APPENDIX 1.

SOURCES OF CHARACTER STATE DATA:

SPECIMENS AND LITERATURE SOURCES EXAMINED

Abbreviations: AMNH, American Museum of Natural History, New York; ANSP, Academy of Natural Sciences, Philadelphia; BMNH, British Museum of Natural History, London; CNRST, Centre Nationale de la Recherché Scientifiqe et Technologique, Bamako, Mali; FAM, Frick American Museum Collection, New York; FMNH, Field Museum of Natural History, Chicago; FMNH UC, University of Chicago Collection, Field Museum of Natural History; HUJ, Hebrew Museum of Jerusalem; IGM, Institute of Geology, Ulaan Baatar, Mongolia; LACM, Los Angeles County Museum of Natural History, Los Angeles; MCZ, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts; NMMNH, New Mexico Museum of Natural History and Science, Albuquerque; PEFO, Petrified Forest National Park, Arizona; SAM, South African Museum, Cape Town; SBU, Anatomical Sciences Museum, Stony Brook University, Stony Brook, New York; UA, University of Antananarivo, Madagascar; UCMP, University of California Museum of Paleontology, Berkeley; ZPAL, Institute of Paleobiology (Zaklad Paleobiologii) of the Polish Academy of Sciences, Warsaw.

Crurotarsi

Akanthosuchus langstoni.—NMMNH P-8628; O'Neill et al., 1981.

Alligator mississippiensis.—MCZ, two uncatalogued specimens; SBU Rp8; UCMP 71672, 119044, 131699, 142041.

Coahomasuchus kahleorum.—NMMNH P-18496; Heckert and Lucas, 1999.

Caiman crocodilus.—AMNH 66379, 73048, 73049, 120030.

Crocodylus.—AMNH 19215, 57773, 77595, 88316, R-141073; MCZ 3762; UCMP 123090, 123733.

Desmatosuchus haplocerus.—ANSP 14688; NMMNH C-4521, P-18162, P-22393; UCMP 27341, 27961; Long and Murry (1995); Small (2002).

Gavialis gangeticus.—AMNH 88316, 131377.

Goniopholis lucasii.—AMNH 5766, 5782.

Mahajangasuchus insignis.—UA 8654, 8785.

Paratypothorax andressorum.—PEFO 3004, Long and Murry (1995).

Protosuchus richardsoni.—MCZ 6727, 8813; UCMP 36717, 130860, 131827; Colbert and Mook (1951).

Pseudopalatus.—NMMNH P-20852, P-31292, P-4793; UCMP 34249; Camp (1930); Long and Murry (1995).

Rutiodon.—UCMP 34245, 34252, 34253, 119364, 121943, 121968, 121991, 122078, 122217, 122225; Long and Murry (1995).

Simosuchus clarki.—UA 8679.

Typothorax coccinarum.—ANSP 14695; MCZ 1487, 1488; NMMNH P-3679 through P-4482, P-16545, P-17579, P-4205, P-4953; UCMP 34227; Long and Murry (1995).

Eureptilia

Araeoscelis.—MCZ 4380, 8828; Reisz et al. (1984).

Captorhinidae.—FMNH PR 913, UC 242, UR 161, UR 634; MCZ 1059, 1158, 1202, 2981, 8918, one uncatalogued specimen.

Choristodera.—Gauthier et al. (1988b); deBraga and Rieppel (1997).

Claudiosaurus germaini.—UCMP 128002 (cast)

Cyamodontoidea.—AMNH 483, 484, 2901, 2999, 3858 24393; HUJ Pal TR 198, 237, 868, 929, 935, 952, 965, 2492, 3060, 3071, 3421, 3422, 3673, 3676; Rieppel (2001, 2002); Chun and Rieppel (2002).

Eosauropterygia.—deBraga and Rieppel (1997).

Kuehneosauridae.—AMNH 2101; Colbert (1970).

Paleothyris acadiana.—MCZ 3481; Carroll (1969); Heaton and Reisz (1986).

Placodus gigas.—AMNH 2901, 24393 (cast); Drevermann (1933).

Prolacertiformes.—Carroll (1988); Gauthier et al. (1988b); deBraga and Rieppel (1997).

Rhynchosauria.—AMNH 7799, 7800.

Trilophosaurus buetnteri.—UCMP 60185, 60189.

Younginiformes.—Gow (1975).

Lepidosauria

Anguis fragilis.—AMNH R-56193, R-69603, R-73056; SBU Rp9; Zylberberg and Castanet (1985).

Cordylus.—AMNH 137120, R-76874, SBU Rp10; UCMP 137621.

Corucia zebrata.—SBU Rp11; UCMP 137662, 137813, 137850.

Elgaria.—AMNH 591, 24761(2); SBU Rp12.

Gerrhonotus.—AMNH R-104476, R-106732, SBU Rp13; UCMP 136914.

Glyptosaurinae.—AMNH 1616, 5168, 6167, 8138, 26200, 42913; FAM 8696, 8706, 8720; FMNH UC 391, UC 426; UCMP 126000, 159171; Sullivan (1979).

Heloderma.—SBU Rp14, Rp15; UCMP 668DRL, 117512, 118927, 118928, 123071, 131261, 131262, 131263, 131265.

Ophisaurus.—AMNH 140828; SBU Rp16; UCMP 140692.

Sphenodon punctatus.—UCMP 123732; Maderson (1968); Alibardi (1999).

Tiliqua.—AMNH 74438, 74600, R-143170; SBU Rp17, Rp18.

Zonosaurus.—SBU Rp19; Richter (1994).

Mammalia: Cingulata

Dasypus novemcinctus.—AMNH 95128, 211670, 255863; SBU MEd7, MEd8.

Doedicurus giganteus.—AMNH 11256, 11257, 11258.

Glyptodon reticulatus.—AMNH 11254.

Glyptotherium.—AMNH 23514; Gillette and Ray (1981).

Panochthus frenzelianus.—AMNH 11243, 11245.

Zaedyus pichiy.—AMNH 238023.

Mesosauridae

AMNH 6988 (cast), 6993 (cast) 11002, 11003, 23800 through 23816 (casts), Modesto, 1999.

Nonmammalian Synapsids

Casea.—Olson (1954, 1968).

Edaphosauridae.—Romer and Price (1940).

Gorgonopsia.—Sigogneau-Russell (1989).

Morganucodon.—Kermack et al. (1973; 1981).

Ophiacodon retroversus.—FMNH UC 458.

Procynosuchus.—Kemp (1979).

Sphenacodontidae.—Romer and Price (1940).

Ornithodira

Euoplocephalus tutus.—AMNH 5223, 5328, 5337, 5403, 5404, 5405, 5406; Vickaryous and Russell (2003).

Malagasy titanosaur.—FMNH PR 2342; UA 8783; Dodson et al. (1998).

Mali titanosaur.—CNRST-SUNY-1.

Pinacosaurus grangeri.—AMNH 6523; IGM 100/1014; ZPAL MgD II/1.

Saltasaurus loricatus.—Powell (1992).

Sauropelta edwardsorum.—AMNH 3032; 3035; Ostrom (1970).

Scelidosaurus harrisonii.—AMNH 6798; BMNH 39516 (cast); UCMP 130056; Owen (1861).

Scutellosaurus lawleri.—MCZ 8792, 8793, 8794, 8798, 8803, 8804, 8805, 8806; Colbert (1981).

Stegosaurus stenops.—AMNH 544, 551; de Buffrénil et al. (1986); Galton (1990).

Outgroups

Diadectomorpha.—FMNH UC 1075, UC 1177; Romer (1956); Berman et al. (1992).

Seymouriidae.—FMNH UC 1313, UC 663, UR 457, UR 458; Berman et al. (2000).

Parareptilia

Acleistorhinus pteroticus.—deBraga and Reisz (1996).

Anthodon serrarius.—AMNH 7001, Lee (1997a).

Bradysaurus seeleyi.—FMNH UC 1525, UC 1533; SAM PK-4345; UCMP 34524.

Lanthanosuchidae.—deBraga and Rieppel (1997).

Macroleter poezicus.—Reisz and Laurin (2001)

Millerettidae.—Gow (1972).

Owenetta rubidgei.—Reisz and Laurin (1991).

Pareiasauridae indet.—AMNH 24170; UCMP 42403, 42404, 42407, 42408, 42668, FMNH Field Nos. 15, 29, 44, 49; FMNH UR 1526, UR 2436, UR 2437, UR 2439, UR 2442, UR 2443, UR 2465, UR 2476, UR 2480, UR 2481, UR 2482, UR 2484, UR 2486.

Pareiasaurus serridens.—FMNH UC 1562; SAM PK-1058; Boonstra (1934).

Procolophon.—AMNH 4980, 5693, 8239, 8240, 8241, 8242, 9501, 9506, 9507, 9508, 9509, 9510, 9511, 9512, 9518, 9533, 23877, 30514, 30515, 30517, 30518; FMNH

UC 1097, UR 347, UR 597; UCMP 42533, 42536, 42537, uncatalogued specimens; Carroll and Lindsay (1985).

Scutosaurus karpinskii.—FMNH UR 865.

Testudines

Baena.—AMNH 5971, 5977; MCZ 4072, 4456; LACM 45959, 45979, uncatalogued specimen.

Chelydra serpentina.—MCZ 17-6, UCMP 131571, 134476; SBU Rp1.

Geochelone.—AMNH 5870; UCMP 137938, 140430, 141013, 141446; SBU, uncatalogued specimen.

Proganochelys quenstedti.—AMNH 6811 (cast), 16980 (cast); Gaffney (1990).

Pseudemys scripta.—SBU Rp4, Rp7.

Trionyx.—AMNH 36599; MCZ Field No. U26; UCMP 177244.

APPENDIX 2 – CHARACTER LIST

1. Single aortic trunk with three semilunar valves: (0) absent; (1) present. Gardiner, 1982 #2; Gauthier et al., 1988b #G2.
2. Pulmonary artery with three semilunar valves: (0) absent; (1) present. Gardiner, 1982 #3 (in part); Gauthier et al., 1988b #G3.
3. Muscular lateral valve of right atrio-ventricular orifice: (0) absent; (1) present. Gardiner, 1982 #3 (in part); Gauthier et al., 1988b #G3a.
4. Smooth erector muscles at bases of epidermally derived structures: (0) absent; (1) present. Gardiner, 1982 #5 (in part); Gauthier et al., 1988b #G5a.
5. Epidermal structures induced by special groups of underlying cells: (0) absent; (1) present. Gardiner, 1982 #5 (in part); Gauthier et al., 1988b #G5b.
6. Three meninges: (0) absent; (1) present. Gardiner, 1982 #6; Gauthier et al., 1988b #G6.
7. Scroll-like turbinals: (0) absent; (1) present and partly lined with olfactory epithelium; (2) present and lined with mucociliary respiratory epithelium. Gardiner, 1982 #8 (in part); Gauthier et al., 1988b #G8.
8. Adventitious (secondary) cartilage: (0) absent; (1) present. Gardiner, 1982 #10; Gauthier et al., 1988b #G10.
9. Vascularized islets of pancreas: (0) absent; (1) present. Gardiner, 1982 #12 (in part); Gauthier et al., 1988b #G12.
10. Pancreas lying between limbs of first duodenal loop, binding them together: (0) absent; (1) present. Gardiner, 1982 #12 (in part); Gauthier et al., 1988b #G12a.

11. Pineal complex: (0) present and with neurosensory function; (1) present but reduced and glandular; (2) absent. Modified from Gardiner, 1982 #13; Gauthier et al., 1988b #G13.
12. Macula densa (thickening of distal tubule): (0) absent; (1) present. Gardiner, 1982 #14; Gauthier et al., 1988b #G14.
13. Loop of Henle: (0) absent; (1) present. Gardiner, 1982 #15; Gauthier et al., 1988b #G15.
14. Completely divided heart: (0) absent; (1) present. Gardiner, 1982 #20 (in part); Gauthier et al., 1988b #G20.
15. Thick, compact myocardium with extensive system of coronary arteries: (0) absent; (1) present. Gardiner, 1982 #20 (in part); Gauthier et al., 1988b #G20a.
16. Septum sinu-venosi interrupting sinus venosus: (0) absent; (1) present. Gardiner, 1982 #21; Gauthier et al., 1988b #G21.
17. Post-hepatic septum: (0) absent; (1) present. Gardiner, 1982 #22 (in part); Gauthier et al., 1988b #G22a.
18. Renal portal system: (0) present; (1) absent. Gardiner, 1982 #25; Gauthier et al., 1988b #G25.
19. Reissner's membrane: (0) simple; (1) medially thickened and thrown into numerous folds. Gardiner, 1982 #27 (in part); Gauthier et al., 1988b #G27a.
20. Eustachian tube passing through cranial base to open by single opening in roof of pharynx: (0) absent; (1) present. Gardiner, 1982 #27 (in part); Gauthier et al., 1988b #G27b.

21. Single penis with erectile tissue: (0) absent; (1) present. Gardiner, 1982 #30; Gauthier et al., 1988b #G30.
22. Ciliary processes: (0) absent; (1) present. Gardiner, 1982 #32; Gauthier et al., 1988b #G32.
23. Pyramidalis muscle of eye: (0) absent; (1) present. Gardiner, 1982 #34 (in part); Gauthier et al., 1988b #G34.
24. Point of attachment of tendon of nictitans: (0) tendon absent; (1) tendon attaches to surface of eye; (2) tendon attaches to interorbital septum. Gardiner, 1982 #34 (in part); Gauthier et al., 1988b #G34a.
25. Nictitans (nictitating membrane): (0) absent; (1) small and immobile; (2) large and mobile. Gardiner, 1982 #34 (in part); Gauthier et al., 1988b #G34b.
26. Tendon involved in moving lower eyelid: (0) present; (1) absent. Gardiner, 1982 #34 (in part); Gauthier et al., 1988b #G34c.
27. Transparent nictitans: (0) absent; (1) present. Gardiner, 1982 #34 (in part); Gauthier et al., 1988b #G34d.
28. Cricoid cartilage composed of two or more tracheal rings: (0) absent; (1) present. Gardiner, 1982 #35 (in part); Gauthier et al., 1988b #G35a.
29. Appearance of independent centers of ossification in longbone epiphyses: (0) absent; (1) present in proximal end of tibia only; (2) present in epiphyses of all longbones. Gardiner, 1982 #36 (in part); Gauthier et al., 1988b #G36a.
30. Origin of subclavian arteries: (0) symmetrical, posterior origin from aorta(e); (1) subclavian arteries displaced cranially to originate from right or left third or fourth aortic arches; (2) subclavian arteries originate far anteriorly, near carotids; (3)

subclavian arteries originate anterior to separation of internal and external carotids. Gardiner, 1982 #37; Gauthier et al., 1988b #G37.

31. Hypophyseal stalk forms at anterior end of anlage and cell cords of the pars distalis grow dorsoventrally: (0) no; (1) yes. Løvtrup, 1985 #1 (in part); Gauthier et al., 1988b #L1a.
32. Atrio-ventricular node: (0) absent; (1) present. Løvtrup, 1985 #4; Gauthier et al., 1988b #L4.
33. Vomeronasal organ in adults: (0) present; (1) absent. Løvtrup, 1985 #6 (in part); Gauthier et al., 1988b #L6a.
34. Histology of adrenal tissue: (0) "generalized" type 1 found in turtles and lissamphibians; (1) type 2 found in lepidosaurs; (2) type 3 found in birds and crocodiles; (3) type 4 found in mammals. Løvtrup, 1985 #7; Gauthier et al., 1988b #L7.
35. Morphology of thymus: (0) single, bilobed structure; (1) two pairs of organs. Løvtrup, 1985 #8; Gauthier et al., 1988b #L8.
36. Three neurofilament proteins: (0) absent; (1) present. Løvtrup, 1985 #9; Gauthier et al., 1988b #L9.
37. Cartilage canals in epiphyses: (0) absent; (1) present. Løvtrup, 1985 #10; Gauthier et al., 1988b #L10.
38. Sinus cavernosus: (0) absent; (1) present. Løvtrup, 1985 #13; Gauthier et al., 1988b #L13.
39. Calcareous egg shell: (0) absent; (1) present. Løvtrup, 1985 #15 (in part); Gauthier et al., 1988b #L15.

40. Numerous large pores in the outer covering of egg: (0) absent; (1) present. Løvtrup, 1985 #15 (in part); Gauthier et al., 1988b #L15a.
41. Pair of tertiary egg membranes: (0) absent; (1) present. Løvtrup, 1985 #15 (in part); Gauthier et al., 1988b #L15b.
42. Production of ornithuric acid in benzoic acid metabolism: (0) absent; (1) present. Løvtrup, 1985 #16 (in part); Gauthier et al., 1988b #L16a.
43. Egg albumen: (0) absent or scarce; (1) present in large amounts. Løvtrup, 1985 #18; Gauthier et al., 1988b #L18.
44. Horny caruncle (cornified epidermal structure similar in function to egg tooth): (0) absent; (1) present. Løvtrup, 1985 #19; Gauthier et al., 1988b #L19.
45. Nasal glands outside nasal capsule: (0) absent; (1) present. Gauthier et al., 1988b #A6.
46. Morphology of stomach: (0) most of stomach lumen lies anterior to pylorus; (1) most of stomach lumen lies posterior to pylorus. Gauthier et al., 1988b #A7.
47. Gizzard: (0) absent; (1) present. Gauthier et al., 1988b #A8.
48. Urea concentration in blood: (0) high; (1) low. Gauthier et al., 1988b #A9.
49. Urinary bladder: (0) present; (1) absent. Gauthier et al., 1988b #A10.
50. Color vision: (0) absent; (1) present. Gauthier et al., 1988b #A11.
51. Nest building behavior: (0) absent; (1) present. Gauthier et al., 1988b #A12.
52. Ependymal cells: (0) present; (1) absent. Gauthier et al., 1988b #A13.
53. Olfactory bulbs: (0) apedunculate; (1) linked to central nervous system by stalks or peduncles. Gauthier et al., 1988b #A14.

54. Dorsoventricular ridge of telencephalon: (0) absent; (1) present, with zone of cell clusters near ventricular surface; (2) present, with evenly distributed cell clusters. Gauthier et al., 1988b #A15.
55. Rhombencephalon: (0) unspecialized and indistinct; (1) specialized and distinct, consisting of many nuclei. Gauthier et al., 1988b #A16.
56. Iris muscle: (0) smooth; (1) striated. Gauthier et al., 1988b #A17.
57. Origin of puboischiofemoralis internus, pars dorsalis: (0) ventrally, from puboischial plate; (1) dorsally. Gauthier et al., 1988b #A18.
58. Masticatory muscle plate: (0) simple; (1) divided into constrictor dorsalis and adductor mandibulae. Gauthier et al., 1988b #A19.
59. Position of kidney: (0) closely appressed to adrenal gland; (1) separated from adrenal gland. Gauthier et al., 1988b #A20.
60. Calcite otoliths: (0) absent; (1) present. Gauthier et al., 1988b #A26.
61. Siphonal system: (0) absent; (1) present. Gauthier et al., 1988b #A28.
62. Premaxillary teeth: (0) present throughout premaxilla; (1) present only in posterior region of premaxilla; (2) absent. Modified from Heckert and Lucas, 1999 #1, #6; Gauthier et al., 1988b, #110; deBraga and Rieppel, 1997 #3.
63. Premaxilla posterolateral process: (0) small so that maxilla contributes greatly to snout tip; (1) large so that premaxilla forms most of snout tip. Modified from Gauthier et al., 1988b #A31, #1; deBraga and Rieppel, 1997 #1.
64. Premaxilla postnarial process: (0) short; (1) prominent, contacting nasal and excluding maxilla from external naris. Modified from Gauthier et al., 1988b #2; deBraga and Rieppel, 1997 #4; Heckert and Lucas, 1999 #13.

65. Nasal length: (0) equal to or shorter than frontal; (1) longer than frontal. Gauthier et al., 1988b #4; deBraga and Rieppel, 1997 #10.
66. Nasal bones paired or fused: (0) paired; (1) fused; (2) absent. deBraga and Rieppel, 1997 #9.
67. External nares exposure: (0) dorsal process of premaxilla broad, restricting nares to a lateral exposure; (1) dorsal process narrow resulting in dorsal (or anterior) exposure of nares. deBraga and Rieppel, 1997 #6.
68. External nares separate or confluent: (0) separated by intranarial bar of premaxilla and/or nasal; (1) confluent. deBraga and Rieppel, 1997 #7.
69. Prefrontal: (0) present; (1) absent. Gauthier et al., 1988b #5.
70. Prefrontal medial extent: (0) narrow, not contacting palatine; (1) narrow, contacting palatine along less than one-third of interorbital width; (2) broad, with strong palatine contact. Laurin and Reisz, 1995 #6, 7; deBraga and Rieppel, 1997 #20.
71. Prefrontal bulbous medial process: (0) absent; (1) present. Laurin and Reisz, 1995 #8; deBraga and Rieppel, 1997 #21.
72. Frontal orbital contribution: (0) frontal excluded from orbit; (1) frontal contributes to orbit. Gauthier et al., 1988b #8; Laurin and Reisz, 1995 #2; deBraga and Rieppel, 1997 #22; #24.
73. Frontal anterior margin: (0) frontal suture with nasal transverse; (1) oblique forming an angle of at least 30 degrees with long axis of skull. deBraga and Rieppel, 1997 #23.
74. Frontal posterolateral processes: (0) absent; (1) present. deBraga and Rieppel, 1997 #25.

75. Frontal proportions: (0) length exceeds width by at least four times; (1) length no more than twice width. deBraga and Rieppel, 1997 #26.
76. Morphology of frontals in dorsal view: (0) parallelogram-shaped; (1) hourglass-shaped. deBraga and Rieppel, 1997 #27.
77. Postfrontal: (0) present; (1) absent. Gauthier et al., 1988b #9.
78. Postfrontal contribution to upper temporal fenestra: (0) postfrontal excluded; (1) postfrontal included. deBraga and Rieppel, 1997 #29.
79. Foramen orbitonasale: (0) absent; (1) represented by a medial indentation on the lacrimal and a dorsal indentation on the palatine; (2) enclosed between the prefrontal, lacrimal and palatine (or prefrontal, maxilla and palatine). Laurin and Reisz, 1995 #10.
80. Postorbital: (0) present; (1) absent. Gauthier et al., 1988b #12.
81. Postorbital and squamosal: (0) in contact; (1) separated. Gauthier et al., 1988b #13.
82. Supraorbital (palpebral) bones: (0) absent; (1) present.
83. Postorbital temporal process: (0) short, extending no more than half the length of the postorbital skull; (1) long, extending nearly to posterior end of skull. Gauthier et al., 1988b #14; Laurin and Reisz, 1995 #13; deBraga and Rieppel, 1997 #32.
84. Postorbital region of skull relative to preorbital length: (0) subequal; (1) preorbital longer; (2) postorbital longer. Gauthier et al., 1988b #15; Laurin and Reisz, 1995 #32; deBraga and Rieppel, 1997 #19 (from Rieppel 1994a #9).
85. Posterior extension of orbit: (0) absent – orbit is nearly circular; (1) present – orbit has elongated oval shape. Laurin and Reisz, 1995 #37; deBraga and Rieppel, 1997 #28.

86. Parietals: (0) paired; (1) fused. Gauthier et al., #A53.
87. Parietal foramen: (0) present; (1) absent. Gauthier et al., 1988b #16.
88. Parietal foramen position: (0) in center of parietal or farther posteriorly; (1) close to frontoparietal suture. Laurin and Reisz, 1995 #3; deBraga and Rieppel, 1997 #49 (from Rieppel 1994 #15).
89. Skull wider than long: (0) absent; (1) present.
90. Parietal skull table: (0) broad with midline, transverse width not less than half length measured across the element's midline; (1) constricted with length exceeding width by at least three times; (2) forming sagittal crest. deBraga and Rieppel, 1997 #47; Gauthier et al.. 1988 #19; Heckert and Lucas, 1999 #11.
91. Temporal muscles on parietal table: (0) originate ventrolaterally – parietal margin straight; (1) originate dorsolaterally – parietal lateral margin embayed. Gauthier et al., 1988b #20; deBraga and Rieppel, 1997 #48.
92. Lambdoidal crest: (0) absent; (1) present. Gauthier et al., 1988b #21.
93. Postparietal: (0) present and paired; (1) present and fused; (2) absent. Modified from Gauthier et al., 1988b #A36, #22; Laurin and Reisz, 1995 #4; deBraga and Rieppel, 1997 #52.
94. Postparietal position: (0) dorsally exposed; (1) occipital. Laurin and Reisz, 1995 #5.
95. Supratemporal: (0) large and in contact with postorbital; (1) small and separated from postorbital; (2) absent. Modified from Gauthier et al., 1988b #23, #24; Laurin and Reisz, 1995 #12, #18; deBraga and Rieppel, 1997 #30, #53.

96. Tabular: (0) large – longer than wide; (1) small – wider than long; (2) absent. Modified from Gauthier et al., 1988b #25, #56; Laurin and Reisz, 1995 #17; deBraga and Rieppel, 1997 #55.
97. Tabular and opisthotic: (0) in contact; (1) separated. Gauthier et al., 1988b #26; Laurin and Reisz, 1995 #16.
98. Maxilla and prefrontal: (0) separated by lacrimal; (1) in contact. Gauthier et al., 1988b #27.
99. Maxilla and quadratojugal: (0) separated by jugal; (1) in contact. Laurin and Reisz, 1995 #22; deBraga and Rieppel, 1997 #16.
100. Maxilla palatal shelves: (0) Narrow and broadly separated; (1) prominent and appressed on midline, contributing to secondary palate. Gauthier et al., 1988b #A39, #29.
101. Anterior lateral maxillary foramen: (0) equal in size to other maxillary foramina; (1) larger than other foramina. Laurin and Reisz, 1995 #20; deBraga and Rieppel, 1997 #13.
102. Maxilla length: (0) extends to posterior orbital margin; (1) does not reach posterior orbital margin. deBraga and Rieppel, 1997 #14.
103. Maxilla orbital exposure: (0) absent; (1) present. deBraga and Rieppel, 1997 #15.
104. Antorbital fossa: (0) absent; (1) present. Gauthier et al., 1988b #32.
105. Antorbital fenestra: (0) absent; (1) present. Gauthier et al., 1988b #31.
106. External nares longer than antorbital fenestra: (0) no; (1) yes. Heckert and Lucas, 1999.

107. Lacrimal: (0) completely separates maxilla and nasal and enters margin of naris; (1) reduced so that maxilla contacts nasal and excludes lacrimal from naris; (2) absent. Gauthier et al., 1988b #33; Laurin and Reisz, 1995 #9; deBraga and Rieppel, 1997 #17.
108. Jugal posterior process: (0) short, extending posteriorly to middle of cheek region; (1) long, extending nearly to posterior end of skull. Gauthier et al., 1988b #34; deBraga and Rieppel, 1997 #33.
109. Upper temporal fenestra: (0) absent; (1) present. Gauthier et al., 1988b #35; Laurin and Reisz, 1995 #29; deBraga and Rieppel, 1997 #50.
110. Lower temporal fenestra: (0) absent; (1) present. Gauthier et al., 1988b #37; Laurin and Reisz, 1995 #30; deBraga and Rieppel, 1997 #51 (in part).
111. Dermal sculpturing on dermal cranial bones: (0) present; (1) absent. Modified from Laurin and Reisz, 1995 #38.
112. Ventral margin of postorbital region of skull: (0) convex; (1) horizontal; (2) concave (emarginated). Gauthier et al., 1988b #39, 40; Laurin and Reisz, 1995 #33.
113. Choana orientation: (0) parallel to maxilla, palatine forms its posterior edge only; (1) curved posteromedially; palatine forms its posterior and part of its lateral edge; (2) palatine excluded from choana. Laurin and Reisz, 1995 #40; deBraga and Rieppel, 1997 #8.
114. Vomer: (0) paired; (1) fused partly or entirely. Gauthier et al., 1988b #43.
115. Vomerine teeth: (0) present; (1) absent. Gauthier et al., 1988b #120.
116. Palatine palatal processes: (0) separated posteriorly; (1) appressed on midline and contributing to secondary palate. Gauthier et al., 1988b #44.

117. Palatine teeth: (0) present; (1) absent. Gauthier et al., 1988b #121.
118. Pterygoid anterior extent: (0) reaches level of posterior end of choana; (1) posterior to choana. Laurin and Reisz, 1995 #44.
119. Palatal ramus of pterygoid: (0) extends anterior to anterior limit of palatine; (1) forms oblique suture with palatine but ends before reaching anterior limit of palatine; (2) forms transverse suture with palatine. deBraga and Rieppel, 1997 #76.
120. Pterygoid arcuate flange: (0) present; (1) absent. Laurin and Reisz, 1995 #42.
121. Pterygoid transverse flange orientation: (0) directed posterolaterally or transversely; (1) directed anterolaterally. Laurin and Reisz, 1995 #45; deBraga and Rieppel, 1997 #77.
122. Ventral extent of transverse flange of pterygoid: (0) extends below maxillary tooth row; (1) terminates above or at level of maxillary tooth row. deBraga and Rieppel, 1997 #79.
123. Transverse flange lateral margin: (0) posterolateral margin forms sharp edge with anteromedial margin; (1) posterolateral margin merges smoothly into anteromedial margin forming a smoothly convex lateral outline. deBraga and Rieppel, 1997 #80.
124. Interpterygoid vacuity length: (0) short; less than 15% of skull length; (1) absent; (2) long; at least 15% of skull length. Laurin and Reisz, 1995 #39.
125. Teeth on transverse processes of pterygoid: (0) present; (1) absent. Gauthier et al., 1988b #123; Laurin and Reisz, 1995 #46; deBraga and Rieppel, 1997 #78.
126. Ectopterygoid: (0) present; (1) absent. Gauthier et al., 1988b #A40, 55; Laurin and Reisz, 1995 #47; deBraga and Rieppel, 1997 #81.
127. Ectopterygoid and palatine: (0) in contact medially; (1) not in contact.

128. Ectopterygoid teeth: (0) present; (1) absent. Gauthier et al., 1988b #122; Laurin and Reisz, 1995 #48; deBraga and Rieppel, 1997 #81 (in part).
129. Suborbital foramen: (0) absent; (1) small; (2) large (fenestra present). Gauthier et al., 1988b #57; Laurin and Reisz, 1995 #49; deBraga and Rieppel, 1997 #74.
130. Suborbital foramen borders: (0) maxilla contributes to lateral border of foramen; (1) maxilla excluded from foramen border. Laurin and Reisz, 1995 #41; deBraga and Rieppel, 1997 #74 (in part).
131. Epipterygoid: (0) present; (1) absent. Gardiner, 1982 #19 (in part), Gauthier et al., 1988b #19a.
132. Temporal emargination: (0) absent – temporal margin straight in lateral view; (1) present – temporal margin embayed, concave in lateral view. Gauthier et al., 1988b #50; Laurin and Reisz, 1995 #31.
133. Squamosal: (0) extends to ventral margin of skull; (1) broadly separated from ventral margin of skull. Gauthier et al., 1988b #48; deBraga and Rieppel, 1997 #35.
134. Squamosal contribution to post-temporal fenestra: (0) absent; (1) present. deBraga and Rieppel, 1997 #36.
135. Squamosal occipital flange: (0) absent or poorly developed forming only a thin ridge; (1) well developed forming a broadly exposed lappet. Modified from Laurin and Reisz, 1995 #27; deBraga and Rieppel, 1997 #37.
136. Quadrate: (0) obscured in lateral view; (1) exposed laterally. Gauthier et al., 1988b #62; Laurin and Reisz, 1995 #34; deBraga and Rieppel, 1997 #39.
137. Quadrate anterior process: (0) long, extending anteriorly along its sutural contact with pterygoid to nearly reach level of transverse flange; (1) short, not extending

anteriorly beyond 55% length of quadrate process of pterygoid. Laurin and Reisz, 1995 #35; deBraga and Rieppel, 1997 #41.

138. Quadrate posterior edge: (0) not excavated; (1) deeply excavated and concave. deBraga and Rieppel, 1997 #38.
139. Cranio-quadrate space: (0) small; quadrate ramus of pterygoid and paroccipital process of opisthotic converge posterolaterally; (1) large; quadrate ramus of pterygoid and paroccipital process of opisthotic nearly parallel. Laurin and Reisz, 1995 #43.
140. Quadratojugal: (0) reaches as far anteriorly as posterior border of orbit; (1) does not reach orbit; (2) absent. Modified from Gauthier et al., 1988b #51; Laurin and Reisz, 1995 #23; deBraga and Rieppel, 1997 #42 (in part).
141. Quadratojugal processes: (0) long anterior and short dorsal; (1) short anterior and long dorsal; (2) processes subequal in length. Gauthier et al., 1988b #52; Laurin and Reisz, 1995 #28; deBraga and Rieppel, 1997 #42 (in part).
142. Quadratojugal ornamentation: (0) absent; (1) present. deBraga and Rieppel, 1997 #43.
143. Parasphenoid pocket for cervical musculature: (0) present; (1) absent. Laurin and Reisz, 1995 #50.
144. Parasphenoid wings: (0) present, parasphenoid broad posteriorly; (1) absent, parasphenoid narrow posteriorly. Laurin and Reisz, 1995 #51.
145. Parasphenoid teeth: (0) absent; (1) present. Laurin and Reisz, 1995 #53.
146. Cultriform process: (0) long; (1) short. Laurin and Reisz, 1995 #52; deBraga and Rieppel, 1997 #75.

147. Prootic/parietal contact: (0) absent; (1) present. deBraga and Rieppel, 1997 #67.
148. Laterosphenoid ossification: (0) absent; (1) present. Gauthier et al., 1988b #G19, 71; deBraga and Rieppel, 1997 #71.
149. Sphenethmoid: (0) present; (1) absent. deBraga and Rieppel, 1997 #70.
150. Elongate cochlea: (0) absent; (1) present. Gardiner, 1982 #27 (in part); Gauthier et al., 1988b #G27.
151. Cochlear promontorium: (0) absent; (1) present.
152. Medial wall of inner ear: (0) unossified; (1) ossified with acoustic nerve foramina. Laurin and Reisz, 1995 #59; deBraga and Rieppel, 1997 #68.
153. Pneumatization of middle ear extending into basioccipital, parasphenoid, quadrate and articular: (0) absent; (1) present. Gardiner, 1982 #26; Gauthier et al., #G26.
154. Stapes: (0) short and stout; (1) long and slender, with length at least twice diameter. Gauthier et al., 1988b #68; Laurin and Reisz, 1995 #66 deBraga and Rieppel, 1997 #45.
155. Stapes dorsal process: (0) ossified; (1) unossified. Gauthier et al., 1988b #69; Laurin and Reisz, 1995 #67; deBraga and Rieppel, 1997 #46.
156. Post-temporal fenestra: (0) small – much less than 1/8 width of occiput; (1) large – at least 1/5 width of occiput. Gauthier et al., 1988b #41; Laurin and Reisz, 1995 #60; deBraga and Rieppel, 1997 #59.
157. Supraoccipital: (0) broad and plate-like, without anterior crista; (1) narrow and with anterior crista; (2) reduced to sagittal pillar. Gauthier et al., 1988b #74; Laurin and Reisz, 1995 #54, 55; deBraga and Rieppel, 1997 #56.

158. Supraoccipital lateral margins: (0) vertical; (1) expanded laterally to roof post-temporal fenestra dorsally. Gauthier et al., 1988b #75.
159. Paroccipital process of opisthotic, distal end: (0) tapering; (1) expanded. Gauthier et al., 1988b #77.
160. Paroccipital process of opisthotic in coronal plane: (0) extends laterally; (1) extends caudolaterally. Gauthier et al., 1998 #78; deBraga and Rieppel, 1997 #60.
161. Paroccipital process of opisthotic in transverse plane: (0) extends horizontally; (1) extends ventrolaterally; (2) extends dorsolaterally.
162. Opisthotic/cheek contact: (0) not in contact; (1) in contact and tightly sutured. deBraga and Rieppel, 1997 #66.
163. Exoccipital: (0) separate from opisthotic; (1) fused with opisthotic in adult. Gauthier et al., 1988b #80.
164. Lateral flange of exoccipital: (0) absent; (1) present. Laurin and Reisz, 1995 #64.
165. Exoccipital bones in contact below foramen magnum: (0) present; (1) absent. Gauthier et al., 1988b #82; deBraga and Rieppel, 1997 #62.
166. Contact between paroccipital process and dermatocranium: (0) to tabular; (1) to supratemporal and tabular; (2) to tabular and squamosal; (3) to squamosal and supratemporal; (4) to supratemporal; (5) to squamosal and quadrate; (6) paroccipital process ends freely. Laurin and Reisz, 1995 #57.
167. Osseous contact between basioccipital and basisphenoid: (0) absent; (1) present. Laurin and Reisz, 1995 #61; deBraga and Rieppel, 1997 #63.
168. Ventral braincase tubera on basioccipital or basisphenoid: (0) absent; (1) present. Modified from Laurin and Reisz, 1995#63; deBraga and Rieppel, 1997 #65.

169. Basisphenoid/parasphenoid ratio: (0) narrowest transverse width no more than 60% of maximum length measured from basipterygoid process to posteriormost limit; (1) narrowest part (waist) exceeds 80% of length. deBraga and Rieppel, 1997 #64.
170. Occipital condyle: (0) basioccipital forms most or all of occipital condyle; (1) exoccipital forms large part of occipital condyle. Modified from Gauthier et al., 1988b #G11a, 81, 83.
171. Occipital condyle morphology: (0) transversely broad; (1) reniform to circular; (2) paired. Laurin and Reisz, 1995 #62.
172. Occipital flange (deeply excavated posterior skull margin): (0) absent; (1) present. deBraga and Rieppel, 1997 #69.
173. Craniomandibular joint: (0) posterior to occiput; (1) even with occiput; (2) anterior to occiput. Gauthier et al., 1988b #70; Laurin and Reisz, 1995 #36; deBraga and Rieppel, 1997 #82.
174. Mandible: (0) transects lateral portion of adductor fossa; (1) transects middle portion of adductor fossa. Gauthier et al., 1988b #86.
175. Predentary bone: (0) absent; (1) present.
176. Dentary: (0) broadly separated from craniomandibular joint; (1) closely approaching or contacting craniomandibular joint. Gauthier et al., 1988b #90.
177. External mandibular fenestra: (0) absent; (1) present. Gauthier et al., 1988b #87.
178. Masseteric fossa: (0) absent; (1) present. Gauthier et al., 1988b #88.
179. Slipper-shaped mandible: (0) absent; (1) present. Heckert and Lucas, 1999 #15.
180. Angular lateral exposure: (0) exposed along one-third of lateral surface of mandible (dorsoventrally tall); (1) exposed only as small sliver along lateral surface of

mandible (dorsoventrally short); (2) absent from lateral aspect of mandible (hidden in lateral view). Gauthier et al., 1997 #99; deBraga and Rieppel, 1997 #89.

181. Surangular length: (0) extends beyond coronoid eminence; (1) does not extend beyond coronoid eminence. Laurin and Reisz, 1995 #72; deBraga and Rieppel, 1997 #86.
182. Lateral shelf on articular region: (0) absent; (1) on articular; (2) on surangular. Laurin and Reisz, 1995 #73, 78; deBraga and Rieppel, 1997 # 87.
183. Splenial contribution to mandibular symphysis: (0) present; (1) absent. Laurin and Reisz, 1995 #80; deBraga and Rieppel, 1997 #88.
184. Meckelian fossa orientation: (0) faces mediodorsally; prearticular (or angular) narrow; (1) faces dorsally; prearticular broad. Laurin and Reisz, 1995 #70; deBraga and Rieppel, 1997 #85.
185. Meckelian fossa length: (0) long, occupies at least 20% of lower jaw length; (1) short, occupies less than 20% of lower jaw length. Laurin and Reisz, 1995 #71.
186. Foramen intermandibularis morphology: (0) anterior symphysial foramen (i.e., posterior foramen absent); (1) two foramina, a symphysial foramen and a posterior foramen located anterior to coronoid process; (2) two foramina, a symphysial foramen and a posterior foramen located posterior to or at level of coronoid process.
187. Coronoid process: (0) absent or very low; confluent with dorsal margin of lower jaw; (1) present and composed of coronoid bone; (2) present and composed partially by dentary. Modified from Gauthier et al., 1988b #92, 95; Laurin and Reisz, 1995 #79; deBraga and Rieppel, 1997 #83.

188. Coronoid ossifications: (0) more than one; (1) only one coronoid bone. Gauthier et al., 1988b #100; Laurin and Reisz, 1995 #74; deBraga and Rieppel, 1997 #84.
189. Prearticular length: (0) extends beyond coronoid eminence; (1) does not extend beyond coronoid eminence. Laurin and Reisz, 1995 #75; deBraga and Rieppel, 1997 #91.
190. Retroarticular process: (0) absent or small and narrow; (1) transversely broad, dorsally concave. Laurin and Reisz, 1995 #76; deBraga and Rieppel, 1997 #92.
191. Retroarticular process composition: (0) composed of articular only; (1) composed of several bones (three of: surangular, articular, angular, prearticular). Laurin and Reisz, 1995 #77.
192. Retroarticular process orientation: (0) medially directed; (1) posteriorly directed. Gauthier et al., 1988b #104.
193. Marginal teeth: (0) present; (1) absent. Gauthier et al., 1988b #A41.
194. Tooth implantation: (0) thecodont – teeth in deep sockets; (1) pleurodont – teeth ankylosed to inner side of supporting bones by attachment bone; (2) acrodont – teeth ankylosed to summit of supporting bone. Modified from Gauthier et al., 1988b #107; deBraga and Rieppel, 1997 #94.
195. Labyrinthodont infolding: (0) present; (1) absent. Laurin and Reisz, 1995 #68, deBraga and Rieppel, 1997#93.
196. Caniniform region: (0) present; (1) absent. Laurin and Reisz, 1995 #24; deBraga and Rieppel, 1997 #95.
197. Caniniform maxillary tooth: (0) absent; (1) present. Gauthier et al., 1988b #111; Laurin and Reisz, 1995 #25; deBraga and Rieppel, 1997 #96.

198. Serrated teeth: (0) absent; (1) present. Gauthier et al., 1988b #108.

199. Maxillary tooth morphology: (0) unicuspid; (1) multicuspid. Modified from Gauthier et al., 1988b #115.

200. Maxillary tooth number: (0) 13 or more; (1) 12 or fewer. Modified from Gauthier et al., 1988b #116.

201. Maxillary tooth cross-section: (0) labiolingually compressed; (1) nearly circular; (2) mesiodistally compressed. Modified from Gauthier et al., 1988b #117; Heckert and Lucas, 1999 #2.

202. Maxillary tooth crown shape: (0) recurved; (1) conical; (2) peg-like; (3) leaf-like. Modified from Heckert and Lucas, 1999 #3.

203. Maxillary tooth row extending anterior to posterior end of external naris: (0) present; (1) absent. Heckert and Lucas, 1999 #5.

204. Anterior part of dentary: (0) with teeth; (1) edentulous. Heckert and Lucas, 1999 #4.

205. Dentary tooth count: (0) 10 or more; (1) fewer than 10. Heckert and Lucas, 1999 #16.

206. Dentary tooth size: (0) subequal in size anteriorly; (1) enlarged tooth near symphysis. Gauthier et al., 1988b #119.

207. Upper and lower tooth rows: (0) end at same level posteriorly; (1) dentary row terminates anterior to maxillary tooth row. Gauthier et al., 1988b #109.

208. Completely co-ossified atlas: (0) absent; (1) present. Gardiner, 1982 #11 (in part); Gauthier et al., 1988b #G11b, 131.

209. Atlantal pleurocentrum and axial intercentrum: (0) separate elements; (1) attached or fused. Gardiner, 1982 #11; Gauthier et al., 1988b #G11; Laurin and Reisz, 1995 #85.

210. Atlantal ribs: (0) ossified; (1) not ossified. deBraga and Rieppel, 1997 #102.

211. Axial centrum orientation: (0) in plane of axial skeleton; (1) sloping anterodorsally. Gauthier et al., 1988a #55; Laurin and Reisz, 1995 #82.

212. Odontoid: (0) separate from axis throughout ontogeny; (1) fused in adult. Gauthier et al., 1988b #133.

213. Cervical centra: (0) rounded; (1) keeled ventrally. Gauthier et al., 1988b #139; Laurin and Reisz, 1995 #87; deBraga and Rieppel, 1997 #103; Heckert and Lucas, 1999 #20.

214. Cervical intercentra: (0) present; (1) absent. Gauthier et al., 1988b #129; deBraga and Rieppel, 1997 #104.

215. Cervical ribs: (0) straight and extending posterolaterally, without anterior process; (1) plowshare-shaped, with rib shafts parallel to centra. Gauthier et al., 1988b #A52, 143; deBraga and Rieppel, 1997 #105.

216. Dorsal intercentra: (0) present; (1) absent. Gauthier et al., 1988b #127, 128; deBraga and Rieppel, 1997 #107.

217. Presacral vertebral count: (0) more than 20; (1) 20 or fewer. Laurin and Reisz, 1995 #81; deBraga and Rieppel, 1997 #97.

218. Notochordal canal in vertebral centra: (0) present; (1) absent. Gauthier et al., 1988b #124; deBraga and Rieppel, 1997 #99.

219. Vertebral central articulations: (0) amphicoelous; (1) platycoelous (amphiplatyan); (2) procoelous; (3) opisthocoelous. Modified from deBraga and Rieppel, 1997 #100.

220. Trunk neural arch shape: (0) swollen with wide zygapophyseal buttresses; (1) narrow; (2) swollen with narrow zygapophyseal buttresses. Laurin and Reisz, 1995 #86; deBraga and Rieppel, 1997 #106.

221. Height of presacral spinous processes: (0) low, less than or equal to height of centrum; (1) tall, greater than height of centrum. Heckert and Lucas, 1999 #19.

222. Apices of spinous processes: (0) narrow; (1) laterally expanded in dorsal view. Gauthier et al., 1988b #A50, 126.

223. Dorsal transverse processes: (0) short, no longer than total transverse width of neural arch; (1) long, exceeding transverse width of neural arch. deBraga and Rieppel, 1997 #108; Heckert and Lucas, 1999 #18.

224. Uncinate processes on ribs: (0) absent; (1) present. Gauthier et al., 1988b #L17.

225. Sacral vertebrae: (0) two or fewer; (1) at least three. Gauthier et al., 1988b #141; Laurin and Reisz, 1995 #88; deBraga and Rieppel, 1997 #109.

226. Sacral rib orientation: (0) pointing ventrally; (1) pointing laterally. Gauthier et al., 1988b #142.

227. Sacral rib distal overlap: (0) broad with narrow gap between ribs; (1) small or absent with wide gap between ribs. Laurin and Reisz, 1995 #89.

228. Number of caudal vertebrae: (0) 20 or more (usually 25); (1) less than 20. deBraga and Rieppel, 1997 #98.

229. Transverse processes or ribs on caudal vertebrae: (0) present on only a few anterior caudals; (1) present on at least 13 caudals. Modified from Laurin and Reisz, 1995 #90; deBraga and Rieppel, 1997 #110.
230. Caudal rib shape: (0) L-shaped, curved; (1) straight. deBraga and Rieppel, 1997 #111.
231. Caudal haemal arches: (0) wedged between centra; (1) attached to anterior centrum. Laurin and Reisz, 1995 #91; deBraga and Rieppel, 1997 #112.
232. Gastralia: (0) present; (1) absent. deBraga and Rieppel, 1997 #168.
233. Scapula: (0) anteroposteriorly broad; (1) high, narrow blade; (2) narrow and cylindrical. Modified from Gauthier et al., 1988b #146; Laurin and Reisz, 1995 #96; deBraga and Rieppel, 1997 #117; Heckert and Lucas, 1999 #22.
234. Acromion: (0) absent; (1) present. Laurin and Reisz, 1995 #99; deBraga and Rieppel, 1997 #118.
235. Glenoid: (0) anteroposteriorly long, helical; (1) short, bipartite. Laurin and Reisz, 1995 #98.
236. Supraglenoid buttress: (0) present; (1) absent. Gauthier et al., 1988b #147; deBraga and Rieppel, 1997 #119.
237. Supraglenoid foramen: (0) present; (1) absent. Laurin and Reisz, 1995 #97.
238. Number of coracoid ossifications: (0) one; (1) two. Gauthier et al., 1988b #148; Laurin and Reisz, 1995 #95; deBraga and Rieppel, 1997 #120.
239. Coracoid foramen: (0) enclosed by coracoid only; (1) enclosed by scapula and coracoid; (2) absent. deBraga and Rieppel, 1997 #121.

240. Cleithrum: (0) present and capping scapula anterodorsally; (1) present but not capping scapula; (2) absent. Gauthier et al., 1988b #151; Laurin and Reisz, 1995 #94; deBraga and Rieppel, 1997 #113.

241. Clavicles: (0) broad medially; (1) narrow medially. Gauthier et al., 1988b #153; deBraga and Rieppel, 1997 #114.

242. Interclavicle: (0) present; (1) absent. Gauthier et al., 1988b #A42.

243. Interclavicle shape: (0) rhomboidal; (1) T-shaped. Modified from Gauthier et al., 1988b #154, 155, 156; Laurin and Reisz, 1995 #92; deBraga and Rieppel, 1997 #115.

244. Mineralized sternum: (0) absent; (1) present. Gauthier et al., 1988b #157; Laurin and Reisz, 1995 #100; deBraga and Rieppel, 1997 #116.

245. Limbs: (0) short and stout; (1) long and slender. Gauthier et al., 1988b #159; Laurin and Reisz, 1995 #113; deBraga and Rieppel, 1997 #162; Heckert and Lucas, 1999 #21.

246. Humeral epicondyles: (0) prominent; (1) reduced. Gauthier et al., 1988b #160; deBraga and Rieppel, 1997 #122.

247. Humeral head: (0) convex articular surface extending broadly across head; (1) articular surface bulbous and inflected. Gauthier et al., 1988b #161.

248. Supinator process: (0) large, strongly angled relative to shaft, separated from it by groove; (1) large, parallel to shaft, separated from it by groove; (2) small, confluent with shaft. Laurin and Reisz, 1995 #101; deBraga and Rieppel, 1997 #126.

249. Humeral torsion: (0) proximal and distal ends set off at 45 to 90 degrees from one another; (1) torsion no more than 20 degrees. deBraga and Rieppel, 1997 #123.

250. Trochlea and capitellum: (0) distinct; (1) low double condyle. deBraga and Rieppel, 1997 #125.
251. Ectepicondylar groove: (0) present; (1) absent. Gauthier et al., 1988b #162; Laurin and Reisz, 1995 #102 (in part); deBraga and Rieppel, 1997 #127 (in part).
252. Ectepicondylar foramen: (0) absent; (1) present. Gauthier et al., 1988b #163; Laurin and Reisz, 1995 #102 (in part); deBraga and Rieppel, 1997 #127 (in part).
253. Entepicondylar foramen: (0) present; (1) absent. Gauthier et al., 1988b #164; Laurin and Reisz, 1995 #103; deBraga and Rieppel, 1997 #128.
254. Olecranon process: (0) large; (1) small. Laurin and Reisz, 1995 #105; deBraga and Rieppel, 1997 #130.
255. Radius width relative to ulna: (0) radius equal to or narrower than ulna; (1) radius broader than ulna distally. Gauthier et al., 1988b #165.
256. Radius/ulna length: (0) radius shorter than ulna; (1) radius longer than ulna; (2) radius and ulna subequal. deBraga and Rieppel, 1997 #129.
257. Manual intermedium size relative to centrale: (0) larger; (1) smaller; (2) intermedium lost. Modified from Gauthier et al., 1988b #166.
258. Relative lengths of manual digit III and digit IV: (0) IV longer; (1) III longer. Gauthier et al., 1988b #A49, 167; deBraga and Rieppel, 1997 #132.
259. Manual phalangeal formula: (0) 2 3 4 5 3; (1) 2 3 4 4 3; (2) 2 3 3 3 3 (or less). Laurin and Reisz, 1995 #106.
260. Perforating foramen of manus: (0) present; (1) absent. deBraga and Rieppel, 1997 #131.
261. Ilium dorsal groove: (0) present; (1) absent. Gauthier et al., 1988b #169.

262. Ilium posterior process: (0) long and horizontally oriented; (1) short; ilium fan-shaped or narrow and dorsally oriented. Modified from Gauthier et al., 1988b #170, 171; Laurin and Reisz, 1995 #108; deBraga and Rieppel, 1997 #134.
263. Dorsoventral height of ilium: (0) less than twice height of acetabulum; (1) more than twice height of acetabulum. Gauthier et al., 1988b #172.
264. Acetabulum shape: (0) oval; (1) circular. Gauthier et al., 1988b #177; deBraga and Rieppel, 1997 #137.
265. Acetabulum composition: (0) ilium, ischium, and pubis contribute nearly equally to acetabulum; (1) ilium comprises over 80% of acetabulum. Gauthier et al., 1988b #175.
266. Acetabular perforation: (0) absent; (1) present. Gauthier et al., 1988b #A44.
267. Cotyloid notch: (0) present; (1) absent. Gauthier et al., 1988b #176.
268. Acetabular buttress: (0) small; (1) large, overhanging acetabulum. Gauthier et al., 1988b #179; Laurin and Reisz, 1995 #109; deBraga and Rieppel, 1997 #138.
269. Obturator foramen: (0) in pubis; (1) between pubis and ischium. Gauthier et al., 1988b #182.
270. Pubis and ischium: (0) diverge below acetabulum; (1) both rotated posteriorly. Gauthier et al., 1988b #181.
271. Pubic tubercle: (0) absent or small and anteroventrally directed; (1) large and strongly turned ventrally. deBraga and Rieppel, 1997 #136.
272. Femoral head and neck: (0) terminal; (1) inflected medially. Gauthier et al., 1988b #A43; 186.

273. Femoral head morphology: (0) anteroposteriorly elongate; (1) subspherical. Gauthier et al., 1988b #188; Laurin and Reisz, 1995 #111.

274. Femoral greater trochanter: (0) absent; (1) present on posterior edge of femur, confluent with femoral head; (2) present and separated from head by marked incisure. Gauthier et al., 1988b #192; Laurin and Reisz, 1995 #112; deBraga and Rieppel, 1997 #141.

275. Intertrochanteric fossa: (0) deep; (1) shallow; (2) absent. Gauthier et al., 1988b #184; deBraga and Rieppel, 1997 #142.

276. Femoral shaft morphology: (0) straight and robust; (1) slender with prominent sigmoidal curve. Gauthier et al., 1988b #191; deBraga and Rieppel, 1997 #139.

277. Femoral adductor crest: (0) prominent; (1) feeble. Gauthier et al., 1988b #190; Gauthier et al., 1988c #83; Laurin and Reisz, 1995 #110.

278. Femoral fourth trochanter: (0) present; (1) absent. Gauthier et al., 1988b #193; deBraga and Rieppel, 1997 #140.

279. Femoral condyles: (0) prominent; (1) not projecting markedly beyond shaft. Gauthier et al., 1988b #187; deBraga and Rieppel, 1997 #143.

280. Anterior femoral condyle: (0) larger and extends further distally; (1) smaller and of subequal extent distally. Gauthier et al., 1988b #189; deBraga and Rieppel, 1997 #144.

281. Fibula: (0) bowed away from tibia; (1) straight. deBraga and Rieppel, 1997 #145.

282. Tibio-astragalar joint: (0) flat simple joint; (1) well-defined joint; ride on tibia and groove on astragalus; (2) ridge on astragalus and groove on tibia. Modified from

Gauthier et al., 1988b #195, 196; Laurin and Reisz, 1995 #116; deBraga and Rieppel, 1997 #147.

283. Astragalus composition: (0) astragalus absent; (1) incorporates incompletely fused tarsal bones; (2) without traces of a compound origin. Laurin and Reisz, 1995 #115.

284. Astragalus and calcaneum: (0) separate; (1) sutured or fused. Laurin and Reisz, 1995 #117; deBraga and Rieppel, 1997 #149.

285. Calcaneal tuber: (0) absent; (1) laterally directed; (2) posteriorly directed. Gauthier et al., 1988b #A45, 198; deBraga and Rieppel, 1997 #151.

286. Astragalus/distal tarsal IV articulation: (0) poorly defined; (1) well defined. deBraga and Rieppel, 1997 #150.

287. Pedal centralia: (0) medial and lateral centralia present; (1) lateral centrale present; (2) both centralia absent. Gauthier et al., 1988b #199 (in part); deBraga and Rieppel, 1997 #158.

288. Manus and pes relative to carpus and tarsus: (0) short and broad; (1) long and slender. Gauthier et al., 1988b #202; Laurin and Reisz, 1995 #114; deBraga and Rieppel, 1997 #163; Heckert and Lucas, 1999 #23.

289. Foramen for perforating artery of pes: (0) located between astragalus and calcaneum; (1) located between distal ends of tibia and fibula. deBraga and Rieppel, 1997 #146.

290. First distal tarsal: (0) present; (1) absent. Gauthier et al., 1988b #203; deBraga and Rieppel, 1997 #152.

291. Fifth distal tarsal: (0) present; (1) absent. Gauthier et al., 1988b #206; Laurin and Reisz, 1995 #119; deBraga and Rieppel, 1997 #153.

292. Metapodials overlapping proximally: (0) absent; (1) present. Laurin and Reisz, 1995 #121; deBraga and Rieppel, 1997 #160.

293. Metatarsals I and IV length ratio: (0) at least 0.5 ratio of I/IV; (1) less than 0.5. Laurin and Reisz, 1995 #123; deBraga and Rieppel, 1997 #157.

294. Fifth pedal digit length relative to first pedal digit: (0) longer than first digit; (1) shorter and more lightly built than first. Laurin and Reisz, 1995 #120; deBraga and Rieppel, 1997 #159.

295. Fifth metatarsal: (0) long and slender; (1) short and broad-based. Gauthier et al., 1988b #204; deBraga and Rieppel, 1997 #154.

296. Hooked fifth metatarsal: (0) absent; (1) present. Gauthier et al., 1988b #205; deBraga and Rieppel, 1997 #155.

297. Plantar tubercle of fifth metatarsal: (0) absent; (1) present. deBraga and Rieppel, 1997 #156.

298. Number of phalanges in third toe: (0) three; (1) four; (2) five; (3) two. Gauthier et al., 1988b #A46.

299. Number of phalanges in fourth toe: (0) three; (1) four; (2) five; (3) two. Gauthier et al., 1988b #A47.

300. Number of phalanges in fifth toe: (0) four; (1) three; (2) two; (3) one; (4) zero. Gauthier et al., 1988b #A48; Laurin and Reisz, 1995 #122; deBraga and Rieppel, 1997 #161.

301. Ungual size relative to phalanges: (0) unguals shorter than phalanges; (1) unguals at least 50% longer than penultimate phalanges. deBraga and Rieppel, 1997 #164.
302. Cephalic osteoderms: (0) absent; (1) present. Estes et al., 1988 #128.
303. Osteoderms on dorsal surface of trunk: (0) absent; (1) present. Estes et al., 1988 #126; Gauthier et al., 1988b #144; Laurin and Reisz, 1995 #124; deBraga and Rieppel, 1997 #165; Lee, 1997 #122.
304. Osteoderms on ventral surface of trunk: (0) absent; (1) present. Estes et al., 1988 #127; Heckert and Lucas, 1999 #59.
305. Gular osteoderms: (0) absent; (1) present.
306. Osteoderms on proximal limb segments: (0) absent; (1) present. deBraga and Rieppel, 1997 #167; Lee, 1997 # 127; Heckert and Lucas, 1999 #60.
307. Caudal osteoderms: (0) absent; (1) present on dorsal or dorsolateral surfaces of tail only; (2) completely surrounding tail.
308. Caudal osteoderms: (0) not fused; (1) fused, forming tail club.
309. Osteoderm dimensions: (0) smaller than a dorsal centrum; (1) equal to or larger than a dorsal centrum. Lee, 1997 #125.
310. Width to length ratio of dorsal osteoderms: (0) longer than wide; (1) equant; (2) wider than long; (3) over four times wider than long. Modified from Heckert and Lucas, 1999 #30, 31.
311. Dorsal osteoderms arranged in paired, paramedian rows: (0) absent; (1) present.
312. Osteoderms arranged in transverse rows: (0) absent; (1) present.
313. Maximum number of contiguous dorsal osteoderms per transverse row: (0) two; (1) four; (2) six; (3) eight; (4) ten or more. Modified from Brochu, 1997 #37.

314. Central figure and surrounding segments on dorsal osteoderms: (0) absent; (1) present.
315. Three to six large pits situated around circumference of central figure: (0) absent; (1) present.
316. Vascular traces on osteoderms: (0) absent or very faint; (1) present and random; (2) present and parallel or radiate.
317. Relief of external surface of dermal ossifications: (0) flat or smoothly convex; (1) with distinct, central knob-like boss; (2) with antero-posteriorly elongate keel; (3) with conical spine. Modified from Lee, 1997 #123; Heckert and Lucas, 1999 #36 – 39.
318. Position of external relief on dorsal osteoderms: (0) not in contact with margin of osteoderm; (1) touching or overlapping posterior margin of osteoderm. Heckert and Lucas, 1999 #35.
319. Mediolateral position of external relief on dermal ossifications: (0) central; (1) displaced medially; (2) displaced laterally.
320. Keel or boss height: (0) shorter than transverse width of osteoderm; (1) taller than transverse width of osteoderm.
321. Tubercular ornamentation of osteoderms: (0) absent; (1) present and irregular; (2) present and spherical.
322. Pitting on dorsal osteoderms: (0) absent; (1) present as subspherical pits; (2) present as elongate pits; (3) mixture of subspherical and elongate pits. Modified from Heckert and Lucas, 1999 #32, 33, 47, 58.

323. Depth of pitting on dorsal osteoderms: (0) shallow; (1) deep. Heckert and Lucas, 1999 #56.

324. Anterior edge of osteoderms with smooth, unornamented transverse band: (0) absent; (1) present.

325. Anterior process on osteoderms: (0) absent; (1) present. Modified from Brochu 1997 #40; Clark 1994 #96.

326. Articulation between osteoderms: (0) osteoderms isolated or imbricating; (1) osteoderms sutured together. Modified from Lee, 1997 #126.

327. Maximum thickness of dermal ossifications: (0) less than one-third of maximum transverse dimension of osteoderm; (1) more than one-third.

328. Cervical osteoderms dorsoventrally thickened relative to dorsal and caudal osteoderms: (0) absent; (1) present. Heckert and Lucas, 1999 #45.

329. Relative thickness of cortical bone on osteoderms: (0) subequal; (1) markedly thicker on external surface; (2) thicker on internal surface.

330. Osteoderms single or compound: (0) single; (1) compound.

331. Internal surface of osteoderms: (0) flat or gently concave; (1) deeply excavated; (2) strongly convex.

332. Foramina on internal surface of osteoderm: (0) numerous small foramina of subequal size, each less than 1/20 transverse width of osteoderm; (1) large primary foramen, 1/10 of l transverse width of osteoderm or larger.

333. Coarsely woven bone texture on internal surface of dermal ossifications: (0) absent; (1) present.

334. Nuchal shield: (0) grades continuously into dorsal shield; (1) differentiated from dorsal shield with four nuchal osteoderms; (2) differentiated from dorsal shield with six nuchal osteoderms; four central and two lateral. Brochu, 1997 #38.
335. Large channels running unidirectionally, mediolaterally within osteoderms: (0) absent; (1) present.
336. Pectoral osteodermal spines: (0) absent; (1) present.
337. Lateral longitudinal rows of osteoderms articulating with paired, paramedian rows: (0) absent; (1) present. Heckert and Lucas, 1999 #57.
338. Dorsal osteoderms constricted anterior to sacrum, resulting in "waist": (0) absent; (1) present. Heckert and Lucas, 1999 #54.
339. Caudal osteoderms: (0) flat; (1) transversely arched. Heckert and Lucas, 1999 #41.
340. Edge of osteoderms: (0) smoothly tapering or rounded; (1) finely crenulated ("splintery"); (2) vertical with sutural boundary.
341. Cingulum around osteoderm base: (0) absent; (1) present.
342. Triangular caudal plates with deep internal concavity: (0) absent; (1) present.
343. Peaked caudal keel (heightened relative to dorsal keels): (0) absent (keels equal); (1) present.
344. Carapace and plastron incorporating endoskeletal elements: (0) absent; (1) present.
345. Epidermal scales: (0) absent; (1) present. Maderson and Alibardi, 2000 #1, 2.
346. Epidermal generations: (0) absent; (1) present. Maderson and Alibardi, 2000 #3.
347. Alpha-keratinization of epidermis: (0) absent; (1) alpha-keratinized stratum corneum with alpha-keratogenic cells. Maderson and Alibardi, 2000 #6.

348. Horizontal homogeneity of epidermis: (0) absent; (1) present. Maderson and Alibardi, 2000 #7.
349. Beta-keratinization of epidermis: (0) absent; (1) present. Gardiner, 1982 #5 (in part); Gauthier et al., 1988b #G5c; Maderson and Alibardi, 2000 #8.
350. Vertical alternation of keratinized layers of epidermis: (0) absent; (1) present. Maderson and Alibardi, 2000 #9.
351. Keratohyalin granules in epidermis: (0) absent; (1) present. Maderson and Alibardi, 2000 #11.
352. Lamellar bodies in epidermis: (0) absent; (1) present. Maderson and Alibardi, 2000 #12.
353. Keratohyalin-like granules in epidermis: (0) absent; (1) present. Maderson and Alibardi, 2000 #13.
354. Dermal papillae: (0) absent; (1) present. Maderson and Alibardi, 2000 #14.
355. Epidermal scales on head: (0) absent; (1) present, small, and granular; (2) present and enlarged. Modified from Estes et al., 1988 #147.
356. Hinge region between scales: (0) gently infolded, rounded; (1) acutely infolded.
357. Direct correspondence between epidermal scale and dermal ossification: (0) present; (1) absent.
358. Glands located in pits on dorsal surface of osteoderms: (0) absent; (1) present.
359. Hair: (0) absent; (1) present. Maderson and Alibardi, 2000 #4.
360. Epaxial myosepta inserting on osteoderms: (0) absent; (1) present.
361. Stratum lucidum: (0) absent; (1) present.

362. Patterning of dermal collagen fibers: (0) crossed (intersecting orthogonally); (1) matted (randomly distributed).

363. Median sagittal arteries emerging between adjacent vertebral spinous processes: (0) absent; (1) present.

364. Cycloid scales: (0) absent; (1) present. Estes et al., 1988 #148.

365. Lateral distribution of alpha- and beta-keratins in epidermis: (0) absent; (1) present.

366. Thermal balance: (0) ectothermic; (1) endothermic.

367. Burrowing/digging behavior: (0) absent; (1) present.

368. Aquatic habits: (0) no aquatic habits; (1) semi-aquatic or fully aquatic.

APPENDIX 3 – TAXON-CHARACTER MATRIX

Data matrix of 80 taxa and 368 characters used in this study. ? = missing data or inapplicable character; numerals 0 through 6 = character states described in Appendix 2. Letter codes indicate polymorphisms as follows: A, states 0 and 1; B, states 0 and 2; C, states 1 and 2; D, states 1 and 3; E, states 0, 2, and 3; F, states 2 and 3; G, states 1, 2, and 3; H, states 0 and 3. Only supraspecific taxon names are listed; for full taxon names see Table 1. Taxa that include extant members indicated in **bold**. Percent missing data for each taxon listed at end of matrix.

	Characters						
Taxa	1	1111111112	2222222223	3333333334	4444444445	5555555556	6666666667
	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890
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Diadectomorpha	??????????	??????????	??????????	??????????	??????????	??????????	?00000000A
Casea	??????????	??????????	??????????	??????????	??????????	??????????	?000100000
Ophiacodon	??????????	??????????	??????????	??????????	??????????	??????????	?000100000
Edaphosauridae	??????????	??????????	??????????	??????????	??????????	??????????	?00000000?
Sphenacodontidae	??????????	??????????	??????????	??????????	??????????	??????????	?000100000
Gorgonopsia	??????????	??????????	??????????	??????????	??????????	??????????	?000100000
Procynosuchus	??????????	??????????	??????????	??????????	??????????	??????????	?000100000
Morganucodon	??????????	??????????	??????????	??????????	??????????	??????????	?000101?1?
Glyptodon	??????????	??????????	??????????	??????????	??????????	??????????	?2001?111?
Glyptotherium	??????????	??????????	??????????	??????????	??????????	??????????	??????111?
Doedicurus	??????????	??????????	??????????	??????????	??????????	??????????	?2001?111?
Panochthus	??????????	??????????	??????????	??????????	??????????	??????????	?2001?111?
Dasypus	1101112110	1111110001	110?010022	0103011110?	?011010000	1110000001	0201001111
Zaedyus	1101112110	1111110001	110?010022	0103011110?	?011010000	1110000001	0201101111
Captorhinidae	??????????	??????????	??????????	??????????	??????????	??????????	?000000001
Paleothyris	??????????	??????????	??????????	??????????	??????????	??????????	?0???000?0
Araeoscelidia	??????????	??????????	??????????	??????????	??????????	??????????	?000000000
Claudiosaurus	??????????	??????????	??????????	??????????	??????????	??????????	?00000000?
Younginiformes	??????????	??????????	??????????	??????????	??????????	??????????	?000000000
Kuehneosauridae	??????????	??????????	??????????	??????????	??????????	??????????	??0?00110?
Coahomasuchus	??????????	??????????	??????????	??????????	??????????	??????????	??????????
Desmatosuchus	??????????	??????????	??????????	??????????	??????????	??????????	?11010000?
Typothorax	??????????	??????????	??????????	??????????	??????????	??????????	?1????????

Paratypothorax	??????????	??????????	??????????	??????????	??????????	??????????	??????????
Pseudopalatus	??????????	??????????	??????????	??????????	??????????	??????????	?01?10100?
Rutiodon	??????????	??????????	??????????	??????????	??????????	??????????	?01?10100?
Protosuchus	??????????	??????????	??????????	??????????	??????????	??????????	?01110100?
Akanthosuchus	??????????	??????????	??????????	??????????	??????????	??????????	??????????
Simosuchus	??????????	??????????	??????????	??????????	??????????	??????????	?001001001
Goniopholis	??????????	??????????	??????????	??????????	??????????	??????????	?011101101
Mahajangasuchus	??????????	??????????	??????????	??????????	??????????	??????????	?011101101
Alligator	0110001001	2001011111	1111211103	1012111111	1111111110	1012111110	1011101001
Crocodylus	0110001001	2001011111	1111211103	1012111111	1111111110	1012111110	1011101101
Caiman	0110001001	2001011111	1111211103	1012111111	1111111110	1012111110	1011101101
Gavialis	0110001001	2001011111	1111211103	1012111111	1111111110	1012111110	100?101101
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Pinacosaurus	??????????	??????????	??????????	??????????	??????????	??????????	?21?10100?
Sauropelta	??????????	??????????	??????????	??????????	??????????	??????????	?21???000?
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Scelidosaurus	??????????	??????????	??????????	??????????	??????????	??????????	?00?10??0?
Scutellosaurus	??????????	??????????	??????????	??????????	??????????	??????????	?01???????
Malagasy titanosaur	??????????	??????????	??????????	??????????	??????????	??????????	??????????
Saltasaurus	??????????	??????????	??????????	??????????	??????????	??????????	??????????
Mali titanosaur	??????????	??????????	??????????	??????????	??????????	??????????	??????????
Proganochelys	??????????	??????????	??????????	??????????	??????????	??????????	?200001002
Pseudemys	000000?000	1000000000	1111200101	0000001111	1111100001	0001010100	0200?21102
Geochelone	000000?000	1000000000	1111200101	0000001111	1111100001	0001010100	0200?21102
Chelydra	000000?000	1000000000	1111200101	0000001111	1111100001	0001010100	0200?21002
Trionyx	000000?000	1000000000	1111200101	0000001111	1111100001	0001010100	0200?21102
Baena	??????????	??????????	??????????	??????????	??????????	??????????	??00001?02
Sphenodon	0000001000	0000010000	0002210121	0001000000	0101100101	0011010110	0000000001
Heloderma	0000001000	0000010000	0002210121	0001000000	0100100101	0011010110	0000001001
Corucia	0000001000	0000010000	0002210121	0001000000	0100100101	0011010110	0000001001
Tiliqua	0000001000	0000010000	0002210121	0001000000	0100100101	0011010110	0000001001
Cordylus	0000001000	0000010000	0002210121	0001000000	0100100101	0011010110	0000001001
Zonosaurus	0000001000	0000010000	0002210121	0001000000	0100100101	0011010110	0000001001
Anguis	0000001000	0000010000	0002210121	0001000000	0100100101	0011010110	0000001001
Ophisaurus	0000001000	0000010000	0002210121	0001000000	0100100101	0011010110	0000000001
Gerrhonotus	0000001000	0000010000	0002210121	0001000000	0100100101	0011010110	0000001001
Elgaria	0000001000	0000010000	0002210121	0001000000	0100100101	0011010110	0000001001
Glyptosaurinae	??????????	??????????	??????????	??????????	??????????	??????????	?000??10?1

Mesosauridae	??????????	??????????	??????????	??????????	??????????	??????????	?01010?000
Millerettidae	??????????	??????????	??????????	??????????	??????????	??????????	?0?0000001
Anthodon	??????????	??????????	??????????	??????????	??????????	??????????	????001001
Scutosaurus	??????????	??????????	??????????	??????????	??????????	??????????	?000001001
Bradysaurus	??????????	??????????	??????????	??????????	??????????	??????????	?000001001
Pareiasaurus	??????????	??????????	??????????	??????????	??????????	??????????	??000??01
Procolophon	??????????	??????????	??????????	??????????	??????????	??????????	?000001001
Owenetta	??????????	??????????	??????????	??????????	??????????	??????????	?000000100?
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Trilophosaurus	??????????	??????????	??????????	??????????	??????????	??????????	?20100000?
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Prolacertiformes	??????????	??????????	??????????	??????????	??????????	??????????	?011101000
Acleistorhinus	??????????	??????????	??????????	??????????	??????????	??????????	??0000101?
Lanthanosuchidae	??????????	??????????	??????????	??????????	??????????	??????????	?10000101?
Macroleter	??????????	??????????	??????????	??????????	??????????	??????????	??0000101?

	Characters						
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Taxa	7777777778	8888888889	9999999990	0000000001	1111111112	2222222223	3333333334
	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890
Seymouriidae	0000000?00	0000000000	0000100000	00000?0000	0000000001	0001000l0?	000?000000
Diadectomorpha	00A0A00??0	00A0000100	0011000000	00000?0000	011??0?000	1100?00?0?	?00?000001
Casea	0100000?00	0010000000	0011000000	00100?0001	1000000000	0002000000?	0000100000
Ophiacodon	0001000?00	0011000000	0011000000	00000?0001	1100?0?000	0002000?0?	0000100000
Edaphosauridae	0100100?00	?0A0000000	0011100000	01000?0001	1200000110	0100000000?	?000100001
Sphenacodontidae	0110000?00	0011000100	0011100000	01000?1001	1200100010	0000000000?	0000100001
Gorgonopsia	0101000?00	0011000100	011?200100	01000?1001	1111100?20	0000000l0?	?000101001
Procynosuchus	0010001?00	1001000102	1111200000	01000?1101	1101101120	0000100l0?	0000101001
Morganucodon	?100001?01	?0?0011?02	112?22???1	00000?1?01	12?1111020	100011??0?	100??01001
Glyptodon	?100101?01	?0?2001?00	112?22???1	00100?1101	12?1111120	010011??0?	101?1????2
Glyptotherium	?100101?01	?0?2001?00	112?22???1	00100?1001	12?1111120	010011??0?	101?1????2
Doedicurus	?100101?01	?0?2001?00	112?22???1	00100?1101	12?1111120	010011??0?	101?1????2
Panochthus	?100101?01	?0?2011?00	112?22???1	00100?1101	12?1111120	010011??0?	101?1????2
Dasypus	?100111?01	?0?1011?00	112?22???1	01000?1?01	12?1111???	?????1??0?	10???????2
Zaedyus	?100111?01	?0?1001?00	112?22???1	01000?1?01	12?1111???	?????1??0?	10???????2
Captorhinidae	0100000?10	0000000000	000112?000	01000?0000	0100000001	000201??10	0001101001
Paleothyris	010000???0	0000000000	0001111?00	00000?0000	1100100011	000200?01?	0001101001
Araeoscelidia	0101000000	00A1000000	0001111000	01000?001A	1100000001	1002000020	0001101001
Claudiosaurus	01?10000?0	0011000000	10??12?100	01100?1011	120000000?	1102100120	?001101001
Younginiformes	0101000100	0011000000	10011C1000	00000?1011	1100000001	0102100120	?001111101
Kuehneosauridae	010101?0?0	?0100?0100	102???2?0?	01100?1011	1?0???????	??0?0??120	??1??111?2
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Desmatosuchus	?1?1100000	0001001?00	002?22?700	0101111111	001?101011	1000100110	101?01?111
Typothorax	??????????	?0????1?0?	??????????	?1?111???1	0?????????	??????????	??????????
Paratypothorax	??????????	??????1???	??????????	??????????	??????????	??????????	??????????
Pseudopalatus	?100100000	0011001?00	002?22?001	0100101111	0101101111	0002100110	1011001001
Rutiodon	?100100000	0011001?00	002?22?001	0100101111	0101101111	0002100110	1011001001
Protosuchus	?100101?00	0001011?00	102?22?100	01000?1111	01?????1?1	01??10?120	1010011001
Akanthosuchus	??????????	??????????	??????????	??????????	??????????	??????????	??????????
Simosuchus	0100111?00	0100011?01	102?22?000	0100111111	11?0101000	1001101120	1011111000
Goniopholis	0110111?00	0?01011?01	102?22??00	01000?1111	012?111021	0001101120	1011010001
Mahajangasuchus	0110111?00	0?01011?01	102?22?101	0100101111	012?111021	0001101120	1011110001
Alligator	0110111?00	0101011?01	102?22?101	01000?1111	0120111021	0001101120	1011110001

Crocodylus	0110111?00	0101011?00	102?22?001	01000?1111	0120111021	0001101120	1011111001
Caiman	01?0111?00	0101011?00	102?22?001	01000?1111	0120111021	0001101120	1011111001
Gavialis	0110111?00	0101011?01	102?22?001	00000?1111	0120111021	0001101120	1011111001
Euoplocephalus	????????00	?1?1011?10	002?22???1	01?00???00	0001101111	1000100110	101110001?
Pinacosaurus	?000101?00	0111011?10	002?22?001	01000?1000	0001101111	1000100110	1011100000
Sauropelta	????????00	?1?10?1?00	002?22???0	01?00???01	0101101120	1010100121	1010110111
Stegosaurus	?010101?00	0101111?00	102?22?000	01000?1011	1101101111	11121??120	?011110111
Scelidosaurus	?010001??0	0111001?01	102?22?10?	01011?1111	10?11?1???	????1??1??	?01??1???1
Scutellosaurus	??????????	??????1?0?	??????????	0?????????	??????????	??????????	??????????
Malagasy titanosaur	??????????	??????????	??????????	??????????	??????????	??????????	??????????
Saltasaurus	??????????	??????????	??????????	??????????	??????????	??????????	??????????
Mali titanosaur	??????????	??????????	??????????	??????????	??????????	??????????	??????????
Proganochelys	0000101?20	0002001?00	002?12?100	00000?1000	1110000110	111211??11	0011110011
Pseudemys	01?0101?20	0002001?00	002?22?100	00100?2000	1201101121	111111??11	0111110001
Geochelone	01?0101?20	0002001?00	002?22?100	01100?2000	1201101121	111111??11	0111110001
Chelydra	00?0101?20	0002001?00	002?22?100	00100?2000	1201101121	111111??11	0111110011
Trionyx	01?0101?20	1002001?00	002?22?101	00100?2000	1201111111	011111??1?	0111110001
Baena	01?1101?20	0002001?00	002?22?100	01100?1000	1201?0?111	1111?1??11	0011?10011
Sphenodon	0110010100	0012000102	102?22?100	00100?2111	1100100111	0102100110	0001011101
Heloderma	0000110101	?0?2011?00	102?12?1?0	01000?1011	1200101111	1112100120	0000011112
Corucia	0111100100	0002010100	002?22???0	01100?1011	1210101121	0012100120	0011011112
Tiliqua	0011111?00	0002011?00	002?22???0	01000?1011	1210101121	1012100120	0011011112
Cordylus	01?1111?00	00021?1?00	002?22???0	01100?1011	1200101111	1112101120	0010011112
Zonosaurus	01?0111?00	0000011?00	002?22?0?0	01100?1011	1200101111	1112101120	0010111112
Anguis	0101111?00	0002011?00	002?22?1?0	01000?1011	1200101111	1012101120	0010011102
Ophisaurus	0101111?00	0002011?00	002?22?1?0	01000?1011	1200100111	1012101120	0010011102
Gerrhonotus	0101111?00	0002010000	002?22?1?0	01000?1011	1200101111	1012101120	0010011102
Elgaria	0101111?00	0002010000	002?22?1?0	01000?1011	1200101111	1012101120	0010011102
Glyptosaurinae	?0????1??0	?0?00?1?00	10?????0?0	01000?1011	02?0101111	1112100120	?0???????0?
Mesosauridae	0100100??0	0001000100	0001200000	01000?0000	1100000011	0?0001????	?0?1100??0
Millerettidae	010A000?20	0010000000	0001010000	10000?000A	0100?0?000	0002000110	01011A0001
Anthodon	0000100?20	0000000110	0?1002?010	11000?0000	00100?0110	1100000111	1000100010
Scutosaurus	0000100?20	0000000110	001002?010	11000?0000	0010000110	1110000111	1000100010
Bradysaurus	0000100?20	0000000110	001002?010	11000?0000	0010000110	1100000111	1000100010
Pareiasaurus	00????0?20	0000000110	001002?010	11000?0000	0010000110	1110000111	1000100010
Procolophon	1101000?20	0000100100	002?02?000	11000?1000	1200000120	1100100110	0110110110
Owenetta	11?1000?20	0000100100	00B?02?000	11000?1000	120?000120	10001001??	?111101?1
Placodus	0001100100	0002000100	102?22?100	01000?1011	1111110121	011110010?	0011111102

Eosauropterygia	0?0A0A01?0	?01A0?0A0A	102??2??0?	?0A00?1011	1?A?????A?	?11?10?10?	??01A1?A?C
Cyamodontoidea	01AA000000	0002010100	102?22?100	00100?1011	1210110121	1011?1??0?	0011111111
Rhynchosauria	0A000A00?0	000C001?12	102?12?000	00A00?1111	1110A00?0?	A102A00121	0001011?1
Trilophosaurus	00100100??	?0?1001?02	10????2??0	0??00?1?10	11?0101?0?	111010?120	001??111??
Choristodera	0000000?0	0001001?01	102??2?000	01000?1011	11?0000?1?	0010001120	0?1??1?1?0
Prolacertiformes	011A0100?0	00010?A100	102?12?000	0AA00?1A11	1100A00?0?	010?000120	01110111??
Acleistorhinus	0010000??0	0010000100	001?011110	10000?1001	1100000000	000200?100	?000101010
Lanthanosuchidae	0010100??0	?011000A10	001101?0A0	10000?1001	110000?010	000200?000	?000101000?
Macroleter	000100???0	?0101?0100	000?02??1?	10000?1001	??0????0?0	000?00?0??	?000101011?

	Characters						
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Taxa	4444444445	5555555556	6666666667	7777777778	8888888889	9999999990	0000000001
	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890
Seymouriidae	0010000000	?0?000??00	0000000001	0100000000	0000000000	??00000000	1100000000
Diadectomorpha	0000001?0?	?1?0000011	00?0010000	010?000000	0000010A00	??00A10001	2?1?????10
Casea	0000100000	00?0000100	0000?21000	1110000000	00000?0000	??00100000	??0??00??0
Ophiacodon	0000?0?00?	0??0000?00	000002?000	1110000000	00000?0001	0000101000	1?00000000
Edaphosauridae	20?00?000?	0??0000100	0100121100	1110000000	0000??0011	0100110000	1200?00??0
Sphenacodontidae	2000?0100?	00?0000100	1100121100	1110000000	0000000001	0100101101	0000010??0
Gorgonopsia	10?0?0?00?	01?0000100	110?121110	?100000000	0000?02101	?100101101	?210100??0
Procynosuchus	1010001000	01?0000000	0110121110	212100A100	00?0102100	??00101011	1200010000
Morganucodon	201101?0??	11?0100000	0?0???1001	2101010101	00?0002110	0100101011	03100100??
Glyptodon	???????11?	11?11?0000	0?????1101	21210?010?	?0?????2?0	?100110011	0211100111
Glyptotherium	???????11?	11?11?0000	0?????1101	21210?010?	?0?????2?0	?100110011	0211100111
Doedicurus	???????01?	11?11?0000	0?????1101	21210?010?	?0?????2?0	?100110011	0211100111
Panochthus	???????01?	11?11?0000	0?????1101	21210?010?	?0?????2?0	?100110011	0211100111
Dasypus	???????111	11?10?????	???????0??	21210?010?	?0?????2?0	?100110011	0211100111
Zaedyus	???????111	11?10?????	???????0??	21210?010?	?0?????2?0	?100110011	0211100111
Captorhinidae	0011A0000?	0??0011000	0000060000	1100000000	0000010100	0100101000	0200000?10
Paleothyris	001110????	???0011000	?0??16?00?	110?000000	?00?0?0100	0000101000	120000?010
Araeoscelidia	0011A0????	0??0011000	00001??000	1100000000	00A00?0100	0000101000	1200000?10
Claudiosaurus	201100????	?????10??0	?0?????01?	?000000000	101???0100	0?00110?00	??00000??1
Younginiformes	001100??0?	???1111000	000016?000	110?0??000	?00?0?01?1	0?00100?0?	1?0???????1
Kuehneosauridae	??????????	?????10??0	????1??10?	?00?0????1	0?????01?1	??00110?0?	??????????
Coahomasuchus	?0110?????	??????????	????????1?	????001010	10????0??1	11????????	??????????
Desmatosuchus	1?1100111?	??1??00?11	011?151110	102?001010	0000000111	1100110001	1101101???
Typothorax	??????????	??????????	??????????	????001010	?0?0010???	?100110001	110100????
Paratypothorax	??????????	??????????	??????????	????0?????	??????????	??????????	??????????
Pseudopalatus	001?00011?	?1???10011	0010051100	1100001001	00001?0111	1100110100	1000000???
Rutiodon	001?00?11?	?1???10011	0010051100	1100001001	02001?0111	1100110100	1100010?1?
Protosuchus	10????111?	011??00011	0?10151?0	1020001000	00101?01?0	0100110000	11?0010???
Akanthosuchus	??????????	??????????	??????????	????0?????	??????????	??????????	??????????
Simosuchus	10????111?	?????00001	1110151?0	1000001000	00000?01?1	1000110011	0300000???
Goniopholis	11????111?	01???00011	0110151?0	10100?1000	0?101?01?1	1?00111000	101???????
Mahajangasuchus	11????11??	?????0?011	0111151?0	1010001000	00?00????1	?100111100	0110000???
Alligator	11????1111	0111100001	0111151?0	1010001000	0010120?1?1	1100111000	1010001011

Crocodylus	11????1111	0111101001	0111151?0	1010001000	001012O1?1	1100111000	1010010010
Caiman	11????1111	0111101000	0111151?0	1000001000	001012O1?1	1100111000	1010000010
Gavialis	10????0111	0111101000	0111151?0	1000001000	000012O1?1	1100110000	1010000010
Euoplocephalus	?1?100?11?	?????00010	0010161110	1?21100001	?211010101	1100110010	0311000???
Pinacosaurus	01?10???1?	?????00010	0010161110	1?01100001	1211010101	1000110010	03110001??
Sauropelta	?0?????11?	?????00011	0110161?10	1?21100001	?010010101	1100110010	0311000170
Stegosaurus	10110??11?	?1?1100001	1010161010	1?00101000	00100?0111	1100110010	0301000110
Scelidosaurus	20????????	??????????	??????????	??0?100000	00????0??1	1100110010	03??0?0?10
Scutellosaurus	??????????	??????????	??????????	????1???0?	??????????	??00110017	03?000????
Malagasy titanosaur	??????????	??????????	??????????	????0?????	??????????	??????????	??????????
Saltasaurus	??????????	??????????	??????????	????0?????	??????????	??????????	??????????
Mali titanosaur	??????????	??????????	??????????	????0?????	??????????	??????????	??????????
Proganochelys	101101101?	0101112011	0101051117	1020000001	1210021110	111???????	???1???011
Pseudemys	1011011010	0101112011	0101051111	1021010001	12?1121101	111???????	???1???011
Geochelone	1011011010	0101112011	0101051111	1021010001	12?1121101	111???????	???1???011
Chelydra	1011011010	0101112001	0101051111	1020010001	12?1121101	111???????	???1???011
Trionyx	0011011010	0101112000	0111051111	1021010002	12?1121111	111???????	???1???011
Baena	101101171?	?1????12010	0111?5111?	002?0???0?	??????????	??????????	??????????
Sphenodon	0010001010	0001111001	0110151100	1001010002	10?0001110	?102110?1	???1??001?
Heloderma	??1100A010	0101111011	0110151100	1020000001	0010101101	1101110001	0000100011
Corucia	??11001010	0101111011	0110151100	1000000001	1010101111	1101110010	0300000011
Tiliqua	??1000A010	0101111011	0110151100	1020000001	0210011111	1101110000	1200000011
Cordylus	??10000010	0101111011	0110151100	1020000001	0010111111	1101110000	2200000011
Zonosaurus	??10000010	0101111010	0110151100	1120000001	0010101111	1101110000	0200000011
Anguis	??10000010	0101111010	0110151100	1000000001	0010111111	1101110001	1000101011
Ophisaurus	??10000010	0101111010	0110151100	1000000001	0010111111	1101110000	1100001011
Gerrhonotus	??10000010	0101111010	0110151100	1000000001	0010111101	1101110000	1200000011
Elgaria	??10000010	0101111010	0110151100	1000000001	0010111101	1101110000	1200000011
Glyptosaurinae	???10??0??	????????10	0?111?1100	1000000001	10101?11?1	1001110000	1200000???
Mesosauridae	000000????	???00?0???	???0???0??	1?0?0?0000	00??0?01?1	010?110000	11?000?01?
Millerettidae	101110????	?0?0011000	000003000?	102?0?0000	00000?0101	01001A0?00	?2?0?0?01?
Anthodon	111101000?	?1????12?11	?1?1031111	11200?0000	1101120111	0100110010	0300000?0?
Scutosaurus	111101000?	?1???12011	0111031111	1120000000	1101120111	0100110010	0300000007
Bradysaurus	111101000?	?1???12011	0101031101	1120000000	1101120111	0000110010	0300000?0?
Pareiasaurus	111101000?	01???12000	0101031111	1120000000	1101120111	0000110010	0300000?0?
Procolophon	101101000?	?0?1112010	01?0A40100	1120000000	1211121111	1100110001	1110100?10
Owenetta	101101????	???1?12?10	00?004?10?	112?000000	1211121111	1100110?00	1100000???
Placodus	??11011?1?	?1???10011	100?15?11?	1010000001	1001121111	1100110001	1200100?0

Eosauropterygia	?0???11?1?	?1???10??A	?1??1?????	?0A?0????1	?010??A1?1	??001A0???	??????????
Cyamodontoidea	?011011?1?	?1???00011	000?0??1??	1010000000	10011?1101	1100110001	1210100???
Rhynchosauria	10?001001?	0??1111001	010?051000	10A0000001	1201??1111	?102100000	1?01?00??1
Trilophosaurus	00?001101?	0??1111001	010??5110?	102000000?	0011??1111	?102100011	2211000??1
Choristodera	10?001101?	0??11??001	010?151000	?01000000?	?010??0111	?100100000	1110000??1
Prolacertiformes	10???0?01?	01?1110001	000?1511A0	?0A0000000	10????A111	?100100001	1110001???
Acleistorhinus	10?010????	???00?1??0	201?14?000	?02?000000	10?????110	??0010??00	1000??????
Lanthanosuchidae	111010????	?????01??0	20??04000?	?0A?0?????	?01???11??	??0011??00	1?0???????
Macroleter	001?00????	?????11???	0???04?00?	?02?0????0	10????1110	??00100?0?	?????????0

	Characters						
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Taxa	1111111112	2222222223	3333333334	4444444445	5555555556	6666666667	7777777778
	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890
Seymouriidae	0000000000	000?000000	0000000000	0000000000	0000000000	0000000000	0000000000
Diadectomorpha	0?00000?00	110?000000	0000000000	0000000000	000000?000	0100000000	0000000000
Casea	1000000001	?00?10?000	0000?0?101	0000000000	0100000?0	0000000000	0000000000
Ophiacodon	1000000001	100?000000	0000000101	0000000000	0000000000	0000000000	0000000000
Edaphosauridae	1000000001	100?10?000	0010?0?101	0000000000	0100000???	1000000000	0000000000
Sphenacodontidae	1010000001	100?10?000	000000?101	0000000000	0000000000	1000000000	0000000000
Gorgonopsia	1010010101	?00?11?001	0?1011?102	0001001100	0010001001	1001000100	0102201011
Procynosuchus	1110010101	100?11?A01	011111?1?2	1001001210	0101101111	1011000110	0102211011
Morganucodon	?111010111	?1??11????	??11111102	1??1001210	0000101???	1001000111	?112211011
Glyptodon	1111?10111	001?110101	1101101122	11?1011110	000010?121	1111101111	0112201000
Glyptotherium	1111?10111	001?110101	1101101122	?1?1011110	001010?121	1111101111	0112201000
Doedicurus	1111?10111	001?110101	1101101122	11?1011110	000010?121	1111101111	0112201000
Panochthus	1111?10111	001?110101	1101101122	11?1011110	000010?121	1111101111	0112201000
Dasypus	1101?10111	1000110011	1111101122	11?1101200	100010?000	0111101111	1112001011
Zaedyus	1111?10111	1000110011	1111101122	11?1101200	100010?000	0111101111	1112001011
Captorhinidae	1000000000	000?000000	000000010C	0000000200	1000000000	0100000000	0000000000
Paleothyris	1?10000001	000?000000	?000000101	1000100100	0000001000	1000000?0	0000010000
Araeoscelidia	1010000000	010?000000	0000000101	0001100C00	0000000000	00000?0000	0000000000
Claudiosaurus	??10100?01	0?0?0??001	0000?1?002	1010?1?101	1001?0?1?0	?0?1???0??	0??011??11
Younginiformes	??10000001	??0?0?001?	000001100C	10A1100101	AA11?A?100	?1?1???1??	0?00111?01
Kuehneosauridae	??11?10101	??1?0??0?1	0100?1?00?	?????0?000	001???2?1?1	???1???0??	0??011??01
Coahomasuchus	??1????11?	?????1????	?????????2	????1?0?1?	???00?????	??0???????	?101211???
Desmatosuchus	??1????1??	1?????????	??10101002	???0000110	011?0?01??	1001101000	?101211011
Typothorax	??1????111	1?1??1????	?010101002	???0100210	011100?1??	1001101?0	1101211011
Paratypothorax	??????????	??????????	??????????	??????????	??????????	1000101?0	??????????
Pseudopalatus	?1?1?101?1	?00???????	?0?????022	?01??00?10	001???????	?0????1???	?001211011
Rutiodon	1111?10111	A00???????	?010101022	?010110210	01110?????	1001101000	0000211011
Protosuchus	??11110?1	001??1??11	?010111002	???1110211	101????10?	?001111?0	0?00?11011
Akanthosuchus	???????1??	?????1????	??????????	????1?0???	????????1??	??????????	?001?11010
Simosuchus	1?01?10131	10????????	??00111?2	????110211	101102????	??????????	??????????
Goniopholis	???????111	00????????	???????0??	??????????	??????????	??????????	??????????
Mahajangasuchus	??0?1?0101	100?01????	??10111???	????110211	1011??????	1000111?0	0000211011
Alligator	1111110121	1011011011	0010111002	1001110211	101102?101	1001111?0	0000211011

Crocodylus	1111110121	1111011011	0010111002	1001110211	101102?111	1001111?0	0000211111
Caiman	1111110121	1111011011	0010111002	1001110211	101102?111	1001111?0	0000211111
Gavialis	1111110121	1011011011	0010111002	1001110211	101102?111	1001111?0	0000211111
Euoplocephalus	??1???0111	001?11100?	0?10101002	???1010211	101010????	1001?011?1	0000100011
Pinacosaurus	??1???0111	000?11100?	??1010?0?2	???1010?11	???010???2	??00?011?1	??????????
Sauropelta	111?0?0111	000?1110??	0?11101002	???1010211	101010?12?	1?01?011?1	1101101011
Stegosaurus	1111010111	111?111000	0?1010?002	????110111	001010?12?	1001011?1	1100101111
Scelidosaurus	??11?10111	100?1110??	0?1010?0?2	????1?0???	??????????	?001011?1	0111?01011
Scutellosaurus	??1???0111	000?1??011	0?10101002	????110211	101102?1??	?000011111	?101101011
Malagasy titanosaur	??????????	??????????	??????????	??????????	??????????	??????????	??????????
Saltasaurus	110????131	010?110???	0?1010?002	???1110211	101111????	1?01011000	1101101111
Mali titanosaur	??????????	??????????	??????????	??????????	??????????	??????????	??????????
Proganochelys	1?01?11101	00??011110	1?21001012	0010011211	0111000021	1000001100	0111101111
Pseudemys	1?11?11101	00?0011100	1?21101022	0010111211	0111001121	1111001110	0112101111
Geochelone	1?11?111E1	00?0011111	??21101022	0000111211	0111021121	1111001110	0111101111
Chelydra	1011?111?1	00?001100?	1?21101022	0010111211	0011021121	1111001110	0112101111
Trionyx	1101?111F1	00?0011111	??21101022	00?0111211	0111010021	1110001?0	0112101111
Baena	??????????	??????????	??????????	??????????	??????????	??????????	??????????
Sphenodon	1110000121	1001011001	001000?002	1001100100	0100000101	1101001000	0002011111
Heloderma	?101010121	0001011011	0110111002	1001100100	0010022?0?1	1000001000	0000011111
Corucia	1111010121	0001011011	1100101002	0011100100	0110021001	1011001000	0112011111
Tiliqua	1111010121	0001011011	1110101002	1011100100	0110021101	1011001000	1111011111
Cordylus	1110010121	0001011001	1110101002	1011100100	011102?001	1011001000	1111011111
Zonosaurus	1110010121	0001011001	1110101002	1011100100	011102?001	1011001000	1111011111
Anguis	1111010121	0001011011	11???????2	???1??????	??????????	10????????	??????????
Ophisaurus	1111010121	0001001011	11???????2	1011??????	??????????	11????????	??????????
Gerrhonotus	1111010121	0001011011	1110111002	1011110210	1011021001	1011001000	0110011111
Elgaria	1111010121	0001011011	1110111002	1011110210	1011021001	1011001000	0110011111
Glyptosaurinae	??0????121	000???????	?????????2	????1?????	???1??????	??????????	?00?0111??
Mesosauridae	1?0???0??0	????000?0?	1?00001?1	00001?01??	0101????0?	?0?00?00??	??100?1??1
Millerettidae	1?00000001	??0?0010?0	?000001101	00000?0101	010??0??00	?1?00?00??	0?00001021
Anthodon	1000001002	000?101?11	11111?1102	0010000210	110000??20	11100?11?0	0?0200000?
Scutosaurus	1010001012	000?101A11	1111101102	0010000200	1100000020	1101001101	0002000001
Bradysaurus	1000001002	000?101011	1111101101	0010000200	1100000020	11000?1101	0001000000
Pareiasaurus	1000001002	00??101011	1101101102	0010000200	1100000020	11010?1100	0001000001
Procolophon	1?10000002	000?101A10	0010101102	1010000200	10010?0A0	?1010?11?0	0?11000001
Owenetta	??00000002	??0?10???0	?0?01??10?	001?000102	0011?0??0?	?1??????1??	0??0?0?0??
Placodus	1?11110001	111?1110?1	1000111012	101001?011	0011?2????	1101101000	0000111011

Eosauropterygia	??1111?1A1	??0?1??001	0020?1?012	A0A0?A?A11	A0A1?C???1	???1???0??	0??0A1?A11
Cyamodontoidea	??11010101	??1?11???1	10?0?1?012	1????1?211	0011?2????	???0???0??	0??0?1?011
Rhynchosauria	?010000101	?00?01?001	1000?1?0A2	101?100101	00110000?1	1101101000	1000111101
Trilophosaurus	?0101001C1	?00?01???1	1010?1?002	101?100201	0010000000	1101101000	1000111101
Choristodera	?010110111	?00?A1?001	10?0?1?002	1010100101	0011020111	1101101000	0000111001
Prolacertiformes	?0101001B1	?00?01?001	1000?1?002	1010100201	00110C0101	1101101000	1000111001
Acleistorhinus	??????????	??????????	??????????	??????????	??????????	??????????	??????????
Lanthanosuchidae	?????0?002	??0???????	??0???????	001?????0?	??????????	??????????	??????????
Macroleter	??00000002	??0?1??0?0	??10???101	0010?0?100	0000?0???0	?1?0???1??	0??000?001

	Characters						
	2222222222	2222222223	3333333333	3333333333	3333333333	3333333333	3333333333
Taxa	8888888889	9999999990	0000000001	1111111112	2222222223	3333333334	4444444445
	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890
Seymouriidae	0000000000	0000000120	0000000???	??????????	??????????	??????????	????0??????
Diadectomorpha	001A000000	0000000120	0000000???	??????????	??????????	??????????	????0??????
Casea	0020000000	0000000120	0000000???	??????????	??????????	??????????	????0??????
Ophiacodon	0020000000	0000000120	0000000???	??????????	??????????	??????????	????0??????
Edaphosauridae	00??000000	0???000???	?000000???	??????????	??????????	??????????	????0??????
Sphenacodontidae	0020000000	0000000120	0000000???	??????????	??????????	??????????	????0??????
Gorgonopsia	0021011010	1000000121	0000?00???	??????????	??????????	??????????	????0??????
Procynosuchus	0020011010	1000000121	0000000???	??????????	??????????	??????????	????0??????
Morganucodon	?0202?00??	1???000111	?000000???	??????????	??????????	??????????	????0??????
Glyptodon	12201?2011	1011100001	1110012101	00?1100???	00?0011010	00A?00?002	00?0??????
Glyptotherium	12201?2011	1011100001	1110002001	00?1A00???	00?0011010	00A?00?002	00?0??????
Doedicurus	12201?2011	1011100001	1110002101	00?0?10???	00?0011000	010?00?002	00?0??????
Panochthus	12201?2011	1011100001	1110002101	00?A000???	00?0011010	001?00?002	00?0??????
Dasypus	01201?2011	1011100111	111001200A	0A41000???	00?A0A0000	001?00?002	00?000110?
Zaedyus	01201?2011	1011100111	111000200A	0A41100???	00?A0A0000	001?00?002	00?000110?
Captorhinidae	0020001000	0000000120	0000000???	??????????	??????????	??????????	????0??????
Paleothyris	0020001100	0000000121	0000000???	??????????	??????????	??????????	????0??????
Araeoscelidia	1120001100	0110000120	0000000???	??????????	??????????	??????????	????0??????
Claudiosaurus	00?0001100	0100000120	0000000???	??????????	??????????	??????????	????0??????
Younginiformes	1120001100	A110100120	0000000???	??????????	??????????	??????????	????0??????
Kuehneosauridae	???0??1???	?1?0??0120	0000000???	??????????	??????????	??????????	????0??????
Coahomasuchus	1??0???1??	?101110???	??11012012	1110?00???	0201000100	0000?01110	0000??????
Desmatosuchus	1???1?21?1	11?111????	?0100?1012	1110?0H020	0210000100	0000011010	0000??????
Typothorax	10201??1??	1101110l2?	1011012013	1110?00???	0101000100	2000001010	0000??????
Paratypothorax	??????????	??????????	??110?2013	1110?03120	0211000100	0000001000	0000??????
Pseudopalatus	???????10?	11??110???	?011110?12	1110?02020	0310A00100	00A0001?11	0010??????
Rutiodon	11201??10?	11??110???	?011110?12	1100?02020	0310A00100	00A0000?11	0000??????
Protosuchus	1020102101	1101110114	0011002012	1100?00???	0201100000	0000?00000	0000??????
Akanthosuchus	1??011?1??	11011??114	0?1????11	???0?1E10A	0300000?00	001?0????1	0000??????
Simosuchus	??????????	??????????	?01100??11	1140?12100	0100000100	00A0000001	00?0??????
Goniopholis	??????????	??????????	?01100??12	1100?02120	0111100?00	0000?000?1	0000??????
Mahajangasuchus	11?01?????	??????????	?010001000	???0?02100	0310000?00	001?000?01	0000??????
Alligator	1120102101	1101110114	1010001011	1130?021A0	0310000100	0011000101	0010101010

Crocodylus	1120102101	1101110114	1010001011	1130?02100	0D10000100	0012?00101	0010101010
Caiman	1120102101	1101110114	1011001011	1130?02100	0310000100	0012?00101	0010101010
Gavialis	1120102101	1101110114	1010001011	1120?02100	0310000100	0010?00101	0010101010
Euoplocephalus	102A0??0??	???????124	0110001110	1140?12100	00?0000??0	1010000001	0000??????
Pinacosaurus	??????????	?????????4	0110001110	11?0?12000	00?0000?00	101?000001	00?0??????
Sauropelta	11210??0??	???????124	0110101010	1140?12100	00?0000??0	0010010001	0110??????
Stegosaurus	11200??01?	?1??1??004	1010101010	??00?22101	00?00000?0	201?00?0?0	00?0??????
Scelidosaurus	1?20???1?1	11011?0124	1010012000	1??0?12100	00?00000?0	A01??000?0	0110??????
Scutellosaurus	112???????	?11????11?	0010002?00	???0?12100	00?0000?00	A00??00001	01?0??????
Malagasy titanosaur	??????????	??????????	??1000??10	???0?10???	00?0001??0	001??0??01	00?0??????
Saltasaurus	1?????????	??????????	?01000??10	???0?1B000	00?0001??0	001??0???1	10?0??????
Mali titanosaur	??????????	??????????	??1000??10	???0?10???	00?0001??0	011??0???0	00?0??????
Proganochelys	1121012010	1111110332	10??01110?	??????????	1????????0	?????????0	00?1??????
Pseudemys	1121012010	1101110001	00??000???	??????????	?????????0	??????????	?0?1101010
Geochelone	1121012010	1101110003	10??000???	??????????	?????????0	??????????	?0?1101010
Chelydra	1121012010	1101110001	00??001??0	??????????	1????????0	?????????0	00?1101010
Trionyx	1121012010	1101000012	00??000???	??????????	??????????	??????????	?0?110100?
Baena	??????????	??????????	?0??00????	??????????	?????????0	??????????	???1??????
Sphenodon	00?1012111	1110111120	0000000???	??????????	??????????	??????????	???0111011
Heloderma	11210?2111	1101111110	0111012001	00?0?00???	10?0001000	0110002000	1000111011
Corucia	1121012111	1101111121	0111002011	00?0?00???	00?0000001	0000002000	0000111011
Tiliqua	1121012111	1101111121	0111012012	00?0?00???	00?1000011	0000002000	0000111011
Cordylus	1121012111	1101111121	0111012000	0140?121B1	00?1000000	0000002100	0010111011
Zonosaurus	1121012111	1101111121	0111012000	0140?00???	00?100000A	0000002000	0000111011
Anguis	??????????	??????????	?1110?2011	00?0?10???	00?1000000	0000102010	0000111011
Ophisaurus	??????????	??????????	?111002011	00?0?0B100	00?1000000	0000102?0	0000111011
Gerrhonotus	1121012111	1101111121	0111002011	00?0?0B100	00?1000000	0000102000	0000111011
Elgaria	1121012111	1101111121	0111002011	00?0?00???	00?1000000	0000102?0	0000111011
Glyptosaurinae	??????????	??????????	?1111???10	00?0?00???	10?1001100	0000102000	0000??????
Mesosauridae	?0201?20?0	0000000120	0000000???	??????????	??????????	??????????	???0??????
Millerettidae	0020001100	1010000120	0000000???	??????????	??????????	??????????	???0??????
Anthodon	0021?02000	1001000012	1010011011	00?0?23000	00?0010020	0100002001	00?0??????
Scutosaurus	0021002000	1001000012	1010011011	00?0?11000	00?0000020	B1000002001	0000??????
Bradysaurus	0021002000	1001000012	1010001001	00?0?10?00	00?0000020	0100002000	0000??????
Pareiasaurus	0021002000	100100?012	1010011011	00?0?11000	00?0000020	0100002001	0000??????
Procolophon	0021012000	1100000120	1000000???	??????????	??????????	??????????	???0??????
Owenetta	002??0????	??????0???	?000000???	??????????	??????????	??????????	???0??????
Placodus	10?000?0?1	1100000120	0010001001	00?0?120?0	00?00010?0	20????0?00	0000??????

Eosauropterygia	A0?0002011	1100000120	0000?00???	??????????	??????????	??????????	???0??????
Cyamodontoidea	1???0??0??	??????????	011A0?A001	00?0?0G00A	00?0?11000	00A??00002	0000??????
Rhynchosauria	11?1111110	1110110121	1000000???	??????????	??????????	??????????	???0??????
Trilophosaurus	10?1111100	1110110121	0000000???	??????????	??????????	??????????	???0??????
Choristodera	1??01111?0	1??0110???	0000000???	??????????	??????????	??????????	???0??????
Prolacertiformes	10?1111100	11A0110120	0000000???	??????????	??????????	??????????	???0??????
Acleistorhinus	??????????	??????????	?0??0?????	??????????	??????????	??????????	???0??????
Lanthanosuchidae	??????????	??????????	?000000???	??????????	??????????	??????????	???0??????
Macroleter	?0?0001000	1000000120	0000000???	??????????	??????????	??????????	???0??????

	Characters		
	3333333333	33333333	
	5555555556	66666666	
	1234567890	12345678	
Seymouriidae	??????????	????????	(36%)
Diadectomorpha	??????????	????????	(41%)
Casea	??????????	????????	(39%)
Ophiacodon	??????????	????????	(37%)
Edaphosauridae	??????????	????????	(42%)
Sphenacodontidae	??????????	????????	(36%)
Gorgonopsia	??????????	????????	(39%)
Procynosuchus	??????????	????????	(36%)
Morganucodon	??????????	????????	(48%)
Glyptodon	?????0????	????????	(39%)
Glyptotherium	?????0????	????????	(40%)
Doedicurus	?????0????	????????	(39%)
Panochthus	?????0????	????????	(39%)
Dasypus	11010A0111	00000110	(21%)
Zaedyus	11010A0111	00000110	(21%)
Captorhinidae	??????????	????????	(36%)
Paleothyris	??????????	????????	(42%)
Araeoscelidia	??????????	????????	(36%)
Claudiosaurus	??????????	????????	(50%)
Younginiformes	??????????	????????	(45%)
Kuehneosauridae	??????????	????????	(67%)
Coahomasuchus	??????????	????????	(77%)
Desmatosuchus	??????????	????????	(40%)
Typothorax	??????????	????????	(62%)
Paratypothorax	??????????	????????	(86%)
Pseudopalatus	??????????	????????	(42%)
Rutiodon	??????????	????????	(35%)
Protosuchus	??????????	????????	(39%)
Akanthosuchus	??????????	????????	(85%)
Simosuchus	??????????	????????	(47%)
Goniopholis	??????????	????????	(56%)
Mahajangasuchus	??????????	????????	(45%)
Alligator	0110000?01	10101011	(4%)
Crocodylus	0110000?01	10101?1	(5%)

Caiman	0110000?01	10101?1	(5%)
Gavialis	0110000?01	10101?1	(5%)
Euoplocephalus	??????????	????????	(42%)
Pinacosaurus	??????????	????????	(45%)
Sauropelta	??????????	????????	(42%)
Stegosaurus	??????????	????????	(35%)
Scelidosaurus	??????????	????????	(55%)
Scutellosaurus	??????????	????????	(70%)
Malagasy titanosaur	??????????	????????	(93%)
Saltasaurus	??????????	????????	(78%)
Mali titanosaur	??????????	????????	(93%)
Proganochelys	?????2?1???	????????	(38%)
Pseudemys	01102?100?	0?0000?1	(18%)
Geochelone	01102?100?	0?0000?0	(19%)
Chelydra	01102?100?	0?0000?1	(17%)
Trionyx	01102?100?	0?000??1	(20%)
Baena	??????????	????????	(73%)
Sphenodon	011000??0?	??000010	(15%)
Heloderma	0110100000	00000010	(5%)
Corucia	0110211100	00010?0	(4%)
Tiliqua	0110211100	A0010?0	(5%)
Cordylus	0110210000	000000A0	(4%)
Zonosaurus	011021A001	0000001A	(4%)
Anguis	0110210000	00000000	(22%)
Ophisaurus	0110210000	00000000	(20%)
Gerrhonotus	0110210000	00000000	(3%)
Elgaria	0110210000	00000000	(4%)
Glyptosaurinae	????1?????	????????	(60%)
Mesosauridae	??????????	????????	(54%)
Millerettidae	??????????	????????	(43%)
Anthodon	??????????	????????	(33%)
Scutosaurus	??????????	????????	(27%)
Bradysaurus	??????????	????????	(28%)
Pareiasaurus	??????????	????????	(30%)
Procolophon	??????????	????????	(37%)
Owenetta	??????????	????????	(54%)
Placodus	??????????	????????	(33%)
Eosauropterygia	??????????	????????	(61%)

Cyamodontoidea	??????1???	???????? (45%)
Rhynchosauria	??????????	???????? (41%)
Trilophosaurus	??????????	???????? (46%)
Choristodera	??????????	???????? (45%)
Prolacertiformes	??????????	???????? (42%)
Acleistorhinus	??????????	???????? (69%)
Lanthanosuchidae	??????????	???????? (68%)
Macroleter	??????????	???????? (59%)

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