SUPPLEMENTARY MATERIAL

Numbering for appendices 1-5 follows Klembara et al. (2021) and for appendices 6 and 7 follows Pardo et al. (2017); characters not requiring correction or comment have been excised. Annotations follow KRHB's or PSAA's character descriptions. Abbrevation: MCZ, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, U.S.A.

APPENDIX 1

Corrections and comments on Klembara et al.'s (2021) [KRHB hereafter] codings for *Paleothyris acadiana*.

33. Parietal-tabular suture: absent (0) or present (1).

KRHB scored *Paleothyris acadiana* as state 1, but Carroll's (1969) description of this element is based on MCZ 3484, which Modesto (2010) regarded as not referable to *P. acadiana* because its parasphenoid morphology is distinct from that of the holotype, MCZ 3481. Marjanović & Laurin (2019) excluded MCZ 3484 from their list of *P. acadiana* specimens that they examined for their study because it was not available for examination (D. Marjanović, pers. comm., 2023). *Paleothyris acadiana* should be scored as "?".

39. Parietal-postparietal sutural course: smooth (0) or interdigitating (1).

KRHB scored *Paleothyris acadiana* as state 0, but it is based on Carroll's (1969) description of this element is based on MCZ 3484, which not referable to *P. acadiana* (see commentary for character 33). *Paleothyris acadiana* should be scored as "?".

41. Postparietal set: paired (0) or unpaired (1).

KRHB scored *Paleothyris acadiana* as state 0, but Carroll's (1969) description of the postparietal is based on MCZ 3484 (see commentary for character 33). *Paleothyris acadiana* should be scored as "?".

42. Postparietal length: less than (0) or more than (1) four times wider than long.

KRHB scored *Paleothyris acadiana* as state 0, but Carroll's (1969) description of the postparietal is based on MCZ 3484 (see commentary for character 33). *Paleothyris acadiana* should be scored as "?".

43. Postparietal median lappets: absent (0) or present (1).

Another scored based on MCZ 3484. *Paleothyris acadiana* should be scored as "?".

44. Postparietal-exoccipital suture: absent (0) or present (1).

Another scored based on MCZ 3484. *Paleothyris acadiana* should be scored as "?".

45. Postparietal occurring entirely on occipital surface of skull: absent (0) or present (1).

Another scored based on MCZ 3484. *Paleothyris acadiana* should be scored as "?".

55. Supratemporal bordering entire edge of dorsalmost part of temporal notch: absent (0) or present (1).

KRHB scored *P. acadiana* as state 0, but there is no temporal notch in this species. *Paleothyris acadiana* should be scored as "?".

59. Supratemporal-intertemporal margin sutural course: irregular (0) or smoothly convex (1).

KRHB scored *P. acadiana* as state 0, but there is no intertemporal in this species. *Paleothyris acadiana* should be scored as "?".

61. Separately ossified tabular: present (0) or absent (1).

KRHB scored *P. acadiana* as state 0, but the tabular is unknown (see commentary for character 33). *P. acadiana* should be scored as "?".

62. Morphology of posterolateral process (extension) of tabular: absent (0), spike-like unornamented 'horn' (1), elongate, recurved, unornamented, and dorsoventrally flattened blade (2), wide, subrectangular, unornamented, and plate-like bony sheet (3), conical extension of unornamented portion of posterolateral corner of tabular (4), or small, quadrangular, ornamented process (5).

KRHB scored *P. acadiana* as state 0, but the tabular is unknown (see commentary for character 33). *Paleothyris acadiana* should be scored as "?".

63. Rounded, button-like posterior process of tabular occurring ventral to tabular ornamented surface: absent (0) or present (1).

KRHB scored *P. acadiana* as state 0, but the tabular is unknown (see commentary for character 33). *Paleothyris acadiana* should be scored as "?".

64. Tabular-squamosal suture: present (0) or absent (1).

KRHB scored *P. acadiana* as state 1, but the tabular is unknown (see commentary for character 33). *Paleothyris acadiana* should be scored as "?".

65. Width of conjoined parietals: smaller than (0) or greater than (1) the distance between the skull table posterior margin and the orbit posterior margin, measured along skull midline.

KRHB scored *P. acadiana* as state 0, but examination of figure 3 in Carroll (1969) suggests that *P. acadiana* should be scored as state 1.

66. Tabular positioned entirely on occipital surface: absent (0) or present (1).

KRHB scored *P. acadiana* as state 1, but the tabular is unknown (see commentary for character 33). *Paleothyris acadiana* should be scored as "?".

67. Tabular width relative to supratemporal: narrower (0) or broader (1) than supratemporal in dorsal view.

KRHB scored *P. acadiana* as state 1, but the tabular is unknown (see commentary for character 33). *Paleothyris acadiana* should be scored as "?".

68. Postorbital outline: irregularly polygonal (0) or broadly crescentric, narrowing to a posterior point (1).

KRHB scored *P. acadiana* as state 1, but Carroll's (1969) reconstruction of the skull in dorsal and lateral views (his figures 4a, b) is based on MCZ 3483, which preserves an incomplete right postorbital that does not allow accurate determination of the character state. *Paleothyris acadiana* scored be scored as "?".

69. Postorbital width relative to orbit: less wide than or approximately equal in width to orbit (0) or wider (1) than orbit.

KRHB scored *P. acadiana* as state 0, but given the incompleteness of the known postorbital of this species (see commentary for character 68), *P. acadiana* should be scored as "?".

70. Postorbital width at least one-fourth of the width of the skull roof at the same transverse level: absent (0) or present (1).

KRHB scored *P. acadiana* as state 1, but given the incompleteness of the known postorbital of this species (see commentary for character 68), *P. acadiana* should be scored as "?".

77. Spatial relationships between quadratojugal and jugal (lateral aspect of suture, if present): quadratojugal underlying jugal (0), jugal-quadratojugal suture oriented approximately vertically (1), or jugal underlying quadratojugal (2).

KRHB scored *P. acadiana* as state 1, but Carroll (1969) states that "the quadratojugal narrows to a wedge anteriorly" and he reconstructs the quadratojugal as overlapping the jugal laterally in his figure 4c, although I see no evidence of this in his specimen drawings. Accordingly, *P. acadiana* should be scored as "?".

85. Depth of jugal ventral to orbit: greater than (0) or smaller than (1) half of anteroposterior orbit diameter.

KRHB scored *P. acadiana* as state 1, and Carroll's (1969) reconstruction in his figure 4a agrees with this state assignment. However, Carroll (1969) himself remarked on the relatively large size of the orbits and inferred that the absolutely smaller size of the skull resulted in size effects on the skull morphology of *P. acadiana*, and I view this character of questionable phylogenetic value in an analysis of such taxonomic breadth.

90. Size of nostril relative to size of choana: nostril less than (0) or equal to or greater than (1) 50 percent of the size of the choana.

KRHB scored *P. acadiana* as state 1, but according to Carroll's (1969) skull reconstruction (his figure 4), it would appear that state 0 applies.

103. Posttemporal fenestra position: occurring at, delimited dorsally by the skull table, not bordered laterally, and floored by a dorsolateral extension of the opisthotic (0), occurring near the dorsolateral corner of the occiput, delimited dorsally by the occipital flanges of the tabular and postparietal, and bordered laterally as well as ventrally by dorsolateral extensions of the opisthotic meeting the ventromedial flange of the tabular (1), small fossa occurring near ventrolateral

corner of the occiput, bordered laterally by ventromedial flange of the tabular, delimited dorsally by the dorsal portion of the lateral margin of the supraoccipital-opisthotic complex, and floored by a lateral extension of the opisthotic (2), or absent altogether (3).

KRHB scored *P. acadiana* as state 1, but this is another coding based on MCZ 3484. *Paleothyris acadiana* should be scored as "?".

105. Distance between quadrate and anterior margin of temporal embayment: equal to (0), less than (1), or greater than (2) the maximum width of the orbit.

KRHB scored *P. acadiana* as state 1, but there is no temporal embayment. *Paleothyris acadiana* should be scored as "?".

135. Dentition pattern on transverse flange of pterygoid: absence of transverse tooth row and/or occurrence of shagreen (0), row of large teeth (1), or row of small teeth (2).

KRHB scored *P. acadiana* as state 1, but there is cluster of small teeth on the transverse flange, so *P. acadiana* should be scored as state 0.

151. Opisthotic forming a thickened plate fused together with the supraoccipital, preventing the exoccipitals from contacting the skull table: absent (0) or present (1).

KRHB scored *P. acadiana* as state 0, but Carroll's (1969) description of the occiput is based almost entirely on MCZ 3484 (see commentary for character 33). *Paleothyris acadiana* should be scored as "?".

157. Single median depression on ventral surface of parasphenoid: absent (0) or present (1).

KRHB scored *P. acadiana* as state 1, but Carroll's (1969) description of the parasphenoid is partly based on the problematic specimen MCZ 3484 (see commentary for character 33). Based on the holotype, *P. acadiana* should be scored as state 0.

158. Paired lateral depressions on ventral surface of parasphenoid: absent (0) or present (1).

KRHB scored *P. acadiana* as state 0, but paired depressions are present on ventral surface of parasphenoid of the holotype. KRHB's coding is based on the problematic specimen MCZ 3484 (see commentary for character 33). *Paleothyris acadiana* should be scored as state 1.

209. Anterior contact between clavicles: present (0) or absent (1).

KRHB scored *P. acadiana* as state 1, but Carroll's (1969) illustrates contact between the clavicles in his figure 1 of the holotype. *Paleothyris acadiana* should be scored as state 0.

211. Interclavicle proportions: not wider than long (excluding parasternal process, if present) (0) or wider than long (1).

KRHB scored *P. acadiana* as "?", but Carroll (1969) illustrates the interclavicle exclusive of the parasternal process as wider than long in his figure 1b. Accordingly, *P. acadiana* should be scored as state 1.

213. Transversely elongate grooves and ridges on central part of interclavicle ventral surface: absent (0) or present (1).

KRHB scored *P. acadiana* as "?", but Carroll's (1969) illustrates no grooves or ridges on the interclavicle his figure 1b. Accordingly, *P. acadiana* should be scored as state 0.

234. Radius length relative to ulna length: radius longer than (0), as long as (1), or shorter than (2) the ulna.

KRHB scored *P. acadiana* as state 1, but Carroll's (1969) figure 1a suggests that *P. acadiana* should be scored as state 2.

258. Axis arch fusion with axis (pleuro)centrum: absent (0) or present (1).

KRHB scored *P. acadiana* as state 1, but Carroll's (1969) description of the atlas-axis complex is based on MCZ 3484 (see commentary for character 33). *Paleothyris acadiana* should be scored as "?".

259. Atlantal pleurocentrum preventing contact between the atlantal and axial intercentra (0) or not preventing contact (1).

KRHB scored *P. acadiana* as state 1, but it should be scored as "?" (see commentary for character 258).

260. Relationship of atlantal pleurocentrum to axial intercentrum: atlantal pleurocentrum in contact with or narrowly separated from anterior surface of axial intercentrum (0); atlantal pleurocentrum articulating with or fused to the dorsal surface of the axial intercentrum (1).

KRHB scored *P. acadiana* as state 1, but it should be scored as "?" (see commentary for character 258).

261. Anteriorly directed, mid-ventral process of axial intercentrum: absent (0) or present (1).

KRHB scored *P. acadiana* as state 0, but it should be scored as "?" (see commentary for character 258).

265. Difference in height between trunk pleurocentra and intercentra: more than 25% (0) or roughly equal in height (1).

KRHB scored *P. acadiana* as "?", but based on figure 2 in Carroll (1969) it should be scored as state 0.

286. Processes of the atlantal neural spines: atlantal neural spines with large, posterodorsally directed processes (0) or atlantal neural spines with small epipophyses (1).

KRHB scored *P. acadiana* as state 1, but Carroll's (1969) description of the atlas-axis complex is based on MCZ 3484 (see commentary for character 33). *Paleothyris acadiana* should be scored as "?".

291. Length of postorbital region of jugal: more than (0) or less than (1) than one-third of the length of the postorbital cheek region.

KRHB scored *P. acadiana* as state 0, but judging from figure 4a in Carroll (1969) this character should be scored as state 1.

292. Elongation of 4th metatarsal: less elongate than all other metatarsals, less than 30% than 3rd metatarsal (0) or at least 30% or more than 3rd metatarsal (1).

KRHB scored *P. acadiana* as state 1. I think this state means that the metatarsal 4 is considered 30% longer than metatarsal 3, but judging from figure 1a in Carroll (1969), this is not the case (the former element is ca. 26% longer than the latter according to my calculations). *P. acadiana* should be scored as state 0.

APPENDIX 2

Corrections and comments on KRHB's codings for *Captorhinus aguti*.

3. Premaxilla alary process: absent (0) or present (1).

Whereas KRHB scored *C. aguti* as state 0, Modesto (1998) described the presence of an alary process as present (state 1).

5. Anterodorsally to posteroventrally oblique orientation of anterior surface of premaxilla, resulting in mouth opening subterminally: absent (0) or present (1).

KRHB scored *C. aguti* as state 0 and *Labidosaurus hamatus* as state 1 for this character. Dodick and Modesto (1995) described the premaxillae of both taxa with ventral margins aligned anteroventrally in lateral view (their state 1) versus premaxillae with ventral margins aligned anteroposteriorly (state 0). Subsequent studies on captorhinids have followed this interpretation (Reisz et al. 2011; Modesto et al. 2014, 2018, 2019). For this reason, I would scored *C. aguti* as state 1.

7. Contribution of premaxilla to choanal margin: broad contact (0), point-like contact (1), or exclusion from choanal margin by vomer (2).

KRHB scored *C. aguti* as state 2, but it should be scored as state 0. No description or reconstruction of *C. aguti* supports state 2; see Reisz et al. (2020).

38. Parietal-frontal sutural course: smooth (0) or interdigitating (1).

C. aguti should be scored as state 1 following figure 1 in Modesto (1998).

47. Nasal size (exposed surface) relative to postparietals: nasals larger or approximately identical in size to (0) or smaller than postparietals (1).

No correction here, but this character is one the most ridiculous I have ever encountered for early tetrapod characters: what is the reasoning for comparing elements from opposite ends of the skull? Would it not make greater sense to examine the length of the nasal with respect to total skull length or similar metric?

88. Quadrate dorsal process: absent (0) or present (1).

C. aguti should be scored as state 1 following figure 13 in Fox and Bowman (1966).

90. Size of nostril relative to size of choana: nostril less than (0) or equal to or greater than (1) 50 percent of the size of the choana.

KRHB scored *C. aguti* as "?" but *C. aguti* can be scored as state 0.

93. Interorbital distance: greater than (0), smaller than (1), or sub-equal to (2) half of the skull table width measured as the widest distance between its lateral margins.

KRHB scored *C. aguti* as state 1, but the skull table curves smoothly into the temporal region with no unequivocal point between the two; see figure 4 in Fox and Bowman (1966), supported by figure 5b in Modesto (1998). If the lateralmost extent of the parietal is used as a proxy for the widest point of the skull table (figure 3 in Fox and Bowman 1966), then *C. aguti* should be scored as state 0.

103. Posttemporal fenestra position: occurring at, delimited dorsally by the skull table, not bordered laterally, and floored by a dorsolateral extension of the opisthotic (0), occurring near the dorsolateral corner of the occiput, delimited dorsally by the occipital flanges of the tabular and postparietal, and bordered laterally as well as ventrally by dorsolateral extensions of the opisthotic meeting the ventromedial flange of the tabular (1), small fossa occurring near ventrolateral corner of the occiput, bordered laterally by ventromedial flange of the tabular, delimited dorsally by the dorsal portion of the lateral margin of the supraoccipital-opisthotic complex, and floored by a lateral extension of the opisthotic (2), or absent altogether (3).

KRHB scored *C. aguti* as state 1. However, the tabular is absent in this species and in *L. hamatus*, such that the squamosal broadly enters the post-temporal fenestra (cf. KRHB character 104). What is needed is a fifth state (a "state 4") to encompass this morphology.

109. Embayments of skull lateral margins: absent (0) or present (1).

KRHB scored *C. aguti* as state 1 but this must be typographic error because this reptile is a classic example of the anapsid condition (state 0).

111. Dermal skull ornament: regular with starburst patterns at areas of growth (0), irregular and deep (1), irregular and shallow (2), or partially or fully absent (3).

Whereas KRHB scored *C. aguti* as state 3, the skull of this reptile is a classic example of ridge-and-pit sculpturing, and should be scored as state 1.

125. Palatine small teeth (denticles) forming continuous shagreen or discrete patches, the basal diameter and/or height of which is less than 30% of that of adjacent marginal teeth (maxillary) and remaining vomer teeth (if present): absent (0) or present (1).

KRHB scored *C. aguti* as "?" here, but this character can be scored as state 1 based on figure 2 in Modesto (1998).

135. Dentition pattern on transverse flange of pterygoid: absence of transverse tooth row and/or occurrence of shagreen (0), row of large teeth (1), or row of small teeth (2).

KRHB scored *C. aguti* as state 1 but rather than a row of large teeth there is a cluster of small teeth on the transverse flange of this reptile; see figure 2 in Modesto (1998). Accordingly, *C. aguti* should be scored as state 0.

151. Opisthotic forming a thickened plate fused together with the supraoccipital, preventing the exoccipitals from contacting the skull table: absent (0) or present (1).

KRHB scored *C. aguti* as state 0 but based on figure 6 in Modesto (1998) it should be scored as state 1.

153. Elongate, strut-like cultriform process of parasphenoid: absent (0) or present (1).

KRHB scored *C. aguti* as state 0, but the anterior extent of the parasphenoid is unknown in this species (e.g. Reisz et al. 2020) and it should be scored as "?".

160. Dentition pattern on parasphenoid cultriform process: shagreen (0), patch of denticles (1), radiating ridges and denticle rows (2), or smooth (3).

Scored as state 0 by KRHB, *C. aguti* should be state 1 based on figure 17 in Fox and Bowman (1966) and figure 2 in Modesto (1998).

162. Lower jaw dimensions: shorter than (0), subequal to (1), or deeper than (2) than the skull in lateral view.

KRHB scored *C. aguti* as state 2 but it should be state 0; see figure 1 in Fox and Bowman (1966).

204. Number of maxillary teeth: greater than 40 (0), between 30 and 40 (1), or less than 30 (2).

KRHB scored *C. aguti* as state 2, but de Ricqlès and Bolt (1983) illustrate a maxilla with 32 teeth (their figure 3). Accordingly, *C. aguti* should be state 1.

205. Number of premaxillary teeth: greater than 4 (0), equal to 4 (1), or less than 4 (2).

KRHB scored *C. aguti* as state 1, but premaxillae with 3 or 5 teeth have been found according to Fox and Bowman (1966). de Ricqlès and Bolt (1983) illustrate a premaxilla with 5 teeth (their figure 2).

209. Anterior contact between clavicles: present (0) or absent (1).

Whereas KRHB scored *C. aguti* as state 1, Holmes (1977) documents state 0 in his figure 2.

231. Humerus length: greater than (0) or less than (1) the combined length of two and a half mid-trunk vertebrae.

KRHB scored *C. aguti* as state 1, but this is an error judging from the work of Fox and Bowman (1966) and Holmes (1977).

251. L-shaped proximal tarsal element: absent (0) or present (1).

This character is scored correctly, as state 1, by KRHB for *C. aguti*, but it is partly duplicated by their character 274 (see below).

274. Astragalus: tibiale, intermedium, and proximal centrale not fused to form an astragalus (0) or fused to form an astragalus (1).

This character is scored correctly, as state 1, by KRHB for *C. aguti*, but it partly duplicates their character 251 (see above).

282. Posterolateral corner of skull table: formed entirely by tabular (0), formed entirely or nearly entirely by supratemporal (1) or with subequal contributions from supratemporal and tabular (2).

KRHB scored *C. aguti* as "?" despite the skull roof of this species being well documented. Presumably state 1, as scored for both *L. hamatus* and *Petrolacosaurus kansensis*, would be appropriate, because the supratemporal is a small, splint-like bone in these three reptiles. Interestingly, KRHB scored *Dimetrodon* as state 2, even though the tabular is restricted to the occiput (i.e. it is not a skull-table element).

APPENDIX 3

Corrections and comments on KRHB's (2021) codings for *Labidosaurus hamatus*.

10. Septomaxilla contact with nasal: present (0) or absent (1).

KRHB scored *L. hamatus* as state 0. This seems to be based their examination of figure 1e in Modesto et al. (2007). However, Modesto et al. (2007) do not describe contact between the septomaxilla and the nasal and the apparent contact in the figure noted is an illusion, akin to interpreting contact between the pterygoid and the postorbital in figure 1b. This character should be scored as state 1.

69. Postorbital width relative to orbit: less wide than or approximately equal in width to orbit (0) or wider (1) than orbit.

KRHB scored *L. hamatus* as state 1, but the width of the orbit appears to be roughly equal to the width of the postorbital when the skull is examined in dorsal aspect using figure 1a in Modesto et al. (2007). This character should be scored as state 0.

70. Postorbital width at least one-fourth of the width of the skull roof at the same transverse level: absent (0) or present (1).

KRHB scored *L. hamatus* as state 1, but the width of the postorbital appears to be about a third of the greatest breadth of the conjoined parietals when the skull is examined in dorsal aspect using figure 1a in Modesto et al. (2007). This character should be scored as state 0.

73. Postorbital proportions in its anterolateroventral portion: absence (0) or presence (1) of drawn out, acutely triangular process bordering posterior orbit margin.

KRHB scored *L. hamatus* as state 0, but the postorbital exhibits a drawn out, acutely triangular, anterolateroventral process when examined in lateral aspect; see figure 1e in Modesto et al. (2007). This character should be scored as state 1.

78. Position of dorsalmost part of quadratojugal relative to maxilla: above (0) or below (1) highest point of maxilla.

KRHB scored *L. hamatus* as state 1, but I fail to see the sense in comparing the height of a temporal bone with one in the antorbital region. Furthermore, if one measures the greatest height of the quadratojugal from the ventral margin and does the same with the maxilla using figure 1e in Modesto et al. (2007), then *L. hamatus* should be scored as state 0.

85. Depth of jugal ventral to orbit: greater than (0) or smaller than (1) half of anteroposterior orbit diameter.

KRHB scored *L. hamatus* as state 0, but examination of figure 1e in Modesto et al. (2007) indicates that state 1 applies.

88. Quadrate dorsal process: absent (0) or present (1).

KRHB scored *L. hamatus* as state 0, but examination of figure 7 in Modesto et al. (2007) indicates that state 1 applies.

91. Naris height in lateral projection: greater than (0) or equal to or less than (1) the distance between the naris ventral rim and the upper jaw margin.

KRHB scored *L. hamatus* as state 1, but examination of figures 1e and 3 in Modesto et al. (2007) indicates that state 0 applies.

93. Interorbital distance: greater than (0), smaller than (1), or sub-equal to (2) half of the skull table width measured as the widest distance between its lateral margins.

KRHB scored *L. hamatus* as state 2, but examination of figures 1a and 2a in Modesto et al. (2007) indicates that state 1 applies.

109. Embayments of skull lateral margins: absent (0) or present (1).

KRHB scored *L. hamatus* as state 1, but like *C. aguti* a exhibits an anapsid condition, i.e. there is no embayment of the lateral margin of the skull (Modesto et al. 2007). Clearly state 0 applies.

148. Exoccipitals enlarged, about as broad as high and forming stout occipital condyles: absent (0) or present (1).

KRHB scored *L. hamatus* as "?", but it can be scored as state 0 based on figure 6 in Modesto et al. (2007).

151. Opisthotic forming a thickened plate fused together with the supraoccipital, preventing the exoccipitals from contacting the skull table: absent (0) or present (1).

KRHB scored *L. hamatus* as state 0, but based on figure 6 in Modesto et al. (2007) it can be scored as state 1 (the supraoccipital interposes between the skull roof and the exoccipitals).

163. Jaw articulation position: posterior to (0), level with (1), or anterior to (2) the occiput.

KRHB scored *L. hamatus* as state 0, but based on figure 1b in Modesto et al. (2007) it can be scored as state 1.

195. Posterior Meckelian fenestra between prearticular and angular: absent (0), present and small (1), or present and large (2).

KRHB scored *L. hamatus* as state 0, but the posterior Meckelian fenestra (= "foramen intermandibularis caudalis" of Heaton, 1979) is present in this species; see figure 11a in Modesto et al. (2007).

196. Anterior Meckelian fenestra between splenial, postsplenial, and prearticular: absent (0), present and small (1), or present and large (2).

KRHB scored *L. hamatus* as state 1, but there is no postsplenial in this species and the anterior Meckelian fenestra is not present in early amniotes, unless it is homologous with the "foramen intermandibularis oralis" of Heaton (1979). I would scored *L. hamatus* as "?".

205. Number of premaxillary teeth: greater than 4 (0), equal to 4 (1), or less than 4 (2).

KRHB scored *L. hamatus* as state 1, but Modesto et al. (2007) state that "four or five teeth are present" in their description of the premaxilla on page 239. Thus, *L. hamatus* is polymorphic and should be scored as states 0 and 1.

214. Separate scapular ossification: absent (0) or present (1).

KRHB scored *L. hamatus* as state 1, but Sumida (1989) describes a scapulocoracoid, so state 0 applies. Related: KRHB scored *C. aguti* as state 0 for this character.

241. Internal trochanter raised as a distinct protuberance: absent (0) or present (1).

KRHB scored *L. hamatus* as state 0, but the internal trochanter is raised as a distinct protuberance in figure 7 in Sumida (1989) and this character should be scored as state 1.

258. Axis arch fusion with axis (pleuro)centrum: absent (0) or present (1).

KRHB scored *L. hamatus* as "?", but it can be scored as state 1 based on figure 1 in Sumida (1989).

259. Atlantal pleurocentrum preventing contact between the atlantal and axial intercentra (0) or not preventing contact (1).

KRHB scored *L. hamatus* as "?", but it can be scored as state 1 based on Sumida (1987).

260. Relationship of atlantal pleurocentrum to axial intercentrum: atlantal pleurocentrum in contact with or narrowly separated from anterior surface of axial intercentrum (0); atlantal pleurocentrum articulating with or fused to the dorsal surface of the axial intercentrum (1).

KRHB scored *L. hamatus* as "?", but it can be scored as state 1 based on Sumida (1987).

261. Anteriorly directed, mid-ventral process of axial intercentrum: absent (0) or present (1).

KRHB scored *L. hamatus* as "?", but it can be scored as state 0 based on Sumida (1987).

282. Posterolateral corner of skull table: formed entirely by tabular (0), formed entirely or nearly entirely by supratemporal (1) or with subequal contributions from supratemporal and tabular (2).

This character is an example of inconsistent interpretation by KRHB, who scored *L. hamatus* as here as state 1, but scored its morphologically similar relative *C. aguti* as "?". See my comments for this character in Appendix 2.

283. Position of jaw articulation: approximately at the same level as the dental occlusal plane (0) or below level of dental occlusal plane (1).

KRHB scored *L. hamatus* as "?", but an imaginary line drawn through the maxillary dentition intersects the ventral tip of the quadrate condyle in figure 1e of Modesto et al. (2007). Accordingly, this character should be scored as state 0.

286. Processes of the atlantal neural spines: atlantal neural spines with large, posterodorsally directed processes (0) or atlantal neural spines with small epipophyses (1).

KRHB scored *L. hamatus* as "?", but it can be scored as state 0 based on Sumida (1987).

288. Keratinous sheath or claw of manus and pes unguals: absent (0) or present (1).

KRHB scored *L. hamatus* as "?", but it can be scored as state 0 based on Sumida (1989).

APPENDIX 4

Corrections and comments on KRHB's codings for *Eothyris parkeyi*.

29. Location of dorsalmost point of maxilla in lateral aspect: in anterior third of maxilla length (0) or approximately at its mid-length (1).

KRHB scored *E. parkeyi* as "?", but based on figure 2 in Reisz et al. (2009) it can be scored as state 0.

37. Parietal-squamosal suture partly extending onto dorsal surface of skull table: absent (0) or present (1).

KRHB scored *E. parkeyi* as "?", but based on figure 1 in Reisz et al. (2009) it is clear that the parietal-squamosal suture, if present, does not extend onto dorsal surface of skull table. Accordingly, it should be scored as state 0.

48. Midline 'peak' projecting posteriorly from conjoined posterior margin of postparietals: absent (0) or present (1).

KRHB scored *E. parkeyi* as state 0, but examination of figure 1 in Reisz et al. (2009) indicates that the paired postparietals form a slight ridge rather than a "peak", and it should be scored as state 0.

66. Tabular positioned entirely on occipital surface: absent (0) or present (1).

KRHB scored *E. parkeyi* as state 0, but according to Reisz et al. (2009) the tabular is entirely occipital. Thus, *E. parkeyi* should be scored as state 1.

67. Tabular width relative to supratemporal: narrower (0) or broader (1) than supratemporal in dorsal view.

KRHB scored *E. parkeyi* as "?". The left supratemporal and tabular are seen in perfect articulation in the skull of the holotype of figure 1 in Reisz et al. (2009). If one conceives of the width of the former bone as the maximum breadth as measured across the element as a line orthogonal to the long axis across the element (because the supratemporal is aligned subparallel to the sagittal plane), the tabular is clearly broader than the supratemporal. Thus, *E. parkeyi* can be scored as state 1.

78. Position of dorsalmost part of quadratojugal relative to maxilla: above (0) or below (1) highest point of maxilla.

KRHB scored *E. parkeyi* as "?". However, if the dorsalmost points of both bones are measured from their respective ventral margins using figures 2 and 5 in Reisz et al. (2009), then *E. parkeyi* can be scored as state 1.

88. Quadrate dorsal process: absent (0) or present (1).

KRHB scored *E. parkeyi* as "?", but figure 4 in Reisz et al. (2009) documents a tall quadrate. Thus, *E. parkeyi* should be scored as state 1.

99. Position of midpoint of maximum anteroposterior orbit diameter: closer to anterior extremity of the snout than to the posterior extremity of the skull (0), situated approximately at skull mid-length (1), or closer to the posterior extremity of the skull than to anterior extremity of the snout (2).

KRHB scored *E. parkeyi* as state 2, but based on figure 5 in Reisz et al. (2009) it should be scored as state 0.

101. Size of greatest diameter of pineal foramen: less than (0) or more than (1) 33% or greater than the anteroposterior length of the parietal suture.

KRHB scored *E. parkeyi* as state 1, but based on figures 1 and 5 in Reisz et al. (2009), the pineal foramen is approximately 28% the anteroposterior length of the parietal suture. Accordingly, *E. parkeyi* should be scored as state 0.

103. Posttemporal fenestra position: occurring at, delimited dorsally by the skull table, not bordered laterally, and floored by a dorsolateral extension of the opisthotic (0), occurring near the dorsolateral corner of the occiput, delimited dorsally by the occipital flanges of the tabular and postparietal, and bordered laterally as well as ventrally by dorsolateral extensions of the opisthotic meeting the ventromedial flange of the tabular (1), small fossa occurring near ventrolateral corner of the occiput, bordered laterally by ventromedial flange of the tabular, delimited dorsally by the dorsal portion of the lateral margin of the supraoccipital-opisthotic complex, and floored by a lateral extension of the opisthotic (2), or absent altogether (3).

KRHB scored *E. parkeyi* as "?", but based on figure 2 in Reisz et al. (2009) it should be scored as state 2.

134. Single row of large teeth on the anterior process of the palatal ramus of the pterygoid: absent (0) or present (1).

KRHB scored *E. parkeyi* as "?", but based on figure 4 in Reisz et al. (2009) it should be scored as state 1.

142. Interpterygoid vacuities: present (0) or absent (1).

KRHB scored *E. parkeyi* as "?", but based on figure 3 in Reisz et al. (2009) it should be scored as state 0.

143. Extension of interpterygoid vacuities: vacuities not occupying (0) or occupying (1) at least half of the palatal width.

KRHB scored *E. parkeyi* as "?", but based on figure 3 in Reisz et al. (2009) it should be scored as state 0.

144. Profile of interpterygoid vacuities: vacuities not concave (0) or concave (1) along their entire margins.

KRHB scored *E. parkeyi* as "?", but based on figure 3 in Reisz et al. (2009) it should be scored as state 0.

145. Proportions of interpterygoid vacuities: conjoined vacuities not broader than long (0) or broader than long (1).

KRHB scored *E. parkeyi* as "?", but based on figure 3 in Reisz et al. (2009) it should be scored as state 0.

148. Exoccipitals enlarged, about as broad as high and forming stout occipital condyles: absent (0) or present (1).

KRHB scored *E. parkeyi* as "?", but based on figure 4 in Reisz et al. (2009) it should be scored as state 0.

162. Lower jaw dimensions: shorter than (0), subequal to (1), or deeper than (2) than the skull in lateral view.

KRHB scored *E. parkeyi* as "?", but based on figures 2 and 5 in Reisz et al. (2009) it should be scored as state 0.

176. Angular mesial lamina: absent (0) or present (1).

KRHB scored *E. parkeyi* as "?", but based on figure 3 in Reisz et al. (2009) it should be scored as state 1.

203. Marginal tooth crowns chisel-tipped: absent (0) or present (1).

KRHB scored *E. parkeyi* as "?", but based on figures 2 and 3 in Reisz et al. (2009) it can be scored as state 0.

205. Number of premaxillary teeth: greater than 4 (0), equal to 4 (1), or less than 4 (2).

KRHB scored *E. parkeyi* as uncertain for states 1 and 2, but based on figures 2 and 3 in Reisz et al. (2009) *E. parkeyi* clearly has less than four premaxillary teeth. Therefore, it should be scored as state 2.

211. Interclavicle proportions: not wider than long (excluding parasternal process, if present) (0) or wider than long (1).

KRHB scored *E. parkeyi* as state 1, but no postcrania are known for this species (Romer and Price 1940; Reisz et al. 2009).

212. Interclavicle shape: rhomboidal with posterior part longer than (0) or shorter than (1) anterior part.

KRHB scored *E. parkeyi* as state 0, but no postcrania are known for this species (Romer and Price 1940; Reisz et al. 2009).

213. Transversely elongate grooves and ridges on central part of interclavicle ventral surface: absent (0) or present (1).

KRHB scored *E. parkeyi* as state 0, but no postcrania are known for this species (Romer and Price 1940; Reisz et al. 2009).

283. Position of jaw articulation: approximately at the same level as the dental occlusal plane (0) or below level of dental occlusal plane (1).

KRHB scored *E. parkeyi* as "?", but based on figures 2 and 5 in Reisz et al. (2009), it can be scored as state 0.

APPENDIX 5

Corrections and comments on KRHB's codings for *Varanops brevirostris*.

13. Nasal-frontal sutural course: smooth (0) or interdigitating (1).

KRHB scored *V. brevirostris* as "?", but based on plate 5 in Romer and Price (1940), it can be scored as state 1.

15. Prefrontal length: less than (0) or more than (1) three times longer than wide.

KRHB scored *V. brevirostris* as state 0, but based on plate 5 in Romer and Price (1940), it can be scored as state 1.

27. Total length of lacrimal: less than (0) or more than (1) two and a quarter times its maximum pre-orbital length.

KRHB scored *V. brevirostris* as "?", but based on plate 5 in Romer and Price (1940) and figure 1 in Campione and Reisz (2010), it can be scored as state 0.

28. Lacrimal contribution to narial margin: present (0) or absent (1).

KRHB scored *V. brevirostris* as "?", but based on figure 1 in Campione and Reisz (2010), it can be scored as state 0. See also the reconstruction of the skull in lateral view in Reisz & Laurin (2004).

29. Location of dorsalmost point of maxilla in lateral aspect: in anterior third of maxilla length (0) or approximately at its mid-length (1).

KRHB scored *V. brevirostris* as state 1, but based on figures 1 and 3 in Campione and Reisz (2010), it can be scored as state 0.

46. Posteromedial extensions of occipital flanges of postparietals projecting posteroventrally forming posteriorly directed process: absent (0) or present (1).

KRHB scored *V. brevirostris* as state 1, but the postparietal does exhibit a distinct posteriorly directed process according to figure 1 in Campione and Reisz (2010). Accordingly, *V. brevirostris* can be scored as state 0.

64. Tabular-squamosal suture: present (0) or absent (1).

KRHB scored *V. brevirostris* as state 1, but these bones appear to make contact in figure 1 in Campione and Reisz (2010), and it should be scored as state 0.

71. Anteriormost part of the postorbital mesial margin with sigmoid profile in dorsal or lateral aspect: absent (0) or present (1).

KRHB scored *V. brevirostris* as state 0, but figure 1 in Campione and Reisz (2010) indicates that this character should be scored as state 1.

87. Position of anterior extremity of jugal relative to anterior margin of orbit: anterior extremity of jugal not extending (0) or extending (1) anterior to anterior margin of orbit.

KRHB scored *V. brevirostris* as state 1, but the jugal does not extend anterior to the orbit according to figure 1 in Campione and Reisz (2010). Accordingly that this character should be scored as state 1. See also the reconstruction of the skull in lateral view in Reisz & Laurin (2004).

93. Interorbital distance: greater than (0), smaller than (1), or sub-equal to (2) half of the skull table width measured as the widest distance between its lateral margins.

KRHB scored *V. brevirostris* as state 2, but according to figure 1 in Campione and Reisz (2010) this character should be scored as state 1.

111. Dermal skull ornament: regular with starburst patterns at areas of growth (0), irregular and deep (1), irregular and shallow (2), or partially or fully absent (3).

KRHB scored *V. brevirostris* as "?", but dermal sculpturing is minimal according to figures 3 and 4 in Campione and Reisz (2010). Thus, this character can be scored as state 3.

155. Posterolaterally orientated, paired ventral thickenings (ridges ending in basal tubera) on parasphenoid: absent (0) or present (1).

KRHB scored *V. brevirostris* as "?", but state 1 applies according to figure 6 in Campione and Reisz (2010).

162. Lower jaw dimensions: shorter than (0), subequal to (1), or deeper than (2) than the skull in lateral view.

KRHB scored *V. brevirostris* as "?", but state 0 applies according to figure 1 in Campione and Reisz (2010). See also the reconstruction of the skull in lateral view in Reisz & Laurin (2004).

169. Dentary anterior fangs generally comparable in size with, or greater than, other dentary teeth and lying close to symphysial region and usually mesial to marginal dentary teeth: present (0) or absent (1).

KRHB scored *V. brevirostris* as state 0. There is no evidence for "fangs" in this species (see figure 3 in Campione and Reisz 2010). Furthermore, the anterior marginal teeth (enlarged or not) in this or any other amniote are clearly not homologous with the anterior dentary fangs of *Whatcheeria deltae* (the outgroup).

179. Prearticular-splenial suture: present (0) or absent (1).

KRHB scored *V. brevirostris* as state 1. However, it is not possible to determine this character in the available material (see Campione and Reisz 2010). Thus, it should be scored as "?".

181. Separately ossified anterior coronoid: present (0) or absent (1).

KRHB scored *V. brevirostris* as state 1. However, Campione and Reisz (2010) describe an anterior coronoid in this species. Thus, it should be scored as state 0.

195. Posterior Meckelian fenestra between prearticular and angular: absent (0), present and small (1), or present and large (2).

KRHB scored *V. brevirostris* as state 0. However, Campione and Reisz (2010) state that a "meckelian fossa or intermandibular foramen is present between the prearticular and the angular, and is bound anteriorly and posteriorly by the two elements" (page 730). Thus, *V. brevirostris* should be scored as state 1 or state 2. Judging from figure 3 in Campione and Reisz (2010), the foramen was relatively large, so state 2 would apply.

217. Morphology of latissimus dorsi process: part of a ridge (0), distinct but low (1), or spike-like (2).

KRHB scored *V. brevirostris* as "?", but state 0 applies according to figure 11 in Campione and Reisz (2010).

224. Humerus waisted shaft: absent (0) or present (1).

KRHB scored *V. brevirostris* as "?", but state 1 would seem to apply according to figure 11 in Campione and Reisz (2010).

259. Atlantal pleurocentrum preventing contact between the atlantal and axial intercentra (0) or not preventing contact (1).

KRHB scored *V. brevirostris* as state 0. However, the axial intercentrum is not preserved in this species. Regardless, Campione and Reisz (2011) infer from the

morphologies of the atlantal pleuro- and intercentra and the axial pleurocentrum that the atlantal pleurocentrum did extend ventrally to prevent contact between the atlantal and the axial intercentra. Accordingly, state 1 applies.

260. Relationship of atlantal pleurocentrum to axial intercentrum: atlantal pleurocentrum in contact with or narrowly separated from anterior surface of axial intercentrum (0); atlantal pleurocentrum articulating with or fused to the dorsal surface of the axial intercentrum (1).

There appears to be a typographic error in the description for state 0: presumably the authors meant that for state 0 to be defined as "atlantal pleurocentrum *not* in contact with or narrowly separated from anterior surface of axial intercentrum". If so, KRHB correctly scored *V. brevirostris* as state 1 (see discussion for character 259).

265. Difference in height between trunk pleurocentra and intercentra: more than 25% (0) or roughly equal in height (1).

KRHB scored *V. brevirostris* as "?", but state 0 applies according to figure 8 in Campione and Reisz (2010).

271. Height of ossified portion of neural arch in mid-trunk vertebrae: greater than (0) or smaller than (1) the distance between pre- and postzygapophyses.

KRHB scored *V. brevirostris* as "?", but state 0 applies according to figure 8 in Campione and Reisz (2010).

273. Manus digit number: five (0) or four (1).

KRHB scored *V. brevirostris* as "?", but state 0 applies according to plate 8 in Williston (1911).

280. Otic trough: absent (0) or present (1).

KRHB scored *V. brevirostris* as state 1, but this character cannot be determined based on the available material. It should be rescored as "?".

282. Posterolateral corner of skull table: formed entirely by tabular (0), formed entirely or nearly entirely by supratemporal (1) or with subequal contributions from supratemporal and tabular (2).

KRHB scored *V. brevirostris* as "?", but the tabular is entirely occipital in this species (Campione and Reisz 2010), as it is in *Dimetrodon*, which they scored as state 2.

283. Position of jaw articulation: approximately at the same level as the dental occlusal plane (0) or below level of dental occlusal plane (1).

KRHB scored *V. brevirostris* as "?", but figures 1 and 3 in Campione and Reisz (2010) indicate that state 0 applies. See also the reconstruction of the skull in lateral view in Reisz & Laurin (2004).

292. Elongation of 4th metatarsal: less elongate than all other metatarsals, less than 30% than 3rd metatarsal (0) or at least 30% or more than 3rd metatarsal (1).

KRHB scored *V. brevirostris* as state 1. However, the fourth metatarsal is only 27% longer than the third metatarsal, as measured from plate 13 in Williston (1911). Thus, state 0 applies.

APPENDIX 6

Corrections and comments on Pardo et al.'s (2017) [PSAA hereafter] codings for *Opisthodontosaurus carrolli*.

19. Frontal into orbital margin: (0) no; (1) yes.

PSAA scored *O. carrolli* as state 0, but Reisz et al. (2015) describe this captorhinid as having a narrower contribution to the orbit than in *Captorhinus laticeps*. Thus, state 1 applies.

21. Nasals: (0) present; (1) absent.

PSAA scored *O. carrolli* as "?", but this should be state 1 because Reisz et al. (2015) illustrated a fragment of the left nasal in their figure 2b.

24. Septomaxilla (HPSA 028): (0) ossified; (1) unossified.

This character is duplicated by PSAA's character 264 (Lateral rostral present: [0] yes; [1] no; originally character 9 from Clack et al., 2012) and should have been restructured as a multistate character for such broad sampling of tetrapod taxa.

26. External naris in dorsal view: (0) exposed; (1) not exposed.

PSAA scored *O. carrolli* as state 1, but the premaxilla is not described apart from its dentition (Reisz et al. 2015) and this character should be scored as "?".

27. External naris shape: (0) circular; (1) posteriorly extended, along lacrimal-prefrontal suture; (2) posteriorly extended excavation of lacrimal only.

Scored as state 1 by PSAA, the shape of the external naris in *O. carrolli* cannot be determined faithfully because the narial borders of the premaxilla and the nasal are not preserved (Reisz et al. 2015); this character should be scored as "?".

28. Dorsal exposure of premaxilla: (0) broad pars dorsalis anteromedial to external naris; (1) pars dorsalis limited, but nasopremaxillary suture exposed dorsally (2) none.

PSAA scored *O. carrolli* as state 1, but the premaxilla is not described apart from its dentition (Reisz et al. 2015) and this character should be scored as "?".

31. Snout shape: (0) blunt; (1) pointed.

PSAA scored *O. carrolli* as state 1, but the bodies of neither the premaxilla (see character 28) nor the nasal (see character 21) are known and I would argue that the snout cannot be faithfully reconstructed to allow this character to be scored confidently. It should be scored as "?".

40. Raised orbital rim: (0) absent; (1) present.

PSAA scored *O. carrolli* as state 1, but Reisz et al. (2015) neither illustrate nor describe a raised orbital rim, and this character should be scored as state 0.

60. Premaxilla anterior margin: (0) vertical; (1) overturned.

PSAA scored *O. carrolli* as state 1, but the alveolar region of the premaxilla is not preserved in this species (Reisz et al. 2015), and this character should be scored as "?".

70. Enlarged teeth mid toothrow (maxillary): (0) absent; (1) present.

PSAA scored *O. carrolli* as state 1, but the character states are too simplistic: is "meristic midrow" or "metrical midrow" meant? If the former, then maxillary tooth 4 represents the midrow position but this tooth is not enlargered according to figures 1a in Reisz et al. (2015) and should thus be scored as state 0. If the latter is intended, then *O. carrolli* could be scored as 0&1 based on figure 1a in Reisz et al. (2015) or state 0 based on figure 2b in Reisz et al. (2015).

88. Dentary: (0) tooth row greater than 50% of total jaw length; (1) tooth row less than 50% of total jaw length.

PSAA scored *O. carrolli* as state 0. However, the tooth row is ca. 45% according to figure 2b in Reisz et al. (2015), and this character should be scored as state 1.

103. Ossified hyoids: (0) present; (1) absent.

PSAA scored *O. carrolli* as "?", but a hyoid element can be seen in figure 2a in Reisz et al. (2015) and this character can be scored as state 0.

110. Trunk intercentra: (0) present; (1) absent.

PSAA scored *O. carrolli* as state 1, but the two specimens that preserve partial postcrania (figure 4 in Reisz et al. 2015) preserve few trunk vertebrae and none of these are articulated, thereby not precluding post-mortem loss of trunk intercentra. *O. carrolli* should be scored as "?".

149. Interclavicle anterior plate: (0) broad; (1) narrow.

PSAA scored *O. carrolli* as state 1, but the one specimen that preserves an interclavicle shows that this element has a broad anterior plate (figure 4a, b in Reisz et al. 2015). Thus, this character should be scored as state 0.

155. Cleithrum ossification: (0) ossified; (1) unossified.

PSAA scored *O. carrolli* as state 1, but the available postcrania is not preserved well enough (figure 4 in Reisz et al. 2015) to confidently make this determination. Thus, this character should be scored as "?".

158. Supraglenoid foramen: (0) present; (1) absent.

PSAA scored *O. carrolli* as state 0, but the one specimen that preserves scapulocoracoids shows no evidence of a supraglenoid foramen (figure 4a, b in Reisz et al. 2015). Thus, this character should be scored as state 1.

165. Radius-humerus ratio: (0) > 0.7; (1) 0.5 - 0.7; (2) < 0.5.

PSAA scored *O. carrolli* as state 0, but according to figure 4b in Reisz et al. (2015), the radius is about 55% the length of the humerus, and so this character should be scored as state 1.

169. Number digits manus: (0) 5; (1) 4; (2) 3; (3) >5.

PSAA scored *O. carrolli* as state 0. Unfortunately, this character is highly problematical because PSAA borrowed it without modification from Huttenlocker et al. (2013), whose phylogenetic analysis limited to evaluating "microsaur" interrelationships. PSAA used *Eusthenopteron* as their outgroup, but none of the character states apply to this taxon and necessarily code it as "?". However, PSAA's addition of *Eusthenopteron* and many other early tetrapod taxa should have prompted the authors to have re-ordered their character states, inasmuch the earliest branching taxa in their phylogeny are polydactylous (their state 3). Furthermore, PSAA should have incorporated their character 349 (autopod: [0] radials; [1] digits; which they use with modification from Clack et al., 2012 [their character 96]). Finally, the manus is not completely known for *O. carrolli* and the relevant specimen preserves only digits 1-4 (figure 4a, b in Reisz et al. 2015).

186. Trabecula cranii (N 01): (0) Without significant median fusion posterior to solum nasi (platytrabic); (1) fused medially posterior to solum nasi to form elongate trabecula communis (tropitrabic).

PSAA scored *O. carrolli* as state 1. The trabeculae cranii are cartilages that project from the cristae trabeculares of the basisphenoid portion of the parabasisphenoid and lay within the cultriform process (Heaton, 1979). This region is, however, not examinable in the two specimens that preserve the anterior end of the braincase (figures 2a,b and 3 in Reisz et al. 2015). This character should be scored as "?".

215. Basal plate of parasphenoid: (0) roughly quadrangular, basipterygoid articulations narrowly spaced; (1) rectangular laterally, anteroposteriorly narrow, basipterygoid articulations distant.

PSAA scored *O. carrolli* as "?", but enough is preserved in one specimen (figure 2a,b in Reisz et al. 2015) to indicate that this character should be scored as state 0 (as PSAA scored for *C. laticeps*).

249. Position of pineal foramen with respect to hypophyseal foramen (N 52): (0) anterior to; (1) approximately the same; (2) far posterior to.

PSAA scored *O. carrolli* as state 1, but it is not clear how this was determined because there is no skull reconstruction known for this species (Reisz et al. 2015). This character should be scored as "?".

251. Median wall of otic capsule (N 54): (0) completely unossified; (1) ossification of opisthotic; (2) ossification of supraoccipital and basioccipital.

PSAA scored *O. carrolli* as state 2, but none of the three bones concerned are known in the available material (Reisz et al. 2015). This character should be scored as "?".

262. Frontal: (0) absent; (1) present.

PSAA scored *O. carrolli* as "?", but the frontal (state 1) is clearly present (Reisz et al. 2015).

263. Jugal: (0) does not extend anterior to orbit; (1) extends anterior to orbit.

PSAA scored *O. carrolli* as "?", but figure 2b in Reisz et al. (2015) suggests that it can be scored as state 0.

265. Maxilla makes interdigitating suture with vomer: (0) no; (1) yes.

PSAA scored *O. carrolli* as "?", but the morphology of the maxilla (figure 1a in Reisz et al. 2015) indicates that state 0 applies.

266. Maxilla external contact with premaxilla: (0) narrow contact point, not interdigitated; (1) interdigitating suture.

PSAA scored *O. carrolli* as "?", but the morphology of the maxilla (figure 1a in Reisz et al. 2015) indicates that state 0 applies.

267. Maxilla extends behind level of posterior margin of orbit: (0) yes; (1) no.

PSAA scored *O. carrolli* as "?", but figure 2b in Reisz et al. (2015) indicates that state 1 applies.

268. Median rostral: (0) single; (1) paired; (2) absent.

PSAA scored *O. carrolli* as "?", but figure 2b in Reisz et al. (2015) indicates that state 2 applies.

270. Prefrontal: (0) twice as long as broad, or less; (1) three times as long as broad.

PSAA scored *O. carrolli* as "?", but the disarticulated, but complete prefrontal illustrated in figure 3b in Reisz et al. (2015) indicates that state 1 applies.

273. Pterygoid quadrate ramus margin in subtemporal vacuity: (0) concave; (1) with some convex component.

PSAA scored *O. carrolli* as "?" Based on the right pterygoid illustrated in figure 3b in Reisz et al. (2015), state 1 appears to apply.

274. Vomers separated by parasphenoid > half length: (0) yes; (1) no.

PSAA scored *O. carrolli* as "?" but figure 3d in Reisz et al. (2015) indicates that state 1 applies.

275. Vomers: (0) as broad as long or broader; (1) about twice as long as broad or longer.

PSAA scored *O. carrolli* as "?" but figure 3d in Reisz et al. (2015) indicates that state 1 applies.

276. Basipterygoid process: (0) not strongly projecting with concave anterior face; (1) strongly projecting with flat anterior face.

PSAA scored *O. carrolli* as "?" but state 1 applies based on figures 2b and 3d in Reisz et al. (2015).

281. Denticulate field of parasphenoid: (0) present; (1) absent.

PSAA scored *O. carrolli* as "?", but parasphenoidal denticles are preserved in two specimens (figure 2b and 3d in Reisz et al. 2015). This character can be scored as state 0.

286. Palatine row of smaller teeth: (0) present; (1) absent.

PSAA scored *O. carrolli* as "?". Small teeth, however, are present and form a row on the palatine of one specimen and are present and form a small cluster on the palatine of the other specimen (figures 2b and 3d, respectively, in Reisz et al. 2015). This character should be scored as state 0.

288. Dentition of transverse flange of pterygoid: (0) Denticle field indistinct from palatine denticle field; (1) distinct raised denticle field; (2) organized tooth row; (3) absent.

PSAA scored *O. carrolli* as "?", but there is a cluster of small teeth on the transverse flange, so state 1 appears to apply (figures 2b and 3d in Reisz et al. 2015).

293. Vomerine row of teeth: (0) present; (1) absent.

PSAA scored *O. carrolli* as "?", but Reisz et al. (2015) describe vomerine teeth as present, so state 0 applies.

294. Vomerine shagreen field: (0) absent; (1) present.

PSAA scored *O. carrolli* as "?", but Reisz et al. (2015) describe only small teeth on the vomer, not a shagreen, so state 0 applies.

295. Adductor fossa: (0) faces dorsally; (1) faces medially.

PSAA scored *O. carrolli* as "?", but examination of figure 3b in Reisz et al. (2015) indicate that this character should be scored as state 1.

296. Adductor crest: (0) absent; (1) peak anterior to adductor fossa, dorsal margin of fossa concave; (2) peak above anterior part of adductor fossa, dorsal margin of fossa convex.

PSAA scored *O. carrolli* as "?", but examination of figures 2b and 3b, d in Reisz et al. (2015) indicate that this character should be scored as state 0.

297. Angular-prearticular contact: (0) prearticular contacts angular edge to edge; (1) absent; (2) medial lamina of angular sutures with prearticular.

PSAA scored *O. carrolli* as "?", but according to figure 3d in Reisz et al. (2015) there is a medial lamina of the angular, and it contacts the prearticular along a long suture, so state 2 applies.

301. Coronoid (posterior) posterodorsal process: (0) no; (1) yes.

PSAA scored *O. carrolli* as "?", but according to figure 3b in Reisz et al. (2015) the coronoid features a posterodorsal process (state 1).

302. Coronoid (posterior) posterodorsal process visible in lateral view: (0) no; (1) yes.

PSAA scored *O. carrolli* as "?", but according to figure 3b in Reisz et al. (2015) the left coronoid is visible in lateral view (state 1).

304. Dentary ventral edge: (0) smooth continuous line; (1) abruptly tapering or "stepped" margin.

PSAA scored *O. carrolli* as "?". Reisz et al. 2015) illustrated a complete isolated dentary in their figure 1b, which shows the stepped condition, and so this character should be scored as state 1.

305. Dentary suture with splenial & postsplenial marked by deep furrow: (0) no; (1) yes.

PSAA scored *O. carrolli* as "?", but no furrow is present according to figures 2b, 3d, or 4b in Reisz et al. (2015), so this character should be scored as state 0. (PSAA also scored *C. laticeps* as state 0.)

306. Mandibular sensory canal: (0) present; (1) absent.

PSAA scored *O. carrolli* as "?", but a mandibular sensory canal is clearly absent (Reisz et al. 2015). This character should be scored as state 1.

324. Splenial has free ventral flange: (0) yes; (1) no.

PSAA scored *O. carrolli* as "?", but examination of figure 2b in Reisz et al. (2015) indicates that this character should be scored as state 1.

331. Dentary tooth row: (0) homodont; (1) markedly heterodont.

PSAA scored *O. carrolli* as "?", but the dentary dentition is remarkably heterodont (Reisz et al. 2015). This character should be scored as state 1.

332. Dentary with parasymphyseal fangs internal to marginal tooth row: (0) yes; (1) no.

PSAA scored *O. carrolli* as "?", but the dentary clearly lacks parasymphyseal fangs (Reisz et al. 2015). This character should be scored as state 1.

333. Dentary teeth: (0) same size as maxillary teeth; (1) larger than maxillary teeth; (2) smaller than maxillary teeth.

PSAA scored *O. carrolli* as "?". The "unique type of heterodonty" complicates a straightfoward coding of this character for *O. carrolli* (page 50 in Reisz et al. 2015). One specimen illustrated by Reisz et al. (2015) indicates that maxillary teeth 1, 2, 4, and 5 are smaller than the opposing dentary teeth and maxillary tooth 3, 6-8 are larger than the opposing dentary teeth according to figure in Reisz et al. (2015). This character can be scored as states 1 and 2 (polymorphic).

334. Dentary with a row of very small teeth or denticles lateral to tooth row: (0) yes; (1) no.

PSAA scored *O. carrolli* as "?", but clearly state 1 applies based on figures 1b and 3b in Reisz et al. (2015).

340. Anterior palatal fenestra: (0) single; (1) double; (2) absent.

PSAA scored *O. carrolli* as "?", but the palate is well enough known from available material to scored state 2 based on figures 2b and 3d in Reisz et al. (2015).

342. Interpterygoid vacuities: (0) absent; (1) at least 2× wider than long; (2) 2× longer than wide.

PSAA scored *O. carrolli* as "?", but state 2 can be inferred from figures 2b and 3d in Reisz et al. (2015).

343. Intracranial joint: (0) present in dermal skull roof; (1) absent in dermal skull roof.

PSAA scored *O. carrolli* as "?", but judging from figure 2c, d in Reisz et al. (2015), state 1 can be scored.

349. Autopod: (0) radials; (1) digits.

PSAA scored *O. carrolli* as "?", but digits (state 1) are clearly present (Reisz et al. (2015).

353. Interclavicle: (0) small and concealed or absent; (1) large and exposed.

PSAA scored *O. carrolli* as "?", but one specimen preserves a large, exposed interclavicle (figure 4a, b in Reisz et al. (2015). Thus, state 1 applies.

354. Interclavicle shape: (0) ovoid; (1) kite shaped; (2) with posterior stem.

PSAA scored *O. carrolli* as "?", but the preserved interclavicle exhibits a prominent posterior stem (figure 4a, b in Reisz et al. (2015), showing that state 1 applies.

355. Lepidotrichia in paired appendages: (0) present; (1) absent.

PSAA scored *O. carrolli* as "?", but lepidotrichia are absent (Reisz et al. 2015) and thus state 1 applies.

357. Radius and ulna: (0) radius much longer than ulna; (1) approximately equal in length.

PSAA scored *O. carrolli* as "?", but figure 4a, b in Reisz et al. (2015) shows that state 1 applies.

359. Scapular blade: (0) absent; (1) small with narrow top; (2) large with broad top.

PSAA scored *O. carrolli* as "?", but figure 4a in Reisz et al. (2015) shows that state 1 applies.

360. Scapulocoracoid: (0) small and tripodal; (1) large plate.

PSAA scored *O. carrolli* as "?", but figure 4a in Reisz et al. (2015) indicates that state 1 applies.

364. Proximal limb of oblique ridge: (0) present, separated from anterior margin of humerus by prepectoral space; (1) absent, replaced by deltopectoral crest.

PSAA scored *O. carrolli* as "?", but a deltopectoral crest (state 1) is present, based on figure 4a in Reisz et al. (2015).

367. Humerus with well-developed anterior plate: (0) yes; (1) no.

PSAA scored *O. carrolli* as "?". Reisz et al. (2015) describe and figure the humerus, so PSAA must have regarded this character as indeterminate in this reptile. However, PSAA do not define what an "anterior plate" is, and I have not found this term used in the descriptions of tetrapod humeri. It is a dubious character.

369. Radial capitulum: (0) approximately same size as ulnar facet; (1) greatly enlarged and rounded, >2× size of ulnar facet.

PSAA scored *O. carrolli* as "?", but the humerus illustrated in figure 4a in Reisz et al. (2015) indicates that this character should be scored as state 1.

APPENDIX 7

Corrections and comments on PSAA's codings for *Captorhinus laticeps*.

18. Frontals: (0) paired; (1) fused.

PSAA correctly scored *Captorhinus laticeps* as state 0. However, this character should have been combined with PSAA's character 262 (Frontal: [0] absent; [1] present).

47. Postparietals: (0) paired; (1) fused; (2) absent.

PSAA scored *C. laticeps* as "?", but the postparietals are paired (Heaton 1979) and, thus, state 1 applies.

49. Postparietal size: (0) much smaller than parietals; (1) approximately as large or larger than parietals.

PSAA scored *C. laticeps* as "?", but the postparietal is much smaller than the parietal according to Heaton (1979). Thus, state 1 applies.

50. Postparietal squamosal contact: (0) absent; (1) present.

PSAA scored *C. laticeps* as "?", but the postparietal contacts the squamosal (Heaton 1979). Thus, state 1 applies.

51. Postparietal length: (0) large, quadrangular; (1) abbreviated anteroposteriorly, elongate lateral rectangle.

PSAA scored *C. laticeps* as "?", but the postparietal, described and illustrated by Heaton (1979) as broader than long, can be scored as state 1.

60. Premaxilla anterior margin: (0) vertical; (1) overturned.

PSAA scored *C. laticeps* as state 0. This character, however, was devised originally for microsaurs by Huttenlocker et al. (2013) and neither state captures the distinct anteroventral inclination of the alveolar portion of the premaxilla of *C. laticeps* and other captorhinids (Heaton 1979). *Captorhinus laticeps* should be scored as "?" pending revision of this character.

66. Marginal teeth shape: (0) pointed pegs; (1) blunt pegs; (2) large cones.

PSAA scored *C. laticeps* as state 1, but Modesto (1998) established that the teeth are pointed and exhibit mesial and distal cutting edges. This is another character that was devised for microsaurs by Huttenlocker et al. (2013), and none of the

states captures the morphology described by Modesto (1998). *Captorhinus laticeps* should be scored as "?" pending revision of this character.

67. Number of premax teeth: (0) 10-20; (1) 5-9; (2) <5; (3) 20 or more.

PSAA scored *C. laticeps* as state 2, but the number of premaxillary teeth ranges from 3-5 (Heaton 1979). *Captorhinus laticeps* should be scored as "1&2" for this character.

68. Number of max teeth: (0) 30-40; (1) 20-29; (2) 15-19; (3) <15; (4) >40.

PSAA scored *C. laticeps* as state 3, but it should be scored as state 1 based on figure 12 in Heaton (1979).

70. Enlarged teeth mid toothrow (maxillary): (0) absent; (1) present.

PSAA scored *C. laticeps* as state 1, but the largest maxillary teeth appear anteriorly according to Heaton (1979). Thus, *C. laticeps* should be scored as state 0.

86. Ectopterygoid palatine width: (0) wider than maxilla; (1) narrower than maxilla.

PSAA scored *C. laticeps* as "?". Whereas *C. laticeps* lacks an ectopterygoid, the palatine is broader than the maxilla (Heaton 1979). Thus, *C. laticeps* can be scored as state 0.

88. Dentary (HPSA 124): (0) tooth row greater than 50% of total jaw length; (1) tooth row less than 50% of total jaw length.

PSAA scored *C. laticeps* as state 0. Heaton (1979), however, reconstructed the lower jaw in his figure 30a and the dentary tooth row occupies ca. 41% of total jaw length. An issue with Heaton's (1979) reconstruction of the mandible is that he based it on a specimen for which he only illustrated the dentary and the splenial. Examination of figure 10 in Heaton (1979), which illustrates a skull of *C. laticeps* with a complete left mandibular ramus, confirms that the dentary tooth row occupies ca. 44% of total jaw length. Thus, *C. laticeps* should be scored as state 1.

101. Splenial participates in symphysis: (0) yes; (1) no.

PSAA scored *C. laticeps* as state 1, but the splenial participates in the symphysis (figure 31a in Heaton 1979); *C. laticeps* should be scored as state 0.

107. Number of presacrals: (0) 25-35; (1) 20-24; (2) >35; (3) <20.

PSAA scored *C. laticeps* as state 1, but it should be state 0 because there are "5 cervical [and] 20 dorsal vertebrae" (page 139 in Heaton and Reisz 1980).

115. Neural spine shape in lateral view: (0) anterior and posterior sides parallel, forming a rectangular surface; (1) non-parallel, triangular.

PSAA scored *C. laticeps* as state 0, but the neural spines exhibit non-parallel anterior and posterior margins (figure 4 in Dilkes and Reisz 1986). Thus, *C. laticeps* should be scored as state 1.

118. Haemal arch presence: (0) present; (1) absent.

PSAA scored *C. laticeps* as state 1, but Dilkes and Reisz (1986) described haemal arches. Accordingly, *C. laticeps* should be scored as state 0.

119. Haemal arch fusion: (0) loosely articulated to intercentra; (1) fused to mid length of centrum.

PSAA scored *C. laticeps* as "?", but this is an artifact of the character state choices rather than uncertainty because Dilkes and Reisz (1986) described the haemal arches as fused to their respective intercentra. This character was adopted unmodified from character 157 of Huttenlocker et al. (2013), who did not include amniotes in their phylogenetic analysis.

121. Haemal accessory articulations: (0) none; (1) one; (2) two.

PSAA scored *C. laticeps* as "?", but accessory articulations are not present on the haemal arches that Dilkes and Reisz (1986) illustrate in their figure 2. Thus, *C. laticeps* can be scored as state 0.

122. Haemal arch shape: (0) non parallel triangular; (1) parallel rectangular.

PSAA scored *C. laticeps* as "?". Judging from figure 2 in Dilkes and Reisz (1986), the haemal arches exhibit parallel anterior and posterior margins, although I would not described them as rectangular (nor triangular); state 1 appears to apply.

124. Tail length: (0) elongate equal to or exceeding trunk and skull length; (1) foreshortened markedly shorter than trunk.

PSAA scored *C. laticeps* as state 1. Dilkes and Reisz (1986), however, estimated that at least 60 caudal vertebrae were present and that the tail was a long as in other early reptiles (page 1293). Thus, state 1 applies.

132. Atlas neural arch centrum fusion: (0) loosely articulated; (1) sutured to centrum; (2) fused to centrum.

PSAA scored *C. laticeps* as state 1, but Dilkes and Reisz (1986) reconstruct the two as separate elements in their figure 5. Thus, state 0 applies.

134. Atlas neural arch midline fusion: (0) paired; (1) sutured at midline; (2) fused at midline.

PSAA scored *C. laticeps* as state 2, but Dilkes and Reisz (1986) describe "two halves of the neural arch" (page 1291) and so this character should be scored as state 0.

140. Ribs anterior to sacrum: (0) short; (1) long.

PSAA scored *C. laticeps* as state 1, but state 0 would appear to apply according to the skeletal reconstruction of Heaton and Reisz (1980).

145. Number pairs of caudal ribs: (0) 5 or more; (1) 4; (2) 3; (3) 2 or fewer.

PSAA scored *C. laticeps* as state 3, but Heaton and Reisz (1980, page 141) describe caudal ribs articulating to the first four caudals, the fifth caudal as bearing a small, hooked rib, and the sixth caudal with a small, diapophysis-like process. Accordingly, state 0 applies.

148. Interclavicle shape: (0) diamond shaped; (1) T-shaped.

PSAA scored *C. laticeps* as state 1 (i.e. not diamond-shaped), but code this species as state 0 (broad diamond) for their character 150 (Interclavicle shape [if diamond present]). I agree that the main body of the interclavicle is diamond-shaped, and this character should be scored as state 0.

153. Cleithrum head dorsal extent: (0) aligned along anterior rim of scapula; (1) posterodorsally enlarged head wrapping around dorsal scapula.

PSAA scored *C. laticeps* as state 0 but they scored the cleithrum as unossified (state 1) for their character 155 (Cleithrum ossification: [0] ossified; [1] unossified.). It should be scored as state 0.

163. Supinator process: (0) absent; (1) present.

PSAA scored *C. laticeps* as state 1. On page 141, Heaton and Reisz (1980) remark that the distal end of the humerus is well preserved only as an isolated bone fragment in one specimen, but it is not illustrated. This character should be scored as "?" until that specimen is documented.

184. Parietal anterior waisting: (0) absent; (1) present.

PSAA scored *C. laticeps* as state 1. Based on Heaton's (1979) illustrations, I conclude that the parietal does not exhibit anterior waisting, and that PSAA's coding is a typo or they have been misled by the presence of the lateral extension of the bone (which they scored as state 2 for their character 4 [i.e. intertemporal replaced by lateral extension of parietal]). I would scored this character as state 0.

186. Trabecula cranii (N 01): (0) Without significant median fusion posterior to solum nasi (platytrabic); (1) fused medially posterior to solum nasi to form elongate trabecula communis (tropitrabic).

PSAA scored *C. laticeps* as state 1. This character should be scored as "?" because this region is not observable in any *C. laticeps* specimen. It should be noted that the braincase reconstruction shown in figure 27 in Heaton (1979) is based largely on that of Price (1935) with some modifications by Malcolm Heaton. However, the parabasisphenoid of *C. laticeps* is not observable in any specimen described by Heaton (1979) and it is clear that much of the dorsal morphology of the braincase shown in figure 27 in Heaton (1979) is based on *C. aguti* specimens from Richards Spur. Thus, the braincase reconstruction in Heaton (1979) is compromised and characters for braincase characters for *C. laticeps* must be based on the specimen drawings of Heaton (1979) or personal observations of the available material.

187. Dorsal trabeculae (N 02): (0) dorsal trabeculae provide dorsolateral bridge between sphenoid region and nasal capsule; (1) dorsal trabeculae absent or incomplete, no dorsolateral bridge between sphenoid region and nasal capsule.

PSAA scored *C. laticeps* as state 1. This character cannot be determined in any *C. laticeps* specimen and it should be scored "?".

188. Ossification between optic foramen and pila antotica (N 03): (0) ossification complete between optic foramen and pila antotica; (1) pila metoptica and associated cartilaginous taenia unossified.

PSAA scored *C. laticeps* as state 1. This character cannot be determined because this area is not accessible in any *C. laticeps* specimen and should be scored "?".

189. Ossification within columella ethmoidalis (N 04): (0) absent; (1) present.

PSAA scored *C. laticeps* as state 1. This character cannot be determined in any *C. laticeps* specimen and should be scored "?".

190. Path of profundus branch of trigeminal nerve (N 05): (0) enclosed in lateral wall of sphenoid region of braincase and exits separately from maxillomandibular branch via series of small foramina; (1) extramural, exits antotic fissure with other branches of trigeminal.

PSAA scored *C. laticeps* as state 1. This character cannot be determined because this area in not accessible in any *C. laticeps* specimen and it should be scored "?".

193. Anterior extent of cultriform process of parasphenoid (N 08): (0) cultriform process extends to anterior margin of sphenethmoid; (1) cultriform process extends far anterior to sphenethmoid; (2) cultriform process does not reach anterior margin of sphenethmoid.

PSAA scored *C. laticeps* as state 2. This character cannot be determined in any *C. laticeps* specimen and should be scored "?".

194. Olfactory bulbs (N 09): (0) narrow; (1) endocasts swollen, leaving considerable impressions in lateral and ventral wall of sphenoid region and in ventral surface of frontal.

PSAA scored *C. laticeps* as state 0. No endocasts are preserved in any *C. laticeps* specimen and it should be scored "?".

195. Flange from skull roof articulating with sphenethmoid (modified from HPSA 223): (0) absent; (1) present on frontal and parietal; (2) present on frontal only.

PSAA scored *C. laticeps* as state 1. The ventral surface of the parietal is not known in *C. laticeps*. Heaton (1979) reconstructs the ventral surface of the parietal in his figure 19, but he did not provide specimen drawings of the *C. laticeps* specimens he used for this reconstruction, and he states that he also used Richards Spur specimens (probably *C. aguti*, but *C. laticeps* is not known from that locality), so the ventral morphology of the parietal in his figure 19 is compromised. Heaton (1979) illustrated a low ridge on the ventral surface of the frontal (his figure 17) and reconstructed it in his figure 9 as contacting the

sphenethmoid. Accordingly, I would scored this character as uncertain (states 1 or 2).

196. Descending lamina of parietal invades medial orbital wall between 'pleurosphenoid' and 'sphenethmoid' elements (N 10): (0) no; (1) yes.

PSAA scored *C. laticeps* as state 0, but it should be scored as "?"; see comments on PSAA character 195.

198. Intermaxillary fossa (modified from HPSA 095): (0) present; (1) absent.

PSAA scored *C. laticeps* as state 1. This character, however, cannot be determined in any *C. laticeps* specimen and should be scored "?".

201. Anterior extent of cultriform process along palate (N 14): (0) cultriform process extends anteriorly to level of posterior margin of choana; (1) cultriform process dramatically shortened, barely reaching the level of the posterior margin of the orbit.

PSAA scored *C. laticeps* as state 0. However, it duplicates PSAA's character 193 (Anterior extent of cultriform process of parasphenoid; see commentary above) This character, however, cannot be determined in any *C. laticeps* specimen and should be scored "?".

202. Sutural contact between cultriform process of parasphenoid and vomer (N 15): (0) no; (1) yes.

PSAA scored *C. laticeps* as state 0. This character, however, cannot be determined in any *C. laticeps* specimen and should be scored "?".

213. Hypophyseal fossa (N 26): (0) single unpaired sulcus; (1) paired sulci divided medially by ridge originating on dorsum sellae.

PSAA scored *C. laticeps* as state 0. Heaton (1979) described the fossa as partially subdivided by a median ridge issuing from the dorsum sellae, but he may be describing this morphology from Richards Spur material; he does not illustrate this area in any of his specimen drawings. Accordingly, this character should be scored as "?".

218. Median ascending process of supraoccipital (N 29): (0) absent; (1) present.

PSAA scored *C. laticeps* as state 1. This is presumably based upon Heaton (1979), but the median ascending process of supraoccipital cannot be seen in any of

Heaton's (1979) specimen drawings of the *C. laticeps* specimens he described; it only appears in his reconstruction on the braincase in his figure 30, which is based largely on the work of Price (1935) with some modifications based of Heaton's observation of Richards Spur captorhinid (probably *C. aguti*) specimens. Szostakiwskyj et al. (2015) identified a median ascending process of supraoccipital in the recumbirostrans *Huskerpeton englehorni*, and *Rhynchonkos stovalli*, but these look nothing like that in *C. aguti* (see figure 8 in Modesto 1998). Related: PSAA scored *Petrolacosaurus kansensis* as state 1. This follows their interpretation of the supraoccipital of this reptile in figure 15d in Szostakiwskyj et al. (2015). Reisz (1981) describes a "process of the supraoccipital that extends to the parietals" that underlie the postparietals. This process is ca. 9.5 times broader than it is tall (see figure 7b in Reisz, 1981), and to homologize it with the median ascending process of captorhinids is ill-advised.

219. Lateral ascending processes of the supraoccipital (N 30): (0) absent; (1) present.

PSAA scored *C. laticeps* as state 1. The bases of these processes can be seen in figures 12 and 13 in Heaton (1979), but the morphology illustrated in figure 30 of Heaton (1979), the reconstruction of the braincase of *C. laticeps*, is probably based on Richards Spur captorhinid (probably *C. aguti*) specimens. Szostakiwskyj et al. (2015) homologized the lateral ascending processes of the supraoccipital of *C. laticeps* and the diapsid *Petrolacosaurus kansensis* with supraoccipital processes in the recumbirostrans *Aletrimyti gaskillae*, *Dvellecanus carrolli*, *Huskerpeton englehorni*, and *Rhynchonkos stovalli*, but the recumbirostran structures look nothing like the lateral ascending processes of the supraoccipital in *C. aguti* (see figure 8 in Modesto 1998), which provide the best approximation of what these structures look like in *C. laticeps*. Szostakiwskyj et al. (2015) appear to have misidentified the lateral ascending processes in *C. laticeps* in their figure 15c: based on my examination of *C. aguti* supraoccipitals from Richards Spur (Modesto 1998), they have mistaken the prootic processes (what Heaton 1979 mistakenly termed the cristae alares) of this bone for the lateral ascending processes.

221. Crista intervestibularis (N 32): (0) crista intervestibularis absent; (1) crista intervestibularis present.

PSAA scored *C. laticeps* as state 1. The internal morphology of the otic region was not described by Heaton (1979), so I do not know how *C. laticeps* could be scored for this character; it should be scored as "?".

224. Facets on dorsal surface of supraoccipital (N 34): (0) absent; (1) present.

PSAA scored *C. laticeps* as state 1. However, PSAA did not elaborate on this character and I am uncertain as to the exact nature and location of these facets. If PSAA mean facets on the exposed dorsal surface of the supraoccipital in articulation with surrounding occipital elements, there are no features that fit that description in Heaton (1979). If PSAA mean the articulating surfaces on the tips of the lateral ascending processes, these are probably present (as they are in *C. aguti*: Modesto 1998) but cannot be confirmed in the *C. laticeps* material that Heaton (1979) illustrated because of the articulated nature of the skulls that preserve the supraoccipital. PSAA scored *Rhynchonkos stovalli* as state 1 but I fail to see facets on the dorsal surface of supraoccipital of this recumbirostran in Szostakiwskyj et al. (2015). This character should be scored as "?".

226. Crista parotica (N 36): (0) Descends posteriorly; (1) Horizontal along the extent of its length.

This character duplicates information in PSAA's character 222 (Morphology of crista parotica).

235. Insertion of epaxial musculature on occiput (N 44): (0) deep within post-temporal fossae; (1) in broad, shallow fossae along occipital surface of postparietals.

PSAA scored *C. laticeps* as state 0. Heaton (1979, page 53), however, describes the posterior surfaces of the postparietals and the supraoccipital as receiving the insertion of epaxial musculature, so state 1 would appear to apply here.

248. Prootic supported by pedicel extending from basisphenoid lateral to prootic foramen (N 51): (0) no; (1) yes.

PSAA scored *C. laticeps* as state 1. Heaton (1979, page 52), however, states that the prootic was not accessible in any of the specimens available to him, and that his description of this element is based on Richards Spur captorhinid materials (i.e. not material referable to *C. laticeps*). This character should be scored as "?".

253. Semicircular canals (N 56): (0) separated from utricular region by bone; (1) not separated from utricular region by bone.

PSAA scored *C. laticeps* as state 1, but this area has not been described or documented in this captorhinid, and this character should be scored as "?".

261. Ectopterygoid reaches subtemporal fossa: (0) no; (1) yes.

PSAA scored *C. laticeps* as state 1, but this determination is not possible because the ectopterygoid is not present in *C. laticeps*. This character should be scored as "?".

262. Frontal: (0) absent; (1) present.

PSAA correctly scored *C. laticeps* as state 1, but his character should have been combined with PSAA's character 18 (Frontals: [0] paired; [1] fused).

263. Jugal: (0) does not extend anterior to orbit; (1) extends anterior to orbit.

PSAA scored *C. laticeps* as state 0, which is supported by figures 12, 13, and possibly 10 in Heaton (1979), but state 1 is definitely present in the specimen illustrated in figure 4 of Heaton (1979). Thus, this character should be scored as state 0 and 1.

270. Prefrontal: (0) twice as long as broad, or less; (1) three times as long as broad.

PSAA correctly scored *C. laticeps* as state 0, but this character should have been combined with PSAA's character 25 (Prefrontal into external narial margin: (0) distant from; [1] near; [2] present).

271. Prefrontal: (0) transverse anterior suture with tectal; (1) tapers to a point anteriorly.

PSAA scored *C. laticeps* as state 1, but this character does not apply to tetrapods that lack an anterior tectal. It overlaps with PSAA character 257 (Anterior tectal: [0] anterior tectal present; [1] absent).

277. Ethmoid: (0) fully ossified; (1) partly or wholly unossified.

PSAA scored *C. laticeps* as state 1, but this character duplicates PSAA's character 216 (Sphenethmoid: [0] ossified; [1] unossified).

278. Hypophyseal region: (0) solid side wall pierced by small foramina for pituitary vein and other vessels; (1) single large foramen.

PSAA scored *C. laticeps* as state 1, but this region of the braincase is not accessible in any *C. laticeps* specimen and should be scored "?".

279. Lateral commissure of otic capsule bearing hyomandibular facets: (0) present; (1) absent.

PSAA scored *C. laticeps* as state 1, but this region of the braincase is not accessible in any *C. laticeps* specimen and should be scored "?".

282. Sphenoid: (0) fully ossified, terminating posteriorly in intracranial joint or fused to otoccipital; (1) separated from otoccipital by unossified gap.

PSAA scored *C. laticeps* as state 1, but this region of the braincase is not accessible in any *C. laticeps* specimen and should be scored "?".

285. Ectopterygoid/palatine shagreen field: (0) absent; (1) present.

PSAA scored *C. laticeps* as state 1, but no shagreen field has been documented in this reptile. This character should be scored as state 0.

286. Palatine row of smaller teeth: (0) present; (1) absent.

PSAA scored *C. laticeps* as state 1, but there is a cluster of small teeth with which the palatine contributes to the pterygopalatine tooth cluster. This character should be scored as state 0.

288. Dentition of transverse flange of pterygoid: (0) Denticle field indistinct from palatine denticle field; (1) distinct raised denticle field; (2) organized tooth row; (3) absent.

PSAA scored *C. laticeps* as state 2, but it is a cluster (field?) of small teeth (Heaton 1979) rather than an organized tooth row (state 2) but it is not raised as is the pterygopalatine tooth cluster (so not state 1). State 0 certainly does not apply, so this is another character that does not capture traits present in the amniote taxa.

331. Dentary tooth row: (0) homodont; (1) markedly heterodont.

PSAA scored *C. laticeps* as state 1. The dentary teeth are not as heterodont as those in *Opisthodontosaurus carrolli*, which PSAA scored as state 1, but are as heterodont as those in *Petrolacosaurus kansensis*, which PSAA scored as state 0. *Captorhinus laticeps* should be rescored as state 0.

344. Nature of dermal ornament: (0) tuberculate; (1) fairly regular pit and ridge; (2) irregular; (3) absent or almost absent.

PSAA scored *C. laticeps* as state 2, but should be scored as state 1.

365. Latissimus dorsi attachment: (0) diffuse ridged area; (1) distinct process.

PSAA scored *C. laticeps* as state 1, but illustrations of this region of the humerus (figure 16 in Holmes 1977; figure 8 in Heaton 1979) do not indicate a distinct process for the insertion of the m. latissimus dorsi. This character should be rescored as state 0.

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