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A new small-bodied dinosaur with theropod affinities from the Late Triassic Santa Maria Formation, South Brazil

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SUPPLEMENTARY DATA

APPENDIX 1S. Scorings modified from the data matrix of Cabreira et al (2016)

157. Ilium; pubic articulation orientation (Langer & Benton, 2006) ORDERED:

- 0, ventral;
- 1, cranioventral
- 2, cranial.

- *Lesothosaurus diagnosticus* has a cranioventrally oriented pubic articulation (Baron et al., 2016). The character-state was (?), and has been rescored as (1).
- *Eodromaeus murphi* (PVSJ 0560) has a cranioventrally oriented pubic articulation. The character-state was (1&2), and has been rescored as (1).
- *Coelophysis bauri* (AMNH FARB 2708 and MCZ 4331) has a cranioventrally oriented pubic articulation. The character-state was (2), and has been rescored as (1).
- “*Syntarsus*” *rhodesiensis* (e.g., BP/1/5246) has a cranially oriented pubic articulation. The character-state was (?), and has been rescored as (2).
- *Zupaysaurus rougieri* has a ventrally oriented pubic articulation (Ezcurra and Novas, 2007). The character-state was (?), and has been rescored as (0).

205. Tibia; distal portion, caudolateral flange (Novas, 1992) ORDERED:

- 0, absent;
- 1, present;
- 2, present and extends well lateral to the cranioventral corner.

- *Coelophysis bauri* has a tibial caudolateral flange which extends laterally and covers the caudomedial portion of the distal fibula (AMNH FARB 30614-15; Tykoski, 2005; Nesbitt and Ezcurra, 2015). The character-state was (?), and has been rescored as (2).

206. Tibia; distal end, caudal margin shape (Irmis et al. 2007):

- 0, straight or convex;
- 1, concave.

- *Coelophysis bauri* has a straight caudal margin of the distal end of the tibia (AMNH FARB 30614-15; Nesbitt and Ezcurra, 2015). The character-state was (?), and has been rescored as (0).

207. Tibia; distal surface outline (Rauhut, 2003):

- 0, rounded or subquadrangular (approximately as wide as long);
- 1, mediolaterally expanded.

- *Coelophysis bauri* has a mediolaterally expanded distal end of the tibia (AMNH FARB 30614-15; Tykoski, 2005; Nesbitt and Ezcurra, 2015). The character-state was (?), and has been rescored as (1).

208. Tibia; distal portion; caudomedial surface (Nesbitt, 2011):

- 0, rounded surface;
- 1, distinct proximodistally oriented ridge present.

APPENDIX 1S (Continued)

- *Coelophysis bauri* has a proximodistally oriented ridge on the caudomedial surface of the distal end of the tibia (AMNH FARB 30614-15; Nesbitt and Ezcurra, 2015). The character-state was (?), and has been rescored as (1).

210. Tibia; distal surface, caudomedial notch (Yates, 2007; Ezcurra and Novas, 2007):
0, absent;
1, present.

- *Buriolestes schultzi* (ULBRA-PVT280) does not possess a caudomedial notch in the distal surface of the tibia. The character-state was (?), and has been rescored as (0).
- “*Syntarsus*” *rhodesiensis* (Raath, 1977:plates 24–26; Nesbitt and Ezcurra, 2015; holotype QG/1) has a shallow notch in the distal surface of the tibia. The character-state was (0), and has been rescored as (1).

247. Ilium, pubic peduncle, shape; width (craniocaudal) at mid-length vs total length (Galton, 1976):
0, less than 0.5;
1, 0.5 or more.

- *Buriolestes schultzi* (ULBRA-PVT280) has a short pubic peduncle. The character-state was (1), and has been rescored as (0).

APPENDIX 2S. Characters excluded from and added to the data matrix of Cabreira et al. (2016):

Character excluded from the data matrix of Cabreira et al. (2016):

248. Ilium, pubic peduncle, position; angle of the long axis to that of the long axis of the iliac lamina (new) ORDERED:

0, less than 45 degrees;

1, about 45 degrees;

2, less 45 degrees.

Characters added to the data-matrix of Cabreira et al. (2016):

256. Tibia, posterolateral process (= lateral malleolus) in anterior or posterior view (Sereno, 1999; Nesbitt & Ezcurra, 2015). This character is inapplicable in taxa without a posterolateral process:

0, lobular;

1, tabular

257. Tibia, diagonal tuberosity on the anterior surface of the distal end of tibia (Ezcurra and Brusatte, 2011):

0, absent;

1, present.

258. Ilium, iliac acetabulum, dorsoventral depth from the acetabular roof to the pubis-ischium articulation (new):

0, equals 60% or more of the craniocaudal width;

1, less than 60% of the craniocaudal width.

APPENDIX 3S. Modified list of characters and updated data matrix of Cabreira et al (2016).

1. Skull; length (Gauthier, 1986):
 - 0, longer than two thirds of the femoral (or estimate of its) length;
 - 1, shorter than, or subequal to, two thirds of the femoral (or estimate of its) length.
2. Premaxilla; rostrrodorsal process (Nesbitt, 2011):
 - 0, shorter than the craniocaudal length of the premaxillary body;
 - 1, longer than, or subequal to, the craniocaudal length of the premaxillary body.
3. Premaxilla; caudodorsal process (Gauthier, 1986) ORDERED:
 - 0, extends caudally between nasal and maxilla;
 - 1, restricted to the ventral-caudal margin of the external naris;
 - 2, restricted to the ventral margin of the external naris.
4. Skull; premaxilla (caudodorsal process) nasal (cranioventral process) contact (Yates, 2003) ORDERED:
 - 0, broad sutured contact;
 - 1, point contact;
 - 2, no contact.
5. Premaxilla; narial fossa at the rostroventral corner of the naris (Sereno, 1999):
 - 0, absent or shallow;
 - 1, deep.
6. Skull; alveolar margin of the premaxilla-maxilla articulation (Gauthier, 1986) ORDERED:
 - 0, continuous/straight;
 - 1, arched;
 - 2, deeply arched (arch deeper than its distance to the external naris).
7. Skull; subnarial foramen (Benton & Clark 1988):
 - 0, absent;
 - 1, present.
8. Premaxilla; caudomedial process (Rauhut 2003):
 - 0, absent;
 - 1, present.
9. Maxilla; facial portion, rostral to the rostral edge of external antorbital fenestra (Nesbitt, 2011):
 - 0, shorter than caudal portion;
 - 1, equal in length or longer than portion caudal to the rostral edge of fenestra.
10. Maxilla; buccal emargination separated from the ventral margin of the antorbital fossa (Butler 2005):
 - 0, absent;
 - 1, present.

APPENDIX 3S (Continued)

11. Maxilla; rostradorsal margin, except for the rostromedial process (Yates, 2003)
ORDERED:
 - 0, straight;
 - 1, slightly concave;
 - 2, with a strong inflection at the base of the ascending ramus.

12. Maxilla; ventral margin of the antorbital fossa (Nesbitt, 2011):
 - 0, smooth (continuous to the more ventral area);
 - 1, elevated relative to the ventral surface (sharp longitudinal ridge present).

13. Maxilla; antorbital fossa, rostrocaudal extension of its medial wall (Langer, 2004):
 - 0, extends onto the whole ventral border of the internal antorbital fenestra;
 - 1, does not reach the caudoventral edge of the internal antorbital fenestra.

14. Maxilla; antorbital fossa, lateral surface of its medial wall, close to the base of the ascending process (Rauhut 2003):
 - 0, smooth; or with subcircular or oval blind pockets;
 - 1, with one or more foramen or fenestra sized perforations.

15. Maxilla; surface ventral to the external antorbital fenestra, except for the articulation area with the lacrimal (Nesbitt, 2011):
 - 0, significantly deeper (more than 50%) rostrally than caudally;
 - 1, approximately the same depth throughout.

16. Nasal; caudolateral process (Yates, 2003):
 - 0, does not envelop part of the rostral ramus of the lacrimal;
 - 1, envelops part of the rostral ramus of the lacrimal.

17. Nasal; contribution to the antorbital fossa (Sereno et al, 1994):
 - 0, does not form part of the dorsal border of the antorbital fossa;
 - 1, forms part of the dorsal border of the antorbital fossa.

18. Nasal; rostroventral process width (Yates, 2007):
 - 0, equally broad or narrower than the rostradorsal process at the basal portion;
 - 1, wider than the rostradorsal process at the basal portion.

19. Lacrimal; shape (Sereno, 1999):
 - 0, does not fold over the caudodorsal part of the antorbital fenestra;
 - 1, fold over the caudodorsal part of the antorbital fenestra.

20. Lacrimal; height (Rauhut, 2003):
 - 0, significantly less than the height of the orbit and usually fails to reach the ventral margin of the orbit;
 - 1, as high as the orbit and contacts the jugal at the level of the ventral margin of the orbit.

APPENDIX 3S (Continued)

21. Lacrimal; dorsal exposure (Yates, 2003):
0, exposed in dorsal view;

1, dorsal portion of the lacrimal does not reach the skull dorsal surface.
22. Squamosal; ventral process (Yates, 2003):
0, wider than one quarter of its length;
1, narrower than one quarter of its length.
23. Squamosal; ventral process contribution to laterotemporal fenestra (Bittencourt et al. 2014):
0, more than half of the caudal margin of the laterotemporal fenestra;
1, less than half of the caudal margin of the laterotemporal fenestra.
24. Postorbital bar (Nesbitt, 2011):
0, composed by both the jugal and postorbital in nearly equal proportions;
1, composed mostly by the postorbital.
25. Postorbital; rostral process (Ezcurra 2006):
0, equal to or longer than the caudal process;
1, shorter than the caudal process.
26. Jugal; long axis of the body (Nesbitt, 2011):
0, nearly horizontal to the alveolar margin of the maxilla;
1, oblique to the alveolar margin of the maxilla.
27. Jugal; rostral and caudal rami ventral margin (Cabreira et al, 2016):
0, straight or forming an angle of more than 180°;
1, forming angle of less than 180°.
28. Jugal; rostral extent of the slot for the quadratojugal (Nesbitt, 2011):
0, caudal to the caudal edge of the dorsal ramus of the jugal;
1, rostral to the caudal edge of the dorsal ramus of the jugal.
29. Jugal; rostral process (Rauhut, 2003):
0, participates in caudal edge of internal antorbital fenestra;
1, excluded from the internal antorbital fenestra by the lacrimal or maxilla.
30. Jugal; forked caudal process (Tykoski & Rowe 2004):
0, ventral tine longer than the dorsal one;
1, dorsal tine longer or subequal than the ventral one
31. Jugal; longitudinal ridge on the lateral surface of the body (Nesbitt, 2011):
0, absent;
1, present.

APPENDIX 3S (Continued)

32. Quadratojugal; dorsal ramus (Langer & Benton 2006):
0, longer than the cranial ramus;
1, equal or shorter than the cranial ramus.
33. Quadratojugal; angle between rostral and dorsal rami (Upchurch *et al.* 2007):
0, about 90° or more;
1, about 60° or lower.
34. Quadrate; ventral portion (Rauhut 2003):
0, aligned to the long axis of the bone;
1, caudally displaced relative to the long axis of the bone.
35. Ectopterygoid; jugal process shape (Yates 2003):
0, slightly curved;
1, strongly curved and hook-shaped.
36. Parabasisphenoid; median recess (Nesbitt, 2011) ORDERED:
0, absent;
1, present as a shallow depression;
2, present as a fossa.
37. Parabasisphenoid; caudal margin; outline in ventral view (Cabreira et al, 2016):
0, flat (approaching basal tubera);
1, excavated.
38. Opisthotic; paraoccipital process (Rauhut 2003):
0, directed laterally or dorsolaterally;
1, directed ventrolaterally.
39. Opisthotic; ventral ramus (Nesbitt, 2011):
0, extends further laterally or about the same as lateralmost edge of exoccipital in caudal view;
1, covered by the lateralmost edge of exoccipital in caudal view.
40. Exoccipital; relative positions of the exits of the hypoglossal nerve XII (Nesbitt, 2011):
0, aligned in a near rostrocaudally plane;
1, aligned sub vertically.
41. Supraoccipital; rugose ridge on the craniolateral edges (Nesbitt, 2011):
0, absent;
1, present.
42. Foramen for trigeminal nerve and middle cerebral vein (Nesbitt, 2011):
0, combined and undivided;
1, fully or partially divided.

APPENDIX 3S (Continued)

43. External narial fenestra length (Yates 2003):
0, half or less than the orbit;
1, more than half of the orbit.
44. External narial fenestra; rostral edge (Yates 2007):
0, rostral or close to the midlength of the premaxillary body;
1, closer to the maxilla articulation than to the rostral edge of the premaxilla.
45. Antorbital fenestra; length (Langer 2004):
0, equal to or longer than the orbit;
1, shorter than the orbit.
46. Laterotemporal fenestra; rostral edge (Yates 2003):
0, caudal to the caudal edge of the orbit;
1, rostral to the caudal edge of the orbit.
47. Supratemporal fossa/fenestra (Gauthier 1986) ORDERED:
0, does not excavate the frontal bone;
1, excavates the frontal bone.
48. Predentary bone (Sereno, 1986) *uninformative*:
0, absent;
1, present.
49. Lower jaw; rostral portion (Nesbitt, 2011):
0, rounded;
1, tapers to a sharp point.
50. Dentary; length versus height (Yates 2007):
0, less than 0.2;
1, more than 0.2.
51. Dentary; rostral tip, dorsal surface (Sereno 1999)
0, at nearly the same plane as the rest of the alveolar margin of the bone;
1, ventrally inclined.
52. Dentary; extension of the caudoventral process (Smith et al. 2007):
0, elongated, extends caudally to the caudodorsal process;
1, short, does not extend caudally to the caudodorsal process.
53. Dentary; coronoid process dorsally expanded (Sereno, 1986):
0, absent;
1, present.
54. Mandibular buccal emargination (Langer & Benton 2006):
0, absent, lateral dentary surface smooth;
1, present, lateral dentary surface with a caudal crest bordering an emargination which encompasses half of the dentary width.

APPENDIX 3S (Continued)

55. Splenial; milohyoid foramen (Rauhut, 2003):

- 0, absent;
- 1, present.

56. Surangular; lateral surface (Tykoski & Rowe 2004):

- 0, evenly convex;
- 1, bears a prominent horizontal shelf.

57. Mandible; articular glenoid location (Gauthier, 1986):

- 0, at the dorsal margin of the dentary;
- 1, well ventral of the dorsal margin of the dentary.

58. Articular, retroarticular process (Yates 2003):

- 0, shorter than the height of the mandible ventral to the glenoid;
- 1, longer than the height of the mandible ventral to the glenoid.

59. Mandibular fenestra rostrocaudal length (Butler, 2005):

- 0, more than maximum depth of dentary ramus;
- 1, reduced, less than maximum depth of dentary ramus.

60. Premaxilla; teeth number (Nesbitt, 2011) ORDERED:

- 0, three;
- 1, four;
- 2, five or more.

61. Premaxilla; tooth row (Tykoski & Rowe 2004):

- 0, extends ventrally below the internal narial fenestra;
- 1, does not extend caudally farther than the cranial edge of the internal narial fenestra.

62. Maxilla; teeth number (Nesbitt et al. 2009) ORDERED:

- 0, 15 or less;
- 1, more than 15 but less than 20;
- 2, 20 or more.

63. Teeth at the caudal half of maxilla/dentary; caudal edge (Nesbitt, 2011):

- 0, concave or straight;
- 1, convex.

64. Middle maxillary/dentary teeth; serrations (Irmis et al. 2007) ORDERED:

- 0, small (c. 10 denticles per mm) forming right angles with the tooth margin;
- 1, large (c. 5 denticles per mm) but mostly forming right angles with the tooth margin;
- 2, larger forming oblique angles with the margin of the tooth.

APPENDIX 3S (Continued)

65. Maxillary/dentary teeth; extensive planar wear facets across multiple teeth (Weishampel & Witmer 1990):
0, absent;
1, present.
66. Maxillary/dentary teeth; medial or lateral overlap of adjacent crowns (Sereno 1986):
0, absent;
1, present.
67. Maxillary/dentary teeth; some with moderately developed lingual expansion of crown cingulum (Sereno 1986):
0, absent;
1, present.
68. Maxillary/dentary teeth; crown shape (Sereno 1986):
0, apicobasally tall and blade like;
1, apicobasally short and subtriangular.
69. Middle maxillary/dentary teeth, distal margin (Sereno 1986):
0, never or subtly expanded at the base;
1, clearly expanded at the base.
70. Middle maxillary/dentary teeth; long axis (Cabreira et al, 2016):
0, caudally curved;
1, straight.
71. Dentary teeth; number (Smith *et al.* 2007):
0, maximal of 25;
1, more than 25.
72. Dentary teeth; rostral portion of the bone (Kammerer *et al.* 2012):
0, teeth remain relatively same size throughout rostral portion of dentition;
1, teeth significantly decrease in size rostrally.
73. Dentary teeth; rostral portion of the bone, long axis (Kammerer *et al.* 2012):
0, vertical;
1, inclined rostrally.
74. Marginal teeth, crown shape in distal-medial view (Sereno 1986):
0, blade-like;
1, labiolingually expanded.
75. Pterygoid teeth on palatal process (Rauhut, 2003):
0, present;
1, absent.

APPENDIX 3S (Continued)

76. Axis; dorsal margin of the neural spine (Nesbitt, 2011):
0, expanded caudodorsally;
1, arcs dorsally where the cranial portion height is equivalent to the caudal height.
77. Axis; parapophysis development (Tykoski & Rowe 2004):
0, well developed;
1, reduced.
78. Axis; epipophysis on postzygapophysis (Rauhut, 2003):
0, absent;
1, present.
79. Cervical vertebrae 3-5, centrum length (Serenio 1991):
0, shorter or the same length as the mid dorsal;
1, longer than mid dorsal.
80. Cervical vertebrae; deep recesses on the cranial face of the neural arch lateral to the neural canal (Nesbitt, 2011):
0, absent;
1, present.
81. Third cervical vertebra; centrum length (Gauthier, 1986):
0, subequal to the axis centrum;
1, longer than the axis centrum.
82. Cervical vertebrae; neural spine shape (Yates, 2007):
0, not twice as long (at the midheight) as height;
1, at least twice at midheight as long as height.
83. Cranial cervical vertebrae, caudal chonos (Langer & Benton, 2006) ORDERED:
0, absent
1, as a shallow fossa;
2, as a deep excavation with a lamina covering the rostral extent.
84. Post-axial cranial cervical vertebrae; epiphyses (Gauthier, 1986):
0, absent;
1, present.
85. Cervical vertebrae 6-9; epiphyses (Serenio et al., 1993):
0, absent;
1, present.
86. Cervical vertebrae; cranial portion of the centrum, pneumatic features/ pleurocoels (Holtz, 1994):
0, absent;
1, present.

APPENDIX 3S (Continued)

87. Cervical vertebrae; neural arch (Galton & Upchurch 2004):
0, neural arch (from the base of neural canal to the top of postzygapophysis) higher than caudal articular facet of the centrum;
1, neural arch lower than caudal articular facet of the centrum.
88. Cervical vertebrae; middle portion of the ventral keel (Nesbitt, 2011):
0, dorsal to the ventralmost extent of the centrum rim;
1, extends ventral to the centrum rims.
89. Cervical ribs; length of relative to the centrum (Tykoski & Rowe 2004):
0, no more than twice longer;
1, at least twice longer.
90. Presacral vertebrae; parapophysis position (Langer & Benton 2006):
0, parapophyses do not contact centrum in vertebra caudal to the twelfth presacral;
1, parapophyses contact centrum in vertebra caudal to the twelfth presacral.
91. Caudal cervical and/or dorsal vertebrae; hyosphene-hypantrum accessory articulations (Gauthier, 1986):
0, absent;
1, present.
92. Trunk vertebrae; neural spine distal lateromedial expansion (Langer, 2004):
0, absent;
1, present
93. Trunk vertebrae; neural spine, distal craniocaudal length (Bittencourt et al. 2014):
0, at least twice longer than the base;
1, less than twice longer than the base.
94. Trunk vertebrae; crest onto the lateral wall of caudal chonos (Yates 2004):
0, absent;
1, present.
95. Caudal trunk centra; shape (Rauhut 2003):
0, short, centra are significantly shorter than high;
1, centra are approximately as long as high, longer than high.
96. Trunk vertebrae; transverse process shape (Tykoski & Rowe 2004):
0, subrectangular;
1, subtriangular.
97. Trunk vertebrae; infradiapophyseal fossa (Yates, 2007):
0, absent;
1, present.

APPENDIX 3S (Continued)

98. Sacral centra (Nesbitt, 2011):
0, separate;
1, co-ossified at the ventral edge.
99. Sacral vertebrae; incorporation of trunk vertebrae (Serenio et al. 1993):
0, free from the sacrum;
1, incorporated into the sacrum with ribs transverse processes articulating with the pelvis.
100. Sacral vertebrae, incorporation of caudal vertebrae (Galton, 1976):
0, free from the sacrum;
1, incorporated into the sacrum with ribs transverse processes articulating with the pelvis.
101. Number vertebra fully incorporated to the sacrum (Gauthier, 1986):
0, 2;
1, 3 or more.
102. Sacral ribs (Nesbitt 2011):
0, almost entirely restricted to a single sacral vertebra;
1, shared between two sacral vertebrae.
103. First primordial sacral vertebra; articular surface of the rib (Langer & Benton, 2006):
0, circular;
1, C-shaped in lateral view.
104. Sacral transverse process; development (Langer & Benton, 2006):
0, craniocaudally short not roofing the space between ribs;
1, craniocaudally long, roofing the space between ribs.
105. Sacral ribs depth (Langer & Benton, 2006):
0, as deep as half of the medial ilium depth;
1, deeper than half of the ilium depth.
106. Sacral rib and transverse process; lateral notch between elements (Bittencourt et al. 2014):
0, absent;
1, present.
107. First three caudal vertebrae; orientation of the neural spine (Langer & Benton, 2006):
0, caudally inclined;
1, vertical.
108. Middle caudal centra; length (Yates, 2003):
0, centra longer than twice the height of the cranial articular facet;
1, centra shorter than twice the height of the cranial articular facet.

APPENDIX 3S (Continued)

109. Distal caudal vertebrae; prezygapophyses (Gauthier, 1986):
0, length is less than a quarter of the adjacent centrum;
1, elongated, more than a quarter of the adjacent centrum.
110. Scapula; cranial margin (Nesbitt 2011):
0, straight convex or partially concave;
1, markedly concave.
111. Scapula; blade height (Sereno, 1999):
0, less than 3 times distal width;
1, more than 3 times distal width.
112. Coracoid; caudal margin (Nesbitt, 2011):
0, continuous (subcircular in lateral view);
1, with notch ventral to the glenoid.
113. Coracoid; post glenoid process (Nesbitt, 2011):
0, absent or short;
1, extending caudal to glenoid.
114. Limbs; humerus+radius/femur+tibia length ratio (Gauthier, 1984):
0, more than 0.55;
1, less than 0.55.
115. Humerus; apex of deltopectoral crest, situated at a point corresponding to (Bakker & Galton, 1974) ORDERED:
0, about or less than 30% down the length of the humerus;
1, between 30% and 43% down the length of the humerus.
2, about or more than 43% down the length of the humerus.
116. Humerus; deltopectoral crest size (Yates, 2007):
0, low;
1, expanded.
117. Humerus; deltopectoral crest shape (Yates, 2007):
0, low rounded crest;
1, subtriangular, concave between apex and articulation;
2, subrectangular, convex/straight between apex and articulation..
118. Limbs; humerus/femur length ratio (Novas, 1996):
0, humerus longer than or subequal to 0.6 of the length of the femur;
1, humerus shorter than 0.6 of the length of the femur.
119. Humerus; distal end width (Langer & Benton, 2006):
0, narrower or equal to 30% of humerus length;
1, wider than 30% of humerus length.

APPENDIX 3S (Continued)

120. Humerus; shape in lateral view (Rauhut, 2003):
0, straight;
1, sigmoid.
121. Forelimb; humerus/radius length ratio (Langer & Benton, 2006):
0, radius longer than 80% of humerus length;
1, radius shorter than or suequal to 80% of humerus length.
122. Ulna; olecranon process (Wilson & Sereno 1998):
0, short;
1, enlarged and strongly striated.
123. Distal carpal 1; articulation (Rauhut, 2003) ORDERED:
0, does not articulate with metacarpal II;
1, articulates to metacarpal II.
2, caps metacarpal II.
124. Distal carpals; number of ossified elements (Sereno, 1999):
0, 5;
1, 4.
125. Medialmost distal carpal; size (Gauthier, 1986):
0, subequal other distal carpals;
1, significantly larger than other distal carpals.
126. Manus; length measured as the average length of digits I-III (Gauthier, 1986):
0, accounts for less than 0.4 of the total length of humerus plus radius;
1, more than 0.4 of the total length of humerus plus radius.
127. Metacarpals; proximal ends (Sereno & Wild, 1992):
0, overlap one another;
1, abut one another without overlapping.
128. Manus; ungual phalanges (Gauthier, 1986):
0, blunt unguals on at least digits II and III;
1, trenchant unguals on digits I to III.
129. Metacarpals II-III; extensor pits on distal/dorsal portion (Sereno et al. 1993):
0, absent or shallow;
1, deep.
130. Digit I; metacarpal/ungual phalanx length ratio (Sereno, 1999):
0, metacarpal subequal or longer than ungual;
1, metacarpal shorter than ungual.

APPENDIX 3S (Continued)

131. Metacarpal I; width (at the middle of the shaft)/length ratio (Bakker & Galton, 1974):
0, width less than 0.35 of the length of the bone;
1, width more than 0.35 of the length of the bone.
132. Metacarpal I; distal condyles (Bakker & Galton, 1974):
0, approximately aligned or slightly offset;
1, lateral condyle strongly distally expanded relative to medial condyle.
133. Manual digit I; first phalanx, twisting of the transverse axis (Sereno, 1999):
0, not twisted;
1, twisted.
134. Manual digit I; first phalanx (Gauthier, 1986):
0, not the longest non ungual phalanx of the manus;
1, longest non ungual phalanx of the manus.
135. Manual unguals; digit I & II length ratio (Yates, 2007):
0, ungual of digit II as long as or longer than that of I;
1, ungual of digit II shorter than that of I.
136. Metacarpals; length ration between II and III (Gauthier, 1986):
0, metacarpal II shorter than metacarpal III;
1, metacarpal II equal to or longer than metacarpal III.
137. Manual digit II; pre-ungual phalanx and phalanx 1 length ratio (Rauhut 2003):
0, pre-ungual phalanx equal or shorter;
1, pre-ungual phalanx longer.
138. Metacarpals; width (at midlength) ratio between elements II & III (Rauhut 2003):
0, equal;
1, metacarpal III at least 30% narrower.
139. Manual digit IV; number of phalanges (Gauthier, 1986) ORDERED:
0, 3 or more;
1, 2;
2, 1 or none.
140. Metacarpal IV; shaft width (Sereno et al. 1993):
0, about the same width as that of metacarpals I-III;
1, significantly narrower than that of metacarpals I-III.
141. Manual digit V; phalanges (Bakker & Galton, 1974):
0, one or more phalanges;
1, no phalanges.

APPENDIX 3S (Continued)

142. Digit V (Bakker & Galton, 1974):
0, present;
1, absent.
143. Ilium; preacetabular ala, tip shape (Galton, 1976):
0, pointed, with vertex projected cranially;
1, rounded.
2, squared.
144. Ilium; preacetabular ala length (Galton, 1976):
0, does not extend cranial to the cranial margin of the pubic peduncle
1, extends cranial to the cranial margin of the pubic peduncle.
145. Ilium; supraacetabular crest, position of thicker (lateromedially) portion (Yates 2003):
0, at the center of the acetabulum;
1, closer to pubic peduncle.
146. Ilium; supraacetabular crest, extension on pubic peduncle (Nesbitt et al. 2009):
0, ends before the distal margin of the peduncle;
1, extends along the peduncle length.
147. Ilium; fossa for the attachment of m. caudifemoralis brevis (Gauthier & Padian, 1985) ORDERED:
0, absent;
1, present as an embankment on the lateral side of the caudal portion of the ilium;
2, present as a fossa on the ventral surface of postacetabular part of ilium.
148. Ilium; ventral margin of the acetabular wall (Bakker & Galton, 1974) ORDERED:
0, convex;
1, slightly concave, straight or slightly convex;
2, markedly concave.
149. Ilium; acetabular antitrochanter (Sereno & Arcucci 1994a):
0, absent or just a slightly planar surface;
1, raised shelf.
150. Ilium; brevis fossa lateral wall (Smith et al. 2007):
0, vertical;
1, lateroventrally directed.
151. Ilium; pubic peduncle distal articulation (Smith et al. 2007):
0, not expanded;
1, expanded distally.
152. Ilium; ischiadic peduncle orientation in lateral view (Langer & Benton, 2006):
0, mainly vertical;
1, well expanded caudal to the cranial margin of the postacetabular embayment.

APPENDIX 3S (Continued)

153. Ilium; strong pillar caudal to the preacetabular embayment (Nesbitt 2011):
0, absent;
1, present.
154. Ilium; dorsal margin shape (Gauthier, 1986):
0, sigmoid;
1, entirely convex.
155. Ilium; position of dorsal margin concavity (Cabreira et al, 2016):
0, above the acetabulum;
1, caudally displaced.
156. Ilium; maximum length of the postacetabular ala (Yates, 2007):
0, shorter than or subequal to the space between the pre and postacetabular embayments;
1, longer than the space between the pre and postacetabular embayments.
157. Ilium; pubic articulation orientation (Langer & Benton, 2006) ORDERED:
0, ventral;
1, cranioventral
2, cranial.
158. Pubis length (Novas, 1996):
0, less than 70% or equal of femoral length;
1, more than 70% or more of femoral length.
159. Pubis orientation (Sereno, 1986):
0, cranioventral;
1, rotated caudoventrally to lie alongside the ischium (opisthopubic).
160. Pubis; distal end (Gauthier, 1986) ORDERED:
0, unexpanded;
1, expanded relative to the shaft
2, expanded and at least twice the breadth of the pubic shaft (pubis boot).
161. Pubis; medial articulation of the pair (Tykoski 2005):
0, complete, reaches the distal edge of the pubis;
1, forms a medial hiatus on the distal portion (bevel).
162. Pubis; distal apron (Langer & Benton, 2006):
0, straight;
1, lateral portion flipped caudally.
163. Pubis; proximal portion (Nesbitt, 2011):
0, articular surfaces with the ilium and the ischium continuous;
1, articular surfaces with the ilium and the ischium separated by a gap.

APPENDIX 3S (Continued)

164. Pubis; shaft in lateral view (Harris, 1998):
0, cranially bowed;
1, straight.
165. Pelvis; ischio-pubis contact (Benton & Clark, 1988):
0, present and extended ventrally;
1, present and reduced to a thin proximal contact.
166. Pubis; distal pubis mediolateral width (Galton, 1976):
0, nearly as broad as proximal width of the bone;
1, significantly narrower than proximal width of the bone.
167. Ischium; medial contact with antimere (Novas 1996):
0, restricted to the ventral edge;
1, more dorsally extensive contact.
168. Ischium; dorsolateral sulcus (Yates, 2003):
0, absent;
1, present.
169. Ischium; outline of the distal portion (Serenio, 1999):
0, thin, plate-like;
1, rounded or elliptical;
2, subtriangular.
170. Ischium; distal portion (Smith & Galton, 1990):
0, unexpanded;
1, expanded relative to the ischial shaft.
171. Ischium; proximal articular surfaces (Irmis et al. 2007) ORDERED:
0, continuous ilium and pubis articular surfaces;
1, ilium and pubis articular surfaces continuous but separated by a fossa;
2, ilium and pubis articular surfaces separated by a non-articulating concave surface.
172. Ischium; length relative to the dorsal margin of the iliac blade minus the preacetabular ala (Nesbitt, 2011):
0, about the same length or shorter;
1, markedly longer.
173. Femur; proximal portion, craniomedial tuber (Gauthier, 1986) ORDERED:
0, small, unprojected, rounded;
1, small and angled (separated from the caudomedial by the lig sulcus);
2, offset medially or caudally relative to the caudomedial tuber.
174. Femur; ligament sulcus (Cabreira et al, 2016):
0, does not form a medial excavation in proximal view;
1, forms a medial excavation in proximal view.

APPENDIX 3S (Continued)

175. Femur; proximal portion, caudomedial tuber (Novas, 1996) ORDERED:
0, present and largest of the proximal tubera.
1, small;
2, absent.
176. Femur; proximal portion, craniolateral tuber (Sereno & Arcucci, 1994a):
0, absent (the craniolateral face is flat or equally rounded);
1, present.
177. Femur; medial articular surface of the head in dorsal view (Nesbitt, 2011):
0, rounded;
1, flat/straight.
178. Femur; head, expansion/shaft transition (Sereno & Arcucci, 1994a) ORDERED:
0, smooth transition from the femoral shaft to the head;
1, kinked transition from the femoral shaft to the head;
2, kinked transition and expanded head.
179. Femur; head long axis angle to the distal intercondylar line (Benton & Clark, 1988)
ORDERED:
0, 45° or more
1, 20-45°;
2, 0-20°.
180. Femur; head in medial and lateral views (Sereno & Arcucci, 1994a):
0, rounded;
1, hook shaped.
181. Femur; dorsolateral trochanter (Nesbitt, 2011):
0, absent;
1, present.
182. Femur; “lesser” trochanter (Bakker & Galton, 1974) ORDERED:
0, absent;
1, present and forms a steep margin with the shaft but is completely connected to it;
2, present and separated from the shaft by a marked cleft;
3; present and approaches the proximal articulation of the bone.
183. Femur; medial articular facet of the proximal portion in caudomedial view
(Nesbitt, 2011):
0, rounded;
1, straight.
184. Femur; craniolateral surface of the femoral head (Sereno & Arcucci, 1994a):
0, smooth, featureless;
1, ventral emargination present.

APPENDIX 3S (Continued)

185. Femur; "trochanteric shelf" (Gauthier, 1986):
0, absent;
1, present.
186. Femur; head, facies articularis antitrochanterica (Novas, 1996):
0, level with "greater trochanter";
1, ventrally descended.
187. Femur; "greater trochanter" shape (Sereno, 1999):
0, rounded;
1, angled.
188. Femur; transverse groove on proximal surface (Ezcurra, 2006):
0, absent;
1, present.
189. Femur; "lesser" trochanter, lateromedial position (Yates, 2007):
0, closer to the medial edge;
1, closer to the lateral margin.
190. Femur; fourth trochanter shape (Gauthier, 1986):
0, mound-like or subtle crest;
1, flange.
191. Femur; fourth trochanter; symmetry (Langer & Benton, 2006):
0, symmetrical, distal and proximal margins forming similar low angle slopes to the shaft;
1, asymmetrical, distal margin forming a steeper angle to the shaft.
192. Femur; bone wall. thickness at or near mid shaft (Nesbitt, 2011):
0, thickness diameter > 0.3;
1, thin, thickness diameter >0.2, <0.3.
193. Femur; distal condyles, extension of the caudal division (Nesbitt, 2011):
0, less than 1/4 the length of the shaft;
1, between 1/4 and 1/3 the length of the shaft.
194. Femur cranial surface of the distal portion (Nesbitt et al. 2009):
0, smooth;
1, distinct scar orientated mediolaterally.
195. Femur; crista tibiofibularis size/shape (Sereno & Arcucci, 1994a) ORDERED:
0, smaller in size to the lateral condyle;
1, larger or equal than the lateral condyle;
2, larger/equal and globular.

APPENDIX 3S (Continued)

196. Femur; craniomedial corner of the distal end (Nesbitt *et al.* 2009):
0, rounded;
1, squared off near 90° or acute.
197. Femur; cranial margin in distal view (Cabreira et al, 2016):
0, concave;
1, straight or convex.
198. Hindlimb; tibia or fibula relative length to the femur (Gauthier, 1986):
0, femur longer or about the same length as the tibia/fibula;
1, tibia/fibula longer than femur.
199. Tibia; depth of the sulcus lateral to cnemial crest (Langer *et al.* 2011):
0, no deeper than 10% of the length of proximal surface of tibia;
1, more than 10% of the length of proximal surface of tibia.
200. Tibia; cnemial crest (Benton & Clark, 1988) ORDERED:
0, absent or just a slight bump;
1, present and straight;
2, present arcs craniolaterally.
201. Tibia; proximal portion, fibular condyle (Langer & Benton, 2006) ORDERED:
0, offset cranially from the medial condyle;
1, level with the medial condyle at its caudal border
2, displaced caudally.
202. Tibia lateral side of the proximal portion (Gauthier, 1986) ORDERED:
0, smooth or scared;
1, dorsoventrally oriented crest present,
2, well developed ridge.
203. Tibia; separation of the proximal condyles (Rauhut, 2003):
0, separated by a shallow notch;
1, separated by a deep groove.
204. Tibia; separation of the condyles in proximal view (Cabreira et al, 2016):
0, single notch/ groove;
1, two separated notches.
205. Tibia; distal portion, caudolateral flange (Novas, 1992) ORDERED:
0, absent;
1, present;
2, present and extends well lateral to the craniolateral corner.
206. Tibia; distal end, caudal margin shape (Irmis *et al.* 2007):
0, straight or convex;
1, concave.

APPENDIX 3S (Continued)

207. Tibia; distal surface outline (Rauhut, 2003):
0, rounded or subquadrangular (approximately as wide as long);
1, mediolaterally expanded.
208. Tibia; distal portion; caudomedial surface (Nesbitt, 2011):
0, rounded surface;
1, distinct proximodistally oriented ridge present.
209. Tibia; distal portion, lateral side (Novas, 1996):
0, smooth rounded;
1, proximodistally oriented groove.
210. Tibia; distal surface, caudomedial notch (Yates, 2007):
0, absent;
1, present.
211. Tibia; astragalar articulation (Novas, 1996):
0, tibia articulates with astragalus medially to the ascending process;
1, tibia covers the medial and caudal portion of the dorsal surface of astragalus.
212. Astragalus; caudal margin, dorsally expanded process (Sereno & Arcucci, 1994):
0, absent or poorly expanded;
1, expanded into a distinct raised process caudal to ascending process.
213. Astragalus; proximal margin in caudal view (Cabreira et al, 2016):
0, straight at the lateralmost portion;
1, depressed at the lateralmost portion (with subtle raised margin medial to it).
214. Astragalus; cranial ascending process (Gauthier, 1986):
0, absent;
1, present.
215. Astragalus; tibial articulation caudal to the ascending process (Langer & Benton, 2006):
0, continuous to the medial articulation surface;
1, markedly rimmed and elliptical fossa (separated by a ridge or step from the medial surface).
216. Astragalus; proximal articular facet for fibula (Langer & Benton, 2006) ORDERED:
0, equal more than 0.3 of the transverse width of the bone;
1, less than 0.3 of the transverse width of the bone;
2, vertical (no horizontal platform).
217. Astragalus; caudal groove (Nesbitt, 2011):
0, present;
1, absent.

APPENDIX 3S (Continued)

218. Astragalus; shape of the craniomedial margin (Yates, 2007):
0, obtuse or forming a right angle;
1, acute.
219. Astragalus; medial portion of the tibial facet (Benton, 1999):
0, concave or flat;
1, divided into caudomedial and craniolateral basins.
220. Astragalus; shape (Cabreira et al, 2016):
0, more than 80% broad lateromedially than craniocaudally;
1, less than 80% broad craniocaudally than lateromedially.
221. Astragalus; cranial margin (Cabreira et al, 2016):
0, straight or concave;
1, deeply excavated with a groove extending along the distal surface of the bone.
222. Astragalus; cranial ascending process, cranial margin (Langer, 2004) ORDERED:
0, continuous to the cranial surface of the astragalar body;
1, separated from the cranial surface of the astragalar body by an oblique slope.
2, separated from the cranial surface of the astragalar body by a platform.
223. Astragalus; caudolateral process (Cabreira et al, 2016):
0, continuous to the caudal margin of the bone;
1, displaced cranially.
224. Astragalus-calcaneum; articulation (Sereno & Arcucci, 1994a):
0, free;
1, co-ossified.
225. Calcaneum; calcaneal tuber (Gauthier, 1986):
0, present;
1, absent.
226. Calcaneum; tibial articulation (Langer *et al.* 2011):
0, absent;
1, present.
227. Calcaneum; articular surface for the fibula (Novas, 1996):
0, convex;
1, concave.
228. Calcaneum; shape (Langer & Benton, 2006):
0, proximodistally compressed and subtriangular, with short caudal projection and medial processes;
1, transversely compressed and subrectangular, reduced projection and processes.

APPENDIX 3S (Continued)

229. Distal tarsal 3; articulation with metatarsus (Butler et al. 2008):
0, articulates with metatarsal III only;
1, articulates with metatarsal II and III.
230. Distal tarsal 4; caudal prong (Langer & Benton, 2006):
0, blunt;
1, pointed.
231. Distal tarsal 4; medial process (Nesbitt 2011):
0, absent;
1, distinct in the craniocaudal middle of the element.
232. Distal tarsal 4; proximal surface (Sereno & Arcucci, 1994a):
0, flat;
1, distinct proximally raised region on the caudal portion.
233. Metatarsus; maximum length (Benton, 1999):
0, equal or shorter than 50% of tibial length;
1, longer than 50% of tibial length.
234. Metatarsus; metatarsals I and II, articulation (Gauthier, 1986):
0, Metatarsal I reaches the proximal surface of metatarsal II;
1, Metatarsal I does not reach and attaches onto the medial side of metatarsal II.
235. Metatarsus; metatarsals II and IV; length relation (Gauthier, 1986):
0, Metatarsal IV longer than metatarsal II;
1, Metatarsal IV subequal or shorter than metatarsal II.
236. Metatarsal IV; distal articulation surface (Sereno, 1999):
0, broader than deep to as broad as deep;
1, deeper than broad.
237. Metatarsal IV; proximal portion (Sereno, 1999):
0, narrow;
1, expanded, overlapping the cranial surface of metatarsal V.
238. Metatarsal IV; shape (Novas, 1996):
0, straight;
1, laterally curved at the distal end.
239. Metatarsus; metatarsals III and V; length relation (Carrano *et al.* 2002):
0, Metatarsal V equal to or longer than 50% of metatarsal III;
1, Metatarsal V shorter than 50% of metatarsal III.
240. Metatarsal V; proximal (Yates, 2003) ORDERED:
0, unexpanded;
1, expanded;
2, expanded, with a width more than 30% the length of the bone.

APPENDIX 3S (Continued)

241. Metatarsal V; distal tip (Gauthier, 1984):
0, blunt and with phalanges;
1, without phalanges and tapers to a point.
242. Osteoderms; dorsal to the vertebral column (Gauthier, 1984):
0, absent;
1, present.
243. Jugal; total length relation relative to that of the skull (Cabreira et al, 2016):
0, more than 35%;
1, 35% or less.
244. Jugal, caudal process; pectoid projecting the forking part of the bone caudally (Cabreira et al, 2016):
0, present;
1, absent.
245. Jugal, caudal process; reaches the caudal margin of the ventral temporal fenestra (Cabreira et al, 2016):
0, yes;
1, no.
246. Premaxillary teeth, serration in the mesial margin (Rowe, 1989):
0, present;
1, absent.
247. Ilium, pubic peduncle, shape; width (craniocaudal) at mid-length vs total length (Galton, 1976):
0, less than 0,5;
1, 0,5 or more.
248. Ilium, dorsal lamina; depth relative to the acetabulum (Makovicky & Sues, 1998):
0, shallow that two times;
1, two times deeper or more.
249. Postfrontal (Gauthier 1986):
0, present;
1, absent.
250. Postparietal (Jull 1994):
0, present;
1, absent.
251. Posttemporal opening (Sereno & Novas 1994):
0, present minimally as a fissure;
1, absent.

APPENDIX 3S (Continued)

252. Basipterygoid process, proximal part; angle to the proximal portion of the cultriform process (Butler et al. 2008):

- 0, less than 90°;
- 1, 90° or more than 90°.

253. Parabasisphenoid, foramina for entrance of cerebral branches of internal carotid artery into the braincase; position (Nesbitt, 2011):

- 0, on the ventral surface;
- 1, on the lateral surface.

254. Parabasisphenoid, lateral wall, caudoventral corner; semilunar depression, presence (Gower and Sennikov, 1996):

- 0, present;
- 1, absent.

255. Basipterygoid process, shape (Cabreira et al, 2016):

- 0, rounded;
- 1, mediolaterally compressed.

256. Tibia, posterolateral process (= lateral malloelus) in anterior or posterior view ((Serenó 1999). This character is inapplicable in taxa without a posterolateral process):

- 0, lobular;
- 1, tabular

257. Tibia, diagonal tuberosity on the anterior surface of the distal end of tibia (Ezcurra & Brusatte, 2011):

- 0, absent;
- 1, present.

258. Ilium, iliac acetabulum, dorsoventral depth from the acetabular roof to the pubis-ischium articulation (new):

- 0, equals 60% or more of the craniocaudal width;
- 1, less than 60% of the craniocaudal width.

Data Matrix

Variable characters are within square brackets

- = inapplicable characters

? = Missing data

Euparkeria capensis

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APPENDIX 3S (Continued)

Lagerpeton chanarensis

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Dromomeron gregorii

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Marasuchus lilloensis

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Saltopus elginensis

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Lewisuchus admixtus

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Pseudolagosuchus major

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APPENDIX 3S (Continued)

Asilisaurus kongwe

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Diodorus scytobrachion

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Eucoelophysibaldwini

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00101111??????111101?012110011?001?0001??11000?????????????????????????????????????????
??1?1?????????????????????0?

Silesaurus opolensis

0?00000?0010000??0???101?110?010100110111000?01010?000001002001100111100
[01]?1000100110001010101010101011100100[01]1111000000000?????????????????????
??10002[01]0110100111001010111101110[12]111101210[01]01110011000100[12]1
10020001010110010?001100010?????1010010?10000101?100011000

Sacisaurus agudoensis

?????????0000101?????????0?????????????????????????????01?????????????11011111011?????
?????????????????????????????????????0??11?????????0?????????????????????????000[12]0??10
1????1100??1?1?11?????1[01][12]1111012100011100?1000110111002110101?????????
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Pisanosaurus mertii

?????????1?0?????????????????????????????????????????1?111?0111?????1?111110?????
??0?????010?????0??0????????????????????????????????????????????????????????????????????
??0?????????????2?????????????????????????????0001?011010?0011?10?1?111?110?11011????
1??1?1??0??1?????????00?

Scutellosaurus lawleri

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?00??0??0?0?0?101000??10??0001?000011000?0?????00??????0?????01??????00
?????11?????1?01??11110002201310[01]011111000001102001021111010010211?000
001111?????????110?1???1?????????00?

Lesothosaurus diagnosticus

00000000110000100000100110000?00111010?00000101110?01100111200120111110
1001010?00?0100?0?001?????111?000????1000101100010?????0000000?000?00001
11111?00001011100?111?010021102002201300011011100000110200102011101?1?
?1?????????1?1?0??01010011??0000100111011?000

APPENDIX 3S (Continued)

Eocursor parvus

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?????0?00?1??0??0?001?1?0?0?????11??01??01??????????????????????01002200000
0100?1??111?010?2?111002201310011111?000011020?102011101??1?????????????
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Heterodontosaurus tucki

000011001100121000001001110001?001?001100100101111?11101111000121001010
0011000000001000000011?1001111?000?000110001120001110001110011001100000
011?221000001001100?111?101021?????2?2?30?0110111?0000110201??0?1??????
?1?????11??10000101101??101101001110110?00

Herrerasaurus ischigualastensis

0000101?0000100000100011010001110001000?1?00001001000001000101000000000
00?1001?01?111011?0111?00101000111011101?1111[12]10101[02]10111100001001
021102010120-
101000110101111112011111021011001110111?00001002100010011010111101?00
200001001101010110100000000110????000

Staurikosaurus pricei

0????????????????????????????????????????????0010?00?0?0????0000000000????
?00?011?010?0?01?001001001110111?????????????????????????????????????1010120-
10100011011111111?1??1111102101[01]00?111-
10?0000110210001000101?????????????????????????????0??000??????000

Sanjuansaurus gordilloi

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?11??1110110011100?10101011101??01111??????1??????????????????????????????
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?10?????????????????0?????????00?

Panphagia protos

0??????????????1?0????????????????????????0??01000100011100??11000010000??
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00??11?000??011111?????????????1??????????02000010011010011111?00200?
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Eoraptor lunensis

0110111?00110111101101111000111001010????100010001?000010?101[01]100000
000000??1??0011000001111010100??1?0?00010121210110??10001011110000201
0100121011101?0110000111011[12]121??1??1011??1?111?000011020100100110
10011111?0020000101110101011110111111111????001

Pampadromaeus barberenai

002[12]11?100111[01]1??0?101011001?1?????????????0??00000?0??001020100001
000000????????????????10111010??001?01?1?10?????0?100?????????????????????100
?2101??0??1?0??1?1??????11110[12]1011?011111111??00?10[12]0????0?????????
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APPENDIX 3S (Continued)

Buriolestes schultzi

0?2[12]01110011?01??010??010?1110?????????00110001?00?01?010200000000?
 001?????????????01110100100110100010?111200110????0??01?????????200
 121011001?01?0110111?111111[12]11102101100111111?00001102000010011010??
 ?110????000100??001111110100001??????0?1

Saturnalia tupiniquim

1?????????????????11?1????????????100?????????00?1????????????11000010000????
 ?10?1?110000010101010010011010101010121201111??????????????????100[01]21
 011001?1110100111011[12]1111111021011011111111?000010020100110110100111
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Chromogisaurus novasi

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Pantyraco caducus

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 ??01111?000??10????????????????00?00?11????????????????????????????0111??1?1?
 0010?0??????11[12]1????????????????????1??00001??200??00?1?1?0?????????????
 ?????0010111210??10111?0110??1

Efraasia minor

1?2110100020101?111101??1?00??10000000??1??10011101101?01?2120?001100
 00????10?111100??10101010?0?011010101010121201110011?0101111?1101[12]00
 0001022011001?11100001110112111111102101100011111100000100200001101101
 0011211????00?1001100010111200??10011?0110001

Plateosaurus engelhardti

11211010002010111111010011[01]00?01110000001111001001110110100202120100
 111000101110111101001101110100110110101010100212011100110010111111100
 0000001022011101?111010011101121[12]111[01]1021011000111111000000020000
 1[01]111010011201?00200001011100010110200100100110111000[01]

Chindesaurus briansmalli

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 ?????1??????????????1011021011001110110?0?001???1?0120001[01]10111111?112[
 01]0????????????????????????????????????000

Guaibasaurus candelariensis

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 ???????????1?1111100001110?0??0?111?10110??1111111100111?1??100121[01]1
 101??11100?0111[01]11?111?????1?11?00?1?11[01]10000?01210002001111011110
 1?01200011011100011111110????00??????0[01]

APPENDIX 3S (Continued)

Tawa hallae

012211?00020100???1000?001010?0100?1100000100010000000?00?001000000000?
001????11112111111?10111?10?000?0?0?001??111[12]10100000101110001001011?
1?010120?101??011020?1011?1??2?1021022111110111100100001102110120001010
111111?1121000110110001111101011100011?1111000

Eodromaeus murphi

0?1??0??0011010??????1??0????1?00??????0??0000100??0?1?000000000000?0
?0011?1???110?0?01?1110?0?????010111?11121011111010?1?0100?110[12]100101
0210110100111011?10?111??11??1?21?11001?1?????00001012210010011110?111?
0?002000011????0? ??????0??000??0101000

Coelophysis bauri

012212?100210011100101111[01]0110100112001000010110000100?1000112000000
00100111111112111101?101011111110010100110111?1?1011021111111011111112
1?1210022111101?111021?10111111212?0002211200111110010000[01]1122200201
11110110111?002011011001011110110101000111110??110

Liliensternus liliensterni

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?11?121?110?11010111?11100?0????????11110?10????????1????????210022011
111?121021?10111111212111022112110111110?00001002220020111110010111?002
0110?1????1?1101??0??011??????100

“Syntarsus” rhodesiensis

01221211?011000110010?101????10011201??10?1??0000000????112000000?0100
11????11112111101?101?11111100101001111111210?11211111?11111011121?121
0122111101?12100??1011111121211102211[12]01[01]111100?000001122200201111
10010111?0020111?1?010111101101011?011?110101110

“Syntarsus” kayentakatae

01221211?021010?101101101?10101110??00?1?010010000000?1000112000000?00
001????11112111101?101?11111100101??110111??1??????????????????11?1???
???1??1??1?1021?101111??2?211102?112001111001000011122200?????10?1???
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Zupaysaurus rougieri

?????2??011010?101101011101100011??00?????01100?0100?1000??2000000?0000
??1????????????????????????????????????????????????????????????????11?????
????0????????????????????????????????????????0001??????2111110010101?0000010?1
??????????????1100??1??????100

Daemonosaurus chauliodus

?00011??010100?0010??11001001001??00??111010010000?0000000?00000?000
0?????10????????????????????????????????????????????????????????????????
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APPENDIX 3S (Continued)

Petrified forest theropod

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1021?1?111?112?211102?112101111110??0001?0212002111111001010??0??0110?10
0101?11?1?????????11?????????10

Dilophosaurus wetherelli

012[12]?2?10010010??11?0101101100101?2011001110010010000110?01110000000
?000111110111111210?11010111011101101001101121[12]10110??1111111011001
21?1210022011101?121021?1111111121211102211210[01]111110100000002120021
111110010101?0021011110010111101101001101111101?0000

Nhandumirim waldsangae

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1?????????????????11110210110101111111000011??????1011111??1????????????????????
?1?11?0?????????00?????????110

APPENDIX 4S. Scorings modified from the data matrix of Nesbitt and Ezcurra (2015):

149) Distal caudal vertebrae, prezygapophyses (Gauthier, 1986; Rauhut, 2003; Nesbitt, 2007; Nesbitt, 2009: 211):

0, not elongated;

1, elongated more than a quarter of the adjacent centrum.

- *Eodromaeus murphi* (PVSJ 0560) does not possess elongated prezygapophyses. The character-state was (1), and has been rescored as (0).
- “*Syntarsus*”*rhodesiensis* has elongated prezygapophyses, which surpass more than a quarter of the adjacent centrum (Raath, 1969; 1977:plate 15). The character-state was (0), and has been rescored as (1).

196) Ilium, distinct fossa present for the attachment of the m caudifemoralis brevis (Gauthier and Padian, 1985; Gauthier, 1986; Juul, 1994; Novas, 1996; Benton, 1999; Hutchinson, 2001; Nesbitt, 2009: 271):

0, absent;

1, present as an embankment on the lateral side of the posterior portion of the ilium;

2, present as a deep fossa on the ventral surface of postacetabular part of the ilium.

- *Saturnalia tupiniquim* (MCP 3844-PV) has a deep fossa, ventral to the postacetabular ala of the ilium. The character-state was (1), and has been rescored as (2).
- *Eoraptor lunensis* (PVSJ 0512) has a deep fossa, ventral to the postacetabular ala of the ilium. The character state was (1), and has been rescored as (2).

197) Ilium, ridge connecting the posterior portion of the supra-acetabular rim to the posterior portion of the ilium: (Langer and Benton 2006; Nesbitt 2009: 272):

0, absent;

1, present.

- *Saturnalia tupiniquim* (MCP 3844-PV) has a ridge that connects the caudal portion of the supracetabular crest to the postacetabular ala. The character-state was (0), and has been rescored as (1).

APPENDIX 5S. Updated character scorings and new character scorings of *Nhandumirim walgsangae* within the data matrix of Nesbitt and Ezcurra (2015).

Saturnalia tupiniquim

????????????[01]??0??0??????11??????1??????????????1??????0?
??????1??????0??????[01]01001001?1??0??0??100001??00000000000010
01??1000?111000111??010??????????????002000021110001001100110012100211
010002102100111110011?000020000111101011100111110010101111??0?01??201
1110000011101?00??????????????020000001000?000

Eoraptor lunensis

00010?00100112000100000100000?0011111000?1010010000013001000101?012?1?0
?00?????????001?011000?00001?????101?0[01]?0101??00?001?0?0?0000200000
?000?0?1?110?0?11110110100010101??0001110??1010020000212?00110011??1001
1100??11??0??1?110?0??100??00020000?1000101?10??11111??10?0??1??0?0??
?2?11110000?1?1?1?00?????10102010??00?0110000000001000

“Syntarsus” rhodesiensis

111011111111000020001111000010010111000010100100001?3001000111?0121111
00001111?1??0011011000020000??00000000000111110?1?111111?010000001100
11101011111010111101101000101121110011113010211211102121111001110100
11111121012000210220011210011110000210111311010111011111010010100111??1
?01??211111010010101200??????111201021?001201011001110101

Eodromaeus murphi

????110?10?10?00[01]?00000101100??0????????????????1??01?0?????01211100
??0?1?????001?????0?00?????0??000000001011?001?10?111000??00000000100?
?001??101??1111011?100?101120010001[01]?3010000?00002021??010011101??0??1
??2?11??00210[12]1001??100011?011020010111101011101?0?????010?0111??0??1
??2??1?10?0?00?????0?????012[12]??21??0??[01]1000001??0?0000

Nhandumirim waldsangae

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????????????????????????????????????????????????????????????????0?000??01?0??????
????????????????????????????????????????0?200002021??1????????????????110002101100
01111001110000??????1010101110001??????1????????????????11?????1?1??0?
?????????????????????1?0010??0??011

APPENDIX 6S. References

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