THE EARLY COMPOSITION AND EVOLUTION OF THE TURTLE SHELL (REPTILIA, TESTUDINATA)

SUPPLEMENTARY INFORMATION:

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SMNS 91895. A disarticulated partial skeleton. Described and partially figured by Schoch and Sues (2015, 2017).

Odontochelys semitestacea

IVPP V 13240. Paratype of *Odontochelys semitestacea*. A nearly complete and mostly articulated skeleton exposed in ventral view. Described and figured by Li et al. (2008).

IVPP V 15653. A disarticulated specimen, comprising of a nearly complete plastron, including the interclavicle and clavicles, but missing the (?)right hyoplastron, most of the dorsal and parts of the caudal vertebral column, corresponding dorsal ribs, (?)right scapula and coracoid, right humerus, pubis, the first pair of sacral ribs, and several unidentified bones or bone fragments. Described and figured by Li et al. (2008).

Proterochersis robusta

CSMM uncat. The holotype of "*Murrhardtia staeschei*" Karl and Tichy 2000. Found in Mettelberg Quarry, near Murrhardt, Germany. A mostly complete shell, missing the marginal sections of the carapace (including the anterior edge of the cervical region, but not the last two right marginal scute areas), parts of the first three and of the fifth vertebral scute, pleurals, inframarginals, right bridge and right part of the anterior lobe of the plastron. Figured by Wild (1987), described and figured by Karl and Tichy (2000) and Szczygielski and Sulej (2016).

SMNS 11396. The holotype of "*Proterochersis intermedia*" Fraas 1913. Found in Stuttgart-Rohracker, Germany. A fragment of the right side of the plastron, with partial areas of the first and second abdominal and femoral, and sutures visible (Fig. 7A–B, D), a natural mould of the visceral surface of the same fragment (Fig. 7C), a partial natural internal mould of the carapace with impressions of the fourth to 10th dorsal rib, with corresponding rib heads and vertebrae embedded in matrix, and fragments of carapace. Described in detail by Fraas (1913) and Szczygielski and Sulej (2016).

SMNS 12777. The holotype of *Proterochersis robusta*. Found in Rudersberg, Germany. A natural mould of the shell, with small fragment of the 9th marginal scute area, complete right side of the pelvis and posterior right side of the plastron preserved (areas of the second abdominal, femoral, anal, intercaudal, base of the caudal, damaged third and fourth inframarginal, bone splinters fragments of the left anal and caudal scute), and some sutures visible as impressions (Figs 7E, 16N). Figured by Stromer (1912) and (in part) by Młynarski (1976). Figured and described in detail by Fraas (1913) and Szczygielski and Sulej (2016).

SMNS 16442. Found in Murrhardt, Germany. A damaged anterior part of the carapace (apparently corresponds to the area of the first, and anterior and medial parts of the second vertebral scute – the anterior region of the first pair of costals and the underlying ribs are preserved, but the posterior region and most of the following costals are missing, Fig. 1), a damaged part of the carapace margin with a fragment of the anterior part of the bridge (Fig. 3), an anterior lobe of the plastron (humeral scute area and entoplastron, bearing the medial parts of gular scutes, with epiplastra missing, Fig. 6), a rock impression of the latter, a posterior lobe of the plastron (area of femorals and anals with a base of the right caudal process, Fig. 8), and some difficult to interpret fragments and impressions in the plaster (one of them probably of a marginal sulci), some of these elements with traceable sutures. Described in detail in Szczygielski and Sulej (2016). Figured in part by de Broin (1984). Histological sections from that specimen were examined by Scheyer and Sander (2007).

SMNS 16603. Found in the vicinity of Lorch, Germany. An internal mould of a shell of a young specimen, with a posterior right part of the carapace, a pelvis, a part of the right axillary buttress and an anterior fragment of the plastron (consisting of the area of the right extragular and gular, a part of the left extragular, and medial parts of humeral scutes) preserved (Fig. 7F). Described in detail by Szczygielski and Sulej (2016), figured in part by de Broin (1984) and Szczygielski and Sulej (2016).

SMNS 17755. Found in Murrhardt, Germany. A left bridge and most of the left half of the plastron, consisting of the areas of the sixth to ninth (and part of the tenth) marginal, second, third, and part of the first supramarginal, second and third inframarginal, fragment of the humeral scute, most of the pectoral, both abdominals, femoral and fragment of anal scute, with visible sutures (Fig. 4). Large part of this specimen is relatively well-preserved, although the lateral surface is heavily damaged and significant area, especially in anterior section, is restored with plaster. This specimen was never described or figured.

SMNS 17755a. Found in Murrhardt, Germany. A fragment of carapace, consisting of the areas of the last vertebral scute, a broken off and dislocated fragment of the fourth vertebral scute area, a part of the third and complete fourth left pleural, a fragment of the 10^{th}, most of the 11^{th}, full 12^{th}, and most of the 13^{th} left marginal, with sacrum and dorsal parts of both ilia preserved inside and with visible sutures (Fig. 2, S1A–C, Movies S1–3). Although the number may suggest otherwise, this specimen is separate from SMNS 17755. Despite being in the SMNS collection since 1935, it was only provisionally prepared, with much of its surface obscured by sediment. The external surface was fully prepared in mid-2014. Most of the preserved pleural and marginal surface is relatively undamaged, with some minor abrasion. A large, plaster-filled crack is running along the posterior edge of the fourth pleural and anterior edge of the 12^{th} marginal scute area. The vertebral area is broken more or less longitudinally in three places, the middle break caused the broken off part to dislocate and its right side to collapse ventrally. The surface of that part is damaged more. Only a fragment of the fourth vertebral scute area is preserved, also dislocated and pushed internally. This specimen was never described or figured.

SMNS 18440. Found in Murrhardt, Germany. A left bridge fragment, comprising the area of small posterior fragments of the pectoral scute, nearly complete first and complete second abdominal scute, most of the femoral scute, a part of the first and complete second, third, and (poorly preserved) fourth inframarginal, a fragment of the fifth and 10^{th} marginal scute, and complete sixth, seventh, eighth, and ninth marginals, complete three supramarginals, and fragments of the second and third pleural scute, with sutures visible (Fig. 5). Apart from several breaks, it is well-preserved. This specimen was never described or figured.

PROTEROCHERSIS POREBENSIS

ZPAL V.39/3. A large part of an isolated costal with sutural edges (Fig. 11C, F).

ZPAL V.39/4. An isolated neural bone with transverse, ω-shaped sulcus (Fig. 10A–B).

ZPAL V.39/5. A fragment of left posterior carapacial rim, consisting of the areas of a complete eighth and nearly complete ninth marginal scute, part of the third supramarginal scute, and a minute fragment of the second abdominal scute (Fig. 16E–G).

ZPAL V.39/8. A fragment of a left bridge region, consisting of the areas of complete first and anterior part of the second supramarginal scute, a part of the fifth, complete sixth, and part of the seventh marginal scute, a fragment of the first pleural scute, and minute fragments of the axillary and the first two inframarginal scutes (Fig. 16A, D, L).

ZPAL V.39/11. A fragment of isolated costal with sutural edges (Fig. 11G–H).

ZPAL V.39/13. A fragment of the posterior plastral lobe, consisting of the area of most of the right femoral and anal, and the medial part of the left anal scute, with external surface partially eroded, and base of the right lateral pubic process and basal part of the ischia attached to the visceral surface (Fig. 18A–C).

ZPAL V.39/14. An anterior part of an isolated peripheral from the left bridge region with intermarginal sulcus (between either the fifth and the sixth, the sixth and the seventh, the seventh and the eighth, or the eighth and the ninth marginal) and sutural edges (Fig. 15E–G).

ZPAL V.39/20. Proximal parts of two right posterior costals (Fig. 12A–B, 14).

ZPAL V.39/21. A fragment of the right bridge region, consisting of the partial area of the fifth and the sixth marginal, parts of the first and the second inframarginal, and a fragment of plastron, with part of the anterior and part of the dorsal sutural surface preserved (Fig. 16I–K).

ZPAL V.39/22. A left nuchal region of the carapace, consisting of the left nuchal bone, basal parts of two or three anteriormost left peripherals, and at least three supernumerary ossifications, with sutures visible and well-preserved sulci delineating the cervical scute, the first and the second marginal, and anterior part of the first vertebral scute (Fig. 9, S2, Movies S4–6).

ZPAL V.39/23. A fragment of the posterior carapacial rim, consisting of the area of the last marginal, a posterior part of the preceding marginal, and a small fragment of the last vertebral scute, with sutural edge (Fig. 14A–B).

ZPAL V.39/48. The holotype of *Proterochersis porebensis*. A nearly complete shell, pelvis, left scapulocoracoid, and right femur. Figured and described in detail in Szczygielski and Sulej (2016) and Szczygielski (2017).

ZPAL V.39/49. A mostly complete shell. Figured and described in detail in Szczygielski and Sulej (2016) and Szczygielski (2017).

ZPAL V.39/51. A proximal part of an isolated costal with sutural edges (Fig. 11D–E).

ZPAL V.39/54. An isolated (?)last peripheral with poorly preserved sutural edges (Fig. 14C–D).

ZPAL V.39/55. An anterior part of an isolated peripheral with intermarginal sulcus and sutural edges (Fig. 15A–D).

ZPAL V.39/59. A posterior left part of the carapace, consisting of two last marginal scute areas and partial last vertebral scute area, with part of the posterior process of ilium.

ZPAL V.39/68. Posterior plastral lobe consisting of the area of the posterior part of the anal scutes, the complete intercaudal scute, and proximal parts of caudal scutes, with the basal part of the ischia attached to the visceral surface (Fig. 18G–H).

ZPAL V.39/69. Posterior plastral lobe consisting of the area of the anal, intercaudal, and caudal scutes, with bases of the lateral pubic processes and basal part of the ischia and pubis attached to the visceral surface (Fig. 18D–E).

ZPAL V.39/167. Isolated left posterior peripheral and four supernumerary ossifications with intermarginal (between the 10th and 11th marginal) and pleuromarginal (4th pleural) sulci, sutural edges and internal sutures visible (Fig. 12I–O).

ZPAL V.39/168*.* A fragment of the left bridge region, consisting of the area of the second supramarginal, part of the sixth and most of the seventh peripheral (Fig. 16B–C).

ZPAL V.39/170. An isolated left xiphiplastron with femoroanal sulcus and sutural borders (Fig. 18I).

ZPAL V.39/173. An isolated peripheral from the right bridge region with intermarginal sulcus (between the 8th and 9th marginal) and sutural edges (Fig. 15H–K).

ZPAL V.39/181. An isolated posterior peripheral with intermarginal sulcus (either between the 10th and 11th or between the 11th and 12th marginal) and sutural edges (Fig. 15L–M).

ZPAL V.39/186. Probable isolated left extragular ossification (Fig. 17M–T).

ZPAL V.39/213. A fragment of the posterior carapacial rim, consisting of the area of the last marginal, a posterior edge of the preceding marginal, and a small fragment of the last vertebral scute, with suture running at the base of the peripheral (Fig. 14E–F).

ZPAL V.39/235. A large part of an isolated costal with sutural edges (Fig. 11A–B).

ZPAL V.39/373. An isolated polygonal ossicle with a wavy sulcus running along its (?)dorsal and (?)posterodorsal edge and a tubercle on its external surface, with sutural edges (Fig. 12E–F).

ZPAL V.39/374. An isolated polygonal ossicle with a wavy sulcus running along one of its edges and a possible straight one along the other one, with sutural edges (Fig. 12G–H).

ZPAL V.39/375. An isolated polygonal ossicle with a shallow sulcus running across its external surface and sutural edges (Fig. 12C–D).

ZPAL V.39/376. A bridge region of the carapace exposed in visceral view (Fig. 16H, M).

ZPAL V.39/402. A middle section of the fifth vertebral scute are with attached last dorsal and both sacral vertebrae (Fig. 14G–J).

ZPAL V.39/404. An isolated right epiplastron with the base of the dorsal process preserved, forming the lateral part of the gular and medial part of the gular scute, with sutural borders (Fig. 17).

ZPAL V.39/416. An isolated neural bone without sulci on the external surface (Fig. 10C–D).

ZPAL V.39/417. An isolated polygonal ossicle with a tubercle on its external surface, with sutural edges.

ZPAL V.39/418. An isolated polygonal ossicle with a wavy sulcus running along one of its edges, with sutural edges.

ZPAL V.39/419. A partial isolated right costal with an intervertebral sulcus (Fig. 12R–W).

PROGANOCHELYS QUENSTEDTI

SMNS 16980. A nearly complete skeleton of a subadult (Fig. S1D). Described and figured by Gaffney (1990).

SMNS 17203. A mostly complete skeleton of a juvenile. Described and figured by Gaffney (1990).

SMNS 17204. A mostly complete skeleton of an adult. Described and figured by Gaffney (1990).

PALAEOCHERSIS TALAMPAYENSIS

PULR 68. The holotype of *Palaeochersis talampayensis*. A complete skeleton (Fig. S3B, D). See Rougier et al. (1995) and Sterli et al. (2007) for detailed description and figures.

CHINLECHELYS TENERTESTA

NMMNH P-16697. The holotype of *Chinlechelys tenertesta*. A partial, disarticulated skeleton, including the fragments of carapace and plastron, an acetabular region of pelvis (?right), a proximal head of the left femur, and osteoderms, including a complex spiked osteoderm (Fig. S1E), all apparently belonging to a single animal. See Lucas (2000) and Joyce et al. (2009) for detailed description and figures.

TABLES

Table S1. Opinions on homologies of turtle carapace elements expressed by various researchers presented in chronological order. [a]The word "dermal" is not used, but the endoskeletal elements are stated to be grown together with the plates of the shell. [b]Possible lack of dermal phase of costal and neural formation in Trionychidae. Question marks indicate no opinion on homologies of given element.

Author	Year	Costalia	Neuralia	Nuchale	Peripheralia	Suprapygale	Pygale
Lachmund	**1676**	Ribs	Neural spines	?	?	?	?
Cuvier	**1798**	Ribs + dermal[a]	Neural spines + dermal[a]	?	?	?	?
Saint-Hilaire	**1809**	Ribs	Neural spines	Neural of C8	Ossified rib cartilages	?	?
Fyfe	**1813**	Ribs + dermal[a]	?	?	?	?	?
Fyfe	**1818**	Ribs + dermal[a]	?	?	?	?	?
Bojanus	**1819**	Ribs	Neural spines	?	?	?	?
Bojanus	**1821**	Ribs	Neural spines	?	?	?	?
Meckel	**1824**	Ribs	?	?	Ossified rib cartilages	?	?
Carus	**1827a**	Transverse processes	Neural spines	?	?	?	?
Carus	**1827b**	Ribs + dermal	Neural spines + dermal	?	Ossified rib cartilages	?	?
Grant	**1834**	Ribs	Neural spines	?	Ossified rib cartilages	?	?
Cuvier	**1835**	Ribs	Neural spines	?	Ossified rib cartilages	?	?
Cuvier	**1837**	Ribs	Neural spines + dermal[a]	?	Ossified rib cartilages	?	?
Peters	**1838**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Roget	**1839**	Ribs	Neural spines	?	Ossified rib cartilages	?	?
Jones	**1841**	Ribs	Neural spines	?	Ossified rib cartilages	?	?
Wagner	**1841**	Ribs + dermal	Neural spines + dermal	?	?	?	?
Wagner	**1845**	Ribs + dermal	Neural spines + dermal	?	?	?	?
Rathke	**1848**	Ribs	Neural spines	Dermal	Dermal	Dermal	Dermal
Owen	**1849**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Gray	**1855**	Ribs	Neural spines	?	Ossified rib cartilages	?	?
Huxley	**1864**	Ribs + dermal	?	?	?	?	?
Parker	**1868**	Ribs + dermal	Neural spines + dermal	?	Dermal	?	?
Cope	**1869**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Huxley	**1869**	Ribs	Neural spines	Dermal	Dermal	Dermal	Dermal
Huxley	**1871**	Ribs (+ dermal?)	Neural spines (+ dermal?)	Dermal	Dermal	Dermal	Dermal
Huxley	**1872**	Ribs (+ dermal?)	Neural spines (+ dermal?)	Dermal	Dermal	Dermal	Dermal
Gervais	**1872**	Ribs + dermal	Neural spines + dermal	?	?	?	?
Gegenbaur	**1878**	Transverse processes + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Baur	**1887**	?	?	Ribs of C8	?	?	?
Boulenger	**1889**	Ribs	Neural spines	Ribs of C8	Dermal	?	Dermal
von Zittel	**1890**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Haycraft	**1892**	Ribs	Neural spines	Dermal	Dermal	Dermal	Dermal
Hay	**1898**	Ribs + fascial	Neural spines + fascial	Fascial	Fascial	Fascial	Fascial
Huxley	**1898**	Ribs (+ dermal?)	Neural spines (+ dermal?)	Dermal	Dermal	Dermal	Dermal
Goette	**1899**	Ribs	Neural spines	Dermal	Dermal	Dermal	Dermal
von Zittel	**1902**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Newman	**1906**	Ribs	Neural spines	Dermal	Dermal	Dermal	Dermal
Wiedersheim	**1907**	Ribs	Neural spines	Dermal	Dermal	Dermal	Dermal
Gadow	**1909**	Ribs + dermal	Neural spines + dermal	Neural of C8 + costalia of D1	Dermal	Dermal	Dermal (fused peripherals)
Völker	**1913**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal (epithecal)	Dermal	Dermal (epithecal)
Versluys	**1914a**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal (epithecal)	Dermal	Dermal
Versluys	**1914b**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal (epithecal)	Dermal	Dermal
Jaekel	**1918**	Ribs	Neural spines	Dermal	Dermal	Dermal	Dermal
Hay	**1922**	?	?	?	Gastralia (letral rows)	?	?
Procter	**1922**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Williston	**1925**	Ribs	Neural spines	?	?	?	?

Author	Year	Costalia	Neuralia	Nuchale	Peripheralia	Suprapygale	Pygale
DeBeer	**1928**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Hay	**1929**	Ribs + dermal	Neural spines + dermal	Neural of C8	Dermal (distal costal osteoderms)	Dermal	Dermal
Goodrich	**1930**	Ribs	?	?	?	?	?
Deraniyagala	**1930**	Ribs	Neural spines	Dermal (neck osteoderm)	Dermal	Dermal	Dermal
Zangerl	**1939**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Vallén	**1942**	Ribs	Neual spines	Supracleithrum	Dermal	Dermal	Dermal
Kälin	**1945**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Gregory	**1946**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Friant	**1961**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Suzuki	**1963**	Ribs + dermal	Neural spines + dermal	Dermal (peripheral)	Dermal	Dermal	Dermal (peripheral)
Romer	**1976**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Sikorska-Piwowska	**1986**	Ribs + dermal	Neural spines + dermal	Supracleithrum	?	?	?
Burke	**1989**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Cherepanov	**1989**	Ribs	Neural spines	Dermal	Dermal	Dermal	Dermal
Gaffney	**1990**	Ribs + dermal[a]	Neural spines + dermal[a]	?	?	?	?
Burke	**1991**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Cherepanov	**1995**	Ribs	Neural spines	Dermal	Dermal	Dermal	Dermal
Rieppel	**1993**	Ribs + dermal	?	?	?	?	?
Romer	**1997**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Cherepanov	**1997**	Ribs	Neural spines	Dermal	Dermal (osteodermal)	Dermal (osteodermal)	Dermal (osteodermal)
Gerlach	**1999**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Alibardi & Thomson	**1999**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Rieppel & Reisz	**1999**	Ribs	Neural spines	Dermal	Dermal	Dermal	Dermal
Kordikova	**2000**	Ribs	Neural spines	Dermal (osteoderm of C8)	Dermal (rib osteoderms)	Dermal (sacral osteoderms)	Dermal (osteodermal)
Gilbert et al.	**2001**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Clark et al.	**2001**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Sheil	**2003**	Ribs + dermal	Neural spines + dermal	Dermal	?	?	?
Vincent et al.	**2003**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Sheil	**2005**	Ribs + dermal	?	Dermal	?	?	?
Cebra-Thomas	**2005**	Ribs + dermal	?	?	?	?	?
Sheil & Greenbaum	**2005**	Ribs + dermal	?	Dermal	?	?	?
Scheyer et al.	**2007**	Ribs + dermal	?	?	?	?	?
Scheyer & Sánchez-Villagra	**2007**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Gilbert et al.	**2007**	?	Neural spines + dermal	Dermal	?	?	?
Nagashima et al.	**2007**	Ribs	?	?	?	?	?
Gilbert et al.	**2008**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Scheyer et al.	**2008**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Sánchez-Villagra et al.	**2009**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Vickaryous & Sire	**2009**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Bona & Alcalde	**2009**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	?
Burke	**2009**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Kuratani et al.	**2011**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Lima et al.	**2011**	Ribs + dermal	Neural spines + dermal	Dermal	Dermal	Dermal	Dermal
Nagashima et al.	**2012**	Ribs	Neural spines	Dermal	Dermal	Dermal	Dermal
Lyson et al.	**2013a**	Ribs + (sub)dermal	Neural spines + (sub)dermal	Cleithrum	Dermal (non-osteodermal)	?	?
Lyson et al.	**2013b**	Ribs + dermal	Neural spines + dermal	Cleithrum	Dermal (non-osteodermal)	Dermal (non-osteodermal)	Dermal (non-osteodermal)
Hirasawa et al.	**2013**	Ribs	Neural spines	Dermal	Dermal	Dermal	Dermal
Nagashima et al.	**2014**	Ribs	Neural spines	Dermal	Dermal	Dermal	Dermal
Rice et al.	**2015**	Ribs + dermal/?ribs[b]	Neural spines + dermal/neural spines[b]	Cleithrum	Dermal	?	?
Hirasawa et al.	**2015**	Ribs	Neural spines	Dermal	Dermal	Dermal	Dermal
Cherepanov	**2016**	Ribs	Neural spines	Dermal	Dermal (osteodermal)	Dermal (osteodermal)	Dermal (osteodermal)

Table S2. Opinions on homologies of turtle plastron elements expressed by various researchers presented in chronological order. [a]Interclavicle interpreted as part of the sternum. [b]Partially homologized with rib cartilages. [c]According to figure caption; lack of interclavicle stated in the main text. [d]Ambiguous due to imprecise wording. Question marks indicate no opinion on homologies of given element.

Author	Year	Epiplastra	Entoplastron	Hyo-xiphiplastra
Lachmund	**1676**	Sternum	Sternum	Sternum
Cuvier	**1798**	Sternum	Sternum	Sternum
Saint-Hilaire	**1809**	Sternum	Sternum	Sternum
Fyfe	**1813**	Sternum	Sternum	Sternum
Fyfe	**1818**	Sternum	Sternum	Sternum
Bojanus	**1819**	Sternum	Sternum	Sternum
Bojanus	**1821**	Sternum	Sternum	Sternum
Oken	**1823**	Clavicle	Interclavicle[b] ("manubrium")	Sternum
Meckel	**1824**	Sternum	Sternum	Sternum
Carus	**1827a**	Sternum	Sternum	Sternum
Carus	**1827b**	Sternum + dermal	Interclavicle[a] + dermal	Sternum + dermal
Grant	**1834**	Sternum	Sternum	Sternum
Cuvier	**1835**	Sternum	Sternum	Sternum
Cuvier	**1837**	Sternum	Sternum	Sternum
Peters	**1838**	Sternum + dermal	Sternum + dermal	Sternum + dermal
Roget	**1839**	Sternum	Sternum	Sternum
Jones	**1841**	Sternum	Sternum	Sternum
Wagner	**1841**	Sternum	Interclavicle[a] ("manubrium")	Sternum
Wagner	**1845**	Sternum	Interclavicle[a] ("manubrium")	Sternum
Rathke	**1848**	Dermal	Dermal	Dermal
Owen	**1849**	Sternum	Interclavicle[b]	Gastralia[b] ("haemapophyses") + dermal
Gray	**1855**	Sternum	Sternum	Sternum
Parker	**1868**	Clavicle	Interclavicle	Gastralia
Cope	**1869**	Sternum	Sternum	Sternum
Huxley	**1869**	Dermal	Dermal	Dermal
Huxley	**1871**	Clavicle	Interclavicle	Dermal
Huxley	**1872**	Clavicle	Interclavicle	Dermal
Gervais	**1872**	Clavicle	Sternum	?
Fürbringer	**1874**	Dermal	Dermal	Dermal
Gegenbaur	**1878**	Dermal	Dermal	Dermal
Boulenger	**1889**	Clavicle	Interclavicle	Gastralia
Baur	**1889**	Clavicle	Interclavicle	Gastralia
von Zittel	**1890**	Clavicle	Interclavicle	Dermal
Baur	**1891**	Clavicle + dermal	Interclavicle + dermal	Gastralia + dermal
Haycraft	**1892**	Dermal	Dermal	Dermal
Hay	**1898**	Clavicle	Interclavicle	Gastralia (fascial)
Huxley	**1898**	Clavicle	Interclavicle	Dermal
Goette	**1899**	Gastralia	Gastralia	Gastralia
Fürbringer	**1900**	Clavicle	Interclavicle ("episternum")	Gastralia ("parasternalia")
Voeltzkow & Doderlein	**1901**	?	?	Gastralia
von Zittel	**1902**	Dermal	Dermal	Dermal
Newman	**1906**	Clavicle	Interclavicle	Gastralia
Wiedersheim	**1907**	Clavicle	Interclavicle ("episternum")[c]	Gastralia
Lane	**1909**	Gastralia	Gastralia	Gastralia
Gadow	**1909**	Clavicle	Interclavicle	Gastralia
Völker	**1913**	Clavicle	Interclavicle	Dermal
Versluys	**1914a**	Clavicle	Interclavicle	Gastralia + dermal
Versluys	**1914b**	Clavicle	Interclavicle	Gastralia + dermal
Jaekel	**1918**	Clavicle	Interclavicle	Gastralia
Hay	**1922**	Clavicle	Interclavicle	Gastralia
Procter	**1922**	Sternum + gastralia[d]	Sternum + gastralia[d]	Sternum + gastralia[d]
Williston	**1925**	Clavicle	Interclavicle	Gastralia
DeBeer	**1928**	Clavicle + dermal	Interclavicle + dermal	Dermal
Goodrich	**1930**	Clavicle	Interclavicle	Gastralia
Deraniyagala	**1930**	Clavicle	Interclavicle	Gastralia
Zangerl	**1939**	Clavicle + dermal	Interclavicle + dermal	Gastralia + dermal
Friant	**1942**	Clavicle	Interclavicle	?
Vallén	**1942**	Clavicle	Interclavicle	Gastralis
Kälin	**1945**	?	?	Gastralia
Gregory	**1946**	Clavicle	Interclavicle	Dermal

Author	Year	Epiplastra	Entoplastron	Hyo-xiphiplastra
Walker	**1947**	Clavicle + dermal	Interclavicle + dermal	?
Williams & McDowell	**1952**	Clavicle + dermal	Interclavicle + dermal	?
Friant	**1961**	Clavicle + dermal	Interclavicle + dermal	Dermal
Walker	**1973**	Clavicle + dermal	Interclavicle + dermal	?
Romer	**1976**	Clavicle	Interclavicle	Gastralia
Cherepanov	**1984**	Clavicle	Interclavicle	?
Sikorska-Piwowska	**1986**	Clavicle	Interclavicle	?
Burke	**1989**	Dermal	Dermal	Dermal
Cherepanov	**1989**	Clavicle	Interclavicle	Dermal
Gaffney	**1990**	Clavicle	Interclavicle	?
Burke	**1991**	Dermal	Dermal	Dermal
Cherepanov	**1995**	Clavicle	Interclavicle	Dermal
Rieppel	**1993**	Clavicle	Interclavicle	Gastralia
Romer	**1997**	Clavicle	Interclavicle	Gastralia
Cherepanov	**1997**	Clavicle	Interclavicle	Gastralia
Alibardi & Thomson	**1999**	Clavicle	Interclavicle	Gastralia
Rieppel & Reisz	**1999**	Clavicle	Interclavicle	?
Kordikova	**2000**	Clavicle	Interclavicle	Gastralia
Gilbert et al.	**2001**	Clavicle	Interclavicle	Gastralia
Clark et al.	**2001**	Clavicle	Interclavicle	Dermal
Sheil	**2003**	Clavicle	Interclavicle	Dermal[d]
Vincent et al.	**2003**	Clavicle	Interclavicle	Dermal
Sheil	**2005**	Clavicle	Interclavicle	Dermal
Sheil & Greenbaum	**2005**	Clavicle	Interclavicle	?
Scheyer & Sánchez-Villagra	**2007**	Dermal	Dermal	Dermal
Gilbert et al.	**2007**	Clavicle	Interclavicle	Gastralia
Cebra-Thomas et al.	**2007**	Clavicle	Interclavicle	Gastralia
Gilbert et al.	**2008**	Clavicle	Interclavicle	Gastralia
Scheyer et al.	**2008**	Clavicle	Interclavicle	Gastralia
Sánchez-Villagra et al.	**2009**	Dermal	Dermal	Dermal
Vickaryous & Sire	**2009**	Clavicle	Interclavicle	Gastralia
Bona & Alcalde	**2009**	Dermal	Interclavicle + dermal	Dermal
Burke	**2009**	Clavicle	Interclavicle	Gastralia
Kuratani et al.	**2011**	Clavicle	Interclavicle	Gastralia
Lima et al.	**2011**	Dermal	Dermal	Dermal
Nagashima et al.	**2012**	Clavicle	Interclavicle	Gastralia
Lyson et al.	**2013a**	Clavicle	Interclavicle	Gastralia
Lyson et al.	**2013b**	Clavicle	Interclavicle	Gastralia
Cebra-Thomas et al.	**2013**	Clavicle	Interclavicle	Gastralia
Nagashima et al.	**2014**	Clavicle	Interclavicle	Gastralia
Hirasawa et al.	**2015**	Clavicle	Interclavicle	Gastralia
Rice et al.	**2016**	Clavicle	Interclavicle	Gastralia
Cherepanov	**2016**	Clavicle	Interclavicle	Gastralia

Homologies of the shell elements

Costals and neurals

The costal and neural bones of the carapace received most attention from researchers. Their affinity to the axial skeleton was already explained in the 17th century by Lachmund (1676), who understood them as simple expansions of ribs and vertebrae. Cuvier (1798), on the other hand, preferred to view these elements as separate entities, which are only grown to the endoskeleton. Although several modes of skeletogenesis (endochondral, intramembranous, metaplastic) were already observed at that time (e.g., van de Spiegel and Casseri 1626; Steno 1673), their mechanisms were not yet understood, the origin of particular skeletal elements in various taxa was quite often confused, and imprecise wording makes it impossible to ascertain whether Cuvier truly considered costals and neurals to be of dermal (exoskeletal) origin. In his later works, however, he treated costals (Cuvier 1835, 1837) and neurals (Cuvier 1835) as modifications of the endoskeleton rather than distinct elements. Carus (1827*a*) is considered to be the first explicit proponent of dual (endoskeletal and dermal) origin of costal and neural bones. Although this composite nature is now frequently accepted by researchers (e.g., Kälin 1945; Suzuki 1963; Gilbert et al. 2001; Scheyer 2007*a*, and many others), interpretations and observations of some others (e.g., Rathke 1848; Haycraft 1892; Vallén 1942; Cherepanov 1989, 1995, 1997, 2016, Hirasawa et al. 2013, 2015) favour a wholly endoskeletal character of these elements. At least in part this disagreement may be a result of developmental differences between the soft-shelled and hard-shelled turtles (Rice et al. 2015). Carus (1827*b*) and Gegenbaur (1878) expressed a view that turtles lack true ribs, and the costals are formed (Carus 1827*b*) or supported (Gegenbaur 1878) by the transverse processes. This, however, never found any developmental support, nor was widely accepted by researchers and was abandoned even by Carus soon after.

Our observations support the view that the costals did not originated as separate osteoderms that were later fused to the underlying ribs. Even though the osteodermal covering was indeed present on the trunk of turtles at a certain stage of their evolution, fully formed costals were present as well. They were fully exposed in the bridge region, and partially exposed dorsally in posterior region of the carapace, as evidenced by ZPAL V.39/20 (Figs 12A–B, 13). The same specimen also shows that there were well-developed, anteroposteriorly sutured costals located deep to the osteodermal mosaic in *Proterochersis porebensis*. SMNS 17755a preserves what appears to be disarticulated distal parts of broadened ribs below the mosaic (Fig. 2G). It is unclear whether throughout life these were suturally connected to each other and to overlying mosaic, and were disarticulated post-mortem, or if they were attaining their sutural contacts later during ontogeny.

Dermal bones of the carapace

The remaining elements of the carapace – the nuchal, peripherals, suprapygal(s), and pygal – are proven to be fully dermal, but their homologies are mostly unsure. The nuchal bone was proposed by Saint-Hilaire (1809) to be an equivalent of the neural bone of the last cervical – a view shared later by Hay (1929) and Gadow (1909), the latter considered it to additionally include the costals of the first dorsal rib pair. Baur (1887*b*) and Boulenger (1889) viewed it as a homologue of the last pair of cervical ribs. Vallén (1942) proposed its affinity with supracleithrum. The most popular, however, was the general assumption that the nuchal is a neomorphic dermal element, first proposed by Peters (1838). Only recently, Lyson et al. (2013*b*) identified it as a homologue of the cleithrum (although see the discussion in Ponomartsev et al. 2017).

Peripherals during the first half of the 19th century were usually considered ossified rib cartilages ("sternal ribs"), as proposed by Saint-Hilaire (1809). Peters (1838) was the first to recognize them as dermal elements. Hay (1922) considered them to be homologous to the lateral rows of gastralia. Probably due to their serial layout, small size, and relatively late ossification, quite frequently they are explicitly stated to be true osteoderms (Hay 1929; Cherepanov 1997, 2016; Kordikova 2000). Lyson et al. (Lyson et al. 2013*a*, *b*) argued that the peripherals are neomorphs not comparable to osteoderms due to their offset from the overlying scales/scutes, but the numerical or positional correlation with the overlying epidermal elements does not define osteoderms (Otto 1909; Westphal 1975; Romer 1997; Hill 2006; Vickaryous and Sire 2009; Arbour et al. 2014), so this view cannot be unambiguously accepted without some developmental clues. Arbour et al. (2014) utilized distinction between ossicles (diameter less than 1 cm according to their table 1 and typically less than 5 mm according to their methods, lack of correlation with overlying scales) and osteoderms (diameter above 1 cm according to their table 1 and above several millimetres according to their methods, each covered by a single scale), but this typology was introduced for convenience, designed for description of ankylosaurian armour, and does not imply any particular qualitative differences between each class of dermal elements. Both classes fit comfortably into the common definition of an osteoderm and in many taxa there is no clear division.

Suprapygals and pygal are the most enigmatic elements of the turtle carapace. Since the work of Peters (1838), they are universally considered truly dermal, but more precise homologies were rarely given, and often these elements were skipped from the discussion altogether. Sometimes vague suggestions were made about a neural-like nature of the suprapygals (e.g., Owen 1849), but even then, usually no explicit statement of the homology was expressed. Gadow (1909) interpreted the suprapygals as neurals that lost their connection to the vertebrae. Gadow (1909) and Suzuki (1963) treated the pygal as the posteriormost peripheral (or fused pair of peripherals). Cherepanov (1997, 2016) and Kordikova (2000) consider them true osteoderms. Virtually no data are present in the literature about the morphogenesis and positioning of these elements, most likely due to their late ossification, beginning just before or after hatching (e.g., Vallén 1942; Cherepanov 1989; Gilbert et al. 2001; Bona and Alcalde 2009; Lima et al. 2011; Vieira et al. 2016). Currently, it is clear, however, that the suprapygals, pygal, and peripherals are fully exoskeletal and ossify without relation to ribs and vertebrae (Vallén 1942; Cherepanov 1989, 1997, Gilbert et al. 2001, 2008; Scheyer et al. 2008; Delfino et al. 2010 and many others).

Based on our observations, we support the view that the peripherals, suprapygals, and pygal plate of derived turtles originated from ancestral mosaic of homogenous dermal elements. Even in derived turtles, their identification is based on their location within the shell rather than any meaningful developmental or structural differences. Likewise, we see little basis other than topology for their differentiation from typical reptilian exoskeleton. We also support the notion that the nuchal bone was paired in *Proterochersis porebensis*, as it is in early developmental stages of some modern turtles (Vallén 1942; Cherepanov 1995; Sánchez-Villagra et al. 2009; Lyson et al. 2013*b*), which may support hypotheses of its homology with paired elements of the dermal pectoral girdle (Vallén 1942; Lyson et al. 2013*b*).

PLASTRON

The homologies of the plastron are more universally accepted than those of carapacial elements. Initially, all the plastral bones were homologized with the sternum (Lachmund 1676). Oken (1823) was probably the first to propose the homology of the epiplastra with the clavicles and the entoplastron with the interclavicle (although the reptilian interclavicle in the early 19th century was generally treated as a part of the sternum, and identified with mammalian manubrium sterni). Just like for the carapace, Carus (1827*a*) suggested the presence of dermal ossifications in the plastron, while Rathke (1848) provided data for its fully dermal character. Owen (1849) was the first to homologize the posterior bones of the carapace with gastralia (his “haemapophyses”), explicitly comparing them to the gastral basket of plesiosaurs, although he was not aware of their dermal origin, and thus identified them with ossified rib cartilages and argued for endoskeletal character of the plastron. The fully dermal origin of the plastral bones and their homology with the clavicles, interclavicle, and gastralia were mostly accepted during the second half of the 19th century, and rarely questioned since. Goette (1899) and Lane (1909) refuted the homology of the epi- and entoplastron with the clavicles and interclavicle, instead opting for their identity as gastralia. Procter (1922) supported the identity of plastron as a mix of sternum and dermal bone. The interpretations of the numerical relationships between each plastral bone (save for ento- and epiplastra) and gastralia that are supposed to build it, varied: Owen (1849) and Zangerl (1939) viewed each plastral element as a bunch of individual gastralia fused together while Hay (1898) interpreted each bone of the plastron as a single, heavily modified gastralium. Jaekel (1916) interpreted the plastron of *Proganochelys quenstedti* as composed of five longitudinal rows of gastralia, each including 25 elements, but this was only a misinterpretation of surficial bone texture due to absence of visible suture lines, as later evidenced by a juvenile, not fully ossified specimen, SMNS 17203 (Gaffney 1985, 1990). The hypothesis of plastron derived from gastralia recently found support in form of *Pappochelys rosinae*, a Middle Triassic stem turtle with forked gastralia (Schoch and Sues 2015, 2016, 2017).

Given the intramembranous character of clavicles, interclavicle and gastralia, the contribution of additional dermal ossifications surrounding these elements in the plastron is usually not highlighted in the literature, although the developmental data support the notion that the primordium of each of the former bones is homologous only to the part of corresponding plastral element (Vallén 1942; Walker 1947; Gilbert et al. 2001). The Late Triassic taxa examined herein already have well-developed plastra, therefore they provide little data concerning the homologies of plastral elements.

THE EARLY EVOLUTION OF THE TURTLE SHELL

BEFORE THE SHELL

Recent years brought proliferation of data on the origin and early evolution of turtles. There is, however, still some major controversy concerning the turtle ancestors. The most popular now is the hypothesis that turtles evolved from a broad-ribbed Permian reptile *Eunotosaurus africanus* Seeley, 1892 (Watson 1914; Lyson et al. 2010, 2013*a*, 2014, 2016; Bever et al. 2015). This would mean that the turtle lineage developed broadened ribs and elongated vertebrae already in the Permian. Unfortunately, the position of that taxon at the base of the turtle branch and within Diapsida is dependent entirely on very few postcranial characters (Schoch and Sues 2017; Szczygielski 2017), which appear to result from its fossorial ecology (Lyson et al. 2016). Furthermore, *E. africanus* appears to be more similar in its morphology to testudinates than to non-testudinate stem turtles (Schoch and Sues 2017; Szczygielski 2017) and there is a conflict in the phylogenetic signal of that animal and recently discovered *Pappochelys rosinae* from the Middle Triassic (Ladinian, Longobardian) of Germany (Szczygielski 2017), therefore its relationship with turtles is controversial and assumptions based on that animal should be made with caution.

In their recent paper, Lichtig et al. (2017) highlighted an interesting question of turtle-like tracks in the Anisian and Olenekian fossil record of USA and Europe. They argue that the turtle-like shell must have developed before the appearance of *Pappochelys rosinae* and *Odontochelys semitestacea* and consider the former as a placodont and the latter as a turtle secondarily adapted to marine environment. Furthermore, they argue for the origin of turtles from pareiasaurs, based on the similarity of the tracks. While we agree that enigmatic turtle-like tracks may indeed indicate the presence of an unknown turtle-like animal in the Triassic, they only convey data about the mode of locomotion and structure of the paws (which, to an extent, influence each other). Therefore, identification of the trackmaker is tricky – it may be an exceptionally early testudinate, but it may as well be an exceptionally late pareiasaurid or eunotosaurid, or some other, yet unknown animal (possibly even related to *Priscochelys hegnabrunnensis*), but not necessarily related to turtles. We also disagree with the identification of *Pa. rosinae* as a placodont – the affinity of *Pa. rosinae* and turtles is extremally well supported in the analyses utilizing the largest dataset thus far (Szczygielski 2017).

Despite the remaining questions and controversies, much is known and an attempt may be made to discuss the evolution of the shell in much greater detail than ever before. For the needs of this work we follow the topology obtained from our phylogenetic analysis (see the main text): *Pappochelys rosinae* (*Odontochelys semitestacea* ((Proterochersidae + *Chinlechelys tenertesta*) (*Proganochelys quenstedti* (*Palaeochersis talampayensis* (Testudines))))).

Pappochelys rosinae may be currently considered the oldest and the most basal uncontroversial stem turtle (Schoch and Sues 2015, 2016, 2017; Szczygielski 2017). It only had primordia of the shell in the form of broadened ribs and relatively thick gastralia, some of which were forked, with no evidence of overlying epidermal scutes. The broadening of the dorsal ribs and gastral apparatus may be a case of pachyostosis (Schoch and Sues 2015) that helped this small animal attain a body mass significant enough to dive and swim effectively (see Houssaye 2009). The increasing girth of gastralia may have led to their coalescence – similar occurrences of fusion are observed in rhynchocephalians (Howes and Swinnerton 1901), dinosaurs (Claessens 2004), and crocodilians (Vickaryous and Hall 2008), possibly do to initial lack of periosteal sheath (Vickaryous and Hall 2008).

The homology of entoplastron and epiplastra with the interclavicle and clavicles is rather uncontroversial and widely accepted. The plate of the interclavicle of *Pap. rosinae*, however, lacks pronounced striation, jagged edges or rugose surficial ornamentation (Schoch and Sues 2015, 2017) indicative of superficial dermal ossification, so postnatally it most likely was located below the dermis and thus cannot be considered an entoplastron yet. The clavicles apparently articulated more or less anteriorly with the interclavicle (Schoch and Sues 2017), so they were distinct from the plastron in that animal as well.

Likewise, there is no evidence of any dermal elements of the carapace. As noted by Schoch and Sues (2015), at least some ribs of *Pap. rosinae* are externally covered with striated ornamentation, which most likely indicates their interaction with the dermis. Their surface, however, lacks fine fibrous or vascular rugosity present in true turtles and is shiny, so they apparently did not approximate the epidermis. Based on the apparent axial arrest of the ribs, Schoch and Sues (2017) suggested presence of an incomplete (restricted to sides of the animal) carapacial ridge (Burke 1989) in *Pap. rosinae*.

Development of the plastron

Analogues of the plastron. The appearance of the plastron before the well-developed dorsal armour is unusual and still not adequately explained from the adaptive or selectional point of view. The dorsal dermal armour appeared independently in numerous lineages of tetrapods (e.g., Vickaryous and Sire 2009), and although in some groups it embraced the ventrum as well (most notably in some temnospondyls, some crocodiles, and some placodonts – e.g., Westphal 1975; Rieppel 2002; Vickaryous and Sire 2009; Burns et al. 2013), such a degree of development is much less common, secondary, and usually occurs only in most derived representatives of the lineage. Turtles seem to be unique as well in the form of their plastron, which is composed of only several large plates, apparently homologous to gastralia, and incorporated the clavicles and interclavicle. In most of other taxa, with very few exceptions, the ventral armour is built from numerous osteoderms. In early temnospondyls like *Greererpeton burkemorani*, the gastralia and the osteoderms/osseous scales did not yet diverged morphologically (Voeltzkow and Döderlein 1901; Romer 1972, 1997; Godfrey 1989) and, possibly, morphogenetically, therefore the ventral armour of these animals is in a sense intermediate in character between those of turtles and most reptiles. In some placodonts, gastralia interacted with osteoderms, sometimes even fusing with them (Westphal 1975; Rieppel 2002). This is an interesting case of interaction between two iterations of deeply homologous elements: the gastralia evolutionarily derived from dermal ossifications and the secondarily developed dermal ossifications. The contribution of gastralia to the ventral armour in placodonts, however, was minor, and the osteodermal armour of derived placodonts ultimately substituted for the gastralia rather than incorporated them (Westphal 1975; Rieppel 2002). At least in some saurosphargids there was a set of broadened, abutting gastralia (Hirasawa et al. 2013), which brings the morphology of these animals closer to turtles, especially considering their relatively straight and broadened ribs (although similar rib morphologies were also present in at least some placodonts – e.g., Westphal 1975). Apparently abutting or partially overlapping, broad ribs (seemingly lacking intercostal muscles) and gastralia were also present in at least some hupehsuchians (Chen et al. 2014*a*, *b*) – these animals may be the closest to pantestudinates in terms of armour anatomy, as they generally lack osteoderms (unlike saurosphargids, placodonts, and other mentioned groups) with exception of a midline row above the spine. The general body plan, however, is very different from turtles and no fusion of gastralia is apparent.

Eunotosaurus africanus was reported to have gastralia organized in only two rows and not crossing the midline (Lyson et al. 2013*a*), similarly to plastral bones of turtles. However (according to the description), they were found in only one specimen, and (according to figures 1 and S1 therein) only four gastral elements are visible in said specimen, which are apparently dislocated (the elements on one side of the specimen do not align with the elements on the other side) and not fully prepared (the elements of the right side are longer than those on the left side). Therefore, we conclude that the number, shape, and position of gastralia in *E. africanus* are not really known.

Scutes. As noted by Li et al. (2008), in modern turtles the development of plastral bones precedes the development of carapacial bones (Cherepanov 1984, 1989, 1995; Ewert 1985; Rieppel 1993; Gilbert et al. 2001; Sheil 2003; Vincent et al. 2003; Sheil and Greenbaum 2005; Bona and Alcalde 2009; Sánchez-Villagra et al. 2009; Lima et al. 2011; Rice et al. 2016), with possible exception of the nuchal bone (Rieppel 1993; Gilbert et al. 2001; Sheil 2003; Sheil and Greenbaum 2005). On the other hand, the scute placodes develop in modern turtles first on the carapace (Cherepanov 1989, 2006), but there is no evidence of carapacial scutes in *O. semitestacea*, although a set of gular, possibly extragular (the extragular spikes are broken off in IVPP V 13240, the only specimen with ventral surface of plastron exposed, possibly obscuring the sulci), humeral, pectoral, two pairs of abdominal, femoral, anal, and possibly at least two pairs of inframarginal scutes is present on the plastron of that prototurtle (Lyson et al. 2014). The lack of carapacial scute sulci may possibly be explained by the lack of well-developed dermal expansions on ribs of *O. semitestacea*. The scutes might have been present, but the dorsal surface of ribs might have been too far from the epidermis to be affected. On the contrary, the intermarginal sulci are considered to induce the ossification of peripheral bones in modern turtles (Cherepanov 1989; Gilbert et al. 2008), so lack of peripheral ossifications may potentially speak for lack of carapacial scutes, but also (alternatively) for lack of relevant developmental mechanism that would lead to ossification of peripherals.

Ribs. The ribs of *Odontochelys semitestacea* specimens IVPP V 13240 and IVPP V 15653 are not exposed dorsally, but in the holotype (figured by Li et al. 2008) they seem to lack any surficial sculpture, unlike the ribs of *Pappochelys rosinae*. It is impossible to say whether they never attained interaction with dermis throughout life of this animal, or if the holotype is too young for this interaction to be visible.

Neurals. In *Odontochelys semitestacea* there are several neural plates present, but their exact number is unknown, they were never described in detail in the holotype, and in IVPP V 15653 they are obscured by overlying vertebrae and ribs. Li et al. (2008) interpreted the displaced neural of the holotype as a sign of initial separation of this elements from the vertebrae. Developmental data show that in modern turtles the neurals develop in continuity with neural spines of dorsal vertebrae (e.g., Rathke 1848; Haycraft 1892; Cherepanov 1995, 1997; Scheyer et al. 2008; Lima et al. 2011; Hirasawa et al. 2013, 2015), although, according to Scheyer et al. (2008) this does not necessarily preclude their initial separation. Alternatively, the neurals in the holotype of *O. semitestacea* may just be broken off, or they may be osteoderms not homologous to neurals of turtles. Notably, a single or double midline row of osteoderms running along the spine was apparently the first component of dermal trunk armour to appear at least in dissorophoids (Dilkes and Brown 2007), chroniosuchians (Golubev 1998; Buchwitz et al. 2012), pareiasaurs (Lee 1996), hupehsuchians (Chen et al. 2014*a*, *b*), placodonts (Westphal 1975), rauisuchians (Scheyer and Desojo 2011), and crocodilians (Ross and Mayer 1983; Frey 1988). At least in some taxa one of their major initial functions was to provide support for the vertebral column during land locomotion (Frey 1988; Buchwitz et al. 2012). In any case, in IVPP V 15653 the supposed neural plates are associated with and most likely connected to the dorsal vertebrae, but unfortunately the points of contact are not visible (pers. obs., T. Sulej 2015). A fused or sutural connection of the osteoderms to the neural spines also occurred in dissorophoids (Dilkes and Brown 2007) and chroniosuchians (Golubev 1998; Buchwitz et al. 2012), and the axial skeleton could be located very close to osteoderms in some placodonts, leaving imprints on the visceral surface of the dermal armour (Westphal 1975), therefore the connection of these elements in *O. semitestacea* does not refute the possibility of their osteodermal nature. Other than possible neurals, no elements of the carapace are present.

Nuchal bone. The nuchal bones or cleithra were not identified thus far in *Odontochelys semitestacea*. There are, however, several unidentified bones present around the pectoral girdle of IVPP V 15653, and the cleithrum may be among them. Possibly, the cleithrum/nuchal bone may also be present in IVPP V 13240 as an elongated, forked element dorsal to the right shoulder interpreted by Lyson et al. (2013*a*, fig. S4) as an anterior dorsal rib – the mesenchymal primordia of the nuchal bone in modern turtles initially have similar processes in the same region (Gilbert et al. 2001; Sánchez-Villagra et al. 2009), which in chelydrids ossifies below the peripherals (e.g., fig. 1 in Szczygielski 2017). Unfortunately, this element is only partially exposed in IVPP V 13240 and thus its definite identification as a rib of as a nuchal/cleithrum is currently impossible. Loosely attached nuchal bones might have potentially been present in *O. semitestacea*, because the nuchal bone of modern turtles usually develops before other carapacial elements, in some taxa approximately at the same time as the plastron (e.g., Cherepanov 1989, 1995; Rieppel 1993; Sánchez-Villagra et al. 2009).

Plesiomorphic character of *O. semitestacea*. Reisz and Head (2008) suggested that the expanded bridge region of *O. semitestacea* may suggest that a more or less complete carapace was initially present, but it was subsequently reduced due to aquatic mode of life of that animal. This, however, is not supported by any data and the morphology of the carapace and plastron is notably different from that of aquatic turtles (e.g., there is no nuchal bone, no contact anywhere between the costals and neurals, no signs of reduction of the plastron), which does not necessarily refute this hypothesis (the pattern of shell reduction may just have been different), but gives no support either. Lichtig and Lucas (2016) suggested that *O. semitestacea* might have had a complete, *Dermochelys*-like osteodermal covering on its back, which was disarticulated and washed away after death, but there is no trace of such integumentary armour in any specimen of *O. semitestacea*, even IVPP V 13240 and IVPP V 15639, in which the degree of disarticulation is very minor. For now, it is most parsimonious to consider the incomplete shell of *O. semitestacea* as plesiomorphic.

CONSOLIDATION OF THE SHELL

Proterochersidae from the Late Triassic (Norian) of Poland and Germany are the oldest and the most basal true (fully-shelled) turtles (Szczygielski and Sulej 2016). This status is further supported by several shell characters described in this work. They already had a consolidated shell composed of the plastron and carapace connected by osseous bridges. They are the first taxa known to possess the nuchal bone (albeit paired, at least in some specimens), peripherals, interconnected costals, and they are the first to exhibit evidence of carapacial scutes. There is a single cervical scute, five vertebral scutes, four pairs of pleurals, three pairs of supramarginals, and 14 or 15 of marginals (Szczygielski and Sulej 2016). On the plastron, the scutes retained the general composition of *Odontochelys semitestacea*, with paired gular, extragular, humeral, pectoral, two sets of abdominal, paired femoral, and anal scutes, and inframarginalia (four pairs). They possibly developed the axillary scutes (there is no evidence of their existence in *O. semitestacea*), and certainly developed the autapomorphic paired caudal and single intercaudal scute. The plastral scute set in proterochersids is the most complex and numerous among all turtles, fossil and extant alike (Cherepanov 2006).

Axial skeleton. Initially, there were eleven dorsal vertebrae in turtles, and ten pairs of ribs participated in the carapace (Szczygielski and Sulej 2016; Szczygielski 2017). In *Proterochersis porebensis* spp. sacral vertebrae participated in or were sutured/fused to the carapace as well (Szczygielski and Sulej 2016). It is currently unknown whether the sacral vertebrae contacted the carapace in other proterochersids, but it seems likely.

Ribs. The viscerally protruding rib apices present in some specimens of *Proterochersis robusta* and *Prot. porebensis* may indicate different spatial relationships between the ribs and peripherals than in modern species. Usually, the rib ends lie in the same level as the peripherals and the former are accommodated by slots in the latter (Hoffstetter and Gasc 1969; Gilbert et al. 2001, 2008). The visceral protrusion of the rib apices may indicate that either the ribs were more internal or the peripherals were more external than in modern turtles. The presence of an exposed cancellous bone, in some specimens only in dorsal part of otherwise empty trough, may be interpreted as a sign of the cartilaginous nature of the rib ends, even in apparently mature individuals, which is also highly unusual for turtles – the distal ends of ribs remain cartilaginous quite long during the development, until the fontanelles are closed, which may even approximate the maturity (Suzuki 1963; Gilbert et al. 2008), but they are already ossified when the fontanelles are closed. The postponed ossification and visceral protrusion may mean that distal parts of ribs at some point in ontogeny escaped the osteogenic dermis of the carapace. The change of spatial relationships between these structures may have also potentially occurred in *Chinlechelys tenertesta*, explaining the curious costal and neural morphology of that taxon (Joyce et al. 2009). Although several of the gathered costals of *Proterochersis* spp. are similar in some aspects of morphology (e.g., thinness, presence of a longitudinal ridge on the visceral surface), they never exhibit these characters to the extent seen in *C. tenertesta*.

Nuchal. Nuchal bone in some turtles originates as paired primordia (Vallén 1942; Cherepanov 1995; Sánchez-Villagra et al. 2009; Lyson et al. 2013), which led Vallén (1942) to homologize it with supracleithrum and, along with its neural and muscular connections, allowed Lyson et al. (2013) to identify it as a homologue of cleithra, although recently Ponomarstev et al. (2017) stressed the uncertainty of such identification. *Proterochersis* spp. may be the first known turtle to exhibit a plesiomorphic condition of a paired nuchal, as in Pappochelys rosinae and *Odontochelys semitestacea* this element is not known (Li et al. 2008; Schoch and Sues 2015). Apparently, the nuchal initially did not have any connection with dorsal processes of epiplastra (contra Lyson et al. 2013), and if its size and position in *Proganochelys quenstedti* were comparable to *Proterochersis porebensis*, it might not contact these processes in the former as well. Currently, paired nuchal is only visible in ZPAL V.39/22 so it is unknown whether this condition is typical to *Proterochersis* spp. It may be noted that ZPAL V.39/22 possesses a wide cervical scute and nuchal embayment, similarly to ZPAL V.39/49, but unlike e.g., ZPAL V.39/48. It is controversial whether ZPAL V.39/48 and other specimens with narrow cervical scute and nuchal embayment also possessed paired nuchal bones. A paired nuchal was recently reported also from the Late Cretaceous/Palaeocene *Denazinemys nodosa* (Gilmore 1917) by Lichtig and Lucas (2017), but the derived phylogenetic position of baenids (e.g., Joyce 2007; Sterli et al. 2007; Sterli 2010; Szczygielski and Sulej 2016; this study) makes the plesiomorphic status of that morphology unlikely.

Neurals. According to Karl and Tichy (2005), the full row of hexagonal, coffin-shaped neurals is a plesiomorphic character for turtles. Contrary to their study, however, at least one of the neurals in *Proterochersis porebensis* had its shorter side turned anteriorly. Anterior neurals visible in SMNS 16442 appear to be wider than the isolated elements of *Prot. porebensis*, and one of them (?second) seems to be hexagonal with shorter end turned posteriorly, but the layout of sutures in this specimen is very dubious. In *Proganochelys quenstedti* the shape of the neural bones can only be seen in SMNS 17203, and they are mostly rectangular, with exception of roughly coffin-shaped seventh neural, which has its shorter side turned anteriorly as well (Gaffney 1990). The shape of neurals in *Odontochelys semitestacea* is poorly known, but they apparently were not constrained laterally by costals, so probably the ossification frontier was less ordered.

Dermal carapacial bones. The exact sequence of appearance of dermal carapacial elements is unknown, but it may be hypothesized that they appeared on the sides of the animal, and subsequently spread anteriorly and posteriorly. Their development on the sides would seem to be the most beneficial from the biomechanical point of view (they would connect the ventral and the dorsal part of the shell), and would agree with their ordered and optimized layout (only peripherals) in the bridge region. It must be noted, however, that the mesenchymatic primordia of the peripherals in modern turtles appear in posteroanterior order (Vallén 1942) and ossify in anteroposterior order (Vallén 1942; Suzuki 1963; Gilbert et al. 2001; Vieira et al. 2016). In the anterior and, even more so, posterior part of the carapace in *Proterochersis* spp. the number of these dermal ossifications is much greater and their layout (at least in the posterior part) is not strictly organized. The supernumerary bones of the carapace seem to be external to costal bones, but lay in the same plane as the dorsal parts of the peripheral bones. Peripherals seem to also be external to the plastral bones, rib apices (at least in some specimens), and they appear to lay at the same plane as the distal parts of the costal plates, which allows the former to form slots for the latter (e.g., ZPAL V.39/22). It should be noted, however, that they start to develop in the external region of the carapacial ridge (Vallén 1942; e.g., Gilbert et al. 2001), effectively in a superficial bulge of dermis, therefore they are in fact external to costals. We therefore lean towards the opinion of some of the previous authors (e.g., Cherepanov 1997, 2016; Kordikova 2000; Vickaryous and Sire 2009) that peripherals may be identified with osteoderms. Additionally, the supernumerary ossifications present in the anterior and posterior region of the carapace are most likely of the same origin. These osteoderms apparently filled the dermis of the carapace along the carapacial ribs, between the costals and the epidermal scutes (where the contact was not established early), and behind the last pair of costals. The molecular background for this proliferation of surplus elements in proterochersids might have theoretically been the same as in case of additional ossifications appearing in modern turtles in places of prolonged fontanelle retention (e.g., Cherepanov 2016; Mautner et al. 2017), but the quantity of these elements in the Triassic taxa suggest that in modern turtles there may exist some mechanisms that constrain the development of large numbers of these bones. It also may be possible that the multiplication of bones in regions not shielded by costals might have had some more pronounced adaptive value. In modern turtles the fontanelles close late in development, around nine years after hatching (Cherepanov 1989; Farke and Distler 2015) or possibly even later, just before reaching maturity (Suzuki 1963; Pritchard 2008). Filling the dermis with multiple small, possibly faster ossifying osteoderms that would probably start to appear as early as peripherals, around or soon after hatching (e.g., Cherepanov 1989; Gilbert et al. 2001; Bona and Alcalde 2009; Lima et al. 2011; Vieira et al. 2016), clearly provided protection at younger age, but also it gave attachment to the pelvis earlier, and this might have been beneficial from the biomechanical point of view, as proposed earlier. Even if osteoderms in the earliest turtles started their ossification around one year post-hatching, like in modern crocodilians (Vickaryous and Hall 2008), their appearance would speed up the consolidation of the shell significantly. Otherwise, this would most probably take very long, due to large distance between the last costal and the posterior carapacial rim in proterochersids (Szczygielski and Sulej 2016). The selection towards early ossification of the shell would most probably be significant during the Triassic, due to variety of predatory terrestrial and aquatic archosaurs, some of them achieving large sizes (e.g., Sulej et al. 2012; Niedźwiedzki et al. 2014; Zatoń et al. 2015), which are mostly absent from modern ecosystems. The exact stage of evolution of the shell-building morphogenetic programs in proterochersids is obviously unknown, so it is uncertain whether the costals in these early turtles would ever close the costoperipheral fontanelles without the participation of additional dermal elements. Apparently, the layout and number of osteoderms was influenced by the empty space available between the costals and the carapacial ridge, hence there is only the peripheral row present in the bridge region (because this space around the time of hatching, when the peripherals of modern turtles start to ossify, was apparently mostly occupied by the plastral bones and rib ends), there are more osteoderms present in the anterior part of the carapace (due to larger distance from the first costal to the anterior rim of the carapace), and there was a large, complex mosaic present in the even larger posterior area.

Currently, no data exists that would suggest any direct correlation between the body segmentation and the positioning of dermal carapacial elements. Instead, a correlation with body somites seems to exist for epidermal scutes (Moustakas-Verho et al. 2014, 2017; Moustakas-Verho and Cherepanov 2015). Cherepanov (1989, 2016) observed a correlation between the layout of epidermal scutes and regularity of underlying shell bones, and suggested that grooves between the scutes may act as local organizers for ossification. This at least superficially seems to be true for *Proterochersis* spp. as well, because the lowest regularity is present in the posterior part of the shell, mostly covered by relatively large pleurals and a single large vertebral scute, while the largest regularity is present in the bridge region, where a complex layout of supramarginal, marginal, and inframarginal scutes is located. Possibly, this stabilizing effect was the reason why the three supramarginal scutes developed in that region in proterochersids, as it might have facilitated the development of rigid, strong connection between the plastron and the carapace. In other regions, however, e.g., along the anterolateral sulcus of the first vertebral scute, this correlation is not visible very well. The overlapping arrangement of the areas shielded by the costals and osteoderms in the anterior and posterior region of the shell may also be adaptive, as it left no sharp limits between these two domains that would potentially be weak spots. Given the ordering influence of epidermal scutes on underlying dermal bones, it may be hypothesized that the scutes were determining whether the body osteoderms were incorporated into the shell (as is the case in the nuchal and pygal region of the carapace) or left out (as cervical, caudal, and limb osteoderms of *Proganochelys* spp. and, possibly, *Chinlechelys tenertesta*).

The osteoderm development pathways do not seem to be inherited from some turtle ancestor, because (as it was stated above) the older, more basal stem turtles lack body osteoderms (Li et al. 2008; Schoch and Sues 2015, 2016). Although the dermal armour of placodonts and the turtle shell are not homologous (e.g., Rieppel 2002; Scheyer 2008) and although the osteoderms of placodonts seem to be unique in their histogenesis (Scheyer 2007*b*; but see also Vickaryous and Sire 2009), the morphology of the mosaic is also very similar to some early (Anisian and Ladinian) cyamodontoid placodonts, e.g., to *Psephosaurus suevicus* Fraas 1896 from the late Ladinian of Germany (compare to Westphal 1975; Rieppel 2002). Some of the cyamodontoids also developed an additional, posterior osteodermal shield above the pelvis (e.g., Rieppel 2002). It may potentially be possible that these similarities are a result of some common developmental pathways that were present in the common ancestor of placodonts and turtles, and were activated at some point in each of these groups, but currently too little is known about molecular characteristics of osteoderm formation to make meaningful assumptions. Osteoderms are known to evolve in several lineages of amniotes and utilize diverse forms of histogenesis which may vary within taxon, within one individual, or even within single osteoderm (Moss 1969, 1972, Scheyer and Sander 2004, 2009; Scheyer 2007*b*; Vickaryous and Hall 2008; Vickaryous and Sire 2009; Hayashi et al. 2010; Scheyer and Desojo 2011; Burns et al. 2013; Scheyer et al. 2014). This may indicate that various morphogenetic pathways may be utilized to form the dermal ossification, which makes any statements of strictly understood homology across taxa risky.

OPTIMIZATION OF THE SHELL

The bony shell composition of *Proganochelys quenstedti* (Norian of Germany) is only partially understood and, unfortunately, the nuchal and pygal region of the carapace are the most enigmatic (Gaffney 1985, 1990). Generally, two trends are apparent: (1) the reduction of the number of bony elements in carapace and plastron, and (2) the reduction of scute number in the plastron in parallel with the increase of scute number in the carapace. Given the extremally poor understanding of shell composition (both bones and scutes) in other Late Triassic turtles, it is often difficult to say which characters are progressive for testudinates and which are just autapomorphies of that taxon. However, at least in several aspects *Prog. quenstedti* seems to be autapomorphic (Szczygielski and Sulej 2016; Joyce 2017). The shell morphology of this turtle was excellently described by Gaffney (1985, 1990), so only a short summary will be made here.

Plastron. The epiplastra articulated with the entoplastron more laterally in *Proganochelys quenstedti* than in *Proterochersis* spp. and the entoplastron had relatively large lateral processes exposed viscerally (Gaffney 1985, 1990), although the sutures are difficult to trace in all of the specimens. The dorsal processes of the epiplastra were attached to carapace (Gaffney 1990). Just like in *Proterochersis* spp., the anterior process of the entoplastron supported the median parts of the gular scutes (or the intergular, if the median tubercle had its own scute), but its anterior exposition was much narrower, and the lateral parts of the gular scutes, whole extragular scutes, and the anterolateral edges of the humeral scutes were supported by the epiplastra (Gaffney 1985, 1990). *Prog. quenstedti* also differs from the preceding taxa in lack of one of the pairs of mesoplastra and lack of one of the abdominal scute pair – only one pair of mesoplastra and abdominal scutes therefore remains (Gaffney 1985, 1990). It is unknown whether one of the mesoplastral pairs just disappeared (and if so, which one), or whether the primordia of both pairs fused anteroposteriorly (like the sets of individual gastral primordia supposedly fused earlier to form the primordia of plastral bones). Given that the locations of both hyomesoplastral and mesohypoplastral sutures are approximately the same in *Prog. quenstedti* as in *Proterochersis* spp., neither of them evidently invading the area previously occupied by the mesoplastra, and that the location, size, and shape of the single mesoplastral pair in *Prog. quenstedti* roughly equals that of combined double pair in *Proterochersis* spp. (Gaffney 1985, 1990) we find the latter option probable. Comparison of the layout of abdominal scutes suggests that the first pair disappeared. No inframarginal scutes are known in *Prog. quenstedti*, but this may result from the poor preservation of the bridge region in all of the specimens (Gaffney 1985, 1990). There is also no trace of the caudal and intercaudal scutes.

Carapace. The scutes on the carapace of *Proganochelys quenstedti* are somewhat difficult to homologize. There are typically 16 marginals, which is more than 14 or 15 in *Proterochersis* spp., but the difference occurs only in the posterior part of the carapace (Szczygielski 2017). An additional, cranialmost marginal is thus far known only in one specimen, and it is unclear if it represents a normal intraspecific variation, an interspecific difference (see Gaffney 1985, 1990 for discussion), or an anomaly. There is a row of supramarginals spanning on each side from the cervical scute to the caudal notch, four pairs of pleurals (but possibly the last supramarginal and maybe the last marginal of Gaffney 1985, 1990 belong to this row; see supplementary material to Szczygielski 2017 for discussion on scute homologies based on developmental data), four vertebrals (the first one most likely composed of fused two first vertebrals of other turtles; see Gaffney 1985, 1990; Szczygielski 2017), a single cervical, and a single supracaudal scute (possibly belonging to the vertebral row; see supplementary material to Szczygielski 2017). The eighth presacral vertebra was transitional between dorsal, as in *Proterochersis* spp., and cervical, as in more derived turtles (Szczygielski 2017), and the ribs of the ninth presacral vertebra lost their costals, but remained large and retained sutural contact with the carapace (Gaffney 1990; Szczygielski and Sulej 2016). The sacral vertebrae had no contact with the carapace, and there is no sutural contact between the pelvis and the shell (Gaffney 1990). The posteriormost costals are directed more posteriorly in *Prog. quenstedti* than in *Proterochersis* spp. (Gaffney 1990), leaving less space for the dermal components in that area.

Dermal carapacial bones. Nearly nothing is known about the layout of peripheral bones and nothing is known about the nuchal and pygal regions of the carapace in *Proganochelys quenstedti*. If the stabilizing effect of scutes on the underlying bones, as proposed by Cherepanov (1989, 2016), indeed played a role in turtle evolution, then the complex system of scutes in *Prog. quenstedti*, most notably along the periphery and in the posterior part, would most likely heavily impact the bony composition of the shell, possibly bringing it much closer to modern layout. Reduction of the number of shell-building bones was beneficial in a long run – smaller number of elements may mean less complex developmental programs and thus lesser risk of developmental anomalies and malformations, and less sutural connections mean more durable shell. Sutures were demonstrated to greatly increase the resistance to hits (according to Jaslow 1990, in mammalian skulls their energy absorption is 16–100% larger than that of the bone tissue), but they are much less resistant to bending and crushing (Jaslow 1990; Achrai et al. 2014), which would be the most probable, predator-related danger. Particularly during several first years after hatching, when the growth is most intensive, the sutures in turtles are not mineralized and thus soft (Suzuki 1963), and even in older individuals they allow some minor movements of adjoining bones (up to 0.3 mm in red-eared slider, according to Krauss et al. 2009), which collectively could amount to notable deformations, given the number of elements in the posterior carapacial region in *Proterochersis* spp. Similar shape, arrangement, and even thickness (3–4 mm in thinnest regions, according to Wood et al. 1996) of osteoderms in *Dermochelys coriacea* accounts for relatively elastic integument (Davenport et al. 2011; Yang et al. 2013), which allows seasonal changes of body shape in females due to using up of blubber, and possibly is beneficial during deep dives and intake of large amounts of food (Davenport et al. 2011). It is, however, hard to imagine benefits from such flexibility for the Triassic turtles. Achrai and Wagner (2013) note that increased hydration causes further deterioration of mechanical properties of the shell, especially of the sutures and epidermal scutes (the latter, together with increased mobility in the water, may be one of the reasons why in some heavily aquatic taxa the scutes are either lost, like in trionychids, carettochelyids, or dermochelyids, or the impact of the natural selection on their layout and number seems to be released, like in cheloniids). It seems possible that relatively steep posterior region of the carapace in *Proterochersis* spp. (and generally high profile in *Prot. robusta*) was thus an adaptation that made it difficult for predators to clench their teeth on this relatively soft area. The flexibility was partially reduced by complex, coarse internal structure of the sutures, but apparently this developed late in ontogeny and is present only in thickest sutures. The ankylosis of the shell, which is so often seen in the Triassic taxa, might also be a developmental adaptation towards lowering of the shell flexibility. Finally, it may be possible that it was this progressing reduction of the number of bony elements (and thus flexibility and susceptibility to crushing) in carapaces of *Proganochelys quenstedti* and more derived turtles that allowed these taxa to adopt a flatter shell. Maybe the spiky peripherals and even spikier neck and tail osteoderms in *Prog. quenstedti* and *Chinlechelys tenertesta* were temporary adaptations aimed to complicate the access to the anterior and posterior carapacial rims for predators, until these regions became strong enough. The optimization of developmental processes of the costals might sped up establishing of the contact between them and the external layers of the dermis, which together with possible heterochronic modifications of ossification time would allow partial substitution of the osteoderms by costals. Posterior inclination of the posteriormost dorsal ribs, exhibited by *Prog. quenstedti* and more derived turtles, would allow more effective shielding of the posterior region of the shell by the costals. Until more informative materials of the Triassic turtles are gathered, all of this remains speculative. Unlike derived turtles, in *Proterochersis* spp. many sutures in the carapace run along the scute sulci, which also limits the sturdiness of the shell, so spreading the sutures apart from the sulci (possibly, at least partially, by reduction of the dermal elements' number) was one of the directions of optimization.

Shell evolution in more derived taxa. Too little is known about the shell composition of other Late Triassic taxa to discuss them in a meaningful way. It may only be noted that *Palaeochersis talampayensis* in some shell characters is close to *Proterochersis* spp. (e.g., in presence of a cleanly-cut caudal notch and the pelvis sutured to the shell), but in others to *Proganochelys quenstedti* (e.g., presence of the supramarginals in the anterior region of the shell, contact between the dorsal epiplastral processes and the carapace, hypoischium free from the plastron). This may be used as a clue that mentioned characters of these two taxa may be progressive for testudinates, and some others (e.g., hypoischium possibly sutured to the plastron in *Proterochersis* spp., lack of sutural contact between the pelvis and the shell and scalloped outline of caudal notch in *Proganochelys quenstedti*) may be autapomorphic. More data, however, are needed to evaluate this hypothesis.

In post-Triassic turtles the reduction of shell elements continued and remains the most prevalent trend in turtle evolution (e.g., Hoffstetter and Gasc 1969; Kordikova 2002; Karl 2005; Cherepanov 2006, 2016; Szczygielski and Sulej 2016; Szczygielski 2017). This is expressed, among others, by the complete removal of the ribs of the first and the last dorsal vertebrae from the carapace, reduction of the peripheral number to 11 pairs or less and the marginal number to 12 pairs or less, reduction or loss of the mesoplastra, loss of the supramarginals and inframarginals, reduction and eventual loss of the dorsal epiplastral processes, etc. As noted by Grant (1936), modern turtles generally tend to have the minimal possible number of connections between the scutes that allows their growth in a sensible way. This also seems to be true for underlying bones. The peripherals, pygal bone, and up to three suprapygals in the posterior part of the carapace in derived turtles are most likely homologous to the elements of the osteodermal mosaic present in proterochersids. Their layout is more ordered, possibly due to more restrictive developmental mechanisms, but maybe (at least partially) due to relatively scarce space between the last costals, last neural, and posterior peripherals, which forces sequential arrangement. Suprapygals differ in number and size between various turtle taxa (e.g., Karl and Tichy 2005) or even within one species (e.g., Młynarski 1956; Kordikova 2002) and frequently express anomalies (e.g., McEwan 1982), which may support the hypothesis that their positioning is not strictly conditioned by body segmentation or other fixed factors, but may at least to some extent be dependent on the spatial constraints (see the discussion above).

SUPPLEMENTARY FIGURES

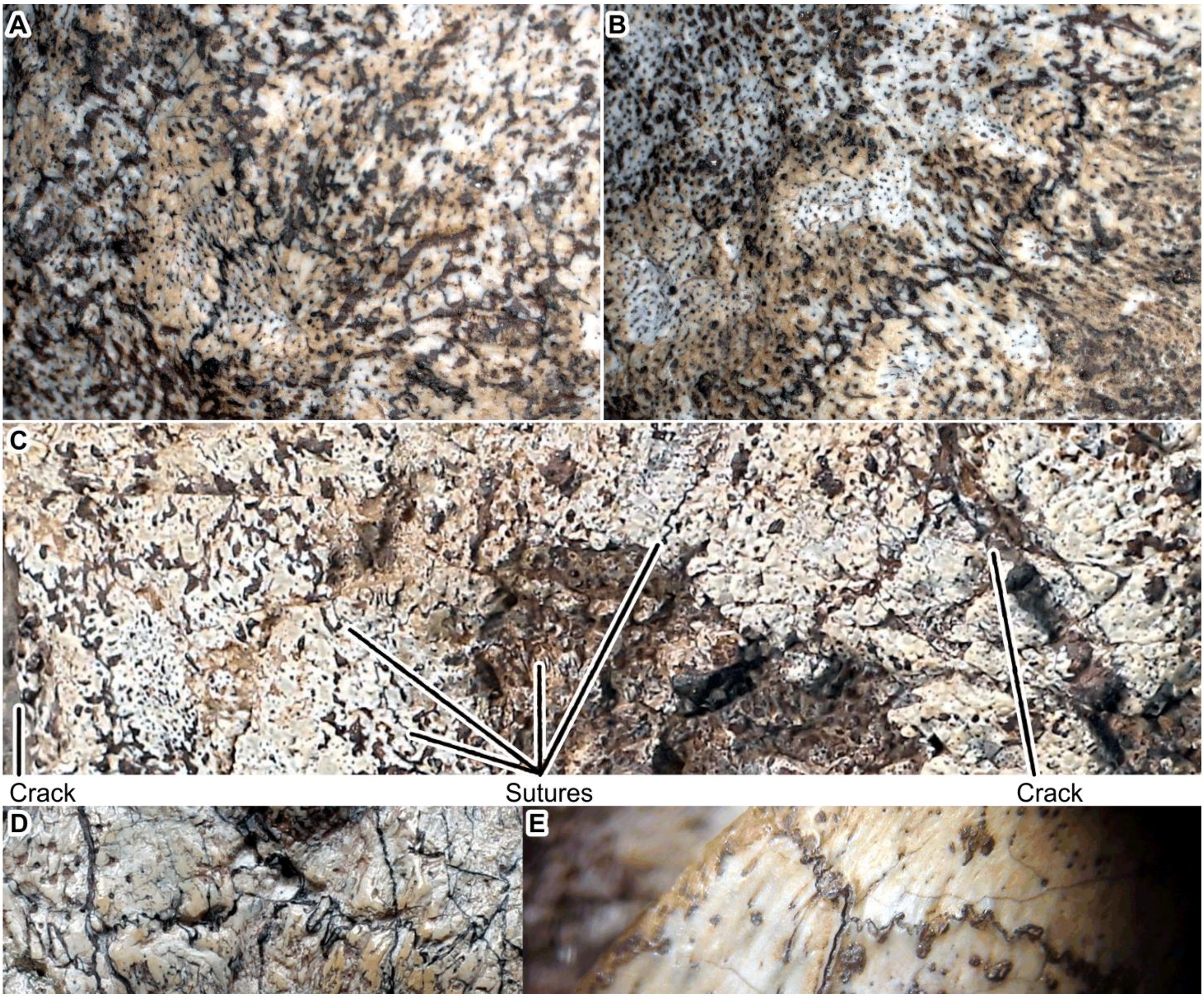

Figure S1. Suture morphology in Late Triassic turtles. **A-C:** *Proterochersis robusta*, SMNS 17755a, macrophotographs of the carapacial surface. Note the relative lack of cracks on the lateral surface (A-B). Even the vertebral scute area, which is more damaged, allows a relatively clear distinction between the sutures and cracks (E). **D:** Comparative photograph of sutures on the skull roof of *Proganochelys quenstedti* (SMNS 16980). **E:** Comparative photograph of sutures on the dermal spikes of *Chinlechelys tenertesta* (NMMNH P-16697).

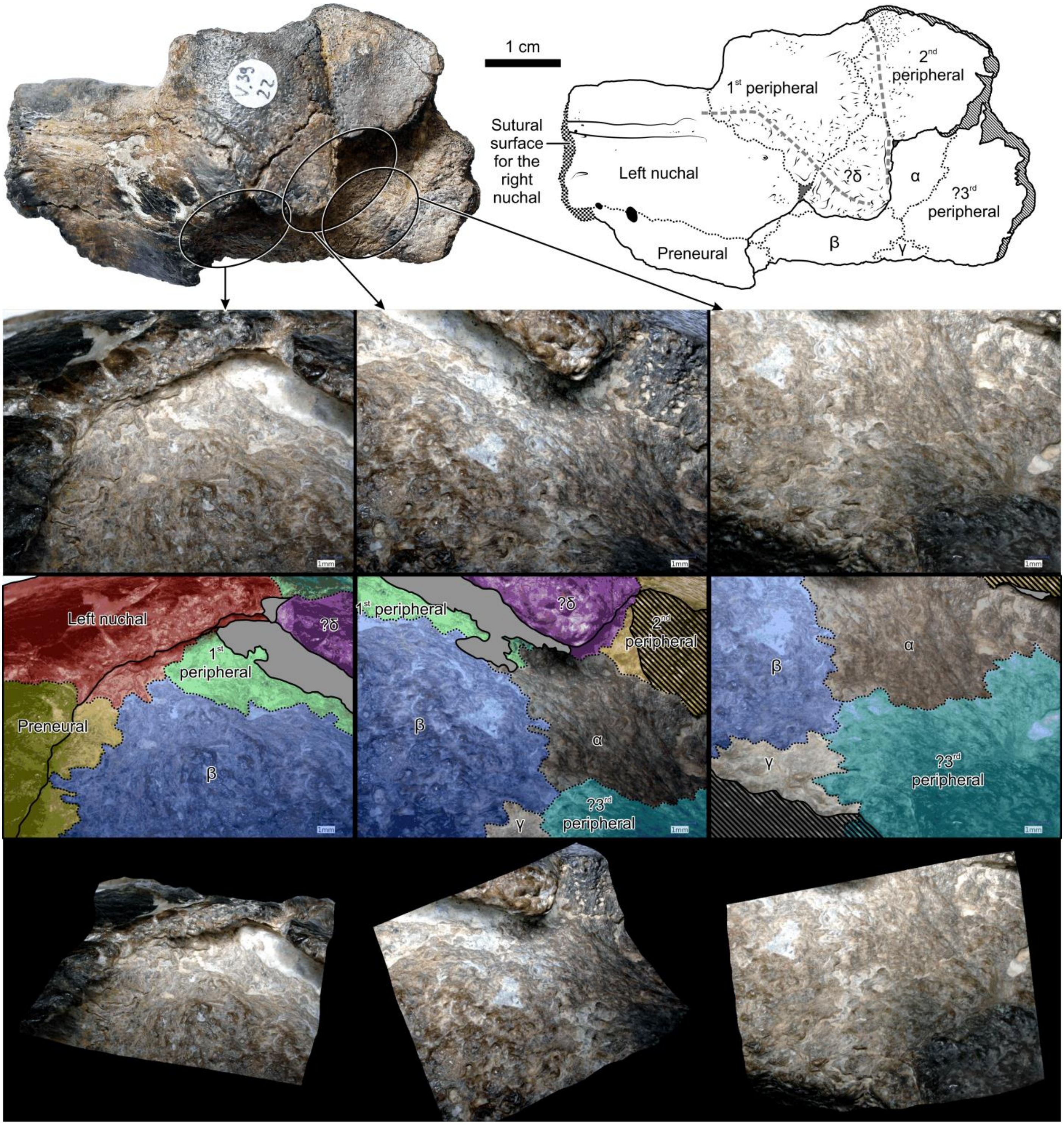

Figure S2. *Proterochersis porebensis*, ZPAL V.39/22, macrophotographs of the sutures. Sutures are indicated by dotted lines, sulci by thick grey dashed lines, broken or damaged bone is hatched, matrix is grey.

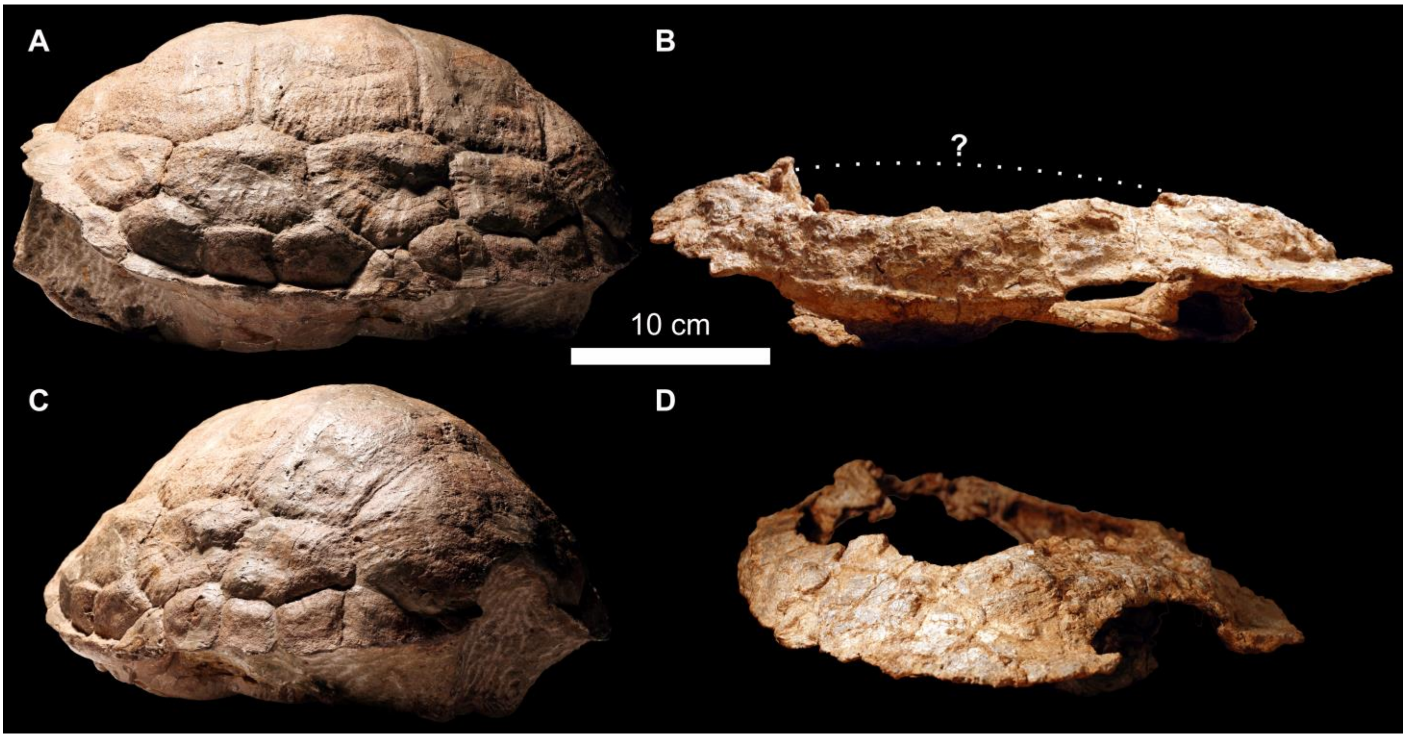

Figure S3. Comparison of shell profile in *Proterochersis robusta* SMNS 17561 (A, C) and *Palaeochersis talampayensis* PULR 68 (B, D) in lateral (A–B; anterior left) and posterolateral (C–D) view. *Pal. talampayensis* photograph in B mirrored for better comparison and with indicated hypothetic shape of the carapace, based on the curvature of preserved sections.

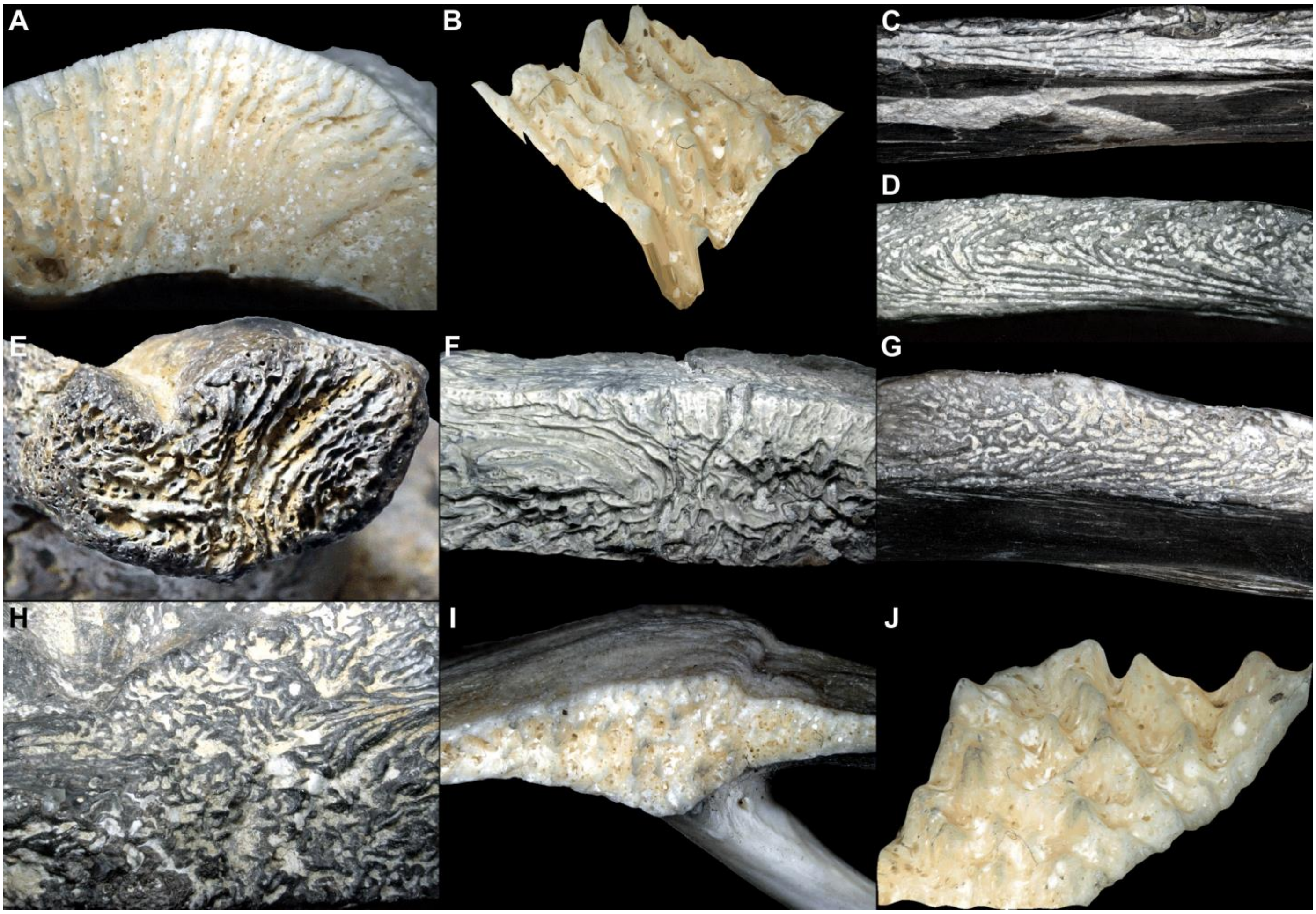

Figure S4. Morphology of shell sutures in turtles. **A–B:** Simple lamellar, interpreripheral suture of *Chelydra serpentina*. **C:** Simple lamellar, intercostal suture of *Proterochersis porebensis* ZPAL V.39/235. **D:** Bent lamellar transitioning to reticular, intercostal suture of *Proterochersis porebensis* ZPAL V.39/419. **E:** Diverging lamellar, internuchal suture of *Proterochersis porebensis* ZPAL V.39/22. **F:** Complex lamellar transitioning to reticular, suture of isolated *Proterochersis porebensis* ossicle ZPAL V.39/418. **G:** Reticular, intercostal suture of *Proterochersis porebensis* ZPAL V.39/419. **H:** Complex lamellar transitioning to reticular and spiky, peripherocostal suture of *Proterochersis porebensis* ZPAL V.39/14. **I–J:** Spiky, intercostal suture of *Chelydra serpentina*. Not to scale.

Character list

New characters are indicated in bold.

0. Nasal A
0: present
1: absent

1. Nasal B
0: nasals contact another medially along their entire length
1: medial contact of nasals partially or fully hindered by long anterior fl

2. Nasal C
0: dorsal exposure of nasal large
1: greately reduced relative to that of all other elements

3. Prefrontal A
0: medial contact on dorsal skull roof absent
1: medial contact on dorsal skull roof present

4. Prefrontal B
0: prefrontal-vomer contact present
1: prefrontal-vomer contact absent

5. Prefrontal C
0: prefrontal-palatine contact present
1: prefrontal-palatine contact absent

6. Prefrontal D
0: prefrontal exposure large
1: reduced
2: absent or near absent

7. Prefrontal E
0: prefrontal heavily sculptured present
1: absent

8. Lacrimal A
0: present
1: absent

9. Frontal A
0: frontal contribution to orbit absent
1: present

10. Frontal B*
0: not fused
1: fused

11. Parietal A
0: parietal-squamosal contact present
1: absent

12. Parietal B
0: parietal contact with pt, epipt, and/or palatine absent
1: present

13. Parietal C
0: length of anterior extension of the lateral braincase wall inter
1: elongated
2: short, enclosing the foramen nervi trigemini

14. Parietal D
0: overhanging process of the skull roof absent
1: present

15. Parietal E
0: processus inferior parietalis forming posterior margin for nerv trigemini absent
1:... present

16. Parietal F*
0: not contribute to the processus trochlearis oticum
1: contributes to the processus trochlearis oticum

17. Parietal G*
0: forming part of the foramen stapedio-temporalis
1: not forming

18. Parietal H*
0: absent or weak, foramen stapedio-temporale concealed in dorsal view
1: moderate, f.s.t. but not entire processes trochlearis exposed in dorsal view
2: strong, entire processus trochlearis exposed in dorsal view

19. Jugal A
0: jugal-squamosal contact present
1: absent

20. Jugal B
0: jugal participation to upper temporal rim absent
1: present

21. Quadratojugal A
0: present
1: absent, due to the presence of a deep lower temporal emargination

22. Quadratojugal B
0: quadratojugal-maxilla contact absent
1: present

23. Quadratojugal C
0: quadratojugal-squamosal contact below cavum tympani absent
1: present

24. Squamosal A
0: squamosal-postorbital contact present
1: absent

25. Squamosal B
0: squamosal-supraoccipital contact absent
1: present

26. Squamosal C*
0: posterolateral protuberances developing horns absent
1: small protuberances
2: big protuberances developed as horns

27. Squamosal D*
0: long posterior process protruding beyond condylus occipitalis absent
1: present

28. Squamosal E*
0: Qu-Sq contact tightly sutured
1: wide open

29. Postorbital A
0: postorbital-palatine contact absent
1: present, foramen palatinum posterius situated posterior to the orbit

30. Supratemporal A
0: present
1: absent

31. Premaxilla A
0: external nares divided
1: united

32. Premaxilla B
0: fusion of premaxilla absent
1: present

33. Premaxilla C
0: foramen praepalatinum present
1: absent, premaxillae well-ossified
2: absent, foramen intermaxillaris present

34. Premaxilla D
0: exclusion of premaxilla from the apertura narium externa absent
1: present

35. Premaxilla E
0: distinct, medial premaxillary hook along the labial margin absent
1: present

36. Maxilla A*
0: do not contact each other in ventral view
1: contacts each other in ventral view

37. Maxilla C*
0: Secondary palate formed by premaxilla, maxilla, and vomer, palatines not contacting in midline absent
1: formed by premaxilla, maxilla, and vomer, palatines not contacting in midline present

38. Maxilla D*
0: Triturating surface with only labial ridge present
1: labial and lingual ridge present
2: labial, lingual and accesory ridges present

39. Maxilla E*
0: Accesory ridge on maxilla present all along the triturating surface
1: accessory ridge only in some sectors of the triturating surface

40. Vomer A
0: paired
1: single
2: single, greatly reduced

41. Vomer B
0: vomer-pterygoid contact in palatal view present
1: absent, medial contact of palatines present

42. Vomer C
0: vomerine and palatine teeth present
1: absent

43. Vomer D
0: vomer-premaxilla contact present
1: absent

44. Vomer E*
0: Narrow and tall ventral crest on vomer absent
1: present all along the vomer

45. Palatine A
0: palatine contribution to anterior extension of lat braincase absent
1: present, well-developed

46. Quadrate A
0: flooring of the cranioquadrate space absent
1: by pt, but pt does not cover the prootic
2: by pt
3: by qu and pro

47. Quadrate B + C
0: development of the c.t. shallow, but not developed antpost
1: shallow, but anteroposteriorly developed
2: deep and anteroposteriorly developed

48. Quadrate D
0: precolumellar fossa absent
1: large and deep

49. Antrum postoticum A
0: antrum postoticum absent
1: incipient
2: fully developed

50. Quadrate F: incisura columella auris
0: present, but qu and the op for an angle of 90 degrees in lat view
1: present, but qu and the op for an angle less 90 degrees in lat view
2: present and closed, but only enclosing the stapes
3: present and closed, enclosing stapes and the Eustachian tube
4: partially closed, allowing see the columella auris in posterior view

51. Quadrate G
0: processus trochlearis oticum absent
1: present

52. Quadrate H*
0: Processus trochlearis oticum formed by a great contribution of quadrate
1: small contribution of the quadrate

53. Quadrate I*
0: Quadrate-basisphenoid contact absent
1: present

54. Epipterygoid A
0: present, rod-like
1: present, laminar
2: absent

55. Pterygoid A
0: pterygoid teeth present
1: absent

56. Pterygoid B
0: basipt process present and movable articulation
1: basipt process present and sutured articulation
2: basipt process absent and sutured articulation

57. Pterygoid C
0: triangular in shape
1: reduced to an interpterygoid slit
2: reduced to a paired foramen caroticum laterale

58. Pterygoid D
0: pterygoid-basioccipital contact absent
1: present

59. Pterygoid E
0: processus trochlearis pterygoidei absent
1: present

60. Pterygoid F
0: foramen palatinum posterius present
1: present, but open laterally
2: absent

61. Pterygoid G
0: medial contact of pterygoids present
1: absent

62. Pterygoid H
0: pterygoid contribution to foramen palatinum posterius present
1: absent

63. Pterygoid I
0: vertical flange on lateral process absent
1: vertical falnge on lateral process present

64. Pterygoid J*
0: not reaching the exoccipitals
1: reaching the exoccipitals

65. Pterygoid K*
0: Fossa podocnemidoidea absent
1: present

66. Supraoccipital A
0: crista occipitalis poorly developed
1: protruding significantly posterior to the foramen magnum

67. Supraoccipital B
0: large supraoccipital exposure to dorsal skull roof absent
1: present

68. Supraoccipital C*
0: horizontal ventral crest in the supraoccipital absent or poorly developed anteriorly
1: horizontal ventral crest present along all the crista supraoccipitalis

69. Exoccipital A
0: medial contact of exoccipitals dorsal to foramen magnum absent
1: present

70. Basioccipital A
0: with two or one ventral basioccipital tubercle
1: tubercle absent

71. Prootic A*
0: dorsal exposure large
1: dorsal exposure reduced or absent

72. Opisthotic A
0: loosely articulated
1: tightly sutured

73. Opisthotic B
0: depressions for musculature absent
1: present

74. Opisthotic C
0: ventral ridge on opisthotic absent
1: present, with an incipient enclosed middle ear region
2: present, but modified with a enclosed middle ear region

75. Opisthotic D: processus interfenestralis
0: present, robust, not reaching the floor of cavum a-j
1: present, robust, reaching the floor of cavum a-j
2: present, small, reaching the floor of cavum a-j

76. Basisphenoid A
0: rostrum basisphenoidale flat
1: rod-like, thick, and rounded

77. Basisphenoid B
0: paired pits on ventral surface absent
1: present

78. Basisphenoid C*
0: reduced to a v-shaped basisphenoid trapped between the pterygoids and the basioccipital absent
1: reduced to a v-shaped basisphenoid trapped between the pterygoids and the basioccipital present

79. Hyomandibular nerve A
0:: path of hyomandibular branch facial nerve through cranio-quadrate space parallel to vena capitis lateralis
1: independent to vena capitis lateralis

80. Stapedial artery A
0: posterior to fenestra ovalis between paraoccipital process and qu
1: anterior to...

81. Stapedial artery B
0: relatively large
1: significantly reduced in size
2: absent

82. Stapedial artery C*
0: Foramen stapedio-temporalis located in the dorsal part of the otic region and points dorsally
1: located in the anterior wall of the otic region and points anteriorly

83. Recessus scalae tympani A*
0: almost inexistent, not surrounded by bone
1: well developed

84. Foramen jugulare posterius A*
0: separated from fenestra postotica
1: coalescent with fenestra postotica

85. Foramen jugulare posterius B*
0: separated from fenestra postotica by pterygoid
1: separated by opisthotic and or exoccipital

86. Foramen nervi hypoglossi (XII)*
0: not covered ventrally by an extension of the pterygoid and the basioccipital
1: covered ventrally by an extension of the pterygoid and the basioccipital
2: covered ventrally by an extension of the bo

87. Canalis caroticum F*
0: Arteria palatina enters the skull through the interpterygoid vacuity or intrapterygoid slit
1: through foramen posterius canalis carotici palatinum or split of branches enclosed in skull

88. Fenestra perilymphatica A
0: large
1: relatively small

89. Cranial scutes A*
0: present
1: absent

90. Cranial scute B*
0: Scute D meeting in midline no
1: yes

91. Cranial scute C*
0: Scute X much smaller than D scute no
1: yes

92. Cranial scute D*
0: X scute partially separates G scales no
1: yes

93. Cranial scute E*
0: Scutes A, B, and C forming a continuous posterolateral shelf yes
1: no

94. Cranial scute F*
0: D scute high
1: low

95. Cranial scute G*
0: B scute a recurved horn no
1: yes

96. Cranial scute H*
0: B scute in cross section triangular
1: round

97. Cranial scute I*
0: Scute B and D in contact yes
1: no

98. Cranial scute J*
0: A scute small and not forming a large shelf no
1: yes

99. Cranial scute K*
0: A scute small A scute very large
1: A scute comparable in size to B scute

100. Cranial scute L*
0: Y and Z scutes relatively larges mall
1: large

101. Cranial scute M*
0: Y scute pentagonal pointing posteriorly and separating the medial contact of G scutes
1: rectangular not separating the medial contact of G scutes

102. Cranial scute N*
0: H scute present
1: absent

103. Cranial scute O*
0: Scale F formed by several scales
1: Scale F formed by only one scale

104. Cranial scale P*
0: Scale J formed by several scales
1: Scale J formed by only one scale

105. Teeth A
0: teeth present in premaxilla, maxilla, and dentary
1: teeth absent in premaxilla, maxilla, and dentary

106. Upper temporal fenestra A
0: present
1: absent

107. Dentary A
0: medial contact of dentaries fused
1: sutured only

108. Carapace A
0: carapacial scutes present
1: partially present
2: absent

109. Carapace B
0: tricarinate carapace absent
1: present, but only slightly
2: present and pronounced

110. Carapace C
0: absent
1: present

111. Carapace D *
0: Sculpturing of the shell absent
1: present

112. Carapace E*
0: Sculpturing of the shell like in Hydromedusa
1: like in *Pleurosternon*
2: like in trionychians

113. Nuchal A
0: cervical articulates with nuchal along a blunt facet
1: articulation absent
2: cervical articulates with nuchal along a raised pedestal

114. Nuchal B
0: elongate costiform process of nuchal absent
1: present, process crosses peripheral I to contact pe II
2: present, contacts pe III

115. Nuchal C*
0: wider than long
1: longer than wide or as long as wide

116. Neural A
0: neural formula 6>4<6<6<6<6 absent
1: present

117. Neural B*
0: irregular in shape, wider than long
1: regular, often hexagonal, longer than wide

118. Peripheral A
0: more than 11 pairs
1: 11 pairs
2: 10 pairs
3: less than 10 pairs

119. Musk ducts A*
0: absent
1: present

120. Costal A
0: medial contact of costal I absent
1: present

121. Costal B
0: medial contact of posterior costals absent
1: medial contact of up to three posterior costals present
2: medial contact of all costals present

122. Costal C
0: absent, costals fully or almost fully ossified, fontanelles abs or red
1: present

123. Costal D*
0: absence of alternative short and long ends in the lateral part of the costals
1: presence

124. Suprapygal A*
0: none
1: one element
2: two elements
3: more than 2 elements

125. Cervical A
0: cervicals absent, carapacial scutes otherwise present
1: one cervical present
2: more than one cervical present

126. Supramarginal A
0: complete row present
1: partial row present
2: absent

127. Vertebral A
0: 4
1: 5

128. Vertebral B
0: vertebral II-IV broader than pleurals
1: vertebrals II-IV narrower or as narrow as pleurals

129. Vertebral C
0: sulcus between V 3 and 4 on neural VI
1: on neural V

130. Marginal A*
0: marginal scales overlap onto costals absent
1: present

131. Plastron A
0: connection between carapace and plastron osseous
1: ligamentous

132. Plastron B
0: central plastral fontanella absent
1: present

133. Plastron C
0: plastral kinesis absent
1: present

134. Plastral kinesis A*
0: anterior
1: anterior and posterior

135. Plastral kinesis B*
0: between hyo and hypoplastron
1: between hyo and epi-entoplastron

136. Entoplastron A
0: anterior entoplastral process present
1: absent

137. Entoplastron B
0: size of posterior entoplastral process long
1: short

138. Entoplastron C
0: distinct posterolateral entoplastral process present
1: absent

139. Entoplastron D
0: entoplastron V-shaped absent
1: present

140. Entoplastron E
0: present
1: absent

141. Epiplastron A
0: epiplastra and entoplastron narrow and elongate absent
1: present

142. Epiplastron B*
0: thick anterior border
1: thick anterior border absent

143. Hyoplastron A
0: axillary buttresses contact peripherals only
1: peripherals and first costal

144. Hyo-hypoplastron A*
0: not fused
1: fused

145. Hyoplastron B*
0: Axillary buttress terminates on peripheral 2 or 1
1: terminates on peripheral 3
2: terminates on peripheral 4

146. Mesoplastron A
0: 1 or 2 pairs of meso with medial contact
1: 1 reduced pair
2: absent

147. Hypoplastron A
0: inguinal buttresses contact peripherals only
1: peripheral and costal V
2: peripherals, costal V, and costal VI

148. Hypoplastron B*
0: Inguinal buttress terminates on peripheral 8
1: 7
2: 6

149. Xiphiplastron A
0: distinct anal notch absent
1: present

150. Xiphiplastron B
0: xiphiplastra narrow absent
1: present

151. Plastral scutes A
0: present
1: absent

152. Plastral scutes B
0: pronounced midline plastral sulcus sinuous absent
1: present

153. Gular A
0: one pair
1: only one scute

154. Extragular A
0: present
1: absent

155. Extragular B
0: medial contact of extragulars absent
1: present, contacting one another anterior to gulars
2: present, contacting one another posterior to gulars

156. Extragular C
0: anterior plastral tuberosities present
1: absent

157. Extragular D*
0: Only in the epiplastra
1: Reach the entoplastron

158. Intergular A
0: absent
1: present

159. Humeral A
0: 1 pair
1: 2 pair subdivided by a plastral hinge

160. Humeral B*
0: Humero-pectoral sulcus only in the hyoplastra
1: humero-pectoral sulcus crossing the entoplastron

161. Pectoral A
0: present
1: absent

162. Pectoral B*
0: antero-posteriorly developed
1: very short antero-posteriorly

163. Abdominal A
0: present, with medial contact
1: present, medial contact absent
2: absent

164. Anal A
0: only cover parts of the xiphiplastra
1: anteromedially overlap onto hypoplastra

165. Inframarginal A
0: present
1: absent

166. Inframarginal B*
0: 3 or more
1: 2

167. Inframarginal C*
0: axillar and inguinal not in contact
1: axillar and inguinal in contact

168. Cervical rib A
0: present
1: absent

169. Cervical vertebra A
0: position of transverse processes middle of the centrum
1: anterior end of the centrum

170. Cervical vertebra B
0: ventral keels absent or slightly developed in all vertebrae
1: ventral keels more developed on posterior vertebrae

171. Cervical vertebra C
0: cervical centrum 8<7 absent
1: present

172. Cervical articulation A
0: not formed
1: formed

173. Cervical articulation H
0: 8(dorsal
1: 8)dorsal
2: none, vertebrae only meet at zygapophyses

174. Cervical vertebra E*
0: Biconvex cervical vertebra in the middle of the neck absent
1: present

175. Cervical vertebra F*
0: Biconvex cervical vertebra in the middle of the neck 2nd
1: 3rd
2: 4th
3: 5th

176. Cervical vertebra G*
0: Biconcave cervical vertebra absent
1: present

177. Cervical articulation I*
0: double articulation between 5th and 6th absent
1: present

178. Cervical articulation J*
0: double articulation between 6th and 7th absent
1: present

179. Cervical articulation K*
0: Central articulation cervical 6-7 concave-convex
1: platicoelous

180. Cervical articulation L*
0: double articulation between 7th and 8th absent
1: present

181. Cervical vertebra H*
0: total height of centra and neural arch longer than the anteroposterior length of the cervical centra
1: total height of centra and neural arch much shorter than the anteroposterior length of the cervical centra

182. Cervical vertebra I*
0: neural arch on 8th cervical not modified
1: neural arch on 8th cervical modified with the postzygapophyses articular surface greatly expanded AND/OR pointing posteroventrally

183. Cervical vertebra J*
0: postzygapophyses not united in midline
1: postzygapophyses united in midline

184. Dorsal rib A
0: length first thoracic rib long, extends full legth of first costal and may contact peripherals
1: intermediate, in contact with axillary buttresses
2: intermediate to short

185. Dorsal rib B
0: contact dorsal rib 9-10 with costals present
1: absent

186. Dorsal rib C
0: dorsal rib X long, contacting peripherals
1: dorsal rib X short

187. Dorsal vertebra A
0: anterior articulation of first dorsal centrum faces at most slightly anteroventrally
1: faces strongly anteroventrally

188. Caudal A
0: tail club present
1: absent

189. Caudal B
0: all centra amphicoelous
1: formed centra

190. Caudal C*
0: anterior caudal vertebrae amphicoelous
1: anterior caudal vertebrae procoelous or platycoelous
2: anterior caudal vertebrae opisthocoelous

191. Caudal D*
0: posterior caudal vertebrae amphicoelous
1: posterior caudal vertebrae procoelous or platycoelous
2: posterior caudal vertebrae opisthocoelous

192. Chevron A
0: present on nearly all caudals
1: absent or poorly developed along posterior caudals

193. Tail ring A*
0: absent
1: present

194. Tail ring B*
0: closed ventrally
1: open ventrally

195. Tail club A*
0: with three spikes
1: with two pairs of spikes

196. Pectoral girdle A
0: horizontal plate with a dorsal process, not triradiate
1: trirradiate

197. Cleithrum/nuchal A
0: in contact with the carapace
1: osseous contact with carapace absent

198. Scapula A*
0: lamina between the dorsal process of the scapula and the acromion well developed
1: lamina between the dorsal process of the scapula and the acromion reduced: *Kallokibotion*
2: lamina between the dorsal process of the scapula and the acromion absent

199. Humerus A*
0: Ectepicondylar foramen in a channel
1: only a groove

200. Humerus B*
0: shoulder present
1: shoulder absent: pleurodires

201. Humerus C*
0: lateral process in the proximal end of the humerus
1: displaced from the proximal end, located in the shaft of the humerus

202. Humerus D*
0: lateral process seen in dorsal view
1: lateral process not seen in dorsal view

203. Humerus E*
0: length of the humerus two times or less than the width of the proximal end
1: length of the humerus more than two times the width of the proximal end

204. Pelvis A
0: pelvis-shell attachment by ligaments
1: ischium attached to plastron by a broad suture
2: ischium attached to plastron by its medial surface

205. Pelvis B*
0: Thyroid fenestra coalescent
1: two separated fenestra completely or partially separated

206. Pubis A*
0: lateral process small, poorly developed, columnar
1: lateral process well developed and flat

207. Pubis B*
0: Epipubis process osseous or calcified
1: cartilaginous or absent

208. Ilium A
0: elongated iliac neck absent
1: present

209. Ilium B
0: iliac scar extends from costals onto the peripherals and pygal
1: positioned on costals only

210. Ilium C
0: shape of articular site narrow and pointed posteriorly
1: oval

211. Ilium D
0: posterior notch in acetabulum absent
1: present

212. Illium E*
0: thelial process absent
1: present

213. Ischium A*
0: with lateral processes absent
1: with lateral processes present

214. Hypoischium A
0: present
1: absent

215. Manus A
0: most digits with two shortened phalanges
1: most digits with three elongate phalanges

216. Manus B
0: paddles absent
1: short paddles present
2: elongate paddles present

217. Manus C
0: flippers absent
1: short flippers present
2: elongate flippers present

218. Pes A
0: claw on 5th digit present
1: absent

219. Pes B
0: metatarsal V functions as true metatarsal
1: metatarsal V functions as a tarsal

220. Pes C*
0: 5 digits
1: 4 digits

221. Manus and Pes B*
0: Hyperphalangy manus digits 4 and 5, pes digit 4 no
1: yes

222. Posterior plastral fontanelle
0: posterior plastral fontanella between the xiphiplastra and/or the hypoplastra: absent in adult stage
1: retained in adults

223. Neural number
0: less than 9 elements
1: 9 elements

224. Plastron lobe
0: posterior lobe of plastron relatively wide and short
1: posterior lobe of plastron elongated and narrow coupled with widely spaced plastral buttresses

225. Shape of costal 3
0: costal 3 tapering towards the lateral side of the shell or with parallel anterior and posterior borders
1: costal 3 broadens towards the lateral side of the shell

226. Costal rib
0: distal portion of costal ribs not visible within the costal
1: distal portion of costal rib visible on the surface of the costal

227. First vertebral
0: vertebral 1 does not enter anterior margin of carapace
1: enters anterior margin

228. Peripheral gutter
0: peripheral gutter absent or only anteriorly developed
1: peripheral gutter extensively developed along anterior and bridge peripherals

229. Costal rib distal end
0: distal end of dorsal rib not visible or only within costo-peripheral fontanelles on the dorsal face of the carapace
1: costo-peripheral fontanelles absent, distal end of posterior dorsal ribs visible or distal end of posterior costals narrow and surrounded by the peripheral

230. Nuchal emargination
0: absent or indistinct
1: present, excludes peripheral 1
2: deep and involves peripheral 1
3: broad, involved peripheral II

231. Tail length
0: tail as long as carapace
1: tail clearly shorter than carapace

232. Cruciform plastron
0: absent
1: present

233. Articulation of posterior cervical centra
0: circular or subcircular outline
1: greatly flattened outline

234. Nuchal posterior edge
0: less than 3 times longer than the lateral edge
1: more than 3 times longer

235. Carotid canal entry
0: fpcci is not at back of skull
1: fpcci located at back of skull in pterygoid

236. Pterygoid extension
0: pterygoid not extending to posterior end of skull and covering prootic
1: pterygoid extending to posterior end of skull and covering prootic

237. Carotid canal split
0: not enclosed in bone
1: not enclosed but carotid canal is covered ventrally from the posterior end of the skull
2: enclosed but carotid canal is not covered ventrally from posterior edge of skull

238. Antrum postoticum
0: region of antrum postoticum enlarged and laterally enclosed
1: region of antrum postoticum enlarged, but not enclosed laterally

239. Jugal/quadrate contact
0: jugal clearly not in contact with quadrate
1: jugal nearly or clearly in contact with quadrate

240. Parabasisphenoid decorated by ridges
0: absent
1: present

241. Entoplastral scute
0: absent
1: present

242. Secondary pair of basioccipital tubercles formed by pterygoid
0: absent
1: present

243. Shell covered by highly distinct turbercles
0: absent
1: present

244. Number of abdominal scutes
0: 2 pairs
1: 1 pair
2: none

245. Number of dorsal vertebrae
0: 11 or more
1: 10 + one intermediate cervico-dorsal
2: 10

246. Number of broadened ribs
0: 10
1: 9
2: 8 or less

247. Cleithrum/nuchal bone
0: paired
1: fused in early development into a single nuchal plate

248. Coracoid shape
0: flat, sub-ovoid or bee wing-shaped
1: flat, rectangular
2: columnar, at least at its base

249. Carapacial dermal mosaic
0: present, at least in posterior region
1: absent, dermal ossifications reduced to peripheral and/or (supra)pygal rows or absent

250. Clavicle
0: large, articulated with or sutured to interclavicle, but with no or reduced ventral dermal expansion (epiplastron)
1: large, forms a ventral dermal expansion (epiplastron) at its base but does not reach the carapace
2: large, forms a ventral dermal expansion (epiplastron) at its base and reaches carapace
3: smaller than the length of the epiplastron or fully reduced

251. Spiky cervical osteoderms
0: absent
1: present

252. Gastralia
0: absent
1: present
2: fused into plastral bones

253. Contact of the neural spines of sacral vertebrae with carapace
0: ossified
1: chondral, ligamentous, or none

254. Posterior notch in hypoplastron
0: present, one or mor notches receive anterior processes of xiphiplastron
1: absent, hypoxiphiplastral suture straight or gently bowed

255. Shape of the articular surface of femoral head in dorsal view
0: ancestral amniotic condition, articular surface of femoral head poorly differentiated dorsally
1: articular surface triangular in dorsal view
2: articular surface rectangular or oval in dorsal view

256. Posterior marginal scutes in adults
0: pronounced serration, rounded tips of underlying peripherals
1: pronounced serration, spiky tips of underlying peripherals
2: weak or no serration

Characters 6, 18, 26, 38, 40, 47, 49, 56, 74, 75, 81, 86, 108, 109, 113, 118, 121, 124, 125, 126, 145, 146, 148, 163, 175, 198, 216, 217, 230, 244, 245, 248, and 252 are considered additive (ordered).

CHARACTER MATRIX

15 characters per line.

Pappochelys rosinae

0	0	0	0	?	?	0	1	?	1	0	0	0	?	0
0	?	?	0	1	0	0	0	0	0	0	0	0	0	0
?	0	0	0	0	0	1	?	?	?	1	?	0	0	0
?	?	0	0	0	?	0	?	?	?	0	?	0	0	?
?	?	?	?	?	?	0	0	0	0	0	1	?	?	?
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Proterochersis porebensis

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?	?	?	0	0	1	0	?	1	0	0	?	1	0	0
0	0	0	0	3	1	1	1	0	?	0	0	0	0	?
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0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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?	0	0	?	0	?	?	?	?	?	?	?	0	?	0
?	[0 1]	0	0	1	1	?	0	?	1	?	?	?	?	?
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1	0													

Proterochersis robusta

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0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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Odontochelys semitestacea

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0	0	0	0	0	?	?	?	0	?	0	0	2	?	1
1	?													

***Chinlechelys tenertesta* A (spikes scored as cervical osteoderms, mosaic unknown in the shell)**

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?	?	?	?	?	?	?	?	?	?	?	1	2	?	0
1	?													

***Chinlechelys tenertesta* B (spikes scored as cervical osteoderms, mosaic present in the shell)**

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?	?	?	?	?	?	?	?	?	0	?	1	2	?	0
1	?													

***Chinlechelys tenertesta* C (spikes scored as posterior carapace margin, mosaic present in the shell)**

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
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?	?	?	?	?	?	?	?	?	0	?	?	?	?	?
0	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
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?	?	?	?	?	?	?	?	?	0	?	?	2	?	0
1	1													

Adocus beatus

1	?	?	1	0	0	0	1	1	1	0	1	1	1	0
0	1	1	2	1	0	0	0	0	1	0	0	1	0	0
1	1	0	0	0	0	0	0	2	1	1	0	1	0	0

1	2	2	0	2	1	1	1	0	1	1	2	2	1	0
0	0	1	1	1	0	1	0	1	0	1	0	1	0	2
2	0	0	0	0	1	0	0	1	1	?	1	1	0	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	1	2	1	0	1	1	1	1	?
0	[0 1]	0	0	?	1	2	1	1	1	1	0	0	0	?
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0	0	?	1	1	1	1	1	0	0	?	0	0	1	0
1	1	1	0	2	?	1	1	1	?	?	?	?	?	?
?	1	0	2	0	0	0	1	1	0	1	0	1	1	?
?	0	1	1	1	1	0	0	1	1	?	?	0	0	0
0	0	0	0	0	0	?	0	1	0	1	1	1	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	1
?	2													

Annemys latiens

0	1	?	0	?	?	1	1	1	1	0	?	1	1	0
0	0	1	2	1	0	?	0	?	?	0	?	?	?	?
1	1	?	?	?	?	?	?	?	?	?	?	?	?	?
0	2	?	?	?	1	1	0	0	1	1	1	2	0	0
?	0	?	?	?	0	?	0	?	?	?	0	1	0	2
?	?	0	0	?	1	0	0	?	?	?	?	1	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	0	0	1	0	?	1	0	0	0	1	1	?
0	[0 1]	0	0	2	1	2	1	1	[0 1]	1	1	0	0	?
?	1	1	1	0	0	0	1	0	0	0	2	0	0	0
0	0	1	0	0	0	1	0	0	0	0	0	0	0	1
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0	0	0	1	0	2	?	0	?	0	1	1	1	?	?
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2	2													

Annemys levensis

0	0	?	1	?	?	0	1	1	1	0	?	1	1	0
0	0	1	2	1	0	0	0	0	0	0	0	0	0	0
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0	2	2	0	2	1	1	0	0	1	1	1	2	0	0
0	0	0	1	?	0	1	0	0	0	0	0	1	0	2
2	?	0	0	?	1	0	0	?	1	?	0	1	0	0
0	1	1	?	?	?	?	?	0	?	0	0	0	0	?
1	1	0	0	0	1	0	?	1	0	0	0	1	1	1
0	1	0	0	2	1	2	1	1	0	1	1	0	0	?
?	1	1	1	0	0	0	1	0	0	0	2	0	0	0
0	0	1	0	0	0	1	0	0	0	0	0	0	0	1
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0	0	0	1	0	2	?	0	?	0	1	1	1	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	0
2	2													

Anosteira ornata

1	?	?	1	?	?	0	1	1	1	?	1	?	?	0
0	1	?	?	1	0	0	0	0	1	0	0	?	?	0
1	1	?	2	0	0	?	?	?	?	1	1	1	1	?
?	2	2	0	2	2	1	?	?	?	1	2	2	1	0
0	1	[0 1]	1	?	0	1	0	?	0	1	?	1	0	2
2	?	0	?	0	1	0	?	?	?	?	?	?	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	1	0	1	1	2	1	0	0	0	1	2	0
0	1	0	0	0	1	2	1	1	?	?	1	0	0	?
?	1	1	1	0	0	0	1	0	0	2	2	0	1	0
0	1	?	?	?	?	1	?	?	?	?	?	?	?	?
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?	?	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	1	1	0	2	1	1	?	?	0	0	0
0	0	0	0	0	1	?	?	?	1	1	1	3	0	0
0	0	0	0	2	2	2	1	2	1	3	0	2	1	1

?	2

Anthodon serrarius

0	0	0	0	?	?	0	0	0	0	0	2	0	?	0
?	?	?	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	?	?	?	0	0	0	0	0
0	0	0	0	0	?	0	?	?	0	0	1	0	0	0
0	0	0	0	0	?	0	0	0	0	1	?	0	0	0
0	0	0	0	?	?	?	?	0	?	?	0	1	?	1
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?	0	?	?	0	1	?	?	0	?	1	?	1	0	?
?	0	0	?	1	?	0	0	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	0	?	0	0	[2 3]	?	0
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0	?													

Apalone spinifera

1	?	?	1	0	1	0	1	1	1	0	1	1	1	0
0	1	1	2	1	1	0	0	0	1	0	0	1	0	0
1	1	1	2	1	0	1	0	1	?	1	1	1	1	0
1	2	2	0	2	2	1	1	0	1	1	2	2	1	0
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2	0	0	0	0	1	0	0	1	1	?	1	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	2	0	1	1	2	1	0	0	0	1	3	0
0	1	?	0	0	?	?	?	?	?	?	1	1	0	?
?	1	1	1	1	0	?	1	0	0	?	2	0	?	0
?	1	?	?	?	?	1	?	?	?	?	?	?	?	?
?	?	?	1	1	0	1	1	2	0	?	0	0	1	0
1	1	1	0	2	0	1	?	1	1	1	1	1	0	?
?	1	0	2	1	1	0	1	1	0	0	1	1	1	?
?	0	0	0	1	1	0	1	1	1	0	1	[0 1]	0	0
0	0	?	?	0	0	1	?	1	1	1	1	3	0	0
0	?	0	0	?	2	2	1	2	1	3	0	2	1	0
?	?													

Araripemys barretoi

1	?	?	1	?	?	0	1	1	1	0	1	1	1	0
?	?	1	2	1	1	0	0	0	1	0	0	0	0	1
1	1	0	0	0	0	?	0	0	?	?	1	1	?	?
?	3	2	1	2	?	0	?	0	2	1	2	2	0	1
0	1	0	0	0	0	?	?	?	0	1	0	1	0	0
2	?	?	0	?	?	0	1	1	1	?	0	1	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	1	0	2	1	1	2	1	0	1	0	1	1	0
0	1	1	0	1	0	2	1	1	1	0	1	1	0	?
?	1	1	1	1	0	1	1	1	0	1	2	0	1	1
0	0	0	1	1	?	?	?	0	0	0	0	0	1	0
1	?	?	1	0	0	?	1	1	1	0	0	0	0	0
0	1	0	1	2	?	?	0	1	1	1	1	1	0	?
?	1	0	2	1	?	0	0	1	1	?	?	?	?	?
?	?	?	?	1	1	0	0	1	1	0	0	1	1	0
0	0	1	0	0	3	1	1	0	0	0	0	2	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	0
?	2													

Australochelys africanus

?	?	?	?	?	?	?	1	0	?	?	0	?	?	1
?	?	?	0	?	0	0	?	0	0	?	0	0	0	?
?	0	?	?	0	0	?	0	1	?	?	0	?	?	0
?	1	1	0	0	0	0	?	0	?	?	1	0	0	0
0	0	0	?	0	0	0	?	?	?	?	?	1	1	1
0	?	0	0	?	?	?	?	0	?	?	0	0	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	0	0	0	?	?
0	?	?	?	?	?	?	?	?	?	?	?	2	?	?
?	?													

Baena arenosa

?	?	?	0	0	0	2	1	1	1	0	0	1	1	0
0	0	?	0	1	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	1	?	1	0	1	0	0
0	2	2	0	2	1	1	0	0	2	1	2	2	1	0
0	0	0	1	0	0	0	0	?	0	1	?	1	0	2
2	0	0	0	0	1	0	?	1	1	?	?	1	1	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	1	1	1	0	1	0	1	1	?
0	0	0	0	1	2	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	?	1	0	1	1	1	?	0
0	0	0	0	0	2	1	1	0	0	0	0	0	0	1
0	0	?	?	1	0	?	0	?	?	?	?	?	?	?
?	0	0	0	1	0	1	0	1	1	2	2	0	0	?
?	1	0	2	0	0	0	0	1	0	1	0	0	1	?
?	0	0	1	1	?	?	?	?	?	?	?	0	0	0
0	0	0	0	0	?	?	0	?	?	0	1	0	0	0
0	0	0	0	1	2	2	1	?	1	3	0	2	?	0
?	0													

Baptemys wyomingensis

1	?	?	1	0	0	0	1	1	1	0	1	1	1	0
0	0	?	2	1	0	0	0	0	1	0	0	0	0	0
1	1	0	0	0	0	0	0	2	?	1	0	1	0	0
1	2	2	0	2	1	1	0	0	1	1	2	2	1	0
0	0	[0 1]	?	0	0	1	0	0	0	1	0	1	0	2
2	?	0	0	0	?	2	?	1	?	?	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	1	1	0	?	1	0	0	0	1	1	?
0	0	0	0	?	1	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	1	1	0	1	2	1	?	0
0	0	0	0	1	?	1	?	0	0	1	1	0	0	0
0	0	?	1	1	?	1	1	1	1	?	?	?	?	?
?	?	?	?	2	?	1	1	1	1	?	?	1	?	?
?	1	0	2	?	?	?	?	?	0	1	?	?	1	?
?	1	?	?	1	1	0	0	1	1	?	?	0	0	0
0	0	0	0	0	0	?	0	?	0	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	[0 1]
2	2													

Basilemys variolosa

1	?	?	1	?	?	0	1	1	1	?	1	?	?	0
0	?	?	?	1	0	0	0	0	1	0	0	?	0	0
1	1	0	?	0	0	?	?	?	?	?	?	1	?	?
?	?	2	0	?	2	1	?	?	?	1	2	2	?	0
?	?	?	?	?	?	?	?	?	?	?	?	1	0	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	1	2	1	0	1	1	1	1	?
0	[0 1]	0	0	1	1	2	1	1	1	1	0	0	0	?
?	1	1	1	0	0	0	1	0	0	0	2	0	?	0
0	0	1	0	0	[0 2]	1	1	0	0	1	0	0	0	0
0	1	0	1	1	?	1	1	?	0	?	0	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	0	?	?	?	?	?	?	0	1	0	1	1	?
?	0	0	?	1	0	0	0	?	?	0	0	0	?	0
0	0	0	0	0	2	?	0	1	0	1	1	1	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	?	1
?	2													

Basilochelys macrobios

?	?	?	?	?	?	?	?	?	?	?	?	1	1	0
0	0	1	2	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	1	0	1	?	?
?	2	?	?	?	?	1	1	0	1	1	1	2	0	0
?	0	?	?	1	0	?	?	?	?	0	0	1	0	?

?	?	1	0	?	1	0	0	?	?	?	0	1	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	1	?	0	0	1	1	?	?	?	0	1	1	1	?
0	?	0	0	?	1	2	1	1	1	1	0	0	0	?
?	1	1	1	0	0	0	?	0	0	[0 1]	2	?	?	0
0	0	?	?	?	?	1	?	?	0	1	?	?	?	0
?	?	?	?	1	1	?	?	?	?	?	?	?	?	?
?	1	?	0	0	?	?	1	?	?	?	?	?	?	?
?	?	0	?	?	?	?	?	?	0	1	0	1	1	?
?	?	0	1	1	?	?	?	?	?	?	?	0	?	0
0	0	0	1	0	0	?	0	?	0	1	1	1	?	0
?	0	0	0	?	2	2	1	?	1	3	0	2	1	1
?	2													

Boremys pulchra

0	0	1	0	0	0	2	1	1	1	0	1	1	1	0
0	0	?	1	1	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	?	?	?	?	1	0	1	?	0
0	2	2	0	2	1	1	0	0	2	1	2	2	1	0
0	0	1	?	0	0	0	0	0	0	1	0	1	0	2
2	0	0	0	0	1	0	0	1	?	?	?	1	1	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	1	1	1	0	0	0	1	1	?
0	0	0	0	2	2	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	?	1	0	?	0	1	?	?
0	0	0	0	0	2	1	?	0	0	0	0	0	0	?
0	0	?	0	1	0	0	0	?	?	?	?	?	?	?
?	?	?	?	1	0	1	0	1	1	2	1	0	0	?
?	?	0	?	?	?	?	?	?	0	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	0	0	0
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	?
?	0													

Caretta caretta

1	?	?	1	0	0	0	1	1	[0 1]	0	0	1	2	0
0	0	1	0	1	0	0	0	0	0	0	0	0	1	0
1	1	0	1	0	0	?	1	0	?	1	0	1	1	0
0	2	2	0	1	1	1	1	0	1	1	2	2	1	0
2	0	?	1	1	0	1	0	0	0	1	0	1	0	2
2	1	0	1	0	1	0	0	1	1	?	0	?	0	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	2	0	0	0	1	0	0
0	0	1	0	2	1	2	1	1	1	0	1	1	0	?
?	1	1	1	0	0	1	1	0	0	2	2	0	?	0
1	0	0	0	1	?	?	?	1	0	?	0	0	0	0
0	?	?	1	1	1	1	1	1	1	2	0	0	0	1
1	1	1	0	2	0	1	1	1	1	1	1	1	0	?
?	1	0	2	1	1	1	?	1	0	0	1	1	1	?
?	0	0	0	1	1	2	0	1	1	0	0	1	0	0
0	0	0	0	0	2	1	1	1	1	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	0
2	2													

Carettochelys insculpta

1	?	?	1	0	1	0	1	1	1	0	1	1	1	0
0	1	1	2	1	0	0	1	0	1	0	0	1	0	0
1	1	1	2	0	0	0	0	0	?	1	1	1	1	0
1	2	2	0	2	2	1	1	0	1	1	2	2	1	0
0	1	1	1	1	0	1	0	1	0	1	0	1	0	2
2	0	0	0	0	1	0	0	1	1	?	1	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	1	0	1	1	2	1	0	0	0	1	2	0
0	1	0	0	1	?	2	?	?	?	?	1	0	0	?
?	1	1	1	0	0	0	1	0	0	2	2	0	1	0
0	1	?	?	?	?	1	?	?	?	?	?	?	?	?
?	?	?	1	1	0	1	1	1	0	?	0	0	1	0
1	1	1	0	2	0	1	1	1	1	1	1	1	0	?
?	1	0	2	0	0	1	?	1	0	0	1	1	1	?
?	0	1	0	1	1	0	2	1	1	0	0	0	0	0
0	0	?	0	0	0	1	?	1	1	1	1	3	0	0
0	?	0	0	2	2	2	1	2	1	3	0	2	1	0
?	?													

Caribemys oxfordiensis

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	0	1	?	?	1	0	0	0	0	?	0
?	?	0	0	?	?	2	?	?	?	?	0	1	0	?
?	1	1	?	0	0	0	?	1	0	1	1	1	1	?
0	0	0	1	0	0	1	1	0	0	0	0	0	0	?
1	?	?	1	?	?	?	1	?	?	?	?	?	?	?
?	?	?	0	?	0	?	?	?	?	?	?	?	0	?
?	?	0	?	?	?	0	?	1	1	1	0	0	?	1
0	?	0	?	?	?	?	?	?	?	?	?	?	?	0
0	0	?	?	0	?	?	0	?	?	?	?	?	?	?
?	0	?	0	1	2	?	?	?	1	?	0	2	?	?
?	?													

Changmachelys bohlini

?	?	?	1	?	?	0	1	1	1	0	0	?	?	0
?	?	1	1	1	0	0	0	0	0	0	0	0	0	0
1	1	?	?	?	?	0	0	0	?	?	?	?	?	?
?	2	2	0	2	1	?	?	0	?	1	?	?	1	0
0	?	0	1	?	0	1	0	0	?	0	0	1	0	2
?	?	1	0	0	1	0	0	1	?	?	0	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	?	0	0	0	1	1	?
0	0	0	0	?	1	2	1	1	?	?	1	?	0	?
?	1	?	1	0	0	?	?	0	0	?	2	0	0	0
0	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	1	1	1	1	?	1	?	0	?	?	0
?	1	?	0	?	?	?	?	1	?	?	?	?	0	?
?	1	0	2	?	?	0	?	1	0	?	?	?	1	?
?	?	?	?	?	1	0	0	1	1	0	0	?	0	0
0	0	0	1	?	1	0	1	?	0	1	1	1	?	?
?	0	0	0	?	2	2	1	2	1	3	0	2	1	0
?	2													

Chelodina colliei

0	1	1	0	1	1	1	1	1	1	1	1	1	1	0
0	?	1	2	1	0	1	?	?	1	0	0	0	0	1
1	1	0	0	0	0	1	0	0	?	1	0	1	?	0
0	3	2	0	2	3	0	?	1	2	1	2	2	0	1
0	0	0	0	0	0	0	0	0	1	1	0	1	0	0
2	0	0	0	1	1	0	1	1	1	?	2	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	1	0	0	1	1	0	1	0	1	0	0	1	?
1	2	0	0	1	1	2	1	1	?	0	0	0	0	?
?	1	1	1	0	0	0	1	1	0	1	2	0	1	1
0	0	0	1	0	1	1	0	0	0	0	0	0	0	0
1	?	?	1	0	0	0	1	1	1	3	1	0	0	0
0	1	0	1	2	0	1	0	1	1	1	1	1	0	?
?	1	0	2	1	1	0	0	1	1	0	0	1	1	1
1	0	0	0	1	1	0	0	1	1	0	?	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	2	0	?
0	0	0	0	1	2	2	1	2	1	3	0	2	1	0
?	2													

Chelodina longicollis

0	1	1	0	1	1	1	1	1	1	1	1	1	1	0
0	?	1	2	1	0	1	?	?	1	0	0	0	0	1
1	1	0	0	0	0	1	0	0	?	1	0	1	1	0
0	3	2	0	2	3	0	?	1	2	1	2	2	0	1
0	0	0	0	0	0	0	0	0	1	1	0	1	0	0
2	0	0	0	1	1	0	1	1	1	?	2	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	1	0	0	1	1	0	1	0	1	0	?	1	1
1	2	0	0	1	1	2	1	1	?	0	0	0	0	?
?	1	1	1	0	0	0	1	1	0	1	2	0	1	1
0	0	0	1	0	1	1	0	0	0	0	0	0	0	0
1	?	?	1	0	0	0	1	1	1	3	1	0	0	0
0	1	0	1	2	0	1	0	1	1	1	1	1	0	?

?	1	0	2	1	1	0	0	1	1	0	0	1	1	1
1	0	0	0	1	1	0	0	1	1	0	0	0	?	0
0	0	0	0	0	0	1	0	0	0	0	0	2	0	?
0	0	0	0	1	2	2	1	2	1	3	0	2	1	?
?	2													

Chelonia mydas

1	?	?	1	?	0	0	1	1	1	0	0	1	2	0
0	0	1	0	1	0	0	0	0	0	0	0	0	1	0
1	1	0	1	0	1	?	1	2	0	1	0	1	1	0
0	2	2	0	1	1	1	0	0	1	1	2	2	1	0
2	0	?	1	1	0	1	0	0	0	1	0	1	0	2
2	1	0	1	0	1	0	0	1	1	?	0	1	0	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	2	0	0	0	1	1	0
0	0	1	0	2	1	2	1	1	1	0	1	1	0	?
?	1	1	1	0	0	1	1	0	0	2	2	0	?	0
1	0	0	0	1	?	?	?	1	0	?	0	?	0	0
0	?	?	1	1	1	1	1	1	1	2	0	0	0	1
1	1	1	0	2	0	1	1	1	1	1	1	1	0	?
?	1	0	2	1	1	1	?	1	0	0	1	1	1	?
?	0	0	0	1	1	2	0	1	1	0	?	1	0	0
0	0	0	0	0	2	1	1	1	?	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	0
2	2													

Chelonoidis chilensis

1	?	?	1	0	0	0	1	1	1	0	1	1	1	0
0	1	1	2	1	0	0	0	0	1	0	0	0	0	0
1	1	0	0	0	0	0	0	2	0	1	0	1	0	1
0	2	2	0	2	2	1	0	0	1	1	2	2	1	0
0	0	1	1	0	0	1	0	0	0	1	0	1	0	2
2	0	0	0	0	1	0	0	1	0	1	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	0	1	0	0	1	0
0	0	0	1	2	0	2	1	1	0	0	0	0	0	?
?	1	1	1	0	0	0	0	0	0	0	2	1	?	1
0	0	0	0	1	?	1	?	0	0	0	0	1	0	0
0	1	0	1	1	0	1	1	1	1	2	1	0	1	0
1	1	1	0	2	0	1	1	1	1	1	1	1	0	?
?	1	0	2	[0 1]	0	0	1	1	0	1	0	1	1	?
?	0	0	0	1	0	0	0	1	1	1	0	0	0	0
0	0	0	0	0	0	?	0	?	0	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	1
?	2													

Chelonoidis gringorum

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	0	1	0	?	?	?	1	0	0	1	0
0	0	0	1	2	0	0	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	0	?	0	?	2	?	?	1
0	0	0	0	1	?	1	?	0	0	0	0	1	0	0
0	1	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	0	?	1	?	0	?	1	0	1	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	0	0	0
0	0	0	0	0	0	1	0	1	0	?	?	?	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	1
?	2													

Chelus fimbriatus

1	?	?	0	1	0	1	1	1	1	0	0	1	1	0
0	?	1	2	1	0	1	?	?	1	0	0	0	0	1
1	1	1	0	0	0	0	0	0	?	1	0	1	0	0
0	3	2	0	2	3	0	?	0	2	1	2	2	0	1
0	0	0	0	0	0	0	0	0	1	1	0	1	0	0
2	0	0	0	1	1	0	1	1	1	?	2	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

1	1	1	0	2	1	0	?	1	0	1	0	0	1	1
0	0	1	0	1	1	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	1	1	0	1	2	1	1	1
1	0	0	1	0	2	0	1	0	0	1	0	0	0	0
1	?	?	1	0	1	1	1	1	1	3	1	0	0	0
0	1	0	1	2	0	1	0	1	1	1	1	1	0	?
?	1	0	2	1	0	0	0	1	1	0	0	1	1	1
1	0	0	0	1	1	0	0	1	1	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	2	0	?
0	0	0	0	1	2	2	1	2	1	3	0	2	1	1
1	[0 1]													

Chelydra serpentina

1	?	?	1	0	0	0	1	1	0	0	1	1	1	0
0	0	?	2	1	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	?	1	0	1	0	0
0	2	2	0	2	2	1	0	0	1	1	2	2	1	0
0	0	1	1	1	0	1	0	0	0	1	0	1	0	2
2	0	0	0	0	1	0	0	1	0	?	?	1	0	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	2	0	0	0	1	0
0	0	0	0	3	1	2	1	1	1	0	1	1	0	?
?	1	1	1	0	0	1	?	0	0	2	2	0	1	0
0	0	0	0	1	?	1	?	0	0	1	0	?	1	1
0	0	?	1	1	1	1	1	1	1	2	0	0	1	0
1	1	1	0	2	0	1	1	1	1	1	2	0	0	?
?	1	0	2	1	0	0	0	1	0	0	0	1	1	?
?	0	0	?	1	1	0	0	1	1	?	?	1	0	0
0	0	0	0	0	0	0	1	1	1	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	0
2	[0 1]													

Chisternon undatum

0	0	1	0	0	0	2	1	1	1	0	0	1	1	0
0	?	?	1	1	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	1	?	1	0	1	0	0
0	2	2	0	2	1	1	0	0	2	1	2	2	1	0
0	0	1	1	0	0	0	0	0	0	1	?	1	0	2
2	0	0	0	0	1	0	0	1	1	?	0	1	1	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	?	?	1	0	0	0	1	1	?
0	0	0	0	?	2	2	1	1	?	?	0	0	0	?
?	1	1	1	0	0	0	?	1	0	?	0	1	?	0
0	0	0	0	0	2	1	1	0	0	0	0	0	0	1
0	?	?	?	0	0	0	1	1	1	2	?	0	0	0
0	?	?	0	1	0	1	0	1	1	?	?	0	0	?
?	?	0	2	?	0	0	0	1	0	1	0	0	1	?
?	0	0	1	1	?	?	?	?	?	?	?	0	0	0
0	0	0	0	0	0	?	0	?	0	0	1	0	0	0
0	0	0	0	1	2	?	1	?	1	3	0	2	?	0
?	0													

Chrysemys picta

1	?	?	1	0	0	0	1	1	1	0	1	1	1	0
0	1	1	2	1	0	0	0	0	1	0	0	0	0	0
1	1	0	0	0	0	0	0	2	0	1	0	1	0	0
0	2	2	0	2	1	1	0	0	1	1	2	2	0	0
0	0	1	1	0	0	1	0	0	0	1	1	1	0	2
2	0	0	0	0	1	0	0	1	0	1	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	0	1	0	1	1	0
0	0	0	0	1	1	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	1	1	0	1	2	1	0	1
0	0	0	0	1	?	1	?	0	0	0	0	1	0	0
0	1	0	1	1	1	1	1	1	1	2	1	1	1	0
1	1	1	0	2	0	1	1	1	1	1	1	1	0	?
?	1	0	2	1	0	0	1	1	0	1	0	1	1	?
?	0	0	1	1	1	0	0	1	1	0	0	0	0	0
0	0	0	0	0	0	1	0	1	0	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	1
1	2													

Chubutemys copelloi

?	?	?	0	0	0	0	1	1	0	0	0	1	1	0

0	?	?	0	?	0	0	0	?	0	0	?	0	0	?
1	1	?	?	?	?	?	0	?	?	1	1	1	0	0
?	1	2	0	2	1	1	?	0	?	1	1	2	0	0
0	0	0	0	0	0	1	?	?	?	0	?	1	0	1
2	0	0	0	?	?	?	?	1	1	?	0	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	0	?	1	?	?	?	?	?	?	?	?	?
0	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	1	?	?	?	?	?	?
?	?	?	0	?	?	?	0	?	?	?	?	?	?	?
?	1	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	0
0	0	0	0	?	0	?	0	?	0	0	1	0	0	0
0	0	0	0	?	2	2	1	?	1	?	0	2	?	?
?	2													

Condorchelys antiqua

?	?	?	?	?	?	?	?	?	?	?	?	?	?	0
?	?	?	0	?	?	?	?	?	?	?	0	0	0	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	1	2	0	?	1	0	?	0	?	1	1	0	0	0
?	0	?	0	0	0	?	?	?	?	0	?	1	0	1
1	?	1	0	?	?	?	?	0	?	?	0	0	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	1	?	0	0	1	0	?	?	?	?	?	0	?	1
?	0	0	0	2	?	?	?	0	0	?	?	1	0	?
?	0	0	1	0	0	?	?	?	?	?	?	?	?	?
?	0	?	?	?	?	?	?	?	0	?	0	?	?	?
?	?	?	0	1	0	?	0	?	?	?	?	?	?	?
?	0	?	0	?	0	?	?	1	?	0	0	?	0	?
?	1	?	?	0	0	0	0	?	0	1	0	0	?	?
?	?	0	?	1	?	?	?	?	?	?	?	?	0	?
0	0	0	0	0	?	0	0	?	?	0	0	0	?	?
?	0	?	0	?	2	1	?	?	1	?	0	2	?	?
?	2													

Dermatemys mawii

1	?	?	1	0	0	0	1	1	[0 1]	0	1	1	1	0
0	0	?	2	1	0	0	0	0	1	0	0	0	0	0
1	1	0	0	0	0	0	0	2	0	1	0	1	0	0
1	2	2	0	2	1	1	0	0	1	1	2	2	1	0
0	0	1	1	0	0	1	0	0	0	1	0	1	0	2
2	0	0	0	0	?	2	?	1	0	1	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	0	0	0	1	1	1
0	1	0	0	1	1	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	?	1	0	1	2	0	0	1
0	0	0	0	1	?	1	?	1	0	0	1	0	0	0
0	0	0	1	1	1	1	1	1	0	?	0	0	1	0
1	1	1	0	2	0	1	1	1	1	?	?	1	0	?
?	1	0	2	1	0	0	1	1	0	1	1	0	1	?
?	0	0	?	1	1	0	0	1	1	0	0	0	0	0
0	0	0	0	0	0	1	0	1	0	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	0
1	2													

Dermochelys coriacea

1	?	?	1	0	1	0	1	1	0	0	0	0	?	0
0	?	1	0	0	0	0	0	0	0	0	0	0	1	0
1	1	0	0	0	0	0	0	1	?	1	0	1	0	0
0	2	2	0	1	1	0	?	0	2	1	2	2	1	0
2	0	?	0	0	0	1	0	0	0	1	0	1	0	2
2	1	0	0	0	1	0	0	1	1	?	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	2	0	1	?	?	2	0	?	0	?	3	0
0	?	1	?	?	?	2	?	?	?	?	1	1	?	?
?	1	1	1	0	0	1	?	0	?	?	2	0	?	0
1	1	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	1	1	1	1	1	1	1	2	0	0	0	1
1	0	1	0	2	0	?	0	1	1	1	1	1	0	?
?	1	1	2	1	1	1	?	1	0	1	1	1	1	?
?	0	0	0	1	1	2	0	1	1	?	?	1	?	0

0	0	?	?	?	0	1	1	1	0	1	1	3	0	0
0	0	0	0	2	2	2	1	2	0	3	0	2	1	1
2	?													

Dorsetochelys delairi

0	0	1	0	0	0	1	1	1	1	0	0	1	?	0
?	?	?	0	1	0	0	0	0	0	0	0	0	0	?
1	1	0	?	0	0	0	0	0	?	1	0	1	0	0
?	2	2	0	2	1	1	?	0	1	1	2	2	1	0
0	0	0	1	0	0	0	0	?	0	0	?	1	0	1
2	?	1	0	?	1	0	?	1	1	?	0	1	?	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	0
0	0	?	?	?	?	?	0	?	?	0	1	0	0	0
0	?	?	?	1	2	2	1	?	1	?	0	2	1	1
?	2													

Dracochelys bicuspis

?	?	?	?	0	?	?	?	1	1	0	?	1	1	0
0	0	1	?	?	0	0	0	0	?	0	0	0	?	?
1	1	0	0	0	0	0	0	1	?	1	0	1	0	0
?	2	2	0	[1 2]	1	1	0	0	1	1	1	2	1	0
0	0	0	1	1	0	?	0	?	0	1	?	1	0	2
2	?	0	0	0	1	0	0	1	?	?	0	1	?	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	?	?	1	0	0	0	1	1	?
0	0	0	0	2	0	?	1	1	1	?	1	1	0	?
?	?	?	?	0	0	1	?	0	0	0	2	0	0	0
0	0	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	1	1	1	1	1	0	?	0	0	0	0
0	1	1	0	0	0	1	0	?	?	?	?	?	0	?
?	1	0	2	0	?	0	0	1	0	?	?	?	?	?
?	?	?	?	?	?	0	0	?	?	?	?	0	1	0
1	1	1	0	1	2	?	1	0	1	1	1	1	0	0
0	0	0	0	?	2	2	1	2	1	?	0	2	1	?
2	2													

Echmatemys wyomingensis

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	0	1	0	?	1	0	1	0	1	1	?
0	0	0	0	?	1	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	1	1	0	0	2	1	1	1
0	0	0	0	1	?	1	?	0	0	1	0	0	0	0
0	1	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	2	0	1	?	?	?	?	?	?	?	?
?	1	0	?	?	?	?	?	?	0	?	?	?	1	?
?	?	0	?	?	?	?	?	?	?	?	?	0	0	0
0	0	0	0	0	0	?	0	?	0	1	1	3	?	?
?	0	?	0	1	2	2	1	?	1	?	0	2	?	1
?	2													

Eileanchelys waldmani

0	0	0	0	0	?	1	1	1	1	0	0	?	?	0
?	?	1	0	1	0	0	0	0	0	?	0	0	0	0
?	1	0	0	0	0	0	0	?	?	1	?	1	0	0
?	1	2	0	2	?	0	?	0	?	1	?	?	0	0
?	?	?	?	0	0	0	?	?	?	0	0	1	0	1
2	?	1	0	?	?	0	0	1	1	?	0	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	?	1	0	?	?	?	0	0	0	1	?
0	0	0	0	2	1	2	1	0	0	?	?	?	0	?

?	1	?	?	0	0	0	?	?	0	?	0	?	?	0
0	0	?	0	0	?	?	?	0	0	?	0	?	?	?
0	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	0	0	0
0	0	0	1	0	2	?	0	?	0	0	0	0	?	0
0	0	0	0	?	2	2	1	?	1	3	0	2	?	?
?	2													

Elseya dentata

0	1	1	0	1	1	1	1	1	1	0	0	1	1	0
0	?	?	0	1	0	1	?	?	1	0	0	0	0	1
1	1	0	0	0	0	1	0	2	0	1	0	1	1	0
0	3	2	0	2	3	0	?	0	2	1	2	2	0	1
0	0	0	0	0	0	1	0	?	0	1	0	1	0	0
2	0	0	0	1	1	0	1	1	1	?	?	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	?	?	1	0	?	0	?	1	?
1	2	0	0	?	0	2	1	1	?	0	0	0	0	?
?	1	1	1	0	0	0	?	1	0	0	2	1	0	1
0	0	0	1	0	0	1	?	0	0	?	0	0	0	0
1	?	?	1	0	?	0	1	1	1	3	1	0	0	0
0	1	0	?	2	0	1	0	1	1	?	?	1	0	?
?	1	0	2	?	?	0	?	?	1	?	?	?	1	1
1	0	0	?	1	1	0	0	1	1	?	?	0	?	0
0	0	0	0	0	0	1	0	0	0	0	0	2	0	?
0	0	0	0	1	2	2	1	2	1	3	0	2	1	?
?	2													

Emarginachelys cretacea

1	?	?	1	0	0	0	1	1	1	?	1	1	1	0
0	0	?	?	1	0	0	0	0	1	0	0	0	?	0
1	1	0	0	0	0	?	?	?	?	1	0	1	0	?
1	2	2	0	2	1	1	?	?	1	1	2	2	1	0
0	0	1	1	?	?	1	0	?	0	1	?	1	0	2
2	0	0	?	0	1	0	?	?	?	?	?	?	?	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	0	1	1	?	?	1	[1 2]	?	0	?	1	?
0	0	0	?	?	?	2	1	1	1	0	1	0	0	?
?	1	1	1	0	0	0	?	0	?	1	2	0	?	0
0	0	0	0	1	?	1	?	0	0	?	?	?	?	0
0	?	?	1	1	?	?	1	1	1	?	?	?	?	?
?	?	?	?	?	?	1	?	?	?	?	?	?	?	?
?	1	0	2	?	?	?	?	?	0	?	?	?	1	?
?	0	1	?	1	1	0	0	1	1	?	?	0	0	0
0	0	0	0	0	0	0	1	?	0	1	1	3	0	0
0	0	0	0	?	2	2	1	2	1	?	0	2	?	1
2	2													

Emys orbicularis

1	?	?	1	0	0	0	1	1	0	0	1	1	1	0
0	1	1	2	1	0	0	0	0	?	0	0	0	0	0
1	1	0	0	0	0	0	0	0	?	1	0	1	0	0
0	2	2	0	2	1	1	0	0	1	1	2	2	0	0
0	0	1	1	0	0	1	0	0	0	1	1	1	0	2
2	0	0	0	0	1	0	0	1	0	1	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	0	1	0	1	1	0
0	0	0	0	1	1	2	1	1	1	0	1	0	1	0
0	1	0	1	0	0	0	1	0	0	1	2	0	1	0
0	0	0	0	1	?	1	?	0	0	1	0	0	0	0
?	?	?	1	1	1	1	1	1	1	2	1	0	1	0
1	1	1	0	2	0	1	1	1	1	1	1	1	?	?
?	1	0	2	1	0	0	1	1	0	1	?	1	1	?
?	0	0	?	1	1	0	0	1	1	0	0	0	0	0
0	0	0	0	0	0	1	0	1	0	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	0
1	2													

Erymnochelys madagascariensis

1	?	?	1	1	1	0	1	1	1	0	1	1	1	0
0	?	?	0	1	0	0	0	0	1	0	0	0	0	1
1	1	0	0	0	0	0	0	2	0	2	1	1	1	?

0	3	2	1	2	3	0	?	1	2	1	2	2	0	1
0	0	0	0	0	1	1	0	0	0	1	?	1	0	0
2	0	0	0	1	1	0	?	1	1	?	?	1	0	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	0	1	0	1	1	1
0	1	0	0	1	0	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	1	1	0	0	1	1	0	1
0	0	0	1	0	0	1	1	0	0	1	0	0	0	0
1	?	?	1	0	0	0	1	1	1	0	0	0	0	0
0	1	0	0	2	0	1	0	1	1	?	?	1	0	?
?	1	0	?	?	?	0	?	?	1	0	0	1	1	1
1	0	0	?	1	1	0	0	1	1	?	?	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	2	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	1
?	2													

Eurotestudo hermanni

1	?	?	1	0	0	0	1	1	1	0	1	1	1	0
0	1	?	2	1	0	0	0	0	1	0	0	0	0	0
1	1	0	0	0	0	0	0	2	0	1	0	1	0	1
0	2	2	0	2	2	1	0	0	1	1	2	2	1	0
0	0	1	1	0	0	1	0	0	0	1	1	1	0	2
2	0	0	0	0	1	0	0	1	0	1	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	0	1	0	0	1	0
0	0	0	1	2	1	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	0	1	0	0	2	0	0	1
0	0	0	0	1	?	1	?	0	0	0	0	1	0	0
0	1	0	1	1	1	1	1	1	1	2	1	0	1	0
1	1	1	0	2	0	1	1	1	1	1	1	1	0	?
?	1	0	2	1	0	0	1	1	0	1	0	1	1	?
?	0	0	1	1	0	0	0	1	1	1	0	0	0	0
0	0	0	0	0	0	1	0	1	0	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	1
2	2													

Geoclemys hamiltonii

1	?	?	1	0	0	0	1	1	0	0	1	1	1	0
0	1	1	2	1	1	0	0	0	1	0	0	0	0	0
1	1	0	0	0	0	0	0	0	?	1	0	1	0	1
0	2	2	0	2	1	1	0	0	1	1	2	2	1	0
0	0	1	1	1	0	1	0	0	0	1	1	1	0	2
2	0	0	0	0	1	0	0	1	0	1	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	1	1	0	?	1	0	1	0	1	1	1
0	0	0	0	2	1	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	0	1	0	1	2	1	1	1
0	0	0	0	1	?	1	?	0	0	1	0	1	0	0
0	1	0	1	1	1	1	1	1	1	2	1	0	1	0
1	1	1	0	2	0	1	1	1	1	1	1	1	0	?
?	1	0	2	1	0	0	1	1	0	1	0	1	1	?
?	0	0	1	1	1	0	0	1	1	0	0	0	0	0
0	0	0	0	0	0	1	0	1	0	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	?
?	2													

Glyptops plicatulus

0	1	1	0	0	?	1	1	1	1	0	?	1	1	?
0	?	?	0	1	0	0	?	0	?	?	0	0	?	?
1	1	0	?	0	1	?	0	1	?	1	?	1	?	?
0	2	2	0	2	1	1	?	0	1	1	1	2	1	0
0	1	0	1	0	0	0	?	?	?	0	?	1	0	2
2	0	0	0	0	1	0	0	1	1	?	2	1	?	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	1	1	1	0	0	0	1	1	?
0	0	0	0	2	1	2	1	0	1	1	0	0	0	?
?	1	1	1	0	0	0	1	1	0	1	0	1	0	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
0	0	?	?	0	0	0	0	?	?	?	?	?	?	?
?	?	?	0	0	0	1	0	1	0	?	?	?	0	?
?	1	0	2	0	0	0	0	1	0	?	?	?	1	?
?	0	0	?	1	?	?	?	?	?	?	?	0	0	0
0	0	0	0	0	1	?	0	?	0	0	1	0	0	0
0	0	0	0	1	2	2	1	?	1	?	0	2	1	1

? 2

Gopherus polyphemus
1 ? ? 1 0 0 0 1 1 1 0 1 1 1 0
0 1 1 2 1 0 0 0 0 1 0 0 0 0 0
1 1 0 0 0 0 0 0 2 0 1 0 1 0 1
0 2 2 0 2 2 1 0 0 1 1 2 2 1 0
0 0 1 1 0 0 1 0 0 0 1 0 1 0 2
2 0 0 0 0 1 0 0 1 0 1 0 1 0 1
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
1 1 0 0 0 1 0 ? 1 0 1 0 0 1 0
0 0 0 1 2 1 2 1 1 1 0 0 0 0 ?
? 1 1 1 0 0 0 0 1 0 0 2 1 0 1
0 0 0 0 1 ? 1 ? 0 0 0 0 1 0 0
0 1 0 1 1 1 1 1 1 1 2 1 0 1 0
1 1 1 0 2 0 1 1 1 1 1 1 1 0 ?
? 1 0 2 0 0 0 1 1 0 1 0 1 1 ?
? 0 0 1 1 0 0 0 1 1 1 0 0 0 0
0 0 0 0 0 0 1 0 1 0 1 1 3 0 0
0 0 0 0 1 2 2 1 2 1 3 0 2 1 1
2 2

Hangaiemys hoburensis
0 0 1 1 0 0 0 1 1 1 0 0 1 1 0
0 0 1 1 1 0 0 0 0 0 0 0 0 0 0
1 1 0 0 0 0 0 0 0 ? 1 0 1 0 0
0 2 2 ? 2 1 1 0 0 1 1 1 2 [0 1] 0
0 0 0 1 0 0 1 0 0 0 0 0 1 0 2
2 0 1 0 0 1 0 0 1 0 1 0 1 ? 0
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
1 1 0 0 0 1 0 ? 1 0 0 0 1 1 ?
0 0 0 0 ? 1 2 1 1 1 0 1 0 0 ?
? 1 1 1 0 0 1 1 0 0 0 2 0 ? 0
0 0 0 0 1 ? 1 ? 0 0 0 0 0 0 [0 1]
0 0 ? ? 1 1 1 1 1 1 2 0 0 0 0
0 1 1 0 2 ? 1 0 ? 1 ? ? ? ? ?
? 1 0 2 0 ? 0 0 1 0 ? ? ? 1 ?
? ? ? ? ? ? ? ? ? ? ? ? 0 0 0
0 0 0 1 0 0 ? 1 1 0 1 1 1 0 0
0 0 0 0 1 2 2 ? ? 1 ? 0 2 ? 0
? 2

Heckerochelys romani
0 ? ? 0 0 ? ? ? 1 1 0 0 ? ? 0
? ? ? 0 1 ? ? ? ? 0 ? ? 0 ? ?
? 1 ? ? ? ? ? ? ? ? 1 ? 1 ? ?
? 1 2 ? ? 1 ? ? 0 ? 1 1 0 0 0
? 0 ? 1 0 0 0 ? ? ? ? ? 1 0 1
2 0 ? 0 ? ? ? ? 1 1 ? 0 0 ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? 0 0 1 0 ? 0 0 0 0 0 ? 1
0 ? 0 0 2 1 ? 1 0 ? 0 1 1 0 ?
? 1 1 0 0 0 1 ? 0 0 0 0 0 0 0
0 0 0 0 0 0 1 0 0 0 0 0 0 0 0
0 0 ? ? ? ? ? 0 ? ? ? ? ? ? ?
? ? ? ? ? ? ? 0 ? ? ? ? ? 0 ?
? ? 0 ? ? ? ? ? ? 0 ? ? ? ? ?
? ? ? ? 1 ? ? ? ? ? ? ? 0 0 0
0 0 0 0 0 0 ? 0 ? 0 0 0 0 ? ?
0 0 0 0 1 2 2 1 ? 1 3 0 2 ? 0
? 2

Helochelydra nopcsai
0 ? 1 0 ? ? 1 1 1 1 0 0 1 [0 1] 0
0 ? ? 0 1 0 0 1 0 0 0 0 0 0 0
1 1 0 ? 0 0 0 1 0 ? 1 ? 1 ? 0
0 2 2 0 2 1 1 0 0 1 1 ? 2 1 0
0 0 0 ? 0 0 0 1 0 0 0 ? 1 0 0
? ? 0 0 ? 1 0 0 0 1 ? 0 1 ? 0
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
1 1 0 0 0 1 1 ? ? ? ? ? 1 ? ?
? ? 0 0 ? ? ? ? ? ? ? ? ? ? ?
? ? 1 1 0 0 ? ? ? ? ? ? ? ? ?
? 0 ? ? ? ? ? ? ? ? ? ? ? ? ?

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	0	?	?	?	1	?	?	?
?	1	1	1	?	?	?	?	?	?	?	?	2	?	?
?	?													

Hoplochelys crassa

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	2	1	0	?	1	1	?	0	?	1	?
0	0	0	?	?	1	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	0	0	0	0	2	0	?	0
0	0	0	0	1	?	1	?	0	0	?	1	?	1	0
0	0	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	2	0	1	?	?	?	?	?	?	?	?
?	1	?	2	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	0	0	0
0	0	0	0	0	?	?	0	?	?	?	?	?	?	?
?	0	0	0	1	2	2	1	?	1	?	0	2	?	0
?	?													

Indochelys spatulata

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	0	1	0	?	?	?	0	0	0	?	?
0	0	0	0	2	?	2	1	0	0	?	?	?	0	?
?	0	?	?	0	0	0	?	?	0	?	0	?	?	0
0	0	?	?	?	?	1	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	0	1	0
0	0	0	0	0	0	?	0	?	0	?	?	?	?	?
?	0	?	0	1	2	2	1	?	1	?	0	2	?	1
2	2													

Judithemys sukhanovi

?	?	?	1	?	?	0	1	1	1	0	?	1	1	0
0	?	?	1	1	0	0	0	0	?	0	0	0	0	0
1	1	?	?	?	0	?	0	?	?	1	0	1	?	0
?	2	2	0	2	1	1	?	0	?	1	1	2	1	0
0	0	0	1	1	0	1	0	0	0	0	?	1	0	2
2	0	1	0	0	1	0	0	1	1	?	0	1	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	0	0	0	1	1	?
0	0	0	0	2	1	2	1	1	1	0	1	0	0	?
?	1	1	1	0	0	1	?	0	0	0	2	0	0	0
0	0	0	0	1	?	1	?	0	0	0	0	0	0	[0 1]
0	0	?	?	1	1	1	1	1	1	2	0	0	0	0
0	1	1	0	2	?	1	0	1	1	1	2	1	0	?
?	1	0	2	0	0	0	0	1	0	?	?	?	1	?
?	0	0	?	1	1	0	0	1	1	0	?	0	0	0
0	0	0	0	0	0	0	1	1	0	1	1	1	0	0
0	0	0	0	1	2	2	1	?	1	?	0	2	?	0
?	2													

Kallokibotion bajazidi

0	0	1	0	?	?	0	1	1	[0 1]	0	0	1	?	0
0	0	?	0	1	0	0	0	0	0	?	0	0	0	?
1	0	0	0	0	0	0	0	2	1	1	1	1	0	0
0	2	2	0	2	?	1	0	0	1	1	?	2	1	0
?	0	?	?	0	0	?	0	0	0	0	1	1	?	1

?	0	0	0	?	1	0	0	1	1	?	0	1	?	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	0	0	0	1	1	1	0
0	0	0	0	2	0	2	1	0	1	0	0	0	0	?
?	1	?	1	0	0	0	?	1	0	?	[0 1]	1	0	1
0	0	0	0	0	0	1	0	0	0	[0 1]	0	0	0	0
0	0	?	?	0	0	1	0	?	?	?	?	?	?	?
?	0	?	0	?	0	1	?	?	0	?	?	0	0	?
?	?	0	1	0	0	0	0	0	0	1	0	0	1	?
?	0	0	?	?	?	?	?	?	?	?	?	0	0	0
0	0	0	?	0	0	0	0	?	?	0	1	0	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	0
1	2													

Kayentachelys aprix

0	0	1	0	0	0	1	1	1	1	0	0	0	?	0
?	?	?	0	1	0	0	0	0	0	0	0	0	0	0
?	1	0	?	0	0	0	0	1	?	1	0	1	0	0
0	1	2	0	1	1	0	?	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	?	0	0	0	1	0	1
1	0	1	0	?	1	0	0	0	?	?	0	0	0	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	1	0	0	1	0	?	0	0	0	0	0	[0 1]	1
0	0	0	0	1	1	2	1	0	0	0	1	0	0	?
?	0	0	1	0	0	0	?	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
0	0	?	0	?	0	?	0	?	?	?	?	?	?	?
?	?	?	0	0	0	0	0	1	?	0	0	0	0	?
?	1	0	?	0	?	0	0	?	0	1	0	0	1	?
?	0	0	?	1	?	0	0	?	?	?	?	0	0	0
0	0	0	0	0	2	0	0	?	0	0	0	0	?	0
0	0	0	0	1	2	2	1	?	1	3	0	2	1	0
?	2													

Kinosternon flavescens

1	?	?	1	0	0	0	1	1	0	0	1	1	1	0
0	1	1	2	1	0	0	1	0	1	0	0	0	0	0
1	1	0	0	0	0	0	0	0	?	1	0	1	0	0
1	2	2	0	2	1	1	1	0	1	1	2	2	1	0
0	0	1	0	0	0	1	0	0	0	1	0	1	0	2
2	0	0	0	0	1	1	0	1	?	?	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	1	1	0	?	1	1	0	0	1	2	0
1	1	0	0	1	1	2	1	1	1	0	0	0	1	1
1	?	?	?	?	1	?	1	0	0	2	2	0	1	0
0	0	0	0	1	?	1	?	1	1	?	1	?	2	0
0	1	1	1	1	1	1	1	1	1	1	0	?	?	?
1	1	1	0	2	1	?	1	1	1	1	1	1	0	?
?	1	0	2	1	0	0	1	1	0	1	1	1	1	?
?	1	1	0	1	1	0	0	1	1	0	?	0	0	0
0	0	0	0	0	0	1	0	1	0	1	1	3	0	0
0	0	0	0	2	2	2	1	2	1	3	0	2	1	1
?	2													

Liaochelys jianchangensis

0	0	1	1	?	0	0	1	1	1	0	1	?	?	0
?	0	1	2	1	0	?	?	?	0	0	0	0	?	?
1	1	0	?	0	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	1	0	?	?	?	?	?	?	?
0	?	?	?	?	?	1	0	0	?	?	0	1	0	?
?	?	?	?	?	1	0	0	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	1	0	0	0	1	0	?	?	?	0	?	1	1	?
0	1	0	0	2	1	2	1	0	1	0	1	1	0	?
?	?	?	?	0	0	1	?	0	0	?	2	0	?	0
0	0	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	1	1	?	1	?	?	?	?	?	?	?
?	1	?	0	?	?	?	?	1	1	1	2	?	0	?
?	?	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	1	1	?	?	1	0	0
1	1	0	[0 1]	1	1	0	1	?	[0 1]	?	?	?	?	0
?	0	0	0	?	2	2	1	2	1	?	0	2	?	?
?	2													

Lissemys punctata

1	?	?	1	0	1	0	1	1	1	0	1	1	1	0
0	1	1	2	1	1	0	0	0	1	0	0	1	0	0
1	1	1	2	1	0	1	0	0	?	1	1	1	1	0
1	2	2	0	2	2	1	1	0	1	1	2	2	1	0
0	1	1	0	1	0	1	0	1	0	1	0	1	0	2
2	0	0	0	0	1	0	0	1	0	0	1	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	2	0	1	1	2	1	0	0	0	1	3	0
0	1	?	0	0	?	?	?	?	?	?	1	1	0	?
?	1	1	1	1	0	?	1	0	1	?	2	0	?	0
?	1	?	?	?	?	1	?	?	?	?	?	?	?	?
?	?	?	1	1	0	1	1	2	0	?	0	0	1	0
1	1	1	0	2	0	1	?	1	1	?	?	1	0	?
?	1	0	2	1	1	0	1	1	0	0	1	1	1	?
?	0	1	0	1	1	0	1	1	1	0	1	1	0	0
0	0	?	?	0	0	1	?	1	1	1	1	3	0	0
0	?	0	0	2	2	2	1	2	1	3	0	2	1	0
?	?													

Macroclemys schmidti

1	?	?	1	?	?	0	1	1	0	0	1	1	1	0
?	0	1	2	1	0	0	0	0	0	0	0	0	0	?
1	1	0	?	0	1	0	0	0	?	1	0	1	0	0
?	2	2	0	2	4	1	0	0	1	1	2	2	1	0
0	0	?	1	1	0	1	0	0	0	1	0	1	0	2
?	?	0	0	?	1	0	0	1	0	1	0	1	?	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	0	?	?	?	?	?	1	?	3	0	0
0	?	0	?	?	2	2	1	2	1	?	0	2	?	1
2	?													

Macroclemys temminckii

1	?	?	1	0	0	0	1	1	0	0	1	1	1	0
0	0	1	2	1	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	?	1	0	1	0	0
0	2	2	0	2	2	1	0	0	1	1	2	2	1	0
0	?	1	1	1	0	1	0	0	0	1	0	1	0	2
2	0	0	0	0	1	0	0	1	0	1	0	1	0	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	2	0	0	0	1	0
0	0	0	0	1	1	1	1	1	1	0	1	1	0	?
?	1	1	1	0	0	1	1	0	0	2	2	0	1	0
0	0	0	0	1	?	1	?	0	0	?	0	0	1	1
0	0	?	1	1	1	1	1	1	1	2	0	0	1	0
1	1	1	0	2	0	1	1	1	1	2	2	0	0	?
?	1	0	2	1	0	0	0	1	0	0	0	0	1	?
?	0	0	1	1	1	0	0	1	1	1	?	1	0	0
0	0	0	0	0	2	0	1	1	1	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	0
2	1													

Manchurochelys manchoukuoensis

?	?	?	1	?	0	0	?	1	1	0	1	?	?	0
?	0	1	2	1	0	?	0	?	?	0	0	0	0	?
1	1	0	?	?	0	0	?	?	?	1	0	1	?	0
?	2	?	?	?	?	1	0	0	?	1	1	2	1	0
?	0	0	?	1	0	1	0	0	?	0	0	1	0	?
?	?	1	0	?	1	0	0	?	1	?	0	1	?	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	?	?	0	?	1	1	?
0	0	0	0	2	1	2	1	1	1	0	1	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	1	1	?	1	?	0	?	0	?	?	?
?	1	?	0	?	?	?	?	1	?	?	?	0	0	?

?	1	0	2	0	?	0	?	1	?	?	?	?	?	?
?	?	?	?	?	?	?	?	1	1	?	?	0	0	1
0	0	0	1	1	0	0	1	?	0	1	1	1	?	0
?	0	0	0	?	2	2	1	?	1	?	0	2	?	?
?	2													

Meiolania platyceps

0	0	0	0	0	0	0	1	1	0	0	0	1	?	0
0	0	1	0	1	0	0	0	1	0	1	2	0	0	0
1	1	0	0	0	0	0	0	2	1	1	0	1	0	1
0	2	2	0	0	3	1	0	0	0	1	2	1	1	0
0	0	[0 1]	0	0	0	1	1	0	0	0	0	1	0	1
2	0	0	0	1	1	0	0	1	[0 1]	?	0	0	0	0
1	1	1	1	1	1	1	0	1	1	1	1	0	1	1
1	1	0	0	0	1	0	?	0	0	0	?	?	1	0
0	0	0	?	?	1	2	1	0	?	1	1	1	0	?
?	1	0	1	0	0	0	?	0	?	1	?	0	0	0
0	0	0	0	0	0	1	0	0	0	?	?	?	?	?
?	?	?	0	1	0	0	1	1	1	2	0	0	0	0
0	0	0	0	0	0	?	0	0	1	2	2	0	1	1
1	1	0	0	0	0	0	0	0	0	1	0	0	1	?
?	0	0	?	?	0	0	0	?	?	0	0	1	?	0
?	0	0	0	0	0	0	0	0	0	1	1	1	0	0
0	0	0	0	?	2	2	1	2	1	3	0	2	1	0
2	[0 1]													

Mesodermochelys undulatus

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	1	0	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	0	1	0	1	0	?	2	0	0	0	1	1	0
0	0	1	0	1	?	2	?	?	?	?	1	1	0	?
?	1	1	1	0	0	1	?	0	0	?	2	0	?	0
1	1	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	1	1	1	0	1	1	1	2	0	0	0	0
0	0	1	0	2	0	1	0	1	1	1	1	1	0	?
?	1	0	2	1	1	1	?	1	0	1	1	1	1	?
?	0	0	0	1	?	2	0	?	?	?	?	1	0	0
0	0	0	?	0	2	1	1	0	0	?	?	?	0	0
0	0	0	0	?	2	2	1	2	1	?	0	2	?	0
2	2													

Mongolemys elegans

1	?	?	[0 1]	0	0	0	1	1	1	0	1	1	1	0
0	?	?	2	1	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0	0	1	0	1	0	0
0	2	2	0	2	1	1	0	0	1	1	2	2	1	0
0	0	0	1	0	0	1	0	?	?	0	0	1	0	2
2	0	0	0	0	1	0	0	1	?	?	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	0	?	0	?	1	0
0	0	0	?	?	1	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	?	1	0	0	2	1	0	1
0	0	0	0	1	?	1	?	0	0	?	0	0	0	0
0	0	?	?	?	?	?	1	1	1	2	1	0	1	0
1	1	1	0	2	?	1	1	1	?	1	1	0	0	?
?	1	0	?	?	?	?	?	?	0	?	?	?	1	?
?	0	?	?	1	1	0	0	?	?	?	?	0	0	0
0	0	0	0	0	0	1	0	1	0	1	1	1	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	0
?	2													

Mongolochelys efremovi

0	[0 1]	1	0	0	0	1	1	1	0	0	0	1	0	0
0	0	1	0	1	0	0	0	0	0	1	1	0	0	0
1	1	0	0	0	0	0	0	2	1	1	0	1	0	0
0	1	2	0	2	1	1	0	0	0	1	1	2	0	0
0	0	0	1	0	0	0	0	0	0	0	1	1	0	1
2	?	1	0	?	1	0	0	1	1	?	0	1	0	0
0	0	0	0	1	?	?	0	1	1	?	0	0	0	0

1	1	0	0	0	1	0	?	0	0	0	0	0	1	?
0	0	0	0	2	1	2	1	0	?	0	1	1	0	?
?	1	0	1	0	0	1	1	0	0	0	0	0	0	0
0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
0	0	?	0	0	0	0	1	1	1	1	1	0	0	0
0	0	0	0	0	0	0	0	1	1	1	2	0	0	?
?	1	0	1	0	0	0	0	1	0	?	0	?	1	?
?	0	0	?	1	1	0	0	?	1	0	0	1	[0 1]	0
0	0	0	0	0	3	0	0	?	0	0	1	0	1	1
1	0	0	0	1	2	2	1	2	1	?	0	2	?	0
2	2													

Myuchelys latisternum

0	1	1	0	1	1	1	1	1	1	0	0	1	1	0
0	?	1	0	1	0	1	?	?	1	0	0	0	0	1
1	1	0	0	0	0	1	0	0	?	1	0	1	1	0
0	3	2	0	2	3	0	?	0	2	1	2	2	0	1
0	0	0	0	0	0	1	0	?	0	1	0	1	0	0
2	0	1	0	1	1	0	1	1	1	?	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	?	?	1	0	1	0	?	1	?
1	2	0	0	1	0	2	1	1	?	0	0	0	0	?
?	1	1	1	0	0	0	1	1	0	0	2	1	1	1
0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
1	?	?	1	0	0	0	1	1	1	3	1	0	0	0
0	1	0	0	2	0	1	0	1	1	1	1	1	0	?
?	1	0	2	?	0	0	0	1	1	0	0	1	1	1
1	0	0	0	1	1	0	0	1	1	?	?	0	?	0
0	0	0	0	0	0	1	0	0	0	0	0	2	0	?
0	0	0	0	1	2	2	1	2	1	3	0	2	1	?
?	1													

Naomichelys speciosa

0	1	1	0	?	?	1	1	1	1	0	0	?	?	0
0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
1	1	0	?	0	0	0	?	?	?	?	?	1	?	?
?	2	2	0	2	1	1	0	0	?	1	?	?	1	?
?	0	?	?	0	0	0	0	0	0	0	0	1	0	0
?	?	0	0	?	1	0	0	0	1	?	0	?	?	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	1	?	?	0	0	0	1	1	?
0	0	0	0	?	1	2	1	0	1	0	0	1	0	?
?	1	1	1	0	0	0	1	0	0	1	0	0	0	0
0	0	0	?	?	?	1	?	0	0	0	0	0	0	0
0	0	?	0	0	0	0	1	1	1	2	?	0	0	1
0	0	0	0	0	0	0	0	1	0	0	0	0	0	?
?	1	0	1	0	0	0	0	1	0	?	0	1	1	?
?	0	0	0	1	1	0	0	0	1	0	0	0	0	0
0	0	0	0	0	2	0	0	0	0	?	1	?	0	0
0	1	1	1	1	2	2	1	2	1	3	0	2	1	1
2	2													

Neurankylus eximius

?	?	?	0	?	?	1	1	?	1	0	?	1	1	?
0	0	?	1	?	?	?	?	?	?	0	0	0	?	0
1	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	2	2	0	?	1	1	0	0	2	1	2	2	1	0
?	0	?	?	0	0	0	0	0	0	1	0	1	?	2
2	0	0	0	0	1	0	0	1	1	?	?	1	1	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	0	0	1	1	1	1	0	0	0	1	1	?
0	0	0	0	2	1	2	1	1	1	1	0	0	0	?
?	1	1	1	0	0	0	?	1	0	?	0	1	?	?
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
0	0	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	1	0	1	?	?	?	?	?	?	?	?
?	?	0	?	?	?	?	?	?	0	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	0	0	0
0	0	0	0	0	0	?	0	?	0	0	1	0	0	0
0	0	0	0	1	2	2	1	2	1	?	0	2	1	0
?	2													

Ninjemys oweni

0	?	?	?	?	?	?	?	1	?	?	?	?	?	0

?	?	?	0	?	0	?	?	?	?	?	2	0	?	?
?	1	?	?	0	0	?	0	2	1	1	?	1	0	1
?	?	2	?	?	?	?	?	?	?	?	?	?	?	?
0	?	?	?	?	?	1	?	0	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	0
1	1	0	0	0	0	0	0	0	1	1	0	0	1	1
1	1	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	0	?	?	?	?	1	0
1	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	0	?
0	?	0	?	?	?	?	?	?	?	?	?	2	?	?
?	?													

Niolamia argentina

0	0	0	0	0	0	0	1	1	0	0	0	?	?	0
?	0	1	0	1	0	0	0	1	0	1	2	0	?	0
1	1	0	?	0	0	0	0	1	?	1	0	1	0	1
0	2	2	0	0	?	1	0	0	[0 1]	1	2	1	1	0
0	0	?	0	0	0	1	1	0	0	0	0	1	0	1
?	?	0	0	1	?	?	0	1	?	?	0	0	?	0
0	0	0	0	[0 1]	0	0	[0 1]	0	0	0	[0 1]	1	1	0
1	1	0	0	?	1	0	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	0	?	?	?	?	1	0
1	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	0	?	?	0	1	?	0	?
0	?	0	?	?	?	?	?	?	?	?	?	2	?	?
?	0													

Notoemys laticentralis

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	0	0	0	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	3	2	0	2	?	0	?	0	?	?	2	?	0	?
?	?	?	?	0	0	?	?	?	0	1	0	1	?	0
2	?	0	0	?	1	0	0	1	1	?	0	1	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	0	1	0	?	1	0	0	0	0	1	0
0	0	0	0	2	1	2	1	0	0	0	0	1	0	?
?	1	1	?	0	0	0	?	1	0	1	1	?	0	1
0	0	0	1	0	0	1	?	0	0	0	0	0	0	0
1	?	?	1	1	0	?	1	?	?	?	?	?	?	?
?	1	?	0	2	0	1	?	?	?	?	?	?	0	?
?	?	0	?	?	?	0	0	1	1	?	?	?	?	1
1	?	0	?	?	?	?	?	?	1	?	?	1	0	0
0	0	0	0	0	0	?	0	?	0	0	0	2	0	?
0	0	0	0	1	2	2	1	?	1	?	0	2	1	1
?	2													

Ordosemys leios

0	?	?	?	?	?	?	1	?	?	?	?	?	?	?
?	0	?	[1 2]	?	?	?	?	0	?	?	?	?	?	?
?	?	?	?	?	?	0	0	0	?	?	?	?	?	?
?	?	2	?	?	1	1	1	?	?	?	1	?	?	?
0	?	0	?	?	?	?	?	?	?	?	0	?	?	?
?	?	1	0	?	1	0	0	?	?	?	0	1	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	0	1	0	?	1	0	0	0	1	1	1
0	0	0	0	2	1	2	1	0	1	0	1	1	0	?
?	?	?	?	0	0	?	?	0	0	0	2	0	0	0
0	0	0	?	?	?	?	?	?	0	?	0	?	0	[0 1]
0	0	?	0	1	1	?	1	1	1	2	1	0	0	0
0	?	1	0	0	?	?	0	1	1	1	2	?	0	?
?	1	0	2	0	?	0	0	1	0	0	0	?	1	?
?	0	0	?	1	?	?	?	?	?	?	?	1	0	0

0	0	0	1	0	1	0	1	0	[0 1]	?	?	?	?	?
?	0	?	0	1	2	2	1	2	1	?	0	2	?	0
?	2													

Otwayemys cunicularius

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	[0 1]	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	0	?	?	?	?	?	?
?	?	?	?	2	?	1	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	0	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	0	0	0	1	?	?	?	0	?	?	?	?	0
0	?	0	0	?	?	2	?	0	?	?	1	1	0	?
?	1	?	?	?	0	?	?	?	0	?	2	0	2	0
0	0	0	0	0	0	0	0	0	0	0	0	0	1	?
0	0	?	0	0	?	?	1	1	?	?	1	0	?	?
?	0	0	0	1	?	?	0	?	1	2	?	0	?	?
?	?	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	0	?	0
?	0	?	?	0	?	?	0	?	?	?	?	?	?	?
?	0	?	0	1	2	2	1	?	1	3	0	2	1	1
?	?													

Owenetta kitchingorum

0	0	0	1	0	0	0	1	0	1	0	2	?	?	0
?	?	?	0	0	0	0	0	0	0	0	0	0	?	0
0	0	0	0	0	0	?	?	?	?	0	0	0	0	?
0	0	0	0	0	0	0	?	0	?	0	0	0	0	0
0	0	0	0	?	?	0	0	?	?	?	?	0	0	0
0	0	0	0	?	?	?	?	0	?	?	0	1	?	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
0	1	0	?	?	0	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	?	?	?	?	1	?	?	?	0	0	?
?	0	?	?	?	?	0	?	1	?	?	?	?	0	?
?	0	0	?	1	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	0	?	0	?	0	0	[2 3]	?	0
?	?	0	?	?	0	?	0	0	1	0	0	0	?	?
?	?													

Palaeochersis talampayensis

0	0	0	0	?	0	0	1	0	0	0	0	0	?	1
?	?	?	0	1	0	0	0	0	0	0	0	0	0	0
0	0	0	?	0	0	?	0	0	?	0	?	1	?	0
0	1	1	0	0	0	0	?	0	?	1	1	0	0	0
0	0	0	0	0	0	0	0	?	0	0	?	1	1	1
0	?	0	0	?	?	?	?	0	?	?	0	0	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	?	0	?	?	?	?	0
?	?	0	?	?	?	?	?	?	?	?	0	0	0	?
?	0	0	1	0	0	0	?	0	0	?	0	0	?	0
0	0	0	?	?	?	0	?	?	?	?	?	?	?	0
?	?	?	1	1	0	0	0	?	?	?	?	?	?	?
?	0	0	0	0	0	?	0	1	0	0	0	0	0	?
?	0	0	0	0	0	0	0	1	2	1	0	0	0	?
?	?	0	?	0	0	0	0	?	?	?	0	0	?	0
0	0	0	0	0	0	0	0	?	?	0	0	0	?	0
0	0	0	0	?	2	?	1	1	?	2	?	2	1	?
2	2													

Patagoniaemys gasparinae

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	0	1	0	?	0	0	0	?	0	?	?
0	?	0	0	?	1	?	1	0	?	?	1	1	0	?

?	?	?	?	?	?	?	?	0	?	?	?	0	?	?
?	0	?	?	?	?	?	?	?	0	?	0	0	?	?
?	?	?	0	1	0	?	1	1	1	2	1	0	0	0
0	0	?	0	1	?	?	0	1	1	2	1	0	0	?
?	?	0	?	?	?	?	?	?	0	?	0	?	1	?
?	0	0	?	1	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	2	0	?	0	?	?	?	0	?	?
?	?	?	?	?	?	?	1	?	1	?	0	2	?	1
?	?													

Peligrochelys

?	?	?	0	?	?	?	?	?	0	0	?	?	?	?
?	0	1	?	?	?	?	?	?	?	?	1	?	0	?
?	?	?	?	?	?	?	?	1	?	?	?	?	?	?
?	?	2	0	?	1	1	0	0	[0 1]	?	2	2	0	?
?	?	?	?	0	?	1	?	?	?	0	0	1	0	1
2	?	0	0	1	1	0	0	1	1	?	0	1	?	0
?	?	?	?	?	?	?	?	?	?	?	0	0	0	0
1	1	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	0	?	0	?	?
?	?	?	?	?	?	?	?	?	?	?	?	2	?	?
?	?													

Pelodiscus sinensis

1	?	?	1	0	1	0	1	1	1	0	1	1	1	0
0	1	1	2	1	1	0	0	0	1	0	0	1	0	0
1	1	?	2	?	?	1	0	0	?	1	1	1	1	0
1	2	2	0	2	2	1	1	0	1	1	2	2	1	0
0	1	0	1	1	0	1	0	1	0	1	0	1	0	2
2	0	0	0	0	1	0	0	1	1	?	1	1	?	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	2	0	1	1	2	1	0	0	0	1	3	0
0	1	?	0	0	?	?	?	?	?	?	1	1	0	?
?	1	1	1	1	0	0	1	?	0	?	2	?	?	0
0	1	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	1	1	0	?	1	2	0	?	0	0	?	0
1	1	1	0	2	0	?	?	1	1	?	?	1	0	?
?	?	0	?	?	?	0	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	0	1	1	0	0
0	0	?	?	0	0	1	?	1	1	1	1	3	0	0
0	?	0	0	?	2	2	1	2	1	3	0	2	1	0
?	?													

Pelomedusa subrufa

1	?	?	1	1	1	0	1	1	1	0	1	1	1	0
0	?	1	2	1	0	0	0	0	1	0	0	0	0	1
1	1	0	0	0	0	0	0	2	0	2	1	1	1	?
0	3	2	1	2	3	0	?	[0 1]	2	1	2	2	0	1
0	0	0	0	0	0	1	0	0	0	1	0	1	0	0
2	0	0	0	1	1	0	1	1	1	?	0	1	0	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	0	1	0	1	1	1
0	1	0	0	1	0	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	1	1	0	1	1	1	0	1
0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
1	?	?	1	0	0	0	1	1	1	0	0	0	0	0
0	1	0	0	2	0	1	0	1	1	1	1	1	0	?
?	1	0	2	1	0	0	0	1	1	0	0	1	1	1
1	0	0	0	1	1	0	0	1	1	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	2	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	1
?	2													

Phrynops geoffroanus

0	1	1	0	1	1	1	1	1	1	0	0	1	1	0
0	?	1	2	1	0	1	?	?	1	0	0	0	0	1
1	1	0	0	0	0	1	0	0	?	1	0	1	1	0

0	3	2	0	2	3	0	?	0	2	1	2	2	0	1
0	0	0	0	0	0	0	0	0	1	1	0	1	0	0
2	0	0	0	1	1	0	1	1	1	?	2	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	1	0	0	1	0	?	1	0	1	0	1	1	1
0	1	0	0	1	1	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	1	1	0	1	2	1	0	1
0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
1	?	?	1	0	0	0	1	1	1	3	1	0	0	0
0	1	0	0	2	0	1	0	1	1	1	1	1	0	?
?	1	0	2	1	0	0	0	1	1	0	0	1	1	1
1	0	0	0	1	1	0	0	1	1	0	0	0	0	0
0	0	0	1	0	0	1	0	0	0	0	0	2	0	?
0	0	0	0	1	2	2	1	2	1	3	0	2	1	0
?	2													

Plastomenus* aff. *thomassii

1	?	?	1	0	?	0	1	1	1	0	1	1	1	0
?	1	1	2	1	1	0	0	0	1	0	0	?	0	?
1	1	?	?	?	?	1	0	0	?	1	1	1	1	0
?	2	2	0	2	2	1	1	0	1	1	2	2	1	0
0	1	1	1	1	0	1	0	1	0	1	0	1	0	2
2	?	0	0	?	?	0	0	1	0	1	1	1	?	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	2	0	1	1	2	1	0	0	0	1	3	0
0	1	?	0	0	?	?	?	?	?	?	1	0	0	?
?	?	?	?	?	?	0	1	?	0	?	2	?	?	?
?	1	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	2	0	?	?	1	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	1	0	0
0	0	?	?	0	0	?	?	?	1	1	1	3	0	0
0	?	0	0	?	?	?	?	?	?	?	?	2	?	?
?	?													

Platychelys oberndorferi

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	0	1	0	?	1	0	0	0	0	1	1
0	0	0	0	1	1	1	1	0	0	0	0	1	0	?
?	1	1	1	0	0	0	?	1	0	1	1	1	1	1
0	0	0	1	0	0	1	1	0	0	0	0	0	0	0
1	?	?	1	1	0	?	1	1	?	?	?	?	?	?
?	1	?	0	0	0	1	0	?	?	?	?	?	0	?
?	?	0	?	?	?	?	?	?	1	1	?	1	1	0
0	0	0	?	?	?	?	?	?	?	?	?	1	0	0
0	0	0	0	0	0	?	0	?	0	?	?	?	?	?
?	0	?	0	1	2	2	1	?	1	3	0	2	1	1
?	0													

Platysternon megacephalum

1	?	?	1	0	0	0	1	1	0	0	1	1	1	0
0	0	1	0	1	0	0	1	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	?	1	0	1	0	0
0	2	2	0	2	2	1	0	0	1	1	2	2	1	0
0	0	1	1	1	0	1	0	0	0	1	0	1	0	2
2	1	0	0	0	1	0	0	1	0	1	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	0	0	0	0	1	1
0	0	0	0	2	1	2	1	1	1	0	1	0	0	?
?	1	1	1	0	0	0	1	0	0	2	2	0	2	1
0	0	0	0	1	?	1	?	0	0	0	0	0	0	0
0	0	?	1	1	0	1	1	1	1	2	1	0	1	0
1	1	1	0	2	0	1	1	1	1	1	2	0	0	?
?	1	0	2	0	0	0	0	1	0	0	0	1	1	?
?	0	0	1	1	1	0	0	1	1	0	?	0	0	0
0	0	0	0	0	2	0	0	1	1	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	?

?	2													

Plesiobaena antiqua

0	0	1	0	0	0	2	1	1	1	0	1	1	1	0
0	0	?	1	1	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0	?	1	0	1	0	0
0	2	2	0	2	1	1	0	0	2	1	2	2	1	0
0	0	0	1	0	0	0	0	0	0	1	?	1	0	2
2	0	0	0	0	1	0	0	1	1	?	?	1	1	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	1	1	1	0	0	0	1	1	?
0	0	0	0	?	1	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	?	1	0	?	0	1	?	0
0	0	0	0	0	2	1	?	0	0	0	0	0	0	1
0	0	?	0	0	0	0	1	1	?	?	?	?	?	?
?	?	0	?	1	0	1	0	1	0	?	?	0	0	?
?	?	0	?	?	?	?	?	?	0	?	?	?	1	?
?	0	?	?	1	1	0	0	1	1	?	?	0	0	0
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	1	2	2	1	?	1	?	0	2	?	0
?	2													

Plesiochelys etalloni

0	0	1	1	0	0	0	1	1	1	0	[0 1]	1	0	0
1	0	?	1	1	0	0	0	0	0	0	0	0	?	0
1	1	0	0	0	0	0	0	1	?	1	0	1	0	0
0	2	2	0	2	1	1	0	0	1	1	2	2	1	0
1	0	0	1	0	0	1	0	0	0	1	0	1	0	1
2	0	0	0	0	1	0	0	?	?	?	?	1	0	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	0	0	0	1	1	?
0	0	0	0	2	2	2	1	0	1	0	[0 1]	[0 1]	0	?
?	1	1	1	0	0	0	?	1	0	?	2	1	0	0
0	0	[0 1]	0	0	0	1	0	0	0	0	0	0	0	[0 1]
0	0	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	0	0	1	0	?	?	?	?	?	?	?
?	1	0	?	?	?	0	0	1	0	?	?	?	1	?
?	0	?	?	1	1	0	0	1	1	?	?	0	0	0
0	0	0	0	0	1	?	0	?	[0 1]	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	0
?	2													

Pleurosternon bullockii

0	1	1	0	?	?	1	1	1	1	0	1	1	1	0
0	?	?	0	1	0	0	0	0	0	0	0	0	0	?
1	1	0	0	0	0	?	?	0	?	1	?	1	0	?
0	2	2	0	2	1	1	?	0	1	1	1	2	?	0
0	1	0	1	?	0	?	0	?	0	?	?	1	0	1
2	0	0	0	?	1	0	?	?	?	?	?	1	1	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	0	0	1	1	1	?	0	0	0	1	1	?
0	0	0	0	1	0	2	1	0	1	1	0	0	0	?
?	1	?	?	0	0	0	?	?	0	1	0	1	0	0
0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
0	0	?	0	0	?	?	0	?	?	?	?	?	?	?
?	?	?	0	0	0	?	?	?	?	?	?	?	?	?
?	?	0	?	?	?	?	?	?	0	?	?	?	1	?
?	0	0	?	?	?	?	?	?	?	?	?	0	0	0
0	0	0	0	0	0	?	0	?	0	0	1	0	0	0
0	0	0	0	?	?	?	?	?	?	?	?	2	?	?
2	2													

Podocnemis expansa

1	?	?	1	1	1	0	1	1	1	0	1	1	1	0
0	?	1	0	1	0	0	0	0	1	0	0	0	0	1
1	1	0	0	0	0	1	0	2	1	2	1	1	1	0
0	3	2	1	2	3	0	?	1	2	1	2	2	0	1
0	0	1	0	0	1	1	0	0	0	1	0	1	0	0
2	0	0	0	1	1	0	1	1	1	?	2	1	0	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	0	1	0	1	1	1
0	1	0	0	1	0	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	1	1	0	1	1	1	0	1
0	0	0	1	0	0	1	0	0	0	1	0	0	0	0

1 ? ? 1 0 0 0 1 1 1 0 0 0 0 0
0 1 0 0 2 0 1 0 1 1 1 1 1 0 ?
? 1 0 2 1 1 0 0 1 1 0 0 1 1 1
1 0 0 0 1 1 0 0 1 1 0 0 0 0 0
0 0 0 0 0 0 1 0 0 0 0 0 2 0 0
0 0 0 0 1 2 2 1 2 1 3 0 2 1 1
2 2

Portlandemys mcdowelli
0 0 1 1 0 0 0 1 1 1 0 ? 1 0 0
1 0 ? 1 ? ? ? ? ? ? 0 0 0 0 0
1 1 0 0 0 0 0 0 1 ? 1 0 1 0 0
0 2 2 0 2 1 1 0 0 1 1 2 2 1 0
0 0 0 1 1 0 ? ? ? 0 1 0 1 0 1
2 0 0 0 0 1 0 0 1 1 ? 0 1 0 0
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
1 1 0 ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? 0
? ? ? ? ? ? ? ? ? ? 1 1 3 0 0
0 ? ? ? ? ? ? ? ? ? ? ? 2 ? ?
? ?

Prochelidella cerrobarcinae
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? 0 0 1 0 ? ? ? 1 0 1 1 0
0 1 0 0 1 1 2 1 1 1 0 1 0 0 ?
? 1 1 1 0 0 0 1 ? 0 ? 1 ? ? 1
0 0 0 1 0 0 1 0 0 0 0 0 0 0 0
1 ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
? ? 0 ? ? ? ? ? ? ? ? ? ? ? ?
? ? 0 ? ? ? ? ? ? ? ? ? 0 0 0
0 0 0 0 0 1 ? 0 0 0 ? ? ? ? ?
? 0 ? 0 ? ? ? 1 ? 1 3 0 2 1 1
? 2

Proganochelys quenstedti
0 0 0 0 ? 0 0 0 0 0 0 0 0 ? 0
? ? ? 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 ? 0 0 0 0 0
0 0 0 0 0 0 0 ? 0 ? 0 0 0 0 0
0 0 0 0 0 0 0 0 ? 0 0 1 0 0 0
0 0 0 0 0 0 ? 0 0 ? ? 0 0 0 0
0 1 1 1 1 0 ? 0 1 1 1 0 0 0 0
1 1 0 0 0 1 0 ? ? 0 ? ? 0 0 0
0 ? 0 ? ? 1 0 0 0 ? ? 0 0 0 ?
? 0 0 0 0 0 0 ? 0 0 ? 0 0 ? 0
0 0 0 0 0 0 0 1 0 0 0 0 0 0 0
? ? ? 0 1 0 0 0 ? ? ? ? ? ? ?
? 0 0 0 0 0 0 0 0 0 0 0 0 0 ?
0 0 0 0 0 0 0 0 0 0 1 0 0 0 ?
? 0 0 ? 0 0 0 0 0 0 0 0 0 ? 0
0 0 0 0 0 1 0 0 0 ? 0 0 0 ? 0
0 0 0 0 1 1 1 ? 1 ? 2 1 2 1 0
2 1

Protochelydra zangerli
1 ? ? 1 0 ? 0 1 1 0 ? 1 1 1 0
0 ? ? ? 1 0 0 0 0 0 0 0 0 ? 0
1 1 0 0 0 0 ? ? ? ? 1 0 1 ? ?
? 2 2 0 ? 2 1 ? ? ? 1 2 2 1 0
0 0 1 ? ? ? 1 0 ? 0 ? ? 1 0 ?

?	?	0	?	0	1	0	?	?	?	?	?	?	0	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	?	?	1	?	?	?	?	?	?	?	?	?
?	?	0	?	?	?	?	?	?	?	0	1	0	0	?
?	1	1	1	0	0	1	?	0	?	?	2	0	?	0
0	0	0	?	1	?	1	?	0	0	?	0	?	1	1
0	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	0	?	?	?	?	?	?	0	?	?	?	1	?
?	0	?	?	?	?	?	?	?	?	?	?	0	0	0
0	0	0	0	0	?	?	?	?	?	1	1	3	0	0
0	?	0	?	?	2	2	1	?	?	3	0	2	1	1
?	2													

Shachemys laosiana

1	?	?	1	?	?	0	1	1	1	0	1	?	?	0
?	1	1	[1 2]	?	?	?	?	?	?	0	0	?	?	?
1	1	?	?	?	?	?	?	?	?	?	?	?	?	?
?	2	?	?	?	?	?	?	?	?	1	2	2	1	0
0	0	1	?	?	0	?	?	?	?	1	1	1	0	?
?	?	0	0	?	1	?	0	?	?	?	?	1	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	0	0	1	0	?	?	?	1	0	?	1	?
[0 1]	2	0	0	1	0	2	1	0	?	0	1	0	0	?
?	1	1	1	0	0	0	?	0	0	0	2	0	1	0
0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
0	0	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	1	?	?	?	?	?	?
?	?	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	0	0	0
0	0	0	0	0	0	?	0	?	?	1	1	3	?	?
?	0	?	0	1	2	2	1	?	1	?	0	2	?	1
?	2													

Siamochelys peninsularis

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	0	1	1	?	?	0	0	0	1	1	1
0	0	0	0	2	1	2	1	1	?	0	1	0	0	?
?	1	?	1	0	0	0	?	?	0	1	2	0	1	0
0	0	1	0	0	0	1	0	0	0	0	0	0	0	?
0	0	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	0	0	0
0	0	0	1	0	[1 2]	?	0	?	0	?	?	?	?	?
?	0	0	0	1	2	2	1	?	1	3	0	2	?	1
?	2													

Sichuanchelys chowi

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	0	1	0	?	?	0	0	0	1	1	?
0	?	0	0	3	1	2	1	0	?	0	?	0	0	?
?	?	?	?	0	0	1	?	?	0	?	0	?	?	0
0	0	0	0	0	1	1	?	0	0	0	0	0	0	0
0	0	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	0	?	0
0	?	0	?	0	3	?	0	?	0	?	?	?	?	?
?	0	?	0	1	2	2	1	?	1	?	0	2	1	1
?	?													

Sichuanchelys palatodentata

0	1	1	0	0	0	1	0	1	0	0	0	?	[0 1]	0
?	0	1	0	1	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	1	?	1	0	1	0	0
?	1	2	0	2	1	1	0	0	?	0	1	2	0	0
0	0	0	1	0	0	0	0	0	0	0	0	1	0	1
2	?	1	0	?	1	0	0	1	1	?	0	1	1	0
0	0	?	0	0	?	?	?	0	?	?	0	0	?	?
1	1	0	0	0	1	0	?	?	0	0	0	1	[0 1]	?
0	0	0	0	?	?	2	1	0	1	?	1	1	0	?
?	1	?	1	0	0	1	1	0	0	[0 1]	0	0	0	0
0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
?	?	?	?	0	0	?	?	?	?	?	?	?	?	?
?	0	?	0	?	?	?	?	1	0	?	?	0	0	?
?	1	0	1	1	?	0	0	1	0	?	?	?	?	?
?	?	?	1	1	?	0	?	?	?	?	?	1	0	0
0	0	0	?	0	3	?	0	?	0	0	0	0	1	1
1	0	0	0	1	2	2	1	2	1	3	0	2	1	0
?	?													

Sinemys brevispinus

?	?	?	?	?	?	?	?	?	?	?	?	1	?	?
?	0	1	?	?	?	?	?	0	?	0	0	0	?	?
1	?	?	?	?	0	?	?	?	?	?	?	?	?	?
?	2	2	1	2	?	1	0	0	?	1	1	?	0	?
?	?	?	?	0	0	?	0	?	0	0	0	1	0	2
2	?	1	0	?	1	0	0	1	?	?	0	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	0	1	1	?	?	0	0	?	1	1	?
0	?	0	0	?	0	2	1	1	?	0	1	1	0	?
?	1	1	1	0	0	0	1	0	0	0	2	0	0	0
0	0	0	?	?	?	1	?	?	0	?	0	0	0	1
?	?	?	1	1	?	?	1	?	0	?	0	0	0	0
0	1	?	0	0	?	?	?	?	1	1	2	?	?	?
?	1	0	2	?	1	0	0	1	0	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	1	?	1
0	0	1	0	1	2	0	1	?	1	1	1	1	0	0
0	0	0	0	1	2	2	1	?	1	?	0	2	?	1
?	2													

Sinemys gamera

0	?	1	0	?	?	1	1	1	1	0	1	1	1	0
?	0	1	2	1	0	?	0	0	0	0	0	?	0	0
1	1	?	?	?	?	0	?	0	?	?	?	?	?	?
?	2	2	1	2	2	1	0	0	1	1	1	2	0	0
0	0	?	1	0	0	1	0	?	0	0	0	1	0	2
2	?	1	0	0	1	0	0	1	0	1	0	1	?	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	0	0	1	1	?	?	?	?	?	1	?	1
0	0	0	0	?	?	2	?	1	1	?	1	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	0	0	?
?	0	?	?	?	?	?	?	?	?	?	?	?	0	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	0	?	0	0	0	0	1	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	1	?
0	?	?	0	1	?	?	?	?	?	1	1	1	0	0
0	0	0	0	?	?	?	?	?	1	?	?	2	?	?
?	2													

Sinemys lens

0	0	1	0	?	?	1	1	1	1	0	1	1	1	0
0	0	1	2	1	0	?	0	0	?	0	0	0	0	?
1	1	?	?	0	0	?	?	0	?	?	?	1	?	?
?	2	2	?	2	?	1	0	0	?	1	?	2	0	0
0	0	0	?	0	0	1	0	?	?	0	0	1	0	2
2	?	1	0	0	1	0	0	1	?	?	0	1	?	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	?	?	1	0	0	0	1	1	1
0	0	0	0	2	0	2	1	1	1	0	1	[0 1]	0	?
?	1	1	1	0	0	0	1	0	0	0	2	0	0	0
0	0	0	?	?	?	1	?	?	0	?	0	0	0	?
0	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	0	?	?	?	1	?	?	?	?	?	?

?	?	0	?	?	?	?	?	?	0	?	?	?	?	?
?	?	?	?	?	1	0	0	1	1	0	0	0	1	1
0	0	1	0	1	2	0	1	?	1	1	1	1	0	0
0	0	0	0	1	2	2	1	?	1	3	0	2	?	0
?	2													

Solnhofia parsonsi

0	0	1	1	0	0	0	1	1	1	0	[0 1]	1	0	0
0	0	?	1	1	0	0	0	0	?	0	0	0	0	0
1	1	0	0	0	0	?	1	0	?	1	1	1	0	?
0	2	2	0	2	1	1	0	0	1	1	2	2	1	0
0	0	0	0	1	0	1	0	0	0	1	0	1	0	2
2	0	0	0	0	1	0	0	1	1	?	0	1	0	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	?	?	0	0	1	1	?
0	0	0	0	3	1	2	1	0	1	?	1	1	0	?
?	?	?	?	0	0	1	?	0	0	0	2	0	0	0
0	0	0	?	?	?	?	?	?	0	0	0	?	0	0
?	?	?	1	1	0	?	0	?	?	?	?	?	?	?
?	?	?	?	?	?	1	?	1	0	?	?	?	?	?
?	1	0	2	?	?	0	0	1	0	?	0	?	?	?
?	?	?	?	1	1	0	0	1	1	0	0	0	0	0
0	0	0	0	?	1	1	0	0	1	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	?	0	2	1	1
2	2													

Sphenodon punctatus

0	0	0	0	1	0	0	1	0	1	0	0	0	?	0
?	?	?	?	0	?	0	0	?	0	0	0	?	1	0
1	0	0	?	0	0	?	?	?	?	0	0	0	0	0
0	0	?	?	?	?	0	?	0	0	1	0	0	0	0
0	0	0	0	0	?	0	0	?	0	1	0	0	0	0
?	1	0	0	?	?	?	?	0	?	?	0	1	?	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
0	0	0	?	?	0	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	1	0	?	0	?	?	?	?	?	?	?
?	0	?	0	?	?	?	?	1	0	0	0	0	0	?
?	0	?	?	?	?	0	?	1	?	1	?	1	0	?
?	0	0	1	1	0	0	0	0	1	0	?	?	?	?
?	?	?	?	?	?	0	?	0	?	0	0	[2 3]	?	0
?	?	0	?	?	0	?	?	0	1	0	1	1	?	?
0	?													

Spoochelys ormondea

?	?	?	?	?	?	?	?	?	0	0	0	1	0	0
0	?	1	0	1	0	0	0	0	?	0	0	0	0	?
1	?	?	?	?	0	0	?	?	?	?	?	?	?	?
?	[0 1]	2	?	[1 2]	1	?	?	0	0	?	1	0	0	?
?	0	?	?	0	0	0	?	?	?	0	0	1	?	1
2	0	0	0	?	1	0	0	1	1	?	0	0	?	0
0	1	1	?	?	0	?	0	0	0	?	?	0	?	0
?	1	0	0	?	1	0	?	?	0	?	?	?	?	?
?	?	?	?	?	1	[0 1]	?	?	?	?	1	?	?	?
?	?	?	?	?	?	?	?	0	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	0	0	0	1	1	1	2	0	0	0	0
0	0	0	?	?	?	?	?	?	1	2	?	0	?	?
?	1	0	1	0	0	0	0	0	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	0	?	0	0	0	0	0	0	0	0
0	?	0	?	?	?	?	1	?	?	?	?	2	?	?
?	?													

Staurotypus triporcatus

1	?	?	1	0	0	0	1	1	0	0	1	1	1	0
0	1	1	2	1	1	0	1	0	1	0	0	0	0	0
1	1	0	0	0	1	?	0	0	?	1	0	1	0	0
1	2	2	0	2	1	1	1	0	1	1	2	2	1	0
0	0	1	0	0	0	1	0	0	0	1	0	1	0	2
2	0	0	0	0	1	1	0	1	0	1	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

1	1	0	0	2	1	0	?	1	1	0	0	1	2	1
0	[0 1]	0	0	1	1	2	1	1	1	0	0	0	1	0
1	1	1	1	0	0	0	1	0	0	2	2	0	1	0
0	0	0	0	1	?	1	?	0	0	?	1	?	2	0
0	1	1	1	1	1	1	1	1	1	1	0	0	1	0
1	1	1	0	2	1	?	1	1	1	1	?	1	0	?
?	1	0	2	1	0	0	1	1	0	0	1	0	1	?
?	1	1	0	1	1	0	0	1	1	?	?	0	0	0
0	0	0	0	0	0	1	1	1	0	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	0
2	2													

Sternotherus odoratus

1	?	?	1	0	0	0	1	1	0	0	1	1	1	0
0	1	1	2	1	0	0	1	0	1	0	0	0	0	0
1	1	0	0	0	0	0	0	0	?	1	0	1	0	0
1	2	2	0	2	1	1	1	0	1	1	2	2	1	0
0	0	1	1	0	0	1	0	0	0	1	0	1	0	2
2	0	0	0	0	1	1	0	1	0	1	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	1	1	0	?	1	1	0	0	1	2	1
1	1	0	0	1	1	2	1	1	1	0	0	0	1	0
1	?	?	?	?	1	?	1	0	0	2	2	0	1	0
0	0	0	0	1	?	1	?	1	1	?	1	?	2	0
0	1	1	1	1	1	1	1	1	1	1	0	0	1	0
1	1	1	0	2	1	?	1	1	1	1	1	1	0	?
?	1	0	2	1	0	0	1	1	0	1	1	0	1	?
?	1	1	0	1	1	0	0	1	1	0	0	0	0	0
0	0	0	0	0	0	1	1	1	0	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	1
?	2													

Stylemys nebraskensis

1	?	?	1	?	?	0	1	1	1	0	1	1	?	0
?	?	?	2	1	0	0	0	0	1	0	0	0	0	?
1	1	?	?	?	?	?	0	?	?	?	?	1	?	?
?	?	2	0	2	?	1	?	0	?	1	2	2	?	0
?	?	?	1	?	0	?	?	?	?	?	?	1	0	?
?	?	?	0	?	?	?	?	?	?	?	?	1	?	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	0	0	1	0	?	?	0	?	0	?	1	0
0	0	0	0	2	1	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	1	1	0	1	2	2	?	1
0	0	0	0	1	?	1	?	0	0	0	0	1	0	0
0	1	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	1	0	2	1	0	0	1	1	1	1	0	0	?	?
?	?	?	1	1	0	0	0	1	1	0	0	0	0	0
0	0	0	0	0	0	?	0	?	0	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	1
?	2													

Thalassemys moseri

0	0	1	0	0	0	1	1	1	1	0	0	1	1	0
1	0	?	1	1	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	1	?	1	1	1	0	0
0	2	2	0	2	1	1	0	0	1	1	2	2	1	0
1	0	?	?	1	0	0	0	0	0	1	1	1	0	2
2	0	0	0	0	1	0	0	1	1	?	0	1	0	0
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	0	0	1	?	?	1	0	0	0	1	?	?
0	?	0	?	?	?	2	?	0	?	?	?	1	0	?
?	?	?	?	?	?	?	?	1	?	0	2	?	?	?
?	0	0	?	?	?	?	?	?	0	?	0	?	0	?
?	?	?	1	1	?	?	0	?	?	?	?	?	?	?
?	0	?	0	1	?	?	?	?	?	?	?	?	?	?
?	?	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	0
0	0	0	0	0	1	?	0	?	0	1	1	3	0	0
0	0	0	0	1	2	?	1	?	?	?	0	2	?	0
?	?													

Toxochelys latiremis

1	0	1	1	0	0	0	1	1	1	0	1	1	?	0

0	0	1	1	1	0	0	0	0	0	0	0	0	1	0
1	1	0	0	0	0	0	0	0	?	1	0	1	0	0
0	2	2	0	2	1	1	0	0	?	1	2	2	1	0
0	0	0	1	1	0	1	0	0	0	1	0	1	0	2
2	0	0	1	0	1	0	0	1	1	?	0	1	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	2	0	0	0	1	1	0
0	0	1	0	2	1	2	1	1	1	0	1	1	0	?
?	1	1	1	0	0	1	1	0	0	2	2	0	1	0
1	0	0	?	?	?	1	?	?	0	?	?	?	0	1
0	?	?	1	1	?	1	1	1	1	2	0	0	?	?
0	?	1	?	?	0	1	0	1	1	?	?	0	0	?
?	1	0	?	?	?	?	?	?	0	0	?	?	?	?
?	0	?	?	1	1	1	0	1	1	?	?	[0 1]	0	0
0	0	0	0	0	[1 2]	1	1	1	[0 1]	1	1	3	0	0
0	0	0	0	?	?	?	1	2	1	?	0	2	?	?
?	2													

Trachemys scripta

1	?	?	1	0	0	0	1	1	1	0	0	1	1	0
0	1	1	2	1	0	0	0	0	1	0	0	0	0	0
1	1	0	0	0	0	0	0	2	1	1	0	1	0	0
0	2	2	0	2	1	1	0	0	1	1	2	2	1	0
0	0	1	1	0	0	1	0	0	0	1	1	1	0	2
2	0	0	0	0	1	0	0	1	0	1	0	1	0	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	0	?	1	0	1	0	1	1	0
0	0	0	1	1	1	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	1	1	0	1	2	1	0	1
0	0	0	0	1	?	1	?	0	0	0	0	0	0	0
0	1	0	1	1	?	?	?	?	1	2	1	1	1	0
1	1	1	0	2	0	1	1	?	?	?	?	?	0	?
?	?	0	2	1	0	0	1	1	0	1	0	1	1	?
?	0	0	1	1	?	?	?	?	?	0	0	0	0	0
0	0	0	0	0	0	1	0	1	0	1	1	3	0	0
0	0	0	0	1	2	2	1	2	1	3	0	2	1	1
?	2													

Trinitichelys hiatti

0	0	1	0	0	0	2	1	1	1	0	1	1	1	0
0	?	?	1	1	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	?	0	0	?	1	0	1	?	0
0	2	2	0	2	1	1	0	?	2	1	2	2	1	0
0	0	0	1	0	0	0	0	0	0	1	?	1	0	2
2	0	0	0	0	1	0	0	1	1	?	0	1	1	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	0	0	0	1	1	1	1	0	?	0	1	?	?
0	?	0	?	?	1	2	1	1	1	?	0	0	0	?
?	1	1	1	0	0	0	?	1	0	?	0	1	?	?
0	0	0	0	0	0	1	1	0	0	0	0	0	0	?
0	0	?	?	?	0	0	0	?	?	?	?	?	?	?
?	?	?	?	?	?	1	0	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	0	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	0	0	0
0	0	0	0	0	?	?	0	?	?	0	1	0	0	0
0	0	0	0	1	?	?	?	?	?	?	0	2	?	?
?	?													

Warkalania carinaminor

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	2	0	0	3	1	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	0
1	1	1	0	1	?	?	0	1	1	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

?	?	?	?	?	?	?	?	?	?	?	?	?	0	?
?	?	?	?	?	?	?	?	?	?	?	?	2	?	?
?	?													

Xenochelys formosa

1	?	?	1	0	?	0	1	1	0	0	?	1	1	0
0	1	1	2	?	?	?	?	?	?	0	0	?	?	?
?	1	0	?	0	1	0	0	0	?	1	?	1	0	?
?	2	?	?	?	?	1	?	0	1	1	2	2	?	0
2	0	?	?	?	?	?	?	?	?	?	0	?	?	?
?	?	0	0	?	1	1	0	?	?	?	?	1	?	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	0	1	1	0	?	1	?	1	0	1	2	1
0	1	0	0	1	1	2	1	1	1	0	0	0	0	?
?	1	1	1	0	0	0	1	0	0	2	2	0	1	1
0	0	0	0	1	?	1	?	0	0	?	1	?	2	0
0	1	1	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	0	0	0
0	0	0	0	0	1	?	0	?	0	1	1	3	?	?
0	0	0	0	?	2	2	1	2	1	3	0	2	1	1
?	2													

Xiaochelys ningchengensis

?	?	?	1	?	?	0	1	1	1	0	?	?	?	0
?	0	1	[1 2]	1	0	?	0	?	0	0	0	0	?	?
1	1	0	?	0	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	1	?	?	?	?	?	?	?	?
?	?	?	?	?	?	1	0	0	?	?	0	1	0	?
?	?	?	?	?	1	0	0	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	1	?	0	0	1	0	?	?	?	0	0	1	1	?
0	0	0	0	2	1	2	1	?	1	0	1	0	?	?
?	?	?	?	?	?	?	?	?	0	?	2	0	0	?
?	0	?	?	?	?	?	?	?	?	?	?	?	0	?
0	?	?	?	1	?	?	1	?	1	2	?	?	?	?
?	1	?	0	?	?	?	?	1	1	1	2	0	0	?
?	?	0	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	0	0
0	0	0	1	1	1	0	?	?	0	?	?	?	?	?
?	?	?	?	?	2	2	1	?	1	?	0	2	1	?
?	2													

Xinjiangchelys junggarensis

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	0	1	?	?	1	0	0	0	1	1	1
0	0	0	0	2	1	2	1	1	1	1	1	0	0	?
?	1	1	1	0	0	0	1	0	0	0	2	0	0	0
0	0	1	0	0	0	1	0	0	0	0	0	0	0	1
0	0	?	?	1	1	1	1	1	?	?	?	?	?	?
0	1	1	?	0	0	0	0	1	1	?	?	0	0	?
?	1	0	2	?	?	?	?	?	0	?	?	?	1	?
?	0	?	?	1	?	?	?	?	?	?	?	0	0	0
0	0	0	1	0	1	?	0	0	0	?	?	?	?	?
?	0	?	0	1	2	2	1	?	1	3	0	2	1	0
?	2													

Xinjiangchelys radiplicatoides

0	1	?	0	?	?	1	1	1	1	0	?	1	1	0
0	0	1	[1 2]	?	0	?	?	?	?	0	?	?	?	?
1	1	?	?	0	?	?	?	?	?	?	?	?	?	?
0	2	2	0	?	1	1	0	0	1	1	1	2	0	0
?	?	?	?	?	0	?	0	0	0	0	0	1	0	2
?	?	0	0	0	1	0	0	?	1	?	0	1	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	?	0	0	1	0	?	1	0	0	0	?	1	?
0	0	0	0	2	1	2	1	1	1	?	?	0	0	?

?	1	?	1	0	0	0	1	0	0	0	2	0	0	0
0	0	1	0	0	0	1	0	0	0	0	0	0	0	1
0	0	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	0	?	?	?	?	?	?	?	?	?	?
?	1	0	2	0	0	0	0	1	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	0	0	0
0	0	0	1	0	1	?	0	?	0	1	1	1	?	?
?	0	0	0	1	2	2	1	?	1	3	0	2	1	0
?	2													

Xinjiangchelys wusu

0	1	1	0	?	0	1	1	1	1	0	0	?	?	0
?	0	1	2	1	0	0	0	0	0	0	0	0	0	0
1	1	0	?	0	0	0	?	?	?	1	?	1	?	0
?	2	2	0	2	1	1	0	0	?	1	1	2	0	0
0	0	0	1	1	0	1	0	0	0	0	0	1	0	2
2	?	0	0	?	1	0	0	?	1	?	0	1	?	0
0	1	1	?	?	?	?	?	0	?	?	0	0	?	?
1	1	0	0	0	1	0	?	?	?	0	0	1	1	1
0	[0 1]	0	0	2	1	2	1	1	1	1	1	0	0	?
?	1	?	1	0	0	0	1	0	0	0	2	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
0	0	?	0	[0 1]	?	?	?	?	?	?	?	?	?	?
?	1	?	0	?	?	?	?	?	?	?	?	?	?	?
?	?	0	?	0	?	0	0	1	?	?	?	?	?	?
?	?	?	?	?	1	0	0	1	1	0	0	0	0	0
0	0	0	1	0	1	0	0	?	0	1	1	1	0	0
0	0	0	0	1	2	2	1	?	1	3	0	2	1	0
?	2													

Yaminuechelys maior

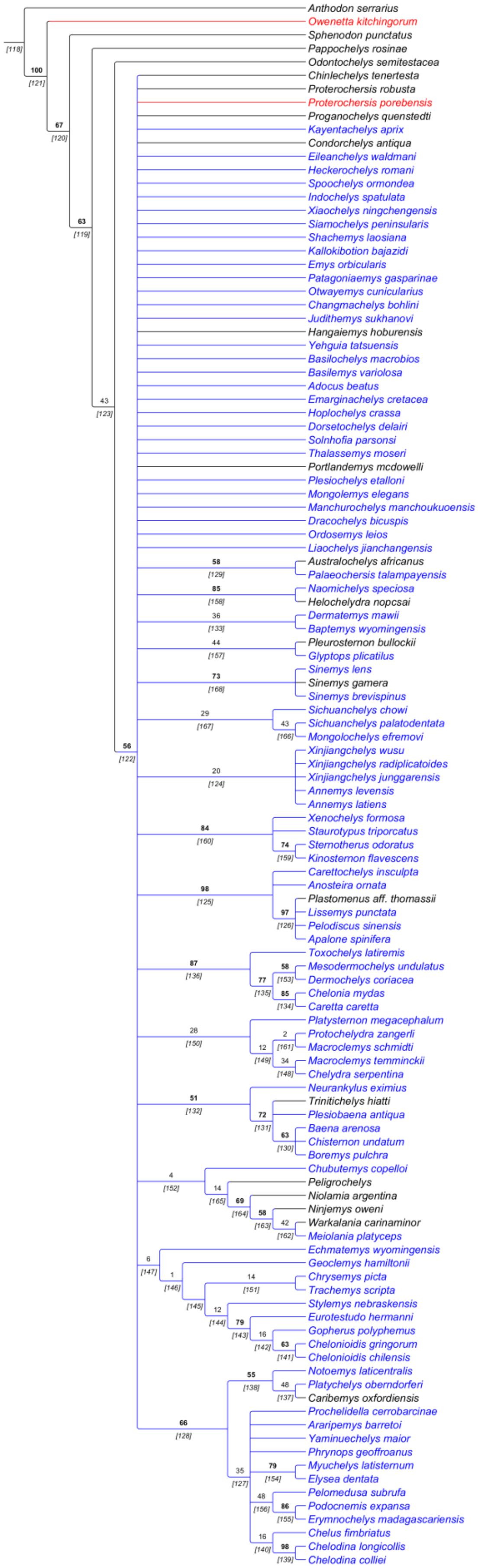
0	?	1	?	?	?	?	?	1	1	0	0	?	?	0
?	?	?	2	?	?	?	?	?	?	1	0	0	0	?
1	?	?	?	?	0	?	0	?	?	?	?	?	?	?
?	?	?	?	?	?	0	?	?	?	?	2	2	?	?
?	?	?	0	0	0	0	0	0	?	1	?	1	0	0
?	?	0	0	?	?	?	?	1	1	?	?	1	?	1
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1	1	1	0	0	1	1	0	1	0	0	0	1	1	?
0	1	0	0	1	1	2	1	1	1	0	1	1	0	?
?	1	1	1	0	0	0	1	1	0	1	1	1	0	1
0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
1	?	?	1	0	0	?	1	1	1	3	1	0	0	0
0	1	0	1	2	0	1	0	1	?	?	?	?	0	?
?	1	?	2	?	?	0	?	?	1	?	?	?	?	0
1	?	?	?	1	?	?	?	?	?	?	?	0	0	0
0	0	0	0	0	2	?	0	0	0	0	0	2	0	?
0	?	?	?	1	2	2	1	?	1	3	0	2	1	0
?	2													

Yehguia tatsuensis

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	0	0	1	1	2	?	?	?	?	1	1	?
?	?	0	0	1	?	2	?	?	?	1	0	0	0	?
?	1	1	1	0	0	0	?	?	0	?	2	?	?	0
0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
0	0	?	?	?	?	?	?	?	?	?	?	?	?	?
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
?	1	?	?	?	?	?	?	?	0	?	?	?	?	?
?	?	?	1	1	?	?	?	?	?	?	?	0	0	0
0	0	0	1	0	?	1	0	?	?	?	?	?	?	?
?	0	?	0	1	2	2	?	?	1	?	0	2	1	0
?	?													

PHYLOGENETIC TREES AND LISTS OF SYNAPOMORPHIES

ANALYSIS 1 – *CHINLECHELYS TENERTESTA* SCORING A
(SPIKY ELEMENTS TREATED AS CERVICAL OSTEODERMS, NO OSTEODERMAL MOSAIC IN THE SHELL)



Tree 1. Analysis 1 (TBR, *Chinlechelys tenertesta* scoring A), strict consensus tree. Node numbers below the branches, Jackknife values above the branches (support of at least 50 in bold). Character 247 (cleithrum/nuchal bone) is mapped using the Character mapping tool of TNT – "0" (paired) is red, "1" (fused in early development into a single nuchal plate) is blue, "?" is black.

SYNAPOMORPHIES – ANALYSIS 1 (*CHINLECHELYS TENERTESTA* SCORING A)

***Pappochelys rosinae*:**
All trees:
Char. 36: 0 → 1
Char. 40: 0 → 1

***Proterochersis porebensis*:**
All trees:
No autapomorphies

***Proterochersis robusta*:**
All trees:
No autapomorphies

***Odontochelys semitestacea*:**
All trees:
Char. 169: 1 → 0
Char. 221: 0 → 1

***Chinlechelys tenertesta* A:**
Some trees:
Char. 251: 0 → 1
Char. 254: 1 → 0
Char. 255: 2 → 1

***Adocus beatus*:**
All trees:
Char. 162: 0 → 1
Some trees:
Char. 212: 0 → 1

***Annemys latiens*:**
Some trees:
Char. 230: 1 → 2

***Annemys levensis*:**
All trees:
Char. 121: 0 → 1
Char. 129: 1 → 0
Some trees:
Char. 230: 1 → 2

***Anosteira ornata*:**
All trees:
Char. 230: 0 → 1
Char. 254: 0 → 1

***Anthodon serrarius*:**
All trees:
No autapomorphies

***Apalone spinifera*:**
All trees:
Char. 38: 0 → 1
Some trees:
Char. 212: 1 → 0

***Araripemys barretoi*:**
All trees:
Char. 109: 0 → 2
Char. 111: 0 → 1
Char. 122: 0 → 1
Char. 132: 0 → 1
Char. 139: 0 → 1
Char. 141: 0 → 1
Char. 154: 0 → 1
Char. 163: 0 → 1
Char. 222: 0 → 1
Char. 223: 0 → 1
Char. 227: 0 → 1
Char. 230: 01 → 3
Char. 232: 0 → 1
Some trees:
Char. 20: 0 → 1
Char. 61: 0 → 1
Char. 107: 0 → 1
Char. 131: 0 → 1
Char. 146: 1 → 2
Char. 147: 1 → 0
Char. 148: 0 → 1
Char. 183: 0 → 1
Char. 254: 1 → 0

***Australochelys africanus*:**
All trees:
No autapomorphies

***Baena arenosa*:**
All trees:
Char. 18: 1 → 0
Char. 89: 1 → 0
Char. 115: 0 → 1
Char. 146: 0 → 1
Some trees:
Char. 124: 2 → 1
Char. 191: 1 → 2

***Baptemys wyomingensis*:**
All trees:
Char. 147: 0 → 1
Some trees:
Char. 160: 0 → 1
Char. 211: 0 → 1

***Basilemys variolosa*:**
All trees:
Char. 157: 0 → 1
Char. 166: 0 → 1
Char. 230: 0 → 2
Some trees:
Char. 215: 1 → 0

***Basilochelys macrobios*:**
Some trees:
Char. 16: 1 → 0
Char. 56: 2 → 1
Char. 58: 1 → 0
Char. 70: 1 → 0
Char. 77: 0 → 1
Char. 184: 2 → 0
Char. 228: 0 → 1
Char. 254: 0 → 1

***Boremys pulchra*:**
Some trees:
Char. 11: 0 → 1
Char. 191: 12 → 1

***Caretta caretta*:**
All trees:
Char. 52: 0 → 1
Char. 118: 1 → 0

***Carettochelys insculpta*:**
All trees:
Char. 22: 0 → 1
Some trees:
Char. 201: 0 → 1

***Caribemys oxfordiensis*:**
All trees:
Char. 207: 1 → 0

***Changmachelys bohlini*:**
All trees:
No autapomorphies

***Chelodina colliei*:**
All trees:
No autapomorphies

***Chelodina longicollis*:**
All trees:
No autapomorphies

***Chelonia mydas*:**
All trees:
Char. 35: 0 → 1
Char. 38: 01 → 2

***Chelonoidis chilensis*:**
All trees:
Char. 129: 1 → 0

***Chelonoidis gringorum*:**
All trees:
Char. 126: 2 → 0

***Chelus fimbriatus*:**
All trees:
Char. 0: 0 → 1
Char. 5: 1 → 0
Char. 32: 0 → 1
Char. 36: 1 → 0
Char. 43: 1 → 0
Char. 109: 0 → 2
Char. 121: 1 → 0
Char. 122: 0 → 1
Char. 150: 0 → 1
Char. 156: 1 → 0
Char. 157: 0 → 1
Char. 160: 0 → 1
Char. 170: 0 → 1
Char. 171: 0 → 1
Char. 254: 0 → 1
Char. 256: 2 → 01

***Chelydra serpentina*:**
All trees:
Char. 124: 2 → 3
Char. 230: 12 → 0

***Chisternon undatum*:**
Some trees:
Char. 172: 0 → 1

***Chrysemys picta*:**
All trees:
Char. 58: 1 → 0

***Chubutemys copelloi*:**
All trees:
Char. 41: 0 → 1

***Condorchelys antiqua*:**
All trees:
No autapomorphies

***Dermatemys mawii*:**
All trees:
Char. 121: 0 → 1
Char. 149: 0 → 1
Char. 158: 0 → 1
Char. 174: 1 → 0
Char. 255: 2 → 1
Some trees:
Char. 109: 1 → 0
Char. 160: 01 → 0

***Dermochelys coriacea*:**
All trees:
Char. 108: 1 → 2
Char. 118: 1 → 3
Char. 197: 0 → 1
Char. 230: 12 → 0
Char. 249: 1 → 0
Char. 254: 0 → 1

***Dorsetochelys delairi*:**
All trees:
Char. 77: 0 → 1
Some trees:
Char. 38: 1 → 0

***Dracochelys bicuspis*:**
Some trees:
Char. 38: 0 → 1
Char. 70: 01 → 1
Char. 77: 01 → 0
Char. 225: 0 → 1
Char. 226: 0 → 1

***Echmatemys wyomingensis*:**
Some trees:
Char. 145: 1 → 0

***Eileanchelys waldmani*:**
All trees:
Char. 228: 0 → 1

***Elseya dentata*:**
All trees:
Char. 38: 0 → 2

***Emarginachelys cretacea*:**
Some trees:
Char. 109: 0 → 1
Char. 114: 0 → 12
Char. 131: 0 → 1
Char. 212: 0 → 1
Char. 231: 1 → 0
Char. 232: 0 → 1
Char. 254: 0 → 1

***Emys orbicularis*:**
All trees:
Char. 9: 1 → 0
Char. 58: 1 → 0
Char. 133: 0 → 1
Char. 137: 1 → 0

***Erymnochelys madagascariensis*:**
All trees:
Char. 145: 1 → 0
Char. 157: 0 → 1

***Eurotestudo hermanni*:**
All trees:
Char. 147: 1 → 0

***Geoclemys hamiltonii*:**
All trees:
Char. 9: 1 → 0
Char. 20: 0 → 1
Char. 64: 0 → 1
Char. 109: 0 → 1
Char. 119: 0 → 1
Char. 142: 1 → 0

***Glyptops plicatulus*:**
All trees:
Char. 35: 0 → 1
Some trees:
Char. 38: 0 → 1
Char. 74: 1 → 2
Char. 230: 0 → 1

***Gopherus polyphemus*:**
All trees:
Char. 199: 1 → 0

***Hangaiemys hoburensis*:**
Some trees:
Char. 64: 1 → 0
Char. 84: 1 → 0
Char. 230: 1 → 0

***Heckerochelys romani*:**
All trees:
Char. 137: 0 → 1
Char. 138: 1 → 0
Char. 141: 0 → 1

***Helochelydra nopcsai*:**
All trees:
Char. 22: 0 → 1
Char. 67: 0 → 1

***Hoplochelys crassa*:**
All trees:
Char. 142: 1 → 0
Char. 145: 1 → 0
Some trees:
Char. 109: 1 → 2

***Indochelys spatulata*:**
Some trees:
Char. 136: 1 → 0
Char. 223: 0 → 1

***Judithemys sukhanovi*:**
Some trees:
Char. 192: 0 → 1
Char. 228: 1 → 0
Char. 230: 1 → 0

***Kallokibotion bajazidi*:**
All trees:
Char. 31: 1 → 0
Char. 38: 01 → 2
Char. 41: 0 → 1
Char. 71: 0 → 1
Char. 116: 0 → 1
Char. 125: 1 → 0
Char. 149: 0 → 1
Char. 171: 0 → 1
Char. 203: 1 → 0
Char. 254: 01 → 0
Char. 255: 2 → 1
Some trees:
Char. 6: 1 → 0

***Kayentachelys aprix*:**
All trees:
Char. 2: 0 → 1
Char. 107: 0 → 1
Char. 124: 2 → 1
Some trees:
Char. 55: 1 → 0

***Kinosternon flavescens*:**
All trees:
Char. 119: 1 → 0
Char. 134: 0 → 1
Char. 207: 0 → 1
Char. 244: 1 → 2

***Liaochelys jianchangensis*:**
Some trees:
Char. 121: 0 → 1
Char. 225: 0 → 1
Char. 226: 0 → 1

***Lissemys punctata*:**
All trees:
Char. 63: 1 → 0
Char. 144: 0 → 1
Some trees:
Char. 84: 1 → 0
Char. 85: 1 → 0

***Macroclemys schmidti*:**
All trees:
Char. 50: 2 → 4

***Macroclemys temminckii*:**
All trees:
Char. 124: 2 → 1
Char. 126: 2 → 1
Char. 190: 1 → 2
Char. 207: 1 → 0

***Manchurochelys manchoukuoensis*:**
All trees:
Char. 230: 1 → 0

***Meiolania platyceps*:**
All trees:
Char. 93: 0 → 1

***Mesodermochelys undulatus*:**
All trees:
Char. 171: 1 → 0
Char. 233: 1 → 0

***Mongolemys elegans*:**
All trees:
Char. 70: 01 → 0
Char. 192: 01 → 0
Some trees:
Char. 24: 1 → 0
Char. 62: 1 → 0
Char. 71: 01 → 0
Char. 145: 1 → 0
Char. 148: 1 → 0
Char. 237: 3 → 1

***Mongolochelys efremovi*:**
All trees:
Char. 25: 0 → 1
Char. 26: 0 → 1
Char. 38: 1 → 2
Char. 71: 0 → 1
Char. 98: 0 → 1
Some trees:
Char. 117: 1 → 0

***Myuchelys latisternum*:**
All trees:
Char. 77: 0 → 1
Char. 148: 0 → 1
Char. 256: 2 → 1

***Naomichelys speciosa*:**
All trees:
No autapomorphies

***Neurankylus eximius*:**
Some trees:
Char. 130: 0 → 1

***Ninjemys oweni*:**
All trees:
Char. 94: 1 → 0

***Niolamia argentina*:**
All trees:
Char. 91: 1 → 0
Char. 99: 1 → 0
Char. 102: 0 → 1

***Notoemys laticentralis*:**
Some trees:
Char. 124: 1 → 2

***Ordosemys leios*:**
All trees:
Char. 52: 0 → 1
Char. 229: 1 → 0

***Otwayemys cunicularius*:**
Some trees:
Char. 146: 0 → 2
Char. 148: 01 → 2
Char. 156: 1 → 0
Char. 163: 0 → 1
Char. 169: 1 → 0
Char. 184: 02 → 1

***Owenetta kitchingorum*:**
All trees:
Char. 3: 0 → 1

***Palaeochersis talampayensis*:**
All trees:
Char. 38: 1 → 0

***Patagoniaemys gasparinae*:**
Some trees:
Char. 169: 0 → 1
Char. 184: 0 → 1
Char. 191: 2 → 1

***Peligrochelys*:**
Some trees:
Char. 87: 0 → 1

***Pelodiscus sinensis*:**
All trees:
Char. 62: 1 → 0

***Pelomedusa subrufa*:**
All trees:
No autapomorphies

***Phrynops geoffroanus*:**
All trees:
Char. 228: 0 → 1

***Plastomenus* aff. *thomassii*:**
Some trees:
Char. 84: 1 → 0
Char. 132: 1 → 0

***Platychelys oberndorferi*:**
All trees:
Char. 119: 0 → 1
Char. 126: 2 → 1
Char. 209: 1 → 0

***Platysternon megacephalum*:**
All trees:
Char. 18: 12 → 0
Char. 22: 0 → 1
Char. 76: 0 → 1
Char. 119: 0 → 1
Char. 148: 1 → 2
Char. 149: 0 → 1
Char. 170: 1 → 0
Char. 176: 0 → 1
Some trees:
Char. 199: 1 → 0
Char. 232: 1 → 0

***Plesiobaena antiqua*:**
Some trees:
Char. 172: 0 → 1

***Plesiochelys etalloni*:**
Some trees:
Char. 60: 0 → 1
Char. 64: 1 → 0
Char. 125: 1 → 2

***Pleurosternon bullockii*:**
All trees:
Char. 124: 2 → 1
Char. 125: 1 → 0
Char. 153: 0 → 1
Some trees:
Char. 38: 1 → 0

***Podocnemis expansa*:**
All trees:
Char. 36: 0 → 1
Char. 39: 0 → 1
Char. 62: 0 → 1

***Portlandemys mcdowelli*:**
All trees:
No autapomorphies

***Prochelidella cerrobarcinae*:**
Some trees:
Char. 254: 0 → 1

***Proganochelys quenstedti*:**
All trees:
Char. 7: 1 → 0
Char. 126: 1 → 0
Char. 127: 1 → 0
Char. 138: 1 → 0
Char. 157: 0 → 1
Char. 188: 1 → 0
Char. 219: 1 → 0
Some trees:
Char. 251: 0 → 1

***Protochelydra zangerli*:**
All trees:
Char. 35: 1 → 0

***Shachemys laosiana*:**
All trees:
Char. 121: 0 → 2
Char. 125: 1 → 0
Char. 128: 1 → 0
Some trees:
Char. 71: 0 → 1
Char. 154: 1 → 0

***Siamochelys peninsularis*:**
Some trees:
Char. 111: 0 → 1
Char. 124: 1 → 2
Char. 145: 01 → 1
Char. 148: 01 → 1
Char. 230: 01 → 12
Char. 254: 01 → 1

***Sichuanchelys chowi*:**
All trees:
Char. 124: 2 → 3
Char. 132: 1 → 0

***Sichuanchelys palatodentata*:**
All trees:
Char. 7: 1 → 0
Char. 55: 1 → 0
Char. 94: 1 → 0
Char. 199: 0 → 1
Some trees:
Char. 88: 0 → 1
Char. 189: 1 → 0
Char. 236: 1 → 0

***Sinemys brevispinus*:**
Some trees:
Char. 200: 0 → 1
Char. 222: 0 → 1
Char. 254: 0 → 1

***Sinemys gamera*:**
All trees:
No autapomorphies

***Sinemys lens*:**
All trees:
No autapomorphies

***Solnhofia parsonsi*:**
All trees:
Char. 37: 0 → 1
Char. 234: 0 → 1
Some trees:
Char. 13: 1 → 0
Char. 41: 0 → 1
Char. 63: 1 → 0
Char. 124: 12 → 3
Char. 231: 01 → 1
Char. 254: 01 → 1

***Sphenodon punctatus*:**
All trees:
Char. 4: 0 → 1
Char. 28: 0 → 1
Char. 30: 0 → 1
Char. 55: 0 → 1
Char. 76: 0 → 1
Some trees:
Char. 251: 0 → 1

***Spoochelys ormondea*:**
All trees:
Char. 126: 2 → 01
Some trees:
Char. 99: 1 → 0
Char. 169: 01 → 0

***Staurotypus triporcatus*:**
Some trees:
Char. 20: 0 → 1
Char. 109: 1 → 2
Char. 205: 1 → 0
Char. 232: 0 → 1
Char. 254: 1 → 0

***Sternotherus odoratus*:**
Some trees:
Char. 232: 0 → 1

***Stylemys nebraskensis*:**
All trees:
Char. 147: 1 → 2
Char. 204: 0 → 1
Char. 207: 1 → 0

***Thalassemys moseri*:**
All trees:
Char. 71: 0 → 1
Some trees:
Char. 3: 1 → 0
Char. 6: 01 → 1
Char. 15: 0 → 1
Char. 38: 01 → 1
Char. 41: 0 → 1
Char. 60: 0 → 1
Char. 66: 1 → 0
Char. 74: 1 → 2
Char. 184: 0 → 1

***Toxochelys latiremis*:**
All trees:
Char. 164: 0 → 1

***Trachemys scripta*:**
All trees:
Char. 11: 1 → 0
Char. 39: 0 → 1
Char. 123: 0 → 1
Char. 162: 1 → 0

***Trinitichelys hiatti*:**
All trees:
No autapomorphies

***Warkalania carinaminor*:**
All trees:
No autapomorphies

***Xenochelys formosa*:**
All trees:
Char. 60: 0 → 2
Char. 115: 0 → 1
Char. 149: 0 → 1
Char. 230: 0 → 1

***Xiaochelys ningchengensis*:**
All trees:
No autapomorphies

***Xinjiangchelys junggarensis*:**
All trees:
No autapomorphies

***Xinjiangchelys radiplicatoides*:**
All trees:
No autapomorphies

***Xinjiangchelys wusu*:**
Some trees:
Char. 152: 1 → 0

***Yaminuechelys maior*:**
All trees:
Char. 115: 1 → 0
Char. 132: 0 → 1
Char. 230: 01 → 2
Some trees:
Char. 25: 0 → 1
Char. 111: 0 → 1
Char. 131: 0 → 1
Char. 146: 12 → 1
Char. 209: 1 → 0

***Yehguia tatsuensis*:**
Some trees:
Char. 160: 1 → 0

Char. 228: 0 → 1
Char. 254: 01 → 0

Node 119:
All trees:
Char. 70: 1 → 0
Char. 207: 1 → 0
Char. 255: 0 → 1

Node 120:
All trees:
Char. 11: 2 → 0
Char. 252: 0 → 1

Node 121:
All trees:
No synapomorphies

Node 122:
All trees:
Char. 110: 0 → 1

Node 123:
All trees:
Char. 9: 1 → 0
Char. 252: 1 → 2

Node 124:
All trees:
Char. 130: 0 → 1
Some trees:
Char. 18: 1 → 2
Char. 58: 1 → 0
Char. 152: 0 → 1
Char. 186: 1 → 0

Node 125:
All trees:
Char. 108: 0 → 1
Char. 118: 1 → 2
Char. 151: 0 → 1
Char. 244: 1 → 2
Some trees:
Char. 5: 0 → 1
Char. 32: 0 → 1
Char. 33: 0 → 2
Char. 41: 0 → 1
Char. 43: 0 → 1
Char. 61: 0 → 1
Char. 121: 0 → 1
Char. 131: 0 → 1
Char. 145: 01 → 2
Char. 170: 1 → 0
Char. 205: 1 → 0
Char. 206: 0 → 1
Char. 213: 1 → 0
Char. 217: 0 → 12
Char. 234: 0 → 1

Node 126:
All trees:
Char. 20: 0 → 1
Char. 108: 1 → 2
Char. 118: 2 → 3
Some trees:
Char. 34: 0 → 1
Char. 36: 0 → 1
Char. 132: 0 → 1
Char. 139: 0 → 1
Char. 173: 1 → 2
Char. 200: 0 → 1
Char. 221: 0 → 1
Char. 222: 0 → 1

Node 127:
All trees:
Char. 82: 0 → 1
Char. 121: 0 → 1
Some trees:
Char. 115: 0 → 1
Char. 128: 0 → 1
Char. 169: 1 → 0
Char. 205: 1 → 0

Node 128:
All trees:
Char. 46: 2 → 3
Char. 51: 1 → 0
Char. 58: 1 → 0
Char. 74: 12 → 0
Char. 153: 0 → 1
Char. 165: 0 → 1
Char. 204: 0 → 1
Char. 236: 1 → 0
Some trees:
Char. 149: 0 → 1
Char. 154: 1 → 0
Char. 172: 0 → 1
Char. 187: 1 → 0
Char. 235: 1 → 0

Node 129:
All trees:
Char. 14: 0 → 1
Char. 73: 0 → 1

Node 130:
All trees:
Char. 125: 1 → 2
Char. 189: 0 → 1
Char. 256: 2 → 0
Some trees:
Char. 38: 0 → 1

Node 131:
All trees:
Char. 6: 1 → 2
Char. 157: 0 → 1
Some trees:
Char. 164: 0 → 1

Node 132:
All trees:
Char. 54: 1 → 2
Char. 128: 01 → 1
Some trees:
Char. 18: 0 → 1
Char. 70: 01 → 1
Char. 184: 0 → 1
Char. 254: 01 → 0

Node 133:
All trees:
Char. 38: 0 → 2
Char. 81: 01 → 2
Char. 143: 0 → 1
Some trees:
Char. 16: 1 → 0

Node 134:
All trees:
Char. 33: 0 → 1
Char. 37: 0 → 1
Char. 43: 0 → 1
Char. 187: 0 → 1

Node 135:
All trees:
Char. 18: 1 → 0
Char. 49: 2 → 1
Char. 60: 0 → 2
Char. 76: 0 → 1
Char. 192: 0 → 1
Char. 216: 1 → 2

Node 136:
All trees:
Char. 28: 0 → 1
Char. 113: 1 → 2
Char. 122: 0 → 1
Char. 150: 0 → 1
Char. 216: 0 → 1
Some trees:
Char. 132: 0 → 1
Char. 141: 0 → 1
Char. 231: 01 → 1
Char. 232: 0 → 1

Node 137:
All trees:
Char. 148: 0 → 1
Char. 210: 1 → 0

Node 138:
All trees:
Char. 117: 1 → 0
Char. 129: 1 → 0
Char. 222: 0 → 1
Some trees:
Char. 115: 1 → 0
Char. 128: 01 → 0
Char. 132: 0 → 1
Char. 146: 2 → 1
Char. 254: 0 → 1

Node 139:
All trees:
Char. 10: 0 → 1
Char. 11: 0 → 1
Char. 53: 0 → 1
Char. 120: 0 → 1
Char. 121: 1 → 2
Char. 147: 1 → 0
Char. 200: 0 → 1
Some trees:
Char. 111: 0 → 1

Node 140:
All trees:
Char. 117: 1 → 0
Char. 148: 0 → 1

Node 141:
All trees:
Char. 125: 1 → 0

Node 142:
All trees:
Char. 71: 1 → 0

Node 143:
All trees:
Char. 123: 0 → 1
Char. 142: 1 → 0
Char. 145: 1 → 0
Char. 220: 0 → 1

Node 144:
All trees:
Char. 215: 1 → 0

Node 145:
All trees:
Char. 38: 0 → 2
Char. 148: 1 → 0
Char. 160: 1 → 0

Node 146:
All trees:
Char. 162: 0 → 1
Some trees:
Char. 145: 0 → 1

Node 147:
All trees:
Char. 166: 0 → 1
Some trees:
Char. 254: 01 → 1

Node 148:
All trees:
Char. 132: 0 → 1
Char. 222: 0 → 1
Char. 256: 2 → 1

Node 149:
All trees:
Char. 163: 0 → 1
Char. 164: 0 → 1
Some trees:
Char. 141: 0 → 1

Node 150:
All trees:
Char. 9: 1 → 0
Char. 35: 0 → 1
Char. 117: 1 → 0
Char. 234: 0 → 1
Some trees:
Char. 50: 1 → 2
Char. 191: 12 → 2
Char. 231: 01 → 0

Node 151:
All trees:
Char. 177: 0 → 1

Node 152:
All trees:
Char. 6: 1 → 0
Char. 66: 01 → 1

Node 153:
All trees:
Char. 108: 0 → 1
Char. 151: 0 → 1
Char. 181: 1 → 0
Char. 205: 0 → 1

Node 154:
All trees:
Char. 18: 12 → 0
Char. 120: 0 → 1
Char. 121: 1 → 2
Char. 145: 1 → 0

Node 155:
All trees:
Char. 18: 12 → 0
Char. 65: 0 → 1
Char. 160: 0 → 1

Node 156:
All trees:
Char. 38: 0 → 2
Some trees:
Char. 119: 0 → 1
Char. 146: 12 → 1
Char. 254: 0 → 1

Node 157:
All trees:
Char. 61: 0 → 1
Some trees:
Char. 1: 0 → 1
Char. 56: 2 → 1
Char. 130: 0 → 1

Node 158:
All trees:
Char. 74: 1 → 0
Char. 83: 1 → 0
Char. 241: 0 → 1
Char. 242: 0 → 1
Char. 243: 0 → 1
Some trees:
Char. 111: 0 → 1

Node 159:
All trees:
Char. 120: 0 → 1
Char. 140: 0 → 1
Char. 158: 0 → 1
Char. 159: 0 → 1

Node 160:
All trees:
Char. 118: 1 → 2
Char. 145: 01 → 2
Some trees:
Char. 9: 1 → 0
Char. 16: 01 → 1
Char. 22: 0 → 1
Char. 121: 0 → 1
Char. 163: 01 → 2
Char. 166: 0 → 1
Char. 185: 0 → 1
Char. 211: 0 → 1

Node 161:
All trees:
Char. 254: 0 → 1

Node 162:
All trees:
Char. 98: 0 → 1

Node 163:
All trees:
Char. 38: 1 → 2
Char. 90: 0 → 1
Char. 104: 0 → 1

Node 164:
All trees:
Char. 26: 1 → 2
Char. 57: 2 → 1
Char. 58: 0 → 1
Char. 103: 0 → 1

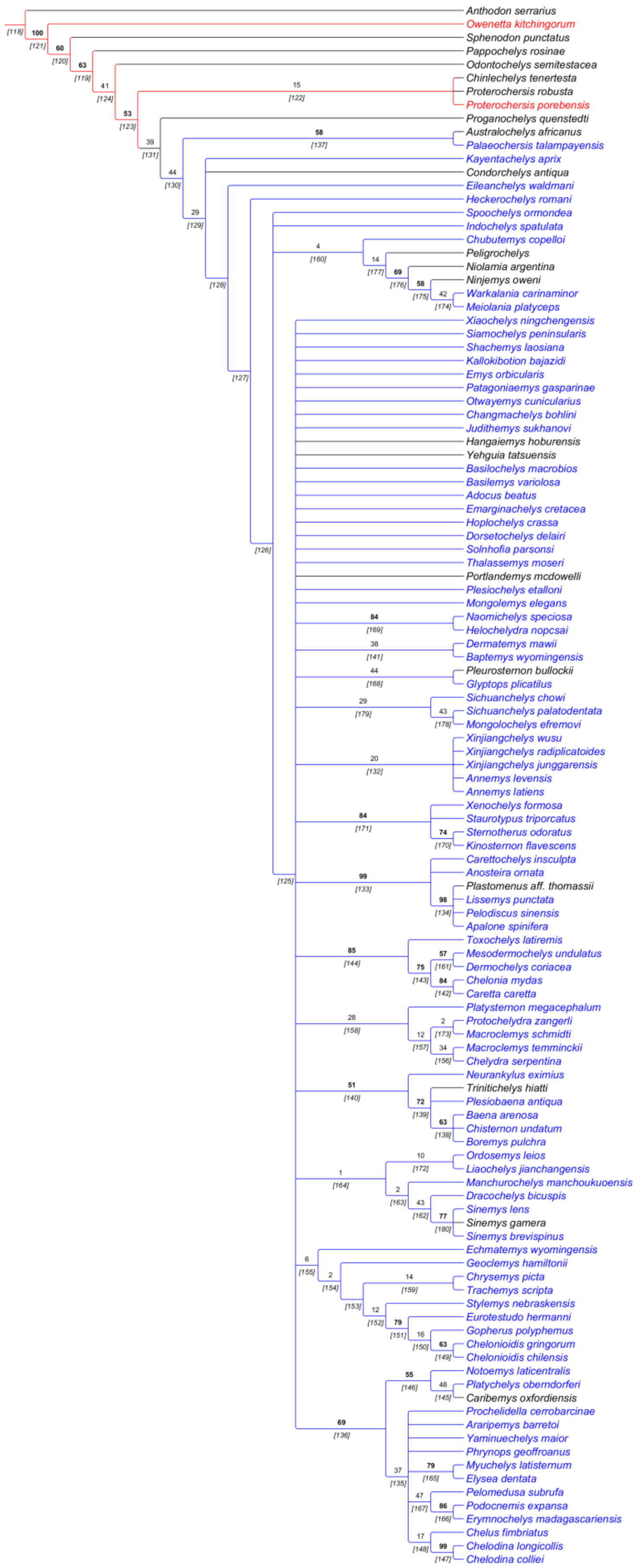
Node 165:
All trees:
Char. 56: 1 → 2

Node 166:
All trees:
Char. 222: 0 → 1
Char. 254: 1 → 0

Node 167:
All trees:
Char. 141: 0 → 1
Char. 155: 0 → 1
Char. 230: 012 → 3

Node 168:	Char. 58: 1 → 0	Some trees:	Char. 111: 0 → 1
All trees:	Char. 64: 1 → 0	Char. 48: 0 → 1	Char. 141: 01 → 0

ANALYSIS 2 – *CHINLECHELYS TENERTESTA* SCORING B
(SPIKY ELEMENTS TREATED AS CERVICAL OSTEODERMS, OSTEODERMAL MOSAIC PRESENT IN THE SHELL)



Tree 2. Analysis 2 (TBR, *Chinlechelys tenertesta* scoring B), strict consensus tree. Node numbers below the branches, Jackknife values above the branches (support of at least 50 in bold). Character 247 (cleithrum/nuchal bone) is mapped using the Character mapping tool of TNT – “0” (paired) is red, “1” (fused in early development into a single nuchal plate) is blue, “?” is black.

SYNAPOMORPHIES – ANALYSIS 2 (*CHINLECHELYS TENERTESTA* SCORING B)

***Pappochelys rosinae*:**
All trees:
Char. 36: 0 → 1
Char. 40: 0 → 1

***Proterochersis porebensis*:**
All trees:
No autapomorphies

***Proterochersis robusta*:**
All trees:
No autapomorphies

***Odontochelys semitestacea*:**
All trees:
Char. 169: 1 → 0
Char. 221: 0 → 1

***Chinlechelys tenertesta* B:**
Some trees:
Char. 254: 1 → 0

***Adocus beatus*:**
All trees:
Char. 162: 0 → 1
Some trees:
Char. 212: 0 → 1

***Annemys latiens*:**
Some trees:
Char. 230: 1 → 2

***Annemys levensis*:**
All trees:
Char. 121: 0 → 1
Char. 129: 1 → 0
Some trees:
Char. 230: 1 → 2

***Anosteira ornata*:**
All trees:
Char. 230: 0 → 1
Char. 254: 0 → 1

***Anthodon serrarius*:**
All trees:
No autapomorphies

***Apalone spinifera*:**
All trees:
Char. 38: 0 → 1
Some trees:
Char. 212: 1 → 0

***Araripemys barretoi*:**
All trees:
Char. 109: 0 → 2
Char. 111: 0 → 1
Char. 122: 0 → 1
Char. 132: 0 → 1
Char. 139: 0 → 1
Char. 141: 0 → 1
Char. 154: 0 → 1
Char. 163: 0 → 1
Char. 222: 0 → 1
Char. 223: 0 → 1
Char. 227: 0 → 1
Char. 230: 01 → 3
Char. 232: 0 → 1
Some trees:
Char. 20: 0 → 1
Char. 61: 0 → 1
Char. 107: 0 → 1
Char. 131: 0 → 1
Char. 146: 1 → 2
Char. 147: 1 → 0
Char. 148: 0 → 1
Char. 183: 0 → 1
Char. 254: 1 → 0

***Australochelys africanus*:**
All trees:
No autapomorphies

***Baena arenosa*:**
All trees:
Char. 18: 1 → 0
Char. 89: 1 → 0
Char. 115: 0 → 1
Char. 146: 0 → 1
Some trees:
Char. 124: 2 → 1
Char. 191: 1 → 2

***Baptemys wyomingensis*:**
All trees:
Char. 147: 0 → 1
Some trees:
Char. 160: 0 → 1
Char. 211: 0 → 1

***Basilemys variolosa*:**
All trees:
Char. 157: 0 → 1
Char. 166: 0 → 1
Char. 230: 0 → 2
Some trees:
Char. 215: 1 → 0

***Basilochelys macrobios*:**
Some trees:
Char. 16: 1 → 0
Char. 56: 2 → 1
Char. 58: 1 → 0
Char. 70: 1 → 0
Char. 77: 0 → 1
Char. 184: 2 → 0
Char. 228: 0 → 1
Char. 254: 0 → 1

***Boremys pulchra*:**
Some trees:
Char. 11: 0 → 1
Char. 191: 12 → 1

***Caretta caretta*:**
All trees:
Char. 52: 0 → 1
Char. 118: 1 → 0

***Carettochelys insculpta*:**
All trees:
Char. 22: 0 → 1
Some trees:
Char. 201: 0 → 1

***Caribemys oxfordiensis*:**
All trees:
Char. 207: 1 → 0

***Changmachelys bohlini*:**
All trees:
No autapomorphies

***Chelodina colliei*:**
All trees:
No autapomorphies

***Chelodina longicollis*:**
All trees:
No autapomorphies

***Chelonia mydas*:**
All trees:
Char. 35: 0 → 1
Char. 38: 01 → 2

***Chelonoidis chilensis*:**
All trees:
Char. 129: 1 → 0

***Chelonoidis gringorum*:**
All trees:
Char. 126: 2 → 0

***Chelus fimbriatus*:**
All trees:
Char. 0: 0 → 1
Char. 5: 1 → 0
Char. 32: 0 → 1
Char. 36: 1 → 0
Char. 43: 1 → 0
Char. 109: 0 → 2
Char. 121: 1 → 0
Char. 122: 0 → 1
Char. 150: 0 → 1
Char. 156: 1 → 0
Char. 157: 0 → 1
Char. 160: 0 → 1
Char. 170: 0 → 1
Char. 171: 0 → 1
Char. 254: 0 → 1
Char. 256: 2 → 01

***Chelydra serpentina*:**
All trees:
Char. 124: 2 → 3
Char. 230: 12 → 0

***Chisternon undatum*:**
Some trees:
Char. 172: 0 → 1

***Chrysemys picta*:**
All trees:
Char. 58: 1 → 0

***Chubutemys copelloi*:**
All trees:
Char. 41: 0 → 1

***Condorchelys antiqua*:**
All trees:
No autapomorphies

***Dermatemys mawii*:**
All trees:
Char. 121: 0 → 1
Char. 149: 0 → 1
Char. 158: 0 → 1
Char. 174: 1 → 0
Char. 255: 2 → 1
Some trees:
Char. 109: 1 → 0
Char. 160: 01 → 0

***Dermochelys coriacea*:**
All trees:
Char. 108: 1 → 2
Char. 118: 1 → 3
Char. 197: 0 → 1
Char. 230: 12 → 0
Char. 249: 1 → 0
Char. 254: 0 → 1

***Dorsetochelys delairi*:**
All trees:
Char. 77: 0 → 1
Some trees:
Char. 38: 1 → 0

***Dracochelys bicuspis*:**
All trees:
Char. 38: 0 → 1
Char. 70: 0 → 1
Char. 77: 1 → 0
Char. 225: 0 → 1
Char. 226: 0 → 1

***Echmatemys wyomingensis*:**
Some trees:
Char. 145: 1 → 0

***Eileanchelys waldmani*:**
All trees:
Char. 228: 0 → 1

***Elseya dentata*:**
All trees:
Char. 38: 0 → 2

***Emarginachelys cretacea*:**
Some trees:
Char. 109: 0 → 1
Char. 114: 0 → 12
Char. 131: 0 → 1
Char. 212: 0 → 1
Char. 231: 1 → 0
Char. 232: 0 → 1
Char. 254: 0 → 1

***Emys orbicularis*:**
All trees:
Char. 9: 1 → 0
Char. 58: 1 → 0
Char. 133: 0 → 1
Char. 137: 1 → 0

***Erymnochelys madagascariensis*:**
All trees:
Char. 145: 1 → 0
Char. 157: 0 → 1

***Eurotestudo hermanni*:**
All trees:
Char. 147: 1 → 0

***Geoclemys hamiltonii*:**
All trees:
Char. 9: 1 → 0
Char. 20: 0 → 1
Char. 64: 0 → 1
Char. 109: 0 → 1
Char. 119: 0 → 1
Char. 142: 1 → 0

***Glyptops plicatulus*:**
All trees:
Char. 35: 0 → 1
Some trees:
Char. 38: 0 → 1
Char. 74: 1 → 2
Char. 230: 0 → 1

***Gopherus polyphemus*:**
All trees:
Char. 199: 1 → 0

***Hangaiemys hoburensis*:**
Some trees:
Char. 64: 1 → 0
Char. 84: 1 → 0
Char. 230: 1 → 0

***Heckerochelys romani*:**
All trees:
Char. 137: 0 → 1
Char. 138: 1 → 0
Char. 141: 0 → 1

***Helochelydra nopcsai*:**
All trees:
Char. 22: 0 → 1
Char. 67: 0 → 1

***Hoplochelys crassa*:**
All trees:
Char. 142: 1 → 0
Char. 145: 1 → 0
Some trees:
Char. 109: 1 → 2

***Indochelys spatulata*:**
Some trees:
Char. 136: 1 → 0
Char. 223: 0 → 1

***Judithemys sukhanovi*:**
Some trees:
Char. 192: 0 → 1
Char. 228: 1 → 0
Char. 230: 1 → 0

***Kallokibotion bajazidi*:**
All trees:
Char. 31: 1 → 0
Char. 38: 01 → 2
Char. 41: 0 → 1
Char. 71: 0 → 1
Char. 116: 0 → 1
Char. 125: 1 → 0
Char. 149: 0 → 1
Char. 171: 0 → 1
Char. 203: 1 → 0
Char. 254: 01 → 0
Char. 255: 2 → 1
Some trees:
Char. 6: 1 → 0

***Kayentachelys aprix*:**
All trees:
Char. 2: 0 → 1
Char. 107: 0 → 1
Char. 124: 2 → 1
Some trees:
Char. 55: 1 → 0

***Kinosternon flavescens*:**
All trees:
Char. 119: 1 → 0
Char. 134: 0 → 1
Char. 207: 0 → 1
Char. 244: 1 → 2

***Liaochelys jianchangensis*:**
All trees:
Char. 121: 0 → 1
Char. 225: 0 → 1
Char. 226: 0 → 1

***Lissemys punctata*:**
All trees:
Char. 63: 1 → 0
Char. 144: 0 → 1
Some trees:
Char. 84: 1 → 0
Char. 85: 1 → 0

***Macroclemys schmidti*:**
All trees:
Char. 50: 2 → 4

***Macroclemys temminckii*:**
All trees:
Char. 124: 2 → 1
Char. 126: 2 → 1
Char. 190: 1 → 2
Char. 207: 1 → 0

***Manchurochelys manchoukuoensis*:**
All trees:
Char. 230: 1 → 0

***Meiolania platyceps*:**
All trees:
Char. 93: 0 → 1

***Mesodermochelys undulatus*:**
All trees:
Char. 171: 1 → 0
Char. 233: 1 → 0

***Mongolemys elegans*:**
All trees:
Char. 70: 1 → 0
Char. 192: 01 → 0
Some trees:
Char. 24: 1 → 0
Char. 62: 1 → 0
Char. 71: 01 → 0
Char. 145: 1 → 0
Char. 148: 1 → 0
Char. 237: 3 → 1

***Mongolochelys efremovi*:**
All trees:
Char. 25: 0 → 1
Char. 26: 0 → 1
Char. 38: 1 → 2
Char. 71: 0 → 1
Char. 98: 0 → 1
Some trees:
Char. 117: 1 → 0

***Myuchelys latisternum*:**
All trees:
Char. 77: 0 → 1
Char. 148: 0 → 1
Char. 256: 2 → 1

***Naomichelys speciosa*:**
All trees:
No autapomorphies

***Neurankylus eximius*:**
Some trees:
Char. 130: 0 → 1

***Ninjemys oweni*:**
All trees:
Char. 94: 1 → 0

***Niolamia argentina*:**
All trees:
Char. 91: 1 → 0
Char. 99: 1 → 0
Char. 102: 0 → 1

***Notoemys laticentralis*:**
Some trees:
Char. 124: 1 → 2

***Ordosemys leios*:**
All trees:
Char. 52: 0 → 1
Char. 229: 1 → 0

***Otwayemys cunicularius*:**
Some trees:
Char. 146: 0 → 2
Char. 148: 01 → 2
Char. 156: 1 → 0
Char. 163: 0 → 1
Char. 169: 1 → 0
Char. 184: 02 → 1

***Owenetta kitchingorum*:**
All trees:
Char. 3: 0 → 1

***Palaeochersis talampayensis*:**
All trees:
Char. 38: 1 → 0

***Patagoniaemys gasparinae*:**
Some trees:
Char. 169: 0 → 1
Char. 184: 0 → 1
Char. 191: 2 → 1

***Peligrochelys*:**
Some trees:
Char. 87: 0 → 1

***Pelodiscus sinensis*:**
All trees:
Char. 62: 1 → 0

***Pelomedusa subrufa*:**
All trees:
No autapomorphies

***Phrynops geoffroanus*:**
All trees:
Char. 228: 0 → 1

***Plastomenus* aff. *thomassii*:**
Some trees:
Char. 84: 1 → 0
Char. 132: 1 → 0

***Platychelys oberndorferi*:**
All trees:
Char. 119: 0 → 1
Char. 126: 2 → 1
Char. 209: 1 → 0

***Platysternon megacephalum*:**
All trees:
Char. 18: 12 → 0
Char. 22: 0 → 1
Char. 76: 0 → 1
Char. 119: 0 → 1
Char. 148: 1 → 2
Char. 149: 0 → 1
Char. 170: 1 → 0
Char. 176: 0 → 1
Some trees:
Char. 199: 1 → 0
Char. 232: 1 → 0

***Plesiobaena antiqua*:**
Some trees:
Char. 172: 0 → 1

***Plesiochelys etalloni*:**
Some trees:
Char. 60: 0 → 1
Char. 64: 1 → 0
Char. 125: 1 → 2

***Pleurosternon bullockii*:**
All trees:
Char. 124: 2 → 1
Char. 125: 1 → 0
Char. 153: 0 → 1
Some trees:
Char. 38: 1 → 0

***Podocnemis expansa*:**
All trees:
Char. 36: 0 → 1
Char. 39: 0 → 1
Char. 62: 0 → 1

***Portlandemys mcdowelli*:**
All trees:
No autapomorphies

***Prochelidella cerrobarcinae*:**
Some trees:
Char. 254: 0 → 1

***Proganochelys quenstedti*:**
All trees:
Char. 7: 1 → 0
Char. 126: 1 → 0
Char. 127: 1 → 0
Char. 138: 1 → 0
Char. 157: 0 → 1
Char. 188: 1 → 0
Char. 219: 1 → 0

***Protochelydra zangerli*:**
All trees:
Char. 35: 1 → 0

***Shachemys laosiana*:**
All trees:
Char. 121: 0 → 2
Char. 125: 1 → 0
Char. 128: 1 → 0
Some trees:
Char. 71: 0 → 1
Char. 154: 1 → 0

***Siamochelys peninsularis*:**
Some trees:
Char. 111: 0 → 1
Char. 124: 1 → 2
Char. 145: 01 → 1
Char. 148: 01 → 1
Char. 230: 01 → 12
Char. 254: 01 → 1

***Sichuanchelys chowi*:**
All trees:
Char. 124: 2 → 3
Char. 132: 1 → 0

***Sichuanchelys palatodentata*:**
All trees:
Char. 7: 1 → 0
Char. 55: 1 → 0
Char. 94: 1 → 0
Char. 199: 0 → 1
Some trees:
Char. 88: 0 → 1
Char. 189: 1 → 0
Char. 236: 1 → 0

***Sinemys brevispinus*:**
Some trees:
Char. 200: 0 → 1
Char. 222: 0 → 1
Char. 254: 0 → 1

***Sinemys gamera*:**
All trees:
No autapomorphies

***Sinemys lens*:**
All trees:
No autapomorphies

***Solnhofia parsonsi*:**
All trees:
Char. 37: 0 → 1
Char. 234: 0 → 1
Some trees:
Char. 13: 1 → 0
Char. 41: 0 → 1
Char. 63: 1 → 0
Char. 124: 12 → 3
Char. 231: 01 → 1
Char. 254: 01 → 1

***Sphenodon punctatus*:**
All trees:
Char. 4: 0 → 1
Char. 28: 0 → 1
Char. 30: 0 → 1
Char. 55: 0 → 1
Char. 76: 0 → 1

***Spoochelys ormondea*:**
All trees:
Char. 126: 2 → 01
Some trees:
Char. 99: 1 → 0
Char. 169: 1 → 0

***Staurotypus triporcatus*:**
Some trees:
Char. 20: 0 → 1
Char. 109: 1 → 2
Char. 205: 1 → 0
Char. 232: 0 → 1
Char. 254: 1 → 0

***Sternotherus odoratus*:**
Some trees:
Char. 232: 0 → 1

***Stylemys nebraskensis*:**
All trees:
Char. 147: 1 → 2
Char. 204: 0 → 1
Char. 207: 1 → 0

***Thalassemys moseri*:**
All trees:
Char. 71: 0 → 1
Some trees:
Char. 3: 1 → 0
Char. 6: 01 → 1
Char. 15: 0 → 1
Char. 38: 01 → 1
Char. 41: 0 → 1
Char. 60: 0 → 1
Char. 66: 1 → 0
Char. 74: 1 → 2
Char. 184: 0 → 1

***Toxochelys latiremis*:**
All trees:
Char. 164: 0 → 1

***Trachemys scripta*:**
All trees:
Char. 11: 1 → 0
Char. 39: 0 → 1
Char. 123: 0 → 1
Char. 162: 1 → 0

***Trinitichelys hiatti*:**
All trees:
No autapomorphies

***Warkalania carinaminor*:**
All trees:
No autapomorphies

***Xenochelys formosa*:**
All trees:
Char. 60: 0 → 2
Char. 115: 0 → 1
Char. 149: 0 → 1
Char. 230: 0 → 1

***Xiaochelys ningchengensis*:**
All trees:
No autapomorphies

***Xinjiangchelys junggarensis*:**
All trees:
No autapomorphies

***Xinjiangchelys radiplicatoides*:**
All trees:
No autapomorphies

***Xinjiangchelys wusu*:**
Some trees:
Char. 152: 1 → 0

***Yaminuechelys maior*:**
All trees:
Char. 115: 1 → 0
Char. 132: 0 → 1
Char. 230: 01 → 2
Some trees:
Char. 25: 0 → 1
Char. 111: 0 → 1
Char. 131: 0 → 1
Char. 146: 12 → 1
Char. 209: 1 → 0

***Yehguia tatsuensis*:**
Some trees:
Char. 160: 1 → 0
Char. 228: 0 → 1
Char. 254: 01 → 0

Node 119:
All trees:
Char. 70: 1 → 0
Char. 207: 1 → 0
Char. 255: 0 → 1

Node 120:
All trees:
Char. 11: 2 → 0
Char. 252: 0 → 1

Node 121:
All trees:
No synapomorphies

Node 122:
All trees:
Char. 229: 0 → 1
Char. 249: 1 → 0
Some trees:
Char. 117: 0 → 1
Char. 204: 0 → 1
Char. 208: 0 → 1

Node 123:
All trees:
Char. 110: 0 → 1

Node 124:
All trees:
Char. 9: 1 → 0
Char. 252: 1 → 2

Node 125:
All trees:
Char. 230: 0 → 2
Some trees:
Char. 87: 0 → 1
Char. 129: 0 → 1

Node 126:
All trees:
Char. 9: 1 → 0
Char. 172: 0 → 1
Some trees:
Char. 119: 1 → 0

Node 127:
All trees:
Char. 230: 12 → 0

Node 128:
All trees:
Char. 75: 1 → 2
Char. 83: 0 → 1
Char. 136: 0 → 1
Some trees:
Char. 49: 1 → 2

Node 129:
All trees:
Char. 47: 1 → 2
Char. 50: 0 → 1
Char. 75: 0 → 1
Char. 77: 0 → 1
Char. 119: 0 → 1
Char. 196: 0 → 1
Char. 214: 0 → 1
Some trees:
Char. 6: 0 → 1
Char. 8: 0 → 1
Char. 9: 0 → 1
Char. 31: 0 → 1
Char. 40: 0 → 1
Char. 49: 0 → 1
Char. 131: 0 → 1
Char. 156: 0 → 1
Char. 208: 0 → 1
Char. 250: 2 → 3

Node 130:
All trees:
Char. 42: 0 → 1
Char. 46: 0 → 1
Char. 47: 0 → 1
Char. 56: 0 → 1
Char. 72: 0 → 1
Char. 74: 0 → 1
Char. 245: 1 → 2
Some trees:
Char. 55: 0 → 1

Node 131:
All trees:
Char. 226: 1 → 0
Char. 244: 0 → 1
Char. 245: 0 → 1
Char. 248: 0 → 1
Char. 255: 1 → 2
Some trees:
Char. 254: 1 → 0

Node 132:
All trees:
Char. 130: 0 → 1
Some trees:
Char. 18: 1 → 2
Char. 58: 1 → 0
Char. 152: 0 → 1
Char. 186: 1 → 0

Node 133:
All trees:
Char. 108: 0 → 1
Char. 118: 1 → 2
Char. 151: 0 → 1
Char. 244: 1 → 2
Some trees:
Char. 5: 0 → 1
Char. 32: 0 → 1
Char. 33: 0 → 2
Char. 41: 0 → 1
Char. 43: 0 → 1
Char. 61: 0 → 1
Char. 121: 0 → 1
Char. 131: 0 → 1
Char. 145: 01 → 2
Char. 170: 1 → 0
Char. 205: 1 → 0
Char. 206: 0 → 1
Char. 213: 1 → 0
Char. 217: 0 → 12
Char. 234: 0 → 1

Node 134:
All trees:
Char. 20: 0 → 1
Char. 108: 1 → 2
Char. 118: 2 → 3
Some trees:
Char. 34: 0 → 1
Char. 36: 0 → 1
Char. 132: 0 → 1
Char. 139: 0 → 1
Char. 173: 1 → 2
Char. 200: 0 → 1
Char. 221: 0 → 1
Char. 222: 0 → 1

Node 135:
All trees:
Char. 82: 0 → 1
Char. 121: 0 → 1
Some trees:
Char. 115: 0 → 1
Char. 128: 0 → 1
Char. 169: 1 → 0
Char. 205: 1 → 0

Node 136:
All trees:
Char. 46: 2 → 3
Char. 51: 1 → 0
Char. 58: 1 → 0
Char. 74: 12 → 0
Char. 153: 0 → 1
Char. 165: 0 → 1
Char. 204: 0 → 1
Char. 236: 1 → 0
Some trees:
Char. 149: 0 → 1
Char. 154: 1 → 0
Char. 172: 0 → 1
Char. 187: 1 → 0
Char. 235: 1 → 0

Node 137:
All trees:
Char. 14: 0 → 1
Char. 73: 0 → 1

Node 138:
All trees:
Char. 125: 1 → 2
Char. 189: 0 → 1
Char. 256: 2 → 0
Some trees:
Char. 38: 0 → 1

Node 139:
All trees:
Char. 6: 1 → 2
Char. 157: 0 → 1
Some trees:
Char. 164: 0 → 1

Node 140:
All trees:
Char. 54: 1 → 2
Char. 128: 01 → 1
Some trees:
Char. 18: 0 → 1
Char. 70: 01 → 1
Char. 184: 0 → 1
Char. 254: 01 → 0

Node 141:
All trees:
Char. 38: 0 → 2
Char. 81: 01 → 2
Char. 143: 0 → 1
Some trees:
Char. 16: 1 → 0

Node 142:
All trees:
Char. 33: 0 → 1
Char. 37: 0 → 1
Char. 43: 0 → 1
Char. 187: 0 → 1

Node 143:
All trees:
Char. 18: 1 → 0
Char. 49: 2 → 1
Char. 60: 0 → 2
Char. 76: 0 → 1
Char. 192: 0 → 1
Char. 216: 1 → 2

Node 144:
All trees:
Char. 28: 0 → 1
Char. 113: 1 → 2
Char. 122: 0 → 1
Char. 150: 0 → 1
Char. 216: 0 → 1
Some trees:
Char. 132: 0 → 1
Char. 141: 0 → 1
Char. 231: 01 → 1
Char. 232: 0 → 1

Node 145:
All trees:
Char. 148: 0 → 1
Char. 210: 1 → 0

Node 146:
All trees:
Char. 117: 1 → 0
Char. 129: 1 → 0
Char. 222: 0 → 1
Some trees:
Char. 115: 1 → 0
Char. 128: 01 → 0
Char. 132: 0 → 1
Char. 146: 2 → 1
Char. 254: 0 → 1

Node 147:
All trees:
Char. 10: 0 → 1
Char. 11: 0 → 1
Char. 53: 0 → 1
Char. 120: 0 → 1
Char. 121: 1 → 2
Char. 147: 1 → 0
Char. 200: 0 → 1
Some trees:
Char. 111: 0 → 1

Node 148:
All trees:
Char. 117: 1 → 0
Char. 148: 0 → 1

Node 149:
All trees:
Char. 125: 1 → 0

Node 150:
All trees:
Char. 71: 1 → 0

Node 151:
All trees:
Char. 123: 0 → 1
Char. 142: 1 → 0
Char. 145: 1 → 0
Char. 220: 0 → 1

Node 152:
All trees:
Char. 215: 1 → 0

Node 153:
All trees:
Char. 38: 0 → 2
Char. 148: 1 → 0
Char. 160: 1 → 0

Node 154:
All trees:
Char. 162: 0 → 1
Some trees:
Char. 145: 0 → 1

Node 155:
All trees:
Char. 166: 0 → 1
Some trees:
Char. 254: 01 → 1

Node 156:
All trees:
Char. 132: 0 → 1
Char. 222: 0 → 1
Char. 256: 2 → 1

Node 157:
All trees:
Char. 163: 0 → 1
Char. 164: 0 → 1
Some trees:
Char. 141: 0 → 1

Node 158:
All trees:
Char. 9: 1 → 0
Char. 35: 0 → 1
Char. 117: 1 → 0
Char. 234: 0 → 1
Some trees:
Char. 50: 1 → 2
Char. 191: 12 → 2
Char. 231: 01 → 0

Node 159:
All trees:
Char. 177: 0 → 1

Node 160:
All trees:
Char. 6: 1 → 0
Char. 66: 0 → 1

Node 161:
All trees:
Char. 108: 0 → 1
Char. 151: 0 → 1
Char. 181: 1 → 0
Char. 205: 0 → 1

Node 162:
All trees:
Char. 125: 1 → 0
Char. 223: 0 → 1
Char. 227: 0 → 1
Char. 228: 1 → 0
Char. 230: 1 → 2
Char. 234: 0 → 1

Node 163:
All trees:
Char. 174: 1 → 0

Node 164:
Some trees:
Char. 11: 0 → 1
Char. 18: 01 → 2
Char. 132: 0 → 1

Node 165:
All trees:

Char. 18: 12 → 0
Char. 120: 0 → 1
Char. 121: 1 → 2
Char. 145: 1 → 0

Node 166:
All trees:
Char. 18: 12 → 0
Char. 65: 0 → 1
Char. 160: 0 → 1

Node 167:
All trees:
Char. 38: 0 → 2
Some trees:
Char. 119: 0 → 1
Char. 146: 12 → 1
Char. 254: 0 → 1

Node 168:
All trees:
Char. 61: 0 → 1
Some trees:
Char. 1: 0 → 1
Char. 56: 2 → 1
Char. 130: 0 → 1

Node 169:
All trees:
Char. 74: 1 → 0
Char. 83: 1 → 0
Char. 241: 0 → 1
Char. 242: 0 → 1
Char. 243: 0 → 1
Some trees:
Char. 111: 0 → 1

Node 170:
All trees:
Char. 120: 0 → 1
Char. 140: 0 → 1
Char. 158: 0 → 1
Char. 159: 0 → 1

Node 171:
All trees:
Char. 118: 1 → 2
Char. 145: 01 → 2
Some trees:
Char. 9: 1 → 0
Char. 16: 01 → 1
Char. 22: 0 → 1
Char. 121: 0 → 1
Char. 163: 01 → 2
Char. 166: 0 → 1
Char. 185: 0 → 1
Char. 211: 0 → 1

Node 172:
All trees:
Char. 128: 1 → 0
Char. 222: 0 → 1

Node 173:
All trees:
Char. 254: 0 → 1

Node 174:
All trees:
Char. 98: 0 → 1

Node 175:
All trees:
Char. 38: 1 → 2
Char. 90: 0 → 1
Char. 104: 0 → 1

Node 176:
All trees:
Char. 26: 1 → 2
Char. 57: 2 → 1
Char. 58: 0 → 1
Char. 103: 0 → 1

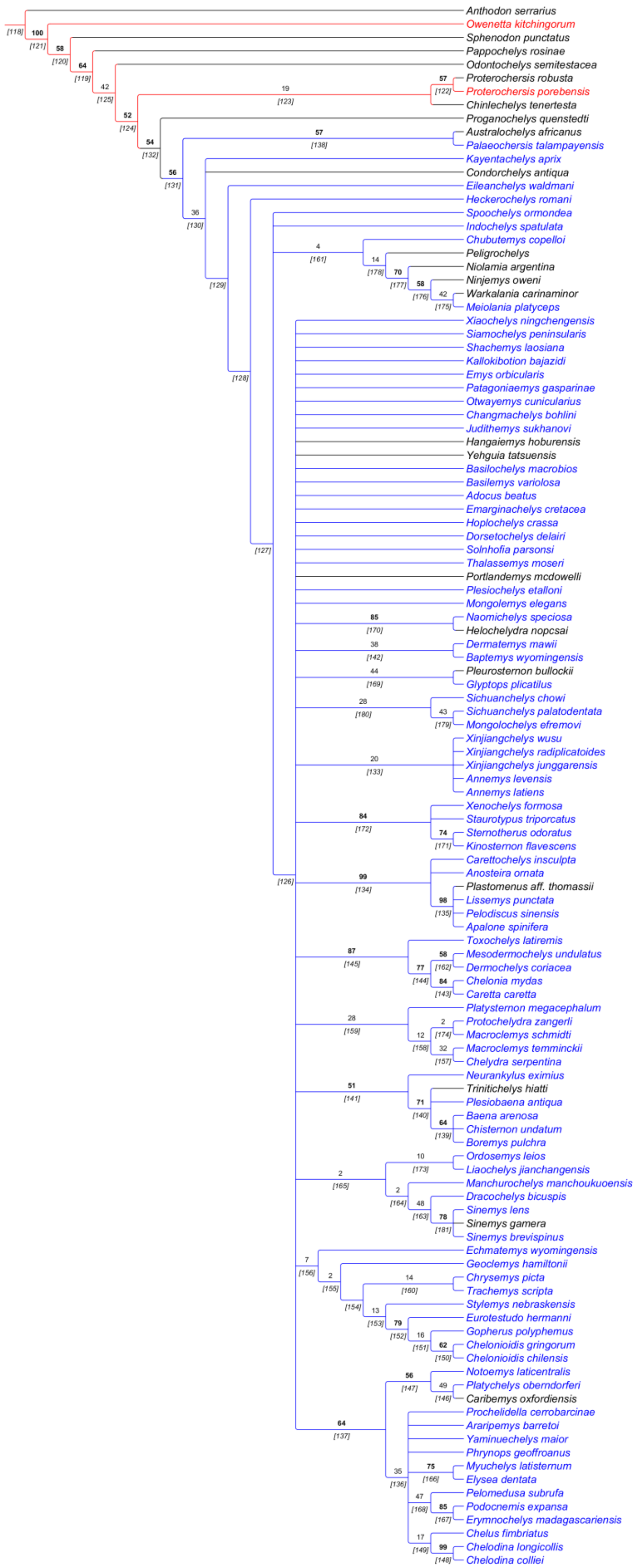
Node 177:
All trees:
Char. 56: 1 → 2

Node 178:
All trees:
Char. 222: 0 → 1
Char. 254: 1 → 0

Node 179:
All trees:
Char. 141: 0 → 1
Char. 155: 0 → 1
Char. 230: 2 → 3

Node 180:
All trees:
Char. 58: 1 → 0
Char. 64: 1 → 0
Some trees:
Char. 48: 0 → 1
Char. 141: 1 → 0

ANALYSIS 3 – *CHINLECHELYS TENERTESTA* SCORING C
(SPIKY ELEMENTS TREATED AS POSTERIOR CARAPACIAL RIM, OSTEODERMAL MOSAIC PRESENT IN THE SHELL)



Tree 3. Analysis 3 (TBR, *Chinlechelys tenertesta* scoring C), strict consensus tree. Node numbers below the branches, Jackknife values above the branches (support of at least 50 in bold). Character 247 (cleithrum/nuchal bone) is mapped using the Character mapping tool of TNT – “0” (paired) is red, “1” (fused in early development into a single nuchal plate) is blue, “?” is black.

SYNAPOMORPHIES – ANALYSIS 3 (*CHINLECHELYS TENERTESTA* SCORING C)

Pappochelys rosinae:
All trees:
Char. 36: 0 → 1
Char. 40: 0 → 1

Proterochersis porebensis:
All trees:
No autapomorphies

Proterochersis robusta:
All trees:
No autapomorphies

Odontochelys semitestacea:
All trees:
Char. 169: 1 → 0
Char. 221: 0 → 1

***Chinlechelys tenertesta* C**:
All trees:
No autapomorphies

Adocus beatus:
All trees:
Char. 162: 0 → 1
Some trees:
Char. 212: 0 → 1

Annemys latiens:
Some trees:
Char. 230: 1 → 2

Annemys levensis:
All trees:
Char. 121: 0 → 1
Char. 129: 1 → 0
Some trees:
Char. 230: 1 → 2

Anosteira ornata:
All trees:
Char. 230: 0 → 1
Char. 254: 0 → 1

Anthodon serrarius:
All trees:
No autapomorphies

Apalone spinifera:
All trees:
Char. 38: 0 → 1
Some trees:
Char. 212: 1 → 0

Araripemys barretoi:
All trees:
Char. 109: 0 → 2
Char. 111: 0 → 1
Char. 122: 0 → 1
Char. 132: 0 → 1
Char. 139: 0 → 1
Char. 141: 0 → 1
Char. 154: 0 → 1
Char. 163: 0 → 1
Char. 222: 0 → 1
Char. 223: 0 → 1
Char. 227: 0 → 1
Char. 230: 01 → 3
Char. 232: 0 → 1
Some trees:
Char. 20: 0 → 1
Char. 61: 0 → 1
Char. 107: 0 → 1
Char. 131: 0 → 1
Char. 146: 1 → 2
Char. 147: 1 → 0
Char. 148: 0 → 1
Char. 183: 0 → 1
Char. 254: 1 → 0

Australochelys africanus:
All trees:
No autapomorphies

Baena arenosa:
All trees:
Char. 18: 1 → 0
Char. 89: 1 → 0
Char. 115: 0 → 1
Char. 146: 0 → 1
Some trees:
Char. 124: 2 → 1
Char. 191: 1 → 2

Baptemys wyomingensis:
All trees:
Char. 147: 0 → 1
Some trees:
Char. 160: 0 → 1
Char. 211: 0 → 1

Basilemys variolosa:
All trees:
Char. 157: 0 → 1
Char. 166: 0 → 1
Char. 230: 0 → 2
Some trees:
Char. 215: 1 → 0

Basilochelys macrobios:
Some trees:
Char. 16: 1 → 0
Char. 56: 2 → 1
Char. 58: 1 → 0
Char. 70: 1 → 0
Char. 77: 0 → 1
Char. 184: 2 → 0
Char. 228: 0 → 1
Char. 254: 0 → 1

Boremys pulchra:
Some trees:
Char. 11: 0 → 1
Char. 191: 12 → 1

Caretta caretta:
All trees:
Char. 52: 0 → 1
Char. 118: 1 → 0

Carettochelys insculpta:
All trees:
Char. 22: 0 → 1
Some trees:
Char. 201: 0 → 1

Caribemys oxfordiensis:
All trees:
Char. 207: 1 → 0

Changmachelys bohlini:
All trees:
No autapomorphies

Chelodina colliei:
All trees:
No autapomorphies

Chelodina longicollis:
All trees:
No autapomorphies

Chelonia mydas:
All trees:
Char. 35: 0 → 1
Char. 38: 01 → 2

Chelonoidis chilensis:
All trees:
Char. 129: 1 → 0

Chelonoidis gringorum:
All trees:
Char. 126: 2 → 0

Chelus fimbriatus:
All trees:
Char. 0: 0 → 1
Char. 5: 1 → 0
Char. 32: 0 → 1
Char. 36: 1 → 0
Char. 43: 1 → 0
Char. 109: 0 → 2
Char. 121: 1 → 0
Char. 122: 0 → 1
Char. 150: 0 → 1
Char. 156: 1 → 0
Char. 157: 0 → 1
Char. 160: 0 → 1
Char. 170: 0 → 1
Char. 171: 0 → 1
Char. 254: 0 → 1
Char. 256: 2 → 01

Chelydra serpentina:
All trees:
Char. 124: 2 → 3
Char. 230: 12 → 0

Chisternon undatum:
Some trees:
Char. 172: 0 → 1

Chrysemys picta:
All trees:
Char. 58: 1 → 0

Chubutemys copelloi:
All trees:
Char. 41: 0 → 1

Condorchelys antiqua:
All trees:
No autapomorphies

Dermatemys mawii:
All trees:
Char. 121: 0 → 1
Char. 149: 0 → 1
Char. 158: 0 → 1
Char. 174: 1 → 0
Char. 255: 2 → 1
Some trees:
Char. 109: 1 → 0
Char. 160: 01 → 0

Dermochelys coriacea:
All trees:
Char. 108: 1 → 2
Char. 118: 1 → 3
Char. 197: 0 → 1
Char. 230: 12 → 0
Char. 249: 1 → 0
Char. 254: 0 → 1

Dorsetochelys delairi:
All trees:
Char. 77: 0 → 1
Some trees:
Char. 38: 1 → 0

Dracochelys bicuspis:
All trees:
Char. 38: 0 → 1
Char. 70: 0 → 1
Char. 77: 1 → 0
Char. 225: 0 → 1
Char. 226: 0 → 1

Echmatemys wyomingensis:
Some trees:
Char. 145: 1 → 0

Eileanchelys waldmani:
All trees:
Char. 228: 0 → 1

Elseya dentata:
All trees:
Char. 38: 0 → 2

Emarginachelys cretacea:
Some trees:
Char. 109: 0 → 1
Char. 114: 0 → 12
Char. 131: 0 → 1
Char. 212: 0 → 1
Char. 231: 1 → 0
Char. 232: 0 → 1
Char. 254: 0 → 1

Emys orbicularis:
All trees:
Char. 9: 1 → 0
Char. 58: 1 → 0
Char. 133: 0 → 1
Char. 137: 1 → 0

Erymnochelys madagascariensis:
All trees:
Char. 145: 1 → 0
Char. 157: 0 → 1

Eurotestudo hermanni:
All trees:
Char. 147: 1 → 0

Geoclemys hamiltonii:
All trees:
Char. 9: 1 → 0
Char. 20: 0 → 1
Char. 64: 0 → 1
Char. 109: 0 → 1
Char. 119: 0 → 1
Char. 142: 1 → 0

Glyptops plicatulus:
All trees:
Char. 35: 0 → 1
Some trees:
Char. 38: 0 → 1
Char. 74: 1 → 2
Char. 230: 0 → 1

Gopherus polyphemus:
All trees:
Char. 199: 1 → 0

Hangaiemys hoburensis:
Some trees:
Char. 64: 1 → 0
Char. 84: 1 → 0
Char. 230: 1 → 0

Heckerochelys romani:
All trees:
Char. 137: 0 → 1
Char. 138: 1 → 0
Char. 141: 0 → 1

Helochelydra nopcsai:
All trees:
Char. 22: 0 → 1
Char. 67: 0 → 1

Hoplochelys crassa:
All trees:
Char. 142: 1 → 0
Char. 145: 1 → 0
Some trees:
Char. 109: 1 → 2

Indochelys spatulata:
Some trees:
Char. 136: 1 → 0
Char. 223: 0 → 1

Judithemys sukhanovi:
Some trees:
Char. 192: 0 → 1
Char. 228: 1 → 0
Char. 230: 1 → 0

Kallokibotion bajazidi:
All trees:
Char. 31: 1 → 0
Char. 38: 01 → 2
Char. 41: 0 → 1
Char. 71: 0 → 1
Char. 116: 0 → 1
Char. 125: 1 → 0
Char. 149: 0 → 1
Char. 171: 0 → 1
Char. 203: 1 → 0
Char. 254: 01 → 0
Char. 255: 2 → 1
Some trees:
Char. 6: 1 → 0

Kayentachelys aprix:
All trees:
Char. 2: 0 → 1
Char. 107: 0 → 1
Char. 124: 2 → 1
Some trees:
Char. 55: 1 → 0

Kinosternon flavescens:
All trees:
Char. 119: 1 → 0
Char. 134: 0 → 1
Char. 207: 0 → 1
Char. 244: 1 → 2

***Liaochelys jianchangensis*:**
All trees:
Char. 121: 0 → 1
Char. 225: 0 → 1
Char. 226: 0 → 1

***Lissemys punctata*:**
All trees:
Char. 63: 1 → 0
Char. 144: 0 → 1
Some trees:
Char. 84: 1 → 0
Char. 85: 1 → 0

***Macroclemys schmidti*:**
All trees:
Char. 50: 2 → 4

***Macroclemys temminckii*:**
All trees:
Char. 124: 2 → 1
Char. 126: 2 → 1
Char. 190: 1 → 2
Char. 207: 1 → 0

***Manchurochelys manchoukuoensis*:**
All trees:
Char. 230: 1 → 0

***Meiolania platyceps*:**
All trees:
Char. 93: 0 → 1

***Mesodermochelys undulatus*:**
All trees:
Char. 171: 1 → 0
Char. 233: 1 → 0

***Mongolemys elegans*:**
All trees:
Char. 70: 1 → 0
Char. 192: 01 → 0
Some trees:
Char. 24: 1 → 0
Char. 62: 1 → 0
Char. 71: 01 → 0
Char. 145: 1 → 0
Char. 148: 1 → 0
Char. 237: 3 → 1

***Mongolochelys efremovi*:**
All trees:
Char. 25: 0 → 1
Char. 26: 0 → 1
Char. 38: 1 → 2
Char. 71: 0 → 1
Char. 98: 0 → 1
Some trees:
Char. 117: 1 → 0

***Myuchelys latisternum*:**
All trees:
Char. 77: 0 → 1
Char. 148: 0 → 1
Char. 256: 2 → 1

***Naomichelys speciosa*:**
All trees:
No autapomorphies

***Neurankylus eximius*:**
Some trees:
Char. 130: 0 → 1

***Ninjemys oweni*:**
All trees:
Char. 94: 1 → 0

***Niolamia argentina*:**
All trees:
Char. 91: 1 → 0
Char. 99: 1 → 0
Char. 102: 0 → 1

***Notoemys laticentralis*:**
Some trees:
Char. 124: 1 → 2

***Ordosemys leios*:**
All trees:
Char. 52: 0 → 1
Char. 229: 1 → 0

***Otwayemys cunicularius*:**
Some trees:
Char. 146: 0 → 2
Char. 148: 01 → 2
Char. 156: 1 → 0
Char. 163: 0 → 1
Char. 169: 1 → 0
Char. 184: 02 → 1

***Owenetta kitchingorum*:**
All trees:
Char. 3: 0 → 1

***Palaeochersis talampayensis*:**
All trees:
Char. 38: 1 → 0

***Patagoniaemys gasparinae*:**
Some trees:
Char. 169: 0 → 1
Char. 184: 0 → 1
Char. 191: 2 → 1

***Peligrochelys*:**
Some trees:
Char. 87: 0 → 1

***Pelodiscus sinensis*:**
All trees:
Char. 62: 1 → 0

***Pelomedusa subrufa*:**
All trees:
No autapomorphies

***Phrynops geoffroanus*:**
All trees:
Char. 228: 0 → 1

***Plastomenus* aff. *thomassii*:**
Some trees:
Char. 84: 1 → 0
Char. 132: 1 → 0

***Platychelys oberndorferi*:**
All trees:
Char. 119: 0 → 1
Char. 126: 2 → 1
Char. 209: 1 → 0

***Platysternon megacephalum*:**
All trees:
Char. 18: 12 → 0
Char. 22: 0 → 1
Char. 76: 0 → 1
Char. 119: 0 → 1
Char. 148: 1 → 2
Char. 149: 0 → 1
Char. 170: 1 → 0
Char. 176: 0 → 1
Some trees:
Char. 199: 1 → 0
Char. 232: 1 → 0

***Plesiobaena antiqua*:**
Some trees:
Char. 172: 0 → 1

***Plesiochelys etalloni*:**
Some trees:
Char. 60: 0 → 1
Char. 64: 1 → 0
Char. 125: 1 → 2

***Pleurosternon bullockii*:**
All trees:
Char. 124: 2 → 1
Char. 125: 1 → 0
Char. 153: 0 → 1
Some trees:
Char. 38: 1 → 0

***Podocnemis expansa*:**
All trees:
Char. 36: 0 → 1
Char. 39: 0 → 1
Char. 62: 0 → 1

***Portlandemys mcdowelli*:**
All trees:
No autapomorphies

***Prochelidella cerrobarcinae*:**
Some trees:
Char. 254: 0 → 1

***Proganochelys quenstedti*:**
All trees:
Char. 7: 1 → 0
Char. 126: 1 → 0
Char. 127: 1 → 0
Char. 138: 1 → 0
Char. 157: 0 → 1
Char. 188: 1 → 0
Char. 219: 1 → 0
Char. 251: 0 → 1

***Protochelydra zangerli*:**
All trees:
Char. 35: 1 → 0

***Shachemys laosiana*:**
All trees:
Char. 121: 0 → 2
Char. 125: 1 → 0
Char. 128: 1 → 0
Some trees:
Char. 71: 0 → 1
Char. 154: 1 → 0

***Siamochelys peninsularis*:**
Some trees:
Char. 111: 0 → 1
Char. 124: 1 → 2
Char. 145: 01 → 1
Char. 148: 01 → 1
Char. 230: 01 → 12
Char. 254: 01 → 1

***Sichuanchelys chowi*:**
All trees:
Char. 124: 2 → 3
Char. 132: 1 → 0

***Sichuanchelys palatodentata*:**
All trees:
Char. 7: 1 → 0
Char. 55: 1 → 0
Char. 94: 1 → 0
Char. 199: 0 → 1
Some trees:
Char. 88: 0 → 1
Char. 189: 1 → 0
Char. 236: 1 → 0

***Sinemys brevispinus*:**
Some trees:
Char. 200: 0 → 1
Char. 222: 0 → 1
Char. 254: 0 → 1

***Sinemys gamera*:**
All trees:
No autapomorphies

***Sinemys lens*:**
All trees:
No autapomorphies

***Solnhofia parsonsi*:**
All trees:
Char. 37: 0 → 1
Char. 234: 0 → 1
Some trees:
Char. 13: 1 → 0
Char. 41: 0 → 1
Char. 63: 1 → 0
Char. 124: 12 → 3
Char. 231: 01 → 1
Char. 254: 01 → 1

***Sphenodon punctatus*:**
All trees:
Char. 4: 0 → 1
Char. 28: 0 → 1
Char. 30: 0 → 1
Char. 55: 0 → 1
Char. 76: 0 → 1
Char. 251: 0 → 1

***Spoochelys ormondea*:**
All trees:
Char. 126: 2 → 01
Some trees:
Char. 99: 1 → 0
Char. 169: 1 → 0

***Staurotypus triporcatus*:**
Some trees:
Char. 20: 0 → 1
Char. 109: 1 → 2
Char. 205: 1 → 0
Char. 232: 0 → 1
Char. 254: 1 → 0

***Sternotherus odoratus*:**
Some trees:
Char. 232: 0 → 1

***Stylemys nebraskensis*:**
All trees:
Char. 147: 1 → 2
Char. 204: 0 → 1
Char. 207: 1 → 0

***Thalassemys moseri*:**
All trees:
Char. 71: 0 → 1
Some trees:
Char. 3: 1 → 0
Char. 6: 01 → 1
Char. 15: 0 → 1
Char. 38: 01 → 1
Char. 41: 0 → 1
Char. 60: 0 → 1
Char. 66: 1 → 0
Char. 74: 1 → 2
Char. 184: 0 → 1

***Toxochelys latiremis*:**
All trees:
Char. 164: 0 → 1

***Trachemys scripta*:**
All trees:
Char. 11: 1 → 0
Char. 39: 0 → 1
Char. 123: 0 → 1
Char. 162: 1 → 0

***Trinitichelys hiatti*:**
All trees:
No autapomorphies

***Warkalania carinaminor*:**
All trees:
No autapomorphies

***Xenochelys formosa*:**
All trees:
Char. 60: 0 → 2
Char. 115: 0 → 1
Char. 149: 0 → 1
Char. 230: 0 → 1

***Xiaochelys ningchengensis*:**
All trees:
No autapomorphies

***Xinjiangchelys junggarensis*:**
All trees:
No autapomorphies

***Xinjiangchelys radiplicatoides*:**
All trees:
No autapomorphies

***Xinjiangchelys wusu*:**
Some trees:
Char. 152: 1 → 0

***Yaminuechelys maior*:**
All trees:
Char. 115: 1 → 0
Char. 132: 0 → 1
Char. 230: 01 → 2
Some trees:
Char. 25: 0 → 1
Char. 111: 0 → 1
Char. 131: 0 → 1
Char. 146: 12 → 1
Char. 209: 1 → 0

***Yehguia tatsuensis*:**
Some trees:
Char. 160: 1 → 0

Char. 228: 0 → 1
Char. 254: 01 → 0

Node 119:
All trees:
Char. 70: 1 → 0
Char. 207: 1 → 0
Char. 255: 0 → 1

Node 120:
All trees:
Char. 11: 2 → 0
Char. 252: 0 → 1

Node 121:
All trees:
No synapomorphies

Node 122:
All trees:
Char. 256: 1 → 0

Node 123:
All trees:
Char. 229: 0 → 1
Char. 249: 1 → 0

Node 124:
All trees:
Char. 110: 0 → 1

Node 125:
All trees:
Char. 9: 1 → 0
Char. 252: 1 → 2

Node 126:
All trees:
Char. 230: 0 → 2
Some trees:
Char. 87: 0 → 1
Char. 129: 0 → 1

Node 127:
All trees:
Char. 9: 1 → 0
Char. 172: 0 → 1
Some trees:
Char. 119: 1 → 0

Node 128:
All trees:
Char. 230: 12 → 0

Node 129:
All trees:
Char. 75: 1 → 2
Char. 83: 0 → 1
Char. 136: 0 → 1
Some trees:
Char. 49: 1 → 2

Node 130:
All trees:
Char. 47: 1 → 2
Char. 50: 0 → 1
Char. 75: 0 → 1
Char. 77: 0 → 1
Char. 119: 0 → 1
Char. 196: 0 → 1
Char. 214: 0 → 1
Some trees:
Char. 6: 0 → 1
Char. 8: 0 → 1
Char. 9: 0 → 1
Char. 31: 0 → 1
Char. 40: 0 → 1
Char. 49: 0 → 1
Char. 131: 0 → 1
Char. 156: 0 → 1
Char. 208: 0 → 1
Char. 250: 2 → 3

Node 131:
All trees:
Char. 42: 0 → 1
Char. 46: 0 → 1
Char. 47: 0 → 1
Char. 56: 0 → 1
Char. 72: 0 → 1
Char. 74: 0 → 1
Char. 245: 1 → 2
Char. 256: 1 → 2
Some trees:
Char. 55: 0 → 1

Node 132:
All trees:
Char. 226: 1 → 0
Char. 244: 0 → 1
Char. 245: 0 → 1
Char. 248: 0 → 1
Char. 255: 1 → 2

Node 133:
All trees:
Char. 130: 0 → 1
Some trees:
Char. 18: 1 → 2
Char. 58: 1 → 0
Char. 152: 0 → 1
Char. 186: 1 → 0

Node 134:
All trees:
Char. 108: 0 → 1
Char. 118: 1 → 2
Char. 151: 0 → 1
Char. 244: 1 → 2
Some trees:
Char. 5: 0 → 1
Char. 32: 0 → 1
Char. 33: 0 → 2
Char. 41: 0 → 1
Char. 43: 0 → 1
Char. 61: 0 → 1
Char. 121: 0 → 1
Char. 131: 0 → 1
Char. 145: 01 → 2
Char. 170: 1 → 0
Char. 205: 1 → 0
Char. 206: 0 → 1
Char. 213: 1 → 0
Char. 217: 0 → 12
Char. 234: 0 → 1

Node 135:
All trees:
Char. 20: 0 → 1
Char. 108: 1 → 2
Char. 118: 2 → 3
Some trees:
Char. 34: 0 → 1
Char. 36: 0 → 1
Char. 132: 0 → 1
Char. 139: 0 → 1
Char. 173: 1 → 2
Char. 200: 0 → 1
Char. 221: 0 → 1
Char. 222: 0 → 1

Node 136:
All trees:
Char. 82: 0 → 1
Char. 121: 0 → 1
Some trees:
Char. 115: 0 → 1
Char. 128: 0 → 1
Char. 169: 1 → 0
Char. 205: 1 → 0

Node 137:
All trees:
Char. 46: 2 → 3
Char. 51: 1 → 0
Char. 58: 1 → 0
Char. 74: 12 → 0
Char. 153: 0 → 1
Char. 165: 0 → 1
Char. 204: 0 → 1
Char. 236: 1 → 0
Some trees:
Char. 149: 0 → 1
Char. 154: 1 → 0
Char. 172: 0 → 1
Char. 187: 1 → 0
Char. 235: 1 → 0

Node 138:
All trees:
Char. 14: 0 → 1
Char. 73: 0 → 1

Node 139:
All trees:
Char. 125: 1 → 2
Char. 189: 0 → 1
Char. 256: 2 → 0
Some trees:
Char. 38: 0 → 1

Node 140:
All trees:
Char. 6: 1 → 2
Char. 157: 0 → 1
Some trees:
Char. 164: 0 → 1

Node 141:
All trees:
Char. 54: 1 → 2
Char. 128: 01 → 1
Some trees:
Char. 18: 0 → 1
Char. 70: 01 → 1
Char. 184: 0 → 1
Char. 254: 01 → 0

Node 142:
All trees:
Char. 38: 0 → 2
Char. 81: 01 → 2
Char. 143: 0 → 1
Some trees:
Char. 16: 1 → 0

Node 143:
All trees:
Char. 33: 0 → 1
Char. 37: 0 → 1
Char. 43: 0 → 1
Char. 187: 0 → 1

Node 144:
All trees:
Char. 18: 1 → 0
Char. 49: 2 → 1
Char. 60: 0 → 2
Char. 76: 0 → 1
Char. 192: 0 → 1
Char. 216: 1 → 2

Node 145:
All trees:
Char. 28: 0 → 1
Char. 113: 1 → 2
Char. 122: 0 → 1
Char. 150: 0 → 1
Char. 216: 0 → 1
Some trees:
Char. 132: 0 → 1
Char. 141: 0 → 1
Char. 231: 01 → 1
Char. 232: 0 → 1

Node 146:
All trees:
Char. 148: 0 → 1
Char. 210: 1 → 0

Node 147:
All trees:
Char. 117: 1 → 0
Char. 129: 1 → 0
Char. 222: 0 → 1
Some trees:
Char. 115: 1 → 0
Char. 128: 01 → 0
Char. 132: 0 → 1
Char. 146: 2 → 1
Char. 254: 0 → 1

Node 148:
All trees:
Char. 10: 0 → 1
Char. 11: 0 → 1
Char. 53: 0 → 1
Char. 120: 0 → 1
Char. 121: 1 → 2
Char. 147: 1 → 0
Char. 200: 0 → 1
Some trees:
Char. 111: 0 → 1

Node 149:
All trees:
Char. 117: 1 → 0
Char. 148: 0 → 1

Node 150:
All trees:
Char. 125: 1 → 0

Node 151:
All trees:
Char. 71: 1 → 0

Node 152:
All trees:
Char. 123: 0 → 1
Char. 142: 1 → 0
Char. 145: 1 → 0
Char. 220: 0 → 1

Node 153:
All trees:
Char. 215: 1 → 0

Node 154:
All trees:
Char. 38: 0 → 2
Char. 148: 1 → 0
Char. 160: 1 → 0

Node 155:
All trees:
Char. 162: 0 → 1
Some trees:
Char. 145: 0 → 1

Node 156:
All trees:
Char. 166: 0 → 1
Some trees:
Char. 254: 01 → 1

Node 157:
All trees:
Char. 132: 0 → 1
Char. 222: 0 → 1
Char. 256: 2 → 1

Node 158:
All trees:
Char. 163: 0 → 1
Char. 164: 0 → 1
Some trees:
Char. 141: 0 → 1

Node 159:
All trees:
Char. 9: 1 → 0
Char. 35: 0 → 1
Char. 117: 1 → 0
Char. 234: 0 → 1
Some trees:
Char. 50: 1 → 2
Char. 191: 12 → 2
Char. 231: 01 → 0

Node 160:
All trees:
Char. 177: 0 → 1

Node 161:
All trees:
Char. 6: 1 → 0
Char. 66: 0 → 1

Node 162:
All trees:
Char. 108: 0 → 1
Char. 151: 0 → 1
Char. 181: 1 → 0
Char. 205: 0 → 1

Node 163:
All trees:
Char. 125: 1 → 0
Char. 223: 0 → 1
Char. 227: 0 → 1
Char. 228: 1 → 0
Char. 230: 1 → 2
Char. 234: 0 → 1

Node 164:
All trees:
Char. 174: 1 → 0

Node 165:
Some trees:
Char. 11: 0 → 1
Char. 18: 01 → 2
Char. 132: 0 → 1

Node 166:
All trees:

Char. 18: 12 → 0
Char. 120: 0 → 1
Char. 121: 1 → 2
Char. 145: 1 → 0

Node 167:
All trees:
Char. 18: 12 → 0
Char. 65: 0 → 1
Char. 160: 0 → 1

Node 168:
All trees:
Char. 38: 0 → 2
Some trees:
Char. 119: 0 → 1
Char. 146: 12 → 1
Char. 254: 0 → 1

Node 169:
All trees:
Char. 61: 0 → 1

Some trees:
Char. 1: 0 → 1
Char. 56: 2 → 1
Char. 130: 0 → 1

Node 170:
All trees:
Char. 74: 1 → 0
Char. 83: 1 → 0
Char. 241: 0 → 1
Char. 242: 0 → 1
Char. 243: 0 → 1
Some trees:
Char. 111: 0 → 1

Node 171:
All trees:
Char. 120: 0 → 1
Char. 140: 0 → 1
Char. 158: 0 → 1
Char. 159: 0 → 1

Node 172:
All trees:
Char. 118: 1 → 2
Char. 145: 01 → 2
Some trees:
Char. 9: 1 → 0
Char. 16: 01 → 1
Char. 22: 0 → 1
Char. 121: 0 → 1
Char. 163: 01 → 2
Char. 166: 0 → 1
Char. 185: 0 → 1
Char. 211: 0 → 1

Node 173:
All trees:
Char. 128: 1 → 0
Char. 222: 0 → 1

Node 174:
All trees:
Char. 254: 0 → 1

Node 175:
All trees:
Char. 98: 0 → 1

Node 176:
All trees:
Char. 38: 1 → 2
Char. 90: 0 → 1
Char. 104: 0 → 1

Node 177:
All trees:
Char. 26: 1 → 2
Char. 57: 2 → 1
Char. 58: 0 → 1
Char. 103: 0 → 1

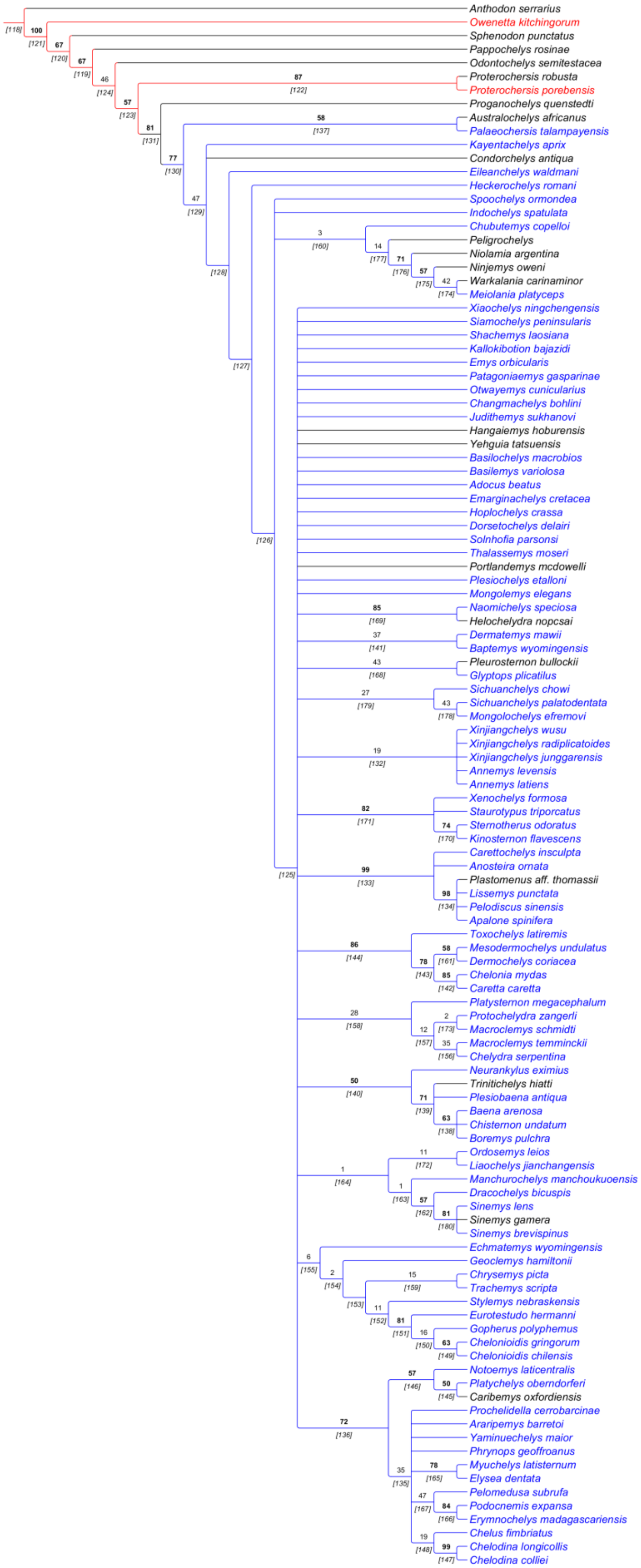
Node 178:
All trees:
Char. 56: 1 → 2

Node 179:
All trees:
Char. 222: 0 → 1
Char. 254: 1 → 0

Node 180:
All trees:
Char. 141: 0 → 1
Char. 155: 0 → 1
Char. 230: 2 → 3

Node 181:
All trees:
Char. 58: 1 → 0
Char. 64: 1 → 0
Some trees:
Char. 48: 0 → 1
Char. 141: 1 → 0

ANALYSIS 4 – NO *CHINLECHELYS TENERTESTA*



Tree 4. Analysis 4 (TBR, no *Chinlechelys tenertesta*), strict consensus tree. Node numbers below the branches, Jackknife values above the branches (support of at least 50 in bold). Character 247 (cleithrum/nuchal bone) is mapped using the Character mapping tool of TNT – "0" (paired) is red, "1" (fused in early development into a single nuchal plate) is blue, "?" is black.

Synapomorphies – analysis 4 (no *Chinlechelys tenertesta*)

Pappochelys rosinae:
All trees:
Char. 36: 0 → 1
Char. 40: 0 → 1

Proterochersis porebensis:
All trees:
No autapomorphies

Proterochersis robusta:
All trees:
No autapomorphies

Odontochelys semitestacea:
All trees:
Char. 169: 1 → 0
Char. 221: 0 → 1

Adocus beatus:
All trees:
Char. 162: 0 → 1
Some trees:
Char. 212: 0 → 1

Annemys latiens:
Some trees:
Char. 230: 1 → 2

Annemys levensis:
All trees:
Char. 121: 0 → 1
Char. 129: 1 → 0
Some trees:
Char. 230: 1 → 2

Anosteira ornata:
All trees:
Char. 230: 0 → 1
Char. 254: 0 → 1

Anthodon serrarius:
All trees:
No autapomorphies

Apalone spinifera:
All trees:
Char. 38: 0 → 1
Some trees:
Char. 212: 1 → 0

Araripemys barretoi:
All trees:
Char. 109: 0 → 2
Char. 111: 0 → 1
Char. 122: 0 → 1
Char. 132: 0 → 1
Char. 139: 0 → 1
Char. 141: 0 → 1
Char. 154: 0 → 1
Char. 163: 0 → 1
Char. 222: 0 → 1
Char. 223: 0 → 1
Char. 227: 0 → 1
Char. 230: 01 → 3
Char. 232: 0 → 1
Some trees:
Char. 20: 0 → 1
Char. 61: 0 → 1
Char. 107: 0 → 1
Char. 131: 0 → 1
Char. 146: 1 → 2
Char. 147: 1 → 0
Char. 148: 0 → 1
Char. 183: 0 → 1
Char. 254: 1 → 0

Australochelys africanus:
All trees:
No autapomorphies

Baena arenosa:
All trees:
Char. 18: 1 → 0
Char. 89: 1 → 0
Char. 115: 0 → 1
Char. 146: 0 → 1
Some trees:
Char. 124: 2 → 1
Char. 191: 1 → 2

Baptemys wyomingensis:
All trees:
Char. 147: 0 → 1
Some trees:
Char. 160: 0 → 1
Char. 211: 0 → 1

Basilemys variolosa:
All trees:
Char. 157: 0 → 1
Char. 166: 0 → 1
Char. 230: 0 → 2
Some trees:
Char. 215: 1 → 0

Basilochelys macrobios:
Some trees:
Char. 16: 1 → 0
Char. 56: 2 → 1
Char. 58: 1 → 0
Char. 70: 1 → 0
Char. 77: 0 → 1
Char. 184: 2 → 0
Char. 228: 0 → 1
Char. 254: 0 → 1

Boremys pulchra:
Some trees:
Char. 11: 0 → 1
Char. 191: 12 → 1

Caretta caretta:
All trees:
Char. 52: 0 → 1
Char. 118: 1 → 0

Carettochelys insculpta:
All trees:
Char. 22: 0 → 1
Some trees:
Char. 201: 0 → 1

Caribemys oxfordiensis:
All trees:
Char. 207: 1 → 0

Changmachelys bohlini:
All trees:
No autapomorphies

Chelodina colliei:
All trees:
No autapomorphies

Chelodina longicollis:
All trees:
No autapomorphies

Chelonia mydas:
All trees:
Char. 35: 0 → 1
Char. 38: 01 → 2

Chelonoidis chilensis:
All trees:
Char. 129: 1 → 0

Chelonoidis gringorum:
All trees:
Char. 126: 2 → 0

Chelus fimbriatus:
All trees:
Char. 0: 0 → 1
Char. 5: 1 → 0
Char. 32: 0 → 1
Char. 36: 1 → 0
Char. 43: 1 → 0
Char. 109: 0 → 2
Char. 121: 1 → 0
Char. 122: 0 → 1
Char. 150: 0 → 1
Char. 156: 1 → 0
Char. 157: 0 → 1
Char. 160: 0 → 1
Char. 170: 0 → 1
Char. 171: 0 → 1
Char. 254: 0 → 1
Char. 256: 2 → 01

Chelydra serpentina:
All trees:
Char. 124: 2 → 3
Char. 230: 12 → 0

Chisternon undatum:
Some trees:
Char. 172: 0 → 1

Chrysemys picta:
All trees:
Char. 58: 1 → 0

Chubutemys copelloi:
All trees:
Char. 41: 0 → 1

Condorchelys antiqua:
All trees:
No autapomorphies

Dermatemys mawii:
All trees:
Char. 121: 0 → 1
Char. 149: 0 → 1
Char. 158: 0 → 1
Char. 174: 1 → 0
Char. 255: 2 → 1
Some trees:
Char. 109: 1 → 0
Char. 160: 01 → 0

Dermochelys coriacea:
All trees:
Char. 108: 1 → 2
Char. 118: 1 → 3
Char. 197: 0 → 1
Char. 230: 12 → 0
Char. 249: 1 → 0
Char. 254: 0 → 1

Dorsetochelys delairi:
All trees:
Char. 77: 0 → 1
Some trees:
Char. 38: 1 → 0

Dracochelys bicuspis:
All trees:
Char. 38: 0 → 1
Char. 70: 0 → 1
Char. 77: 1 → 0
Char. 225: 0 → 1
Char. 226: 0 → 1

Echmatemys wyomingensis:
Some trees:
Char. 145: 1 → 0

Eileanchelys waldmani:
All trees:
Char. 228: 0 → 1

Elseya dentata:
All trees:
Char. 38: 0 → 2

Emarginachelys cretacea:
Some trees:
Char. 109: 0 → 1
Char. 114: 0 → 12
Char. 131: 0 → 1
Char. 212: 0 → 1
Char. 231: 1 → 0
Char. 232: 0 → 1
Char. 254: 0 → 1

Emys orbicularis:
All trees:
Char. 9: 1 → 0
Char. 58: 1 → 0
Char. 133: 0 → 1
Char. 137: 1 → 0

Erymnochelys madagascariensis:
All trees:
Char. 145: 1 → 0
Char. 157: 0 → 1

Eurotestudo hermanni:
All trees:
Char. 147: 1 → 0

Geoclemys hamiltonii:
All trees:
Char. 9: 1 → 0
Char. 20: 0 → 1
Char. 64: 0 → 1
Char. 109: 0 → 1
Char. 119: 0 → 1
Char. 142: 1 → 0

Glyptops plicatulus:
All trees:
Char. 35: 0 → 1
Some trees:
Char. 38: 0 → 1
Char. 74: 1 → 2
Char. 230: 0 → 1

Gopherus polyphemus:
All trees:
Char. 199: 1 → 0

Hangaiemys hoburensis:
Some trees:
Char. 64: 1 → 0
Char. 84: 1 → 0
Char. 230: 1 → 0

Heckerochelys romani:
All trees:
Char. 137: 0 → 1
Char. 138: 1 → 0
Char. 141: 0 → 1

Helochelydra nopcsai:
All trees:
Char. 22: 0 → 1
Char. 67: 0 → 1

Hoplochelys crassa:
All trees:
Char. 142: 1 → 0
Char. 145: 1 → 0
Some trees:
Char. 109: 1 → 2

Indochelys spatulata:
Some trees:
Char. 136: 1 → 0
Char. 223: 0 → 1

Judithemys sukhanovi:
Some trees:
Char. 192: 0 → 1
Char. 228: 1 → 0
Char. 230: 1 → 0

Kallokibotion bajazidi:
All trees:
Char. 31: 1 → 0
Char. 38: 01 → 2
Char. 41: 0 → 1
Char. 71: 0 → 1
Char. 116: 0 → 1
Char. 125: 1 → 0
Char. 149: 0 → 1
Char. 171: 0 → 1
Char. 203: 1 → 0
Char. 254: 01 → 0
Char. 255: 2 → 1
Some trees:
Char. 6: 1 → 0

Kayentachelys aprix:
All trees:
Char. 2: 0 → 1
Char. 107: 0 → 1
Char. 124: 2 → 1
Some trees:
Char. 55: 1 → 0

Kinosternon flavescens:
All trees:
Char. 119: 1 → 0
Char. 134: 0 → 1
Char. 207: 0 → 1
Char. 244: 1 → 2

Liaochelys jianchangensis:
All trees:
Char. 121: 0 → 1
Char. 225: 0 → 1
Char. 226: 0 → 1

***Lissemys punctata*:**
All trees:
Char. 63: 1 → 0
Char. 144: 0 → 1
Some trees:
Char. 84: 1 → 0
Char. 85: 1 → 0

***Macroclemys schmidti*:**
All trees:
Char. 50: 2 → 4

***Macroclemys temminckii*:**
All trees:
Char. 124: 2 → 1
Char. 126: 2 → 1
Char. 190: 1 → 2
Char. 207: 1 → 0

***Manchurochelys manchoukuoensis*:**
All trees:
Char. 230: 1 → 0

***Meiolania platyceps*:**
All trees:
Char. 93: 0 → 1

***Mesodermochelys undulatus*:**
All trees:
Char. 171: 1 → 0
Char. 233: 1 → 0

***Mongolemys elegans*:**
All trees:
Char. 70: 1 → 0
Char. 192: 01 → 0
Some trees:
Char. 24: 1 → 0
Char. 62: 1 → 0
Char. 71: 01 → 0
Char. 145: 1 → 0
Char. 148: 1 → 0
Char. 237: 3 → 1

***Mongolochelys efremovi*:**
All trees:
Char. 25: 0 → 1
Char. 26: 0 → 1
Char. 38: 1 → 2
Char. 71: 0 → 1
Char. 98: 0 → 1
Some trees:
Char. 117: 1 → 0

***Myuchelys latisternum*:**
All trees:
Char. 77: 0 → 1
Char. 148: 0 → 1
Char. 256: 2 → 1

***Naomichelys speciosa*:**
All trees:
No autapomorphies

***Neurankylus eximius*:**
Some trees:
Char. 130: 0 → 1

***Ninjemys oweni*:**
All trees:
Char. 94: 1 → 0

***Niolamia argentina*:**
All trees:
Char. 91: 1 → 0
Char. 99: 1 → 0
Char. 102: 0 → 1

***Notoemys laticentralis*:**
Some trees:
Char. 124: 1 → 2

***Ordosemys leios*:**
All trees:
Char. 52: 0 → 1
Char. 229: 1 → 0

***Otwayemys cunicularius*:**
Some trees:
Char. 146: 0 → 2
Char. 148: 01 → 2
Char. 156: 1 → 0
Char. 163: 0 → 1
Char. 169: 1 → 0
Char. 184: 02 → 1

***Owenetta kitchingorum*:**
All trees:
Char. 3: 0 → 1

***Palaeochersis talampayensis*:**
All trees:
Char. 38: 1 → 0

***Patagoniaemys gasparinae*:**
Some trees:
Char. 169: 0 → 1
Char. 184: 0 → 1
Char. 191: 2 → 1

***Peligrochelys*:**
Some trees:
Char. 87: 0 → 1

***Pelodiscus sinensis*:**
All trees:
Char. 62: 1 → 0

***Pelomedusa subrufa*:**
All trees:
No autapomorphies

***Phrynops geoffroanus*:**
All trees:
Char. 228: 0 → 1

***Plastomenus* aff. *thomassii*:**
Some trees:
Char. 84: 1 → 0
Char. 132: 1 → 0

***Platychelys oberndorferi*:**
All trees:
Char. 119: 0 → 1
Char. 126: 2 → 1
Char. 209: 1 → 0

***Platysternon megacephalum*:**
All trees:
Char. 18: 12 → 0
Char. 22: 0 → 1
Char. 76: 0 → 1
Char. 119: 0 → 1
Char. 148: 1 → 2
Char. 149: 0 → 1
Char. 170: 1 → 0
Char. 176: 0 → 1
Some trees:
Char. 199: 1 → 0
Char. 232: 1 → 0

***Plesiobaena antiqua*:**
Some trees:
Char. 172: 0 → 1

***Plesiochelys etalloni*:**
Some trees:
Char. 60: 0 → 1
Char. 64: 1 → 0
Char. 125: 1 → 2

***Pleurosternon bullockii*:**
All trees:
Char. 124: 2 → 1
Char. 125: 1 → 0
Char. 153: 0 → 1
Some trees:
Char. 38: 1 → 0

***Podocnemis expansa*:**
All trees:
Char. 36: 0 → 1
Char. 39: 0 → 1
Char. 62: 0 → 1

***Portlandemys mcdowelli*:**
All trees:
No autapomorphies

***Prochelidella cerrobarcinae*:**
Some trees:
Char. 254: 0 → 1

***Proganochelys quenstedti*:**
All trees:
Char. 7: 1 → 0
Char. 126: 1 → 0
Char. 127: 1 → 0
Char. 138: 1 → 0
Char. 157: 0 → 1
Char. 188: 1 → 0
Char. 219: 1 → 0
Char. 251: 0 → 1

***Protochelydra zangerli*:**
All trees:
Char. 35: 1 → 0

***Shachemys laosiana*:**
All trees:
Char. 121: 01 → 2
Char. 125: 1 → 0
Char. 128: 1 → 0
Some trees:
Char. 71: 0 → 1
Char. 154: 1 → 0

***Siamochelys peninsularis*:**
Some trees:
Char. 111: 0 → 1
Char. 124: 1 → 2
Char. 145: 01 → 1
Char. 148: 01 → 1
Char. 230: 01 → 12
Char. 254: 01 → 1

***Sichuanchelys chowi*:**
All trees:
Char. 124: 2 → 3
Char. 132: 1 → 0

***Sichuanchelys palatodentata*:**
All trees:
Char. 7: 1 → 0
Char. 55: 1 → 0
Char. 94: 1 → 0
Char. 199: 0 → 1
Some trees:
Char. 88: 0 → 1
Char. 189: 1 → 0
Char. 236: 1 → 0

***Sinemys brevispinus*:**
Some trees:
Char. 200: 0 → 1
Char. 222: 0 → 1
Char. 254: 0 → 1

***Sinemys gamera*:**
All trees:
No autapomorphies

***Sinemys lens*:**
All trees:
No autapomorphies

***Solnhofia parsonsi*:**
All trees:
Char. 37: 0 → 1
Char. 234: 0 → 1
Some trees:
Char. 13: 1 → 0
Char. 41: 0 → 1
Char. 63: 1 → 0
Char. 124: 12 → 3
Char. 231: 01 → 1
Char. 254: 01 → 1

***Sphenodon punctatus*:**
All trees:
Char. 4: 0 → 1
Char. 28: 0 → 1
Char. 30: 0 → 1
Char. 55: 0 → 1
Char. 76: 0 → 1
Char. 251: 0 → 1

***Spoochelys ormondea*:**
All trees:
Char. 126: 2 → 01
Some trees:
Char. 99: 1 → 0
Char. 169: 1 → 0

***Staurotypus triporcatus*:**
Some trees:
Char. 20: 0 → 1
Char. 109: 1 → 2
Char. 205: 1 → 0
Char. 232: 0 → 1
Char. 254: 1 → 0

***Sternotherus odoratus*:**
Some trees:
Char. 232: 0 → 1

***Stylemys nebraskensis*:**
All trees:
Char. 147: 1 → 2
Char. 204: 0 → 1
Char. 207: 1 → 0

***Thalassemys moseri*:**
All trees:
Char. 71: 0 → 1
Some trees:
Char. 3: 1 → 0
Char. 6: 01 → 1
Char. 15: 0 → 1
Char. 38: 01 → 1
Char. 41: 0 → 1
Char. 60: 0 → 1
Char. 66: 1 → 0
Char. 74: 1 → 2
Char. 184: 0 → 1

***Toxochelys latiremis*:**
All trees:
Char. 164: 0 → 1

***Trachemys scripta*:**
All trees:
Char. 11: 1 → 0
Char. 39: 0 → 1
Char. 123: 0 → 1
Char. 162: 1 → 0

***Trinitichelys hiatti*:**
All trees:
No autapomorphies

***Warkalania carinaminor*:**
All trees:
No autapomorphies

***Xenochelys formosa*:**
All trees:
Char. 60: 0 → 2
Char. 115: 0 → 1
Char. 149: 0 → 1
Char. 230: 0 → 1

***Xiaochelys ningchengensis*:**
All trees:
No autapomorphies

***Xinjiangchelys junggarensis*:**
All trees:
No autapomorphies

***Xinjiangchelys radiplicatoides*:**
All trees:
No autapomorphies

***Xinjiangchelys wusu*:**
Some trees:
Char. 152: 1 → 0

***Yaminuechelys maior*:**
All trees:
Char. 115: 1 → 0
Char. 132: 0 → 1
Char. 230: 01 → 2
Some trees:
Char. 25: 0 → 1
Char. 111: 0 → 1
Char. 131: 0 → 1
Char. 146: 12 → 1
Char. 209: 1 → 0

***Yehguia tatsuensis*:**
Some trees:
Char. 160: 1 → 0
Char. 228: 0 → 1
Char. 254: 01 → 0

Node 119:
All trees:
Char. 70: 1 → 0
Char. 207: 1 → 0
Char. 255: 0 → 1

Node 120:
All trees:
Char. 11: 2 → 0
Char. 252: 0 → 1

Node 121:
All trees:
No synapomorphies

Node 122:
All trees:
Char. 117: 0 → 1
Char. 204: 0 → 1
Char. 208: 0 → 1
Char. 229: 0 → 1
Char. 249: 1 → 0

Node 123:
All trees:
Char. 110: 0 → 1

Node 124:
All trees:
Char. 9: 1 → 0
Char. 252: 1 → 2

Node 125:
All trees:
Char. 230: 0 → 2
Some trees:
Char. 87: 0 → 1
Char. 129: 0 → 1

Node 126:
All trees:
Char. 9: 1 → 0
Char. 172: 0 → 1
Some trees:
Char. 119: 1 → 0

Node 127:
All trees:
Char. 230: 12 → 0

Node 128:
All trees:
Char. 75: 1 → 2
Char. 83: 0 → 1
Char. 136: 0 → 1
Some trees:
Char. 49: 1 → 2

Node 129:
All trees:
Char. 47: 1 → 2
Char. 50: 0 → 1
Char. 75: 0 → 1
Char. 77: 0 → 1
Char. 119: 0 → 1
Char. 196: 0 → 1
Char. 214: 0 → 1
Some trees:
Char. 6: 0 → 1
Char. 8: 0 → 1
Char. 9: 0 → 1
Char. 31: 0 → 1
Char. 40: 0 → 1
Char. 49: 0 → 1
Char. 131: 0 → 1
Char. 156: 0 → 1
Char. 208: 0 → 1
Char. 250: 2 → 3

Node 130:
All trees:
Char. 42: 0 → 1
Char. 46: 0 → 1
Char. 47: 0 → 1
Char. 56: 0 → 1
Char. 72: 0 → 1
Char. 74: 0 → 1
Char. 245: 1 → 2
Some trees:
Char. 55: 0 → 1

Node 131:
All trees:
Char. 244: 0 → 1
Char. 245: 0 → 1
Char. 248: 0 → 1
Char. 254: 1 → 0
Char. 255: 1 → 2

Node 132:
All trees:
Char. 130: 0 → 1
Some trees:
Char. 18: 1 → 2
Char. 58: 1 → 0
Char. 152: 0 → 1
Char. 186: 1 → 0

Node 133:
All trees:
Char. 108: 0 → 1
Char. 118: 1 → 2
Char. 151: 0 → 1
Char. 244: 1 → 2
Some trees:
Char. 5: 0 → 1
Char. 32: 0 → 1
Char. 33: 0 → 2
Char. 41: 0 → 1
Char. 43: 0 → 1
Char. 61: 0 → 1
Char. 121: 01 → 1
Char. 131: 0 → 1
Char. 145: 01 → 2
Char. 170: 1 → 0
Char. 205: 1 → 0
Char. 206: 0 → 1
Char. 213: 1 → 0
Char. 217: 0 → 12
Char. 234: 0 → 1

Node 134:
All trees:
Char. 20: 0 → 1
Char. 108: 1 → 2
Char. 118: 2 → 3
Some trees:
Char. 34: 0 → 1
Char. 36: 0 → 1
Char. 132: 0 → 1
Char. 139: 0 → 1
Char. 173: 1 → 2
Char. 200: 0 → 1
Char. 221: 0 → 1
Char. 222: 0 → 1

Node 135:
All trees:
Char. 82: 0 → 1
Char. 121: 0 → 1
Some trees:
Char. 115: 0 → 1
Char. 128: 0 → 1
Char. 169: 1 → 0
Char. 205: 1 → 0

Node 136:
All trees:
Char. 46: 2 → 3
Char. 51: 1 → 0
Char. 58: 1 → 0
Char. 74: 12 → 0
Char. 153: 0 → 1
Char. 165: 0 → 1
Char. 204: 0 → 1
Char. 236: 1 → 0
Some trees:
Char. 149: 0 → 1
Char. 154: 1 → 0
Char. 172: 0 → 1
Char. 187: 1 → 0
Char. 235: 1 → 0

Node 137:
All trees:
Char. 14: 0 → 1
Char. 73: 0 → 1

Node 138:
All trees:
Char. 125: 1 → 2
Char. 189: 0 → 1
Char. 256: 2 → 0
Some trees:
Char. 38: 0 → 1

Node 139:
All trees:
Char. 6: 1 → 2
Char. 157: 0 → 1
Some trees:
Char. 164: 0 → 1

Node 140:
All trees:
Char. 54: 1 → 2
Char. 128: 01 → 1
Some trees:
Char. 18: 0 → 1
Char. 70: 01 → 1
Char. 184: 0 → 1
Char. 254: 01 → 0

Node 141:
All trees:
Char. 38: 0 → 2
Char. 81: 01 → 2
Char. 143: 0 → 1
Some trees:
Char. 16: 1 → 0

Node 142:
All trees:
Char. 33: 0 → 1
Char. 37: 0 → 1
Char. 43: 0 → 1
Char. 187: 0 → 1

Node 143:
All trees:
Char. 18: 1 → 0
Char. 49: 2 → 1
Char. 60: 0 → 2
Char. 76: 0 → 1
Char. 192: 0 → 1
Char. 216: 1 → 2

Node 144:
All trees:
Char. 28: 0 → 1
Char. 113: 1 → 2
Char. 122: 0 → 1
Char. 150: 0 → 1
Char. 216: 0 → 1
Some trees:
Char. 132: 0 → 1
Char. 141: 0 → 1
Char. 231: 01 → 1
Char. 232: 0 → 1

Node 145:
All trees:
Char. 148: 0 → 1
Char. 210: 1 → 0

Node 146:
All trees:
Char. 117: 1 → 0
Char. 129: 1 → 0
Char. 222: 0 → 1
Some trees:
Char. 115: 1 → 0
Char. 128: 01 → 0
Char. 132: 0 → 1
Char. 146: 2 → 1
Char. 254: 0 → 1

Node 147:
All trees:
Char. 10: 0 → 1
Char. 11: 0 → 1
Char. 53: 0 → 1
Char. 120: 0 → 1
Char. 121: 1 → 2
Char. 147: 1 → 0
Char. 200: 0 → 1
Some trees:
Char. 111: 0 → 1

Node 148:
All trees:
Char. 117: 1 → 0
Char. 148: 0 → 1

Node 149:
All trees:
Char. 125: 1 → 0

Node 150:
All trees:
Char. 71: 1 → 0

Node 151:
All trees:
Char. 123: 0 → 1
Char. 142: 1 → 0
Char. 145: 1 → 0
Char. 220: 0 → 1

Node 152:
All trees:
Char. 215: 1 → 0

Node 153:
All trees:
Char. 38: 0 → 2
Char. 148: 1 → 0
Char. 160: 1 → 0

Node 154:
All trees:
Char. 162: 0 → 1
Some trees:
Char. 145: 0 → 1

Node 155:
All trees:
Char. 166: 0 → 1
Some trees:
Char. 254: 01 → 1

Node 156:
All trees:
Char. 132: 0 → 1
Char. 222: 0 → 1
Char. 256: 2 → 1

Node 157:
All trees:
Char. 163: 0 → 1
Char. 164: 0 → 1
Some trees:
Char. 141: 0 → 1

Node 158:
All trees:
Char. 9: 1 → 0
Char. 35: 0 → 1
Char. 117: 1 → 0
Char. 234: 0 → 1
Some trees:
Char. 50: 1 → 2
Char. 191: 12 → 2
Char. 231: 01 → 0

Node 159:
All trees:
Char. 177: 0 → 1

Node 160:
All trees:
Char. 6: 1 → 0
Char. 66: 0 → 1

Node 161:
All trees:
Char. 108: 0 → 1
Char. 151: 0 → 1
Char. 181: 1 → 0
Char. 205: 0 → 1

Node 162:
All trees:
Char. 125: 1 → 0
Char. 223: 0 → 1
Char. 227: 0 → 1
Char. 228: 1 → 0
Char. 230: 1 → 2
Char. 234: 0 → 1

Node 163:
All trees:
Char. 174: 1 → 0

Node 164:
Some trees:
Char. 11: 0 → 1
Char. 18: 01 → 2
Char. 132: 0 → 1

Node 165:
All trees:
Char. 18: 12 → 0
Char. 120: 0 → 1
Char. 121: 1 → 2
Char. 145: 1 → 0

Node 166:
All trees:
Char. 18: 12 → 0

Char. 65: 0 → 1
Char. 160: 0 → 1

Node 167:
All trees:
Char. 38: 0 → 2
Some trees:
Char. 119: 0 → 1
Char. 146: 12 → 1
Char. 254: 0 → 1

Node 168:
All trees:
Char. 61: 0 → 1
Some trees:
Char. 1: 0 → 1
Char. 56: 2 → 1
Char. 130: 0 → 1

Node 169:
All trees:
Char. 74: 1 → 0
Char. 83: 1 → 0
Char. 241: 0 → 1
Char. 242: 0 → 1
Char. 243: 0 → 1
Some trees:
Char. 111: 0 → 1

Node 170:
All trees:
Char. 120: 0 → 1
Char. 140: 0 → 1
Char. 158: 0 → 1
Char. 159: 0 → 1

Node 171:
All trees:
Char. 118: 1 → 2
Char. 145: 01 → 2
Some trees:
Char. 9: 1 → 0
Char. 16: 01 → 1
Char. 22: 0 → 1
Char. 121: 01 → 1
Char. 163: 01 → 2
Char. 166: 0 → 1
Char. 185: 0 → 1
Char. 211: 0 → 1

Node 172:
All trees:
Char. 128: 1 → 0
Char. 222: 0 → 1

Node 173:
All trees:
Char. 254: 0 → 1

Node 174:
All trees:
Char. 98: 0 → 1

Node 175:
All trees:
Char. 38: 1 → 2
Char. 90: 0 → 1
Char. 104: 0 → 1

Node 176:
All trees:
Char. 26: 1 → 2
Char. 57: 2 → 1
Char. 58: 0 → 1
Char. 103: 0 → 1

Node 177:
All trees:
Char. 56: 1 → 2

Node 178:
All trees:
Char. 222: 0 → 1
Char. 254: 1 → 0

Node 179:
All trees:
Char. 141: 0 → 1
Char. 155: 0 → 1
Char. 230: 2 → 3

Node 180:
All trees:
Char. 58: 1 → 0
Char. 64: 1 → 0
Some trees:
Char. 48: 0 → 1
Char. 141: 1 → 0

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