (U139): caudal or caudodorsal to costolateral eminence (0); dorsal to costolateral eminence (1).

Ratio of mediolateral width:craniocaudal length of caudal (non-bifid) thoracic spinous processes (W92, U152): ≤ 1.0 (longer than wide) (0); >1.0 (wider than long) (1).

Morphology of caudal thoracic spinous processes in cranial view (W107, U155): rectangular for most of its length with little or no lateral expansion (except at distal end)
(0); progressively expanding mediolaterally through most or all of its length (‘petal’ or ‘paddle’ shaped) (1).

(156) Number of sacral vertebrae (W108, U161-163): ≤ 3 (0); 4 (1); 5 (2); ≥ 6 (3). 26
(157) Sacrocostal yoke (W109): absent (0); present (1).
(158) Ratio of maximum mediolateral width across sacral vertebrae and ribs:average length of sacral vertebral body (U164): <4.0 (0); ≥ 4.0 (1).
(159) Lateral pneumatic fossae and/or foramina in sacral vertebral bodies (U165): absent (0); present (1).
(160) Ratio of proximodistal length of sacral spinous processes:craniocaudal length of vertebral body (W111): <2.0 (0); 2.0-3.49 (1); ≥ 3.50 (2).
(161) Dorsoventral length of sacral ribs (W112, U168): low (not projecting beyond dorsal margin of ilium) (0); high (extending to or beyond dorsal margin of ilium) (1).
(162) Caudal vertebral bone internal construction (W113): solid (0); spongy (with large internal cells) (1).
(163) Number of caudal vertebrae (W114, U170): ≤ 35 (0); 36-60 (1); ≥ 61 (2).
(164) Ratio of height of spinous process:dorsoventral height of caudal articular facet of vertebral body in caudal thoracic, sacral and proximal caudal vertebrae (U166-167, C33, S19, S36): <2.0 (0); 2.0-3.0 (1); >3.0 (2).
(165) Caudal vertebral transverse processes (ribs) (W115, U193): persist through caudal vertebra 20 or farther distally (0); disappear by caudal 15 (1); disappear by caudal 10 (2).
(166) Morphology of articular face of first caudal vertebral body (W116, U171): flat (0); procoelous (1); opisthocoelous (2); biconvex (3). 27
(167) Spinous process of first caudal vertebra (W117): simple and alaminar or single fossa on lateral aspect (0); complex system of laminae, resembling spines of thoracics (‘dorsalized’) (1).
(168) Morphology of articular face of proximal caudal vertebral bodies (excluding first) (W118, U173-174, C30, S16): amphiplatyan or platycoelous (0); weakly procoelous (1); strongly procoelous (2); opisthocoelous (3).
(169) Morphology of articular surfaces in proximal caudal vertebral bodies (U172): subcircular (0); dorsoventrally compressed (1); mediolaterally compressed (2).
(170) Pneumatopores (lateral pneumatic fossae and/or foramina) on proximal caudal vertebral bodies (W119, U181, C31): absent (0); present (1).
(171) Length of caudal vertebral bodies (W120, U178): ~same over first 20 (0); doubling over first 20 (1).
(172) Ratio of proximodistal length:dorsoventral height of proximal caudal vertebral body (U177): ≥ 0.6 (0); <0.6 (1).
(173) Cranial spinozygapophyseal lamina on proximal caudal vertebral arches (W121, U188): absent (0); present and extending onto lateral aspect of spinous process (1).
(174) Cranial and caudal spinozygapophyseal laminae contact on proximal caudal vertebral arches (W122, U188): absent (0); present (1).
(175) Prespinal lamina on proximal caudal vertebral arches (W123, U188): absent (0); present (1).
(176) Postspinal lamina on proximal caudal vertebral arches (W124, U188): absent (0); present (1).
(177) Postspinal fossa on proximal caudal vertebral arches (W125, U188): absent (0); present (1).
(178) Hyposphenal ridge on proximal caudal vertebrae (U187): absent (0); present (1).
(179) Transverse process morphology on proximal caudal vertebrae (W128, U190-192, C32, S11): simple, flattened processes (0); triangular or aliform process (connected via
laminae to vertebral arch) on caudal 1 only (1); triangular or aliform processes through caudal 3 (2); triangular or aliform processes on or beyond caudal 4 (3).

(180) Dorsoventral extent of proximal end of transverse processes on proximal caudal vertebrae (W127): shallow (on vertebral body only) (0); deep (extending from vertebral body to vertebral arch) (1).

(181) Diapophyseal laminae (= proximal and distal corporodiapophyseal laminae and cranial and caudal zygapophyseal laminae) on proximal caudal transverse processes (W129): absent (0); present (1).

(182) Morphology of proximal corporodiapophyseal lamina on proximal caudal transverse processes (W130): single (0); divided (1).

(183) Ratio of mediolateral width:proximodistal length of proximal caudal spinous processes (W126, U189): \( \leq 1.0 \) (longer than wide) (0); >1.0 (wider than long) (1). 29

(184) Ratio of vertebral body length:height in middle caudal vertebrae (U179): <2.0 (0); \( \geq 2.0 \) (1).

(185) Sharp ridge on lateral surface of middle caudal vertebral bodies at arch-body junction (U186): absent (0); present (1).

(186) Morphology of articular surfaces in middle caudal vertebral bodies (W131, U184): subcircular (0); flat dorsal and ventral surfaces (~ quadrangular) (1).

(187) Ventral longitudinal sulcus on proximal and middle caudal vertebral bodies (W132, U182-183): absent (0); present (1).

(188) Morphology of proximal articular face of middle and distal caudal vertebral bodies (W134, U175): amphicoelous/amphiplatyan (0); procoelous (conical) (1); opisthocoelous (2).

(189) Position of vertebral arches over vertebral bodies on middle caudal vertebrae (U185, C35): straddles midpoint (significant portions located on either side of midpoint) (0); located mostly or entirely over proximal half of body (1).

(190) Orientation of middle caudal spinous processes (W133): distodorsal (0); vertical (1).

(191) Morphology of distal caudal vertebral bodies (W135): cylindrical (0); flattened dorsoventrally (at least 2x as wide mediolaterally as tall dorsoventrally) (1).

(192) Number of anarcuate, distal caudal vertebrae (W136, W138, U176): \( \leq 10 \) (0); \( \geq 30 \) (1).

(193) Morphology of articular surfaces of anarcuate (‘whiplash’) distal caudal vertebrae (W136, W138, U176): absent (0); amphiplatyan (1); proximo- or distoplatyan (2); biconvex (3). 30

(194) Ratio of distalmost caudal vertebral body length:width (W137, U180, C36, S8): \( \leq 4.0 \) (0); 4.01-4.99 (1); \( \geq 5.0 \) (2). Ordered.

(195) Angle between tuberculum and capitulum costae of cervical ribs (W139, U121): greater than 90° (0); less than 90° (rib ventrolateral to vertebral body) (1).

(196) Length of cervical rib bodies (W140, U120): much longer than vertebral body (overlapping as many as three subsequent vertebrae) (0); slightly longer, equal to, or shorter than vertebral body (little or no overlap) (1).

(197) Proximal pneumatopores on thoracic ribs (W141, U160): absent (0); present (1).

(198) Morphology of proximal ends of cranial thoracic ribs (U159): shallowly concave on both cranial and caudal faces (0); strongly convex cranially and deeply concave caudally (1).

(199) Cross-sectional shape of cranial thoracic ribs (W142): subcircular (0); ‘plank’-like (cranio-caudal dimension >3x mediolateral dimension) (1).

(200) Haemal arch persistence (W147): throughout at least 80% of tail (0); disappearing by caudal 30 (1).

(201) Morphology of haemal arches on middle and distal caudal vertebrae (W143-144, U197-198, S17): simple or curve caudoventrally (forming caudal process) (0); develop small
cranial process (1); cranial and caudal processes elongate so arch is proximodistally much longer than tall dorsoventrally (‘skid-like’) (2).

(202) Ratio of haemal canal dorsoventral height:total haemal arch length (W146, U196): 
\[ <0.30 \text{ (0); } \geq 0.30 \text{ (1).} \]

(203) ‘Crus’ bridging proximal margin of haemal canal (W145, U194-195, C34, S18): present in proximal through distal haemal arches (0); present in proximal arches but absent in middle and distal arches (1); absent in proximal through distal arches (2).

(204) Distal ends of distal haemal arches (W148, U199, C37): fused (0); unfused (open) (1).

(205) Ratio of forelimb:hindlimb length (W149, U214-215): 
\[ \leq 0.6 \text{ (0); } 0.6-0.74 \text{ (1); } \geq 0.75 \text{ (2).} \]

(206) Ratio of humerus:femur proximodistal length (W172, U216, C48, S12): 
\[ <0.60 \text{ (0); } 0.60-0.89 \text{ (1); } \geq 0.90 \text{ (2).} \]

(207) Position of dorsalmost point of acromion process of scapula: closer to level of glenoid fossa than to level of midpoint of scapular body (0); equidistant between or closer to level of midpoint of scapular body than to level of glenoid fossa (1).

(208) Size of scapular acromion (W150, U200): small and narrow (0); broad (dorsoventral width more than 150% minimum width of scapular body) (1).

(209) Deltoid crest (= crest of acromion process) (U201): absent (0); present (1).

(210) Morphology of portion of acromion caudal to deltoid crest (U202): flat or convex and decreases in mediolateral thickness toward caudal margin (0); forms distinct fossa (1).

(211) Orientation of scapular body with respect to coracoid articulation (W151): roughly perpendicular (0); roughly 45° angle (1).

(212) Morphology of scapular body (W152, U206, C38, S19): acromial (dorsal) edge not expanded (parallels long axis of body) (0); acromial edge with rounded dorsal expansion caudal to acromion but cranial to distal end (1); distal end racquet-shaped (dorsoventrally expanded) (2). 32

(213) Orientation of scapular glenoid fossa (W153, U203): flat or facing laterally (0); strongly bevelled medially (1).

(214) Cross-sectional shape of proximal end of scapular body (W154): flat or rectangular (0); D-shaped (1).

(215) Dorsal ridge on medial surface of scapular body (U204): absent (0); present (1).

(216) Ventral ridge on medial surface of scapular body (U205): absent (0); present (1).

(217) Ratio of craniocephalic length of coracoid:maximum length of scapula-coracoid articulation (W155): 
\[ <1.5 \text{ (articular surface longer) (0); } \geq 1.5 \text{ (craniocephalic length longer) (1).} \]

(218) Morphology of craniodorsal margin of coracoid (W156, U208): rounded (cranial and dorsal margins grade into one another) (0); rectangular (meet at abrupt angle) (1).

(219) Position of dorsal margin of coracoid with respect to dorsal margin of scapula (U207): equal or dorsal to acromion (0); ventral to acromion and separated from it by V-shaped notch (1).

(220) Infraglenoid lip of coracoid (W157): absent (0); present (1).

(221) Morphology of sternal plate (W158, U210, C39): ovoid (0); triangular due to presence of acute craniolateral projection (1); elliptical with concave lateral margin (2).

(222) Ratio of maximum length of sternal plate:length of humerus (U209): 
\[ <0.75 \text{ (0); } \geq 0.75 \text{ (1).} \]

(223) Ridge on ventral surface of sternal plate (U213): absent (0); present (1).

(224) Prominent caudolateral expansion of sternal plate producing reniform profile in dorsal view (U211): absent (0); present (1).

(225) Prominent proximolateral process on humerus (W159, U218): present (proximal end of humerus markedly convex in cranial view) (0); absent (proximal end of humerus flat or gently sinusoidal in cranial view) (1).
(226) Supracoracoideus tuberculum on proximolateral portion of humerus (U217): absent (0); present (1).
(227) Development of humeral deltopectoral crest (W160, U219): prominent (0); reduced to low crest or ridge (1). 34
(228) Position of deltopectoral crest (U220): restricted to lateral edge of humerus (0); expanded medially across cranial face of humerus (1).
(229) Morphology of humeral deltopectoral crest (W161): relatively narrow throughout length (0); markedly expanded distally (1).
(230) Cross-sectional shape of humerus at mid-shaft (W162): circular (0); elliptical with long axis oriented transversely (1).
(231) Extent of distal articular surface of humerus (W163, U222): restricted to distal end (articular surface flat) (0); exposed on cranial and caudal portions of humeral shaft (forming convex articular surface) (1).
(232) Distocaudal surface of humerus (U221): shallowly concave (0); deeply concave, bounded between prominent vertical ridges (1).
(233) Morphology of distal humeral articular surface (W164): divided (0); flat (separate condyles indistinct) (1).
(234) Morphology of proximal ulna (W165, U223): subtriangular (0); triradiate with deep radial fossa (1).
(235) Morphology of articular surface of craniomedial process of ulna in cranial view (U224): flat (0); strongly concave on proximal surface (1).
(236) Relative length of proximal ulnar condylar processes (W166): subequal (0); unequal (with cranial process longer) (1).
(237) Development of ulnar olecranon process (W167): prominent (projecting beyond proximal articular surface) (0); rudimentary (level with proximal articular surface) (1).
(238) Ratio of proximodistal length:proximal breadth of ulna (W168): gracile (0); stout (1). 35
(239) Ratio of maximum diameter of proximal end of radius:radius length (U225): <0.30 (0); ≥ 0.30 (1).
(240) Morphology of distal condyle of radius (W169, U226): round (0); subrectangular (flattened caudally and articulating on cranial side of ulna) (1).
(241) Ratio of distal:midshaft breadth of radius (W170): <1.50 (0); 1.50-1.90 (1); >1.90 (2).
(242) Orientation of distal radial condyle with respect to long axis of shaft (W171): perpendicular (0); bevelled approximately 20° proximolaterally (1).
(243) Number of ossified carpal bones (W173, U228-230): ≥ 3 (0); 2 (1); 1 (2); none (3).
(244) Morphology of carpal bones (W174, U227): round (0); blocky (with flattened proximal and distal articular surfaces) (1).
(245) Morphology of metacarpus (W175, U235): spreading (0); bound (with subparallel shafts and articular surfaces extending half their length) (1).
(246) Morphology of proximal surface of metacarpals in articulation (W176): gently curving to form 90° arc (0); U-shaped (subtending arc of 270°) (1).
(247) Triangular, striated areas for ligament attachment on proximal parts of metacarpal shafts (U236): absent (0); present (1).
(248) Ratio of length of longest metacarpal:length of radius (W177, U233, C49): <0.35 (0); 0.35-0.45 (1); >0.45 (2).
(249) Ratio of length of metacarpal I:lengths of metacarpal II or III (whichever is longest) (U232): ≤ 1.0 (0); >1.0 (McI is longest metacarpal) (1).
(250) Ratio of length of metacarpal I:length of metacarpal IV (W178, U231): <1.0 (0); ≥ 1.0 (1).
(251) Morphology of distal condyle of metacarpal I (W179): divided (0); undivided (1). 36
(252) Ratio of length of metacarpal V:length of longest metacarpal (U234): <0.90 (0); ≥ 0.90 (1).
(253) Orientation of mediolateral axis of metacarpal I distal condyle with respect to axis of shaft (W180): bevelled ~20º proximodistally (0); perpendicular (1).
(254) Manual phalangeal formula (W181, U238-239, U241): 2-3-4-3-2 or more (0); reduced to 2-2-2-2 or fewer (1); completely absent or unossified (2).
(255) Morphology of manual phalanx I-1 (W182): rectangular (0); wedge-shaped (1).
(256) Ratio of proximodistal length:mediolateral width of manual nonungual phalanges (W183, U237): >1.0 (longer than wide) (0); <1.0 (wider than long) (1).
(257) Size of ungual on manual digit I (U240): large (at least 50% length of metacarpal I) (0); reduced (<25% length of metacarpal I) or absent (1).
(258) Cranial mediolateral dimension of pelvis (W184): narrow (ilia longer craniocaudally than distance separating preacetabular processes) (0); wide (distance between preacetabular processes exceeds craniocaudal dimension of ilia) (1).
(259) Morphology of dorsal margin of ilium body (in lateral view) (W186, U247): flat, sigmoid, or gently convex (0); semicircular (markedly convex) (1).
(260) Position of dorsalmost point on ilium (U245): caudal or dorsal to base of pubic process (0); cranial to base of pubic process (1).
(261) In lateral view, the cranioventralmost point on the iliac preacetabular process (W188, U244, C40): is also the cranialmost point (preacetabular process is pointed) (0); is caudal to the cranialmost part of process (process is semicircular with caudoventral excursion of cartilage cap) (1).
(262) Orientation of preacetabular ala of ilium with respect to axis of body (W187, U242-243): cranial in vertical plane (0); craniolateral in vertical plane (1); craniolateral and cranial edge curls laterally into horizontal plane (2).
(263) Size of ischiadic peduncle of ilium (W185, U248): large and prominent (long axis of ilium roughly horizontal) (0); low and rounded (long axis of ilium oriented craniodorsally-caudoventrally) (1).
(264) Projected line (chord) connecting articular surfaces of ischiadic and pubic processes of ilium (U249): passes ventral to ventral margin of postacetabular portion of ilium (0); passes through or dorsal to ventral edge of postacetabular portion of ilium (1).
(265) Brevis fossa on postacetabular ala of ilium (U246): present (0); absent (1).
(266) Development of ambiens process of pubis (W189, U250, C42, S20): absent or small, striated area confluent with cranial margin of pubis (0); prominent and projecting cranial to cranial margin of pubis (‘hook-like’) (1).
(267) Morphology of pubic ‘apron’ (W190, U252): flat (with straight symphysis, proximal end in parasagittal plane but middle and distal ends in mediolateral plane) (0); canted craniomedially (middle and distal ends in same plane as proximal end; gently sigmoid symphysis and V-shaped in cross section at body midlength) (1).
(268) Ratio of length of puboischiadic contact:proximodistal length of pubis (W191, U253, C41): <0.40 (0); ≥0.40 (1).
(269) Ratio of proximodistal length of ischium body:length of pubis body (W192, U251, C45): <0.90 (0); ≥0.90 (1). 38
(270) Tuberosity on lateral surface of iliac process of ischium (U255): absent (0); present (1).
(271) Projected line (chord) of long axis of ischium body in articulation with ilium (U259): passes through lower part of acetabulum or upper part of pubic articular surface (long axis of ischium ~60º to horizontal) (0); passes through upper part of acetabular margin or approaches rim of iliac articulation (long axis of ischium ~80º to horizontal) (1).
(272) Morphology of ischium body distal to pubic process (W193, U254, C46): emarginate (sagittal notch) (0); not emarginated (1).
(273) Morphology of distal shaft of ischium (W194, U260): craniocaudal depth increases medially but not laterally (0); blade-like (craniocaudal depths on both medial and lateral sides subequal) (1).
(274) Ratio of mediolateral width of distal end of ischium:proximodistal length of ischium
(U256): ≤ 0.15 (0); >0.15 (1).
(275) Ratio of mediolateral width:craniocaudal thickness of distal end of ischium body
(U260): <2.0 (0); ≥2.0 (1).
(276) Cross-sectional morphology of articulated distal ischial bodies (W195, U258, C43,
S22): V-shaped (forming marked angle to one another) (0); flat (nearly coplanar) (1).
(277) Expansion of distal end of ischium body (U257, C44, S21): slight (0); strong
dorsoventrally (1).
(278) Morphology of cranial face of femoral body in lateral view (U266): convex (0); straight
(1).
(279) Orientation of femoral caput in cranial view (U263): medial or ventromedial (0);
dorsomedial (1). 39
(280) Position of fourth trochanter on femoral body (U268): on caudal surface, near midline
(0); on caudomedial margin (1).
(281) Development of fourth trochanter of femur (W196, U269): prominent and blade-like
(0); reduced to low crest or ridge (1).
(282) Position of distal tip of fourth trochanter (U267): lies above midshaft height (0); lies at
or below midshaft height (1).
(283) Morphology of lesser trochanter of femur (W197, U261-262): well-developed ridge or
plate (0); weakly developed ridge or plate (1); absent (2).
(284) Ratio of mediolateral:craniocaudal diameter of femur at midshaft (W198, U270): <1.25
(1.0) (0); 1.25-1.50 (1); ≥ 1.85 (2).
(285) Morphology of middle portion of femoral body in cranial view (U264): sigmoid (0); straight (1).
(286) Relative mediolateral breadth of distal femoral condyles (W200, U271): subequal (0);
tibial condyle much broader than fibular condyle (1).
(287) Orientation of femoral distal condyles with respect to femoral shaft (W201):
perpendicular or slightly bevelled dorsolaterally (0); bevelled dorsomedially ~10° (1).
(288) Morphology of articular surface of femoral distal condyles (W202, U272): restricted to
distal portion of femur (0); expanded onto cranial and caudal portion of femoral shaft
(surfaces visible in cranial and caudal views) (1).
(289) Ratio of tibia:femur length (U273): ≥ 0.70 (0); <0.70 (1). 40
(290) Size of distal caudoventral process of tibia (W206, U278): broad mediolaterally
(covering caudal fossa of astragalus) (0); shortened mediolaterally (caudal fossa of
astragalus visible caudally) (1).
(291) Distal end of tibia (U277): wider mediolaterally than craniocaudally (0); roughly equal
mediolateral and craniocaudal dimensions (1).
(292) Development of proximal tibial scar on fibula (W207, U279): not well marked (0); well
marked and widening cranio-caudally toward proximal end (1). 42
(298) Morphology of M. flexor digitorum longus sulcus and tuberculum of fibula (W208, U281): absent (0); present and ovoid (tuberculum angled) (1); present, fossa bounded by two vertically elongate, parallel ridges (tuberculum linear) (2).

(299) Size of distal condyle of fibula (W209): subequal to shaft (0); expanded mediolaterally (>2x midshaft mediolateral dimension) (1).

(300) Morphology of astragalus (W210, U284): rectangular (0); wedge-shaped (with reduced craniomedical corner) (1).

(301) Craniocaudal dimension of astragalus as seen in dorsal view (U285): widens medially (0); narrows medially (1).

(302) Morphology of ventral surface of astragalus (U282): flat or slightly concave mediolaterally (0); convex mediolaterally (1).

(303) Vascular foramina at base of ascending process of astragalus (W211, U286): present (0); absent (1).

(304) Extent of ascending process of astragalus (W212, U283): terminates cranial to caudal edge (0); extending to caudal margin (1).

(305) Morphology of caudal fossa of astragalus (W213, U287): undivided (0); divided by vertical, caudomedially-oriented crest (1).

(306) Ratio of mediolateral width:maximum craniocaudal length of astragalus (W214): ≤ 1.25 (dimensions subequal) (0); >1.25 (1).

(307) Ossified calcaneum (W215, U288): present (0); absent or unossified (1).

(308) Ossified distal tarsals 3 and 4 (W216, U289): present (0); absent (1).

(309) Posture of metatarsus (W217, U291): bound (0); spreading (1).

(310) Angle between long axis of body of metatarsal I and plane of proximal articular surface as seen in cranial view (W218): perpendicular (0); angled ventromedially (1).

(311) Angle between long axis of body of metatarsal I and plane of distal articular surface as seen in cranial view (W219): perpendicular (0); angled dorsomedially (1).

(312) Caudolateral projection of distal condyle of metatarsal I (W220, U293, S23): absent (0); present (1).

(313) Size of metatarsal I (W221, U292): slender, reduced, or absent (0); robust (ratio of length:mediolateral width of proximal end ≤ 1.5) (1).

(314) Rugosities on distal parts of dorsolateral portions of bodies of metatarsals I-III (U294): absent (0); present (1).

(315) Size of proximal condyles of metatarsals I and V compared to metatarsals II, III, and IV (W222, U296): smaller than (0); subequal to (1).

(316) Ratio of length of metatarsal III:length of tibia (W223, U290, U295): ≥ 0.40 (0); 0.26-0.39 (1); ≤ 0.25 (2).

(317) Ratio of minimum mediolateral shaft diameters of metatarsals III and IV:minimum mediolateral shaft diameters of metatarsals I or II (W224, U297): ≥ 0.65 (0); <0.65 (1).

(318) Ratio of length of metatarsal V:length of metatarsal IV (W225, U298): <0.70 (usually <=0.70) (0); ≥ 0.70 (1).

(319) Relationship of plantar to proximal surface of pedal phalanx I-1 (U301): meet at ~90° angle (0); meet at acute angle (area drawn into thin plate that projects caudal to distal condyles of metatarsal I) (1).

(320) Collateral ligament foveae on non-ungual pedal phalanges (U302): present (0); absent (1).

(321) Ratio of maximum proximodistal:mediolateral dimensions of pedal nonungual phalanges (W226, U304): >1.0 (longer than wide) (0); ≤ 1.0 (wider than long) (1).

(322) Development of penultimate phalanges of pedal digits II-IV (W227, U305): subequal in size to more proximal phalanges (0); rudimentary or absent (1).

(323) Morphology of pedal phalanx II-2 (U303): square or rectangular in dorsal view (0); reduced craniocaudally, irregular in shape, and semicircular in dorsal view (1).
(324) Number of phalanges on pedal digit IV (U299-300): ≥ 4 (0); 3 (1); ≤ 2 (2).
(325) Orientation of pedal unguals with respect to digit axis (W228, U306): aligned (point forward) (0); deflected ventrolaterally (1).
(326) Length of pedal ungual I relative to pedal digit II ungual (W229): subequal (0); 25% larger than (1).
(327) Ratio of length of pedal digit I ungual:length of metatarsal I (W230, U307): <1.0 (0); ≥ 1.0 (1).
(328) Ratio of mediolateral width:dorsoventral height of pedal digit I ungual (W231): >1.0 (wider than tall) (0); ≤ 1.0 (sickle-shaped, much taller than wide) (1).
(329) Morphology of pedal unguals II-III (W232, U308): broader mediolaterally than dorsoventrally (0); sickle-shaped (much deeper dorsoventrally than broad mediolaterally) (1).
(330) Development of pedal digit IV ungual (W233): subequal in size to unguals of pedal digits II and III (0); rudimentary or absent (1).
(331) Osteoderms (W234): absent (0); present (1).
(332) Occipital condyle, an angle with respect to the supraoccipital plane: less than (0); more than (1) 100 degrees.
(333) Foramen magnum: vertically taller than wide transversely (0); wider than tall (1).
(334) A vertical ridge extending from the postorbital contact of the laterosphenoid along the frontal-parietal suture dorsally and eventually reaching the posterolateral corner of the frontal: absent (0); present (1).
(335) Transverse distance between right and left laterosphenoid-postorbital contacts: nearly equal to (0); approximately 25% narrower than (1) transverse distance between the lateral tips of posterior lateral wings of the parietal.
(336) Frontoparietal fenestra: enclosed within parietal (0); incorporates frontal (1).
(337) Supraoccipital: vertically taller than transversely wide (0); wider than tall (1).
(338) Contribution of supraoccipital to the margin of foramen magnum: more than 10% the entire margin or more than 50% the dorsal margin (0); less than 10% the entire margin; less than 50% the dorsal margin due to medially expanded exoccipitals (1).
(339) Supraoccipital ridge: transversely narrow (0), transversely robust (1), robust with a knob near the skull roof (2). Unordered.
(340) The height of parietal along the supraoccipital-parietal suture: more than (0), approximately equal to (1); or less than (2) the height of exoccipital along the supraoccipital-exoccipital suture. Unordered.
(341) External foramen for trigeminal nerve (CN V): posterior to (0), or directly below or anterior to crista antotica (1).
(342) Crista interfenesralis: absent (0); incipient (1); nearly or entirely separating the fenestra ovalis and the metotic fissure (2).
(343) Craniopharyngeal foramen: posterior (0), or anterior (1) to basal tubera. This character is scored inapplicable for taxa lacking the foramen.
(344) Craniopharyngeal foramen: does not (0), or does (1) form a notch that separates the basal tubera from each other. This character is scored inapplicable for taxa lacking the foramen.
SOM_2
Character matrix used for a maximum parsimony analysis in nexus format.

http://app.pan.pl/SOM/app60-Xing_etal_SOM/SOM_2.nex

References