JOURNAL OF VERTEBRATE PALEONTOLOGY

SUPPLEMENTARY DATA

Tacuarembemys kusterae gen. et sp. nov., a new Late Jurassic–?earliest Cretaceous continental turtle from Western Gondwana

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APPENDIX S1. Data set used in the phylogenetic analysis.

Sphenodon punctatus
0000100101000-0----0-00-000-10100-00?----00000?00----0-00120-0000000---00-0100000-10000-???0--0-1124?1---------------000--0----------010-00--------0-00----100000--00--??0?1-1-10--00110000100-5

Simosaurus gaillardoti
0110?01111100-0--?-1000-010000100-000----00100000----0-0212--1020-01--001-01-1100??----????????-?????1---------------000--0----------0?00?0--------?-00----1???00--00--?????-0??1--0??1?????????

Owenetta kitchingorum
000100010102?-0--?000000000?0000000?----0000??0000000-0?000-000000?-0-00-?-0?000000000????0--0-1124?1---------------010--0----------0??-??--------?-0-----1???00--00--??0?1-???0--00?1?????????

Anthodon serrarius
0000??0000020-0--?000000000000000000----00000000000-0-?0020-0000000-0-000010?000000000????0--0-1124?1---------------010--0----------??????--------?-0-----100000--00--01--0-1-10--00?1?00???0??

Odontochelys semitestacea
0000??01?000??0?-?0?00??0?000?00??00?-0--??0????0000?0-0?000-00?0??002-00-?00???????000????0-??-????????????????????010--0-----00----------100--0??0000?-0-0--00????????????????000?00--------?00?----100000--01-0??0010100?--???0100???01?

Proganochelys quenstedti
0000?00000000-0--?000000000000000000001-0000010000000-0?000-000001000-00-000100000000000?00--0?000000011110-011100001100010-00??000000??--000-?000--0000000?00?00?000000001000000???010000--------00000000000000-001000000001000--00?000000000?

Proterochersis robusta
??0010-?????00??0??-0110??000--0010000?00?00?100000000000000000-????????????????????????????????10???????1?0?1??00???????????

Palaeochersis talampayensis
0000?00100000-1--?010000000000000?00??00-0?1?0?0110000-0?110-000001000000-000?1110?0000????0--0???0?????????????????????1100010-?0????0??0??--?????000--0010000?00?00?0000???0???????0???110000--------000000?0100000--01000?00121000???0?0000???00?

Australochelys africanus
???????10??0??1--?0?00?00?000??0??00?001-?0??01?110000-0??10-00000?00?00?-????1110?00??????0--0???0?????????????????11??

Kayentachelys aprix
0010001111000-0--?010000000000?10?000001-1010000120110-00010-000000002000-0010101101000?1000--0?000000?????????????????1110010-00000[0 1]1000000021000100--0010000?000000000000010000000000-0?0?00--------??0000001?0000--111?0?00?01001--00?1?00??????

Condorchelys antiqua
??????????????0?-?0???????000????????????????????120?10-0?110-00?0?000[0 2]0??-
?01?1011?1000????0--0?0000?????????????????????1?0010-????0?1?0001????00??10--
001000??????????0????????0?0??????010?00?-??----0?00?0??1?00?0--11??0000?0100????0?1?????????

Heckerochelys romani
0??00???1100??0?-?01????0??0???1?????????1?1????12??1??0?110-00?0?200200?-??1?10120?000????11-
0?0000?????????????????????????0010-00000?10?00100?10?0110--1100001?000000000000010000000000-
?????0--------???????0?????0--?11??????0????--???1?????????

Eileanchelys waldmani
00000?111100??0?-10100000?0000?100000?0??1?1000?1202?0-0?12?-00????00?00?-
?0001012?1000??0011-0-?????????????????????1100?10-??0001?00001002100???0--
1??0000??0?0??000?00???00?0???0??????????????????????????????????1?????????????????????????

Indochelys spatulata
??
??????????????????????0010-??000??00001??2100???0--
0??0000??0?0??000????1???1?????????????????????????

Siamochelys peninsularis
??
??????????????????????00111?000111000010021110100--1?10000??0100100000010000000000-
??????????????????2???

Niolamia argentina
000000011000??0?0101000101 20?0110?000001-10101102200?100[0
1]12101000?000111100010101??00[0 2]01??01??0-0101?00000[0 1]00[0 1]000[0 1]1101100?10-
??0????101??????????
??????????????????

Ninjemys oweni
0???????1?????0???0?0?????20???1??00?00211?1011??2?????????????0???????1?0??????????????????
??????011000000011001111???
?????????????0????101?????????????????????????????

Warkalania carinaminor
????????????????????0?????????????????????????????????20031?????????????????????????????????????
????011101--
011??
?????????????????????????????????????

Meiolania platyceps
0000000110001-000101000101200011000000021101011022003100012111000[0
1]000111100010101 2000[0 2]011001[0 1]?0-0101001111111011110111100010-
000??10000??00210?1110--
1010000?0?1?0000000001000????????0100011120000000000?00122011111100000001001--
00??000??000?

Chubutemys copelloi
???00001100011 00??0?000?00?00?11??????0??111000?120211?0?122-000000000?1?-
?00?101200010????11-

0?????????????????????11?0?1?????????0??1?1??
???????0????0????????11?????????????????????????

Mongolochelys efremovi
0010000110001?000?0100000110001100000002110101101202110001 22-
0000000001110001110 12?0021?10011-0-00100000001--011-00001100010-000001?000000021010110--
1010001?000000000000010000000000-0000011111000000000000111200--1111000010?0?1--
00??100?1000?

Peligrochelys walshae
???0?????00?????01????????1?0??????????1-????????20?1100[0 1]?22-
0?????0??11???0101012?0021110011-0-
0?1??0???????????000011???
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Patagoniaemys gasparinae
??
??????????????????????0010-000?0??0?00?00?10??110--
????????0???0???0???????0?00?????010?01112100000?0?1??0112100--?1???????0?0?1--00?1?????????

Otwayemys cunicularius
??????????????????[0 1]?????????????????????0-??????????2?1?????????????????-
???????????????0????????????????????????????0001???0????00?00???2?0??110--
1???00???0?2020000000000000001?00-00??011??10???000?1??0?12?0????1?????????????????????????????

Kallokibotion bajazidi
00?0??011?0010?00?0100000?000?100?00??0??111?1?02202310011 22-
1??0?00011100?0111?1?00020?10011-0?0010?0????????????????1100010-00001?000001?0?100??00--
1?10000??001?200000001000?000000-?00000--------0?0??????0--00--?1110000001001--00???????????

Platychelys oberndorferi
??
??????????????????????0010-10000110000001110000 10--1110000?10111110001001100000001--
110??11???----1?0?0010?????0--?1???????11?110000???????????

Caribemys oxfordiensis
??
??????????????????????001??10000?0??00???2????010--11?0000?101111?000100110000 00?1--
1????1????----??0??0???????0--?1????0?11100?10?0???????????

Notoemys laticentralis
???????????????-?????????000????????????????????3202?0-0??2??0?????00?0???01001?02?0000?10011-
0?1123????????????????????0010-10000100000100210000 10--11?0000?1011?010001001?00000001--
110?11?-------1?0?201??????0--?1????0011????11?0??????1????

Tacuarembemys
??
??????????????????????0010-
??001??0000?112?110??
??????????????????????

Prochelidella cerrobarcinae

??
??????????????????????0010-??10110010000021110100--11100001?0?1??10001001000000001--
??0???????????

Elseya dentata
0110111111001100-?0101--10000111000011020101100032023O-02122-01000-00-010-
0100100200000110111-??112301----------110001??10?0-1?1200?10211-0000--
1110000?10021010001001?00?00001--10?01111310000l0?0201011??10--
1122??0??1???11100?110011????

Myuchelys latisternum
0110111111001100-10101--1000011100001100-1011000320230-02122-01000-00-010-
0100100201000110111-0?112301----------110001??1010-1?1200010211-0000--
1110000110021110001001000000001--10001111310000100020101111l0--
1122?000110011110001100l1????

Chelodina colliei
0110111111111100-12101--1000011100001100-101?000320230-12122-01000-00-
0000110010020000011011l-2?112301----------1110011010100l?1200000211-0000--
1110000110120110001011000000001--10001111310000101020101111l0--
1122110011001111000110011002?

Chelodina longicollis
0110111111111100-12101--1000011100001100-1011000320230-12122-01000-00-
0000110010020000011011l-2?112301----------111001101010-111200000211-0000--
1110000110120110001011000000001--10001111310000101020101111l0--
1122110011001111000110011000l

Yaminuechelys maior
0?1?????1100??0?-?2???????1000?1????0??0??????????????0-????22-?????-00-0000?10?100??0000????11-
??1123?1----------1110011010001l?010000021110110--11100001101110100010010000000001--
100?1111310000101020101????0--11?2??0??1????01???1?????????

Phrynops geoffroanus
0110111111001100-12101--1000011100001100-1011000320230-02122-01000-00-
0000110010020000011011l-2?112301----------1110010-10101110100000211100O0--
1110000110121010001001000000001--10001111310000100020101111l0--
1122100011001111000110011000G

Chelus fimbriatus
1--0101111001100-12101--1000011110000100-1010000320230-02122-01000-00-
0000110010020000011011l-2-112301----------1110210-10100110010000021110000--
1110000110121111001020100100001--10111111310000101020101111l0--
1122100011001111000110011000O

Araripemys barretoi
1--1??011101110?-12110001000011100O0?000-?11??0?3212?0-02122-01010-00-
0???01001002??000??0111-0-1123??????????????????11102112101011001100102111011O--
1111011110120110001l---00000101--100?1111000000101O2??0111110--
11221?0011?????????110011000?

Erymnochelys madagascariensis

1--1110111011100-?0100001000011100000102021l1-00321230-12122-01000-01-
0100010?10020000011O?11-?-112-00----------1100010-10101110100010211100O0--
1110000110011010001001100100001--10001111000000100020101l??10--
112???0??10011110O?110011????

Pelomedusa subrufa
1--1110111011100-12100001000011100000102021l1-00321230-[0 1]2122-01000-00-
0100010010020000011011l-0-112300----------1100010-10101110100010211100O0--
1110000110111010001001000000001--10001111000000100020101111l0--
1122100011001111000110011000 5

Podocnemis expansa
1--1110111011100-10100001000011100001102121110003212 30-12122-01001-01-
0100010010020000011011l-2?112-00----------1100010-10101110100010211100O0--
1110000110111010001001000100001--10001111000000100020101111l0--
1122110011001111000110011000 5

Dorsetochelys delairi
0010001111001?0???0100000000O?110?000100-10100??220211?01122-100002002000-
000?1012?1020?10?11-0?1120?1----------
11??
??????????????????????????

Pleurosternon bullockii
0110??1111011100??0100000000O?110000???0-1?10??0220211?01122-
?00102?020?0?0???101200020?10??????001011----------11?00111?00011?000001021011000--
1??0000??0101000001001000000000-00???0--------??0?00???????????1???????0???1--00???????????

Glyptops plicatulus
01100?11110?11?0??0100?0??00??110?01?001-1?1??00220211?01112-10010200200?-
?01?102200020010011-2?0010?1----------1100011110001 1?000010021011000--
1110000110101000000001000000000-?00010--------??0?001010???0--1112000010???1--00?1?????????

Dinochelys whitei
0?10??11110???00??0100000?00???10?01?????????????20?11?????2-
???????0?0????????0??0?????10??????????????????????????1100011 1??0011?000010021011000--
1110000??000?0000000010000000[0 1]1--00???0--------????0?1?1????????11??????0??????????10011????

Neurankylus eximius
???0??11?10?11?00?1??????000?01??????????????220?11002122-
10?0??00?000001001?2200010010011-??11221??????????????11?00111100011?000010021111000--
1110000?10?01??0000001000000000-??????????????????101??????????1???????0????--?????????????

Trinitichelys hiatti
0010002111011100??1100000000000110000?100-101?00022021 10?2122-
1000020020000010?1022000?0010011-0?112211----------1100011110?01??0?0??002111?000--
1110000?10?01??0000001100000?00-??00?0--------??????10?????????1???????0??????????????????

Plesiobaena antiqua
0010002111011100 0?1100000000001100000100-1010000220211002122-
1000020020000011?102200010010011-??112211----------1100011110001 1?0000?0021110000--
1110000?10?01?00000021?000000100-0000?11???????????101010??00--?1???????0???1--0??110011????

Boremys pulchra
0010002111011100?1100000000001100000?1???101?0?0220211002122-
10001?00?000001?0102200010010011????112211----------1100011110001 1?000012121110000--
1110000?10?01??0000021?000000?00-010010--------????1010112100--?12??????0????--?????????????

Baena arenosa
???0002111001100?0100000000001100000001-1010000220211002122-100002002000-
011?102200010010?11-??112210??????????????1100011110101 1?000002121110000--
1110000?10111?00000021100000010 0-?10?10--------000?1010112200--11220000101001--0011?????????

Chisternon undatum
0010002111001100??1100000000001100000101-1010000220211002122-
10001200200000 11?102200010010011-0?112211----------110001??100011?0000?21211-?000--
1110000?10?01?000000211000000 10???000?1112?0000??0?101011??00-??1?2?000101001--
0011?????????

Portlandemys macdowelli
00110001110?10010?1??????000001100000101-1010000220211001122-
1000021020???0100101200010010011-
0?112100??????????????110??
??

Plesiochelys etalloni
00110001110[0 1]10010?1100000000?01100000101-1010000220211001122-
10100200201000 1?0101200010010 0?????112100??????????????1100010?100011?0000120210100[0 1]0-
-1110000?10?2100000000 10000000000-??????????????????0010????????11????0010???1--0??110011????

Solnhofia parsonsi
00110001110[0 1]10000?110000?00000110000-110-1110--0220211001122-
1000001010100011010220001001001 1-0?112100??????????????1100010-??0011?000020?2101?110--
???0011?0002000000??????000?00???110?00--------??????1?10??????11?2??0010?0??--???110011000?

Thalassemys moseri
0010001111001101 0?1100000000001100000?01-1110000220211001122-1010-
?102000001?110220001?010011-0?112100??????????????11?001??10001??0?0????2?0???10--
????????1?02????00??????0?0?0????11??00--------0?0?1????????????1?????????????????????????

Santanachelys gaffneyi
0010000111011000??0100000000?0110?00?101-1110000220211001?122-1010-
?002010?01??102??001?010?1?????????0??????????????110001???00011?00100?02100?110--
1110010?00120?00?0??????????????11???????????0????0?1?1???????11?2?????0????--0??111011?1??

Chengyunchelys
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??????????????????????0011-?000???0000?2021101100--
1110000?0000000000000000000010???

Xinjiangchelys latimarginalis
??????????????????????????0?????????????????????2???????????2??????????????1???????10????????????
??????????????????????001??1000111000000021111100--1110000?000200000000010000000100-
110010--------1???201011??00--111??????0???1--0??1?????????

Hangaiemys hoburensis
00110001110011000?1100000000001100000010??10100002 2?21100?122-
10010200201000 1?01022?102?01001??0?0111?0??????????????11?001??10?0?1?0000?002111?100--
1110001?00?20?000001-1?000000[0 1]00-
110??111200000????2?10?????????1???????0??????????????????

Judithemys sukhanovi
???1??01110?1100??110000?0000011???0??0??101?00?220211?0?122-
100002?020100000?10220101001001??0?0111?1----------110001??100011?000010021110100--
1110011?000200000001-1?000000[0 1]00-?11?0111200000100 12?10111210--11?2000010???1--
00?11001100??

Dracochelys bicuspis
???10?0111011100??210000?000??1100000001-101000?220?11001122-
100002102010?010?1022??01001001??0?0111?1----------110001??100011?00001?0?111?110--
????011?000200000?????????????????0111?110-0000010?00010?????0--11?20?0010???????????00-?????

Ordosemys leios
00100001110?1100???2?0000?000?0110000?????1010??0220211??1112-
10000??0?010?00??1022010??010??????0?1?????????????????11?0010-
100011100001002111011??????00?-?0002000000???10?0?0?0100-01?00111210000?00?0?10111210--
11?20?001000?1--00?1?????????

Sinemys lens
0010??11110111000?210000?000??11??00???0-??1????22022110?122-
00000?002010?00001022?10?001001??0?011101----------110001??10001110000110211101[0 1]0--
111001-?0002000000???1??0?000?0?????0?????0????????0???1????????1???????0??????????10011000?

Toxochelys latiremys
1011000111011?000111000000001011000001 00-101000022021100?122-
10000210201000100102200110010011-0?1121??----------1100010-200011000101 0?21110110--
11100111002201010 0???1??0???010??11?10111200??0?????01011??00--11???????00???--0??111011?1??

Caretta caretta
1--100011[0 1]00120001010000000010110100-110-1011000220111101122-1020-
01010100011010221011001001 1-0?11?100----------1100010-200010000101002 1110110--
11100111002 20?010001---10?00000??11110111200011100020111111 10--1122111-100111--
0001120110103

Chelonia mydas
1--1?00111001200010100000000010110101-11201011000220111001122-1020-
01010100011010221011001001 1-0?112100----------1100010-200011000101002 1110110--
11100111002 20?010001---10?0?000??11110111200011100120111111 10--1122111-100111--
000112011 01?3

Mesodermochelys undulatus
??10??????????????????????
??????????????????????01010-200011000100??2???-110--1110011?00?20?011----------
11100111200000000020101111 10--1122111-101111--0001?20???1??

Dermochelys coriacea

1--1010110000-00-10000000000101100000001-1010000220110-02122-1020-
000101000100102210010010011-0?112201----------110201-?20-0-300-1----2----11-
??1110011?0??20?011----------1111011120001100002O-0111110--1122111-101111--000112011?1??

Macroclemys schmidti
1??1??01100111O?0121000000000?110?010100-101000?220241001122-
1000?21020100010010??0010?100101001121?0??
??

Macroclemys temminckii
1--10001100111000121000000000001100010100-1010000220221001122-
100?121020100010010220001001001010011210O?????????????????1100010-1100010000000011110110--
1110011100220100000l-1-00?001100-1111011120010111012011112200--11221000100001--
001110011l0?1

Protochelydra zangerli
1--10?0110?11100???100000000?0110000?????101????220?21???122-
10001????010?0???10???0???010??????????0?????????????????11???1???????????0????????0100--
11100?1?0??20?0000?1-1-00?0?110??????????????????????????????????12??????0???1--0????????????

Chelydra serpentina
1--10001100111000?2100000000001100010100-1010000220221001122-
100012102010001001022000100100l0??0112100?????????????????1100010-1100010000020021110110--
1110011?002201000001-1-0010?1100-1111011120010111012011111200--11221000100011--
00?110011???1

Platysternon megacephalum
1--10001100111000101001000000001100010100-1010000220221001122-
100012102010001001022100100100101001121O1----------1100010-10000110000100211101O0--
11100001002202100001-1-000000000-1101011121010111002011111200--11220000100011--
001110011001?2

Mongolemys elegans
1--[0 1]000111011100?121000000000011000000020101000022021100l122-
100000002010??000102200010010O1??0?011101----------1100010-10?0?10000??0021110000--
1110000?101210100001-1-00?000000-?????111210101110l2?111???00--112??????0???1--0??1100??????

Gopherus polyphemus
1--10001110111001121000010000011000000020101011022022100l122-
100010002010001001022000100100101001121O1----------1100010-10100100001100211100O0--
11100000100210100001-1-000010001011110111210101110l2011111110--11220001101011--
001100011100[1 2]

Eurotestudo hermanni
1--1000111011100l?1000010000011000000020101011022022100l122-
100010002010001011022000100100101001121O1----------1100010-10100100001100211100O0--
11100000100200100001-1-000010001011110111210101110l2011111110--11221001101011--
001100011100?

Chelonoidis gringorum
??
??????????????????????0010-??10010000111001110000--11100000?0?2??100001-1-
0000100010?????????????????????????????????????1?0?101?????????????????

Chelonoidis chilensis
1--10001110111001121000010000011000000020101011022022100112 2-
10001000201000100102200010010010100112101----------1100010-101001000011102110000 0--
1110000000021?100001-1-000010001011010111210101110120111111 10--1122[0 1]001101011--
0001000111001

Stylemys nebraskensis
1--1??0111011?0???210000100 00?11??????0????1?????202?1?0?122-
?0?????0?????????10????0??????????01121?1?????????????????11?0010-?0?0?10000010021110000--
1110000110122?100001-1-0000100010??????????????????????????????11?2100111100?--??1100011000?

Chrysemys picta
1--10001110111001121000010000011000000020101000022021100112 2-
00001200201000101102200010010010100112101----------1100010-101011000000002111 0000--
1110000110121010000 1-1-000010001011110111211101110120111111 10--11221001101011--
0011100110000

Trachemys scripta
1--10001110011001121000010000011000000021101000022021100112 2-
10001200201000101102200010010010100112101----------1100010-101011000010002111 0000--
1110000110121010000 1-1-000000001011?-0--1211101110?2011--??-0-----21001101011--0011-----0000

Emys orbicularis
1--10001100111001121000?000001100000?00-1010000220211001122-
00001200201000101102200010010010100112101----------1100010-
10101100000000211101010010100001001201000001-1-
0010000???111101112101011101201111111???1122100110 1?11--00?1100110000

Geoclemys hamiltonii
1--10001100111001121100010000011000000000-1010110220211001122-
10001210201000101102200010010010100112101----------1100110-101011100001002111 0000--
1110000010121110000 1-1-00101000101111011121010111012011111110--11221001101011--
001110011000?

Echmatemys wyomingensis
??
??????????????????????0010-101011?0000?0021110000--11100001100211100001-1-
0010000010?????????????????????201?????????112??????0???1--?0???????????

Emarginachelys cretacea
1--1000111?111000??100001000?0110000?????1010??1220211??1122-
100012????10?01??102200???010???????????1----------11?011??11?0?1?000????21110100--
11100?0?0??20?000001-1-00????00??11???111????????????1?????????11?2?????0???1--01?110011????

Baptemys wyomingensis
1--10001110111000?2100001000001100000002?10100012202110011 22-1000[0
1]?002?10001?01022?001?0-2-1??0?112101----------1100110-100011?0000?0021110000--
1110000110121?000001-1-001100000-11?1?111???????????2?1111??1???1122?????01??1--1??110011????

Dermatemys mawii
1--100011[0 1]0111000?2100001000001100000002010100012202110011 22-
10001200201000110102200010 0-2-1010?112101----------1100010-1[0 1]00111010000021110000--

1110000?101200100001-1-100100000011110110-0010111012011l1??10--11221001101101--
00?1100110003

Xenochelys formosa
1--10?01100?1100112??????00????10?010000-1?10?0?2????1?01122-?020-
0??20??????0?????001??110?????1121?1----------11?0110-1?10121010000021110000--
1110000100220110000l-1-00-1-20011??

Staurotypus triporcatus
1--10001100111001121101010000011000l?000-1010001220211101122-
100010002010001001022000100110101011210l----------1100210-11001210[0
1]0000021110001011110010100220100000l-1-00-1-200111111011110010111012l-1111?10--
11221001100101--110110011???3

Sternotherus odoratus
1--10001100111001121001010000011000000000-1010001220211101122-
100010002010001001022000100110101011210l----------1100110-11001211100000211100010l---?1-
-1002201000001-1-11-1-200111111011110010111012l-1111110--11221001101101--1101100110003

Kinosternon flavescens
1--10001100111001121001010000011000000000-1010001220211101122-
100010002010001001022000100110l??01112101----------1100110-11001201100000211100011l---?1-
-1002201000001-1-11-1-200111111011110???1110121-1111110--11221001101111--110110011l00?3

Basilemys variolosa
1--1??0111?1??00???10000100?00110?00???????1?????20?21???122-
?0??????????????10??????????????????????????????????1100011210111l?0[0 1]0000?21111000--
1110000100?20?000100[0 2]1100100000l011?1?1?0-0??????????????????????12??????01011--
00?1000??000?

Yehguia tatsuensis
??
??????????????????????00112????11???000?02???1000--1110000??0?2??000100010000000000-
??????????????????????????????11???????0????????11?????????

Adocus beatus
1--10001110111001121000010010011000001021101000122021110l122-
100012102?10101?010220001?010011-1?011100??????????????1100010-101111?0[0 1]00?0021111000--
1110000100020000010001000l010000-1111?100-0010111012?111???????11220001101011--
011110011????

Hoplochelys crassa
??
??????????????????????0210-11?0?1?000??0?21110000--1110000000020?000001-1-00-1-1000-
??????????????????201?????????1122??????????--?????????????

Apalone spinifera
1--10101110111001121100010010011121010l1-1111001220221101122-
100112101010101001022000100100l1-12112101----------1102011210001300l-03-------110--111101-
100-20-0-1----1----------11010120-001011100201-111110--11221101100111--0001101110014

Plastomenus aff. *thomassii*

1--10?01110111O?11211000100?0?11----1000-111100?220221101122-
10011210101010100102 2?0010??0010112112 1?1----------11020112100013001-03-------100--?????101-
0-2--??1----------??????????????????20??1??????????????????????????????????????
Pelodiscus sinensis
1--10101110111001121100010010011?2??1000-1111001220221101122-
10010210101010100102200010010011-1?1121?1----------11?20112100013001-03-------110--
11110101-0-2--001----------110?0120-00?01110020--11??10--?1????0??????????????????001?
Lissemys punctata
1--10101110111001121100010010011121010 00-1111001220221101122-
10011010101010100102200010010010012112101----------11020112100013001-03-------110--111101-
101-20-0-1----1----------11010120-001011100201-11--10--11221101100111--0101101110014
Shachemys laosiana
1--1??011101??0?11[1 2]??????00???11??????????????2????????122-
10001??0?0????10110???0010?1?0?????1121??????????????????11?0010-??10-1?[0 1]200010210-0100--
1110000?000201000000010001000000-?????????????????????1?????????????????????????????????
Anosteira ornata
1--1??0111?1??001??10000100??011?200????1111???220221???122-1001[0
1]0?0?010?01??1022?0???010??????????01----------11?10112100012001003002 11?-100--
11100101002201001----1----------?????????????????????????????1???????????--???110211????
Carettochelys insculpta
1--10101110111001121001010010011120 00000-1111001220221101122-
10011010101010100102200010010011-1?112101----------11010112100012001000--2----100--
11100101002201001----1----------11010110-00101110020111111 10--1122001-100111--0101102110004

APPENDIX S2. List of common synapomorphies to all 240 most parsimonious trees (MPTs). Node numbers correspond to node numbers in the strict consensus tree (see Supplementary Data 3).

Sphenodon punctatus :
All trees:
No autapomorphies:

Simosaurus gaillardoti :
All trees:
Char. 1: 0 --> 1
Char. 2: 0 --> 1
Char. 6: 0 --> 1
Char. 8: 0 --> 1
Char. 10: 0 --> 1
Char. 19: 0 --> 1
Char. 25: 0 --> 1
Char. 43: 0 --> 1
Char. 56: 0 --> 2
Char. 61: 0 --> 1
Char. 63: 0 --> 2
Char. 67: 0 --> 1
Char. 72: 0 --> 1
Char. 78: 0 --> 1
Char. 222: 1 --> 0
Char. 225: 0 --> 1

Owenetta kitchingorum :
All trees:
Char. 3: 0 --> 1

Anthodon serrarius :
All trees:
Char. 7: 1 --> 0
Char. 220: 1 --> 0

Odontochelys semitestacea :
All trees:
Char. 69: 0 --> 2
Char. 183: 1 --> 0
Char. 232: 0 --> 1

Proganochelys quenstedti :
All trees:
Char. 7: 1 --> 0
Char. 204: 1 --> 0
Char. 220: 1 --> 0
Char. 236: 1 --> 0

Proterochersis robusta :
All trees:
Char. 163: 0 --> 1
Char. 221: 0 --> 1

Palaeochersis talampayensis :
  All trees:
    Char. 39: 1 --> 0

Australochelys africanus :
  All trees:
    No autapomorphies:

Kayentachelys aprix :
  Some trees:
    Char. 57: 1 --> 0
    Char. 119: 0 --> 1
    Char. 136: 1 --> 0

Condorchelys antiqua :
  All trees:
    No autapomorphies:

Heckerochelys romani :
  All trees:
    Char. 151: 1 --> 0
    Char. 155: 0 --> 1

Eileanchelys waldmani :
  All trees:
    No autapomorphies:

Indochelys spatulata :
  All trees:
    No autapomorphies:

Siamochelys peninsularis :
  All trees:
    Char. 162: 0 --> 1
    Char. 200: 01 --> 2

Niolamia argentina :
  All trees:
    Char. 111: 1 --> 0
    Char. 112: 1 --> 0
    Char. 114: 0 --> 1

Ninjemys oweni :
  All trees:
    Char. 106: 1 --> 0

Warkalania carinaminor :
  All trees:
    No autapomorphies:

Meiolania platyceps :
  All trees:
    Char. 105: 0 --> 1

Chubutemys copelloi :
All trees:
Char. 42: 0 --> 1
Char. 85: 2 --> 1

Mongolochelys efremovi :
All trees:
Char. 39: 1 --> 2
Char. 77: 0 --> 1

Peligrochelys walshae :
All trees:
No autapomorphies:

Patagoniaemys gasparinae :
All trees:
No autapomorphies:

Otwayemys cunicularius :
All trees:
Char. 160: 1 --> 2
Char. 170: 1 --> 0
Char. 177: 0 --> 1

Kallokibotion bajazidi :
All trees:
Char. 145: 1 --> 0
Char. 187: 1 --> 0
Char. 205: 1 --> 0

Platychelys oberndorferi :
All trees:
Char. 139: 2 --> 1
Char. 226: 1 --> 0

Caribemys oxfordiensis :
All trees:
Char. 224: 1 --> 0

Notoemys laticentralis :
All trees:
Char. 136: 0 --> 1

Sinemys lens :
Some trees:
Char. 6: 0 --> 1
Char. 52: 1 --> 2
Char. 61: 1 --> 0
Char. 137: 0 --> 1

Tacuarembemys :
All trees:

Char. 138: 0 --> 1

Prochelidella cerrobarcinae :
All trees:
No autapomorphies:

Elseya dentata :
All trees:
Char. 39: 0 --> 2

Myuchelys latisternum :
All trees:
Char. 83: 0 --> 1
Char. 162: 0 --> 1

Chelodina colliei :
All trees:
No autapomorphies:

Chelodina longicollis :
All trees:
No autapomorphies:

Yaminuechelys maior :
All trees:
Char. 123: 0 --> 1
Char. 127: 1 --> 0
Char. 145: 0 --> 1

Phrynops geoffroanus :
All trees:
No autapomorphies:

Chelus fimbriatus :
All trees:
Char. 0: 0 --> 1
Char. 5: 1 --> 0
Char. 32: 0 --> 1
Char. 36: 1 --> 0
Char. 44: 1 --> 0
Char. 121: 0 --> 2
Char. 134: 0 --> 1
Char. 164: 0 --> 1
Char. 170: 1 --> 0
Char. 171: 0 --> 1
Char. 174: 0 --> 1
Char. 184: 0 --> 1
Char. 185: 0 --> 1

Araripemys barretoi :
All trees:
Char. 20: 0 --> 1
Char. 37: 1 --> 0

Char. 64: 0 --> 1
Char. 119: 0 --> 1
Char. 121: 0 --> 2
Char. 123: 0 --> 1
Char. 131: 1 --> 0
Char. 134: 0 --> 1
Char. 144: 0 --> 1
Char. 145: 0 --> 1
Char. 152: 0 --> 1
Char. 154: 0 --> 1
Char. 155: 0 --> 1
Char. 161: 1 --> 0
Char. 162: 0 --> 1
Char. 168: 0 --> 1
Char. 177: 0 --> 1
Char. 198: 0 --> 1

Erymnochelys madagascariensis :
All trees:
Char. 159: 1 --> 0
Char. 171: 0 --> 1

Pelomedusa subrufa :
All trees:
No autapomorphies:

Podocnemis expansa :
All trees:
Char. 36: 0 --> 1
Char. 40: 0 --> 1
Char. 65: 0 --> 1

Dorsetochelys delairi :
All trees:
Char. 83: 0 --> 1

Pleurosternon bullockii :
All trees:
Char. 136: 1 --> 0
Char. 137: 0 --> 1
Char. 167: 0 --> 1

Glyptops plicatulus :
All trees:
No autapomorphies:

Dinochelys whitei :
All trees:
Char. 159: 1 --> 0
Char. 179: 0 --> 1

Neurankylus eximius :
All trees:

Char. 143: 0 --> 1

Trinitichelys hiatti :
All trees:
No autapomorphies:

Plesiobaena antiqua :
All trees:
Char. 183: 1 --> 0
Char. 187: 0 --> 1

Boremys pulchra :
Some trees:
Char. 207: 2 --> 1

Baena arenosa :
All trees:
Char. 18: 1 --> 0
Char. 37: 1 --> 0
Char. 101: 1 --> 0
Char. 127: 0 --> 1
Char. 160: 0 --> 1
Some trees:
Char. 136: 1 --> 0

Chisternon undatum :
All trees:
Char. 183: 1 --> 0
Char. 187: 0 --> 1

Portlandemys macdowelli :
All trees:
Char. 67: 0 --> 1

Plesiochelys etalloni :
All trees:
Char. 63: 0 --> 1

Solnhofia parsonsi :
All trees:
Char. 38: 0 --> 1
Char. 69: 2 --> 1
Char. 136: 0 --> 2

Thalassemys moseri :
All trees:
Char. 6: 0 --> 1
Char. 15: 0 --> 1
Char. 71: 1 --> 0
Char. 157: 0 --> 1
Some trees:
Char. 11: 1 --> 0

Santanachelys gaffneyi :
  All trees:
    Char. 18: 1 --> 0
    Char. 134: 0 --> 1
    Char. 159: 0 --> 1
    Char. 200: 1 --> 0
  Some trees:
    Char. 67: 1 --> 0

Chengyunchelys :
  All trees:
    Char. 137: 0 --> 2
    Char. 143: 0 --> 1
    Char. 170: 1 --> 0
    Char. 178: 0 --> 1

Xinjiangchelys latimarginalis :
  All trees:
    Char. 143: 0 --> 1
    Char. 178: 0 --> 1
    Char. 214: 2 --> 1
  Some trees:
    Char. 83: 0 --> 1

Hangaiemys hoburensis :
  All trees:
    Char. 64: 0 --> 1
    Char. 85: 1 --> 2
  Some trees:
    Char. 11: 1 --> 0
    Char. 96: 1 --> 0
    Char. 98: 2 --> 1
    Char. 101: 1 --> 0
    Char. 154: 1 --> 0
    Char. 184: 1 --> 0

Judithemys sukhanovi :
  Some trees:
    Char. 75: 1 --> 0
    Char. 199: 0 --> 1

Dracochelys bicuspis :
  All trees:
    Char. 39: 0 --> 1
    Char. 189: 1 --> 0

Ordosemys leios :
  All trees:
    Char. 58: 2 --> 1
    Char. 191: 0 --> 1

Toxochelys latiremys :
  All trees:

Char. 178: 0 --> 1

Caretta caretta :
All trees:
Char. 54: 0 --> 1
Char. 130: 1 --> 0

Chelonia mydas :
All trees:
Char. 35: 0 --> 1
Char. 39: 01 --> 2
Char. 199: 0 --> 1

Mesodermochelys undulatus :
All trees:
Char. 185: 1 --> 0

Dermochelys coriacea :
All trees:
Char. 120: 1 --> 2
Char. 130: 1 --> 3

Macroclemys schmidti :
All trees:
Char. 52: 2 --> 4

Macroclemys temminckii :
Some trees:
Char. 139: 2 --> 1
Char. 206: 1 --> 2
Char. 224: 1 --> 0

Protochelydra zangerli :
All trees:
No autapomorphies:

Chelydra serpentina :
Some trees:
Char. 136: 0 --> 2

Platysternon megacephalum :
All trees:
Char. 18: 1 --> 0
Char. 22: 0 --> 1
Char. 35: 0 --> 1
Char. 82: 0 --> 1
Char. 162: 1 --> 2
Char. 163: 0 --> 1
Char. 191: 0 --> 1
Char. 240: 3 --> 2
Some trees:
Char. 184: 1 --> 0

Mongolemys elegans :
  All trees:
    Char. 24: 1 --> 0
    Char. 65: 1 --> 0
    Char. 75: 1 --> 0
    Char. 96: 1 --> 0
    Char. 98: 2 --> 1
    Char. 180: 1 --> 0
    Char. 208: 1 --> 0

Gopherus polyphemus :
  All trees:
    Char. 216: 1 --> 0

Eurotestudo hermanni :
  All trees:
    Char. 161: 1 --> 0
  Some trees:
    Char. 77: 0 --> 1

Chelonoidis gringorum :
  All trees:
    Char. 139: 2 --> 0

Chelonoidis chilensis :
  All trees:
    Char. 142: 1 --> 0

Stylemys nebraskensis :
  All trees:
    Char. 161: 1 --> 2
    Char. 221: 0 --> 1
    Char. 224: 1 --> 0

Chrysemys picta :
  All trees:
    Char. 61: 1 --> 0
  Some trees:
    Char. 176: 0 --> 1

Trachemys scripta :
  All trees:
    Char. 11: 1 --> 0
    Char. 40: 0 --> 1
    Char. 135: 0 --> 1

Emys orbicularis :
  All trees:
    Char. 61: 1 --> 0
    Char. 146: 0 --> 1
    Char. 150: 1 --> 0

Geoclemys hamiltonii :

All trees:
Char. 121: 0 --> 1
Char. 156: 1 --> 0
Some trees:
Char. 20: 0 --> 1
Char. 45: 0 --> 1
Char. 46: 0 --> 1
Char. 131: 0 --> 1
Char. 176: 0 --> 1

Echmatemys wyomingensis :
All trees:
Char. 159: 1 --> 0

Emarginachelys cretacea :
All trees:
No autapomorphies:

Baptemys wyomingensis :
All trees:
Char. 161: 0 --> 1

Dermatemys mawii :
All trees:
Char. 121: 1 --> 0
Char. 133: 0 --> 1
Char. 163: 0 --> 1
Char. 172: 0 --> 1
Char. 174: 1 --> 0
Char. 189: 1 --> 0

Xenochelys formosa :
All trees:
Char. 63: 0 --> 2
Char. 127: 0 --> 1
Char. 163: 0 --> 1

Staurotypus triporcatus :
All trees:
Char. 121: 1 --> 2
Some trees:
Char. 20: 0 --> 1
Char. 154: 0 --> 1
Char. 222: 1 --> 0

Sternotherus odoratus :
All trees:
No autapomorphies:

Kinosternon flavescens :
All trees:
Char. 131: 1 --> 0
Char. 147: 0 --> 1

Char. 224: 0 --> 1

Basilemys variolosa :
All trees:
Char. 171: 0 --> 1
Char. 180: 0 --> 1

Yehguia tatsuensis :
All trees:
Char. 174: 1 --> 0

Adocus beatus :
All trees:
Char. 176: 0 --> 1

Hoplochelys crassa :
All trees:
Char. 121: 1 --> 2
Char. 156: 1 --> 0
Char. 159: 2 --> 0

Apalone spinifera :
All trees:
Char. 39: 0 --> 1
Some trees:
Char. 229: 1 --> 0

Plastomenus aff. *thomassii* :
Some trees:
Char. 92: 1 --> 0
Char. 145: 1 --> 0

Pelodiscus sinensis :
All trees:
Char. 65: 1 --> 0

Lissemys punctata :
All trees:
Char. 158: 0 --> 1
Some trees:
Char. 66: 2 --> 0
Char. 92: 1 --> 0
Char. 93: 1 --> 0

Shachemys laosiana :
All trees:
Char. 77: 0 --> 1
Char. 133: 01 --> 2
Char. 137: 0 --> 1
Char. 141: 1 --> 0

Anosteira ornata :
All trees:

No autapomorphies:

Carettochelys insculpta :
All trees:
Char. 22: 0 --> 1
Some trees:
Char. 218: 0 --> 1

Node 103 :
All trees:
No synapomorphies

Node 104 :
All trees:
Char. 58: 2 --> 0

Node 105 :
All trees:
Char. 30: 1 --> 0
Char. 57: 1 --> 0
Char. 118: 0 --> 1

Node 106 :
All trees:
Char. 213: 0 --> 1
Char. 231: 1 --> 0

Node 107 :
All trees:
Char. 117: 0 --> 1
Char. 122: 0 --> 1

Node 108 :
All trees:
Char. 225: 0 --> 1

Node 109 :
All trees:
Char. 19: 0 --> 1
Char. 43: 0 --> 1
Char. 48: 0 --> 1
Char. 49: 0 --> 1
Char. 58: 0 --> 1
Char. 78: 0 --> 1
Char. 80: 0 --> 1
Some trees:
Char. 57: 0 --> 1

Node 110 :
All trees:
Char. 14: 0 --> 1
Char. 79: 0 --> 1

Node 111 :
  All trees:
    Char. 139: 1 --> 2
    Char. 170: 0 --> 1
  Some trees:
    Char. 131: 0 --> 1
    Char. 144: 0 --> 1
    Char. 214: 0 --> 1

Node 112 :
  All trees:
    Char. 149: 0 --> 1
  Some trees:
    Char. 81: 1 --> 2
    Char. 91: 0 --> 1

Node 113 :
  All trees:
    Char. 58: 1 --> 2

Node 114 :
  All trees:
    Char. 142: 0 --> 1
    Char. 159: 0 --> 1

Node 115 : *CHENGYUNCHELYS* CROWNWARDS
  All trees:
    Char. 123: 0 --> 1
    Char. 141: 0 --> 1
  Some trees:
    Char. 145: 1 --> 0

Node 116 : *SIAMOCHELYS* CROWNWARDS
  All trees:
    Char. 53: 0 --> 1
    Char. 85: 0 --> 2
  Some trees:
    Char. 83: 1 --> 0

Node 117 :
  All trees:
    Char. 23: 0 --> 1
    Char. 26: 01 --> 2
    Char. 51: 2 --> 0
    Char. 59: 2 --> 1
    Char. 97: 0 --> 1
    Char. 98: 1 --> 0
    Char. 99: 0 --> 1
    Char. 204: 1 --> 0
    Char. 209: 0 --> 1

Node 118 :
  All trees:

Char. 48: 1 --> 2
Char. 52: 1 --> 3
Char. 61: 0 --> 1
Char. 69: 0 --> 1
Char. 220: 1 --> 0

Node 119 :
All trees:
Char. 25: 0 --> 1
Char. 45: 0 --> 1
Char. 46: 0 --> 1

Node 120 :
All trees:
Char. 6: 1 --> 0
Char. 9: 1 --> 0
Char. 69: 2 --> 0
Char. 71: 0 --> 1
Some trees:
Char. 66: 12 --> 0

Node 121 :
All trees:
Char. 39: 1 --> 2
Char. 102: 0 --> 1
Char. 116: 0 --> 1

Node 122 :
All trees:
Char. 104: 0 --> 1

Node 123 :
All trees:
Char. 86: 0 --> 1

Node 124 :
All trees:
Char. 200: 0 --> 1

Node 125 :
All trees:
Char. 183: 1 --> 0

Node 126 :
All trees:
Char. 162: 0 --> 1
Char. 227: 1 --> 0

Node 127 :
All trees:
Char. 129: 1 --> 0
Char. 141: 1 --> 0
Char. 142: 1 --> 0

Char. 145: 0 --> 1
Char. 160: 2 --> 1

Node 128 : TESTUDINES
All trees:
Char. 136: 1 --> 0
Char. 200: 01 --> 2

Node 129 : *PLESIOCHELYS* CROWNWARD
All trees:
Char. 3: 0 --> 1
Char. 6: 1 --> 0
Char. 71: 0 --> 1
Char. 123: 1 --> 0
Char. 160: 0 --> 2
Some trees:
Char. 101: 1 --> 0

Node 130 :
All trees:
Char. 18: 0 --> 1
Char. 75: 0 --> 1
Char. 85: 2 --> 1

Node 131 :
All trees:
Char. 37: 0 --> 1
Char. 96: 0 --> 1
Char. 97: 0 --> 1
Char. 98: 1 --> 2

Node 132 :
All trees:
Char. 144: 1 --> 0
Char. 161: 0 --> 1

Node 133 :
All trees:
Char. 144: 0 --> 1
Char. 160: 2 --> 1

Node 134 :
All trees:
Char. 198: 0 --> 1

Node 135 :
All trees:
Char. 71: 1 --> 0
Char. 74: 0 --> 1
Char. 94: 0 --> 2
Char. 119: 0 --> 1
Some trees:
Char. 137: 1 --> 0

Node 136 :
  All trees:
    Char. 3: 1 --> 0
    Char. 6: 0 --> 1
    Char. 21: 0 --> 1
    Char. 36: 0 --> 1
  Some trees:
    Char. 11: 1 --> 0
    Char. 101: 0 --> 1

Node 137 : CROWN PLEURODIRA
  All trees:
    Char. 127: 0 --> 1
    Char. 133: 0 --> 1
  Some trees:
    Char. 90: 0 --> 1
    Char. 183: 1 --> 0

Node 138 :
  All trees:
    Char. 18: 12 --> 0
    Char. 132: 0 --> 1
    Char. 133: 1 --> 2
    Char. 159: 1 --> 0

Node 139 :
  All trees:
    Char. 10: 0 --> 1
    Char. 11: 0 --> 1
    Char. 55: 0 --> 1
    Char. 123: 0 --> 1
    Char. 132: 0 --> 1
    Char. 161: 1 --> 0
    Char. 217: 0 --> 1

Node 140 :
  All trees:
    Char. 129: 1 --> 0
    Char. 162: 0 --> 1

Node 141 :
  All trees:
    Char. 0: 0 --> 1
    Char. 42: 0 --> 1
    Char. 50: 0 --> 1

Node 142 :
  All trees:
    Char. 18: 12 --> 0
    Char. 68: 0 --> 1
    Char. 174: 0 --> 1

Node 143 :
  All trees:
    Char. 39: 0 --> 2
    Char. 160: 2 --> 1

Node 144 :
  All trees:
    Char. 1: 0 --> 1
    Char. 64: 0 --> 1
    Char. 141: 1 --> 0
    Char. 143: 0 --> 1
    Char. 183: 1 --> 0

Node 145 :
  All trees:
    Char. 35: 0 --> 1

Node 146 :
  All trees:
    Char. 56: 1 --> 2
    Char. 80: 1 --> 2

Node 147 :
  All trees:
    Char. 6: 1 --> 2
    Char. 171: 0 --> 1

Node 148 :
  All trees:
    Char. 76: 0 --> 1
    Char. 169: 0 --> 2

Node 149 :
  All trees:
    Char. 137: 0 --> 2
    Char. 138: 0 --> 1
  Some trees:
    Char. 39: 0 --> 1

Node 150 :
  All trees:
    Char. 13: 1 --> 0
    Char. 15: 0 --> 1
    Char. 39: 0 --> 1

Node 151 :
  All trees:
    Char. 42: 0 --> 1
    Char. 141: 1 --> 0
  Some trees:
    Char. 145: 0 --> 1

Node 152 :

All trees:
Char. 3: 1 --> 0
Char. 39: 0 --> 1
Char. 63: 0 --> 1

Node 153 :
All trees:
Char. 28: 0 --> 1
Char. 125: 1 --> 2
Char. 134: 0 --> 1
Char. 164: 0 --> 1
Char. 238: 0 --> 1
Some trees:
Char. 145: 0 --> 1

Node 154 : CROWN CRYPTODIRA
All trees:
Char. 0: 0 --> 1
Char. 159: 0 --> 2
Char. 162: 0 --> 1

Node 155 :
All trees:
Char. 33: 0 --> 1
Char. 38: 0 --> 1
Char. 44: 0 --> 1
Char. 76: 0 --> 1
Char. 203: 0 --> 1
Some trees:
Char. 101: 1 --> 0

Node 156 :
All trees:
Char. 11: 1 --> 0
Char. 18: 1 --> 0
Char. 51: 2 --> 1
Char. 63: 0 --> 2
Char. 66: 2 --> 0
Char. 69: 2 --> 1
Char. 82: 0 --> 1
Char. 208: 0 --> 1

Node 157 :
All trees:
Char. 120: 0 --> 1
Char. 165: 0 --> 1
Char. 196: 1 --> 0
Char. 222: 0 --> 1

Node 158 :
All trees:
Char. 35: 0 --> 1
Some trees:

Char. 145: 0 --> 1

Node 159 :
All trees:
Char. 177: 0 --> 1
Char. 178: 0 --> 1

Node 160 :
All trees:
Char. 18: 1 --> 2
Char. 136: 1 --> 0
Char. 174: 0 --> 1
Char. 199: 0 --> 1

Node 161 :
All trees:
Char. 9: 1 --> 0
Char. 65: 0 --> 1
Char. 92: 1 --> 0
Char. 193: 0 --> 1
Char. 197: 0 --> 1
Char. 203: 0 --> 1

Node 162 :
All trees:
Char. 66: 2 --> 0
Some trees:
Char. 77: 1 --> 0

Node 163 :
All trees:
Char. 162: 1 --> 0
Char. 174: 1 --> 0
Some trees:
Char. 9: 0 --> 1
Char. 39: 0 --> 2

Node 164 :
All trees:
Char. 144: 1 --> 0
Char. 157: 0 --> 1
Char. 161: 0 --> 1
Char. 163: 0 --> 1

Node 165 :
All trees:
Char. 77: 0 --> 1
Char. 127: 0 --> 1
Char. 159: 2 --> 1
Char. 191: 0 --> 1
Char. 240: 3 --> 0

Node 166 :

All trees:
Char. 24: 0 --> 1
Char. 37: 1 --> 0
Char. 207: 2 --> 1
Char. 208: 0 --> 1
Char. 219: 0 --> 1
Char. 222: 0 --> 1

Node 167 :
All trees:
Char. 135: 0 --> 1
Char. 156: 1 --> 0
Char. 159: 1 --> 0
Char. 237: 0 --> 1

Node 168 :
All trees:
Char. 232: 1 --> 0
Some trees:
Char. 176: 0 --> 1

Node 169 :
All trees:
Char. 137: 0 --> 1

Node 170 :
All trees:
Char. 192: 0 --> 1

Node 171 :
All trees:
Char. 121: 0 --> 1

Node 172 :
All trees:
Char. 9: 0 --> 1
Char. 47: 0 --> 1
Char. 229: 0 --> 1

Node 173 :
All trees:
Char. 39: 0 --> 2
Char. 89: 1 --> 2
Char. 157: 0 --> 1
Char. 159: 2 --> 1

Node 174 :
All trees:
Char. 89: 0 --> 1
Char. 144: 1 --> 0

Node 175 :
All trees:

Char. 130: 1 --> 2
Char. 133: 0 --> 1
Char. 177: 1 --> 2
Char. 180: 0 --> 1
Some trees:
Char. 201: 0 --> 1

Node 176 :
All trees:
Char. 177: 0 --> 1

Node 177 :
All trees:
Char. 132: 0 --> 1
Char. 153: 0 --> 1
Char. 172: 0 --> 1
Char. 173: 0 --> 1

Node 178 :
All trees:
Char. 123: 0 --> 1

Node 179 :
All trees:
Char. 128: 0 --> 1
Char. 143: 0 --> 1
Char. 144: 1 --> 0
Char. 166: 0 --> 1

Node 180 :
All trees:
Char. 127: 0 --> 1
Char. 159: 2 --> 0

Node 181 :
All trees:
Char. 27: 0 --> 1
Char. 73: 0 --> 1
Char. 94: 0 --> 1
Char. 189: 1 --> 0
Some trees:
Char. 92: 0 --> 1

Node 182 :
All trees:
Char. 20: 0 --> 1
Char. 120: 1 --> 2
Char. 130: 2 --> 3
Some trees:
Char. 34: 0 --> 1
Char. 36: 0 --> 1
Char. 145: 0 --> 1
Char. 152: 0 --> 1

Char. 188: 1 --> 2
Char. 217: 0 --> 1
Char. 234: 2 --> 1
Char. 239: 0 --> 1

Node 183 :
All trees:
Char. 5: 0 --> 1
Char. 32: 0 --> 1
Char. 33: 0 --> 2
Char. 42: 0 --> 1
Char. 44: 0 --> 1
Char. 64: 0 --> 1
Char. 69: 2 --> 1
Char. 120: 0 --> 1
Char. 123: 0 --> 1
Char. 130: 1 --> 2
Char. 154: 0 --> 1
Char. 165: 0 --> 1
Char. 184: 1 --> 0
Char. 199: 1 --> 0
Char. 222: 1 --> 0
Some trees:
Char. 66: 2 --> 0
Char. 234: 0 --> 2

FIGURE S1. Strict consensus of 240 MPTs of length 905 steps (no taxa excluded). Numbers below clades correspond to node numbers. Numbers above clades correspond to support measures (Bremer/Bootstrap/Jackknife). Note that Bootstrap and Jackknife are GC measures, not absolute ones.

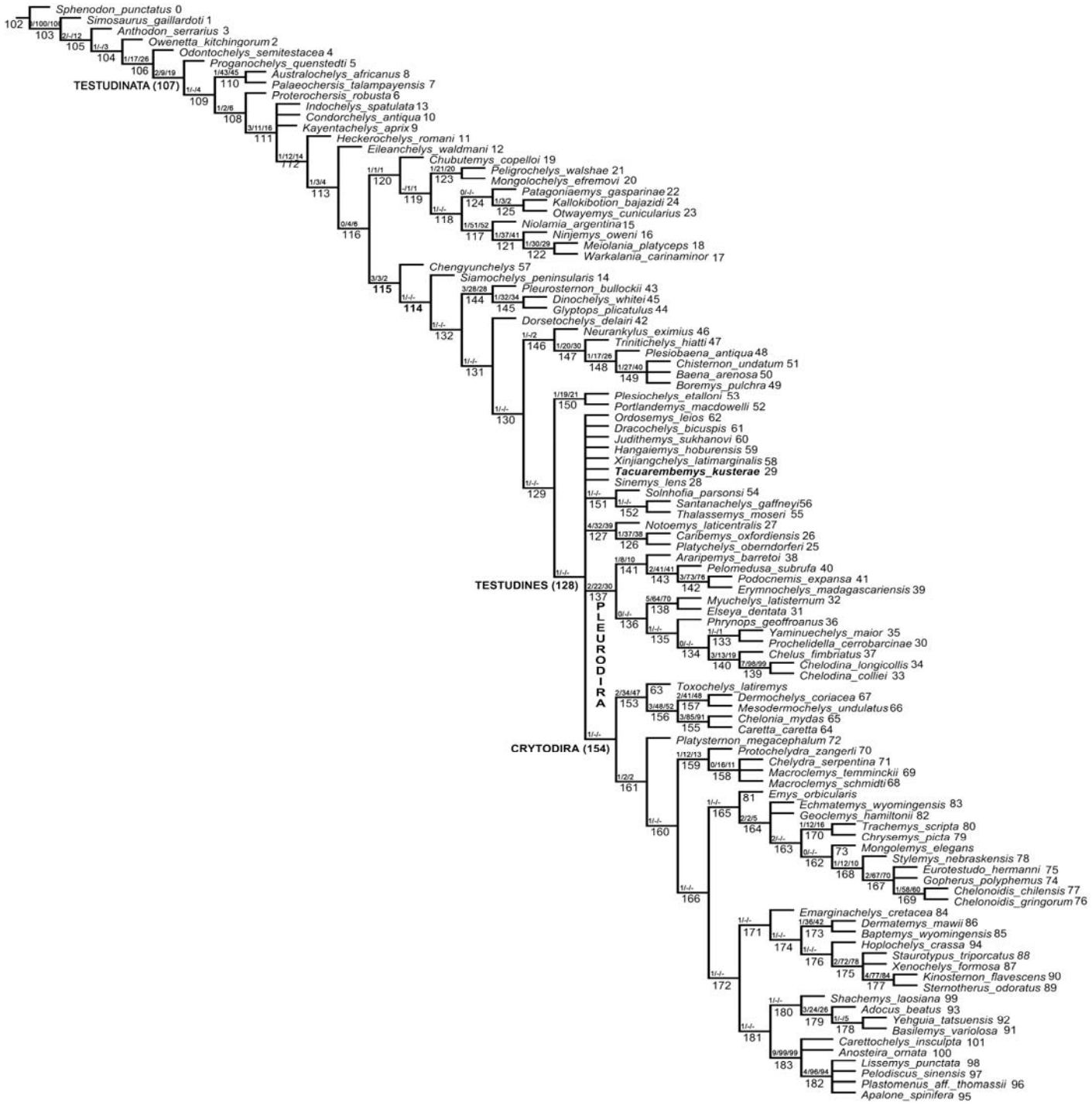


FIGURE 2S. Reduced strict consensus of 240 MPTs showing the alternative position of *Tacuarembemys kusterae* (stars).

FIGURE 3S

Results of the script by Pol and Escapa (2009) run for *Tacuarembemys kusterae* dataset. The following reduced consensus is obtained after pruning the most unstable taxa (for consensus calculation, tree was collapsed).

Legends:
a: Tacuarembemys (29)
b: Hangaiemys_hoburensis (59)

The following taxa are unstable and collapse nodes in the strict consensus:

Tacuarembemys
Scoring the following characters may help to resolve its position:
1 3 4 5 6 11 18 24 29 37 44 48 52 53 54 56 61 62 67 75 80 83 85 87 90 96 98 99 101 136 144 145 154 155 157 159 161 163 167 168 178 179 182 183 184 186 190 191 200 207 208 216 221 222 240

Hangaiemys_hoburensis
The following characters support alternative positions in different trees:
67 83 96 98 101 154 184 187
Scoring the following characters may help to resolve its position:
136 186 199 208 216 222

The following taxa form polytomies in which all descendants are unstable:

The following taxa form an unstable clade that appears in the reduced consensus [absent from the strict consensus]):
This node includes the following taxa: 11 12 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101
.
The following characters support alternative positions in different trees:
49 52 66 76 81 83 131 136 139 145 170 212 231

Indochelys_spatulata
Scoring the following characters may help to resolve its position:
6 8 9 12 31 41 46 49 51 52 57 66 69 76 77 81 83 88 91 119 131 144 145 150 186 206 207 212 214 231

Condorchelys_antiqua
The following characters support alternative positions in different trees:
66 145
Scoring the following characters may help to resolve its position:
12 51 119

Kayentachelys_aprix
The following characters support alternative positions in different trees:
66 145

Lissemys_punctata

The following characters support alternative positions in different trees:
     66 92 145

Pelodiscus_sinensis
Scoring the following characters may help to resolve its position:
     34 93 95 216 217 229 234

Plastomenus_aff._thomassii
The following characters support alternative positions in different trees:
     92 145
Scoring the following characters may help to resolve its position:
     34 152 188 216 217 229 234 239

Apalone_spinifera
Scoring the following characters may help to resolve its position:
     93

FIGURE S4. Comparison of the degree of nuchal notch development in several turtle taxa, based on the nuchal notch length/nuchal notch width ratio. See Table 2.

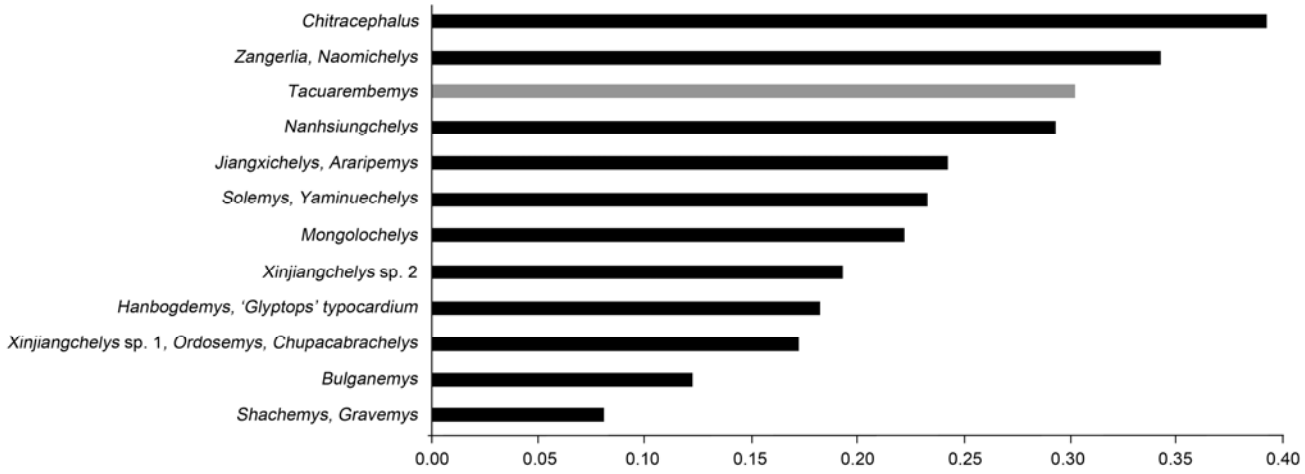


FIGURE S5.Optimization of character 123 (shell sculpturing) discussed in the text.

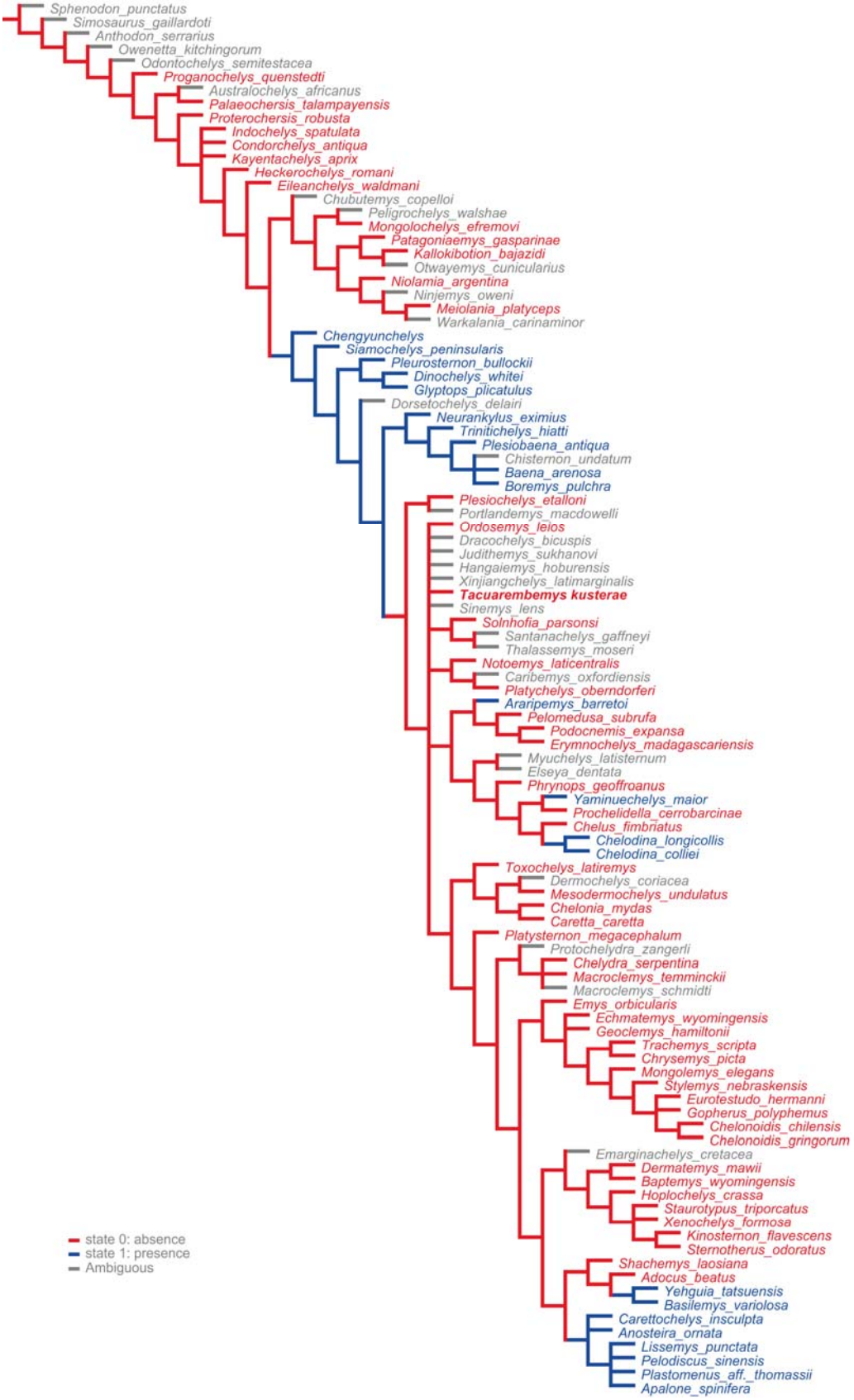


FIGURE S6. Optimization of character 137 (cervical scale) discussed in the text.

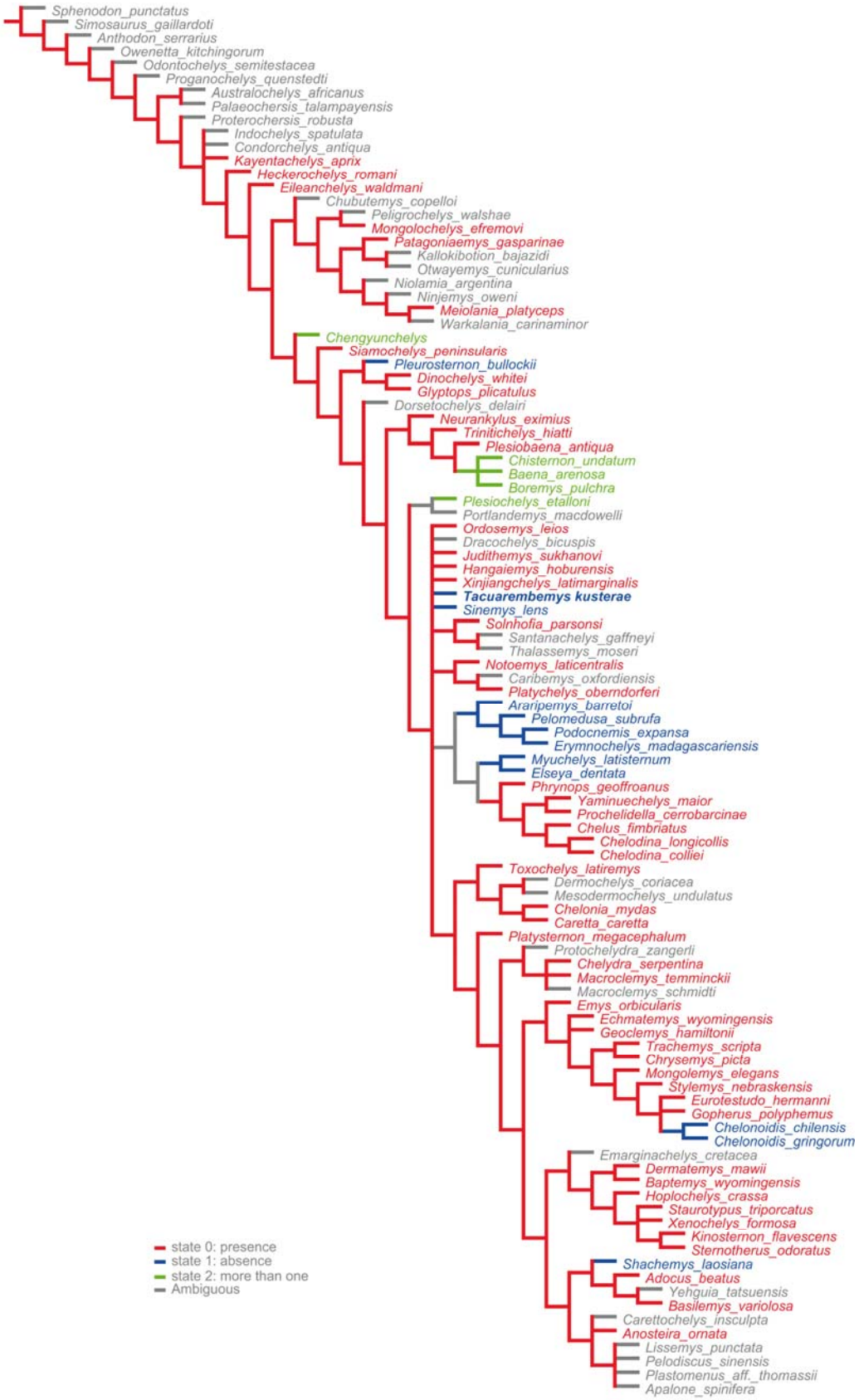


FIGURE S7. Optimization of character 138 (anterior supernumerary scales) discussed in the text.

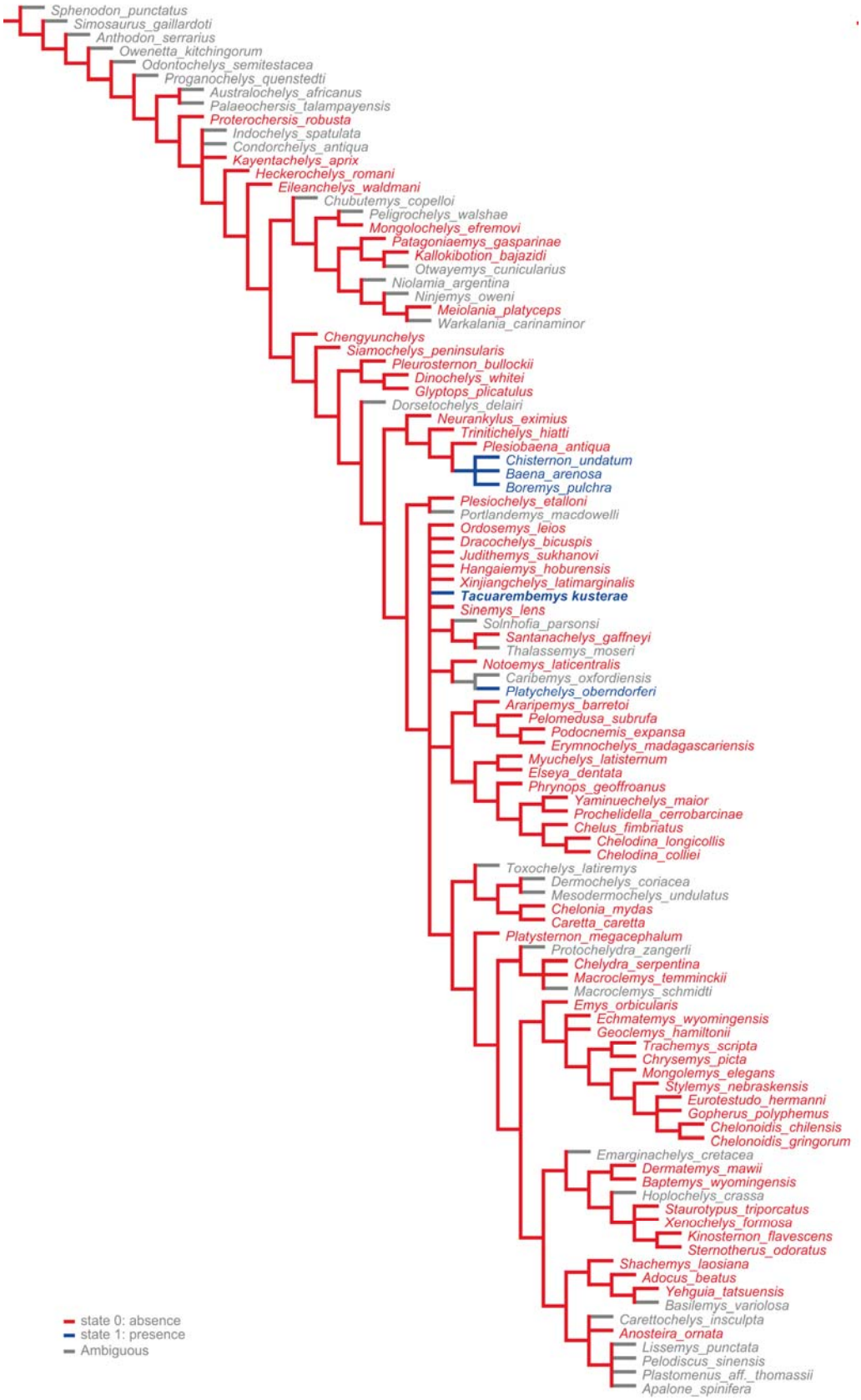


FIGURE S8. Optimization of character 141 (width of vertebrals vs. pleurals) discussed in the text.

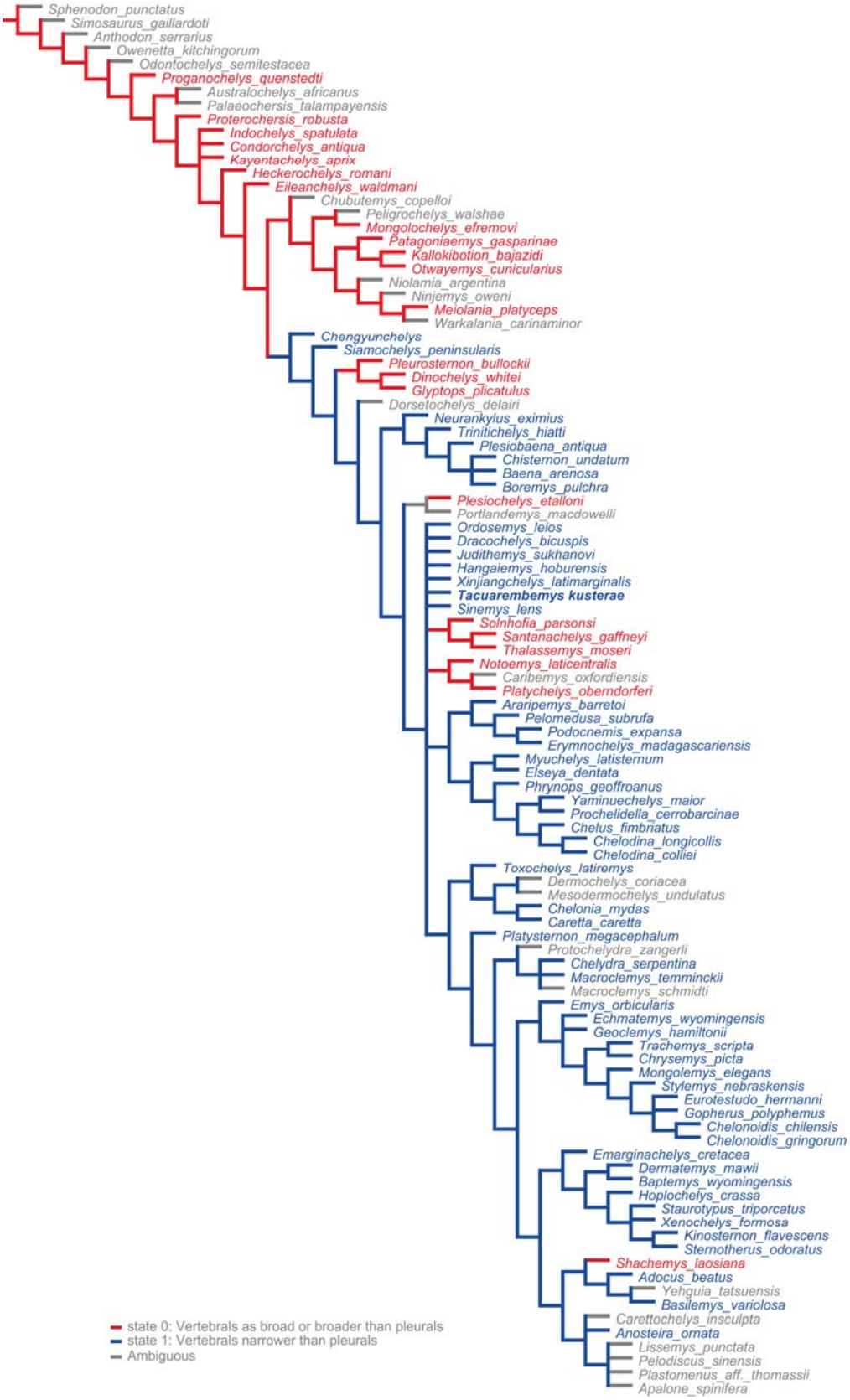
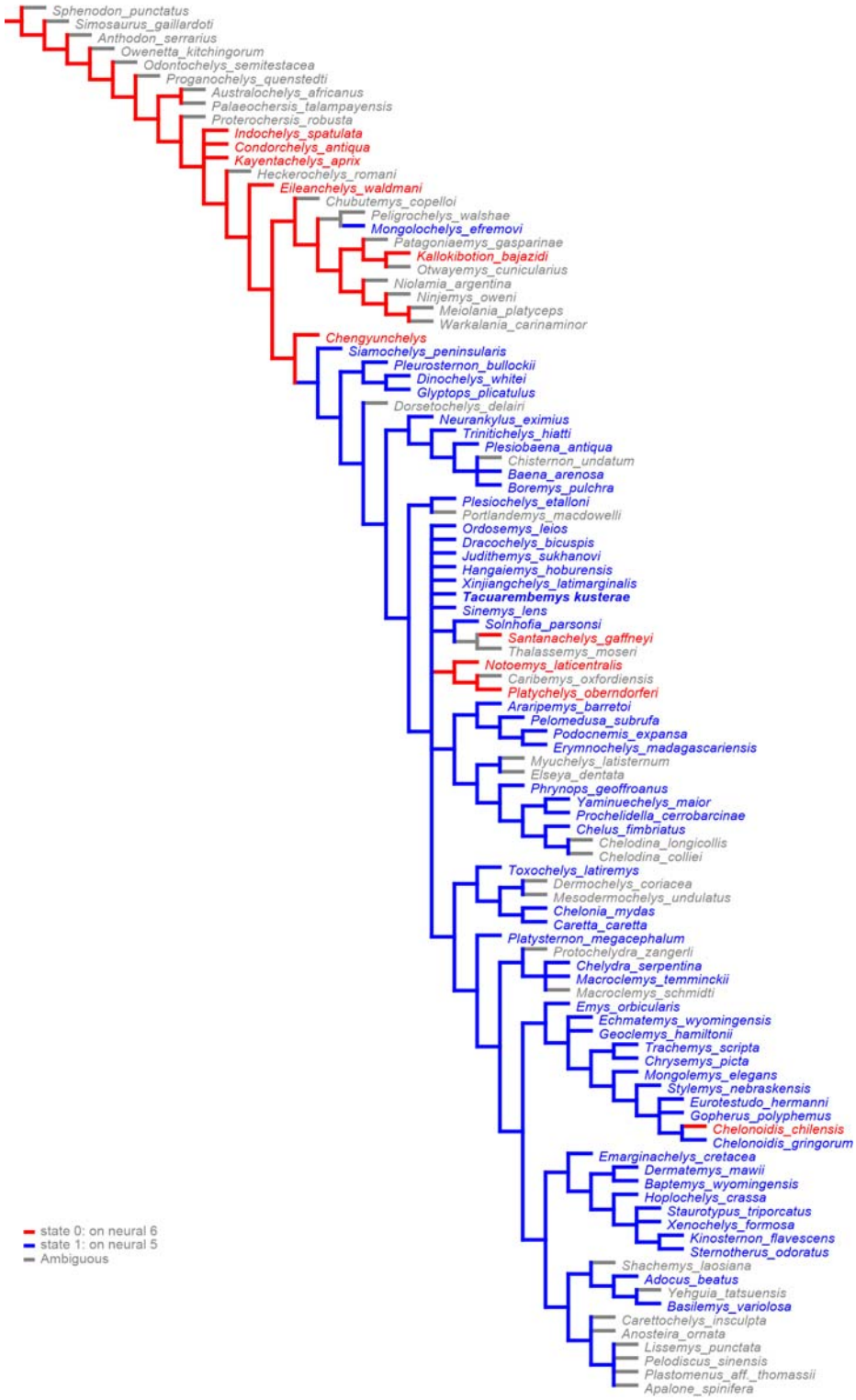


FIGURE S9. Optimization of character 142 (sulcus between vertebrals 3 and 4) discussed in the text.



LITERATURE CITED

Pol, D., and I. H. Escapa. 2009. Unstable taxa in cladistic analysis: identification and the assessment of relevant characters. Cladistics 25:515–527.