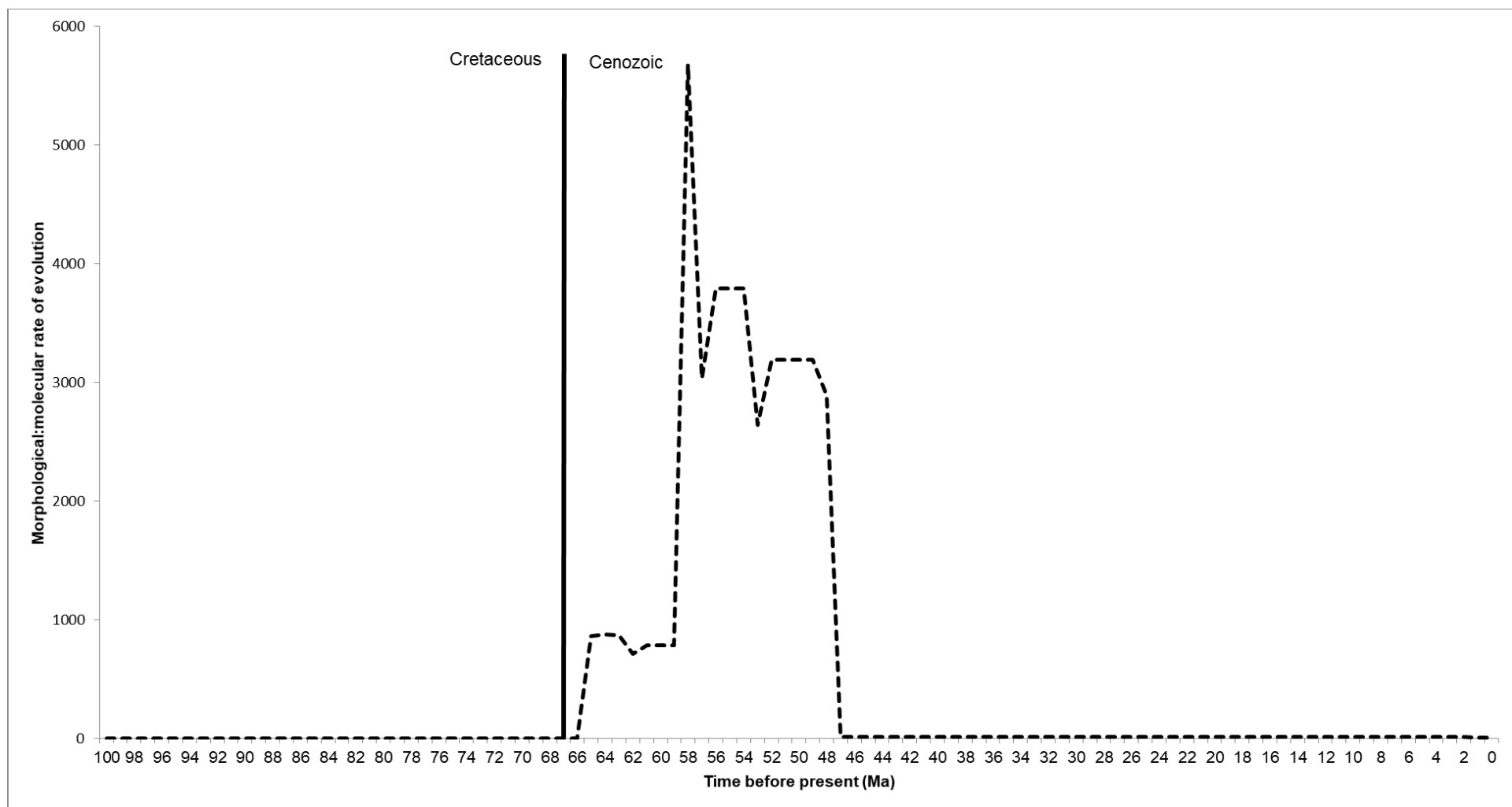
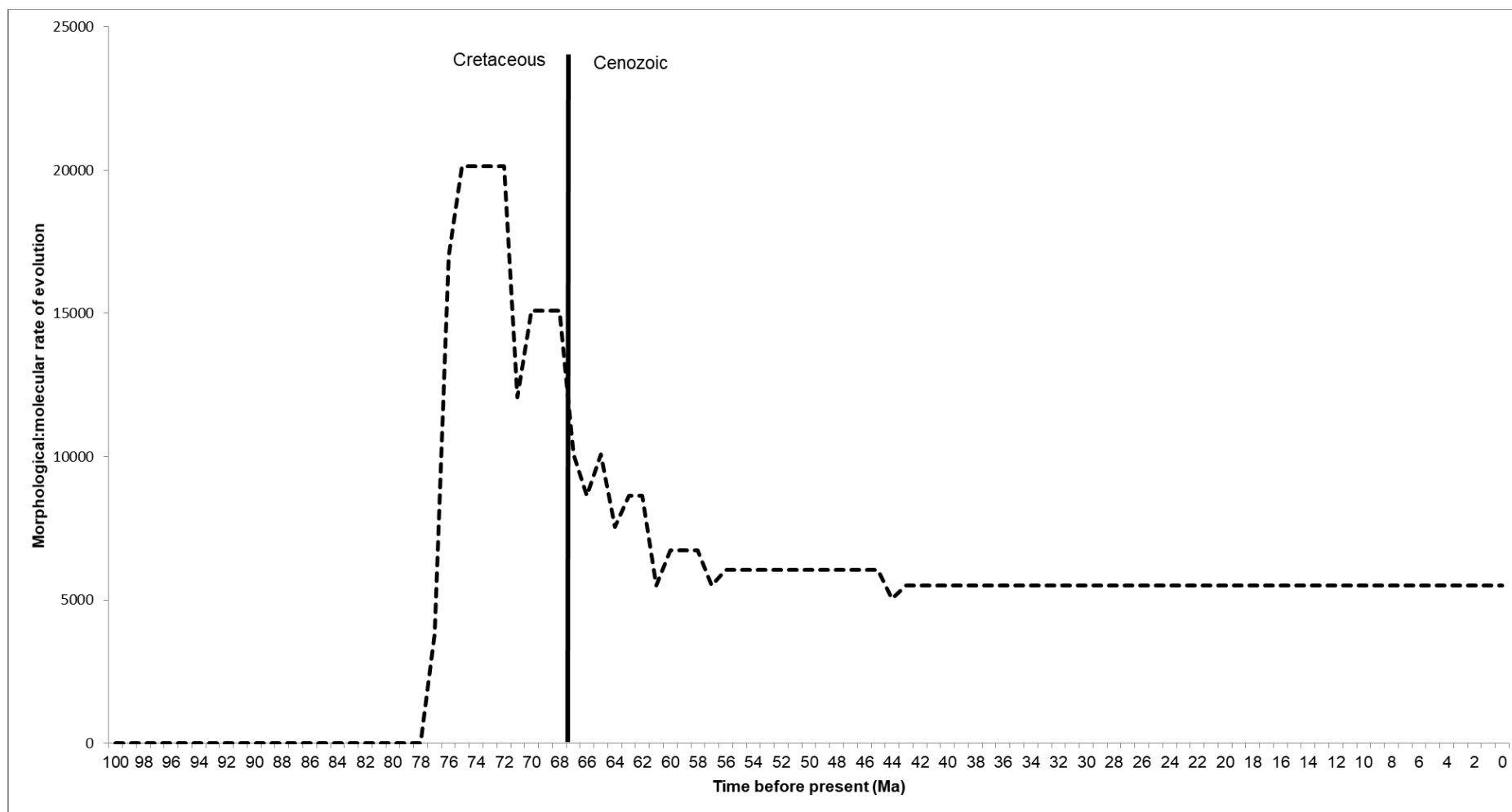
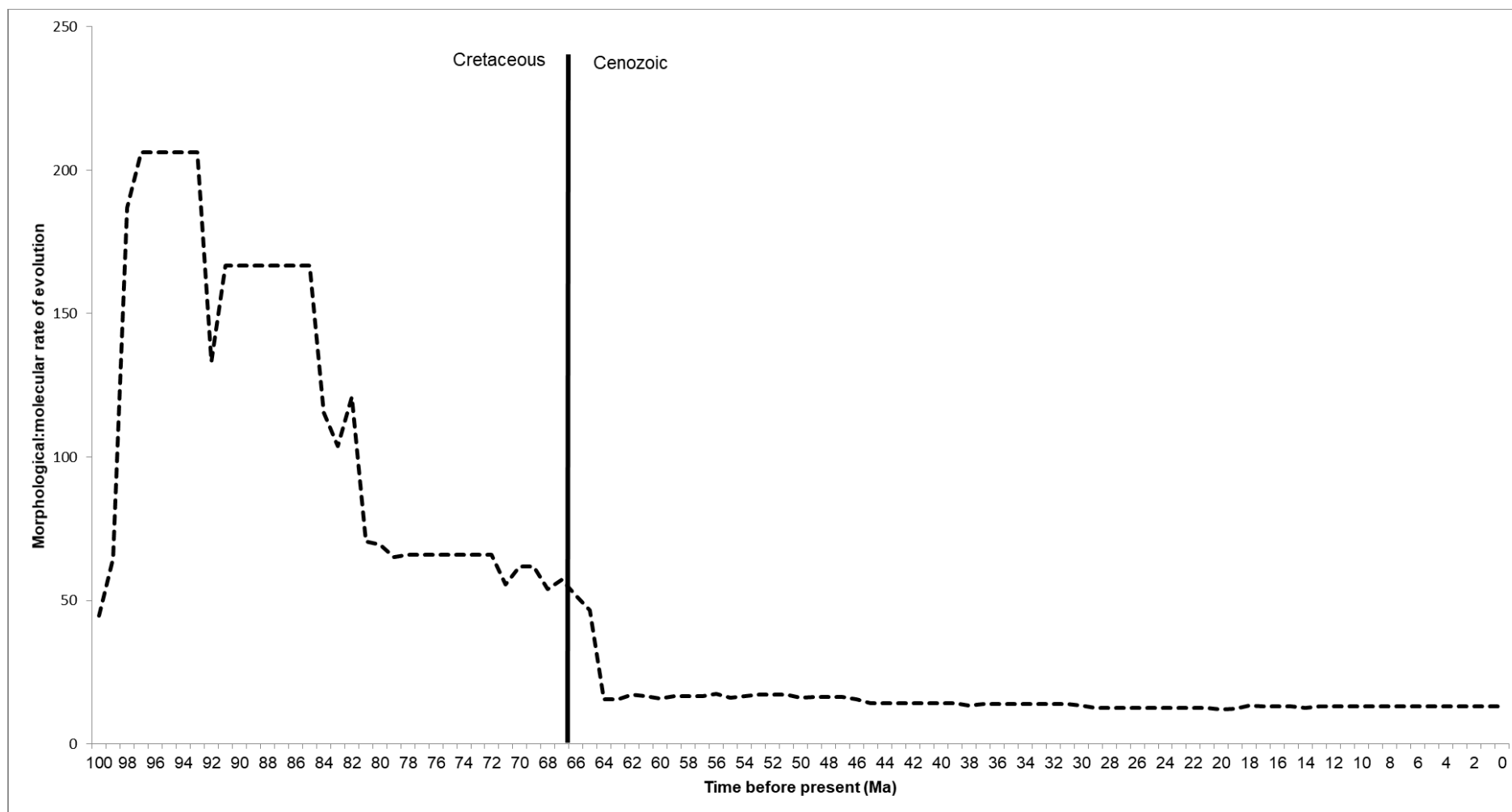
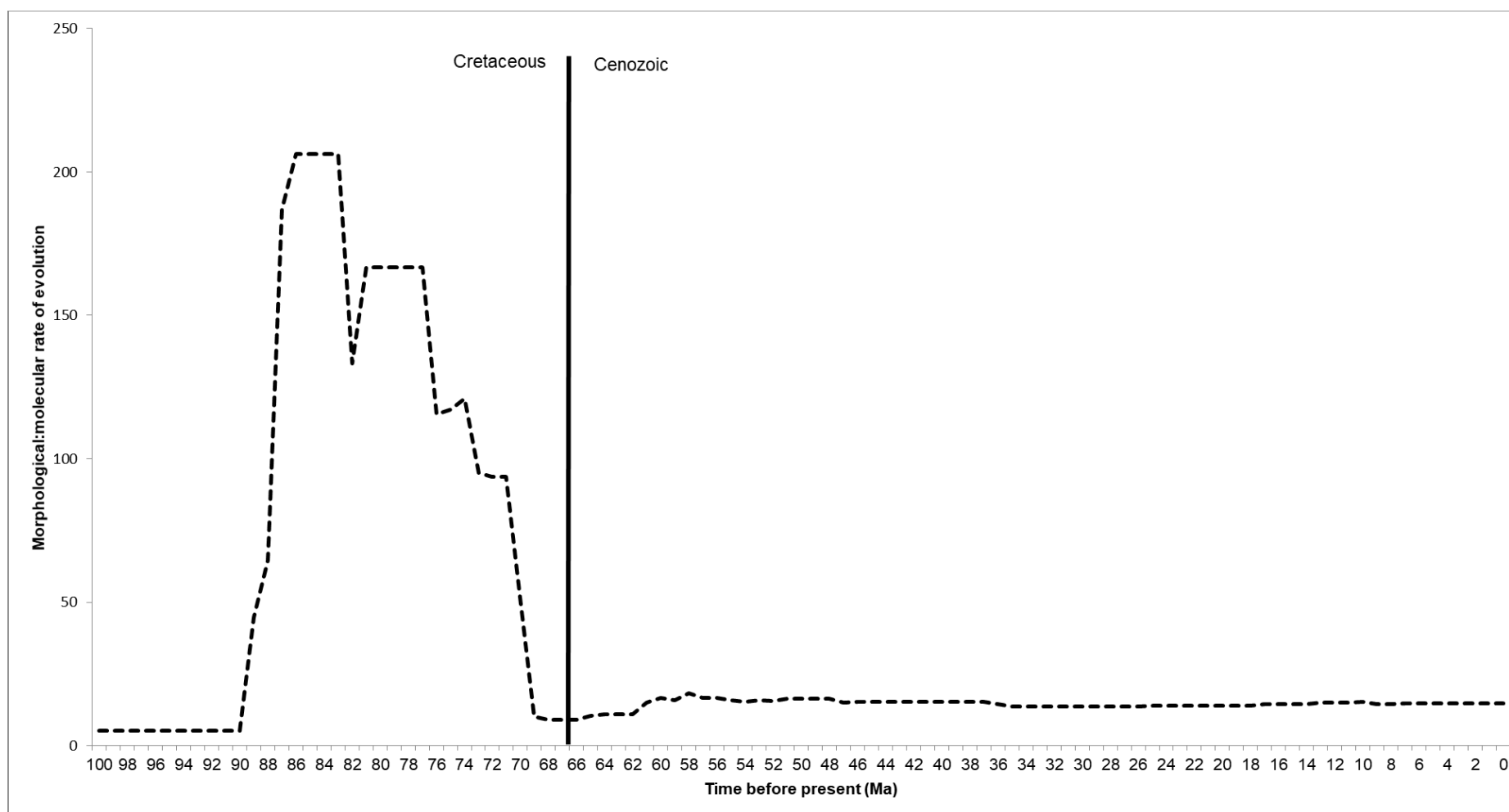










SI Figure 1C - Relative rates of morphological:molecular evolution including the branch leading to Xenarthra, time-scaled according to dos Reis *et al.* (2012)

(Peramus,((Deltatheridium,(monodelphis_domestica,
(macropus_eugenii,sarcophilus_harrisii))),(((Potamogale,echinops_telfairi),
(procavia_capensis,(Eritherium,loxodonta_africana))),((Tamandua,
(Bradypus,choloepus_hoffmanni)),(Utaetus,
(Chaetophractus,dasypus_novemcinctus)))),(((Solenodon,(Oreotalpa,((Domnina,
(Blarina,sorex_araneus)),(Echinosorex,erinaceus_europaeus)))),
((Miacis,Viverravus,(felis_catus,(canis_familiaris,
(mustela_putorius_furo,ailuropoda_melanoleuca)))),((Litolophus,
(Heptodon,Homogalax)),(Lambdotherium,
(Eohippus,Hyracotherium),equus_caballus)))),
(pteropus_vampyrus,myotis_lucifugus),(Gobiohyus,((Poebrotherium,vicugna_pacos),
(sus_scrofa,((Elomeryx,(Pakicetus,(Rodhocetus,tursiops_truncatus))), (Leptomeryx,
(bos_taurus,ovis_aries)))))))),(((Gomphos,
(oryctolagus_cuniculus,ochotona_princeps)),(Tribosphenomys,Paramys,
(cavia_porcellus,(ictidomys_tridecemlineatus,
(mus_musculus,rattus_norvegicus)))))),
((Ptilocercus,tupaia_belangeri),Cynocephalus,(Saxonella,Cantius,(Adapis,
(microcebus_murinus,otolemur_garnetti)),(tarsius_syrichtha,(callithrix_jacchus,
((chlorocebus_sabaeus,(papio_anubis,macaca_mulatta)),(nomascus_leucogenys,
(pongo_abelii,(gorilla_gorilla,(pan_troglodytes,homo_sapiens))))))))))));

#NEXUS

[written Sat Dec 16 11:50:15 GMT 2017 by Mesquite version 2.75 (build 564) at Acer/192.168.1.108]

BEGIN TAXA;

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DIMENSIONS NTAX=235;

TAXLABELS

Peramus Deltatheridium Macropus_eugenii Monodelphis_domestica
Sarcophilus_harrisii Bobolestes Paranyctoides Sheikhdzheilia Alosteria Lainodon
Avitotherium Gallolestes Parazhelestes Aspanlestes Zhelestes Altacreodus
Maelestes Batodon Bulaklestes Daulestes Uchkudukodon Kennalestes Asioryctes
Ukhaatherium Kulbeckia Zhangolestes Alymlestes Zalambdalestes Afrodon
Deccanolestes Barunlestes Gypsonictops Leptictis Purgatorius Protungulatum
Vulpavus Miacis Diacodexis Hyopsodus Meniscotherium Phenacodus Ptilocercus
Notharctus Plesiadapis Adapis Tribosphenomys Paramys Rhombomylus Gomphos
Oryctolagus_cuniculus Ochotona_princeps Blarina Solenodon Eoryctes Potamogale
Rhynchocyon Procavia Ocepeia Eritherium Peltephilus Chaetophractus Bradypus
Tamandua Puercolestes Chacopterygus Betonnia Procerberus Dissacus Chriacus
Eohippus Hyracotherium Equus_caballus Protoselene Hapalodectes Pachyaena
Ankalagon Eoconodon Mimatuta Oxycloa Cantius Apatemys Thryptacodon
Desmatoclaenus Loxolophus Lambertocyon Didelphodus Acmeodon Gelastops Utaetus
Bunophorus Tubulodon Adapisorex Echinorex Litocherus Escavadodon Centetodon
Prolimnocyon Pyrocyon Molinodus Prodiacodon Wyolestes Palaeonodon Eomanis
Eurotamandua Mixodectes Leptacodon Palaeoryctes Aptoryctes Pararyctes
Aphronorus Bessoecetor Palaeosinopa Anisonchus Conacodon Ectoconus Hemithlaeus
Periptychus Haploconus Tetracloa Copeion Ectocion Saxonella Cynocephalus
Onychodectes Uropsilus Desmana Homogalax Goniacodon Tupaia Viverravus Arctocyon
Homacodon Teilhardimys Orthaspidotherium Pleuraspidotherium Hilalia Heptodon
Mesonyx Sinonyx Macrocranion Alsaticopithecus Wyonycteris Parapternodus
Bisonalveus Pentacodon Asiostylops Arctostylops Elpidophorus Worlandia
Plagiomene Elphidotarsius Esthonyx Uintatherium Alcidedorbignya Pantolambda
Titanoides Coryphodon Cyriacotherium Dipsalidictis Didymictis Uintacyon
Claenodon Anacodon Apheliscus Haplomylus Domnina Tytthaena Onychonycteris
Icaronycteris Lambdotherium Litolophus Gobiohyus Leptomeryx Poebrotherium
Vicugna_pacos Oreotalpa Pakicetus Rodhocetus Tursiops_truncatus Indohyus
Elomeryx Chambius Todralestes Dilambdogale Widanelfarasia Protictis Lessnessina
Pteropus Simpsonotus Interatherium Protolipterna Asmithwoodwardia Astraponotus
Parastrapotherium Carodnia Pyrotherium Homo_sapiens Pan_troglodytes
Gorilla_gorilla_gorilla Pongo_pygmaeus Papio_cynocephalus Nomascus_concolor
Microcebus_murinus Macaca_mulatta Otlemur_garnetti Callithrix_jacchus
Cercopithecus_diana Anomalurus Aplodontia Myocastor Rhizomys Echinops_telfairi
Cavia_porcellus Erinaceus_europaeus Rattus_norvegicus Oryzomys_afer
Bos_taurus Sus_scrofa Ovis_aries Dasypus_noveboracensis Choloepus_hoffmanni
Ictidomys_tridecemlineatus Tinimomys Navajovius Loxodonta_africana
Chlorocebus_sabaeus Tarsius_syrichta Mus_musculus Ailuropoda_melanoleuca
Canis_lupus_familiaris Felis_catus Mustela_putorius Myotis_lucifugus
Sorex_araneus Dipodomys_ordii

;

END;

BEGIN CHARACTERS;

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7 8 9 A B C D E F G H J K M N P Q R S T U V W X Y Z a b c d e f g h j k m n p";

CHARSTATELABELS

1 'Ratio of upper incisor-canine diastema to M2 length - continuous'
/ less_than_one_molar_length greater_than_or_equal_to_one_molar_length, 2
'Ratio of upper canine-premolar diastema to M2 length - continuous' /
less_than_one_molar_length greater_than_or_equal_to_one_molar_length, 3 'Ratio
of lower incisor-canine diastema to m2 length - continuous' /

less_than_one_molar_length greater_than_or_equal_to_one_molar_length, 4 'Area of upper ultimate premolar to area of M1 - continuous' / P4_smaller_than_or_equal_to_M1 P4_larger_than_M1, 5 'Ultimate lower premolar talonid:trigonid width - continuous' / talonid_narrower_than_trigonid talonid_wider_than_or_equal_to_trigonid, 6 'Ratio of penultimate:ultimate premolar length - continuous' / p3_shorter_or_equal_than_p4 p3_longer_than_p4, 7 'M2 length:width ratio - continuous' / 'length greater than or equal to width (x>1)' width_greater_than_length, 8 'Percentage of M2 width taken up by stylar shelf - continuous' / more_than_25%_of_width less_than_25%_of_width, 9 'Ratio of M2 metacone:paracone height - continuous' / metacone_smaller_than_paracone metacone_equal_or_larger_than_paracone, 10 'Percentage of tooth width taken by conular region - continuous' / less_than_50%_of_width more_than_50%_of_width, 11 'Protocone:paracone anteroposterior length - continuous' / subequal_or_smaller_than_paracone larger_than_paracone, 12 'Protocone:paracone height - continuous' / protocone_smaller_than_paracone protocone_larger_than_or_equal_to_paracone, 13 'Hypocone:protocone height - continuous' / lower_than_protocone equal_to_or_larger_than_protocone, 14 'M3 width:M2 width - continuous' / M3_larger_than_or_equal_to_M2 M3_smaller_than_M2, 15 'M3 length:M2 length - continuous' / M3_smaller_than_M2 Subequal_or_M3_bigger, 16 'm2 paraconid height:metaconid height - continuous' / shorter equal_or_taller, 17 'Paraconid-protoconid-metaconid angle - continuous' / open_paracristid_protocristid_angle_more_than_0.873_radians less_than_0.873_radians, 18 'Trigonid distal wall angle from vertical - continuous' / less_than_or_equal_to_1.7_radians greater_than_1.7_radians, 19 'Protoconid height:paraconid height - continuous' / tallest_cusp_on_trigonid equal_to_or_smaller_than_paraconid, 20 'Trigonid height:talonid height - continuous' / twice_or_more_the_height_of_talonid less_than_twice_the_height_of_talonid, 21 'Trigonid length:talonid length - continuous' / longer_than_talonid shorter_than_talonid, 22 'Talonid width:trigonid width - continuous' / narrower_than_trigonid wider_or_equal_to_trigonid, 23 'm2 width as percentage of length - continuous' / 'wide, maximum width >60% max length' less_than_60%_maximum_length, 24 'm3 area:m2 area - continuous' / subequal_or_larger smaller, 25 'Width of coronoid process to m2 width - continuous' / broad_roughly_2_molar_lengths_narrow_subequal_to_or_less_than_molar_length_, 26 'Angle of coronoid process to alveolar plane - continuous' / greater_than_1.745_radians less_than_1.745_radians, 27 'Infraorbital canal length - continuous' / long_more_than_one_molar_length_ short_subequal_or_less_than_one_molar_length_, 28 'Proportion of skull anterior to the orbit - continuous' / less_than_one_third more_than_one_third, 29 'Frontal:parietal length - continuous' / shorter_than_parietal longer_than_parietal, 30 'Angle of suture of squamosal with petrosal or exoccipital, in ventral view - continuous' / greater_than_2.182_radians less_than_2.182_radians, 31 'Stapedial ratio - continuous' / rounded_less_than_1.8 ellipital_more_than_1.8, 32 'Pars cochlearis length:skull length - continuous' / greater_than_or_equal_to_12%_skull_length less_than_12_%_skull_length, 33 External_auditory_meatus / absent present, 34 'Length of EAM as proportion of basicranial width at level of EAM - continuous' / less_than_15%_of_the_basicranial_width_at_level_of_EAM more_than_15%_of_width, 35 'Separation between occipital condyles: basioccipital width - continuous' / 'large, more than 50% of basioccipital width' 'small, less than 50% of basioccipital width', 36 'Angle between humeral trochlea and capitulum - continuous' / 'trochlea slopes distomedially, angle greater than 30 degrees' 'trochlea flat, angle between trochlea and capitulum less than 30 degrees', 37 'Longest metacarpal length:radial length - continuous' / much_shorter_than_radius at_least_50%_the_length_of_the_the_radius, 38 'Angle between pubis and ilium/ischium - continuous' / Less_than_2.879_radians More_than_2.879_radians, 39 'Distal femoral width:distal femoral depth (mediolateral:anteroposterior) - continuous' / Wider_than_deep Deeper_than_wide, 40 'Tibia length to femoral length - continuous' / equal_or_tibia_shorter_than_femur femur_shorter_than_tibia, 41 'Astragalus angle bet med and lat tib facets - continuous' / 3.141_radians_or_more less_than_3.141_radians, 42 'Astragalus angle betw fib facet and lat tib facet - continuous' / 3.141_radians_or_more less_than_3.141_radians, 43 'Angle of

mediolateral axis of cuboid facet to the calcaneal long axis - continuous' /
 less_than_1.222_radians more_than_1.222_radians, 44 'Proportions of cuboid facet
 - continuous' / deeper_than_wide depth_and_width_subequal_or_wider_than_deep,
 45 'First metatarsal reduction - continuous' /
 First_metatarsal_present_and_not_substantially_reduced 'Highly reduced in form
 of small splint or nodule, or absent', 46 'Fifth metatarsal reduction -
 continuous' / First_metatarsal_present_and_not_substantially_reduced 'Highly
 reduced in form of small splint or nodule, or absent', 47 'Astragalar trochlear
 proportions - continuous' / wider_than_long subequal_or_longer_than_wide, 48
 'Femorotarsal index - continuous' / 'not elongated, femorotarsal index less
 than 40' femorotarsal_index_greater_than_40, 49 Teeth / present absent, 50
 Teeth_types /
 differentiated_into_morphological_types incisors canines premolars molars_with_e
 namel simple_peg_like_teeth, 51 Lower_postcanine_loci / 7_or_more 6_or_fewer,
 52 Upper_diastema_between_incisors_and_canines / present absent, 53
 Upper_diastema_between_canines_and_premolars / present absent, 54
 Lower_diastema_between_incisors_and_canines / present absent, 55 'Lower canine-
 premolar diastema' / absent present, 56 Incisor_shape /
 root_and_crown_are_straight_and_continuous_in_length
 root_and_crown_form_a_continuous_curve, 57 Upper_incisors / 4_or_more
 3_or_fewer, 58 Lower_incisors / 3_or_more 2_or_fewer, 59
 Upper anteriormost incisors aveoli / approximating separated_by_broad_gap, 60
 'Basolingual cusp (posterocone) on I1' / weak_or_absent 'well-developed', 61
 'Ratio of crown height of anterior incisors (I1:I2) - continuous' /
 I1_crown_height_shorter_than_I2 crown_height_subequal_or_I1_longer_than_I2, 62
 Compression_of_anteriormost_upper_incisor / absent present, 63
 Direction_of_compression_of_anteriormost_upper_incisor / mediolateral
 anteroposterior, 64 Anteriormost_upper_incisor_cuspate_one_major_one_minor /
 absent present, 65 Upper_anteriormost_incisor_root / rooted hypsodont, 66
 Extent_of_incisor / premaxilla maxilla, 67 I1_root_orientation /
 vertically_implanted horizontally_implanted, 68 I2_presence / present absent,
 69 I2_size / small enlarged, 70 I2_morphology / 'non-gliriform' gliriform, 71
 I2_roots / rooted hypsodont, 72
 Enamel_distribution_on_upper_and_lower_anterior_dentition / surrounds_tooth
 discontinuous_posteriorly, 73 Ultimate_upper_incisor_contacts_premaxilla /
 present absent, 74 Ultimate_upper_incisor_contacts_maxilla / absent present, 75
 Size_of_I3_relative_to_I1_and_I2 / Subequal_or_smaller Enlarged, 76 'Number of
 cusps on i1-3' / One Two, 77 Lower_anteriormost_incisor_size /
 smaller_or_equal_to_subsequent greatly_enlarged, 78
 Compression_of_anteriormost_lower_incisor / absent present, 79
 Direction_of_compression_of_anteriormost_lower_incisor / mediolateral
 anteroposterior, 80 Anteriormost_lower_incisor_cuspate_one_major_one_minor /
 absent present, 81 Basal_accessory_cusps / present absent, 82
 Lower_anteriormost_incisor_procumbency / absent present, 83
 Lower_anteriormost_incisor_growth / determinate ever_growing, 84
 Extent_of_i1_root / p3_or_anterior p4_or_posterior, 85 i2_presence / present
 absent, 86 i2_size / small large, 87 i2_morphology / 'non-gliriform'
 gliriform, 88 i2_roots / present absent, 89 Lower_post._incisors_procumbency /
 absent present, 90 Staggered_lower_incisor / absent present, 91 Upper_canine /
 present absent, 92 Upper_canine_size / enlarged small, 93 Upper_canine_roots /
 two one, 94 Upper_canine_morphology / caniniform incisiiform_or_premolariform,
 95 Lower_canine / present absent, 96 Lower_canine_size / enlarged small, 97
 Lower_canine_roots / two one, 98 Lower_canine_procumbency / absent present, 99
 Deciduous_canine / present absent, 100 Lower_canine_morphology / caniniform
 incisoriform_or_premolariform, 101 Lower_canine_lateral_divergence / absent
 present, 102 Lower_premolars / four_or_more three_or_fewer, 103
 P1p1_P2p2_replacement / present absent, 104 Tall_trenchant_premolar / present
 absent, 105 Position_of_tall_trenchant_premolar / in_ultimate_premolar_position
 in_penultimate_premolar_position, 106 P1_procumbency / absent present, 107
 P1_roots / one two_or_more, 108 P1_posterior_diastema / absent present, 109
 P_c_roots_only_for_taxa_with_five_ / two one, 110 P2_size / 'not reduced,
 double rooted, parastyle' smaller_and_simplified, 111
 Penult_upper_premolar_protocone / absent present, 112
 Size_of_penultimate_upper_premolar_protocone / small_lingual_bulge

with_enlarged_basin, 113 Penult_upper_premolar_metacone / absent present, 114
 P4_morphology / premolariform molarised, 115 Degree_of_P4_molarisation /
 semimolariform submolariform, 116 P4_metastyle / absent_or_weak well_developed,
 117 Penult_upper_premolar_para_metastyle / absent_or_weak well_developed, 118
 Penult_upper_premolar_roots
 / one_or_two three_or_four, 119 Base_of_P4_in_buccal_view / level 'inclined,
 bridging split-level dentition with bases of more mesial teeth superior to molar
 bases', 120 P4_entocingulum / present absent_or_very_small, 121
 Ult_upper_premolar_protocone / absent present, 122
 Ult_upper_premolar_protocone_height_to_paracone / smaller_than_paracone
 equal_to_or_larger_than_paracone, 123 Ult_upper_premolar_metacone / absent
 present, 124 Ult_upper_premolar_metacone_size / swelling large, 125
 Ult_upper_premolar_para_metastylar_lobe / absent present, 126
 Relative_sizes_of_parastylar_and_metastylar_lobes / metastylar_larger
 subequal_or_parastylar_larger, 127 Ult_upper_premolar_precingulum / absent
 present, 128 Ult_upper_premolar_postcingulum / absent present, 129
 Ult_upper_premolar_postcingulum_position / lower_than_protocone
 forming_hypoconal_shelf, 130 Ult_upper_premolar_conules / weak_or_absent
 prominent, 131 'P4/m1 carnassial pair' / absent present, 132
 P4_protocone_position_to_paracone / lingual_to_paracone
 mesiolingual_to_paracone, 133 p1_orientation / in_line_with_jaw_axis oblique,
 134 First_lower_premolar_roots / two one, 135 p1_p2_diastema / absent
 present_subequal_to_one_tooth_root_diameter, 136 p3_morphology / 'simple,
 premolariform' partly_or_completely_molarised, 137
 p_c_size_only_for_taxa_with_5_premolars / longer_than_p2 shorter_than_p2, 138
 p_c_roots_only_for_taxa_with_5_ / two one, 139
 Penult_lower_premolar_paraconid / absent present, 140
 Penult_lower_premolar_metaconid / absent present, 141
 Size_of_penultimate_lower_premolar_metaconid / swelling separate, 142
 Penult_lower_premolar_talonid_cusps / one two_or_more, 143
 Ult_lower_premolar_inflation / uninflated strongly_inflated, 144
 Ultimate_lower_premolar_shape / mesiodistally_short_but_tall elongate_and_low,
 145 Ult_lower_premolar_paraconid / absent present, 146
 Ultimate_lower_premolar_paraconid_height / low high, 147
 Ult_lower_prem_metaconid / absent present, 148
 Size_of_ultimate_lower_premolar_metaconid / swelling separate, 149
 Ultimate_lower_premolar_protoconid / erect retroflexed, 150
 Ult_lower_premolar_talonid_cusps / one two_or_more, 151
 Ratio_of_areas_of_p4_to_m1 / p4_subequal_or_larger_than_m1 m1_larger_than_p4,
 152 Ultimate_lower_premolar_anterolingual_cingulid / absent present, 153
 p4_morphology / premolariform molarised, 154 Molars / four_or_more
 three_or_fewer, 155 Lower_molar_size_increasing_posteriorly /
 moderate_posterior_increase no_change_or_marked_posterior_decrease, 156
 Robust_molar_cusps / absent present, 157 Molar_cusps_linked_as_crests / absent
 present, 158 Presence_of_metastylar_and_parastylar_lobes / present absent, 159
 Metastylar_and_parastylar_lobe_labial_extent / parastylar_more_labial
 subequal_or_metastylar_more_labial, 160
 Upper_first_molar_parastylar_lobe_position_to_paracone / anterolabial anterior,
 161 M1_parastylar_hook_plus_cusp / absent present, 162 Parastylar_lobe_width /
 more_than_30%_total_width less_than_30%, 163 Development_of_M2_parastylar_region
 / 'preparacrista short and mesially directed, parastyle close to paracone'
 'preparacrista elongate ad buccally directed, parastyle separate from paracone',
 164 Stylocone / absent present, 165 Preparastyle / absent present, 166
 Styler_cusp_A / present absent, 167 Styler_cusp_B_to_paracone / absent
 present, 168 Styler_cusp_C_mesostyle_ / absent present, 169 Styler_cusp_D /
 absent present, 170 Styler_cusp_E / present absent, 171 M1_metastyle_size /
 small elongate_and_salient, 172 M1_metastyle_position / distal_to_metacone
 distobuccal_to_metacone, 173 Styler_cusp_E_position / directly_lingual_to_D
 distal_to_D, 174 Preparacingulum / absent present, 175
 Preparacingulum_continuosity /
 interrupted_between_stylar_margin_and_paraconule continuous_with_preprotocrista,
 176 M2_preparaconule_crista / present absent, 177 M2_premetaconule_crista /
 present absent, 178 M2_premetaconule_crista_direction /
 directed_mesio Buccally_towards_centrocrista_notch_between_paracone_and_metacone

'directed buccally toward metacone, joining postprotocrista and metaconule', 179
 Ectocingula_on_upper_molars / present absent, 180 Deep_ectoflexus / present
 absent, 181 Presence_of_deep_ectoflexus_on_penultimate_and_succeeding_molars /
 present absent, 182 Metacone_presence / present absent, 183
 Metacone_position_to_paracone / labial approximately_at_same_level_or_lingual,
 184 Paracone_and_metacone_bases / adjoined separate, 185 Preparacrista /
 strong weak_or_absent, 186 Preparacrista_1 / cuspsate not_cuspsate, 187
 Centrocrista / present absent, 188 Centrocrista_height / low elevated, 189
 Centrocrista_morphology / straight V_shaped, 190 Postmetacrista / present
 absent, 191 Postmetacrista_position /
 extends_from_side_of_metacone_to_metastyle salient_from_base_of_metacone, 192
 Postmetacrista_cusps / cuspsate not_cuspsate, 193 Preprotocrista / present
 absent, 194 Preprotocrista_labial_extent /
 does_not_extend_labially_beyond_paracone does_extend_labially_beyond_paracone,
 195 Postprotocrista / present absent, 196 Postprotocrista_contact_with_metacone
 / extends_to_mid_lingual_surface_of_metacone
 extends_to_distal_surface_of_metacone, 197 Postprotocrista_to_cristid_obliqua /
 absent present, 198 Paracristid_carnassial_notch / absent present, 199
 Postprotocrista_to_cristid_obliqua_on_m3 / absent
 connects_protocone_to_cristid_obliqua, 200 'p4/m1 carnassial pair' / absent
 present, 201 Postvallum_wear_only_to_first_rank_postmetacrista / present
 absent, 202 Postvallum_wear_extends_to_metastyle / absent present, 203
 Paraconule / absent present, 204 Paraconule_position /
 prominent_closer_to_protocone prominent_midway_or_closer_to_paracone, 205
 Metaconule / absent present, 206 Metaconule_position /
 prominent_closer_to_protocone prominent_midway_or_closer_to_metacone, 207
 Internal_conular_cristae / indistinctive distinctive_and_wing_like, 208
 Protocone / absent present, 209 Presence_of_trigonid_basin_with_protocone /
 absent present, 210 M2_protocone_length / 'mesiodistally compressed, lingual
 margin of crown v-shaped' 'mesiodistally broadened, lingual margin of crown u-
 shaped', 211 Procumbent_protocone / absent present, 212 'Labiolingual position
 of protocone, as percentage of width from lingual edge - continuous' /
 no_shift_10_20%_ shift_more_than_20%, 213 Protocone_position_to_paracone /
 transversely_aligned_with_paracone between_paracone_and_metacone, 214
 Protocone_apex_position / 'at lingual margin of crown, lingual face vertical'
 'buccal to lingual margin, sloping or horizontal', 215
 Precingulum_on_upper_molars / absent present, 216
 Extent_of_precingulum_on_upper_molars / does_not_reach_labially_past_paraconule
 reaches_labially_past_paraconule, 217 Postcingulum_on_upper_molars / absent
 present, 218 Postmetaconule_crista / present absent, 219
 Postmetaconule_crista_to_postcingulum /
 no_contact_between_postmetaconule_crista_and_postcingulum
 contact_buccal_to_metacone, 220 Width_of_postcingulum / narrow expanded, 221
 Labial_extent_of_postcingulum_on_upper_molars /
 does_not_labially_reach_metaconule labially_reaches_metaconule_or_beyond, 222
 Hypocone_on_postcingulum / absent present, 223
 Position_of_hypocone_to_protocone / even_with_protocone lingual_to_protocone,
 224 Connection_between_M2_postvallum_and_hypocone / absent present, 225
 Position_of_connection_of_postvallum_and_hypocone /
 between_apices_of_protocone_and_hypocone
 between_apices_of_hypocone_and_postprotocrista_or_metaconule, 226
 M2_pseudohypocone / absent present, 227 Pre_and_postcingulum / separated
 continuous, 228 Upper_molar_roots / three four_or_more, 229
 Hypoconule_in_posterolingual_quadrant / absent present, 230
 Metacone_present_on_M3 / present absent, 231 Metastyle_present_on_M3 / present
 absent, 232 Last_upper_molar_roots / two_or_fewer three_or_more, 233
 Lingual_root_on_upper_molars / supporting_paracone supporting_trigon, 234
 Last_upper_molar_metastylar_lobe / absent present, 235 m2_hypsodonty / 'not
 hypsodont, talonid near base of crown' 'hypsodont, talonid far above base of
 crown', 236 Paraconid / distinctive vestigial_or_absent, 237
 Paraconid_separation_from_metaconid / 'paraconid and metaconid well separated,
 trigonid open' paraconid_and_metaconid_connected, 238 Shape_of_paraconid /
 'mesiodistally compressed, crestiform' 'basally swollen (conical)', 239
 Position_of_paraconid / mesial_to_metaconid_or_more_lingual

mesial_to_protocristid_or_more_buccal, 240
 Mesiolingual_vertical_crest_of_paraconid / rounded forming a keel, 241
 Paracristid / notched continous_curve, 242 m2_paracristid_flatness / 'salient, paracristid erect and crestiform' 'flattened, paracristid forms a blunt shelf', 243 Protoconid_position / anterolateral_to_metaconid in_line_with_or_posterolateral_to_metaconid, 244
 Metalophid_formation_between_protoconid_and_metaconid / absent present, 245
 Degree_of_development_of_metalophid / moderate strong, 246
 Protocristid_orientation / oblique transverse, 247 m2_protocristid_strength / 'weak, trigonid notch between protoconid and metaconid is deep' 'strong, forming well-developed, elevated transverse shearing crest', 248
 Mesio Buccal_cingular_cusp_f / present absent, 249
 Cingular_shelf_on_cingular_cusp / present absent, 250
 Extent_of_cingular_shelf_on_cingular_cusp / 'distinct and posteroventral, not reaching buccal border' shelf_continues_along_buccal_border, 251
 Additional_conulid_on_distal_slope_of_metaconid / absent present, 252 Talonid / small_heel multicuspidated_basin, 253 Talonid_depth / 'deep, cusps in strong relief' shallow, 254 Cristid_obliqua / present absent, 255
 Completeness_of_cristid_obliqua / incomplete complete, 256
 Attachment_site_of_cristid_obliqua / at_notch_to_protocristid_or_more_lingual below_protoconid_or_more_labial, 257 m2_hypoconid / absent present, 258
 Hypoconulid / absent present, 259
 Hypoconulid_size / well_developed reduced, 260 m3_hypoconulid_development / unenlarged_relative_to_m1_and_m2_hypoconulids enlarged, 261 Hypoconulid_position / 'buccally placed, in line with trigonid notch' in_posteromedial_or_lingual_position, 262
 Separation_of_m1_hypoconid_and_hypoconulid_apices / 'appressed, hypocristid short' 'well-separated, hypocristid elongate', 263 Labial_edge_of_lower_molars / edge_emarginated_between_protoconid_and_hypoconid edge_straight, 264
 m2_hypoconulid_shape / 'hypoconulid relatively conical, separated from hypoconid by notches or inflections' 'hypoconulid crestiform, forming a low, smooth border to the distal margin of the talonid', 265 Hypoconulid_of_m3 / present absent, 266 Shape_of_hypoconulid_of_last_molar / short tall, 267
 Entoconid / absent present, 268 Sizr_of_entoconid_relative_to_hypoconid / smaller subequal_to_or_larger, 269 Position_of_entoconid_on_m2 / at_lingual_margin_of_crown buccal_to_lingual_margin, 270
 Postcristid_between_entoconid_and_hypoconulid_taller_than_hypoconulid_and_nearly_transverse / absent present, 271 m2_entoconid_contact_with_metacristid / does_not_wrap_around_base_of_metaconid entoconid_wraps_around_base_of_metaconid, 272 m2_entoconid_aligning_with_postmetacristid / aligns_with_postmetacristid does_not_align_with_postmetacristid, 273 Mesoconid / absent present, 274
 Hypolophid / absent present, 275 Labial_postcingulid / absent present, 276
 m1_metaconid_size / taller_or_subequal_to_protoconid smaller_than_protoconid, 277 m2_metaconid_size / taller_or_subequal_to_protoconid subequal_to_protoconid, 278 m3_metaconid_size / taller_or_subequal_to_protoconid subequal_to_protoconid, 279
 m2_metaconid_inflation / 'uninflated, metaconid not expanded into mesiolingual talonid basin' 'inflated, base of metaconid expanded into basin', 280
 m2_postentocristid_orientation / directed_toward_hypoconulid 'directed toward hypoconid, does not contact hypoconulid', 281 m2_hypocristid_orientation / Oblique_to_the_mesiodistal_axis_of_the_tooth transverse_or_nearly_transverse, 282 m2_buccal_distention_of_enamel_relative_to_superior_margin_of_dentary / 'weak or absent, buccal enamel does not extend further basally than lingual enamel' 'stronger, buccal enamel extends further basally than lingual enamel', 283 Reentrant_grooves / present absent, 284 'Position of reentrant grooves, where present' / proximal distal, 285 Presence_of_mental_foramina / present absent, 286 Number_of_mental_foramina / two_or_more one, 287
 Anteriormost_mental_foramen / below_p1_or_more_anterior below_p2_or_more_posterior, 288 Posteriormost_mental_foramen / below_penultimate_premolar_or_more_anterior below_ultimate_premolar_or_more_posterior, 289 Depth_of_mandibular_body / shallow_and_long deep_and_short, 290 Ramus_of_mandible / approximately_same_dorsoventral_thickness_throughout deepens_below_cheek_teeth, 291 Space_between_ultimate_molar_and_coronoid_process / absent present, 292

Coronoid_process_height / higher_than_condyle even_with_or_lower_than_condyle,
 293 Coronoid_crest / absent present, 294 Coronoid_crest_lateral_flare /
 laterally_flaring straight, 295 Ventral_border_of_masseteric_fossa / absent
 present, 296 Height_of_masseteric_fossa_crest /
 Less_than_half_height_of_the_body More_than_half_height_of_the_body, 297
 Anteroventral_extension_of_masseteric_fossa / absent
 extending_anteriorly_onto_body, 298 Labial_mandibular_foramen / absent present,
 299 Condylod_crest / absent present, 300 Posterior_shelf_of_masseteric_fossa /
 absent present, 301 Lower_jaw_angle / present absent, 302
 Lower_jaw_angle_medial_inflection / present absent, 303
 Lower_jaw_angle_ventral_inflection / present absent, 304 Lower_jaw_angle_length
 / length_less_than_ramus_length equal_or_greater_than_ramus_length, 305
 Lower_jaw_angle_shape / tapers_base_wider_than_tip rounded_base_as_wide_as_tip,
 306 Angular_process_vertical_position / posteroventral_border
 posterodorsal_near_or_above_alveolar_plane, 307
 Angular_process_to_condylar_process / level_with_or_posterior_to anterior, 308
 Angular_process / no_dorsal_hook presence_of_dorsal_hook, 309
 Condylar_process / peduncle_posteriorly_directed absent, 310
 Deep_concavity_between_condylod_and_condylar_processes / absent present, 311
 Condyle_shape / ovoid_or_cylindrical anteroposteriorly_elongate, 312
 Condyle_position_to_tooth_row / above_tooth_row at_or_below_tooth_row, 313
 Mandibular_symphysis / tapered deep, 314
 Mandibular_symphysis_posterior_extent / p2_or_more_posterior
 p1_or_more_anterior, 315 Mandibular_symphysis_fused / absent present, 316
 _Meckel_s_sulcus / present absent, 317 Curvature_of_Meckel_s_sulcus /
 parallel_to convergent_on_ventral_border_of_body, 318 _Coronoid_facet / present
 absent, 319 Mandibular_foramen / ventrally_placed
 recessed_dorsally_from_ventral_margin, 320
 Mandibular_foramen_dorsal_to_prominent_oblique_subpterygoid_ridge / present
 absent, 321 Septomaxilla / present absent, 322
 Premaxilla_posterodorsal_process_dorsal_extent / does_not does_reach_nasal, 323
 Premaxilla_posterodorsal_process_extends_beyond_canine / absent present, 324
 Premaxilla_posterodorsal_process_contacts_frontal / absent present, 325
 Posterodorsal_process_of_premaxilla_with_distinct_finger_like_extension /
 present absent, 326 Lateral_margin_of_paracanine_fossa / formed_by_maxilla
 maxilla_and_premaxilla, 327 Lateral_surface_of_maxilla /
 flat_or_slightly_concave highly_concave, 328 Exit_s_of_infraorbital_canal /
 multiple single, 329 Infraorbital_foramen /
 to_penultimate_premolar_or_more_anterior
 dorsal_to_ultimate_premolar_or_more_posterior, 330 Supraorbital_process /
 'absent, no projection laterally from sagittal plane' 'present, elongate and
 tabular', 331 Flaring_of_cheeks_behind_infraorbital_foramen / present absent,
 332 Nasal / widest_posteriorly sides_sub_parallel_or_widest_anteriorly, 333
 Nasal_overhangs_external_nasal_aperture / present absent, 334
 Naso_frontal_suture_with_medial_process_of_frontals_wedged_between_nasals /
 present absent, 335 Nasofrontal_suture_position /
 posterior_to_or_even_with_anterior_orbital_rim anterior_to_orbital_rim, 336
 Nasal_foramina / present absent, 337 Elongation_of_face / short
 intermediate_or_long, 338 Fronto_maxillary_contact_on_rostrum / absent present,
 339 Maxillary_process_of_frontal / vestigial_or_absent elongate_and_thin, 340
 Lacrimal / present absent, 341 Facial_process_of_lacrimal /
 large_triangular_and_pointed_anteriorly small_rectangular_or_crescentic, 342
 Lacrimal_tubercle / present absent, 343 Lacrimal_foramen_exposed_on_face /
 present absent, 344 Lacrimal_foramen_number / two one, 345
 Maxillary_contribution_to_lacrimal_foramen / absent present, 346
 Jugal_contribution_to_lacrimal_foramen / absent present, 347
 Translacrimal_canal / absent present, 348 Palate / flat vaulted, 349
 Embrasure_pits_on_palate / absent present, 350 Premaxilla_palatal_process /
 does_not does_reach_nearly_to_canine_alveolus, 351
 Premaxillary_maxillary_suture_on_palate /
 transverse_or_wedge_shape_pointing_anteriorly wedge_shaped_pointing_posteriorly,
 352 Incisive_foramen / small_length_of_1_or_2_incisors
 longer_than_1_or_2_incisors, 353 Incisive_foramen_composition /
 between_maxilla_and_premaxilla within_premaxilla, 354 Palatal_vacuties /

absent present, 355 Single_large_palatine_foramen / present
 multiple_small_foramina_or_absent, 356 Position_of_major_palatine_foramen /
 within_palatine some_contribution_from_the_maxilla, 357
 Anterior_extent_of_palatine_on_palate / posterior_to_or_even_with_first_molar
 anterior_to_first_molar, 358 Palatal_expansion_to_last_molar / posterior
 even_or_anterior, 359 Postpalatine_torus / absent present, 360
 Posterior_nasal_spine / weak_or_absent prominent, 361 Minor_palatine_foramen /
 absent_or_small large_with_posterior_bony_bridge, 362
 Minor_palatine_foramen_composition / palatine_or_palatine_maxilla_
 palatine_and_pterygoid, 363 Maxilla_expanded_posterior_to_last_molar / absent
 present, 364 Posterior_edge_of_anterior_zygomatic_root /
 aligned_with_premolars_or_anterior_molars
 aligned_with_last_molar_or_more_posterior, 365 Zygomatic_process_of_maxilla /
 present vestigial, 366 Zygomatic_process_of_jugal / directed_posterolaterally
 directed_posteriorly, 367 Jugal / present absent, 368 Jugal_1 /
 contributes_toanteroventral_orbit_and_zygoma contributes_to_zygoma, 369
 Maxillary_jugal_contact_bifurcated / absent present, 370 Jugal_lacrimal_contact
 / present absent, 371 Zygomatic_arch_completeness / complete incomplete, 372
 Thickness_of_zygomatic_arch / stout delicate, 373
 Molar_roots_exposed_in_orbit_floor / absent present, 374
 Position_of_orbit_relative_to_tooth_row / over_M1_or_more_anterior
 over_M2_or_more_posterior, 375 Palatine_reaches_infraorbital_canal / present
 absent, 376 Ventral_edge_of_orbit / projects_dorsally flared_laterally, 377
 Lacrimal_contributes_to_maxillary_foramen / present absent, 378
 Groove_connects_maxillary_and_sphenopalatine_foramina / absent present, 379
 Contribution_of_the_palatine_to_sphenopalatine_foramen / present absent, 380
 Contribution_of_maxilla_to_sphenopalatine_foramen / present absent, 381
 Contribution_of_frontal_to_sphenopalatine_foramen / present absent, 382
 Sphenopalatine_foramen_proximal_to_maxillary_foramen / absent present, 383
 Maxilla_excluded_from_medial_orbital_wall / present absent, 384
 Frontal_and_maxilla_contact_in_medial_orbital_wall / absent present, 385
 Orbital_process_of_palatine / present
 absent_palatine_excluded_from_medial_wall_or_thin_sliver_in_ventromedial_wall,
 386 Ethmoid_exposure_in_orbit / absent present, 387 Ethmoid_foramen /
 between_frontal_and_orbitosphenoid within_frontal, 388
 Foramen_for_frontal_diploic_vein / absent present, 389
 Frontal_foramen_on_skull_roof / absent present, 390 Postorbital_process /
 present absent, 391 Postorbital_process_composition
 / frontal_parietal, 392 Postorbital_bar / absent present, 393
 Dorsal_process_of_jugal / weak_or_absent strong, 394 Separate_optic_foramen /
 absent present, 395 Size_of_optic_foramen_relative_to_trigeminal_nerve /
 smaller_than_trigeminal_nerve subequal_to_trigeminal_nerve, 396
 Optic_foramen_position / narrowly_separated_from_sphenorbital_fissure
 broadly_separated_from_sphenorbital_fissure, 397 Orbitosphenoid / expanded
 confined_to_optic_forament_and_vicinity, 398
 Sphenorbital_fissure_confluent_with_foramen_rotundum / absent present, 399
 Suboptic_foramen / absent present, 400 Orbitotemporal_canal / present absent,
 401 Frontal_alisphenoid_contact / absent_or_minimal_contact
 more_extensive_contact_50%_of_dorsal_border, 402 Frontoparietal_suture /
 with_anterior_process transverse_or_with_posterior_process, 403
 Position_of_frontoparietal_suture_process / off_the_midline on_the_midline, 404
 Temporal_lines_meet_to_form_sagittal_crest / present absent, 405
 Interparietal / absent present, 406 Nuchal_crest /
 level_with_or_anterior_to_foramen_magnum extends_posteriorly, 407
 Anterior_lamina_on_side_wall / present absent, 408 Squama_of_squamosal /
 absent present, 409 Foramina_for_temporal_rami / present absent, 410
 Position_of_foramina_for_temporal_rami / on_petrosal 'on_parietal_and/or
 squamosal', 411 Choanae / as_wide_as_posterior_palate narrower, 412
 Vomer_contacts_pterygoid / present absent, 413
 Pterygoids_contact_on_midline_in_roof_of_basipharyngeal_canal / present absent,
 414 Pterygopalatine_crests / present absent, 415
 Midline_crest_in_basipharyngeal_canal / absent present, 416
 Entopterygoid_process / absent present, 417 Length_of_entopterygoid_process /
 ends_at_anterior_basisphenoid approaches_ear_region, 418

Midline_cordiform_eminence_on_basisphenoid / absent present, 419
 Ectopterygoid_process_of_alisphenoid / absent present, 420
 Length_of_ectopterygoid_process_of_alisphenoid / ends_at_anterior_basisphenoid
 approaches_ear_region, 421 Ectopterygoid_process / Long_crest small_process,
 422 Transverse_canal_foramen / absent present, 423
 Exit_for_maxillary_nerve_to_alisphenoid / behind_or_within in_front, 424
 Number_of_mandibular_nerve_exits / two_or_more one, 425
 Foramen_ovale_composition / in_petrosal contribution_from_the_alisphenoid, 426
 Foramen_ovale_position / on_lateral_wall_of_braincase
 on_ventral_surface_of_skull, 427
 Foramen_ovale_position_relative_to_glenoid_fossa / anterior_to_glenoid_fossa
 medial_to_glenoid_fossa, 428 Dorsal_edge_of_braincase_relative_to_occlusal_plane
 / slopes_posterodorsally_or_level curves_posteroventrally, 429
 Alisphenoid_canal / absent present, 430
 Posterior_opening_of_alisphenoid_canal / separated_from_foramen_ovale
 in_common_depression_with_foramen_ovale, 431
 Position_of_jaw_articulation_to_fenestra_vestibuli / at_same_level in_front,
 432 Preglenoid_process / absent present, 433 Glenoid_fossa / on_zygoma
 partially_on_braincase, 434 Glenoid_fossa_concavity / concave not_concave, 435
 Glenoid_fossa_anteroposteriorly_short / not_short short, 436
 Glenoid_fossa_vertical_position / even_with_central_stem significantly_higher,
 437 Glenoid_fossa_to_basioccipital /
 in_same_vertical_plane_or_dorsal_to_basioccipital ventral_to_basioccipital, 438
 Glenoid_process_of_jugal / present absent, 439
 Articular_facet_on_glenoid_process / present absent, 440
 Glenoid_process_of_alisphenoid / absent present, 441 Postglenoid_process /
 absent present, 442 Postglenoid_foramen / absent_or_vestigial present, 443
 Postglenoid_foramen_size / large similar_to_fenestra_vestibuli, 444
 Postglenoid_foramen_anteroposterior_position /
 present_behind_postglenoid_process
 present_medial_to_postglenoid_process_within_glenoid_fossa, 445
 Postglenoid_foramen_mediolateral_position / on_ventral_aspect_of_braincase
 on_lateral_aspect_of_braincase, 446 Postglenoid_foramen_composition /
 within_squamosal behind_squamosal, 447 Suprameatal_foramen / absent present,
 448 Ectotympanic_part_of_the_meatal_tube / absent present, 449
 Length_of_ectotympanic_part_of_the_meatal_tube / short long, 450
 Entoglenoid_process_of_squamosal / absent present, 451
 Entoglenoid_process_contact_with_postglenoid_process /
 separate_from_postglenoid_process continuous_with_postglenoid_process, 452
 Posttympanic_crest_of_squamosal / absent present, 453
 Posterior_edge_of_squamosal / flat sharply_upturned, 454 Carotid_foramen /
 present absent, 455 Position_of_carotid_foramen / within_basisphenoid
 between_basisphenoid_and_petrosal, 456 Cavum_eptericum / floored
 open_as_piriform_fenestra, 457 Petrosal_contributes_to_cavum_eptericum /
 present absent, 458 Alisphenoid_tympanic_process / absent present_low, 459
 Basisphenoid_tympanic_process / absent present, 460
 Basisphenoid_tympanic_process_position / Contributes_to_anteromedial_middle_ear
 Anterior_to_middle_ear, 461
 Tympanic_process_or_medial_section_of_the_caudal_TP_of_petrosal / absent
 present, 462 Length_of_medial_section_of_caudal_TP_of_petrosal / short 'long,
 contacting_tympanohyal', 463 Lateral_section_of_the_caudal_TP_of_petrosal /
 tiny_or_absent 'well-developed, separating stylomastoid foramen in two passages
 for facial and vagus nerves', 464 Basicochlear_fissure / closed patent, 465
 Epitympanic_wing_medial_to_promontorium / absent present, 466
 Thickness_of_epitympanic_wing / flat thickened, 467
 Rostral_Tympanic_Process_of_Petrosal / vestigial_or_absent
 contributes_to_bulla, 468 Internal_carotid / present absent, 469
 Course_of_internal_carotid_artery / lateral_transpromontorial_
 medial_perbullar_or_extrabullar_, 470
 Intratympanic_vascular_canal_for_internal_carotid_in_lateral_position / absent
 present, 471 Deep_groove_for_internal_carotid_on_anterior_pole / absent
 present, 472 Perbullar_carotid_canal_for_medial_course_ / absent present, 473
 Stapedial_artery / sulcus canal, 474
 Foramen_for_ramus_superior_of_stapedial_artery / 'through petrosal or

petrosal/squamosal suture on dorsolateral edge of epitympanic recess'
 'anterolateral, through basioccipital', 475 Coiling_of_cochlea / less_than_360
 360_or_greater, 476 'Pars cochlearis articulation with
 basisphenoid/basioccipital' / present absent, 477 Promontorium_shape / flat
 globose, 478 Promontorium_depth / even_with_or_lower_than_basioccipital
 higher_than_basioccipital, 479 Facial_nerve_intratympanic_course /
 open_in_sulcus_partially_or_totally_in_canal, 480
 Facial_nerve_sulcus_distal_to_stylomastoid_foramen / absent present, 481
 Anterior_wall_of_facial_nerve_sulcus / squamosal anterior_wall_of_foramen
 petrosal_or_ectotympanic, 482 Position_of_tympanic_aperture_of_hiatus_fallopil /
 in_roof_through_petrosal at_anterior_edge_of_petrosal, 483
 Shape_of_hiatus_fallopil / straight 'semi-lunar', 484 Prootic_canal / present
 absent, 485 Prootic_canal_1 / long short, 486 Lateral_flange /
 parallels_length_of_promontorium greatly_reduced_or_absent, 487
 Bony_shelf_lateral_to_promontorium / posterolateral anterior, 488
 Length_of_lateral_bony_shelf_anterior_to_promontorium / short
 prolonged_anterior_to_promontorium, 489 Tegmen_tympani_width / uniform
 expanded_anteriorly, 490 Tegmen_tympani_inflation / absent present, 491
 Stapedial_canal_on_tegmen_tympani / absent present, 492 Tensor_tympani_fossa /
 shallow_or_vestigial circular_pit, 493
 Medial_process_of_squamosal_in_tympanic_cavity / absent present, 494
 Hypotympanic_sinus / absent present, 495 Composition_of_hypotympanic_sinus /
 Contribution_from_alisphenoid petrosal_only, 496 Epitympanic_sinus / present
 absent, 497 Epitympanic_recess_fossa_incudis_size /
 epitympanic_recess_larger_or_equal no_visible_depression_for_epitympanic_recess,
 498 Epitympanic_recess / squamosal_contributes_to_lateral_wall
 no_squamosal_contribution, 499 Fossa_incudis / continuous_with
 separated_from_epitympanic_recess, 500 Fossa_incudis_1 / open_ventrally
 floored_by_squamosal_or_epitympanic, 501
 Fossa_incudis_position_relative_to_fenestra_vestibuli / lateral anterior, 502
 Foramen_for_ramus_superior_of_stapedial_artery / present absent, 503
 Position_of_foramen_for_ramus_superior_of_stapedial_artery / on_petrosal 'on
 petrosal-squamosal suture', 504 Foramen_for_ramus_superior_to_f._vestibuli /
 posterior_or_lateral anterior, 505 Ascending_canal / present absent, 506
 Position_of_ascending_canal / intramural intracranial, 507 Stapedius_fossa /
 twice_size_of_fenestra_vestibuli small_and_shallow, 508
 Cochlear_canaliculus_visible_canal_in_middle_ear / absent present, 509
 Cochlear_fossula / vestigial_or_absent distinct_pit_behind_fenestra_cochleae,
 510 Fenestra_cochleae / posteromedial_to_fenestra_vestibuli
 posterior_to_fenestra_vestibuli, 511 Aqueductus_cochleae / dorsal 'ventral and
 slit-like', 512 Posterior_septum_shields_fenestra_cochleae / absent present,
 513 Paroccipital_process / present absent, 514 Paroccipital_process_orientation
 / vertical slanted_towards_back_of_promontorium, 515
 Caudal_Tympanic_Process_of_Petrosal_notched / absent present, 516
 Crista_interfenestralis_and_CTPP_connected_by_curved_ridge / absent present,
 517 Tympanic_process / absent present, 518 Size_of_tympanic_process / low
 inflated_into_bulla_wall, 519 Tympanic_process_composition / petrosal
 petrosal_and_exoccipital, 520 Rear_margin_of_auditory_region /
 marked_by_steep_wall extended_onto_flat_surface, 521 Inferior_petrosal_sinus /
 intrapetrosal 'contribution from basioccipital/basisphenoid', 522
 Jugular_foramen_size_to_f._cochleae / subequal larger, 523 Jugular_foramen /
 confluent_with separated_from_opening_for_inferior_petrosal_sinus, 524
 Hypoglossal_foramen / two_or_more one, 525 Hypoglossal_foramen_size /
 smaller_than_jugular_foramen
 housed_in_large_opening subequal_to_larger_than_jugular_foramen, 526
 Paracondylar_process / weak_or_absent present, 527
 Direction_of_paracondylar_process / vertical posterior, 528 Ectotympanic /
 phaneric aphaneric,
 529 Ectotympanic_shape / ring_like fusiform, 530
 Ectotympanic_contributes_to_bullar_floor / absent present, 531
 Ant_crus_ectotympanic_broadly_contacts_squamosal / absent present, 532
 Elongate_ossified_external_acoustic_meatus / absent present, 533
 Roof_of_external_acoustic_meatus / petrosal squamosal, 534 Edge_of_the_EAM /
 dorsal_edge_flat_in_lateral_view edge_bowed_dorsally, 535 Entotympanic / absent

present, 536 Hyoid_pit / absent present, 537
 Hyoid_contributes_to_bullar_floor / absent present, 538 Dorsum_sellae / tall
 low, 539 Post_clinoid_process_contacts_promontorium / absent present, 540
 Transverse_sinus / present absent, 541
 Position_of_ant_distrib_of_transverse_sinus_to_subarcuate_fossa / anterolateral
 posterolateral, 542 Wall_separating_cavum_supracochleare_and_epiptericum /
 absent present, 543 Completeness_of_wall_between_CS_and_E / incomplete
 complete, 544 Crista_petrosa / vestigial_or_absent tall_thin_crest, 545
 Subarcuate_fossa_aperture / present absent, 546
 Constriction_of_subarcuate_fossa_aperture / not_constricted constricted, 547
 Anterior_semicircular_canal / does
 does_not_form_lateral_wall_of_subarcuate_fossa, 548 Internal_acoustic_meatus /
 deep_with_thick_prefacial_commissure shallow_with_thin_prefacial_commissure, 549
 Posttemporal_canal / large small_or_absent, 550
 Posttemporal_canal_composition /
 posterior_opening_between_petrosal_and_squamosal within_petrosal, 551
 Posttemporal_canal_position / on_occiput dorsal_to_external_acoustic_meatus,
 552 Perilymphatic_foramen / situated_in_wide_fossa not_in_a_fossa, 553
 Mastoid_foramen / absent present, 554
 Participation_of_supraoccipital_in_mastoid_foramen / absent present, 555
 Length_of_mastoid_process_of_petrosal / ventral_portion_short_or_absent
 ventral_portion_present, 556 Mastoid_exposure_orientation / occipital lateral,
 557 Amastoidy / absent present, 558 'Foramen magnum diameter:basicranial width
 at EAM - continuous' / 'large, maximum dorsoventral diameter >28% the
 basicranial width at the EAM' 'smaller, less than 28% width at EAM', 559
 Dorsal_margin_of_foramen_magnum / formed_by_exoccipitals
 by_exoccipitals_and_supraoccipital, 560 Occipital_condyles /
 broadly_rounded_in_lateral_view 'v-shaped in lateral view; in posterior view the
 condyle is divided into dorsal and ventral halves', 561 Atlantal_foramen /
 present absent, 562 Atlas_neural_arch_fused / absent present, 563
 Atlas_neural_arch_and_intercentrum_fused / absent present, 564 Axis /
 with_suture_between_atlantal_and_axial_parts without_suture, 565
 Axis_with_extra_pair_of_transverse_processes_on_ventral_surface / present
 absent, 566 Axis_anterior_facets_and_dens_connection / absent present, 567
 Axis_anterior_facets_extension_ventral_to_dens / absent present, 568
 Posteroventral_keel_on_axis / absent_or_weak strong, 569
 Atlantoid_facet_of_axis_vertebra / restricted_in_coverage
 extended_dorsally_at_least_halfway_up_neural_arch, 570
 Cervical_inferior_lamellae / present absent, 571 Cervical_neural_spines /
 'well-developed and of variable length' 'reduced, dorsum of neural arch
 flattened', 572 C7_or_last_transverse_foramen / present absent, 573
 Thoracic_vertebrae / 13_or_fewer 15_or_more, 574 Number_of_lumbars /
 six_or_more five_or_fewer, 575
 Xenarthrous_articulation_in_addition_to_the_pre_and_post_zygapophyses_of_lumbar_
 vertebrae / absent present, 576 Sacral_vertebrae / three_or_fewer
 four_or_more, 577 Sacral_vertebra_fused_to_pelvis / absent present, 578
 Infraspinous_fossa_position_and_size_to_supraspinous /
 different_planes_and_larger coplanar_and_subequal, 579 Suprascapular_incisure /
 absent present, 580 Acromion / present absent, 581 Acromion_distal_extent /
 reaches_distal_to_glenoid_articulation_with_humerus remains_proximal, 582
 Clavicular_facet_on_acromion / present absent, 583 Metacromion /
 weak_or_absent distinct_process, 584 'Length of vertebral border of scapula
 relative to length of scapular body - continuous' /
 narrow_vertebral_border_short_relative_to_length_of_scapular_body
 broad_vertebral_border_elongate_relative_to_length_of_scapula_body, 585
 Neck_of_scapula / 'short (end of spine near glenoid)' 'long (end of spine well
 superior to glenoid)', 586 Glenoid_fossa_shape / 'relatively broad, posterior
 portion circular' 'narrow and elongate, posterior portion ovoid', 587
 Coracoid_process_anteriorly_elongate / absent present, 588
 Coracoid_process_curves_ventral_to_humeral_head / present absent, 589
 Greater_tubercle_of_humerus / ventral_to_humeral_head
 even_or_dorsal_to_humeral_head, 590 Humeral_head_shape / rounded flattened, 591
 Humeral_head_orientation / more_posterior_than_dorsal
 more_dorsal_than_posterior, 592 Greater_tubercle_of_humerus_shape /

elongate_and_bladelike mound_shaped, 593 Lesser_tubercle_size / small
 large_and_expanded_medially, 594 Teres_tubercle / small_and_indistinct
 prominent_and_crestlike, 595 Deltopectoral_crest / proximal_half_of_humerus
 distal_half_of_humerus, 596 Distal_deltopectoral_crest_shape / sharp broad, 597
 Distal_deltopectoral_crest_height / low elevated, 598 'Distal end of
 deltopectoral crest (medial)' / forms_a_sharp_point_tapers_into_shaft, 599
 Supinator_ridge / weak_or_absent shelf_like, 600 Medial_epicondyle / robust
 weak, 601 Entepicondylar_foramen / present absent, 602
 Shape_of_humeral_entepicondyle / wide narrow, 603 Supratrochlear_foramen /
 absent present, 604 Ulnar_articulation_on_humerus / spherical cylindrical, 605
 Radial_articulation_on_humerus /
 rounded_radial_condyle_anteriorly_but_cylindrical_posteriorly capitulum, 606
 Radial_fossa_size / 'small and shallow, margins poorly defined' 'larger and
 deeper, well defined margins', 607
 Articulation_of_radial_head_and_humeral_trochlea / very_small_or_absent
 present, 608 Radius_articulation_with_distal_humerus / single_fossa
 two_or_more_fossae, 609 Central_process_of_radial_head / small_or_absent
 present, 610 Shape_of_radial_head / round ovoid, 611
 Curvation_of_ulnar_facet_on_radial_head / curved flat, 612
 Radius_and_ulna_distal_fusion / absent present, 613 Capitulum_shape /
 'spindle-shaped' spherical_with_depressed_medial_and_lateral_gutters, 614
 Presence_of_strong_central_ridge_on_capitulum / absent present, 615
 Lateral_accessory_articulation_of_radial_head / absent present, 616
 Radial_distal_expansion / not_significantly_expanded_relative_to_proximal_end
 expanded, 617 Position_of_extensor_tubercle / 'lateral, groove for digital
 extensors narrow' 'central, grooves for digital extensors and extensor carpi
 radialis longus/brevis subequal', 618 Brachioradialis_crest_on_distal_radius /
 strong weak_or_absent, 619 Radius_articulation_with_carpals / single_fossa
 two_fossae, 620 Distal_articular_surface_of_radius_concavity / concave
 not_concave, 621 Distal_articular_surface_of_radius_depth_of_fossa / shallow
 deep, 622 Distal_articular_surface_of_radius_divided_into_two_surfaces / absent
 present, 623 Orientation_of_radial_facet_on_proximal_ulna /
 lateral_oranterolateral anterior, 624 Concavity_of_proximal_ulna /
 convex_posteriorly straight_or_concave_posteriorly, 625
 Ulnocarpal_articulation /
 restricted_to_triquetrum_and_pisiform_via_elongate_styloid_process 'broader,
 comparable in size to the radial articular surface', 626 Olecranon_orientation /
 straight medially_expanded, 627 Depth_of_olecranon_fossa / shallow deep, 628
 Length_of_olecranon_process / short long, 629 Scaphoid_and_lunate / separate
 fused, 630 Centrale / present absent, 631 Paraxony_of_manus / absent present,
 632 Width_of_middle_of_second_metacarpal / wide constricted, 633
 Proximal_halves_of_3rd_and_4th_metacarpals / separate contact_one_another, 634
 Proximal_end_of_5th_metacarpal / expanded_laterally 'in line with shaft, not
 expanded', 635 Pubic_symphysis / extensive narrow, 636 Epipubic_bone / present
 absent, 637 'Sacral-innominate fusion' / absent 'present, with complete closure
 of ischiatic notch', 638 Dorsal_expansion_of_iliacum / 'absent, gluteal origin
 subequal to iliopubic eminence' 'present, gluteal origin enlarged, iliopubic
 eminence reduced', 639 Tuberosity_for_rectus_femoris_on_iliacum / 'well-developed'
 weak_or_absent, 640 Ischial_spine / well_posterior_to_acetabulum
 immediately_posterior_to_acetabulum, 641 Iliopubic_eminence / absent_or_weak
 'well-developed', 642 Pubic_length_to_ramus_of_ischium /
 similar_in_length_to_horizontal_ramus_of_ischium
 longer_than_horizontal_ramus_of_ischium, 643 Articular_surface_of_femoral_head /
 extended_posterolaterally limited_to_sphere_of_femoral_head, 644
 Fovea_for_ligamentum_teres / present absent, 645
 Position_of_fovea_for_ligamentum_teres /
 does_not_interrupt_margin_of_articular_surface
 interrupts_margin_of_articular_surface, 646 Greater_trochanter_to_femoral_head /
 lower_equal_or_higher, 647 Third_trochanter / absent present, 648
 Pectineal_tubercle / absent_or_vestigial distinct, 649
 Femoral_head_size_and_neck_development / 'large, neck short and broad' 'small,
 neck elongate and narrow', 650 Separation_of_greater_trochanter_and_femoral_head
 / separated_by_distinct_notch continuous, 651 Trochanteric_fossa_depth / deep
 shallow, 652 Orientation_of_lessor_trochanter / medially_directed

posteromedially_directed, 653 Size_of_lesser_trochanter_of_femur / large small,
 654 Relative_sizes_of_scars_on_lesser_trochanter / dominated_by_pectineus_scar
 equal_or_dominated_by_quadrtis_femoris_insertion, 655 Third_trochanter_position
 / gluteal_insertion_at_level_of_lesser_trochanter
 gluteal_insertion_distal_to_lesser_trochanter, 656
 Relative_heights_of_margin_of_femoral_trochlea /
 lateral_margins_taller_than_medial_margin
 equal_or_medial_margin_taller_than_lateral, 657 Distal_femur /
 longer_anteroposteriorly_than_mediolaterally
 equal_or_wider_mediolaterally_than_anteroposteriorly, 658 'Femoral midshaft
 cross-section' / round anteroposteriorly_compressed, 659
 Patellar_facet_of_femur /
 broad_and_shallow narrow_and_elevated, 660 Ossified_patella / absent present,
 661 Articulation_betw_femur_and_fibula / absent present, 662 Cnemial_crest /
 weak_or_absent present, 663 Size_of_cnemial_crest /
 smaller_than_rest_of_the_shaft as_large_as_or_larger_than_the_rest_of_the_shaft,
 664 Tibia_and_fibula_proximal_fusion / absent present, 665
 Tibia_and_fibula_distal_fusion / absent present, 666 Tibial_shaft / straight
 'strongly bowed, concave laterally', 667 Posterior_process_on_distal_tibia /
 absent present, 668 Medial_malleolus / broad_and_robust 'narrow - fingerlike or
 bladelike', 669 Anterolateral_process_on_distal_tibia / absent present, 670
 Fibula_robusticity_to_tibia / robust_relative_to_the_tibia slim, 671
 Trochlear_groove / absent present, 672 Shape_of_trochlear_groove / 'U-shaped'
 'V-shaped', 673 Astragalar_medial_trochlear_ridge / absent present, 674
 Astragalus_tibial_facet / present absent, 675
 Trochleation_of_central_tibial_facet / shallow_and_poorly_grooved
 trochlea_moderately_to_deeply_grooved, 676
 Radius_of_curvature_of_lateral_trochlear_ridge / greater_than_medial
 subequal_or_smaller_than_medial, 677 Cotylar_fossa / absent present, 678
 Sustentacular_and_navicular_facets_of_astragalus_contact / absent present, 679
 Shape_of_navicular_facet / convex concave, 680 Trochlea_on_navicular_facet /
 absent present, 681 Astragalar_sustentacular_facet_medial_extent / does_not
 does_reach_medial_edge_of_neck, 682 Shape_of_sustentacular_facet /
 oval_and_medial rectangular_and_wide, 683 Sustentacular_facet_curvature /
 axis_of_curvature_subparallel_to_long_axis
 axis_of_curvature_perpendicular_to_lng_axis, 684 Ectal_facet_width /
 transversly_narrow transversly_broad, 685
 Astragalar_medial_plantar_tubercle_ampt_ / vestigial_or_absent protruding, 686
 Posteromedial_projection_of_astragalar_body / absent present, 687
 Astragalar_neck / absent present, 688 Length_of_astragalar_neck / short long,
 689 Squatting_facet_on_dorsal_side_of_astragalr_neck / absent present, 690
 Astragalar_navicular_facet_convexity / present absent, 691
 Navicular_facet_convex_in_two_directions / one_direction two_directions, 692
 Navicular_facet_flat / present absent, 693
 Spring_ligament_facet_on_astragalar_neck / absent present, 694
 Contact_of_squatting_facet_with_navicular_facet / contacts_navicular_facet
 offset_from_navicular_facet, 695 Astragalar_cuboid_facet / absent present, 696
 Cuboid_facet_contact_with_navicular_facet / confluent separated_by_a_ridge, 697
 Astragalar_head_convexity / absent present, 698
 Astragalar_canal_ventral_foramen / present absent, 699
 Astragalar_canal_dorsal_foramen / present absent, 700
 Posterior_extension_of_trochlear_articular_surface / absent medial_ridge, 701
 Extension_of_entire_trochlea / only_medial_ridge entire_trochlea, 702
 Posterior_trochlear_shelf_of_astragalus / reduced strong, 703
 Lateral_process_of_astrgalus / 'present, ectal facet of astragalus faces in
 plantar direction and distal end points laterally' 'absent, ectal facet faces
 laterally and long axis is parasagittal', 704 Calcaneal_width /
 broad_with_sustentacular_and_ectal_facets_extending_away_from_body
 narrow_with_sustentacular_and_ectal_facets_in_line_with_long_axis_of_body, 705
 Ectal_post_calcaneoastragalar_facet_longest_dimension /
 anteromedial_to_posterolateral straight_or_posteromedial_toanterolateral, 706
 Ectal_facet_curvature / curved flat, 707 Ectal_facet_convexity / present
 absent, 708 Strength_of_convexity_of_ectal_facet / gentle strong, 709
 Number_of_ectal_facet_surfaces / two one, 710

Overlap_between_ectal_and_sustentacular_facets / present absent, 711
Completeness_of_overlap / complete partial, 712
Calcaneal_sustentacular_facet_mesiolateral_orientation / medial dorsal, 713
Calcaneal_sustentacular_facet_expanded_onto_body / absent present, 714
Sustentacular_facet_shape / subcircular_or_subquadratic 'transversely longer, elliptic', 715
Calcaneal_anterior_peroneal_tubercle_protrudes_anterior_to_cuboid_facet / absent present, 716
Calcaneal_anterior_peroneal_tubercle_position_relative_to_end_of_calcaneum / at_anterior_end at_distance_from_end, 717
Calcaneal_anterior_peroneal_process_size / short elongate, 718
Distal_part_of_calcaneum / large_with_a_robust_peroneal_process_that_forms_the_laterodistal_corner_of_the_b one lateromedially_compressed_with_small_to_indistinguishable_peroneal_process, 719
Lateral_astragalar_facet_on_calcaneus / 'not in transverse line with sustentacular facet, instead closer to tip of calcaneal tuber' nearly_aligned_with_sustentacular_facet, 720
Calcaneal_plantar_tubercle / absent present, 721
Position_of_calcaneal_plantar_tubercle / at_distal_margin more_proximal, 722
Tuber_calcis_ventral_curvature / present absent, 723
Proportions_of_tuber_calcis / short_and_robust elongate_and_gracile, 724
Calcaneal_facet_for_fibula / present absent, 725
Dorsoventral_concavity_of_cuboid_facet / flat concave, 726
Mediolateral_concavity_of_cuboid_facet / flat concave, 727
Plantar_pit_on_cuboid_facet_of_calcaneus / absent present, 728
Deep_groove_for_tendon_of_flexor_fibularis / absent present, 729
Width_of_middle_portion_of_second_metatarsal / wide constricted, 730
Third_metatarsal_elongation / absent present, 731
Degree_of_third_metatarsal_elongation / slight substantial, 732
Ventral_edge_of_distal_phalanges / distinctly_concave flat, 733
Distal_phalanges_breadth_in_dorsal_view / phalanx_compressed_transversely phalanx_broad, 734
Distal_phalanges_symmetry_in_dorsal_view / bilaterally_symmetrical asymmetrical, 735
Size_of_calcaneal_plantar_tubercle / relatively_large reduced, 736
Peroneal_tubercle_size / reduced elongate, 737
Dorsal_astragalar_foramen / present absent, 738
Depression_on_fibular_facet_of_astragalus / absent present, 739
Orientation_of_long_axis_of_navicular_facet / perpendicular_to_transverse_axis_of_trochlea oblique_to_or_parallel_to_transverse_axis_of_trochlea, 740
'Calcaneal-navicular contact' / absent present, 741
Plantar_process_of_navicular / short elongate, 742
Medial_process_of_navicular / small_or_absent prominent_and_proximally_extensive, 743
Cuboid_shape / short elongate, 744
Opposability_of_first_metatarsal / absent present, 745
Pedal_digit_1 / 'weight-bearing' 'not weight-bearing', 746
Pedal_digit_5 / 'weight-bearing' 'not weight-bearing', 747
'Ungual cross-sectional shape' / mediolaterally_compressed dorsoventrally_compressed, 748
Ungual_elongation / relatively_short anterioposteriorly_elongate ;

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[illegible]

11110100101011111010100101000010---0101100010000-10110-0010001-1010011101--
11000000-?010000111-1000?01-000-0011010100011111100101-1000011100?0-0?
111001111001000110010111-101100-100000010101111111100000000011???00001101????
0100?11000111000001111001100110001010-1010110010011010000-0-1001111011100111-
1001-0110-1000000?????????????????
Ocepeia ?-?010110011011000011110110100?
1100?????????001?1?1????????????????????????????????????00100110?101?1--0--
110-100101110-0-00-000--0--110000101100100101000000000011101011111-01-
01101001001010110001-100-0111011111101011011000000110000000100100111-
0100111111101011100001100001110010000000????010?00100?????????01?1-?00?????
0010000?1111?01?????00????0-?001?000010000?001?1?????00?00?01-0????????
011010111-1?0?100100???1110101001010?0010--010110001000?????0-0010001-??
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000010011--001--0--1-0-0-010101010-01--100-0001011100100001010-
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01111011101100010000-1010100010011-1?101??-01--1000000100111001-?1-0010101-000-
01101110-001111010010101100001010?0-0?01110111100?11111111100?0?????1?????0???
100?011?00?0?0?0?0?1?0?0?0?0?1?0?0?11?0?0?0?0?11?0?0?0?0?1?11?0?11?0?0?0-?0?
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Bradypus -----010011-10----1010110101?0010?00001-
10001?00111110-11-----01111---
0-----?-----11101--0--010001--0-11-
11-0101-0101--1-1--0---0-0-011100?00-01--0--0--011--011-----10--111-0011--
10----1-----0000000--1-000110000-0101000100000110001111-1111000100-
100110010100110100000010001-?10000010000001-011110011011001101-00110110101-
100111-011101100--01110010-10100001-010---0?0-0?010000-10100-0010011-1?100??-
01--1000001100011001-?1-0010101-000-01100100-0011010110101001-?1001?0-?0?0?1?
01111000?1?0111111001?0?????0?????001?011?000?0?????0?????01????
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11????????00110--00-001100-100011110????0000????00??01-0??0?1??000????????111??
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001000000100-000000000100001111011-101????0?0????0?????1?1??
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0111100010111110-1110000?10--0100001011011011011110000100001-1101-01-
00101000001001--0--01111111100011011-1111101010111001--1111011001010010110?
011001110000010000010001???0000100001000000110001100111-1??1?????0?01000???
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001000001000001000100101-1010011011010-00-----0-
00011100010100001110000010010010000100110000001011100011-
00010100101011000000100101110001-100111000111001??1?11100?????00?????????0?????
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0101111100001-0011-000001000100????1001011000101110011100-0001?????
001010011101001-010011010101100011000001000100000-0010011?
1010????????????????????????????????011?01?111110100100100???????1000??0?????????
01?1?101110001110????1111001101100101-1101???????00?0110101000000?001100000??
111000???10111???10011100?0101????1--11??10?0-000111000???1????
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Palaeosinopa ???100100001000011001001?0?????????00000??11?
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Anisonchus ???010110011010011010000?0?????????0?????
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000101100-101101000?00--10-00010110101111101--010001000100-1001-01-0011-

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Uropsilus -- -010101011010011010111100110?
111000011????????000111011100-11000001-- -00-0-0-011001-- -001110111?10001-000-
110100000010-100-00-0000100-- -00-- -10100-001101100011001100010011-0-00001-
01101011001000000000??1010011100001111-10100-0-1001110000001001101011-
010010011011000011010000011101111-01-10010110011000000000101000011-?
1111001001101011011000110111?00?00011011101011000000010110??????1100-001-000?-?
10100111011?1?10000100101100011111110010101111010????1100????????????????????
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111????????????????????????????10001101100001001011000001101??
110011011010001110111001010010010001101100001011000111001110010000110011001101-
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Desmana -- -010001001110010010101111?0?11000011110??
00?1000111010000111000000000010000-001000100100101011101000?0000-1100-
00001111100-0110000100-- -00-- -100-10001001011010001100010011-0-00001-
01101011001001-00-- -1-1110111100011111001100-0-0001110000001101101011-
010010011011000011010001000001100100010010110011000000000101000011-
1010100101110101111100110111000000011001101001010000010110??????01-
01????????0110110110000100101100011111110010101110000?11110001?01011100-
0001?00?1001?00?0???100011????????01?00?01?00?100-01?01100-000111100-
1????????????????0-000100?1?1?0?0?100101110000110??
0100010111000011101001000110010????????????0?01011000111?11100000???10111101101-
01100001010101000011000-1-11011101????????????????????????????0101????????000?0
Homogalax ???010100101101-0111011????0111?110?0??1????0??
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01111101101111111110000???1- -011?000-11010?11011001010001000100-0-00011-
01101010001001-00001-010111101011111001111100000111001-- -
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00001-0-0-111101011010001101101000111001---1010-1011-010011011?
01000111000001100010101-????????????????????????????0????????????????
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1000-0000110--01000011?100?111100000000????00?0-11-01-01001000010001111???-
0-011100110-100010--0000011?0000010?000-00???0000?1011001101-0---00?1110???
01001000000-0011??????01000110001-?0111100011110001010100000000000?0?
10011000-?100000001011000011?00001?01-0011???0?01-00111011??????????1011100-
11000011?110---?11?0?1????????????????????000?10?????????
10????????????????????01????????100?000?111000????????????0??0-000110????00??
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Macrocranion

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00101000001000100001-1111011101011110000110-0001011100010001100-1001-
010010011101001-110000000100000101??
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Alsaticopithecus

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Vicugna_pacos

11111001110010100111001010011100101????????????????0010001110-----1--0--000-
0111100001001100110100101-101-00-0-100000100-0-00?0000110--???00110---
1001011001011000010010-1100011-0110100100000001010010-0-111000000-01-1-100-0-
0000110100001110110101-
0100101101010101110000010000000000000010100110000000100010101100111-
1001110000111000011110000000100111100--
0100000110000001010101110000010110011111110111001101-1111110011110101110-
100001001011001001111101?00-10100-00000001100001?000101111111?01????01??????
1001??011110010011000100001001100-
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Oreotalpa

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000010100011-1--0--1-0-0-0111001011101110--
0000001100????????????????????????????????????1-????????????1????
1-????????????????????????????????????0??????1????0?10101?10?10100?
11000????????????????????????????10????????????0????000?111?????1-0?11????1??
101101100??1?000-01010100??1????011???101?00-00?00-000???01?001?????????1-
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Tursiops_truncatus

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Indohyus

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Dilambdogale ???010100001-
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Protictis

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Pteropus

00-0110??????10?????????1?0111111?0?1?11????

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Simpsonotus

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Interatherium

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Protolipterna

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Gorilla_gorilla_gorilla --000011111000011010101110011101011000100????
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Pongo_pygmaeus --000011111000011010100100111101011000100????
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[illegible]

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Rattus_norvegicus 1-1--1111011101111110011101101111100001????
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Orycteropus_afer -----01-----00--1-
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Bos_taurus
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Sus_scrofa

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Ovis_aries

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Dasypus_novemcinctus

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Choloepus_hoffmanni

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Ictidomys_tridecemlineatus 1-1-1-110111-

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Tinimomys

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Canis_lupus_familiaris 00-1101101000--
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Mustela_putorius 11-1001101010--00110000-
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[illegible]

[illegible]


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1      1      1      1      1      1      1      1      1      1      1      1      1
1      1      1      0

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TYPESET * UNTITLED = unord: 34 49 - 50 52 - 56 59 - 60 62 - 64 66
- 72 74 - 83 85 - 101 103 - 113 115 - 117 119 - 125 127 - 139 141 - 146
148 - 149 151 - 152 156 - 158 160 - 161 163 - 170 172 - 179 181 - 182 184
- 200 202 - 211 213 215 - 220 222 - 227 229 - 236 238 240 - 242 245 - 255
257 - 259 262 - 266 268 - 275 279 - 285 289 - 295 297 - 313 315 - 322 324
- 327 330 - 336 338 - 350 352 - 355 359 - 363 365 - 373 375 - 389 391 -
400 402 - 415 417 - 418 420 - 422 424 - 427 429 - 447 449 - 452 454 - 486
488 - 523 525 - 541 543 - 548 550 - 552 554 - 557 559 - 575 577 - 593 595
597 - 607 609 - 615 617 - 645 647 - 653 657 - 661 663 - 670 672 - 675 677
- 686 688 - 704 706 - 728 731 - 748, ord: 1 - 33 35 - 48 51 57 - 58 61
65 73 84 102 114 118 126 140 147 - 153\3 154 - 155 159 - 162\3 171 180 - 183\3
201 212 214 221 228 237 239 243 - 244 256 260 - 261 267 276 - 278 286 - 288
296 314 323 328 - 329 337 351 356 - 358 364 374 390 401 416 - 419\3 423 428
448 453 487 524 542 549 553 558 576 594 596 608 616 646 654 - 656 662 671 676
687 705 729 - 730;

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TYPESET Mammal_tree_model = unord: 8 34 49 - 50 52 - 56 59 - 60 62 - 64
66 - 72 74 - 83 85 - 101 103 - 113 115 - 117 119 - 125 127 - 139 141 -
146 148 - 149 151 - 152 156 - 158 160 - 161 163 - 170 172 - 179 181 - 182
184 - 200 202 - 211 213 215 - 220 222 - 227 229 - 236 238 240 - 242 245 -
255 257 - 259 262 - 266 268 - 275 279 - 285 289 - 295 297 - 313 315 - 322
324 - 327 330 - 336 338 - 350 352 - 355 359 - 363 365 - 373 375 - 389 391
- 400 402 - 415 417 - 418 420 - 422 424 - 427 429 - 447 449 - 452 454 -
486 488 - 523 525 - 541 543 - 548 550 - 552 554 - 557 559 - 575 577 - 593
595 597 - 607 609 - 615 617 - 645 647 - 653 657 - 661 663 - 670 672 - 675
677 - 686 688 - 704 706 - 728 731 - 748, ord: 1 - 7 9 - 33 35 - 48 51 57
- 58 61 65 73 84 102 114 118 126 140 147 - 153\3 154 - 155 159 - 162\3 171 180
- 183\3 201 212 214 221 228 237 239 243 - 244 256 260 - 261 267 276 - 278 286
- 288 296 314 323 328 - 329 337 351 356 - 358 364 374 390 401 416 - 419\3 423
428 448 453 487 524 542 549 553 558 576 594 596 608 616 646 654 - 656 662 671
676 687 705 729 - 730;

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TYPESET Parsimony_Model_Set = unord: 8 34 49 - 50 52 - 56 59 - 60 62 -
64 66 - 72 74 - 83 85 - 101 103 - 113 115 - 117 119 - 125 127 - 139 141 -
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184 - 200 202 - 211 213 215 - 220 222 - 227 229 - 236 238 240 - 242 245 -
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324 - 327 330 - 336 338 - 350 352 - 355 359 - 363 365 - 373 375 - 389 391
- 400 402 - 415 417 - 418 420 - 422 424 - 427 429 - 447 449 - 452 454 -
486 488 - 523 525 - 541 543 - 548 550 - 552 554 - 557 559 - 575 577 - 593
595 597 - 607 609 - 615 617 - 645 647 - 653 657 - 661 663 - 670 672 - 675
677 - 686 688 - 704 706 - 728 731 - 748, ord: 1 - 7 9 - 33 35 - 48 51 57
- 58 61 65 73 84 102 114 118 126 140 147 - 153\3 154 - 155 159 - 162\3 171 180
- 183\3 201 212 214 221 228 237 239 243 - 244 256 260 - 261 267 276 - 278 286
- 288 296 314 323 328 - 329 337 351 356 - 358 364 374 390 401 416 - 419\3 423
428 448 453 487 524 542 549 553 558 576 594 596 608 616 646 654 - 656 662 671
676 687 705 729 - 730;

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WTSET * UNTITLED = 1.0: 1 - 6 11 14 - 16 18 - 19 24 - 25 27 - 28 31
- 32 34 36 - 38 40 49 - 748 , 0.5: 7 7 9 - 10 12 - 13 17 20 - 23 29 39 41
- 48, 0.33: 8 8 26 30 35, 0.25: 33 33;
WTSET Weight_Set = 1.0: 1 - 6 11 14 - 16 18 - 19 24 - 25 27 - 28 31 - 32
34 36 - 38 40 49 - 748 , 0.5: 7 7 9 - 10 12 - 13 17 20 - 23 29 39 41 - 48,
0.33: 8 8 26 30 35, 0.25: 33 33;
WTSET Weight_Set2 = 1.0: 1 - 6 11 14 - 16 18 - 19 24 - 25 27 - 28 31 -
32 34 36 - 38 40 49 - 748 , 0.5: 7 7 9 - 10 12 - 13 17 20 - 23 29 39 41 -
48, 0.33: 8 8 26 30 35, 0.25: 33 33;

```

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END;
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Begin MESQUITE;
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MESQUITESCRIPTVERSION 2;
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    tell It;
        setDefaultOrder 1 4 240 241 242 10 12 14 15 16 17 18 19
20 21 22 23 24 25 26 27 28 29 30 32 33 34 35 203 204 36 37 38 39 40 42 43 44 45
46 47 48 50 174 51 52 53 54 55 196 217 57 61 62 63 65 66 205 259 216 68 69 70 71
72 73 75 76 77 78 59 233 78 79 80 81 82 83 84 85 88 89 90 91 93 94 95 96 97 98
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263 264 266 267 268 269 270 272 275 276 277 278 279 282 283 285 286 287 288 289
290 291 215 292 293 294 295 296 297 298 299 303 305 309 310 151 152 153 154 155
156 157 158 159 208 160 161 162 221 163 164 165 166 167 168 169 170 173 175 219
176 218 210 222 211 212 209 177 178 179 180 181 182 183 184 185 207 186 187 188
189 190 191 192 193 197 198 199 200 201 202 206 213 214 223 224 225 226 227 228
229 230 231 232 234;
        attachments ;
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endTell;
getEmployee
#mesquite.charMatrices.ManageCharacters.ManageCharacters;
tell It;
    setID 0 8113994614837970269;
    tell It;
        setDefaultOrder 4 6 8 68 88 90 96 97 121 145 149 152
163 175 176 183 188 189 190 204 205 206 230 233 243 244 278 289 351 359 417 419
474 696 500 533 570 579 594 600 612 613 655 657 659 660 668 677 0 1 2 3 5 7 9 10
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645 646 647 648 649 650 651 652 653 654 656 658 661 662 683 663 664 665 666 667
669 670 671 672 673 674 675 676 678 679 753 762;

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usingShortMatrix true  NumFiles 1 NumMatrices 1;
    mqVersion;
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    setPopoutState 233;
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    setAnnotationSize 0;
    setFontIncAnnot 0;
    setFontIncExp 0;
    setSize 1366 649;
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    setFont SanSerif;
    setFontSize 10;
    getToolPalette;
    tell It;
    endTell;
    desuppress;
endTell;
getEmployee
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#mesquite.charMatrices.BasicDataWindowMaker.BasicDataWindowMaker;
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        getWindow;
        tell It;
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            tell It;
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            setExplanationSize 30;
            setAnnotationSize 20;
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            setFontIncExp 0;
            setSize 1344 582;
            setLocation -8 -8;
            setFont SanSerif;
            setFontSize 10;
            getToolPalette;
            tell It;
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            colorRowNames
#mesquite.charMatrices.TaxonGroupColor.TaxonGroupColor;
            colorColumnNames
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            colorText #mesquite.charMatrices.NoColor.NoColor;
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            toggleShowTaxonNames on;

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toggleSeparateLines off;
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toggleAutoTaxonNames off;
toggleShowDefaultCharNames off;
toggleConstrainCW on;
toggleBirdsEye off;
toggleShowPaleGrid off;
toggleShowPaleCellColors off;
togglePaleInapplicable on;
toggleShowBoldCellText off;
toggleAllowAutosize on;
toggleColorsPanel off;
toggleDiagonal on;
setDiagonalHeight 80;
toggleLinkedScrolling on;
toggleScrollLinkedTables off;
endTell;
showWindow;
getWindow;
tell It;
    forceAutosize;
endTell;
getEmployee
#mesquite.charMatrices.ColorByState.ColorByState;
tell It;
    setStateLimit 9;
    toggleUniformMaximum on;
endTell;
getEmployee
#mesquite.charMatrices.ColorCells.ColorCells;
tell It;
    setColor Red;
    removeColor off;
endTell;
getEmployee
#mesquite.categ.StateNamesEditor.StateNamesEditor;
tell It;
    makeWindow;
    tell It;
        getTable;
        tell It;
            rowNamesWidth 398;
        endTell;
        setExplanationSize 30;
        setAnnotationSize 20;
        setFontIncAnnot 0;
        setFontIncExp 0;
        setSize 1344 582;
        setLocation -8 -8;
        setFont SanSerif;
        setFontSize 10;
        getToolPalette;
        tell It;
            setTool
mesquite.categ.StateNamesEditor.StateNamesWindow.ibeam;
endTell;
setActive;
rowsAreCharacters on;
toggleConstrainChar on;
toggleConstrainCharNum 3;

```

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        togglePanel off;
        toggleSummaryPanel off;
    endTell;
    showWindow;
endTell;
getEmployee
#mesquite.categ.StateNamesStrip.StateNamesStrip;
    tell It;
        showStrip on;
    endTell;
    getEmployee
#mesquite.charMatrices.AnnotPanel.AnnotPanel;
    tell It;
        togglePanel off;
    endTell;
    getEmployee
#mesquite.charMatrices.CharReferenceStrip.CharReferenceStrip;
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        showStrip off;
    endTell;
    getEmployee
#mesquite.charMatrices.QuickKeySelector.QuickKeySelector;
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    endTell;
    getEmployee
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    tell It;
        showStrip off;
    endTell;
    getEmployee
#mesquite.categ.SmallStateNamesEditor.SmallStateNamesEditor;
    tell It;
        panelOpen true;
    endTell;
endTell;
endTell;
endTell;
end;

```

SI TABLES

Tables S1-3 - Relative rates of important branches

These three tables show the numerical values that go into the creation of Figure 1. Averaged lengths of the morphological partition, molecular partition, and the ratio between those lengths, with confidence intervals. Because some branches, particularly within Laurasiatheria, are variable due to the position of Chiroptera, these are divided into the three topologies that are found, with Chiroptera sister to (a) the rest of Scrotifera, (b) Artiodactyla, and (c) the rest of Pegasoferae.

Significance thresholds are calculated as the 5th and 95th centile of the normal distribution that arises in the logged data once outliers have been identified (using the X² test of outliers) and removed.

Branch leading to node (Chiro-Scrot)	Morpho.length (mean)	Mol.length (mean)	Ratio (mean)	95% CI on Ratio (BCa)	Above/below significance thresholds (1.29 ; 8.16)
Placentalia	0.448	0.087	5.315	5.185-5.435	-
Atlantogenata	0.048	3×10^{-4}	8245.89	6154-10437	High
Afrotheria	0.013	0.017	0.775	0.741-0.816	Low
Xenarthra	0.280	5×10^{-4}	61530.62	49388-80879	High
Boreoeutheria	1×10^{-6}	0.004	2×10^{-4}	2×10^{-4} - 3×10^{-4}	Low
Laurasiatheria	0.003	0.007	0.454	0.337-0.586	Low
Eulipotyphla	0.257	0.013	20.023	19.58-20.50	High
Scrotifera	0.033	0.002	17.039	15.74-18.32	High
Chiroptera	0.429	0.009	50.126	48.96-51.44	High
Pegasoferae	0.004	0.001	3.118	2.724-3.529	-
Perissodactyla	0.564	0.031	18.704	18.32-19.01	High
Carnivora	0.478	0.013	37.492	36.59-38.40	High
Artiodactyla	0.320	0.011	31.342	30.68-32.11	High
Euarchontoglires	0.034	0.005	6.795	6.624-6.985	-

Glires	0.237	0.004	58.396	56.96-59.69	High
Rodentia	0.283	0.007	42.885	41.86-43.87	High
Lagomorpha	0.203	0.025	8.273	8.069-8.438	High
Euarchonta	0.059	0.001	52.477	50.45-54.41	High
Primates	0.103	0.005	23.489	22.97-24.08	High
Scandentia	0.311	0.051	6.227	6.114-6.348	-

Branch leading to node (Chiro- Artio)	Morpho.length (mean)	Mol.length (mean)	Ratio (mean)	95% CI on Ratio (BCa)	Above/below significance thresholds (1.28, 8.14)
Placentalia	0.431	0.091	4.998	4.898-5.095	-
Atlantogenata	0.047	3×10^{-4}	6468.064	5218-7859	High
Afrotheria	0.013	0.018	0.771	0.753-0.790	Low
Xenarthra	0.282	5×10^{-4}	41174.15	33217-49555	High
Boreoeutheria	2×10^{-5}	0.004	0.009	0.003-0.027	Low
Laurasiatheria	0.012	0.007	1.846	1.752-1.927	-
Eulipotyphla	0.281	0.014	21.685	21.29-22.09	High
Scrotifera	0.042	0.002	19.512	18.89-20.10	High
Chiroptera	0.316	0.010	34.195	33.53-35.00	High
Pegasoferae	0.005	0.001	3.825	3.450-4.288	-
Perissodactyla	0.566	0.032	18.442	18.17-18.73	High
Carnivora	0.456	0.014	34.540	33.91-35.15	High
Artiodactyla	0.323	0.019	19.114	18.69-19.52	High
Euarchontoglires	0.037	0.005	7.212	7.087-7.334	-
Glires	0.236	0.004	56.788	55.84-57.74	High
Rodentia	0.281	0.007	40.534	39.76-	High

				41.3	
Lagomorpha	0.201	0.027	7.728	7.588-7.854	-
Euarchonta	0.060	0.001	51.793	50.52-53.09	High
Primates	0.102	0.005	23.268	22.85-23.68	High
Scandentia	0.309	0.053	6.028	5.938-6.124	-

Branch leading to node (Chiro-Pegaso)	Morpho.length (mean)	Mol.length (mean)	Ratio (mean)	95% CI on Ratio (BCa)	Above/below significance threshold (1.28 ; 8.19)
Placentalia	0.442	0.091	5.134	4.964-5.313	-
Atlantogenata	0.048	4×10^{-4}	7584.723	5271-10355	High
Afrotheria	0.013	0.018	0.723	0.680-0.777	Low
Xenarthra	0.280	5×10^{-4}	40000.94	27649-58188	High
Boreoeutheria	1×10^{-6}	0.004	2×10^{-4}	2×10^{-4} - 3×10^{-4}	Low
Laurasiatheria	0.005	0.007	0.718	0.574-0.896	Low
Eulipotyphla	0.262	0.014	19.861	19.20-20.61	High
Scrotifera	0.052	0.002	25.408	24.20-26.85	High
Chiroptera	0.318	0.026	12.693	46.29-49.17	High
Pegasoferae	0.006	0.001	5.861	4.891-7.049	-
Perissodactyla	0.568	0.032	18.527	18.02-19.11	High
Carnivora	0.472	0.014	36.145	35.06-37.48	High
Artiodactyla	0.428	0.009	47.585	29.95-31.91	High
Euarchontoglires	0.038	0.005	7.343	7.054-7.669	-
Glires	0.236	0.004	56.834	55.14-58.66	High
Rodentia	0.281	0.007	39.956	38.61-41.38	High
Lagomorpha	0.203	0.027	8.014	7.755-8.311	-

Euarchonta	0.057	0.001	50.592	48.29- 52.84	High
Primates	0.102	0.005	23.363	22.54- 24.09	High
Scandentia	0.311	0.053	6.069	5.901- 6.247	-

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CGGCCTAAAATTTTAGCAAATACTAGGTAAGGTGCATGAACAACATC-
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CCAGGCCGATGACCGGCCAGCTCAGAACACAACCTCCAGCCAGCAAACCAG-----

TCACCAGT-----
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-TC-----
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 T-----
 -----G-----T-----
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A-----
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[illegible]

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[illegible]

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C-----
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[illegible]

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[illegible]

[illegible]

[illegible]

[illegible]

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CAG-----

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[illegible]

[illegible]

[illegible]

[illegible]

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CTT-----

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[illegible]

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[illegible]

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[illegible]

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[illegible]

[illegible]

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TCT-----

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CCCTC-----

T-----
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AATA-----
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CG-----TGATT-----
ACTAG-----

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CATACT-----G-----
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[illegible]

[illegible]

[illegible]

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[illegible]

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[illegible]

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C-----
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[illegible]

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[illegible]

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C - - - - C - CCATAA - AGGCG - - - - - GCCCCG - - GGAGAACCGCCCCG - - - CGACACAG - - AGAA - - - - -
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[illegible]

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CAGCG--GCAT-
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TAGC-----AACTAATACGTAAATATGGCTATTACATGTCT-----
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GGAGTA-----
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[illegible]

[illegible]

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[illegible]

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 TTAG - - - - - CTCCAG - - - - - CCGCCCTCC - -
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 TTATCGGCTGCACTAGAGGAACATGAGGTCGATATACGAGTGG - - - - - TCACCA - GGTTAGGTCCG - -
 CTGTCCCATCCCC - - - AAGCTCGGCGG - - - - - C - - - - - ACC - - - -
 AAGTA - - - - - AG - - - - - AC -
 CACAATTTACAGAGCCCTTG - - - - -
 CACATGGCGGGACACCCACGCCACGCCT - - - - - TCAGG - - - - - CGGAGCCGGG - C - -
 ATAA - - - - - TTA - - -
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 ----- CACTGTCA - ATTGAGA - - - - - TGCA - - - - - GT - - - - -
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 GCTGACCCG - - - - - TCGCCAAACCCGCAGGACTCGGAGGGGTTAAGGAT - - ACTCAC -
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 CCTCAGACTGA - - - - -
 ----- CCAA - CGAGC - - - - -
 GGCC - - - - - CGGCTCCGG - GTACTTTGCCGGGGGAC - - - - -
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 AATTTTCACCGC - - - - - C - - - -
 TATCC - - - - -
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 CA - - - - -
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 ----- CCTCTAGTCTAAAT -
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[illegible]

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TAGC-----AACTGATACGCAAATATGCCTAATATGTGTCA-----
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[illegible]

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GGCG-----TAGTTCCGG-GTACTTCGGCAG-----
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GCC-----

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CAAA-GGT-T-----CGTTAATTCTTACTCTC---
ACTCTAATAAGAGTTATTTATACTTCC-----GGGT-----
ACTTAACATTT-----AGATCATTAGAAAGATT----
CATTATTATACGTATAAACGACTCAAATCCTAAAGTCCTAGCCTCATCATAATCTCATCATACGACTTATTGCTGCACTA
ATCCATGTTTCTCAAACCTAAATTTATTTGGAAGGTCATAATAATCTACCAATTGAAATTCCAAACG-
A-----
GGTCTCATATATTCTAAATTGATATTGTACCAATGAATAAGTGGTACGACAA-----
GGTTTGGGCGTCACTTCTCTTATCACATGAAGCCGTGCATCTATATGAATAAAGA-----
-----G-
CACGCATGGACGCTGTTTACAAAAATCACTAGGCAATAACTATTTGGACAAAATACTTA-
TGATTACAGTTCAGTAATTTGAGACGGCAACATCAATCCTATAACTTCTAATACGTGCAATATCTAACCTATCCTGTCTC
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TCGGAAATGATAAAG-----AC-----
TCATCATCCTTCTAAATCACCACCTTAGGCAAAATATCAGGTGATA-----
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CTGAT-G---
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AGCCAATATTAATCATCATTAAATATATTACCAAAACTTATCCCTTAAGAATAGAATATACAAACTCCACATTG-
TCA--CGCGAACCCAC--ACCC-----G--A-----C-----
GA--CCACACCCCTCGTC--CCTCACGAACAA-----
CCCCCACA-----TCGTTCCGATTACTAAGTGTGATCCAAAGA-
TCA-----
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ACAAAATTCATCCA---
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GCACTTGTGCGATTCTGTCGCACAATCTCAGGAACTTATCAGACTTCCAAAGACTAA-
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CTG-----
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[illegible]

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GATCGTTCCTAATTTTC-CTTAAC-----TTCCG-----A-GTTAATCCTAAACCATGCTGCC----
GCTCTC---TTAAAAC-TTACACA--
GTCACGAACATCAAATGAGCTGCACGAAACCCACGTCATGGCCGAATAACAAGAATTTACTATGGTCGAAGGTAAGCAAT
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CTGGGCGCAC-----
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CG-----TATTT-----
AGTAC-----

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GATACTA-----

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ACG---TATTGTGAGATCAGGGGCTCCTTGCAAGTAATATGAA-----
GTGACGTA-----

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-----TTGTCTGGCTTGTC-ACCAG-GT-
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GCGCGATTGTTTCGTAAATAAAGTCAACGTCAAGTAGAGTCACTTGAAAGTTACCCGAACCTCGTCGTTAATAGAATCCTCG
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-----G-----
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AGATTAT

sus_scrofa
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[illegible]

[illegible]

[illegible]

[illegible]

-----GAA-----
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AATCGTTGCTAATTTTC-CTCAAC-----TTACG-----A-
GTAAATCCTAAACCATGCTACAG---CTCTC--TAAAAC-TTACACA--
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CCCTTATCGACTCA-----ATGAGAGATCA-----TCTCGATGTGATCTACCTTCAACT-
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AAAA---
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-----A-----
GG-----
TCC-----
ACCGGAGCTCCCTTCCACCTCCC--
TCCGCCATTTTCGCACAACAATAACTATACGCGGTGCGCAAACAAAATTACAATCAGACCACAAACATGTAAAAAAGAAAC
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CTGTCCAATCCCCCTGAGG-----CGCAGCCGTACC-----
GGGTA-----

TAAGATCACTTCCTAAATAATAATTAATGAAATGGCGCGCAAATATGAAAT-----

CACTGTCA-ATTGAAA-----TACA-----GT-----CCAG-----C---GTA---
TA-----G---AATA-ACGGAAGAAA--CCAAGTCCTAGCGGACTCCAC-----CA-----C-
TCCAGGGAAACGCTAC---TCTGA-----G-----
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ACGGGCCGTCCCGGATGGCTTACATGACG-----GTCACAT-
CCTCGAACCAG-----
-----CCAAA-CGAGT-----
GGCG-----TGGCTCCGGGGCACTTTGGCGG-----
CAC-----

-----GG-----
T-----
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CA-----
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[illegible]

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TCA--GGCGAACCCAC--ACCC-----
AACGC--GCGCACTCTTCATC--CCTCACTCCTCCC-----
GCCAACCCCCACA-----
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ACAAAATTCATCCA---
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CGGCG--GCAT-
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CCAATTAC-GTGACAATAGACCA----ATCGCAAACACATAGCTTAACCGATGTGTGTATC-----
GT-----
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AACTGATACGCACGTATGCCTATTACATGTCC-----
GAGAGTTAATA-----
-----T-ACTAATTCCCATCACGCTAAATAGCTAATAAACGCGAGCCGAGAGTCTTAA--
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CGCGCCCACTAG-----
T-----

[illegible]

CTAAATAATAATTAATGAAATTGCGCGCAACTATAACAT-----
-----CACTGTCA-
ATTGCAG-----TACTACCCGTGA-----ACAG-----C-----
CCA-----ACGGTAGAAA--CCAAGTCCCAGCGGGCTCAAC-----GG-----
C-TCCAGGGGAACGCCCC---
CCCGA-----
GGGCCGCTC-----CCGCGCCG-----GTGCCAG-
CGTCGAACTAA-----
-----CCAAA-CCAGT-----
GTG-----AGGCTCCGG-GCACTTAGTCCA-----
ACGACGGTAGCATAATACGCGACCCGATT-----CCCTAATTCTAT-
TCCAACAGCTCACGCA--CGCAG-TCCAT--GTGGATGCTAGTCG-GTAC-
ACGAGATAGTTCTG-----GCC-----CTATCAGGAA-----
TTCAGAAA-----TTTAC----
CAGTTTCACGTTTCAAAATTTTCAACAAC-----C-
GGG-----CAG-----
TGCTGCTTATAATAATAGTGAGGCTTCTGTTCTGCCTCTTACTTGAGCTACCGGGTATTTTTAGCTTTTAAATACTTTGC
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-----TTCAAT-GG-----ATATCCTCAGA--AGC--GGG-AAG-
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GAGTAGAATTAACCTTAGTCGTGGGTCGAGTAAGCGACACAACCAGAAACG-----

TAGTA-----

TC-----G-----
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A-----
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CCTC-----

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CGAAGGTGTCCATGAGAACGGTTACTTAAATGGGTAAATGATAGATCACAGCATCATA-----

TT--TTTTATTTTA-TGTTAACCACTCC-AGTG-AAG-----TA-
CTTATAAGTGCGA-----

T-----
-----G-----T-----
AT-----AGAATGAC-----GGCATTCTT-----
AAAC-----
TTG-----

-----TAAGATCCCGGACTCC-----

[illegible]

GA--GCGCGCTCCACATC--CCTCACTCTCCAA-----
ACCAACCCCCGACA-----TATTG-----
TATAATCCAACGA-TCG-----
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GCAATGGG-
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TACCGC--GCGGCCCAT-----TTGCTCGTGTCGCG--
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CAGCG--GGAT-
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CCAATTAC-
GTGACAATAATTCA-----
-----AGCTTACGCATATCGAATACGATTTAAATTAGT-----AGTC-----
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GACTTAATTTTTGGGCGAATCCTCAGATCCCATTAAAG-----GACTAAACCTTATAC-
ACTAATCCCATCAGCTGAATAGCTAATAAATGCGAGCCGAGAGTCTTAG--CGG---AGTGCCGTAGCCGAT-
CAGA-----

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CCAGGCCGACGACCGGCTAGCTCAGGACACAACCTCCAGCCAGCAAACCAG-----

TCACCACT-----
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-TC-----
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[illegible]

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GC-----CCAG-----G-----GGA-----A-----A-C--AATA-GCGCAAGAAA--
CCAAGTCCTAGCGGACTCAAC-----CA-----AC--CAGGGTAGTCC-GC--CCCGC-----
G-----TCCGTAGGCCATCAAGCCTCTCATAGGCCACGAAT--ACTCAC-
CCGGGCCACCTTTGACGGGTGTACATGACG-----CTCAAAT-
CCCCGAACAAA-----
-----TCGAA-CGAGA-----
GGGC-----TGGCCT-----CTTCGGCGA-----
CACGGTGATGGCATGGCGCGCGATTTTACC-----CCCAAACGCTAT-
TCCGACAGCCACGCA--CGAGGTTGCAG--GTCGACGATAACCG-GCAC-
ACAGGATAGTCCTG-----ACT-----CTAACGGGCC-----
TCCAGAAA-----TTTAC-----
CAGACTCACGCTTCGAGATTTTCACAGC-----C-----
GG-----GCCG-----
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GATACTAAATGGGAATAATTATGTAATAATTTACCTAGATTAAGGTCATTTACGAAAAAGAAGGTTTACTCTCACTCCA
CCCTGACA-----
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AAGTGCGAACCAGAAAGAGAA-----

C-----

T-----
-----A-----T-----
AT-----AGAATGAC-----GGCATTCTT-----
AAAA-----
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GG-----TATTT-----
AGTAG-----

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GATACTATA-----

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A-----
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TCGGAAATGATAAAG-----GC-----
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GC--GCGCACTCCTCATC--CCTCGCTGTCGAG-----
ACCAACCCCGGACA-----

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[illegible]

[illegible]

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