

Supplementary Information I

Character List

Dental Features

1. Maximum number of dental alveoluses (tooth positions) in the dentary dental battery (modified from Horner et al., 2004 character 1): (0) 30 or fewer; (1) 31 to 45; (2) more than 45.
2. Number of dentary teeth per centimeter of the dental battery (corresponding with Prieto-Marquez and Wagner, 2009 character 2): (0) less than 1.1 teeth/cm of dental battery; (1) 1.1 or more teeth/cm of dental battery.
3. Maximum number of teeth per alveolus of the dentary in adults (modified from Horner et al., 2004 character 2): (0) two; (1) three; (2) four; (3) five or more.
4. Maximum number of the functional teeth on the dentary occlusal plane (corresponding with Prieto-Marquez and Wagner, 2009 character 4): (0) only one functional tooth; (1) one functional tooth on the rostral and caudal portions of the occlusal plane, and up to two near the middle part of the dental battery; (2) three functional teeth throughout the most part of the occlusal plane, decreasing to two at the rostral and caudal ends of the dental battery.
5. Height/width ratio of the dentary tooth crown in lingual view (corresponding with Prieto-Marquez and Wagner, 2009 character 5): (0) ratio less than 1.95; (1) ratio from 1.95 to 2.70; (2) ratio greater than 2.70 and up to 3.30; (3) ratio greater than 3.30.
6. Maximum number of ridges on the enameled surface of the dentary tooth crown in lingual view (modified from Horner et al., 2004 character 6): (0) five or more in total (a primary and pronounced ridge ranging from the dorsal to the ventral end of the tooth crown, a slightly short secondary ridge and several subsidiary and less developed ridges); (1) three or four in total (a primary and pronounced ridge, a slightly short secondary ridge and one or two subsidiary and less developed ridges); (2) two or three in total (a primary and pronounced ridge and one or two subsidiary and less developed ridges); (3) only one primary ridge.

7. Position of the primary ridge on the enameled surface of the dentary tooth crown (corresponding with Prieto-Marquez and Wagner, 2009 character 7): (0) caudal to the midline of the tooth crown; (1) median for most teeth and maybe caudal to the midline of the tooth crown for some teeth.
8. Shape of the primary ridge of the dentary tooth crown (modified from Godefroit et al., 2000 character 23): (0) straight in all teeth; (1) straight for some teeth and slightly curved for others.
9. Angle between crown and root of dentary teeth (modified from Godefroit et al., 2000 character 24): (0) not more than 110°; (1) more than 110° and at most 130°; (2) more than 130°.
10. General profile of the root of dentary teeth in rostral view (new character): (0) curved labially; (1) basically straight and slightly inclined lingually.
11. General shape of the marginal denticles on the lingual enameled crowns of dentary teeth (modified from Prieto-Marquez and Wagner, 2009 character 10): (0) bamboo leaf-like denticles on the dorsal half of the crown; (1) slightly big mammilliform denticles on the dorsal half of the crown; (2) relatively small mammilliform denticles on the dorsal half of the crown.
12. Composition of the marginal denticles of dentary teeth (modified from Prieto-Marquez and Wagner, 2009 character 11): (0) each denticle consisting of several small and rounded knobs; (1) each denticle consisting of one rounded knob.
13. Shape of septa that separate the dentary alveoluses (corresponding with Prieto-Marquez and Wagner, 2009 character 13): (0) thick and stick-like septa; (1) thin and sheet-like septa.
14. Morphological character of dental alveoluses in the dentary (modified from Prieto-Marquez and Wagner, 2009 character 14): (0) short and tongue-like alveoluses; (1) long, narrow and upright alveoluses which is parallel with each other.
15. Distribution of the enamel of dentary crowns (corresponding with Norman, 2002 character 30): (0) presence of a thin veneer labially, thick lingually; (1) only present lingually.
16. Maximum number of dental alveoluses (tooth positions) in the maxillary dental

battery (modified from Horner et al., 2004 character 1): (0) 32 or fewer; (1) 33 to 45; (2) more than 45.

17. Number of teeth per centimeter of maxillary dental battery (corresponding with Prieto-Marquez and Wagner, 2009 character 17): (0) less than 1.25 teeth/cm of dental battery; (1) 1.25 or more teeth/cm of dental battery.

18. Comparison between the number of maxillary alveoluses (N_m) and dentary ones (N_d) in adult specimens (new character): (0) $N_m \leq N_d$; (1) $N_m > N_d$.

19. Maximum number of functional teeth exposed on the maxillary occlusal plane (modified from Horner et al., 2004 character 3): (0) only one functional tooth; (1) one functional tooth for most of the occlusal plane, and up to two casually near the middle part of the maxilla; (2) two functional teeth throughout the most part of the occlusal plane, decreasing to one at the rostral and caudal ends of the maxilla.

20. Maximum number of ridges on the enameled surface of the maxillary tooth crown in labial view (modified from Horner et al., 2004 character 7): (0) four or more in total (a primary and pronounced ridge ranging from the dorsal to the ventral end of the tooth crown and three or more subsidiary and less developed ridges); (1) one or two in total (a primary and pronounced ridge and at most one subsidiary and less developed ridge);

21. Position of the primary ridge on the enameled surface of the maxillary tooth crown (modified from You et al., 2003 character 36): (0) caudal to the midline of the tooth crown; (1) median for most teeth and maybe caudal to the midline of the tooth crown for the minority of teeth.

22. Shape of the primary ridge of the maxillary tooth crown (modified from Godefroit et al., 2000 character 23): (0) straight for all teeth; (1) straight for some teeth and slightly curved for others.

23. General shape of the marginal denticles on the labial enameled crowns of maxillary teeth (modified from Prieto-Marquez and Wagner, 2009 character 23): (0) saw-toothed denticles on the ventral half of the crown; (1) slightly big mammilliform denticles on the ventral half of the crown; (2) relatively small mammilliform denticles on the ventral half of the crown.

Mandible

Prementary

24. Ratio between the maximum mediolateral width and maximum rostrocaudal length of the prementary (corresponding with Prieto-Marquez and Wagner, 2009 character 24): (0) less than 1.20; (1) 1.20 to 1.75; (2) more than 1.75.
25. Ratio between the dorsoventral depth of rostral end and the length of lateral process of the prementary (corresponding with Prieto-Marquez and Wagner, 2009 character 25): (0) more than 0.38; (1) 0.38 or less.
26. Shape of the denticles of the prementary rostral margin (modified from Horner et al., 2004 character 13): (0) triangular; (1) trapeziform.
27. Angle between the rostroventral margin of the rostral end and the dorsal margin of the lateral process of the prementary in lateral view (corresponding with Prieto-Marquez and Wagner, 2009 character 26): (0) 75° or greater; (1) 56° to 74°; (2) 40° to 55°; (3) less than 40°.
28. Spacing between two adjacent denticles of the prementary in adult individuals (corresponding with Prieto-Marquez and Wagner, 2009 character 28): (0) the spacing between two adjacent denticles is longer than or equal to the width of each denticle; (1) the spacing between two adjacent denticles is shorter than the width of each denticle but longer than 25% of its width; (2) no obvious spacing between two adjacent denticles, tightly connecting with each other.
29. Number of the denticles on the rostral surface of the half prementary in adults, not including the middle one in the count (modified from Prieto-Marquez and Wagner, 2009 character 29): (0) up to five; (1) six; (2) more than six.
30. Extension of the prementary denticles (corresponding with Prieto-Marquez and Wagner, 2009 character 30): (0) denticles extending to the lateral process of the prementary; (1) denticles only limited to the rostral surface of the prementary.
31. Shape of the joint between the rostral part and the lateral process of the prementary (modified from Horner et al., 2004 character 13): (0) smoothly rounded, forming an bowed prementary in dorsal view; (1) almost square; (2) almost square,

with the presence of a rostrolateral projection.

32. Lateral shelf of the predentary lateral process (new character): (0) absent; (1) present.

33. Morphological character of lateral shelf on the lateral surface of the predentary lateral process (modified from Prieto-Marquez and Wagner, 2009 character 32): (0) absent, presence of a rostrocaudally short and shallow depression at the caudal end of the lateral process; (1) presence of a short and less developed lateral shelf at the laterocaudal margin of the lateral process; (2) presence of a short, well developed and mediolaterally broad lateral shelf at the rostrolateral margin of the lateral process; (3) presence of a long and well developed lateral shelf throughout the lateral margin of the lateral process, forming a mediolaterally broad plane; (4) presence of a long, well developed and mediolaterally narrow lateral shelf throughout the lateral margin of the lateral process.

34. Development of the dorsal median process of the predentary (new character): (0) absence of the dorsal median process; (1) presence of a less developed dorsal median process without a prominent ridge; (2) presence of a well developed dorsal median process with a prominent ridge on the dorsal surface of it, obviously extending caudally from the caudal margin of the predentary rostral region.

35. Comparison between the rostrocaudal length of the ventral median process (L) and the dorsoventral depth (D) of the rostral end of the predentary (modified from Prieto-Marquez and Wagner, 2009 character 35): (0) $L > D$; (1) $L \leq D$.

36. Rostrocaudal length of the split of the bilobate ventral median process relative to the undivided portion in ventral view (modified from Prieto-Marquez and Wagner, 2009 character 36): (0) short split and relatively long undivided portion; (1) long split and relatively short undivided portion.

Dentary

37. Ratio between the length of the edentulous slope anterior to the dentary dental battery (not including the rostralmost portion which articulates with the predentary) and the horizontal distance between the first tooth position and the caudal end of the coronoid process (corresponding with Prieto-Marquez and Wagner, 2009 character

37): (0) less than 0.20; (1) 0.20 to 0.31; (2) greater than 0.31 and up to 0.45; (3) greater than 0.45.

38. Angle between the edentulous slope of dentary rostral portion and the level (corresponding with Prieto-Marquez and Wagner, 2009 character 38): (0) less than 150°; (1) 150° or greater.

39. Angle between the slope of the dentary rostral region which articulates with the prementary and the horizontal (modified from Prieto-Marquez and Wagner, 2009 character 39): (0) greater than 130°; (1) 115° to 130°; (2) less than 115°.

40. Degree of downward deflection of the rostral part of the dentary which articulates with the prementary (modified from Prieto-Marquez and Wagner, 2009 character 40): (0) faintly curved ventrally, with the angle which is less than 17°; (1) moderately curved ventrally, with the angle between 17° to 25°; (2) markedly curved ventrally, with the angle which is greater than 25°.

41. Ratio between horizontal distance from the caudal margin of the coronoid process to the caudal end of the deflected ventral margin of the dentary and horizontal distance from the caudal margin the coronoid process to the rostralmost alveolus (corresponding with Prieto-Marquez and Wagner, 2009 character 41): (0) greater than 0.78; (1) 0.66 to 0.78; (2) less than 0.66.

42. Ratio between the maximum mediolateral width of the dentary symphyseal region and the minimum breadth of the dentary caudal to the dentary symphyseal region in dorsal view (modified from Prieto-Marquez and Wagner, 2009 character 42): (0) up to 1.65; (1) greater than 1.65 and up to 2.60; (2) more than 2.60.

43. Angle between the medial surface of dentary symphysis and the lateral surface of the rostral region of the dentary in ventral view (modified from Prieto-Marquez and Wagner, 2009 character 43): (0) greater than 15°; (1) up to 15°.

44. General profile of the dorsal margin of the dentary rostral region which articulates with the prementary in medial or lateral view (new character): (0) a smooth and gradually descending dorsal margin in the rostradorsal region of the dentary; (1) a relatively steep dorsal margin, forming a prominent depression in the dentary symphyseal region.

45. Degree of the lingual curvature of the dentary symphyseal region in rostral view (corresponding with Prieto-Marquez and Wagner, 2009 character 44): (0) markedly curved lingually, forming a nearly horizontal symphyseal region of the dentary; (1) gently curved lingually, forming a sloping symphyseal region of the dentary.
46. General profile of the dentary ventral margin under the coronoid process in lateral view (modified from Prieto-Marquez and Wagner, 2009 character 46): (0) a slightly bowed ventral margin ventral to the coronoid process; (1) a well developed bowed ventral margin ventral to the coronoid process.
47. Coronoid process (modified from Godefroit et al., 2008 character 39): (0) basically vertical to the dorsal margin of the dentary or inclined caudally; (1) slightly inclined rostrally, with an angle between 70° and 85°; (2) obviously inclined rostrally, with an angle less than 70°.
48. Shape of the apex of the coronoid process in adult individuals (modified from Horner et al., 2004 character 17): (0) only slightly expanded rostrally, with less developed rostral and caudal margins; (1) markedly expanded rostrocaudally, with well developed rostral and caudal margins; (2) markedly expanded rostrocaudally, with well developed rostral and caudal margins, bearing a more pronounced caudal margin.
49. A triangular depression in the caudal region of the coronoid process in caudal view (new character): (0) absent; (1) present.
50. A sharp projection on the caudodorsal surface of the coronoid process of the dentary (corresponding with Prieto-Marquez and Wagner, 2009 character 49): (0) absent; (1) present.
51. Development of the ridge on the medial surface of the coronoid process of the dentary (new character): (0) presence of a faint and less developed ridge on the medial surface of the coronoid process; (1) presence of a well developed and expanded caudally ridge which form a depressed facet articulating with the rostradorsal process of the surangular.
52. Angle between the lateral surface of the dentary portion rostral to the coronoid process and that of the dentary portion rostroventral to the coronoid process in dorsal

or ventral view (corresponding with Prieto-Marquez and Wagner, 2009 character 51): (0) the lateral surface of the dentary portion ventral to the coronoid process is only slightly expanded laterally, with an angle greater than 165°; (1) the lateral surface of the dentary portion ventral to the coronoid process is remarkably extended laterally, with an angle up to 165°.

53. Orientation of the longitudinal axis of the dentary occlusal plane relative to the lateral margin of the dentary in dorsal view (corresponding with Prieto-Marquez and Wagner, 2009 character 52): (0) presence of a relatively inclined longitudinal axis, forming an angle of about 20° with the lateral margin of the dentary; (1) presence of a longitudinal axis running parallel with the lateral margin of the dentary.

54. Lingual curvature of the longitudinal axis of the dentary occlusal plane in dorsal view (corresponding with Prieto-Marquez and Wagner, 2009 character 53): (0) present; (1) absent.

55. Position of the coronoid process relative to the dentary dental battery (modified from Horner et al., 2004 character 10): (0) the caudal margin of the coronoid process is caudal to the caudal end of the dental battery; (1) the caudal margin of the coronoid process is overlapped with the caudal end of the dental battery; (2) the caudal margin of the coronoid process is rostral to the caudal end of the dental battery.

56. Degree of separation between the dentary dental battery and the coronoid process (corresponding with Prieto-Marquez and Wagner, 2009 character 55): (0) the coronoid process is not obviously separate from the dentary dental battery; (1) the coronoid process is obviously separate from the dentary dental battery, with the presence of a depressed facet separating the base of coronoid process from the dental battery.

57. Lateral profile of the dentary in adult individuals (new character): (0) greatly elongated and dorsoventrally narrow, forming a relatively slender dentary in lateral view; (1) moderately long and dorsoventrally deep, forming a robust dentary in lateral view.

Surangular

58. Surangular foramen (corresponding with Norman, 2002 character 27): (0) present; (1) absent.

59. Surangular accessory foramen on the rostromedial surface of the surangular (corresponding with Kobayashi and Azuma, 1999 character 15): (0) present; (1) absent.

60. Articulating facet of the surangular rostromedial process articulating with the coronoid process of the dentary (new character): (0) the rostral surface of the surangular rostromedial process, with the presence of the articulation with the caudal surface of the coronoid process; (1) the lateral surface of the surangular rostromedial process, with the presence of the articulation with the medial surface of the coronoid process owing to the insertion of the surangular rostromedial process into the caudal depression of the coronoid process.

61. Position of the apex of the surangular rostromedial process (new character): (0) located at two-thirds of the height of the coronoid process; (1) located at one-third of the height of the coronoid process.

62. Participation of the surangular in the ventral side of the mandibular caudal end (modified from Prieto-Marquez and Wagner, 2009 character 59): (0) absent, surangular only participating in the lateral side of the mandibular caudal end; (1) present, surangular facing more laterally than ventrally; (2) present, surangular facing more ventrally than laterally.

63. Upward curvature of the caudal process of the surangular (corresponding with Prieto-Marquez and Wagner, 2009 character 60): (0) absent; (1) present.

64. Angle between the ventromedial margin of the rostral part of the surangular and that of the surangular caudal process (modified from Prieto-Marquez and Wagner, 2009 character 61): (0) 150° or greater; (1) less than 150°.

Angular

65. Position of the angular of the mandible (corresponding with Weishampel et al., 1993 character 26): (0) the angular exposed in lateral view, with a ventral and slightly lateral position; (1) the angular not exposed in lateral view, with a medial position.

Coronoid

66. Coronoid bone (corresponding with Wagner, 2001 character 28): (0) present; (1) absent.

Prearticular

67. Prearticular bone (corresponding with Prieto-Marquez and Wagner, 2009 character 64): (0) present; (1) absent.

Splénial

68. Position of the mandibular splénial relative to the dentary dental battery in medial view (new character): (0) the splénial ventral to the dental battery; (1) the splénial caudal to dental battery.

Other Viscerocranial Bones

Premaxilla

69. Shape of the premaxillary oral margin in dorsal view (corresponding with Horner et al., 2004 character 22): (0) horseshoe-shaped, forming a continuous semicircle that curves smoothly to postoral constricted region; (1) broadly arcuate in the oral margin and abruptly constricted behind the oral margin.

70. Degree of transverse expansion of the premaxilla in the oral region (ratio between the maximum premaxillary width and the minimum width of the premaxilla at posterior contractive region) (modified from Prieto-Marquez and Wagner, 2009 character 65): (0) faintly expanded, with the ratio less than 1.70; (1) moderately expanded, with the ratio between 1.70 and 2.00; (2) markedly expanded, with the ratio greater than 2.00.

71. Degree of downward deflection of the rostral end of the premaxilla relative to the occlusal plane of the dentition (corresponding with Norman, 2002 character 2): (0) slightly deflected ventrally from the occlusal plane; (1) strongly deflected ventrally from the occlusal plane, almost covering the prementary in lateral view.

72. Morphological character of the rostral portion of the premaxillary oral margin (modified from Prieto-Marquez and Wagner, 2009 character 67): (0) presence of a relatively narrow, dorsoventrally thick and slightly deflected ventrally oral margin rostral to the circumnarial fossa; (1) presence of a moderately expanded breadthwise, dorsoventrally thin and strongly deflected ventrally oral margin, forming a smooth and gentle slope from the circumnarial fossa to the premaxillary oral margin; (2)

presence of a moderately expanded transversely, dorsoventrally thin and strongly deflected ventrally oral margin which is slightly recurved and rostral to the premaxillary accessory narial fossa; (3) presence of a moderately expanded breadthwise, dorsoventrally thick and strongly deflected ventrally oral margin which is lip-shaped and markedly recurved.

73. Shape of the rostromedial corner of the premaxillary oral margin (corresponding with Prieto-Marquez and Wagner, 2009 character 68): (0) rounded; (1) triangular.

74. Premaxillary foramen in the rostral region of external naris that opens onto the palatine (corresponding with Horner et al., 2004 character 23): (0) absent; (1) present.

75. Premaxillary accessory foramen entering into the premaxillary accessory narial fossa, located rostral to the premaxillary foramen (corresponding with Horner et al., 2004 character 24): (0) absent; (1) present, sharing a common chamber with the premaxillary foramen.

76. Premaxillary accessory narial fossa located rostral to the circumnarial fossa (corresponding with Horner et al., 2004 character 26): (0) absent; (1) present.

77. Premaxillary oral margin with a “double layer” morphology consisting of an external denticle-bearing layer and an internal layer of thickened bone set back slightly from the oral margin and separated from the denticular layer by a deep sulcus bearing vascular foramina (corresponding with Horner et al., 2004 character 25): (0) absent; (1) present.

78. Premaxillary additional accessory fossa located lateral to the premaxillary accessory narial fossa and rostral to the circumnarial fossa (corresponding with Prieto-Marquez and Wagner, 2009 character 73): (0) absent; (1) present.

79. The structure of the external naris rostral to the orbit (modified from Horner et al., 2004 character 27): (0) the external naris consists of the premaxilla and the nasal, and premaxillary caudodorsal process does not meet premaxillary caudoventral process caudally to the external naris; (1) the external naris only consists of the premaxilla, and premaxillary caudodorsal and caudoventral processes elongate and meet caudally to the external naris, forming the caudal margin of the external naris and excluding the nasal.

80. Degree of the development of premaxillary caudodorsal process in adult individuals (modified from Prieto-Marquez and Wagner, 2009 character 74): (0) relatively short, forming the dorsal margin of the external naris with the nasal; (1) moderately elongate caudodorsally, forming the dorsal margin of the external naris solely but not participating in the hollow supracranial crest; (2) markedly elongate caudodorsally and long, forming the rostral part of the hollow supracranial crest; (3) markedly elongate caudodorsally and very long, forming the rostral and caudodorsal portions of the hollow supracranial crest; (4) markedly elongate caudodorsally and very long, forming the rostral and most caudal portions of the hollow supracranial crest.

81. Degree of the development of premaxillary caudoventral process in adult individuals (modified from Prieto-Marquez and Wagner, 2009 character 76): (0) relatively short, the caudal end of premaxillary caudoventral process is located rostradorsal to the lacrimal; (1) moderately elongate caudodorsally, the caudal end of premaxillary caudoventral process is located rostradorsal to the prefrontal; (2) remarkably elongate caudodorsally and long, the caudal end of premaxillary caudoventral process is located dorsal or caudodorsal to the prefrontal, forming the rostroventral part of the hollow supracranial crest.

82. Premaxillary caudoventral process articulating with the nasal (new character): (0) present; (1) absent.

83. Vertical groove on the caudoventral process of the premaxilla, located rostral to the dorsal process of the maxilla (corresponding with Evans and Reisz, 2007 character 5): (0) absent; (1) present.

84. Morphological character of the caudal region of the premaxillary caudoventral process in adult individuals (modified from Prieto-Marquez and Wagner, 2009 character 77): (0) mediolaterally compressed, arrowhead-shaped and rostral to the orbit; (1) arrowhead-shaped, rostrocaudally expanded and dorsal to the orbit; (2) triangular, dorsoventrally expanded and dorsal to the orbit.

85. The bone caudal to the premaxillary caudoventral process (new character): (0) lacrimal; (1) nasal.

86. Premaxillary caudodorsal process with an accessory rostroventral flange that overlaps the lateral surface of the nasal in the rostral region of the crest (corresponding with Evans and Reisz, 2007 character 18): (0) absent; (1) present.

87. Shape of the external naris (modified from Evans and Reisz, 2007 character 4): (0) basically spindle-shaped or elliptical; (1) triangular, the caudodorsal and caudoventral margins of the external naris gradually constricted caudodorsally in the caudal region; (2) relatively short and teardrop-shaped, the caudodorsal and caudoventral margins of the external naris abruptly constricted caudodorsally in the caudal region.

88. Ratio between the rostrocaudal length and the maximum mediolateral width of the external naris of derived lambeosaurine dinosaurs in dorsolateral view (modified from Prieto-Marquez and Wagner, 2009 character 81): (0) less than 4; (1) 4 or greater.

89. Deflection angle of the dorsal margin of the premaxillary caudodorsal process rostral to the lacrimal in the adult individuals of lambeosaurine dinosaurs (new character): (0) greater than 170°; (1) 100° to 170°; (2) less than 100°.

90. A well developed dorsolateral flange which is sheet-shaped in the middle of mediolaterally compressed premaxillary caudoventral process in non-lambeosaurine iguanodontoidean dinosaurs (corresponding with Prieto-Marquez and Wagner, 2009 character 82): (0) absent; (1) present.

Maxilla

91. Rostrodorsal process of the maxilla (corresponding with Horner et al., 2004 character 42): (0) presence of the maxillary rostradorsal process extending the region medial to the premaxillary caudoventral process and forming a part of ventral margin of the external naris; (1) absence of the maxillary rostradorsal process, the rostradorsal portion of the maxilla forming a sloping shelf which underlies the premaxilla.

92. Lateral exposure of the rostradorsal process of the maxilla (corresponding with Gates and Sampson, 2007 character 45): (0) absent, the rostradorsal process cannot be observed through external naris in lateral view; (1) present, the rostradorsal process can be seen through external naris in lateral view.

93. Strongly downward curvature of the rostroventral process of the maxilla

(corresponding with Prieto-Marquez and Wagner, 2009 character 94): (0) present; (1) absent.

94. Angle between the dorsal margin of the maxillary rostroventral process and the ventral margin of the maxillary rostral portion where the dental battery begin to appear (modified from Prieto-Marquez and Wagner, 2009 character 95): (0) less than 25°; (1) 25° to 40°; (2) greater than 40°.

95. General shape of the maxillary lateral surface rostroventral to the maxillary facet articulating with the jugal (modified from Prieto-Marquez and Wagner, 2009 character 96): (0) trapeziform or subrectangular; (1) triangular and rostrocaudally compressed.

96. Ratio between the distance from the apex of the maxillary lateral surface rostroventral to jugal articular surface to the rostral end of the maxilla and the rostrocaudal length of the maxilla (corresponding with Prieto-Marquez and Wagner, 2009 character 98): (0) more than 0.57; (1) 0.47 to 0.57; (2) 0.35 to 0.46; (3) less than 0.35.

97. Location of the apex of the maxilla in lateral view (corresponding with Horner et al., 2004 character 47): (0) markedly caudal to the midline of the maxilla; (1) at or rostral to the midline of the maxilla.

98. Shape of the dorsal process (dorsal ramus) of the maxilla in lateral view (modified from Horner et al., 2004 character 48): (0) triangular and the width is greater than the height, bearing a slightly round apex; (1) triangular and the height is greater than the width, bearing a peaked and caudally inclined apex.

99. Morphological character of the jugal articular surface in the dorsolateral region of the maxilla (modified from Prieto-Marquez and Wagner, 2009 character 100): (0) presence of a finger-shaped and laterally offset jugal articular surface located at two-thirds of the length of the maxilla; (1) presence of a subtriangular and laterally inclined jugal articular surface located rostradorsal to the ectopterygoid shelf; (2) presence of an irregular diamond-shaped jugal articular surface at the midline of the maxilla, bearing a dorsolaterally facing ventral half which is slightly inclined caudally and rostral to the ectopterygoid shelf in lateral view; (3) presence of a regular diamond-shaped jugal articular surface at the midline of the maxilla, bearing a

dorsolaterally facing ventral half rostral to the ectopterygoid shelf; (4) presence of a subrectangular and dorsally elevated jugal articular surface rostradorsal to the ectopterygoid shelf.

100. Arrangement of the maxillary foramina rostroventral to the jugal articulating facet (corresponding with Prieto-Marquez and Wagner, 2009 character 101): (0) the maxillary foramina are arranged rostrocaudally and scattered on the lateral surface of the maxilla; (1) the maxillary foramina are arranged in a row and oriented rostradorsally.

101. Number of the maxillary foramina rostroventral to the jugal articulating facet excluding the large rostral foramen (modified from Prieto-Marquez and Wagner, 2009 character 102): (0) seven or more; (1) at most six.

102. Location of large rostral maxillary foramen (modified from Evans and Reisz, 2007 character 22): (0) located on the rostral half of the maxillary rostralateral surface and exposed in lateral view; (1) located on the dorsal half of the maxillary rostralateral surface and exposed in lateral view; (2) located on the maxillary rostradorsal surface along the maxilla-premaxilla articular surface and not exposed in lateral view.

103. Lateral exposure of the antorbital fenestra (corresponding with You et al., 2003 character 4): (0) present; (1) absent.

104. Lateral exposure of the maxilla-lacrima contact (corresponding with Evans and Reisz, 2007 character 23): (0) present in lateral view; (1) absent in lateral view and laterally covered by the jugal-premaxilla contact.

105. Ratio between the vertical distance from the apex of the maxillary dorsal process to the maxillary ventral margin and the maximum length of the maxillary ventral margin (modified from Weishampel et al., 1993 character 20): (0) up to 0.35; (1) greater than 0.35 and up to 0.45; (2) greater than 0.45.

106. Ratio between the length of the ectopterygoid shelf and the rostrocaudal length of the maxillary dental battery (corresponding with Prieto-Marquez and Wagner, 2009 character 105): (0) up to 0.25; (1) greater than 0.25 and at most 0.35; (2) more than 0.35.

107. Degree of the inclination of the ectopterygoid shelf (angle between the dorsal margin of the ectopterygoid shelf and the rostrocaudal axis of the maxillary dental battery in lateral view) (modified from Prieto-Marquez and Wagner, 2009 character 106): (0) presence of a steeply inclined caudoventrally ectopterygoid shelf with an angle greater than 20°; (1) presence of a markedly inclined caudoventrally ectopterygoid shelf with an angle from 10° to 20°; (2) presence of a slightly inclined caudoventrally ectopterygoid shelf with an angle greater than 5° and less than 10°; (3) presence of a almost horizontal ectopterygoid shelf with an angle up to 5°.

108. Degree of the development of the lateral ridge of the ectopterygoid shelf (modified from Godefroit et al., 2000 character 14): (0) presence of a less developed and dorsoventrally thin ridge on the lateral surface of the maxillary caudal portion; (1) presence of a faint ridge which is dorsoventrally thin rostrally and dorsoventrally thick caudally along the lateral margin of the maxillary caudal segment; (2) presence a pronounced and dorsoventrally thick ridge on the lateral surface of the maxillary caudal portion.

109. Location of the middle part of the special foramina (neurovascular alveolar foramina) on the medial side of the maxilla relative to half dorsoventral height of the maxilla excluding the height of the dorsal process (corresponding with Prieto-Marquez and Wagner, 2009 character 108): (0) ventral to or at the half height of the maxilla; (1) dorsal to the half height of the maxilla.

Jugal

110. Morphological character of the caudodorsal margin of the jugal rostral process (modified from Weishampel et al., 1993 character 15): (0) dorsoventrally narrow and slightly curved ; (1) dorsoventrally deep and markedly recurved.

111. Rostral apex of the rostral process of the jugal (modified from Prieto-Marquez and Wagner, 2009 character 111): (0) presence of a very long, wedge-shaped and sharp rostral apex located at the middle point of dorsoventral depth of the rostral process; (1) presence of a long, wedge-shaped and sharp rostral apex located near the dorsal half of the rostral process; (2) presence of a short, mammilla-shaped and blunt rostral apex near the dorsal half of the rostral process; (3) presence an extremely short,

less developed and blunt rostral apex near the dorsal half of the rostral process; (4) absence of the rostral apex.

112. General shape of the ventral margin of the jugal rostral process (corresponding with Prieto-Marquez and Wagner, 2009 character 113): (0) bowed or curved; (1) inverted triangular, with the width approximately equal to the height; (2) inverted triangular and often recurved caudally, with the height greater than the width.

113. Position of palatine articulating facet on the medial surface of the jugal rostral process (new character): (0) dorsal to the maxillary articular surface; (1) caudal to the maxillary articular surface and dorsal to the maxillary process of the jugal.

114. Degree of the inclination of palatine articular surface of the jugal (angle between the rostrocaudal axis of the jugal and the long axis of palatine articular surface) (modified from Prieto-Marquez and Wagner, 2009 character 116): (0) extremely inclined rostrally and almost horizontal, with an angle of approximately 180° ; (1) obviously inclined rostrally, with an angle between 110° and 130° ; (2) slightly inclined rostrally and almost vertical, with an angle less than 110° .

115. Location of the ventral apex of the jugal rostral process relative to the caudal margin of the lacrimal process of the jugal (the longitudinal axis of the rostral process represents horizontal) (corresponding with Prieto-Marquez and Wagner, 2009 character 114): (0) located caudoventral to the caudal margin of the lacrimal process; (1) located ventral to the caudal margin of the lacrimal process.

116. Morphological character of concave ventral margin of the jugal (modified from Norman, 2002 character 16): (0) relatively shallow and wide; (1) relatively deep and narrow.

117. Ratio between maximum dorsoventral depth of the jugal caudoventral portion ventral to the infratemporal fenestra and minimum vertical distance of the caudal contractive portion of the jugal (modified from Prieto-Marquez and Wagner, 2009 character 118): (0) up to 1.35; (1) greater than 1.35 and up to 1.55; (2) more than 1.55.

118. General profile of the caudal process of the jugal in lateral view (corresponding with Prieto-Marquez and Wagner, 2009 character 119): (0) auricular in shape and relatively slender, with a nearly straight caudal margin; (1) auricular in shape and

relatively wide rostrocaudally, with a convex caudal margin and a short blunt apex along the dorsal margin of the caudal process; (2) auricular in shape and relatively wide rostrocaudally, with a convex caudal margin and a tall pointed apex along the dorsal margin of the caudal process; (3) regular fan-shaped, with a nearly straight or slightly convex caudal margin.

119. Morphological character of the concavity of the caudoventral margin of the jugal (modified from Weishampel et al., 1993 character 18): (0) relatively short and shallow; (1) relatively long and deep.

120. Ratio between minimum vertical distance of the caudal contractive portion of the jugal ventral to the infratemporal fenestra and the distance from the lowest point of the orbital rim to the lowest point of the rim of the infratemporal fenestra (modified from Weishampel et al., 1993 character 13): (0) up to 0.5; (1) greater than 0.5 and less than 0.6; (2) 0.6 to 0.8; (3) greater than 0.8.

121. Width of the orbital margin of the jugal relative to that of the jugal margin of the infratemporal fenestra (corresponding with Prieto-Marquez and Wagner, 2009 character 123): (0) wider orbital margin; (1) the orbital margin and the margin of the infratemporal fenestra are almost equally wide; (2) wider infratemporal fenestra.

122. Ectopterygoid articulating facet on the medial side of the jugal (corresponding with Godefroit et al., 2001 character 12): (0) present; (1) absent.

Quadratojugal

123. General shape of the quadratojugal in lateral view (new character): (0) L-shaped; (1) trapeziform.

Quadrate

124. Degree of the curvature of the quadrate in lateral view (angle between the long axis of the dorsal portion of the quadrate and the one of the ventral portion of the quadrate) (modified from Wagner, 2001 character 35): (0) slightly curved caudally, with an angle more than 150°; (1) strongly curved caudally, with an angle up to 150°.

125. Position of the quadratojugal notch relative to the dorsoventral height of the quadrate (corresponding with Prieto-Marquez and Wagner, 2009 character 125): (0) the midpoint of the quadratojugal notch is located near the half dorsoventral height of

the quadrate; (1) the midpoint of the quadratojugal notch is located ventral to the half dorsoventral height of the quadrate.

126. Angle between the dorsal margin of the quadratojugal notch and the long axis of the quadrate (modified from Prieto-Marquez and Wagner, 2009 character 126): (0) greater than 40°; (1) up to 40°.

127. General shape of the quadratojugal notch of the quadrate (modified from Weishampel and Horner, 1986): (0) semicircular and relatively deep rostrocaudally, with the ventral margin of the notch which is slightly recurved and oriented rostrally; (1) wide arcuate and relatively shallow rostrocaudally, with the ventral margin of the notch which is smooth and oriented rostroventrally; (2) wide arcuate and relatively shallow rostrocaudally, with the ventral margin of the notch which is slightly recurved and oriented rostrally.

128. Squamosal buttress (dorsocaudal protuberance) on the caudal surface of the dorsal end of the quadrate (modified from Weishampel and Horner, 1986): (0) presence of a well developed protuberant buttress; (1) absence of the buttress or presence of a less developed faint buttress.

129. Ratio between the rostrocaudal length of the lateral condyle and the mediolateral width of the ventral end of the quadrate (modified from Weishampel et al., 1993 character 22): (0) up to 0.75; (1) more than 0.75.

130. Degree of the elevation of the medial condyle of the quadrate in rostral view (modified from Prieto-Marquez and Wagner, 2009 character 129): (0) the medial condyle is slightly elevated upwards relative to the lateral condyle; (1) the medial condyle is remarkably elevated upwards relative to the lateral condyle.

131. Lateral exposure of the quadratojugal notch of the quadrate (modified from Prieto-Marquez and Wagner, 2009 character 198): (0) present; (1) absent.

Neurocranial Bones

Nasal

132. Hollow supracranial crest (corresponding with Godefroit et al., 2008 character 6): (0) absent; (1) present.

133. Solid supracranial crest (modified from Horner et al., 2004 character 38): (0) absent; (1) present but not laterally excavated by caudal expansion of the circumnarial fossa; (2) present but laterally excavated by caudal expansion of the circumnarial fossa.

134. Supracranial crest in iguanodontoidean dinosaurs (modified from Horner et al., 2004 character 40): (0) absent; (1) present, composed of nasals; (2) present, composed of frontals and nasals; (3) present, composed of nasals and premaxillae.

135. Participation of the nasal in the hollow crest (modified from Godefroit et al., 2008 character 19): (0) absent, with the presence of the nasal rostral to the orbit forming a part of the margin of the external naris; (1) present, with the presence of the nasal rostral to the orbit forming a part of the margin of the external naris and bearing a less developed crest-like structure which is hollow; (2) present, with the presence of the nasal dorsal to the orbit forming the entire hollow crest which is well developed; (3) present, with the presence of the well developed nasal dorsal to the orbit participating in half part of the hollow crest and forming the caudal half of the hollow crest; (4) present, with the presence of the well developed nasal dorsal to the orbit participating in a small part of the hollow crest and excluded from the caudodorsal region of the hollow crest.

136. Position of the nasal cavity (common median chamber inside the crest) in the adult skull (modified from Horner et al., 2004 character 33): (0) restricted to an almost horizontal area rostromedial to the orbit; (1) restricted to a vertical tube-shaped area rostradorsal to the orbit; (2) restricted to an ellipsoid-shaped area dorsal to the orbit.

137. General shape of the caudal part of the nasal in non-lambeosaurine iguanodontoidean dinosaurs (new character): (0) presence of a relatively flat caudal part without any promontory or crest; (1) presence of a dome-shaped and low protuberance on the dorsal surface of the caudal part; (2) presence of a pronounced promontory in the caudodorsal region of the nasal; (3) presence a paddle-like caudal portion extending to the region dorsal to the braincase; (4) presence of a long and stick-shaped caudal portion which bears a middle ridge and is triangular in transverse

cross section, extending to the region dorsal to the occiput; (5) presence of a recurved and abruptly elevated caudodorsally caudal portion forming a sharp protuberance with the frontal; (6) presence of a gradually elevated caudodorsally and laterally depressed caudal part dorsal to the rostral part of the frontal.

138. The nasal inserting under the premaxillary caudoventral process (new character): (0) absent; (1) present.

139. Morphological feature of the rostral end of the nasal articulating with premaxillary caudodorsal process in lateral view (modified from Horner et al., 2004 character 34): (0) presence of a slender and wedge-shaped rostral end, gradually decreasing rostrally in width and depth; (1) presence of a relatively thick and subrectangular rostral end, abruptly and markedly decreasing rostrally in depth near the rostralmost end; (2) presence of a long and finger-shaped rostral end without any prominent change in depth; (3) presence of a particular rostral end bearing a vertical tube-shaped structure with a relatively thick base articulating with premaxillary caudodorsal process; (4) presence of a relatively slender rostral end fitting along the ventral margin of premaxillary caudodorsal process; (5) presence of a thick and sheet-shaped rostral end with bilobate rostral margin meeting premaxilla in a complex W-shaped interfingering suture.

140. Morphological feature of caudoventral portion of the nasal articulating with premaxillary caudoventral process in non-lambeosaurine iguanodontoidean dinosaurs (corresponding with Prieto-Marquez and Wagner, 2009 character 86): (0) the nasal forms a subrectangular flange, exposed dorsal to the premaxillary caudoventral process; (1) the nasal forms a large long hook-like rostroventral process, exposed dorsal to the premaxillary caudoventral process; (2) the nasal forms a greatly shortened and dorsoventrally narrow hook-like rostroventral process, exposed dorsal to the premaxillary caudoventral process.

141. Caudalmost apex of the external naris (corresponding with Godefroit et al., 2008 character 16): (0) consisting of nasal and premaxilla; (1) consisting entirely of nasal; (2) consisting entirely of premaxilla.

142. Participation of the rostral end of the nasal in the rostral margin of the external

naris (modified from Prieto-Marquez and Wagner, 2009 character 87): (0) absent, the rostral end of the nasal is located at one-third of the length of the external naris; (1) absent, the rostral end of the nasal participating in hollow supracranial crest is far away from the rostral margin of the external naris; (2) present, the rostral end of the nasal reaches the rostral margin of the external naris.

143. Caudal end of the nasals forming a pair of processes along the frontonasal suture of the skull (modified from Gates and Sampson, 2007 character 65): (0) absent; (1) present, the caudal end of the nasals forms a pair of divergent processes lying on top of the frontals; (2) present, the caudal end of the nasals forms a pair of conjunctive processes inserted into the frontals.

144. A pronounced promontory in the caudodorsal region of the nasal anterior to the orbit (modified from Prieto-Marquez and Wagner, 2009 character 91): (0) absent; (1) present, the summit of the promontory is located dorsal to the caudal margin of the external naris; (2) present, the summit of the promontory is located caudodorsal to the caudal margin of the external naris.

145. Lateral profile of the dorsal margin of the rostrum dorsal to the external naris (modified from Prieto-Marquez and Wagner, 2009 character 176): (0) slightly convex and arcuate; (1) highly convex and arcuate; (2) basically straight.

146. Angle between the long axis of the external naris and the maxillary dental battery (modified from Prieto-Marquez and Wagner, 2009 character 177): (0) less than 30°; (1) 30° to 40°; (2) more than 40°.

147. Lateral exposure of the circumnarial fossa (nasal vestibule) (new character): (0) present, with the presence of the circumnarial fossa surrounding the external naris; (1) absent, with the presence of the circumnarial fossa enclosed within the caudodorsal and caudoventral premaxillary processes and internalized.

148. The roof of the nasal passage in the rostral region of the skull (modified from Horner et al., 2004 character 27): (0) formed by the nasal; (1) formed by premaxillary caudodorsal process owing to the nasal passages completely enclosed by tubular premaxilla.

149. Nasal passage divided into two parts (new character): (0) absent, presence of

only one nasal passage connecting with cavum nasi proprium; (1) present, presence of two nasal passages (left and right ones) connecting with lateral diverticulum and common medial chamber.

150. Caudal extension of the nasal passage (modified from Evans and Reisz, 2007 character 9): (0) absent, the nasal passage restricted to the region rostral to the orbit; (1) present, the nasal passage extending to the region dorsal to the orbit; (2) present, the nasal passage extremely extending to the region caudodorsal to the occipital.

151. The narial foramen which is external opening of the nasal (new character): (0) presence of the narial foramen which is equivalent to the external naris when the nasal is located rostral to the orbit; (1) absence of the narial foramen when the nasal is located above the orbit and becomes a part of hollow supracranial crest.

152. General shape of the narial foramen in lateral view (corresponding with Prieto-Marquez and Wagner, 2009 character 179): (0) broad dorsoventrally and elliptic; (1) narrow dorsoventrally and subelliptic; (2) extremely narrow dorsoventrally and slit-shaped.

153. Premaxilla-nasal fontanelle surrounded by the nasal and the premaxilla on the lateral surface of the supracranial crest (modified from Norman, 2002 character 5): (0) absent; (1) present, the nasal passage is incompletely closed on the lateral surface of the crest because of the premaxilla-nasal fontanelle persisting into the late ontogenetic stage; (2) present, the nasal passage is completely closed on the lateral surface of the crest because of the premaxilla-nasal fontanelle disappearing in the adult stage.

154. Ratio between the length of the external naris and the length of the lateroventral margin of the rostrum of the skull in non-lambeosaurine iguanodontoidean dinosaurs (corresponding with Prieto-Marquez and Wagner, 2009 character 181): (0) up to 0.40; (1) greater than 0.40 but less than 0.60; (2) 0.60 to 0.65; (3) greater than 0.65.

155. Caudal margin of the circumnarial fossa caudodorsal to the narial foramen (corresponding with Horner et al., 2004 character 31): (0) absent, the circumnarial fossa does not reach the caudal margin of the narial foramen; (1) present, the circumnarial fossa reaches the caudal margin of the narial foramen.

156. Morphological character of the caudal region of the circumnarial fossa along the

caudal margin of the external naris (corresponding with Horner et al., 2004 character 32): (0) absent; (1) present, lightly incised into nasal and premaxilla, often poorly demarcated; (2) present, deeply incised into nasal and premaxilla, well demarcated, and usually invaginated.

157. Elevation and development of the nasal in hadrosaurid dinosaurs (corresponding with Prieto-Marquez and Wagner, 2009 character 190): (0) absent; (1) present.

158. Morphological feature and evolutionary stage of the hollow supracranial crest in lambeosaurine dinosaurs (modified from Horner et al., 2004 character 36): (0) the nasal rostral to the orbit forms the caudodorsal margin of the external naris, bearing a less developed crest-like structure which is hollow and projecting; (1) the nasal, which grows and develops upwards owing to the caudodorsal extension of the premaxilla, forms exclusively a vertical tube-shaped hollow crest dorsal to the orbit; (2) the premaxilla extending caudodorsally results in backward growth and development of the nasal, forming a long curved and tubular hollow crest dorsal to the occiput with the nasal; (3) the premaxilla extending caudodorsally results in backward growth and development of the nasal, forming a thin plate-like or cockscomb-shaped hollow crest dorsal to the occiput with the nasal.

159. Position of the caudalmost end of the nasal of adult lambeosaurine dinosaurs in lateral view (new character): (0) rostradorsal to the orbit; (1) dorsal to the caudal margin of the orbit; (2) dorsal to the occiput.

160. S-loop in the nasal passage (nasal vestibule) completely enclosed by premaxilla rostral to the orbit (corresponding with Evans and Reisz, 2007 character 8): (0) absent; (1) present.

161. Lateral diverticulum connecting with common medial chamber of nasal cavity (new character): (0) absence of the lateral diverticulum; (1) presence of the lateral diverticulum as a part of the cavum nasi proprium (the lateral diverticulum and common median chamber are together homologous with the cavum nasi proprium).

162. Position of the lateral diverticulum relative to the common median chamber (corresponding with Weishampel, 1981): (0) caudodorsal to the common median chamber; (1) lateral to the common median chamber; (2) rostral to the common

median chamber.

163. Connection between the nasal passage and the lateral diverticulum inside the hollow crest (corresponding with Weishampel, 1981 and Evans, 2006): (0) absent, the nasal passage completely enclosed by the premaxilla connects directly with the common median chamber without the participation of the lateral diverticulum; (1) present, the nasal passage connects with the lateral diverticulum which communicates with the common median chamber in succession.

Lacrimal

164. General shape of the lacrimal of the adult individuals in lateral view (modified from Prieto-Marquez and Wagner, 2009 character 109): (0) subquadrangular or trapeziform; (1) triangular and rostrocaudally elongate, with a long rostral process; (2) triangular and rostrocaudally curtate, with a relatively short rostral process.

Prefrontal

165. Participation of the prefrontal in the lateral border of the hollow supracranial crest (corresponding with Godefroit et al., 2008 character 22): (0) absent; (1) present.

166. A well-developed and oriented caudodorsally ridge on the dorsal surface of the prefrontal as the medial wall of the rostral platform supporting the base of the hollow crest (modified from Prieto-Marquez and Wagner, 2009 character 130): (0) absence of the prefrontal ridge; (1) presence of the prefrontal ridge not extending caudally to the prefrontofrontal suture; (2) presence of the prefrontal ridge extending caudally over the dorsal surface of the frontal.

167. General shape of the rostradorsal margin of the prefrontal in lateral view (modified from Horner et al., 2004 character 50): (0) arcuate or smoothly curved; (1) nearly right-angled.

168. Morphological character of the laterally exposed prefrontal rostral portion articulating with the lacrimal (corresponding with Prieto-Marquez and Wagner, 2009 character 132): (0) mediolaterally wide and relatively robust in lateral view; (1) mediolaterally narrow and relatively slender in lateral view.

169. Eversion of the rostradorsal orbital margin of the prefrontal (corresponding with Horner et al., 2004 character 49): (0) absent, the prefrontal lies flush with surrounding

elements; (1) present, the prefrontal flares dorsolaterally to form a thin, everted, wing-shaped margin around rostradorsal orbital rim.

170. Degree of the lateral exposure of the prefrontal-nasal contact (modified from Wagner, 2001 character 37): (0) the prefrontal-nasal contact is completely exposed in lateral view; (1) only the caudal region of the prefrontal-nasal contact is visible in lateral view owing to the covering of the premaxilla along the dorsal margin of the prefrontal.

Palpebral

171. Palpebral (supraorbital) bone (corresponding with Norman, 2002 character 13): (0) present; (1) absent or fused to the orbital margin.

Postorbital

172. Dorsal promontorium on the dorsal surface of the postorbital rostral process in adult specimens (corresponding with Godefroit et al., 2004 character 17): (0) absent; (1) present.

173. A prominent depression on the dorsal surface of the postorbital above the ventral process (jugal process) (new character): (0) absent, the dorsal surface of the postorbital is flat or slightly concave; (1) present, the dorsal surface of the postorbital is deeply depressed.

174. Degree of the curvature of the caudodorsal orbital margin of the postorbital (new character): (0) presence of a slightly convex or almost straight caudodorsal orbital margin; (1) presence of a strongly concave caudodorsal orbital margin which is often semicircular or deeply arcuate.

175. Rostroventrally oriented expansion of the caudodorsal orbital margin of the postorbital (modified from Prieto-Marquez and Wagner, 2009 character 138): (0) present, the caudodorsal orbital margin is markedly expanded rostroventrally, forming a triangular rostral process in lateral view; (1) present, the postorbital is expanded rostroventrally along the lateral surfaces of its rostral and ventral processes, forming an inner cavity covered with the expanded portion; (2) absent, the caudodorsal orbital margin is strongly constricted caudodorsally.

176. Morphological character of the caudal process (squamosal process) of the

postorbital (corresponding with Evans and Reisz, 2007 character 36): (0) presence of a relatively long caudal process forming a broad dorsal margin of the infratemporal fenestra; (1) presence of a relatively short and dorsoventrally deep caudal process forming a constricted dorsal margin of the infratemporal fenestra.

177. Bifurcation of the caudal process of the postorbital (corresponding with Evans and Reisz, 2007 character 35): (0) absent; (1) present.

178. General length of the ventral process of the postorbital relative to maximum rostrocaudal width of the orbit (modified from Prieto-Marquez and Wagner, 2009 character 139): (0) presence of a relatively short ventral process which is shorter than the rostrocaudal width of the orbit; (1) presence of a relatively long ventral process which is approximately equal to the rostrocaudal width of the orbit.

179. Position of the caudal end of the postorbital caudal process relative to the quadrate cotylus of the squamosal (new character): (0) located rostral to the quadrate cotylus; (1) located above the rostral half of the quadrate cotylus; (2) located dorsal to the caudal end of the quadrate cotylus.

Squamosal

180. Dorsoventral expansion of the body of the squamosal in lateral view (modified from Horner et al., 2004 character 64): (0) slightly expanded dorsoventrally above the quadrate cotylus; (1) markedly expanded dorsoventrally and elevated above the quadrate cotylus.

181. Degree of the elongation of the precotyloid process of the squamosal (ratio between the length of the precotyloid process and the width of the quadrate cotylus of the squamosal) (corresponding with Prieto-Marquez and Wagner, 2009 character 142): (0) presence of a relatively short precotyloid process, with the ratio less than 1.00; (1) presence of a moderately long precotyloid process, with the ratio from 1.00 to 1.25; (2) presence of a very long precotyloid process, with the ratio greater than 1.25.

182. Rostromedially oriented curvature of the medial ramus of the squamosal (corresponding with Prieto-Marquez and Wagner, 2009 character 145): (0) present; (1) absent.

183. Separation of the squamosals along the occipital margin of the skull roof in adult

specimens (corresponding with Horner et al., 2004 character 63): (0) present, the squamosals are widely separated by the parietal; (1) present, the squamosals approach the midline of the skull and are separated by a narrow band of the parietal; (2) absent, the medial rami of the squamosals closely contact with each other.

Frontal

184. Rostroventrally sloping frontal platform (nasal articular surface of the frontal) for supporting the supracranial crest (new character): (0) absent; (1) present.

185. Deeply excavated rostral platform composed of the prefrontal and the frontal (corresponding with Godefroit et al., 2008 character 8): (0) absent; (1) present, the rostral platform is inclined rostroventrally and occupies the rostral part of the frontal in adults; (2) present, the rostral platform markedly extends caudodorsally and overhangs the parietal in adults.

186. Angle between the dorsal surface of the frontal rostral part and the level (new character): (0) up to 10°; (1) greater than 10° and less than 25°; (2) 25° to 35°; (3) more than 35°.

187. Median cleft on the nasal articular surface of the frontal (corresponding with Evans and Reisz, 2007 character 40): (0) absent; (1) present.

188. Frontal doming on the dorsal surface of the braincase in subadult or adult individuals (modified from Horner et al., 2004 character 58): (0) absent; (1) present.

189. Participation of the frontal in the dorsal margin of the orbit (corresponding with Horner et al., 2004 character 57): (0) present, the frontal forms part of the orbital margin; (1) absent, the frontal is excluded by prefrontal-postorbital contact.

190. Ratio between the rostrocaudal length of the interfrontal suture of the frontal ectocranial surface and the maximum mediolateral width of the frontal ectocranial surface in dorsal view (modified from Godefroit et al., 2008 character 7): (0) presence of a relatively long ectocranial surface, with the ratio greater than 0.8; (1) presence of a relatively short ectocranial surface because of the extension of the nasal articular surface of the frontal, with the ratio from 0.4 to 0.8; (2) presence of an extremely short ectocranial surface by reason of the thickening of the nasal articular surface of the frontal which obviously extends caudodorsally and overhangs the parietal, with the

ratio less than 0.4.

191. Fontanelle of the skull roof in juvenile or subadult individuals (new character): (0) presence of the nasal-frontal fontanelle surrounded by the nasal and the frontal; (1) presence of the premaxilla-nasal fontanelle enclosed by the nasal and the premaxilla; (2) absence of the fontanelle of the skull roof.

192. Nasal-frontal fontanelle on the dorsal surface of the braincase (modified from Prieto-Marquez and Wagner, 2009 character 147): (0) present, the nasal-frontal fontanelle is still well developed and large in subadults or young adults; (1) present, the nasal-frontal fontanelle is strongly contractive or entirely closed in subadults or young adults; (2) absent, the nasal-frontal fontanelle cannot be identified owing to the development of the supracranial crest.

193. Morphological character of annular ridge on the ventral side of the frontal that defines the rostral extent of the cerebral fossa (corresponding with Evans and Reisz, 2007 character 43): (0) relatively wide and shallow; (1) relatively narrow and sharp.

Parietal

194. Ratio between the rostrocaudal length of the parietal along the sagittal plane and the width of the parietal at half the length in subadult and adult individuals (modified from Godefroit et al., 2008 character 2): (0) less than 2.2; (1) 2.2 or greater.

195. Degree of downward curvature of the parietal dorsal surface (corresponding with Horner et al., 2004 character 69): (0) straight or slightly downwarped along its length; (1) strongly downwarped relative to the horizontal of the skull roof.

196. Morphological character of the median anterior process of the parietal along the frontoparietal suture (modified from Prieto-Marquez and Wagner, 2009 character 157): (0) arcuate or subtriangular, rostrocaudally short and mediolaterally wide; (1) finger-shaped or subtriangular, rostrocaudally long and mediolaterally narrow.

197. Sagittal crest on the dorsal surface of the parietal (modified from Horner et al., 2004 character 70): (0) present, the sagittal crest only extends along the rostral half of the parietal and splits into two crests on the dorsal surfaces of paired parietal caudolateral processes; (1) present, the sagittal crest extends along the entire length of the parietal and its rostral half is relatively wide mediolaterally, gradually narrowing

and sharpening caudally; (2) present, the sagittal crest extends along the entire length of the parietal and keeps narrow and sharp all the while; (3) present, the sagittal crest only extends along the caudal half of the parietal and the rostral half of the parietal dorsal surface is relatively flat; (4) absent, the dorsal side of the parietal is relatively flat and lacks any crest or ridge.

Supraoccipital

198. Orientation of the caudal surface of the supraoccipital (corresponding with Horner et al., 2004 character 65): (0) nearly vertical and oriented caudally; (1) inclined rostrally and oriented caudodorsally.

199. Lateroventral portion of the supraoccipital deeply inserted into the exoccipital, with two short flanges along the supraoccipital-exoccipital suture in caudal view (corresponding with Horner et al., 2004 character 66): (0) absent; (1) present.

200. Degree of the caudal extension of the supraoccipital-exoccipital shelf relative to the foramen magnum in ventral view (modified from Godefroit et al., 2008 character 26): (0) slightly elongate caudally; (1) moderately extended caudally; (2) extremely extended caudally.

Exoccipital

201. Orientation of the distal end of the paroccipital process (corresponding with Horner et al., 2004 character 62): (0) rostroventrally directed; (1) ventrally directed.

Basioccipital

202. Participation of the basioccipital in the ventral margin of the foramen magnum (corresponding with Weishampel et al., 1993 character 24): (0) absent, the paired exoccipital condyles completely exclude the basioccipital from the ventral margin of the foramen magnum; (1) present, the exoccipital condyles are well separated and allow the basioccipital to form the ventral margin of the foramen magnum.

203. Shallow groove of the occipital condyle along the exoccipital-basioccipital junction in caudal view (modified from Prieto-Marquez and Wagner, 2009 character 160): (0) absent; (1) present.

204. Degree of the constriction of the basioccipital portion between the occipital condyle and the speno-occipital tubercles (corresponding with Prieto-Marquez and

Wagner, 2009 character 161): (0) strongly constricted, forming a relatively long constricted portion of the basioccipital; (1) faintly constricted, forming a relatively short constricted portion of the basioccipital.

Basisphenoid

205. Length of the basipterygoid process of the basisphenoid (corresponding with Godefroit et al., 2001 character 2): (0) very short; (1) relatively long and markedly extended below the ventral border of the occipital condyle.

206. Ratio between the ventral margin of the paired basipterygoid processes of the basisphenoid (modified from Prieto-Marquez and Wagner, 2009 character 162): (0) greater than 100°; (1) up to 100°.

207. Degree of the development of the alar process of the basisphenoid (corresponding with Prieto-Marquez and Wagner, 2009 character 163): (0) moderately developed and relatively small in size; (1) well developed and relatively large in size.

208. Ventral transverse ridge between the basipterygoid processes of the basisphenoid (corresponding with Gates and Sampson, 2007 character 78): (0) present; (1) absent.

209. Ventral median process between the basipterygoid processes of the basisphenoid (corresponding with Gates and Sampson, 2007 character 79): (0) present; (1) absent.

210. Ratio between the maximum width across the spheno-occipital tubercles and the minimum width of the rostral constriction of the basisphenoid (modified from Prieto-Marquez, 2009 character 166): (0) less than 1.5; (1) 1.5 to 1.9; (2) greater than 1.9.

Laterosphenoid

211. Complete closure of the forward sulcus as the passage of the ramus ophthalmicus of the trigeminal nerve (V_1) on the lateral surface of the laterosphenoid (corresponding with Evans and Reisz, 2007 character 51): (0) absent; (1) present.

212. Great reduction of the length of the postorbital process of the laterosphenoid (corresponding with Prieto-Marquez and Wagner, 2009 character 168): (0) absent; (1) present.

Pterygoid

213. Dorsal expansion of the caudodorsal border of the pterygoid palatine ramus

forming a small flange (corresponding with Prieto-Marquez and Wagner, 2009 character 173): (0) absent; (1) present.

214. Ventral expansion of the lamina restricted by two ventrally oriented ridges along the medial surface of the ectopterygoid process and the quadrate ramus of the pterygoid (corresponding with Prieto-Marquez and Wagner, 2009 character 174): (0) moderately extended ventrally, relatively large portions of the ectopterygoid process and the quadrate ramus are located below the ventral margin of the lamina; (1) markedly extended ventrally, only relatively small portions of the ectopterygoid process and the quadrate ramus are located below the ventral margin of the lamina.

Regional Cranial Characters

215. General shape of the orbit in lateral view (new character): (0) almost circular; (1) elliptic, the rostrocaudal width of the orbit is less than the dorsoventral height of this element.

216. Rostrocaudal width of the orbit relative to that of the infratemporal fenestra (modified from Prieto-Marquez and Wagner, 2009 character 199): (0) the rostrocaudal width of the orbit is approximately equal to that of the infratemporal fenestra; (1) the rostrocaudal width of the orbit is greater than that of the infratemporal fenestra.

217. Position of the dorsal margin of the orbit relative to that of the infratemporal fenestra (corresponding with Prieto-Marquez and Wagner, 2009 character 201): (0) the dorsal margin of the orbit and the dorsal margin of the infratemporal fenestra are basically at the same level and height; (1) the dorsal margin of the orbit is obviously lower than that of the infratemporal fenestra; (2) the dorsal margin of the orbit is slightly higher than that of the infratemporal fenestra.

218. General shape of the infratemporal fenestra in lateral view (new character): (0) subrectangular in shape; (1) subtriangular in shape.

219. Rostrocaudal width of the dorsal margin relative to that of the ventral margin of the infratemporal fenestra (corresponding with Prieto-Marquez and Wagner, 2009 character 200): (0) the dorsal margin of the infratemporal fenestra is approximately as wide as the ventral margin of this element; (1) the dorsal margin of the infratemporal

fenestra is narrower than the ventral margin of this element.

220. General shape of the supratemporal fenestra in dorsal view (modified from Prieto-Marquez and Wagner, 2009 character 202): (0) subrectangular, with the long axis directed rostrally; (1) oval, with the long axis oriented rostrolaterally.

221. Length/height ratio of the skull (the length of the skull is measured from the caudal margin of the quadrate to the rostralmost end of the premaxilla, and the height of the skull is measured from the ventral margin of the quadrate to the dorsal margin of the squamosal) (modified from You et al., 2003 character 1): (0) up to 2; (1) greater than 2.

222. Ratio between the length of the external naris and that of the skull (the length of the skull is measured from the caudal margin of the quadrate to the rostralmost end of the premaxilla) (modified from Horner et al., 2004 character 28): (0) up to 0.25; (1) greater than 0.25 but less than 0.40; (2) 0.40 or greater.

223. Ratio between the maximum mediolateral width of the braincase across the postorbitals and the mediolateral width of the occiput across the quadrate cotyli of the squamosals (corresponding with Prieto-Marquez and Wagner, 2009 character 204): (0) more than 1.25; (1) up to 1.25.

224. Shape of the occiput in caudal view (modified from Horner et al., 2004 character 68): (0) rectangular; (1) trapezoidal.

Trunk Skeleton

Cervical Vertebrae

225. Number of the cervical vertebrae (corresponding with Horner et al., 2004 character 72): (0) 11 or fewer; (1) 12 or more.

226. Morphological character of the dorsal margin of the axis (corresponding with Prieto-Marquez and Wagner, 2009 character 206): (0) presence of a convex dorsal margin of the neural spine extending to the region above the postzygapophyses; (1) presence of a concave dorsal margin in the caudal region of the axial neural spine.

227. Ratio between the craniocaudal length of the postzygapophyseal process and the craniocaudal width of the vertebral arch of the cranial and middle cervical vertebrae

(modified from Prieto-Marquez and Wagner, 2009 character 207): (0) less than 3; (1) 3 or greater.

228. Morphological character of the postzygapophyseal processes of the cervical vertebrae (corresponding with Horner et al., 2004 character 74): (0) low and relatively short; (1) elevated and relatively long.

Dorsal Vertebrae

229. Number of the dorsal vertebrae, not including the last dorsal vertebra (the dorsosacral vertebra) incorporated into the sacrum (new character): (0) 16 or fewer; (1) 17 or more.

230. Slightly elongated neural spines of the cranial dorsal vertebrae (corresponding with Prieto-Marquez and Wagner, 2009 character 210): (0) absent; (1) present.

231. Ratio between the height and the length of the neural spines of the middle dorsal vertebrae (modified from Norman, 2002 character 41): (0) greater than 2.5 but less than 4.0; (1) 4.0 or greater.

Sacral Vertebrae

232. Number of the sacral vertebrae, including the dorsosacral and caudosacral vertebrae fused to the sacrum (corresponding with Godefroit et al., 2000 character 27): (0) 7 or fewer; (1) 8 or more.

233. Ratio between the height of the neural spine and that of the centrum of the tallest sacral vertebra (modified from Prieto-Marquez and Wagner, 2009 character 209): (0) up to 2.0; (1) greater than 2.0 and up to 3.5; (2) greater than 3.5.

234. Participation of the caudal vertebrae (the caudosacral vertebrae) in the sacrum (new character): (0) absent; (1) present.

Caudal Vertebrae

235. Length of the chevrons relative to that of the neural spines in the cranial region of the caudal vertebrae (corresponding with Wagner, 2001 character 40): (0) the chevrons are shorter than or nearly as long as the neural spines; (1) the chevrons are longer than the neural spines.

Sternum

236. Length of the distal handle-shaped process (caudolateral process) relative to that

of the proximal plate (craniomedial plate) of the sternum (corresponding with Prieto-Marquez and Wagner, 2009 character 213): (0) the distal handle-shaped process is slightly shorter than or as long as the proximal plate; (1) the distal handle-shaped process is longer than the proximal plate.

Shoulder Girdle

Coracoid

237. Coracoid size relative to the length of the scapula (corresponding with Horner et al., 2004 character 77): (0) relatively large in size; (1) reduced in size relative to the scapula.

238. Morphological character of the craniodorsal margin of the coracoid (modified from Horner et al., 2004 character 78): (0) straight or convex in lateral view; (1) concave in lateral view.

239. Degree of the development of the biceps tubercle in the cranial region of the coracoid (corresponding with Godefroit et al., 2008 character 47): (0) presence of a relatively small and slightly projecting biceps tubercle; (1) presence of a relatively large and markedly projecting laterally biceps tubercle.

240. Ratio between the length of the lateral margin of the scapular articular surface and that of the lateral margin of the glenoid (modified from Prieto-Marquez and Wagner, 2009 character 215): (0) greater than 1.3; (1) 1.0 to 1.3; (2) less than 1.0.

241. Angle between the lateral margin of the scapular articular surface and the lateral margin of the glenoid of the coracoid (corresponding with Prieto-Marquez and Wagner, 2009 character 216): (0) greater than 115°; (1) up to 115°.

242. Morphological character of the hook-shaped ventral process of the coracoid (corresponding with Horner et al., 2004 character 79): (0) relatively short and directed ventrally; (1) relatively long, recurved and directed caudoventrally.

243. Ratio between the dorsoventral height and the craniocaudal width of the hook-shaped ventral process of the coracoid (modified from Prieto-Marquez and Wagner, 2009 character 218): (0) less than 0.6; (1) 0.6 to 0.8; (2) more than 0.8.

Scapula

244. General profile of the dorsal margin of the scapula in lateral view (modified from Sereno, 1986): (0) nearly straight craniocaudally from the cranial margin of the acromial process to the caudal margin of the scapular blade; (1) obviously curved from the cranial margin of the acromial process to the caudal margin of the scapular blade.
245. General profile of the ventral margin along the caudal half of the scapular blade (corresponding with Prieto-Marquez and Wagner, 2009 character 222): (0) almost straight or slightly convex ventrally; (1) remarkably convex ventrally.
246. Orientation of the dorsal margin of the scapular caudal end relative to the ventral margin of this element (modified from Horner et al., 2004 character 81): (0) the dorsal margin of the scapular caudal end is markedly sloping caudodorsally and divergent relative to the ventral margin of this element; (1) the dorsal margin of the scapular caudal end is slightly divergent relative to the ventral margin of this element; (2) the dorsal margin of the scapular caudal end is nearly parallel to the ventral margin of this element, so that they are in the same direction.
247. Ratio between the maximum dorsoventral depth of the scapular cranial end and the distance from the cranial end of the acromial process to the caudal margin of the scapular blade (modified from Prieto-Marquez and Wagner, 2009 character 221): (0) greater than 0.25; (1) up to 0.25.
248. Ratio between the maximum dorsoventral depth of the scapular blade and that of the cranial end of the scapula (corresponding with Prieto-Marquez and Wagner, 2009 character 223): (0) less than 1; (1) 1 or greater.
249. Ratio between the dorsoventral depth of the scapular neck and the maximum dorsoventral depth of the scapular cranial end (new character): (0) up to 0.6; (1) more than 0.6.
250. Ratio between the distance from the cranial margin of the coracoid facet to the cranialmost end of the acromial process and the maximum dorsoventral height of the scapular cranial end (corresponding with Prieto-Marquez and Wagner, 2009 character 227): (0) less than 0.45; (1) 0.45 or greater.
251. Morphological character of the acromial process of the scapula (modified from

Horner et al., 2004 character 80): (0) strongly recurved, with the cranial end of the acromial process oriented dorsally; (1) slightly recurved, with the cranial end of the acromial process oriented craniodorsally; (2) almost straight, with the cranial end of the acromial process directed cranially.

252. Degree of the development of the deltoid ridge on the lateral surface of the scapular cranial portion (corresponding with Prieto-Marquez and Wagner, 2009 character 228): (0) presence of a poorly developed deltoid ridge which is dorsoventrally narrow and relatively faint; (1) presence of a well developed deltoid ridge which is dorsoventrally deep and relatively sharp.

Forelimb and Manus

Humerus

253. Morphological character of the humerus in caudal view (modified from Weishampel et al., 1993 character 36): (0) relatively long and gracile; (1) relatively short and robust.

254. Degree of the development of the deltopectoral crest in adult individuals (modified from Godefroit et al., 2000 character 26): (0) presence of a poorly developed deltopectoral crest moderately expanded craniolaterally and ventrally; (1) presence of a well developed deltopectoral crest markedly expanded craniolaterally and ventrally.

255. Position of the maximum lateral expansion of the deltopectoral crest relative to the midshaft of the humerus (modified from Horner et al., 2004 character 83): (0) located above the midshaft of the humerus; (1) located at or below the midshaft of the humerus.

256. Strong constriction of the distal half of the humerus below the deltopectoral crest (new character): (0) present; (1) absent.

257. Ratio between the distance from the dorsal margin of the lateral tuberosity to the maximum lateral expansion of the deltopectoral crest and the proximodistal length of the humerus (corresponding with Prieto-Marquez and Wagner, 2009 character 229): (0) less than 0.48; (1) 0.48 to 0.55; (2) greater than 0.55.

258. Ratio between the width of the humerus at the distal third of the deltopectoral crest and the width of the distal constriction of the humerus (corresponding with Prieto-Marquez and Wagner, 2009 character 230): (0) less than 1.65; (1) 1.65 to 1.90; (2) greater than 1.90.

259. Angle between the craniolateral margin and the ventral margin of the humeral deltopectoral crest (modified from Weishampel et al., 1993 character 37): (0) greater than 130°; (1) 110° to 130°; (2) less than 110°.

260. Ratio between the width of the humerus at the midshaft and the proximodistal length of the humerus in caudal view (new character): (0) up to 0.20; (1) greater than 0.20 but less than 0.25; (2) 0.25 or greater.

261. Torsion between the proximal and distal ends of the humerus (new character): (0) moderate, with the angle up to 20°; (1) very strong, with the angle more than 20°.

Ulna

262. Ratio between the proximodistal length of the ulna and the craniocaudal width of this element at the midshaft (corresponding with Prieto-Marquez and Wagner, 2009 character 233): (0) less than 10; (1) 10 or greater.

263. Ratio between the proximodistal length of the ulna and that of the humerus (modified from Norman, 2002 character 47): (0) presence of a relatively short ulna, with the ratio up to 1.0; (1) presence of a moderately long ulna, with the ratio greater than 1.0 and up to 1.2; (2) presence of a very long ulna, with the ratio greater than 1.2.

Carpals

264. Composition of the carpus (corresponding with Horner et al., 2004 character 86): (0) presence of fused ulnare, radiale, intermedium and distal carpals; (1) presence of two small unfused carpals.

Metacarpals

265. Metacarpal I (modified from Norman, 2002 character 49): (0) present and fused to the carpus; (1) absent.

266. Ratio between the proximodistal length and the mediolateral width at the midshaft of the metacarpal III (modified from Horner et al., 2004 character 89): (0) up to 5; (1) greater than 5.

267. Ratio between the proximodistal length and the mediolateral width of the proximal end of the metacarpal V (modified from Prieto-Marquez and Wagner, 2009 character 238): (0) less than 2; (1) 2 or greater.

268. Strong mediolateral expansion of the proximal end of the metacarpal V relative to the distal end (corresponding with Prieto-Marquez and Wagner, 2009 character 239): (0) absent; (1) present.

269. Position of the proximal end of the metacarpal III (corresponding with Horner et al., 2004 character 88): (0) the proximal end of the metacarpal III is aligned with those of the metacarpal II and IV; (1) the proximal end of the metacarpal III is offset distally relative to those of the metacarpal II and IV.

Manual Phalanges

270. Morphological character of manual phalanx III-1 in dorsal view (modified from Prieto-Marquez and Wagner, 2009 character 240): (0) moderately elongated proximodistally, with the proximodistal length almost equal to or slightly greater than the mediolateral width; (1) greatly elongated proximodistally, with the proximodistal length obviously greater than the mediolateral width; (2) strongly compressed proximodistally, with the proximodistal length less than the mediolateral width.

271. Manual digit I (corresponding with Norman, 2002 character 51): (0) present; (1) absent.

272. General shape of manual ungual II (corresponding with Norman, 2002 character 53): (0) claw-shaped; (1) hoof-shaped.

273. General shape of manual phalanx III-2 in dorsal view (corresponding with Horner et al., 2004 character 90): (0) rectangular, the medial and lateral margins are subequal in length; (1) wedge-shaped and strongly compressed, the medial margin is significantly shorter than the lateral margin.

274. Proximodistal length of manual phalanx II-1 relative to that of the manual phalanx II-2 (modified from Prieto-Marquez and Wagner, 2009 character 242): (0) manual phalanx II-1 is less than three times as long as manual phalanx II-2; (1) manual phalanx II-1 is three times or more as long as manual phalanx II-2.

Pelvic Girdle

Ilium

275. Degree of ventral deflection of the iliac preacetabular process (modified from Suzuki et al., 2004 character 69): (0) slightly deflected ventrally, with the angle greater than 150°; (1) markedly deflected ventrally, with the angle up to 150°.
276. Ratio between the craniocaudal length of the preacetabular process and that of the central plate (main blade) of the ilium (modified from Prieto-Marquez and Wagner, 2009 character 244): (0) up to 1.7; (1) more than 1.7.
277. Ratio between the maximum dorsoventral depth of the caudal end of the preacetabular process and the dorsoventral distance from the pubic peduncle to the dorsal margin of the ilium (corresponding with Prieto-Marquez and Wagner, 2009 character 245): (0) less than 0.50; (1) 0.50 to 0.55; (2) greater than 0.55.
278. Ratio between the dorsoventral height and craniocaudal length of the iliac central plate (corresponding with Prieto-Marquez and Wagner, 2009 character 246): (0) 0.8 or greater; (1) less than 0.8.
279. Position of the ventral apex of the supraacetabular process (antitrochanter) relative to that of the caudal tuberosity of the iliac ischial peduncle (corresponding with Brett-Surman and Wagner, 2007): (0) located caudodorsal to ventral apex of the caudal tuberosity of the iliac ischial peduncle; (1) located craniodorsal to ventral apex of the caudal tuberosity of the iliac ischial peduncle.
280. Ratio between the craniocaudal breadth of the supraacetabular process along its dorsal margin and the craniocaudal length of the iliac central plate (modified from Prieto-Marquez and Wagner, 2009 character 249): (0) greater than 0.85; (1) greater than 0.70 and up to 0.85; (2) 0.55 to 0.70; (3) less than 0.55.
281. Lateroventral expansion of the iliac supraacetabular process (modified from Horner et al., 2004 character 91): (0) absent, the supraacetabular process slightly swells laterally along the dorsal margin of the central plate of the ilium; (1) present, the supraacetabular process slightly expands lateroventrally, with its lateroventral margin located at three-fourths of the dorsoventral height of the iliac central plate; (2)

present, the supraacetabular process moderately expands lateroventrally, with its lateroventral margin located at approximately half dorsoventral height of the iliac central plate; (3) present, the supraacetabular process extremely expands lateroventrally and nearly overlaps the whole central plate of the ilium in lateral view.

282. General shape of the lateroventral margin of the iliac supraacetabular process in lateral view (new character): (0) strip-shaped; (1) widely arcuate; (2) U-shaped or V-shaped.

283. Symmetry of the lateral profile of the supraacetabular process (corresponding with Prieto-Marquez and Wagner, 2009 character 250): (0) absent; (1) present.

284. A strong ridge connecting the caudoventral margin of the iliac supraacetabular process with the dorsal margin of the iliac postacetabular process (corresponding with Prieto-Marquez, 2009 character 252): (0) present; (1) absent.

285. Lateral profile of the dorsal margin of the ilium above the supraacetabular process (corresponding with Horner et al., 2004 character 100): (0) nearly straight or slightly convex; (1) strongly concave.

286. Morphological character of the pubic peduncle of the ilium (modified from Horner et al., 2004 character 92): (0) relatively long and stick-shaped in lateral view; (1) relatively short and triangular in lateral view.

287. Morphological character of the ischial peduncle of the ilium (modified from Godefroit et al., 2001 character 30): (0) formed by a single large knob; (1) composed of a relatively large knob and a relatively small knob separated by a shallow embayment; (2) composed of two knobs with similar size separated by a shallow embayment.

288. Ratio between the craniocaudal length of the postacetabular process and that of the central plate of the ilium (corresponding with Prieto-Marquez and Wagner, 2009 character 255): (0) up to 0.8; (1) greater than 0.8 but less than 1.1; (2) 1.1 or greater.

289. General profile of the postacetabular process of the ilium in lateral view (modified from Horner et al., 2004 character 93): (0) gradually tapering caudally, forming a wedge-shaped postacetabular process; (1) rectangular, with a straight or arched caudal margin.

290. Brevis shelf at the base of the postacetabular process of the ilium (modified from Godefroit et al., 2008 character 52): (0) present; (1) absent.

291. Mediolateral thickening of the caudal portion of the iliac postacetabular process (modified from Prieto-Marquez and Wagner, 2009 character 257): (0) present, the caudal portion of the postacetabular process moderately thickens mediolaterally on account of the mediolateral expansion of its ventral surface; (1) present, the caudal portion of the postacetabular process markedly thickens mediolaterally triggered by the dorsomedial twist of the postacetabular process; (2) absent, the caudal portion of the postacetabular process is compressed mediolaterally.

292. Orientation of the dorsal margin of the postacetabular process relative to the ventral margin of the iliac acetabular region (modified from Prieto-Marquez and Wagner, 2009 character 260): (0) almost horizontal; (1) oriented caudodorsally.

293. Position of the sacral ridge on the medial surface of the iliac central plate (corresponding with Prieto-Marquez and Wagner, 2009 character 261): (0) located at 50% to 70% dorsoventral height of the iliac central plate; (1) located at 80% dorsoventral height of the iliac central plate.

294. Morphological character of the sacral ridge on the medial surface of the iliac central plate in medial view (modified from Prieto-Marquez and Wagner, 2009 character 262): (0) nearly straight and directed craniocaudally; (1) arched and convex dorsally, with the cranial portion of the sacral ridge directed cranioventrally.

Pubis

295. Strong constriction of the caudal portion of the prepubic process adjacent to the cranial end of the postpubic process (new character): (0) absent; (1) present.

296. Orientation of the dorsoventral expansion in the cranial region of the pubic prepubic process (corresponding with Prieto-Marquez and Wagner, 2009 character 264): (0) the dorsal portion of the cranial blade of the prepubic process is more expanded than the ventral portion, so that the expansion of the cranial blade is directed dorsally; (1) the ventral portion of the cranial blade of the prepubic process is more expanded than the dorsal portion, so that the expansion of the cranial blade is directed ventrally.

297. Lateral profile of the cranial blade of the pubic prepubic process (modified from Prieto-Marquez and Wagner, 2009 character 265): (0) circular or elliptic, with the dorsal region much more expanded than the ventral region; (1) elliptic or oval, with the dorsal region a little more expanded than the ventral region; (2) elliptic or oval, with the ventral region much more expanded than the dorsal region; (3) rectangular or subrectangular, with the ventral region much more expanded than the dorsal region.
298. Dorsoventral depth of the cranial blade of the pubic prepubic process relative to that of the pubic acetabular region (modified from Prieto-Marquez and Wagner, 2009 character 266): (0) the dorsoventral depth of the cranial blade is greater than that of the pubic acetabular region; (1) the dorsoventral depth of the cranial blade is equal to or less than that of the pubic acetabular region.
299. Craniocaudal length of the cranial blade of the prepubic process relative to that of the caudal neck (caudal constriction) of the prepubic process (modified from Horner et al., 2004 character 96): (0) the length of the cranial blade is less than that of the caudal neck; (1) the length of the cranial blade is equal to or greater than that of the caudal neck.
300. Morphological character of the iliac peduncle of the pubis (new character): (0) relatively short and robust; (1) relatively long and slender.
301. A sharp ridge on the lateral surface of the iliac and ischial peduncles, bounding the cranioventral margin of the acetabulum (corresponding with Prieto-Marquez and Wagner, 2009 character 269): (0) present; (1) absent or bearing a faint ridge.
302. A pubic obturator notch ventral to the ischial peduncle of the pubis for the passage of the obturator nerve (modified from Horner et al., 2004 character 97): (0) present; (1) absent.
303. Length/width ratio of the ischial peduncle of the pubis (modified from Prieto-Marquez and Wagner, 2009 character 271): (0) less than 2; (1) 2 to 3; (2) greater than 3.
304. Lateroventral protuberance in the proximal region of the ischial peduncle of the pubis (corresponding with Prieto-Marquez and Wagner, 2009 character 272): (0) absent or faintly developed; (1) present.

305. Ratio between the craniocaudal distance from the cranial margin of the prepubic process to that of the pubic acetabular foramen and the dorsoventral distance from the dorsal margin of the iliac peduncle to the ventral margin of the cranial end of the postpubic process (modified from Prieto-Marquez and Wagner, 2009 character 274): (0) less than 2.8; (1) 2.8 to 3.0; (2) greater than 3.0.

Ischium

306. Caudally oriented curvature of the iliac peduncle of the ischium (corresponding with Prieto-Marquez and Wagner, 2009 character 275): (0) present, the ischial iliac peduncle is slightly curved caudally; (1) present, the ischial iliac peduncle is markedly curved caudally; (2) absent.

307. Angle between the craniodorsal margin and the cranioventral margin of the iliac peduncle of the ischium (corresponding with Prieto-Marquez and Wagner, 2009 character 276): up to 115°; (1) greater than 115°.

308. Ratio between the dorsoventral height of the iliac peduncle of the ischium and the length of the craniodorsal margin of the ischial iliac peduncle (corresponding with Prieto-Marquez and Wagner, 2009 character 277): (0) less than 1.5; (1) 1.5 to 2; (2) greater than 2.

309. Orientation of the cranioventral margin of the ischial iliac peduncle relative to the caudodorsal margin of this element (corresponding with Prieto-Marquez and Wagner, 2009 character 278): (0) the cranioventral margin is either parallel or convergent with the caudodorsal margin along the caudoventral direction; (1) the cranioventral margin is divergent with the caudodorsal margin along the caudoventral direction.

310. Orientation of the craniocaudal axis of the ischial pubic peduncle relative to the ischial shaft in parallel with the level (modified from Prieto-Marquez and Wagner, 2009 character 279): (0) directed cranioventrally; (1) almost directed cranially.

311. Craniocaudal length of the ischial pubic peduncle relative to the dorsoventral depth of this element (corresponding with Prieto-Marquez and Wagner, 2009 character 280): (0) the craniocaudal length is greater than the dorsoventral depth; (1) the craniocaudal length is approximately equal to the dorsoventral depth; (2) the

craniocaudal length is less than the dorsoventral depth.

312. A completely enclosed foramen surrounded by the obturator process and the pubic peduncle of the ischium in adults (new character): (0) absent; (1) present.

313. Location of the craniodorsal corner of the ischial pubic peduncle relative to the dorsal margin of the ischial shaft (corresponding with Prieto-Marquez and Wagner, 2009 character 281): (0) ventral to or at the same level as the dorsal margin of the ischial shaft; (1) dorsal to the dorsal margin of the ischial shaft.

314. Morphological character of the ischial shaft in lateral view (corresponding with Horner et al., 2004 character 98): (0) strongly curved downwards; (1) nearly straight.

315. Ratio between the dorsoventral depth of the ischial shaft at the midshaft and the craniocaudal length of the ischial shaft (corresponding with Prieto-Marquez and Wagner, 2009 character 282): (0) up to 0.05; (1) more than 0.05 and up to 0.075; (2) greater than 0.075.

316. Morphological character of the caudal end of the ischial shaft (modified from Godefroit et al., 2001 character 31): (0) strongly expanded ventrally, forming a large foot-shaped or boot-like protuberance at the caudal end of the ischium; (1) straight and gracile, without the pronounced ventral expansion at the caudal end of the ischium.

317. Orientation of the long axis of the ventral expansion of the ischial caudal end relative to the ischial shaft (corresponding with Prieto-Marquez and Wagner, 2009 character 286): (0) oriented ventrally; (1) oriented cranioventrally.

318. Strong recurvation of the ventral expansion of the ischial caudal end (new character): (0) absent; (1) present.

Hindlimb and Pes

Femur

319. Slightly curved caudomedially distal half of the femoral shaft (modified from Norman, 2002 character 62): (0) present; (1) absent.

320. Degree of the development of the lesser trochanter on the cranioventral surface of the proximal portion of the femur (new character): (0) presence of a strongly

developed lesser trochanter; (1) presence of a moderately developed lesser trochanter which is sometimes fused to the greater trochanter.

321. General profile of the caudal margin of the femoral fourth trochanter in lateral view (corresponding with Prieto-Marquez and Wagner, 2009 character 288): (0) triangular; (1) arcuate and smooth.

322. Morphological character of the cranial intercondylar groove in the distal region of the femur (modified from Norman, 2002 character 64): (0) fully open ventrally; (1) nearly or completely enclosed by the lateral and medial condyles owing to the fusion of these two condyles.

Tibia

323. Morphological character of the cnemial crest of the tibia (corresponding with Godefroit et al., 2000 character 31): (0) presence of an expanded cranially cnemial crest restricted to the proximal end of the tibia; (1) presence of an extended ventrally cnemial crest along the proximal half of the tibial shaft.

Fibula

324. General shape of the distal end of the fibula in lateral view (modified from Godefroit et al., 2000 character 32): (0) subtriangular, forming a moderately expanded cranially fibular distal end; (1) club-shaped, forming a greatly expanded cranially fibular distal end.

Tarsals

325. General shape of the cranial ascending process of the astragalus in cranial view (corresponding with Godefroit et al., 2000 character 33): (0) subtriangular in shape and skewed laterally; (1) triangular in shape and equilateral for each margin of the cranial ascending process.

326. Development degree of the articular surface of the astragalus for the internal malleolus of the tibia (corresponding with Prieto-Marquez and Wagner, 2009 character 291): (0) markedly expanded medially, articulating with the whole ventral surface of the tibial internal malleolus; (1) moderately expanded medially, articulating with only part of the ventral surface of the tibial internal malleolus.

327. Distal tarsals II and III (corresponding with Horner et al., 2004 character 102):

(0) present; (1) absent.

Metatarsals

328. Metatarsal I (modified from Norman, 2002 character 66): (0) present, slender and rod-shaped; (1) absent.

329. Ratio between the proximodistal length of the metatarsal III and the mediolateral width of this element at the midshaft (modified from Prieto-Marquez and Wagner, 2009 character 294): (0) greater than 4.5; (1) up to 4.5.

Pedal Phalanges

330. Proximodistal length of pedal phalanx II-2 relative to the mediolateral width of this element at the midshaft (modified from Prieto-Marquez and Wagner, 2009 character 295): (0) the proximodistal length is slightly less than the mediolateral width at the midshaft; (1) the mediolateral width at the midshaft is approximately twice as long as the proximodistal length.

331. Ratio between the mediolateral width at the midshaft and the proximodistal length of pedal phalanges III-2 and III-3 (modified from Horner et al., 2004 character 104): (0) up to 3; (1) greater than 3.

332. Ratio between the mediolateral width at the midshaft and the proximodistal length of pedal phalanges IV-2, IV-3 and IV-4 (modified from Prieto-Marquez., 2009 character 297): (0) up to 3; (1) greater than 3.

333. General shape of pedal unguals in dorsal view (modified from Norman, 2002 character 67): (0) claw-shaped, with the presence of prominent claw grooves; (1) hoof-shaped, with the presence of faint claw grooves or absence of the claw grooves.

334. Plantar median ridge on the ventral surface of pedal ungual (corresponding with Godefroit et al., 2008 character 56): (0) absent; (1) present.

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