Appendix 1

## Dentition-based Character List

1. Premaxillary teeth (**Ordered**; Modified from Russell and Dong (1993) #2):

(0) present in the anterior and posterior portions of the premaxilla

(1) absent in the posterior portion of the premaxilla

(2) absent in the anterior portion of the premaxilla

(3) absent in the whole premaxilla, toothless premaxilla

2. Number of premaxillary teeth (or alveoli) (**Ordered**; Modified from Harris (1998) #47; Sereno et al. (1998) #19):

(0) 3 or less

(1) 4

(2) 5

(3) 6

(4) 7 or more

3. Premaxillary alveoli, direction of main axis of elongation in palatal view (Unordered; Hendrickx and Mateus (2014) #3):

(0) all alveoli mesio-distally oriented

(1) anterior alveoli labio-lingually oriented, posterior alveoli mesio-distally oriented

(2) all alveoli labio-lingually oriented

4. Premaxillary alveoli, overlap of the first and second alveoli in palatal view (**Ordered**; Hendrickx and Mateus (2014) #4):

(0) absent

(1) present, partial

(2) present, almost complete

5. Premaxillary alveoli, overlap of the second and third alveoli in palatal view (Hendrickx and Mateus (2014) #5):

(0) absent

(1) present

6. Premaxillary alveoli, overlap of the third and fourth alveoli in palatal view (Hendrickx and Mateus (2014) #6):

(0) absent

(1) present

7. Premaxillary teeth (or alveoli), size (Unordered; Modified from Holtz et al. (2004) #261):

(0) all approximately equal in size

(1) posterior teeth (or alveoli) smaller than anterior teeth (or alveoli)

(2) anterior teeth (or alveoli) smaller than posterior teeth (or alveoli)

8. Anterior premaxillary teeth (or alveoli), size (Unordered; Hendrickx and Mateus (2014) #8):

(0) significantly smaller than the first six anterior maxillary teeth (or alveoli)

(1) subequal in size than the first six anterior maxillary teeth (or alveoli)

(2) significantly larger than the first six anterior maxillary teeth (or alveoli)

9. Posterior premaxillary teeth (or alveoli), size (Modified from Holtz (2001) #15):

(0) significantly smaller than the first six anterior maxillary teeth (or alveoli)

(1) subequal in size than the first six anterior maxillary teeth (or alveoli)

(2) significantly larger than the first six anterior maxillary teeth (or alveoli)

10. First premaxillary tooth (or alveolus), size (Unordered; Modified from Sereno et al. (1998) #38):

(0) subequal in size than second tooth (or alveolus)

(1) significantly smaller than second tooth (or alveolus)

(2) significantly bigger than second tooth (or alveolus)

11. Second premaxillary tooth (or alveolus), size (Unordered; Modified from Currie (1995) #4):

(0) subequal in size than third (and fourth) premaxillary tooth (or alveolus)

(1) significantly smaller than third (and fourth) tooth (or alveolus)

(2) significantly larger than third (and fourth) tooth (or alveolus)

12. Posteriormost premaxillary tooth (or alveolus), mesiodistal length in palatal view (Unordered; Hendrickx and Mateus (2014) #12):

(0) subequal in size than more anterior teeth (or alveoli)

(1) significantly smaller than more anterior teeth (or alveoli)

(2) significantly larger than anterior teeth (or alveoli)

13. Distal premaxillary alveoli, shape in palatal view (Hendrickx and Mateus (2014) #13):

(0) oval to subcircular

(1) subrectangular

14. Premaxillary tooth row, posterior extension (position of posteriormost premaxillary tooth): (Modified from Sereno (1999) #36):

(0) aligned (ventral) to external naris

(1) anterior to external naris

15. Premaxilla in palatal view (**Ordered**; Hendrickx and Mateus (2014) #16):

(0) unconstricted

(1) slightly constricted

(2) strongly constricted, terminal rosette of premaxilla

16. Subnarial gap/diastema (i.e., posterior part of premaxillary alveolar margin edentulous, resulting in an interruption of the upper tooth row) (Modified from Gauthier (1986) #36; Sereno (1999) #34; Welles (1984); Rowe 1989; Rowe and Gauthier 1990):

(0) absent

(1) present and short, diastema not extensive enough to host more than one tooth

(2) present and long, diastema extensive enough to host more than one tooth

17. First premaxillary alveoli open (**New**):

(0) ventrally, decumbent teeth

(1) anteroventrally, procumbent teeth

18. Maxillary teeth (**Ordered**; Modified from Holtz (1998b) #56):

(0) present in the anterior and posterior portions of the maxilla (posteriormost portion excluded)

(1) absent in the anteriormost portions of the maxilla

(2) absent in the posterior portion of the maxilla (i.e., more than one fourth of the bone edentulous)

(3) absent in the whole maxilla, toothless maxilla

19. Number of maxillary teeth (or alveoli) (**Ordered**; Modified from Carrano et al. (2002) #58):

(0) >19

(1) 18-19

(2) 16-17

(3) 15

(4) 10-14

(5) 1-9

20. Anterior maxillary teeth (or alveoli), size (Unordered; Modified from Zanno et al. (2009) #340):

(0) subequal in size than posterior teeth (or alveoli)

(1) significantly larger than posterior maxillary teeth (or alveoli)

(2) significantly smaller than posterior maxillary teeth (or alveoli)

21. Mid-maxillary teeth (or alveoli), mesiodistal length (Unordered; Hendrickx and Mateus (2014) #19):

(0) subequal in size than anteriormost maxillary teeth (or alveoli)

(1) significantly larger than anteriormost maxillary teeth (or alveoli)

(2) significantly smaller than anteriormost maxillary teeth (or alveoli)

22. First maxillary tooth (or alveolus), size (Modified from Sereno et al. (1998) #38):

(0) significantly smaller than second tooth (or alveolus)

(1) subequal in size than second tooth (or alveolus)

23. First maxillary teeth (or alveoli) open (Tykoski (2005) #26; Rowe 1989):

(0) ventrally, decumbent teeth

(1) anteroventrally, procumbent teeth

24. Mid-maxillary teeth, inclination (Unordered; Hendrickx and Mateus (2014) #22):

(0) pointing ventrally (decumbent)

(1) pointing lateroventrally (laterocumbent)

(2) pointing anteroventrally (procumbent)

(3) pointing posteroventrally (retrocumbent)

25. Maxillary alveoli, shape in palatal view (Unordered; Hendrickx and Mateus (2014) #23):

(0) oval to lenticular

(1) subrectangular

(2) circular

(3) merged to form an open alveolar groove (interdental septa absent)

26. Maxillary tooth row, posterior extension (position of posteriormost tooth) (**Ordered**; Modified from Gauthier (1986) #38; Harris (1998) #3; Holtz (1998b) #133; Rauhut (2003) #70):

(0) posterior to the anteriormost rim of orbit

(1) anterior or aligned to the anteriormost rim of orbit, posterior to the posteriormost rim of antorbital fenestra

(2) anterior or aligned to the posteriormost rim of antorbital fenestra, posterior to the anteriormost rim of antorbital fenestra

(3) aligned to the anteriormost rim of antorbital fenestra

(4) anterior to the anteriormost rim of the antorbital fenestra

27. Dentary teeth (**Ordered**; Modified from Sereno (1999) #175):

(0) present in the anterior and posterior portions of the dentary

(1) absent in the anteriormost portion of the dentary

(2) absent in the posterior portion of the dentary (more than one fourth of the bone edentulous)

(3) absent in the whole dentary, toothless dentary

28. Number of dentary teeth (or alveoli) (**Ordered**; Modified from Norell et al. (2001b) #86; Carrano et al. (2002) #59):

(0) > 25

(1) 18-25

(2) 15-17

(3) < 15

29. Dentary alveoli in dorsal view (Chiappe et al. (1996) #92; Currie 1987):

(0) in separate alveoli

(1) merged to form an open alveolar groove (interdental septa absent)

30. Anteriormost dentary teeth (or alveoli), size (Unordered; Modified from Rauhut (2003) #83; Tykoski (2005) #101):

(0) subequal in size than mid- and posterior dentary teeth (or alveoli)

(1) significantly larger than mid- and posterior dentary teeth (or alveoli)

(2) significantly smaller than mid- and posterior dentary teeth (or alveoli)

31. First dentary tooth (or alveolus), size in comparison to second and third dentary alveoli (Unordered; Modified from Gauthier (1986) #36 and Harris (1998) #48. Based on Holtz et al. (2004) #213 and Sereno et al. (2004) #71):

(0) subequal in size

(1) first tooth (or alveolus) substantially smaller

(2) first tooth (or alveolus) substantially larger

32. Mid-dentary teeth (or alveoli), size (Unordered; Modified from Pérez-Moreno et al. (1994) #3):

(0) subequal in size than anterior maxillary teeth (or alveoli)

(1) significantly smaller than anterior maxillary teeth (or alveoli)

(2) significantly larger than anterior maxillary teeth (or alveoli)

33. Terminal rosette of dentary, number of teeth (or alveoli) (Unordered; Hendrickx and Mateus (2014) #31):

(0) terminal rosette absent

(1) four teeth (or alveoli)

(2) five teeth (or alveoli)

34. First two or three dentary alveoli open (Hendrickx and Mateus (2014) #32):

(0) dorsally, decumbent teeth

(1) anterodorsally, procumbent teeth

35. Mid-dentary teeth, inclination (**New**):

(0) pointing dorsally, decumbent

(1) pointing anterodorsally, procumbent

36. Dentary teeth, spacing (Norell et al. (2001b) #90):

(0) evenly spaced

(1) anterior dentary teeth more closely appressed than those in middle and posterior parts of the tooth row

37. Palatal teeth on the pterygoid (Sereno (1999) #107):

(0) present

(1) absent

38. Mesial teeth, constriction between root and crown (**Ordered**; Modified from Pérez-Moreno et al. (1994) #4; Martin et al. 1980):

(0) absent

(1) constriction weak, base of crown occupying more than 85% of largest crown width

(2) constriction important, base of crown occupying 85% or less of largest crown width

39. Mesial teeth, constriction between root and crown along the tooth row (Hendrickx and Mateus (2014) #35):

(0) present in some teeth

(1) present in all teeth

40. Mesial teeth, height of the largest crown (CH in centimeters) in subadults/adults (**Ordered**; Modified from Hendrickx and Mateus (2014) #36):

(0) CH ≤ 1

(1) 1 < CH ≤ 6

(2) CH > 6

41. Mesial teeth, labiolingual compression of the crown (CBR = CBW/CBL) (Unordered; Modified from Sereno et al. (1998) #17; Charig and Milner 1997):

(0) CBR < 0.5, lenticular and strongly labiolingually compressed

(1) 0.5<CBR ≤ 0.75, oval to lenticular

(2) weak, 0.75 < CBR < 1.2, tooth subcircular

(3) CBR ≥ 1.2, teeth labiolingually elongated

42. Mesial teeth, baso-apical elongation of the crown (CHR = CH/CBL) (Unordered; Hendrickx and Mateus (2014) #38):

(0) strongly elongated, CHR > 3

(1) important, 2.5 < CHR ≤ 3

(2) normal, 2 < CHR ≤ 2.5

(3) weak, CHR ≤ 2

43. Mesial teeth, crown recurvature (lingually or distally) (Unordered; Modified from Sereno et al. (1998) #35):

(0) present, strongly recurved

(1) present, slightly recurved

(2) absent, tooth crown straight and apex centrally positioned or almost centrally positioned

44. Mesial teeth, distal margin of the crown in lateral view (Unordered; Modified from Canale et al. (2009) #5; Smith 2007):

(0) mainly concave

(1) straight

(2) mainly convex

45. Mesial teeth, outline of basal cross-section of the crown in the mesialmost tooth (Unordered; Modified from Bakker et al. (1988) #1):

(0) subcircular, ovoid or elliptical

(1) lanceolate, with acute and well-developed distal carina

(2) Salinon shape, with labial margin convex and lingual margin biconcave

(3) D-shaped or J-shaped, with lingual margins strongly convex and labial margin convex or sigmoid

(4) U-shaped, with mesial and distal margin subparallel; lenticular, with acute and well-developed distal and mesial carinae

46. Mesial teeth, concave surface adjacent to the carina (Unordered; Hendrickx and Mateus (2014) #42):

(0) absent

(1) on the labial surface and adjacent to the distal carina

(2) on the lingual surface and adjacent to both carinae

(3) on the lingual surface and adjacent to the mesial carina only

(4) on the lingual surface and adjacent to the distal carina only; one main concave surface centrally positioned on the lingual side of the crown

47. Mesial teeth, mesial carina (Hendrickx and Mateus (2014) #43):

(0) absent

(1) present

48. Mesial teeth, mesial carina (Modified from Senter et al. (2004) #20):

(0) non-serrated

(1) serrated

49. Mesial teeth, distal carina (Hendrickx and Mateus (2014) #45):

(0) serrated

(1) non-serrated

50. Mesial teeth, mesial carina (**Ordered**; Modified from Hendrickx and Mateus (2014a) #46):

(0) straight and centrally positioned on the crown

(1) slightly twisted, curves onto the mesiolingual surface

(2) strongly twisted, curves onto the lingual surface

(3) almost straight and strongly lingually deflected

51. Mesial teeth, mesial carina, and if serrated, mesial serration (Unordered; Modified from Benson (2010) #89):

(0) terminates well-above the cervix

(1) extends to the cervix or just above it

(2) terminates well beneath the cervix

52. Mesial teeth, distal carina (Modified from Hendrickx and Mateus (2014) #48):

(0) centrally positioned or slightly displaced

(1) strongly labially deflected

53. Mesial teeth, position of mesial carina on the crown in articulation in mesialmost teeth (Unordered; Modified from Currie (1995) #2 and Hendrickx and Mateus (2014) #47):

(0) facing mostly labially

(1) facing mostly mesially

(2) facing mostly lingually

54. Mesial teeth, position of distal carina on the crown in articulation in mesialmost teeth (Modified from Hendrickx and Mateus (2014) #48):

(0) facing mostly distally or labiodistally

(1) facing mostly lingually

55. Mesial teeth, average number of denticles per five millimeters on mesial carina at two-thirds height of crown (MCA) in subadults/adults (Unordered; Modified from Russell and Dong (1993) #20):

(0) ≥ 20 (1) 14-19

(2) 9-13

(3) ≤ 8

56. Mesial teeth, average number of mid-crown denticles per five millimeters on distal carina (DC) in subadults/adults (Unordered; Modified from Russell and Dong (1993) #20):

(0) ≥ 20

(1) 14-19

(2) 9-13

(3) ≤ 8

57. Mesial teeth, denticle size (except in embryos and hatchlings) (**Ordered**; Hendrickx and Mateus (2014) #53):

(0) minute denticles, more than 250 denticles on the distal carina

(1) normal in height, between 15 to 250 denticles on the distal carina

(2) very larges denticles, fewer than 15 denticles on the distal carina

58. Mesial teeth, denticles on mesial carina (Unordered; Modified from Norell et al. (2001b) #88):

(0) rounded and symmetrically convex

(1) rounded and asymmetrically convex

(2) strongly hooked/pointed, denticles with a tip pointing apically

59. Mesial teeth, denticles on distal carina (Unordered; Modified from Senter et al. (2004) #23):

(0) rounded and symmetrically convex

(1) rounded and asymmetrically convex

(2) strongly hooked/pointed, denticles with a tip pointing apically

60. Mesial teeth, size of mesial denticles relative to distal denticles (DSDI) (Unordered; Modified from Holtz (1998b) #129; Rauhut and Werner 1995):

(0) mesial and distal denticles of same size, 0.8 < DSDI <1.2

(1) mesial denticles larger than distal ones, DSDI < 0.8

(2) distal denticles larger than mesial ones, DSDI > 1.2

61. Mesial teeth, denticles contiguous over tip or very close to the apex (Modified from Harris (1998) #45):

(0) present

(1) absent

62. Mesial teeth, interdenticular sulci (Unordered; Modified from Benson (2010) #90):

(0) absent

(1) present, short

(2) present, long and well-developed

63. Mesial teeth, flutes (i.e., subparallel longitudinal grooves separated by acute ridges) on the crown (Unordered; Modified from Sereno et al. (1998) #18; Charig and Milner 1997):

(0) absent

(1) present on the lingual surface only

(2) present on both labial and lingual surfaces

(3) present on the labial surface only

64. Mesial teeth, longitudinal groove on the labial and/or lingual side of the crown (Unordered; Hendrickx and Mateus (2014) #60):

(0) absent

(1) present, a single groove centrally positioned

(2) present, a single groove mesially positioned

65. Mesial teeth, longitudinal ridge (differing from flutes) on the lingual side of the crown (Unordered; Hendrickx and Mateus (2014) #61):

(0) absent

(1) present, a single ridge centrally positioned

66. Mesial teeth, basal striations on both lingual and labial sides of the crown (Hendrickx and Mateus (2014) #62):

(0) absent

(1) present

67. Lateral teeth, constriction between root and crown (**Ordered**; Pérez-Moreno et al. (1994) #4; Martin et al. 1980):

(0) absent

(1) constriction weak, crown base occupying more than 85% of largest crown width mesiodistally

(2) constriction important, crown base occupying 85% or less of largest crown width mesiodistally

68. Lateral teeth, constriction between root and crown along the tooth row (Hendrickx and Mateus (2014) #64):

(0) present in some teeth

(1) present in all teeth

69. Lateral teeth, height of the largest crown (CH in centimeters) in subadults/adults (**Ordered**; Hendrickx and Mateus (2014) #65):

(0) CH ≤ 1

(1) 1 < CH ≤ 6

(2) CH > 6

70. Lateral teeth, labiolingual compression of the crown (CBR = CBW/CBL) (Unordered; Hendrickx and Mateus (2014) #66):

(0) important, CBR ≤ 0.5, tooth strongly flattened

(1) normal, 0.5 < CBR ≤ 0.75

(2) weak, CBR > 0.75, tooth incrassate or subcircular

71. Lateral teeth, baso-apical elongation of the crown (CHR = CH/CBL) (Unordered; Hendrickx and Mateus (2014) #67):

(0) weak, CHR ≤ 1.5

(1) normal, 1.5 < CHR ≤ 2.5

(2) important, CHR > 2.5

72. Lateral teeth, distal margin of crown in lateral view (Unordered; Modified from Hendrickx and Mateus (2014) #68):

(0) strongly concave

(1) slightly concave, roughly straight, or straight, apex positioned at the same level as distal profile

(2) convex, apex positioned mesial to distal profile

(3) sigmoid, basal half concave and apical half convex

(4) sigmoid, basal half convex and apical half concave

73. Lateral teeth, mesial margin of crown in lateral view (Modified from Hendrickx and Mateus (2014) #69):

(0) strongly convex

(1) slightly convex, almost straight

74. Lateral teeth, mesiodistal curvature of the labial surface of the crown at one third of the crown (Unordered; Modified from Hendrickx and Mateus (2014) #70 and #73; Peyer 2006):

(0) convex

(1) surface centrally positioned on the crown roughly flattened

(2) surface centrally positioned on the crown concave, labial depression restricted to the crown base

(3) surface centrally positioned on the crown concave, labial depression extends along the basal half of the crown or more apically

75. Lateral teeth, concave surface adjacent to carinae all along the crown (Unordered; Hendrickx and Mateus (2014) #71):

(0) absent

(1) present on labial surface and adjacent to distal carina

(2) present on lingual surface and adjacent to distal carina

(3) present on labial surface and adjacent to both mesial and distal carinae

(4) present on lingual surface and adjacent to both mesial and distal carinae

76. Lateral teeth, outline of basal cross-section of the crown (Unordered; Hendrickx and Mateus (2014) #72):

(0) subcircular

(1) lenticular or lanceolate

(2) elliptical or bean-shaped (i.e., longitudinal depression centrally positioned on one side only)

(3) 8-shaped (i.e., longitudinal depression centrally positioned on both lingual and labial margins)

(4) Subrectangular

77. Lateral teeth, mesial carina (Hendrickx and Mateus (2014) #74):

(0) present

(1) absent

78. Lateral teeth, mesial carina (Modified from Senter et al. (2004) #20):

(0) serrated

(1) non-serrated

79. Lateral teeth, distal carina (Hendrickx and Mateus (2014) #77):

(0) present

(1) absent

80. Lateral teeth, distal carina (Hendrickx and Mateus (2014) #78):

(0) serrated

(1) non-serrated

81. Lateral teeth, extension of mesial carina relative to distal carina (Hendrickx and Mateus (2014) #79):

(0) mesial carina extends at the same level or terminates more apically than the distal carina

(1) mesial carina extends more basally than the distal carina

82. Lateral teeth, mesial carina, and if serrated, basalmost serration of the mesial carina (Unordered; Modified from Benson (2010) #89):

(0) terminates around mid-height of crown or more apically

(1) extends to base of crown or slightly above the cervix

(2) terminates well beneath the cervix

83. Lateral teeth, twisted mesial carina in some crowns (Modified from Currie (1995) #2):

(0) absent, mesial carina centrally positioned on mesial margin or weakly curved lingually towards the base in all teeth

(1) present, mesial carina strongly twisting onto the mesiolingual surface in some teeth

84. Lateral teeth, distal carina, and if serrated, basalmost serration of the distal carina (Unordered; Modified from Benson (2010) #89):

(0) extends to the cervix or just above it

(1) terminates well beneath the cervix

(2) terminates well above the cervix

85. Lateral teeth, profile of the distal carina on the crown in distal view (Hendrickx and Mateus (2014) #82):

(0) straight or very slightly bowed

(1) strongly bowed or sigmoid

86. Lateral teeth, position of distal carina on the crown in distal view (Hendrickx and Mateus (2014) #83):

(0) centrally positioned or slightly displaced, crown subsymmetrical

(1) strongly labially deflected, crown asymmetrical

87. Lateral teeth, average number of denticles per five millimeters on mesial carina at two-thirds height of crown (MCA) in subadults/adults (Unordered; Modified from Russell and Dong (1993) #20):

(0) ≥ 30

(1) 16-29

(2) 9-15

(3) ≤ 8

88. Lateral teeth, average number of mid-crown denticles per five millimeters on distal carina (DC) in subadults/adults (Unordered; Modified from Russell and Dong (1993) #20):

(0) ≥ 30

(1) 16-29

(2) 9-15

(3) ≤ 8

89. Lateral teeth, denticle number on both mesial and distal carinae (except in embryos and hatchlings) (**Ordered**; Hendrickx and Mateus (2014) #86):

(0) more than 250 denticles (minute denticles or very large number of denticles of normal size)

(1) between 15 to 250 denticles (denticles of average size)

(2) fewer than 15 denticles (very large denticles or very small number of small denticles)

90. Lateral teeth, shape of denticles on mesial carina in lateral view (Unordered; Modified from Norell et al. (2001b) #88):

(0) symmetrically convex

(1) asymmetrically convex

(2) hooked/pointed

91. Lateral teeth, shape of denticles on distal carina in lateral view (Unordered; Senter et al. (2004) #23):

(0) symmetrically convex

(1) asymmetrically convex

(2) hooked/pointed

92. Lateral teeth, shape of mesial margin of rounded denticles on mesial carina in lateral view (Hendrickx and Mateus (2014) #89):

(0) parabolic

(1) subrectangular, with flattened surface

93. Lateral teeth, shape of distal margin of rounded denticles on distal carina in lateral view (Unordered; Hendrickx and Mateus (2014) #90):

(0) parabolic

(1) subrectangular, with flattened surface

(2) semi-circular

94. Lateral teeth, shape of denticles at two-thirds height of crown (MC-MA) on mesial carina in lateral view (Unordered; Hendrickx and Mateus (2014) #91):

(0) longer apicobasally than mesiodistally, vertical subrectangular

(1) as long mediodistally as apicobasally, subquadrangular

(2) longer mediodistally than apicobasally, horizontal subrectangular

95. Lateral teeth, shape of mid-crown denticles (DC) on distal carina in lateral view (Unordered; Hendrickx and Mateus (2014) #92):

(0) as long mediodistally as apicobasally, subquadrangular

(1) longer mediodistally than apicobasally, horizontal subrectangular

(2) longer apicobasally than mesiodistally, vertical subrectangular

96. Lateral teeth, denticle size along the carinae (Hendrickx and Mateus (2014) #93; Mateus et al. 2011):

(0) regular, gradual change in denticle size

(1) irregular, sporadic change in denticle size

97. Lateral teeth, biconvex apical denticles (i.e., biconvex external margin of denticle) on mesial carina in lateral view (Hendrickx and Mateus (2014) #94):

(0) absent

(1) present

98. Lateral teeth, orientation of mesiodistal axis of apical denticles on mesial carina in lateral view (Hendrickx and Mateus (2014) #95):

(0) perpendicular to mesial margin

(1) inclined apically from mesial margin

99. Lateral teeth, orientation of mesiodistal axis of mid-crown denticles on distal carina in lateral view (Hendrickx and Mateus (2014) #96):

(0) perpendicular to distal margin

(1) inclined apically from distal margin

100. Lateral teeth, average number of denticles on mesial carina (Unordered; Hendrickx and Mateus (2014) #97):

(0) higher number of denticles basally than at the mid-crown

(1) lower number of denticles basally than at the mid-crown

(2) subequal number of denticles basally than at the mid-crown

101. Lateral teeth, average number of denticles on mesial carina (Unordered; Hendrickx and Mateus (2014) #98):

(0) higher number of denticles apically than at the mid-crown

(1) lower number of denticles apically than at the mid-crown

(2) subequal number of denticles apically than at the mid-crown

102. Lateral teeth, average number of denticles on distal carina (except in embryos and hatchlings) (Hendrickx and Mateus (2014) #99):

(0) higher number of denticles basally than at the mid-crown

(1) subequal or lower number of denticles basally than at the mid-crown

103. Lateral teeth, average number of denticles on distal carina (Unordered; Hendrickx and Mateus (2014) #100):

(0) higher number of denticles apically than at the mid-crown

(1) lower number of denticles apically than at the mid-crown

(2) subequal number of denticles apically than at the mid-crown

104. Lateral teeth, size of mesial denticles relative to distal denticles (DSDI) (Unordered; Rauhut and Werner 1995):

(0) mesial and distal denticles of same size, 0.8 < DSDI <1.2

(1) mesial denticles larger than distal ones, DSDI < 0.8

(2) distal denticles larger than mesial ones, DSDI > 1.2

105. Lateral teeth, distal denticles on the apex (Harris (1998) #45):

(0) contiguous over tip, or very close to the apex

(1) distal denticles disappear well beneath apex

106. Lateral teeth, interdenticular space between mid-crown denticles on the distal carina (Hendrickx and Mateus (2014) #103):

(0) narrow, less than one third of the denticle width

(1) broad, more than one third of the denticle width

107. Lateral teeth, interdenticular sulci between apical denticles on the mesial carina (Unordered; Modified from Benson (2010) #90):

(0) absent

(1) present, short and poorly developed, shorter than proximodistal denticle height

(2) present, long and well-developed, equal or longer than proximodistal denticle height

108. Lateral teeth, interdenticular sulci between mid-crown denticles on the distal carina (Unordered; Modified from Benson (2010) #90):

(0) absent

(1) present, short and poorly developed, shorter than proximodistal denticle height

(2) present, long and well-developed, equal or longer than proximodistal denticle height

109. Lateral teeth, interdenticular sulci between basalmost denticles on the distal carina (Unordered; Modified from Benson (2010) #90):

(0) absent

(1) present, short and poorly developed, shorter than proximodistal denticle height

(2) present, long and well-developed, equal or longer than proximodistal denticle height

110. Lateral teeth, flutes (i.e., subparallel longitudinal grooves separated by acute ridges) on the crown (Unordered; Modified from Sereno et al. (1998) #18; Bakker et al. (1988) #2):

(0) absent

(1) present on the lingual surface

(2) present on labial surface or both labial and lingual surfaces

111. Lateral teeth, average number of flutes on the crown (Unordered; Modified from Hendrickx and Mateus (2014) #108):

(0) 1-7

(1) 7-8

(2) >8

112. Lateral teeth, large transversal undulations on the crown in some teeth (Unordered; Modified from Holtz (1998b) #131):

(0) absent

(1) present, tenuous and barely visible with light

(2) present, pronounced and well visible with light

113. Lateral teeth, large transversal undulations on the crown in some teeth when present (Hendrickx and Mateus (2014) #110):

(0) just a few

(1) numerous and closely packed

114. Lateral teeth, marginal undulations (i.e., short undulations adjacent to carinae) in some teeth (Unordered; Modified from Currie and Carpenter (2000) #42; Brusatte et al. 2007):

(0) absent

(1) present and short, the mesiodistal elongation is less than four times the space separating each undulation

(2) present and elongated, the mesiodistal elongation is longer than four times the space separating each undulation

115. Lateral teeth, marginal undulations in some teeth (Hendrickx and Mateus (2014) #112):

(0) present and shallow, only visible with light

(1) present and pronounced, well visible in lateral view

116. Lateral teeth, marginal undulations in some teeth (Unordered; Hendrickx and Mateus (2014) #113):

(0) present only on the mesial side of the crown

(1) present only on the distal side of the crown

(2) present on both mesial and distal sides

117. Lateral teeth, marginal undulations in some teeth (Hendrickx and Mateus (2014) #114):

(0) present and mesio-distally oriented

(1) present and diagonally oriented

118. Lateral teeth, longitudinal groove on the labial and/or lingual surface of the crown (Unordered; Hendrickx and Mateus (2014) #115):

(0) absent

(1) present, a single groove centrally positioned

(2) present, a single groove adjacent to mesial carina

(3) present, two grooves or more

119. Lateral teeth, elongated longitudinal and rounded ridge (differing from flutes) on the lingual surface of the crown (Unordered; Hendrickx and Mateus (2014) #116):

(0) absent

(1) present, a single ridge centrally positioned

(2) present, two or three ridges

(3) present, several fainted ridges

120. Enamel surface texture (Unordered; Hendrickx and Mateus (2014) #117):

(0) smooth or irregular (non-oriented) texture

(1) braided (oriented) texture not clearly visible with light

(2) braided (oriented) texture clearly visible with or without light

(3) deeply veined/anastomosed (oriented) texture

121. Coarse enamel surface texture (Hendrickx and Mateus (2014) #118):

(0) remains baso-apically/diagonally oriented or slightly curved basally close to the carinae

(1) strongly curved basally close to the carinae

122. Enamel microstructure, enamel tubules (Unordered; Hwang (2007) #12):

(0) absent or rare

(1) common only in basal unit layer (BUL) and/or inner potion of enamel

(2) common and extend throughout entire enamel thickness

(3) extremely common and forming an integral structural component of enamel

123. Enamel microstructure, predominant enamel type (Unordered; Modified from Hwang (2007) #13; character state 2 removed):

(0) parallel crystallites

(1) basal unit layer (BUL)

(2) columnar

124. Enamel microstructure, predominant enamel type, percentage of enamel thickness (Hwang (2007) #14):

(0) ≥ 75%

(1) < 75%

125. Enamel microstructure, number of enamel types present in schmelzmuster (Hwang (2007) #15):

(0) one

(1) two

(2) three

(3) four

126. Enamel microstructure, number of different module types present in schmelzmuster (Hwang (2007) #16):

(0) one

(1) two

127. Enamel microstructure, boundary between first and second enamel types from the enamel-dentine junction (EDJ; Hwang (2007) #17):

(0) parallel to EDJ

(1) jagged, varies in distance from EDJ

128. Enamel microstructure, boundary between second and third enamel types from the enamel-dentine junction (EDJ; Hwang (2007) #18):

(0) parallel to EDJ

(1) jagged, varies in distance from EDJ

129. Enamel microstructure, basal unit layer (BUL; Hwang (2007) #19):

(0) present

(1) absent

130. Enamel microstructure, basal unit layer (BUL; Hwang (2007) #20):

(0) poorly developed

(1) well-developed, with distinct planes of separation between adjacent units

131. Enamel microstructure, basal unit layer (BUL), maximum unit diameter (Hwang (2007) #21):

(0) < 10 µm

(1) ≥ 10 µm

132. Enamel microstructure, basal unit layer (BUL; Unordered; Hwang (2007) #22):

(0) < 25% of total enamel thickness

(1) 25-50% of total enamel thickness

(2) ≥ 50% of enamel thickness

133. Enamel microstructure, incremental lines (Unordered; Hwang (2007) #23):

(0) absent

(1) faint, poorly defined

(2) well-defined

134. Enamel microstructure, incremental lines (Unordered; Hwang (2007) #24):

(0) present in one section of the schmelzmuster only

(1) present in more than one section of the schmelzmuster but not throughout entire schmelzmuster

(2) present throughout entire schmelzmuster

135. Enamel microstructure, columnar units closest to the enamel-dentine junction (EDJ), shape of units in cross-sections (Unordered; Hwang (2007) #27):

(0) polygons with sharp corners and more than 4 sides

(1) subcircular or polygons with rounded corners and more than 4 sides

(2) triangles and/or rectangles with sharp corners

136. Enamel microstructure, columnar units closest to the enamel-dentine junction (EDJ; Hwang (2007) #28):

(0) extend straight and unbroken to the outer enamel surface (OES) or to within 20µm below the OES

(1) end, split, or are interrupted less than two-thirds of the distance from the EDJ to OES

137. Enamel microstructure, columnar units closest to the enamel-dentine junction (EDJ), maximum unit diameter (Hwang (2007) #29):

(0) < 15µm

(1) ≥ 15µm

138. Enamel microstructure, columnar units closest to the outer enamel surface (OES; Hwang (2007) #33):

(0) no dominant direction of orientation, planes of separations equally well-developed in all directions

(1) distinct longitudinal orientation, planes of separation better developed in an apicobasal (longitudinal) direction

139. Enamel microstructure, ratio of thickest enamel type in schmelzmuster divided by second thickest enamel type (Unordered; Hwang (2007) #39):

(0) > 7

(1) 1.3 to 7

(2) 1 to 1.3

140. Root, shape in lateral view (Hendrickx and Mateus (2014) #137):

(0) with subparallel mesial and distal margins

(1) with convex margins, root significantly larger than crown base

141. Root, distal shape in lateral view (Sereno et al. (1998) #21; Charig and Milner 1997):

(0) broad

(1) strongly tapered

142. Root, outline of mid-root in cross section (Unordered; Hendrickx and Mateus (2014) #139):

(0) oval to subcircular

(1) 8-shape (i.e., longitudinal depression centrally positioned on both lingual and labial margins)

(2) bean-shaped (i.e., longitudinal depression centrally positioned on one side only)

143. Root, form of the resorption pit in lingual view (Hendrickx and Mateus (2014) #140):

(0) deep and well-delimited depression

(1) shallow concavity

144. Root, transversal undulations below the cervix in some crowns (Hendrickx and Mateus (2014) #141):

(0) absent

(1) present

145. Root, apicobasal length in lateral view (**New**):

(0) less than twice the apicobasal length of the crown

(1) twice or more the apicobasal length of the crown

## Phylogenetic Character Dataset

### Files

The Excel, Mesquite and TNT files are downloadable at <https://drive.google.com/drive/folders/1BgC97GEJQs6mI6Tf8OIUFZdolKHe6LsR?usp=sharing> and can be obtained by request to Christophe Hendrickx ([christophendrickx@gmail.com](mailto:christophendrickx@gmail.com)).

### Dentition-based data matrix

xread

145 103

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Tyrannosaurus 01221100000000000041110002030211000010-233[0 1]04[0 2]11031[0 1][1 2][0 1][2 3][2 3]10000000[0 1]00-2[1 2][0 1 2][0 1]000000000[0 1]1001[2 3][2 3]100001[0 1]0100020200122?0-2[0 1]112[0 1]00[0 1]022021101---0-01112001[0 1]0[0 1]

Compsognathus 01?100?000?1?0??00210?00?20100?1000010-0?3[0 1 2]0?00-1-------------00000-0[0 1][0 1]0000?1-0[0 1]---2??-01-0-[0 1]-20--0--00-10-000-0-0---000-??????????????????10?000

Juravenator 01??00?00?01?0?000510000?2?3?????????0-0?[0 1 2]00??0-[0 1]--?-0-0--0-1000000-0?[1 2]00?011-01---2??-01-0-0-[0 2]0-----[0 1]0-[0 1]0-000-0-0---000-??????????????????10??00

Scipionyx 02?100-11122?00100510000?2030011000010-??2000?0-1-------------10000-??[0 1 2][0 1]02011-00---[0 2]??-?--0-0-[0 2]0--0--?0-10-000-0-0---000-????????????????????????

Ornitholestes 01110012[0 2]021?000104101000203000101001100[1 2 3]21[0 1][3 4][0 3][0 1]0111010--------00000-0[1 2][0 1]0[0 1]001[0 1]10[0 1]?10201-01-0-0-00--0--?0-1?-0-0-[0 1]00---0010??????????????????0?[0 1]??1

Nqwebasaurus ?????????????????2????0234????????????????????????????????????????0-022210001-1------------------------------0-0-0---000-????????????????????????

Pelecanimimus 04??????????0000020???00340011?100001110??1[0 1]3?0-1-------------0000[1 2]10?0[0 1][0 1]00?1-1------------------------------0-0-0---000-??????????????????0?0?0?

Shenzhousaurus 3----------------3--------230-?-011010-02?22000-1-------------00000-021210001-1------------------------------0-0-0---000-????????????????????????

Garudimimus 3----------------3--------3---------1------------------------------------------------------------------------------------------------------------

Struthiomimus 3----------------3--------3---------1------------------------------------------------------------------------------------------------------------

Haplocheirus 01??00000000000000012?00[0 2]2000?1?00001000?210000-1--0-0--------00000-0[1 2][1 2]0000?[0 1]0000000??0[0 1]1000000000[0 1]-??0?[0 1]10000-0-0---030-????????????????????????

Shuvuuia ?????????????????2000100340010000000?1102?22000-1-------------00?011021210001-1------------------------------0-0-0---000-??????????????????0?0???

Mononykus ??????????????????????????????????????????????????????????????????1?021210001-1------------------------------0-0-0---030-??????????????????0?0?0?

Eshanosaurus ??????????????????????????0001??0?00??????????????????????????????21021[1 2]00000000000200112[0 1][0 1 2]00[0 2][0 2]0000-[1 2]-20010000-0-0---0[0 1]0-??????????????????1?0?0?

Falcarius ?????????????????0?100002?000???000011002[2 3]220[0 5]001-------------0000210[1 2][0 1][2 4]00[0 2 3]000000012000010000[0 1][0 2]0000-1-1[0 2]00[0 2][0 2]00-100---0[0 1]0-000[0 1]?0-[0 1]00022----0[0 1][0 1]010[0 1]

Jianchangosaurus 3----------------0000?00?2?0000-0000?211221004110201201?2220000?0021021[2 4]00[0 3]000000002002222200000011-2-20010000-0-0---000-??????????????????110?01

Erlikosaurus 3----------------10???00?210010?010011002222000-0--0-0-02-1-?0000021021200000000000200??2[0 2][0 2]00020011-2-20010000-0-0---000-??????????????????110??1

Incisivosaurus 0100001222010000005101000213[0 1]00?01101001?22[1 2]001010?010--------00001?0?021000[0 1]?[0 1][0 1]??0200-?01?0?0?10??0??-???0?0--0-0---00[0 3]0????????????????????????

Caudipteryx 11????[1 2]--????10013--------3---------10-0?0[0 2][0 1]?-0-1-------------0000-----------------------------------------------------0-??????????????????10[1 2]00[0 1]

Chirostenotes 3----------------3--------3---------1------------------------------------------------------------------------------------------------------------

Citipati 3----------------3--------3---------1------------------------------------------------------------------------------------------------------------

Halszkaraptor 041111000000000000001?0001010???0???11?0??003-0-1-------------00?00-0??000011-1------------------------------0-??????00????????????????????0[0 1]?0?0

Buitreraptor ?????????????????0?????0020?0??00000??????????????????????????????0-0[0 1][0 1]003[0 1]31-1------------------------------0-0-0---[1 3][1 2]0-??????????????????1?1?00

Microraptor 011000100[0 1]20?00000401?00?20?0?110[0 1]0010-0?[1 2][0 1]0?[0 3]0-1--0-0--------00[0 1 2]0100?1[0 1]03131-0[0 1]---[0 2]??-0[1 2]-0-0-[0 2]0--0--1--[0 1]0-00[0 2]00-0---0[0 2][0 1]0??????????????????0[0 1]??00

Sinornithosaurus 011000101020?00000?01000?20?0011010010-0?[2 3][0 1]0?[2 3]1[0 1][0 1][0 1][0 1][0 1]10001[0 1][0 1]?1002[0 1 2]00-[0 1]?1003[0 1]30[0 1]000000??00100[0 1][0 1]0[0 2]000000002[0 1]0000210-0---0010??????????????????[0 1]01[0 1]00

Dromaeosaurus 0????00?1??000000050010002030010000010-1[1 2 3][1 2][0 1]03[1 3]110210201111[0 1]00100000-1[0 1]100[2 3][0 1]300000[0 1]1001[1 2][1 2]100000[0 1]000100000000100-100---0010201110-000112----2??????

Atrociraptor 010000000?20000000400103?20300110000?0-[0 1]1[2 3]113[1 3]110[1 2]1010[0 1 2][0 1]1[1 2][1 2]20[0 1]00000-1[0 1][0 1][0 1]020?00000[0 1]0000[0 1][1 2]102[0 1]00[0 1]0001000020001[0 1]0-100---0010??????????????????00?00[0 1]

Bambiraptor 01??00??????0000004???03?2030?100000??????????????????????????????0-0[0 1]1003[0 1]3[0 1]0000000000010[0 1]0001000[0 1]-?002010000-0-0---0[0 2]1000000--1---12-----??????

Tsaagan 011100110021?00000400?00?20[2 3]0010000010-1?3[0 1][0 1]000-0--0-0-01-0-0000?00-1?1[0 1]02031-00---000-11-0-0-10--0--00-00-000-0-0---000-????????????????????????

Velociraptor 011000110?21?00000[3 4]10?00?20[2 3]0011000010-00310300-0--0-0-01-0-?030?00-00[0 1][0 1]021?[0 1]00000000001100000[0 1]0000-0022000000-0-0---0[0 1 2]0-100110-00000-----1??????

Deinonychus 01000011000100000?3?110302020000000010-01[2 3]1[0 1][1 3]3110210?0011[0 1]120002000-1[0 1][0 1]0020200000[0 1]0000[0 1][1 2]1011001000[0 1][0 2]0[0 2][0 2]20101[0 1]0-1[0 1]0---0010200110-000012----0001100

Saurornitholestes 01?????????????00??101000?0200010100?0-002[0 1][0 1]331[0 1]021[0 1]200[1 2]1[0 1][1 2]20100000-1[0 1]1002[1 2][2 3]0[0 1]000[0 1]1[0 1]00[0 1][0 1]1[0 1][1 2]0001000000002010110-110---0010211110-00020-----1001000

'MPC\_D100\_1128' 0???1?????0?000?020????0?3001??00?00?1102222000-1-------------0000[1 2]1021[0 1 2][0 1]0001-1------------------------------0-0-0---000-??????????????????1?0?0?

Almas 0???00000??0?00002121100?30112100001?110?222000-1-------------0000[1 2]10?[0 1][1 2]00001-1------------------------------0-0-0---000-00000--1---22-----1???0?

Sinusonasus 0????0??1??0?00000121?00?20[0 1]?2010?01?[1 2]10?3[1 2][0 2]??0-1-------------0000[1 2]00?0[0 1 2]00??1-[0 1][0 1]---2?0-02-0-0-[0 2]0--0--1--0[0 1]-000-0-0---000-????????????????????????

Byronosaurus 0101000110?0000002021100?200100?0001?100?211010-1----1--------0000[1 2]00[1 2][1 2][0 1]0[0 1 2 3][0 1][2 4]1-1------------------------------0-0-0---[1 3][1 2]0-00000--1---22-----??????

Zanabazar 010100000000000000[0 1]211000300100100011110?3112?1102?010222??0--0000[1 2]10[1 2][0 1][0 1]001[1 3][0 1]1000?0000[1 2][1 2]2?2?0?000?1??1221[0 1]0000-0-0---200-????????????????????????

Troodon 01????????????????????????00100?00011210221050[0 1][0 1]0010??332220000000[1 2]111[0 1][0 1]0[0 2][1 3 4]1[0 1][0 1]00010000[2 3][2 3][1 2]22[1 2]00[0 1]001100000010000-100---000-110110-00020-----11[0 1]1101

Epidexipteryx 01?000121020?0?0125--112??23?1200110?0-0?0[0 1]0?00-1-------------00000-0?[0 1]10?0?1-1------------------------------0-0-0---000-??????????????????00??0[0 1]

Archaeopteryx 01?000011000?000[0 1]0500100?303001000[0 1]01100?310?00-1-------------0000100?[0 1][0 1]000?1-1------------------------------0-0-0---000-??????????????????10?00?

'GLAHM\_125390a\_mesial' ???????????????????????????????????????11310????0??0???01?0?010000??????????????????????????????????????????????????0-???????????????????????????

'GLAHM\_125390a\_lateral' ????????????????????????????????????????????????????????????????????11110?????00???000?[0 1]1?0?0?10??0??00?01?[0 1]10-100---000-????????????????????????

'Large\_Skye\_tooth\_mesial' ???????????????????????????????????????1[0 1]200??110[0 1]?0??221?0000000????????????????????????????????????????????????????????????????????????????????

'Large\_Skye\_tooth\_lateral' ????????????????????????????????????????????????????????????????????1[0 1]110???0000??[0 1][0 1]00221?0?0010??0?00?001000[0 1]???????????????????????????????????

'Small\_Skye\_tooth\_mesial' ???????????????????????????????????????????[0 1]??0-0--1-?-0?-0-0??????????????????????????????????????????????????????????0-????????????????????????

'Small\_Skye\_tooth\_lateral' ????????????????????????????????????????????????????????????????????????????1-00---??1-1?-0-0-10--0--?2-01-????????????0-????????????????????????

;

cnames

{0 Premaxillary\_teeth present\_in\_the\_anterior\_and\_posterior\_portions\_of\_the\_premaxilla absent\_in\_the\_posterior\_portion\_of\_the\_premaxilla absent\_in\_the\_anterior\_portion\_of\_the\_premaxilla absent\_in\_the\_whole\_premaxilla,\_toothless\_premaxilla;

{1 Number\_of\_premaxillary\_teeth\_(or\_alveoli) 3\_or\_less 4 5 6 7\_or\_more;

{2 Premaxillary\_alveoli,\_direction\_of\_main\_axis\_of\_elongation\_in\_palatal\_view all\_alveoli\_mesio-distally\_oriented anterior\_alveoli\_labio-lingually\_oriented,\_posterior\_alveoli\_mesio-distally\_oriented all\_alveoli\_labio-lingually\_oriented;

{3 Premaxillary\_alveoli,\_overlap\_of\_the\_first\_and\_second\_alveoli\_in\_palatal\_view absent present,\_partial present,\_complete;

{4 Premaxillary\_alveoli,\_overlap\_of\_the\_second\_and\_third\_alveoli\_in\_palatal\_view absent present;

{5 Premaxillary\_alveoli,\_overlap\_of\_the\_third\_and\_fourth\_alveoli\_in\_palatal\_view absent present;

{6 Premaxillary\_teeth\_(or\_alveoli),\_size all\_approximately\_equal\_in\_size posterior\_teeth\_(or\_alveoli)\_smaller\_than\_anterior\_teeth\_(or\_alveoli) anterior\_teeth\_(or\_alveoli)\_smaller\_than\_posterior\_teeth\_(or\_alveoli);

{7 Anterior\_premaxillary\_teeth\_(or\_alveoli),\_size significantly\_smaller\_than\_the\_first\_six\_anterior\_maxillary\_teeth\_(or\_alveoli) subequal\_in\_size\_than\_the\_first\_six\_anterior\_maxillary\_teeth\_(or\_alveoli) significantly\_larger\_than\_the\_first\_six\_anterior\_maxillary\_teeth\_(or\_alveoli);

{8 Posterior\_premaxillary\_teeth\_(or\_alveoli),\_size significantly\_smaller\_than\_the\_first\_six\_anterior\_maxillary\_teeth\_(or\_alveoli) subequal\_in\_size\_than\_the\_first\_six\_anterior\_\_maxillary\_teeth\_(or\_alveoli) significantly\_larger\_than\_the\_first\_six\_anterior\_maxillary\_teeth\_(or\_alveoli);

{9 First\_premaxillary\_tooth\_(or\_alveolus),\_size subequal\_in\_size\_than\_second\_tooth\_(or\_alveolus) significantly\_smaller\_than\_second\_tooth\_(or\_alveolus) significantly\_bigger\_than\_second\_tooth\_(or\_alveolus);

{10 Second\_premaxillary\_tooth\_(or\_alveolus),\_size subequal\_in\_size\_than\_third\_(and\_fourth)\_premaxillary\_tooth\_(or\_alveolus) significantly\_smaller\_than\_third\_(and\_fourth)\_tooth\_(or\_alveolus) significantly\_larger\_than\_third\_(and\_fourth)\_tooth\_(or\_alveolus);

{11 Posteriormost\_premaxillary\_tooth\_(or\_alveolus),\_mesiodistal\_length\_in\_palatal\_view subequal\_in\_size\_than\_more\_anterior\_teeth\_(or\_alveoli) significantly\_smaller\_than\_more\_anterior\_teeth\_(or\_alveoli) significantly\_larger\_than\_anterior\_teeth\_(or\_alveoli);

{12 Distal\_premaxillary\_alveoli,\_shape\_in\_palatal\_view oval\_to\_subcircular subrectangular;

{13 Premaxillary\_tooth\_row,\_posterior\_extension\_(position\_of\_posteriormost\_premaxillary\_tooth)\_ aligned\_(ventral)\_to\_external\_naris anterior\_to\_external\_naris\_;

{14 Premaxilla\_in\_palatal\_view unconstricted slightly\_constricted strongly\_constricted,\_terminal\_rosette\_of\_premaxilla;

{15 Subnarial\_gap/diastema\_(i.e.,\_posterior\_part\_of\_premaxillary\_alveolar\_margin\_unedentelous,\_resulting\_in\_an\_interruption\_of\_the\_upper\_tooth\_row) absent\_ present\_and\_short,\_diastema\_not\_extensive\_enough\_to\_host\_more\_than\_one\_tooth present\_and\_long,\_diastema\_extensive\_enough\_to\_host\_more\_than\_one\_tooth;

{16 First\_premaxillary\_alveoli\_open ventrally,\_decumbent\_teeth anteroventrally,\_procumbent\_teeth;

{17 Maxillary\_teeth present\_in\_the\_anterior\_and\_posterior\_portions\_of\_the\_maxilla\_(posteriormost\_portion\_excluded) absent\_in\_the\_anteriormost\_portion\_of\_the\_maxilla absent\_in\_the\_posterior\_portion\_of\_the\_maxilla\_(i.e.,\_tooth\_row\_extending\_only\_on\_the\_anterior\_75%\_of\_the\_bone\_or\_less) absent\_in\_the\_whole\_maxilla,\_toothless\_maxilla;

{18 Number\_of\_maxillary\_teeth\_(or\_alveoli) >19 18-19 16-17 15 10-14 \_1-9;

{19 Anterior\_maxillary\_teeth\_(or\_alveoli),\_size subequal\_in\_size\_than\_posterior\_teeth\_(or\_alveoli) significantly\_larger\_than\_posterior\_maxillary\_teeth\_(or\_alveoli) significantly\_smaller\_than\_posterior\_maxillary\_teeth\_(or\_alveoli);

{20 Mid-maxillary\_teeth\_(or\_alveoli),\_mesiodistal\_length subequal\_in\_size\_than\_anteriormost\_maxillary\_teeth\_(or\_alveoli) significantly\_larger\_than\_anteriormost\_maxillary\_teeth\_(or\_alveoli) significantly\_smaller\_than\_anteriormost\_maxillary\_teeth\_(or\_alveoli);

{21 First\_maxillary\_tooth\_(or\_alveolus),\_size significantly\_smaller\_than\_second\_tooth\_(or\_alveolus) subequal\_in\_size\_than\_second\_tooth\_(or\_alveolus);

{22 First\_maxillary\_teeth\_(or\_alveoli)\_open ventrally,\_decumbent\_teeth anteroventrally,\_procumbent\_teeth;

{23 Mid-maxillary\_teeth,\_inclination pointing\_ventrally\_(decumbent) pointing\_lateroventrally\_(laterocumbent) pointing\_anteroventrally\_(procumbent) pointing\_posteroventrally\_(retrocumbent);

{24 Maxillary\_alveoli,\_shape\_in\_palatal\_view oval\_to\_lenticular subrectangular circular merged\_to\_form\_an\_open\_alveolar\_\_groove\_(interdental\_septa\_absent);

{25 Maxillary\_tooth\_row,\_posterior\_extension\_(position\_of\_posteriormost\_tooth) posterior\_to\_the\_anteriormost\_rim\_of\_orbit anterior\_or\_aligned\_to\_the\_anteriormost\_rim\_of\_orbit,\_posterior\_to\_the\_posteriormost\_rim\_of\_antorbital\_fenestra anterior\_or\_aligned\_to\_the\_posteriormost\_rim\_of\_antorbital\_fenestra,\_posterior\_to\_the\_anteriormost\_rim\_of\_antorbital\_fenestra aligned\_to\_the\_anteriormost\_rim\_of\_antorbital\_fenestra anterior\_to\_the\_anteroventral\_rim\_of\_the\_antorbital\_fenestra;

{26 Dentary\_teeth present\_in\_the\_anterior\_and\_posterior\_portions\_of\_the\_dentary absent\_in\_the\_anteriormost\_portion\_of\_the\_dentary absent\_in\_the\_posterior\_portion\_of\_the\_dentary\_(i.e.,\_tooth\_row\_extending\_only\_on\_the\_anterior\_75%\_of\_the\_bone\_or\_less) absent\_in\_the\_whole\_dentary,\_toothless\_dentary;

{27 Number\_of\_dentary\_teeth\_(or\_alveoli) >\_25 18-25 15-17 <\_15;

{28 Dentary\_alveoli\_in\_dorsal\_view in\_separate\_alveoli merged\_to\_form\_an\_open\_alveolar\_groove\_(interdental\_septa\_absent);

{29 Anteriormost\_dentary\_teeth\_(or\_alveoli),\_size subequal\_in\_size\_than\_mid-\_and\_posterior\_dentary\_teeth\_(or\_alveoli) significantly\_larger\_than\_mid-\_and\_posterior\_dentary\_teeth\_(or\_alveoli) significantly\_smaller\_than\_mid-\_and\_posterior\_dentary\_teeth\_(or\_alveoli);

{30 First\_dentary\_tooth\_(or\_alveolus),\_size\_in\_comparison\_to\_second\_and\_third\_dentary\_alveoli subequal\_in\_size first\_tooth\_(or\_alveolus)\_substantially\_smaller\_ first\_tooth\_(or\_alveolus)\_substantially\_larger;

{31 Mid-dentary\_teeth\_(or\_alveoli),\_size subequal\_in\_size\_than\_anterior\_maxillary\_teeth\_(or\_alveoli) significantly\_smaller\_than\_anterior\_maxillary\_teeth\_(or\_alveoli) significantly\_larger\_than\_anterior\_maxillary\_teeth\_(or\_alveoli);

{32 Terminal\_rosette\_of\_dentary,\_number\_of\_teeth\_(or\_alveoli) terminal\_rosette\_absent four\_teeth\_(or\_alveoli) five\_teeth\_(or\_alveoli);

{33 First\_dentary\_alveoli\_open dorsally anterodorsally,\_procumbent\_teeth;

{34 Mid-dentary\_teeth,\_inclination pointing\_dorsally pointing\_anterodorsally,\_procumbent;

{35 Dentary\_teeth,\_spacing evenly\_spaced anterior\_dentary\_teeth\_more\_closely\_appressed\_than\_those\_in\_middle\_and\_posterior\_parts\_of\_the\_tooth\_row;

{36 Palatal\_teeth\_on\_the\_pterygoid present absent;

{37 Mesial\_teeth,\_constriction\_between\_root\_and\_crown absent constriction\_weak,\_base\_of\_crown\_occupying\_more\_than\_85%\_of\_largest\_crown\_width constriction\_important,\_base\_of\_crown\_occupying\_85%\_or\_less\_of\_largest\_crown\_width;

{38 Mesial\_teeth,\_constriction\_between\_root\_and\_crown\_along\_the\_tooth\_row present\_in\_some\_teeth present\_in\_all\_teeth;

{39 Mesial\_teeth,\_height\_of\_the\_largest\_crown\_(CH\_in\_centimetres)\_in\_subadult/adults CH\_?\_1 1\_<\_CH\_?\_6 CH\_>\_6;

{40 Mesial\_teeth,\_labiolingual\_compression\_of\_the\_crown\_(CBR\_=\_CBW/CBL) CBR\_<\_0.5,\_lenticular\_and\_strongly\_labiolingually\_compressed 0.5<CBR\_?\_0.75,\_oval\_to\_lenticular weak,\_0.75\_<\_CBR\_<\_1.2,\_tooth\_subcircular CBR\_?\_1.2,\_teeth\_labiolingually\_elongated;

{41 Mesial\_teeth,\_baso-apical\_elongation\_of\_the\_crown\_(CHR\_=\_CH/CBL) strongly\_elongated,\_CHR\_>\_3 important,\_2.5\_<\_CHR\_?\_3 normal,\_2\_<\_CHR\_?\_2.5 weak,\_CHR\_?\_2;

{42 Mesial\_teeth,\_crown\_recurvature\_(lingually\_or\_distally) present,\_strongly\_recurved present,\_slightly\_recurved absent,\_tooth\_crown\_straight\_and\_apex\_centrally\_positioned\_or\_almost\_centrally\_positioned;

{43 Mesial\_teeth,\_distal\_margin\_of\_the\_crown\_in\_lateral\_view mainly\_concave straight mainly\_convex;

{44 Mesial\_teeth,\_outline\_of\_basal\_cross-section\_of\_the\_crown\_in\_the\_mesialmost\_tooth subcircular,\_ovoid\_or\_elliptical lanceolate,\_with\_acute\_and\_well-developed\_distal\_carina Salinon\_shape,\_with\_labial\_margin\_convex\_and\_lingual\_margin\_biconcave D-shaped\_or\_J-shaped,\_with\_lingual\_margins\_strongly\_convex\_and\_labial\_margin\_convex\_or\_sigmoid U-shaped,\_with\_mesial\_and\_distal\_margin\_subparalell lenticular,\_with\_acute\_and\_well-developed\_distal\_and\_mesial\_carinae;

{45 Mesial\_teeth,\_concave\_surface\_adjacent\_to\_the\_carina absent on\_the\_labial\_surface\_and\_adjacent\_to\_the\_distal\_carina on\_the\_lingual\_surface\_and\_adjacent\_to\_both\_carinae on\_the\_lingual\_surface\_and\_adjacent\_to\_the\_mesial\_carina\_only on\_the\_lingual\_surface\_and\_adjacent\_to\_the\_distal\_carina\_only one\_main\_concave\_surface\_centrally\_positioned\_on\_the\_lingual\_side\_of\_the\_crown;

{46 Mesial\_teeth,\_mesial\_carina absent present;

{47 Mesial\_teeth,\_mesial\_carina non-serrated serrated;

{48 Mesial\_teeth,\_distal\_carina serrated non-serrated;

{49 Mesial\_teeth,\_mesial\_carina straight\_and\_centrally\_positioned\_on\_the\_crown slightly\_twisted,\_curves\_onto\_the\_mesiolingual\_surface strongly\_twisted,\_curves\_onto\_the\_lingual\_surface almost\_straight\_and\_strongly\_lingually\_deflected;

{50 Mesial\_teeth,\_mesial\_carina,\_and\_if\_serrated,\_mesial\_serration terminates\_well-above\_the\_cervix extends\_to\_the\_cervix\_or\_just\_above\_it terminates\_well\_beneath\_the\_cervix;

{51 Mesial\_teeth,\_distal\_carina centrally\_positioned\_or\_slightly\_displaced strongly\_labially\_deflected;

{52 Mesial\_teeth,\_position\_of\_mesial\_carina\_on\_the\_crown\_in\_articulation\_in\_mesialmost\_teeth facing\_mostly\_labially facing\_mostly\_mesially facing\_mostly\_lingually;

{53 Mesial\_teeth,\_position\_of\_distal\_carina\_on\_the\_crown\_in\_articulation\_in\_mesialmost\_teeth facing\_mostly\_distally\_or\_labiodistally facing\_mostly\_lingually;

{54 Mesial\_teeth,\_average\_number\_of\_denticles\_per\_five\_millimetres\_on\_mesial\_carina\_at\_thirds\_height\_of\_the\_crown\_(MCA)\_in\_subadult/adult ?\_20 14-19 9-13 ?\_8;

{55 Mesial\_teeth,\_average\_number\_of\_mid-crown\_denticles\_per\_five\_millimetres\_on\_distal\_carina\_(DC)\_in\_subadult/adult ?\_20 14-19 9-13 ?\_8;

{56 Mesial\_teeth,\_denticle\_size\_(except\_in\_embryos\_and\_hatchlings) minute\_denticles,\_more\_than\_250\_denticles\_on\_the\_distal\_carina normal\_in\_height,\_between\_15\_to\_250\_denticles\_on\_the\_distal\_carina very\_larges\_denticles,\_less\_than\_15\_denticles\_on\_the\_distal\_carina;

{57 Mesial\_teeth,\_denticles\_on\_mesial\_carina rounded\_and\_symmetrically\_convex\_ rounded\_and\_asymmetrically\_convex strongly\_hooked/pointed,\_denticles\_with\_a\_tip\_pointing\_apically;

{58 Mesial\_teeth,\_denticles\_on\_distal\_carina rounded\_and\_symmetrically\_convex\_ rounded\_and\_asymmetrically\_convex strongly\_hooked/pointed,\_denticles\_with\_a\_tip\_pointing\_apically;

{59 Mesial\_teeth,\_size\_of\_mesial\_denticles\_relative\_to\_distal\_denticles\_(DSDI) mesial\_and\_distal\_denticles\_of\_same\_size,\_0.8\_<\_DSDI\_<1.2 mesial\_denticles\_larger\_than\_distal\_ones,\_DSDI\_<\_0.8 distal\_denticles\_larger\_than\_mesial\_ones,\_DSDI\_>\_1.2;

{60 Mesial\_teeth,\_denticles\_contiguous\_over\_tip\_or\_very\_close\_to\_the\_apex present absent\_;

{61 Mesial\_teeth,\_interdenticular\_sulci absent present,\_short present,\_long\_and\_well-developed;

{62 Mesial\_teeth,\_flutes\_(i.e.,\_subparallel\_longitudinal\_grooves\_separated\_by\_acute\_ridges)\_on\_the\_crown absent present\_on\_the\_lingual\_surface\_only present\_on\_both\_labial\_and\_lingual\_surfaces present\_on\_the\_labial\_surface\_only;

{63 Mesial\_teeth,\_longitudinal\_groove\_on\_the\_labial\_and/or\_lingual\_side\_of\_the\_crown absent present,\_a\_single\_groove\_centrally\_positioned present,\_a\_single\_groove\_mesially\_positioned;

{64 Mesial\_teeth,\_longitudinal\_ridge,\_different\_of\_flutes,\_on\_the\_lingual\_side\_of\_the\_crown absent present,\_a\_single\_ridge\_centrally\_positioned;

{65 Mesial\_teeth,\_basal\_striations,\_different\_of\_flutes,\_on\_both\_lingual\_and\_labial\_sides\_of\_the\_crown absent present;

{66 Lateral\_teeth,\_constriction\_between\_root\_and\_crown absent constriction\_weak,\_base\_of\_crown\_base\_occupying\_more\_than\_85%\_of\_largest\_crown\_width\_mesiodistally constriction\_important,\_base\_of\_crown\_base\_occupying\_85%\_or\_less\_of\_largest\_crown\_width\_mesiodistally;

{67 Lateral\_teeth,\_constriction\_between\_root\_and\_crown\_along\_the\_tooth\_row present\_in\_some\_teeth present\_in\_all\_teeth;

{68 Lateral\_teeth,\_height\_of\_the\_largest\_crown\_(CH\_in\_centimetres)\_in\_subadult/adults CH\_?\_1 1\_<\_CH\_?\_6 CH\_>\_6;

{69 Lateral\_teeth,\_labiolingual\_compression\_of\_the\_crown\_(CBR\_=\_CBW/CBL) important,\_CBR\_?\_0.5,\_tooth\_strongly\_flattened normal,\_0.5\_<\_CBR\_?\_0.75 weak,\_CBR\_>\_0.75,\_tooth\_incrassate\_or\_subcircular;

{70 Lateral\_teeth,\_baso-apical\_elongation\_of\_the\_crown\_(CHR\_=\_CH/CBL) weak,\_CHR\_?\_1.5 normal,\_1.5\_<\_CHR\_?\_2.5 important,\_CHR\_>\_2.5;

{71 Lateral\_teeth,\_distal\_margin\_of\_crown\_in\_lateral\_view strongly\_concave slightly\_concave,\_roughly\_straight,\_or\_straight,\_apex\_positioned\_at\_the\_same\_level\_as\_distal\_profile convex,\_apex\_positioned\_mesial\_to\_mesial\_profile sigmoid,\_basal\_half\_concave\_and\_apical\_half\_convex sigmoid,\_basal\_half\_convex\_and\_apical\_half\_concave;

{72 Lateral\_teeth,\_mesial\_margin\_of\_crown\_in\_lateral\_view strongly\_convex slightly\_convex,\_almost\_straight;

{73 Lateral\_teeth,\_mesiodistal\_curvature\_of\_the\_labial\_surface\_of\_the\_crown\_at\_one\_third\_of\_the\_crown convex surface\_centrally\_positioned\_on\_the\_crown\_roughly\_flattened surface\_centrally\_positioned\_on\_the\_crown\_concave,\_labial\_depression\_restricted\_to\_the\_crown\_base surface\_centrally\_positioned\_on\_the\_crown\_concave,\_labial\_depression\_extends\_along\_the\_basal\_half\_of\_the\_crown\_or\_more\_apically;

{74 Lateral\_teeth,\_concave\_surface\_adjacent\_to\_carinae\_all\_along\_the\_crown absent present\_on\_labial\_surface\_and\_adjacent\_to\_distal\_carina present\_on\_lingual\_surface\_and\_adjacent\_to\_distal\_carina present\_on\_labial\_surface\_and\_adjacent\_to\_both\_mesial\_and\_distal\_carinae present\_on\_lingual\_surface\_and\_adjacent\_to\_both\_mesial\_and\_distal\_carinae;

{75 Lateral\_teeth,\_outline\_of\_basal\_cross-section\_of\_the\_crown subcircular lenticular\_or\_lanceolate elliptical\_or\_bean-shaped\_(i.e.,\_longitudinal\_depression\_centrally\_positioned\_on\_one\_side\_only) 8-shaped\_(i.e.,\_longitudinal\_depression\_centrally\_positioned\_on\_both\_lingual\_and\_labial\_margins) Subrectangular;

{76 Lateral\_teeth,\_mesial\_carina present absent;

{77 Lateral\_teeth,\_mesial\_carina serrated non-serrated;

{78 Lateral\_teeth,\_distal\_carina present absent;

{79 Lateral\_teeth,\_distal\_carina serrated non-serrated;

{80 Lateral\_teeth,\_extension\_of\_mesial\_carina\_relative\_to\_distal\_carina mesial\_carina\_extends\_at\_the\_same\_level\_or\_terminates\_more\_apically\_than\_the\_distal\_carina mesial\_carina\_extends\_more\_basally\_than\_the\_distal\_carina;

{81 Lateral\_teeth,\_mesial\_carina,\_and\_if\_serrated,\_basalmost\_serration\_of\_the\_mesial\_carina terminates\_around\_mid-height\_of\_crown\_or\_more\_apically extends\_to\_base\_of\_crown\_or\_slightly\_above\_the\_cervix terminates\_well\_beneath\_the\_cervix;

{82 Lateral\_teeth,\_twisted\_mesial\_carina\_in\_some\_crowns absent,\_mesial\_carina\_centrally\_positioned\_on\_mesial\_margin\_or\_weakly\_curved\_lingually\_towards\_the\_base\_in\_all\_teeth present,\_mesial\_carina\_strongly\_twisting\_onto\_the\_mesiolingual\_surface\_in\_some\_teeth;

{83 Lateral\_teeth,\_distal\_carina,\_and\_if\_serrated,\_basalmost\_serration\_of\_the\_distal\_carina extends\_to\_the\_cervix\_or\_just\_above\_it terminates\_well\_beneath\_the\_cervix terminates\_well\_above\_the\_cervix;

{84 Lateral\_teeth,\_profile\_of\_the\_distal\_carina\_on\_the\_crown\_in\_distal\_view straight\_or\_very\_slightly\_bowed strongly\_bowed\_or\_sigmoid;

{85 Lateral\_teeth,\_position\_of\_distal\_carina\_on\_the\_crown\_in\_distal\_view centrally\_positioned\_or\_slightly\_displaced,\_crown\_subsymmetrical strongly\_labially\_deflected,\_crown\_asymmetrical;

{86 Lateral\_teeth,\_average\_number\_of\_denticles\_per\_five\_millimeters\_on\_mesial\_carina\_at\_two-thirds\_height\_of\_the\_crown\_(MCA)\_in\_subadult/adult: ?\_30 16-29 9-15 ?\_8 <\_9;

{87 Lateral\_teeth,\_average\_number\_of\_mid-crown\_denticles\_per\_five\_millimetres\_on\_distal\_carina\_(DC)\_in\_subadult/adult ?\_30 16-29 9-15 ?\_8 <\_9;

{88 Lateral\_teeth,\_denticle\_number\_on\_both\_mesial\_and\_distal\_carinae\_(except\_in\_embryos\_and\_hatchlings) more\_than\_250\_denticles\_(minute\_denticles\_or\_very\_large\_number\_of\_denticles\_of\_normal\_size) between\_15\_to\_250\_denticles\_(denticles\_of\_average\_size)\_ less\_than\_15\_denticles\_(very\_large\_denticles\_or\_very\_small\_number\_of\_small\_denticles);

{89 Lateral\_teeth,\_shape\_of\_denticles\_on\_mesial\_carina\_in\_lateral\_view symmetrically\_convex\_ asymmetrically\_convex hooked/pointed;

{90 Lateral\_teeth,\_shape\_of\_denticles\_on\_distal\_carina\_in\_lateral\_view symmetrically\_convex\_ asymmetrically\_convex hooked/pointed;

{91 Lateral\_teeth,\_shape\_of\_mesial\_margin\_of\_rounded\_denticles\_on\_mesial\_carina\_in\_lateral\_view parabolic subrectangular,\_with\_flattened\_surface;

{92 Lateral\_teeth,\_shape\_of\_distal\_margin\_of\_rounded\_denticles\_on\_distal\_carina\_in\_lateral\_view parabolic subrectangular,\_with\_flattened\_surface semi-circular;

{93 Lateral\_teeth,\_shape\_of\_denticles\_at\_two-thirds\_height\_of\_the\_crown\_(MC-MA)\_on\_mesial\_carina\_in\_lateral\_view longer\_apicobasally\_than\_mesiodistally,\_vertical\_subrectangular\_ as\_long\_mediodistally\_as\_apicobasally,\_subquadrangular longer\_mediodistally\_than\_apicobasally,\_horizontal\_subrectangular;

{94 Lateral\_teeth,\_shape\_of\_mid-crown\_denticles\_(DC)\_on\_distal\_carina\_in\_lateral\_view as\_long\_mediodistally\_as\_apicobasally,\_subquadrangular longer\_mediodistally\_than\_apicobasally,\_horizontal\_subrectangular longer\_apicobasally\_than\_mesiodistally,\_vertical\_subrectangular\_;

{95 Lateral\_teeth,\_denticle\_size\_along\_the\_carinae regular,\_gradual\_change\_in\_denticle\_size irregular,\_sporadic\_change\_in\_denticle\_size;

{96 Lateral\_teeth,\_biconvex\_apical\_denticles\_(i.e.,\_biconvex\_external\_margin\_of\_denticle)\_on\_mesial\_carina\_in\_lateral\_view absent present;

{97 Lateral\_teeth,\_orientation\_of\_mesiodistal\_axis\_of\_apical\_denticles\_on\_mesial\_carina\_in\_lateral\_view perpendicular\_to\_mesial\_margin inclined\_apically\_from\_mesial\_margin;

{98 Lateral\_teeth,\_orientation\_of\_mesiodistal\_axis\_of\_mid-crown\_denticles\_on\_distal\_carina\_in\_lateral\_view perpendicular\_to\_distal\_margin inclined\_apically\_from\_distal\_margin;

{99 Lateral\_teeth,\_average\_number\_of\_denticles\_on\_mesial\_carina higher\_number\_of\_denticles\_basally\_than\_at\_the\_mid-crown lower\_number\_of\_denticles\_basally\_than\_at\_the\_mid-crown subequal\_number\_of\_denticles\_basally\_than\_at\_the\_mid-crown;

{100 Lateral\_teeth,\_average\_number\_of\_denticles\_on\_mesial\_carina higher\_number\_of\_denticles\_apically\_than\_at\_the\_mid-crown lower\_number\_of\_denticles\_apically\_than\_at\_the\_mid-crown subequal\_number\_of\_denticles\_apically\_than\_at\_the\_mid-crown;

{101 Lateral\_teeth,\_average\_number\_of\_denticles\_on\_distal\_carina\_(except\_in\_embryos\_and\_hatchlings) higher\_number\_of\_denticles\_basally\_than\_at\_the\_mid-crown subequal\_or\_lower\_number\_of\_denticles\_basally\_than\_at\_the\_mid-crown;

{102 Lateral\_teeth,\_average\_number\_of\_denticles\_on\_distal\_carina higher\_number\_of\_denticles\_apically\_than\_at\_the\_mid-crown lower\_number\_of\_denticles\_apically\_than\_at\_the\_mid-crown subequal\_number\_of\_denticles\_apically\_than\_at\_the\_mid-crown;

{103 Lateral\_teeth,\_size\_of\_mesial\_denticles\_relative\_to\_distal\_denticles\_(DSDI) mesial\_and\_distal\_denticles\_of\_same\_size,\_0.8\_<\_DSDI\_<1.2 mesial\_denticles\_larger\_than\_distal\_ones,\_DSDI\_<\_0.8 distal\_denticles\_larger\_than\_mesial\_ones,\_DSDI\_>\_1.2;

{104 Lateral\_teeth,\_distal\_denticles\_on\_the\_apex contiguous\_over\_tip,\_or\_very\_close\_to\_the\_apex distal\_denticles\_disappear\_well\_beneath\_apex;

{105 Lateral\_teeth,\_interdenticular\_space\_between\_mid-crown\_denticles\_on\_the\_distal\_carina narrow,\_less\_than\_one\_third\_of\_the\_denticle\_width broad,\_more\_than\_one\_third\_of\_the\_denticle\_width;

{106 Lateral\_teeth,\_interdenticular\_sulci\_between\_apical\_denticles\_on\_the\_mesial\_carina absent present,\_short\_and\_poorly\_developed,\_shorter\_than\_proximodistal\_denticle\_height\_ present,\_long\_and\_well-developed,\_equal\_or\_longer\_than\_proximodistal\_denticle\_;

{107 Lateral\_teeth,\_interdenticular\_sulci\_between\_mid-crown\_denticles\_on\_the\_distal\_carina absent present,\_short\_and\_poorly\_developed,\_shorter\_than\_proximodistal\_denticle\_height\_ present,\_long\_and\_well-developed,\_equal\_or\_longer\_than\_proximodistal\_denticle\_;

{108 Lateral\_teeth,\_interdenticular\_sulci\_between\_basalmost\_denticles\_on\_the\_distal\_carina absent present,\_short\_and\_poorly\_developed,\_shorter\_than\_proximodistal\_denticle\_height\_ present,\_long\_and\_well-developed,\_equal\_or\_longer\_than\_proximodistal\_denticle\_;

{109 Lateral\_teeth,\_flutes\_(i.e.,\_subparallel\_longitudinal\_grooves\_separated\_by\_acute\_ridges)\_on\_the\_crown absent present\_on\_the\_lingual\_surface present\_on\_labial\_surface\_or\_both\_labial\_and\_lingual\_surfaces;

{110 Lateral\_teeth,\_average\_number\_of\_flutes\_on\_the\_crown 1-7 7-8 >8;

{111 Lateral\_teeth,\_large\_transversal\_undulations\_on\_the\_crown\_in\_some\_teeth absent present,\_tenuous\_and\_barely\_visible\_with\_light present,\_pronounced\_and\_well\_visible\_with\_light;

{112 Lateral\_teeth,\_large\_transversal\_undulations\_on\_the\_crown\_in\_some\_teeth\_when\_present just\_a\_few numerous\_and\_closely\_packed;

{113 Lateral\_teeth,\_marginal\_undulations\_(i.e.,\_short\_undulations\_adjacent\_to\_carinae)\_in\_some\_teeth absent\_ present\_and\_short,\_the\_mesiodistal\_elongation\_is\_less\_than\_four\_times\_the\_space\_separating\_each\_undulations present\_and\_elongated,\_\_the\_mesiodistal\_elongation\_is\_longer\_than\_four\_times\_the\_space\_separating\_each\_undulations;

{114 Lateral\_teeth,\_marginal\_undulations\_in\_some\_teeth present\_and\_shallow,\_only\_visible\_with\_light present\_and\_pronounced,\_well\_visible\_in\_lateral\_view;

{115 Lateral\_teeth,\_marginal\_undulations\_in\_some\_teeth present\_only\_on\_the\_mesial\_side\_of\_the\_crown present\_only\_on\_the\_distal\_side\_of\_the\_crown present\_on\_both\_mesial\_and\_distal\_sides;

{116 Lateral\_teeth,\_marginal\_undulations\_in\_some\_teeth present\_and\_mesio-distally\_oriented present\_and\_diagonally\_oriented;

{117 Lateral\_teeth,\_longitudinal\_groove\_on\_the\_labial\_and/or\_lingual\_surface\_of\_the\_crown absent present,\_a\_single\_groove\_centrally\_positioned present,\_a\_single\_groove\_adjacent\_to\_mesial\_carina present,\_two\_grooves\_or\_more;

{118 Lateral\_teeth,\_elongated\_longitudinal\_and\_rounded\_ridge\_(differing\_from\_flutes)\_on\_the\_lingual\_surface\_of\_the\_crown absent present,\_a\_single\_ridge\_centrally\_positioned present,\_two\_or\_three\_ridges present,\_several\_fainted\_ridges;

{119 Enamel\_surface\_texture smooth\_or\_irregular\_(non-oriented)\_texture\_ braided\_(oriented)\_texture\_not\_clearly\_visible\_with\_light braided\_(oriented)\_texture\_clearly\_visible\_with\_or\_without\_light deeply\_veined/anastomosed\_(oriented)\_texture;

{120 Coarse\_enamel\_surface\_texture remains\_baso-apically/diagonally\_oriented\_or\_slightly\_curved\_basally\_close\_to\_the\_carinae strongly\_curved\_basally\_close\_to\_the\_carinae;

{121 Enamel\_microstructure,\_enamel\_tubules absent\_or\_rare common\_only\_in\_basal\_unit\_layer\_(BUL)\_and/or\_inner\_potion\_of\_enamel common\_and\_extend\_throughout\_entire\_enamel\_thickness extremely\_common\_and\_forming\_an\_integral\_structural\_component\_of\_enamel;

{122 Enamel\_microstructure,\_predominant\_enamel\_type parallel\_crystallites basal\_unit\_layer\_(BUL) columnar;

{123 Enamel\_microstructure,\_predominant\_enamel\_type,\_percentage\_of\_enamel\_thickness ?\_75% <\_75%;

{124 Enamel\_microstructure,\_number\_of\_enamel\_types\_present\_in\_schmelzmuster one two three four;

{125 Enamel\_microstructure,\_number\_of\_different\_module\_types\_present\_in\_schmelzmuster one two;

{126 Enamel\_microstructure,\_boundary\_between\_first\_and\_second\_enamel\_types\_from\_the\_enamel-dentine\_junction\_(EDJ) parallel\_to\_EDJ jagged,\_varies\_in\_distance\_from\_EDJ;

{127 Enamel\_microstructure,\_boundary\_between\_second\_and\_third\_enamel\_types\_from\_the\_EDJ parallel\_to\_EDJ jagged,\_varies\_in\_distance\_from\_EDJ;

{128 Enamel\_microstructure,\_basal\_unit\_layer\_(BUL) present absent;

{129 Enamel\_microstructure,\_basal\_unit\_layer\_(BUL) poorly\_developed well-developed,\_with\_distinct\_planes\_of\_separation\_between\_adjacent\_units;

{130 Enamel\_microstructure,\_basal\_unit\_layer\_(BUL),\_maximum\_unit\_diameter <\_10\_µm ?\_10\_µm;

{131 Enamel\_microstructure,\_basal\_unit\_layer\_(BUL) <\_25%\_of\_total\_enamel\_thickness 25-50%\_of\_total\_enamel\_thickness ?\_50%\_of\_enamel\_thickness;

{132 Enamel\_microstructure,\_incremental\_lines absent faint,\_poorly\_defined well-defined;

{133 Enamel\_microstructure,\_incremental\_lines present\_in\_one\_section\_of\_the\_schmelzmuster\_only present\_in\_more\_than\_one\_section\_of\_the\_schmelzmuster\_but\_not\_throughout\_entire\_schmelzmuster present\_throughout\_entire\_schmelzmuster;

{134 Enamel\_microstructure,\_columnar\_units\_closest\_to\_the\_EDJ,\_shape\_of\_units\_in\_cross-sections polygons\_with\_sharp\_corners\_and\_more\_than\_4\_sides subcircular\_or\_polygons\_with\_rounded\_corners\_and\_more\_than\_4\_sides triangles\_and/or\_rectangles\_with\_sharp\_corners;

{135 Enamel\_microstructure,\_columnar\_units\_closest\_to\_the\_enamel-dentine\_junction\_(EDJ) extend\_straight\_and\_unbroken\_to\_the\_OES\_or\_to\_within\_20\_µm\_below\_the\_OES end,\_split,\_or\_are\_interrupter\_less\_than\_two-thirds\_of\_the\_distance\_from\_the\_EDJ\_to\_OES;

{136 Enamel\_microstructure,\_columnar\_units\_closest\_to\_the\_enamel-dentine\_junction\_(EDJ),\_maximum\_unit\_diameter <\_15\_µm ?\_15µm;

{137 Enamel\_microstructure,\_columnar\_units\_closest\_to\_the\_outer\_enamel\_surface\_(OES) no\_dominant\_direction\_of\_orientation,\_planes\_of\_separations\_equally\_well-developed\_in\_all\_directions distinct\_longitudinal\_orientation,\_planes\_of\_separation\_better\_developed\_in\_an\_apicobasal\_(longitudinal)\_direction;

{138 Enamel\_microstructure,\_ratio\_of\_thickest\_enamel\_type\_in\_schmelzmuster\_divided\_by\_second\_thickest\_enamel\_type >\_7 1.3\_to\_7 1\_to\_1.3;

{139 Root,\_shape\_in\_lateral\_view with\_subparallel\_mesial\_and\_distal\_margins with\_convex\_margins,\_root\_significantly\_larger\_than\_base\_crown;

{140 Root,\_distal\_shape\_in\_lateral\_view broad strongly\_tapered\_apically;

{141 Root,\_outline\_of\_mid-root\_in\_cross\_section oval\_to\_subcircular 8-shape\_(i.e.,\_longitudinal\_depression\_centrally\_positioned\_on\_both\_lingual\_and\_labial\_margins) bean-shaped\_(i.e.,\_longitudinal\_depression\_centrally\_positioned\_on\_one\_side\_only);

{142 Root,\_form\_of\_the\_resorption\_pit\_in\_lingual\_view deep\_and\_well-delimited\_depression shallow\_concavity;

{143 Root,\_\_transversal\_undulations\_below\_the\_cervix absent present;

{144 Root,\_apicobasal\_height\_in\_lateral\_view less\_than\_twice\_the\_apicobasal\_height\_of\_the\_crown twice\_or\_more\_the\_apicobasal\_height\_of\_the\_crown;

;

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67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 (97 98 99 100 101 102)] [6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 (97 98 99 100 101 102)] [7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 (97 98 99 100 101 102)] [8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 (97 98 99 100 101 102)] [8 9 10 11 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## Datasets used in the Discriminant Analysis (DFA)

The Excel and .dat (Past3) files are downloadable at <https://drive.google.com/drive/folders/1BgC97GEJQs6mI6Tf8OIUFZdolKHe6LsR?usp=sharing> and can be obtained by request to Christophe Hendrickx ([christophendrickx@gmail.com](mailto:christophendrickx@gmail.com)).

## Results of the Discriminant Analysis (DFA)

The DFA performed on the whole dataset recovers NMS G.2018.17.1 and GLAHM 125390a outside the morphospace occupied by other theropods. The two isolated teeth are both assigned to the abelisaurid *Rugops* at the taxon-level (Axes 1 and 2 account for 38.98% and 21.36% of the total variance, respectively) and to neovenatorid and troodontid theropods, respectively, at the group-level (Axes 1 and 2 account for 51.51% and 19.72% of the total variance, respectively; Table 1). The reclassification rate (RR) of this analysis is low, given that it correctly discriminates ~62.5% of the teeth to their respective taxon/group. A slightly better RR is seen at the group-level (63.4%) when the absence of denticles is considered as inapplicable; yet, unlike GLAHM 125390a, NMS G.2018.17.1, is still recovered outside the morphospace occupied by other theropods. In this analysis, both are classified as Troodontidae at the group-level (Axis 1 50.31%, Axis 2 19.14%), and as the abelisaurids *Rugops* and *Majungasaurus* at the taxon-level, respectively (Table 1).

The DFAs of our personal dataset yield relatively similar results and slightly lower RR than those of the whole dataset (59.27−61.82%). NMS G.2018.17.1 remains outside the morphospace occupied by other theropod taxa whereas GLAHM 125390a is retrieved within the morphospace occupation of non-abelisaurid ceratosaurs and non-spinosaurid megalosauroids (Figure 3). Both are assigned to the same groups as in previous analyses (Neovenatoridae and Troodontidae, respectively). NMS G.2018.17.1 and GLAHM 125390a were assigned to the same groups as in the previous analyses (Neovenatoridae and Troodontidae, respectively), with NMS G.2018.17.1 being also classified as a non-abelisauroid ceratosaur when absence of denticles was treated as in applicable (Table 1). Unlike the previous analysis, NMS G.2018.17.1 was referred to *Megaraptor* or *Arcovenator*, and GLAHM 125390a to *Megaraptor* or *Majungasaurus*, depending on whether denticles were included or treated as inapplicable.

Much higher RRs (73.73−86.57%) were obtained when performing the DFA on the datasets of Smith & Lamanna (2006) and Gerke & Wings (2016). Using the Smith & Lamanna (2006) dataset, GLAHM 125390a and NMS G.2018.17.1 were classified as belonging to Ceratosauridae and Carcharodontosauridae, respectively, at the group-level (Axis 1 55.77%, Axis 2 33.54%), and to *Ceratosaurus* and *Dilophosaurus*, respectively, at the taxon-level (Axis 1 70.07%, Axis 2 14.55%), when CA2 and DAVG2 are considered in the analysis (RR of 78.49%). Excluding these variables yielded different results, with NMS G.2018.17.1 and GLAHM 125390a assigned to Ceratosauridae/*Carcharodontosaurus* and Carcharodontosauridae/*Suchomimus* at the group/taxon level, respectively (Axis 1 56.29%, Axis 2 33.99% / Axis 1 71.27%, Axis 2 14.47%; Table 1). However, NMS G.2018.17.1 and GLAHM 125390a were referred to Ceratosauridae and Neovenatoridae at the group-level (RR of 73.73%; Axis 1 51.46%, Axis 2 38.12%) and to *Carcharodontosaurus* and *Neovenator* at the taxon-level (86.57%; Axis 1 64.14%, Axis 2 24.42%), respectively, in the DFA of the Gerke & Wings (2016) dataset, in which CHR is considered instead of CBL. Excluding ratio variables from the dataset and considering CBL yields slightly different results, with NMS G.2018.17.1 assigned to Metriacanthosauridae.

When only large teeth are considered, and datasets restricted to taxa with teeth larger than two centimetres (whole dataset and personal dataset), NMS G.2018.17.1 is repeatedly found outside the morphospace of other theropod taxa (i.e., the whole dataset and our personal dataset). RR remains low in these analyses and varies between 59.47% and 63.43% at the group-level, and between 58.4% and 61.87% at the taxon-level (Table 1). Consistently, the specimen is classified as a non-abelisauroid Ceratosauria, and assigned to the megalosaurid *Torvosaurus* and the abelisaurid *Arcovenator* at the taxon-level, dependent on whether denticles are considered relevant or treated as inapplicable.

## Credits of the theropod silhouettes illustrating figures 2 and 3

* *Herrerasaurus*/Non-neotheropod Saurischia, *Eoraptor*, *Coelophysis*, *Ceratosaurus*/Non-abelisauroid Ceratosauria, *Masiakasaurus*/Noasauridae, *Aucasaurus*/*Carnotaurus*/Abelisauridae, *Marshosaurus*/Non-megalosauran Megalosauroidea, *Torvosaurus*/Megalosauridae, *Baryonyx*/Spinosauridae, *Allosaurus*/Metriacanthosauridae + Allosauridae, *Neovenator*, *Acrocanthosaurus*, *Giganotosaurus*/Carcharodontosauridae, *Guanlong*, *Eotyrannus*/Non-tyrannosaurid Tyrannosauroidea, *Tyrannosaurus*/Tyrannosauridae, *Ornitholestes*/Basalmost Coelurosauria, *Compsognathus*/Compsognathidae, *Oviraptor*/Oviraptorosauria (Fig. 2), *Velociraptor*, *Troodon*/Troodontidae, *Archaeopteryx*: Scott Hartman (Phylopic; <https://creativecommons.org/licenses/by-sa/3.0/>).
* *Daemonosaurus*: © Smithsonian Institution (modified)
* *Dilophosaurus*/Non-averostran Neotheropoda: Julio Garza (Phylopic; <https://creativecommons.org/licenses/by-sa/3.0/>).
* *Yangchuanosaurus* (as Metriacanthosauridae): Gregory S. Paul (used with permission)
* *Australovenator*: T. Tischler (Phylopic; <https://creativecommons.org/licenses/by-sa/3.0/>).
* *Pelecanimimus*/Ornithomimosauria: Nobu Tamura (Phylopic; <https://creativecommons.org/licenses/by-nc/3.0/>).
* *Shuvuuia*/Alvarezsauroidea, *Dromaeosauroides*: FunkMonk (Phylopic; <https://creativecommons.org/publicdomain/zero/1.0/>).
* *Therizinosaurus*: Martin Kevil (Phylopic; <https://creativecommons.org/licenses/by-nc/3.0/>).
* *Similicaudipteryx*/Oviraptorosauria (Fig. 3): Matt Martyniuk (Phylopic; <https://creativecommons.org/licenses/by-nc/3.0/>).
* *Rahonavis*: T. Michael Keesey (Phylopic; <https://creativecommons.org/publicdomain/zero/1.0/>).
* *Microraptor* /Microraptorinae, *Utahraptor*/Dromaeosauridae/Dromaeosaurinae: Emily Willoughby (Phylopic; <https://creativecommons.org/licenses/by-nc/3.0/>).

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