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Crocodylian diversity peak and extinction in the late Cenozoic of the northern Neotropics

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19 April 2024

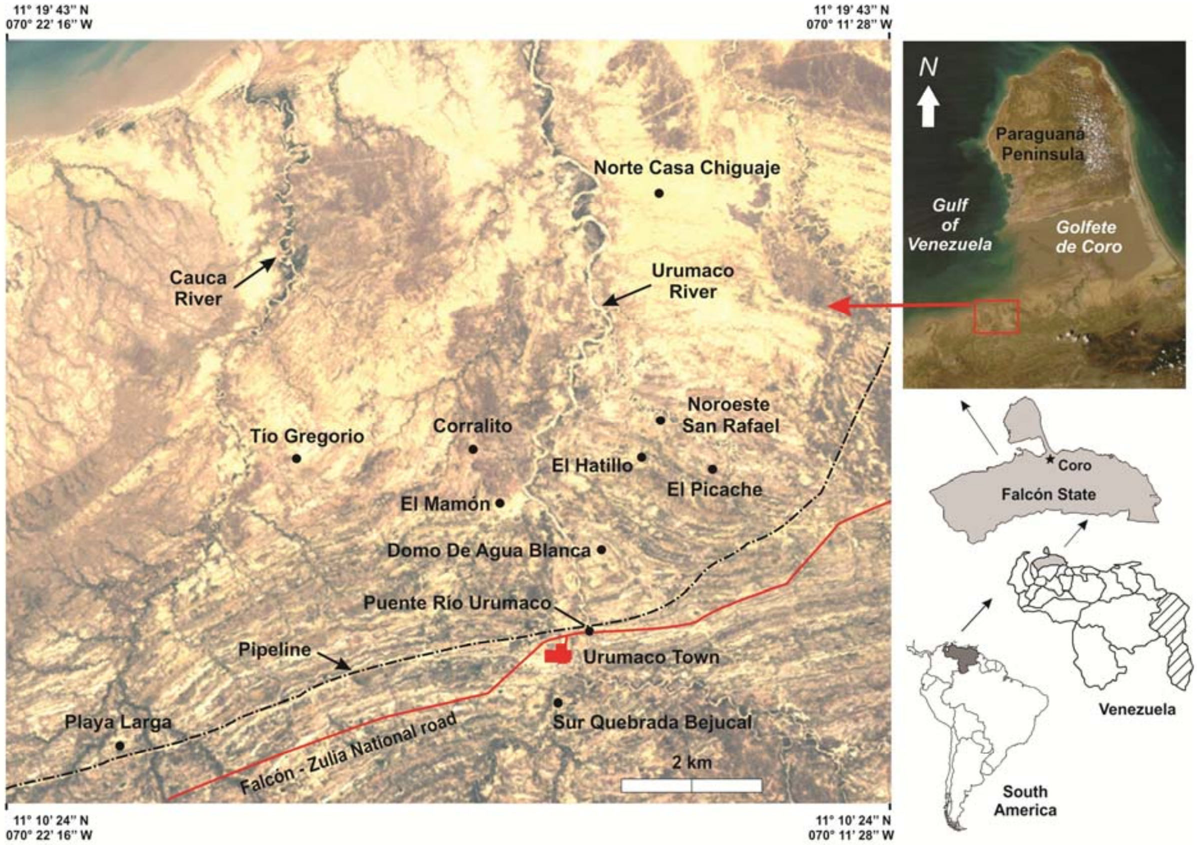
Supplementary Information for:

Crocodylian diversity peak and extinction in the late Cenozoic of the northern Neotropics

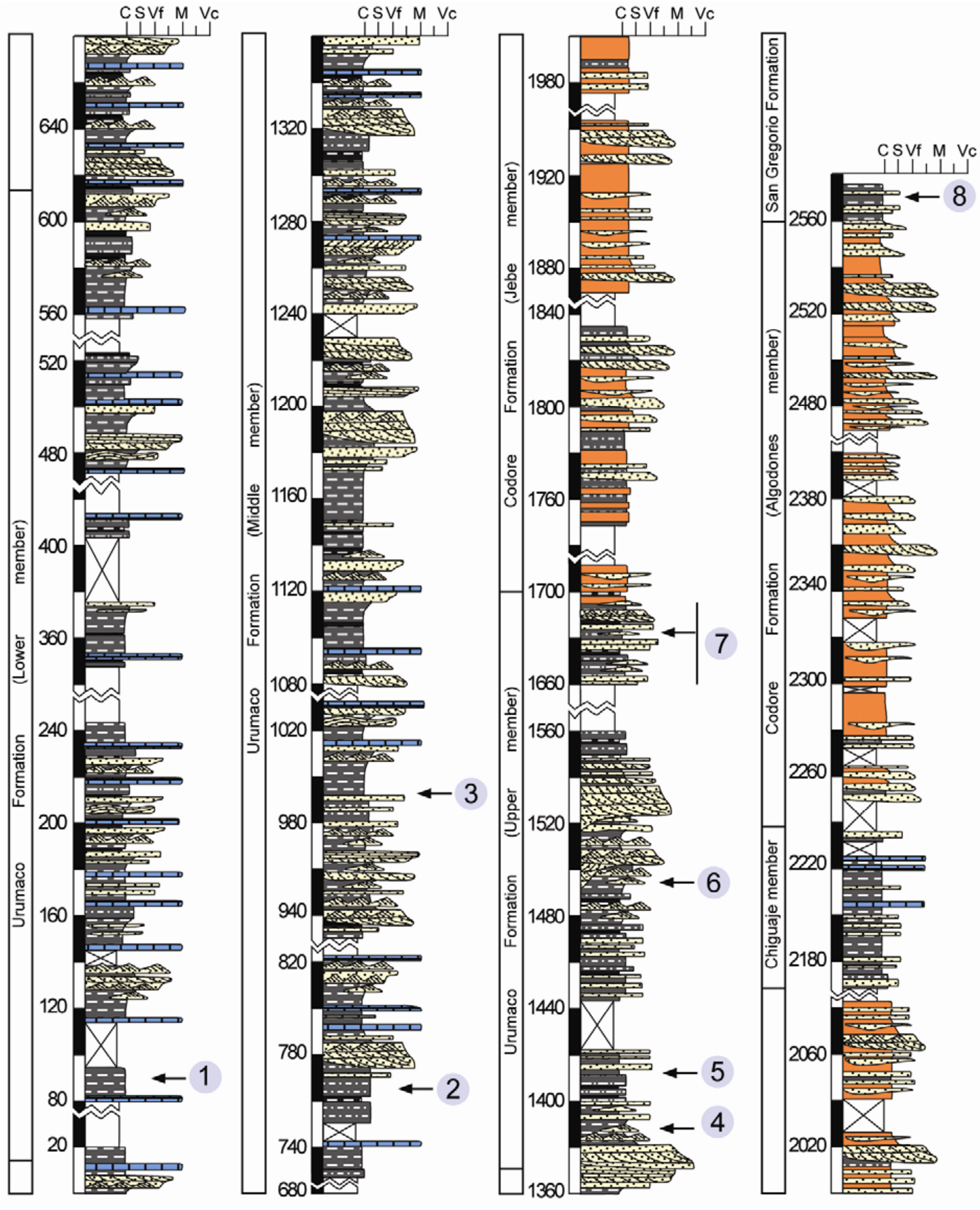
Scheyer, T. M., Aguilera, O. A., Delfino, M., Fortier, D. C., Carlini, A. A., Sánchez, R., Carrillo-Briceño, J. D., Quiroz, L. & Sánchez-Villagra, M. R.

Supplementary Figures

Supplementary Figure S1. Satellite image of Urumaco region with localities.

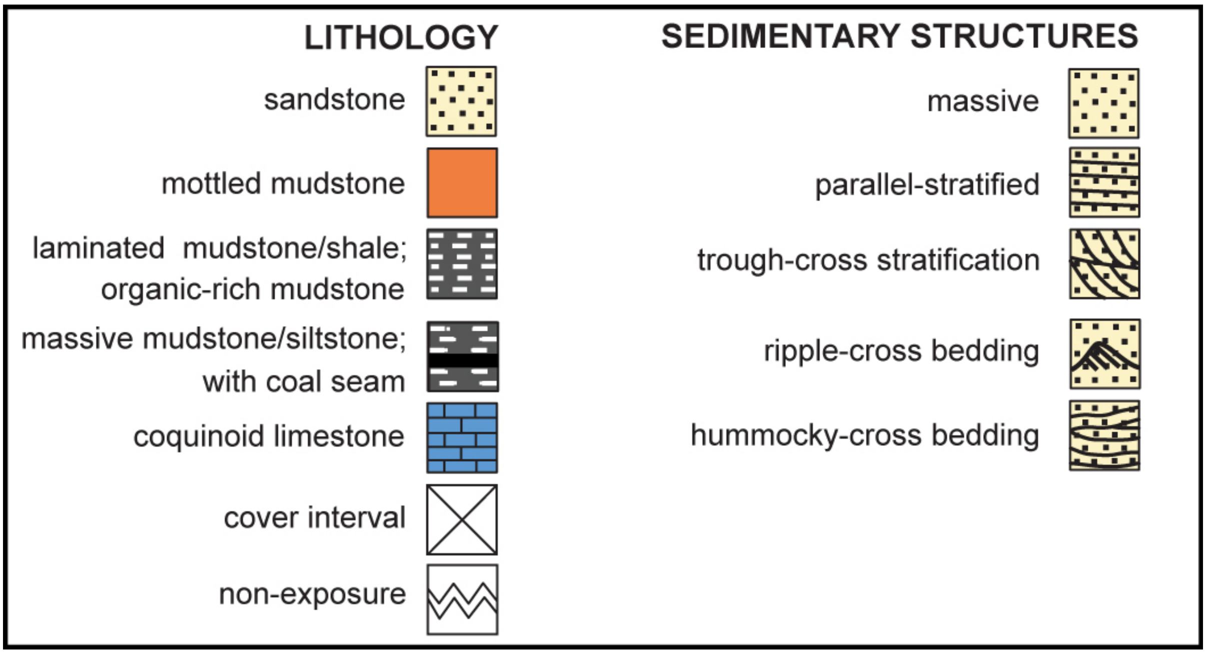


Supplementary Figure S2. Detailed stratigraphic log showing the localities in the Urumaco and San Gregorio Formations used herein.



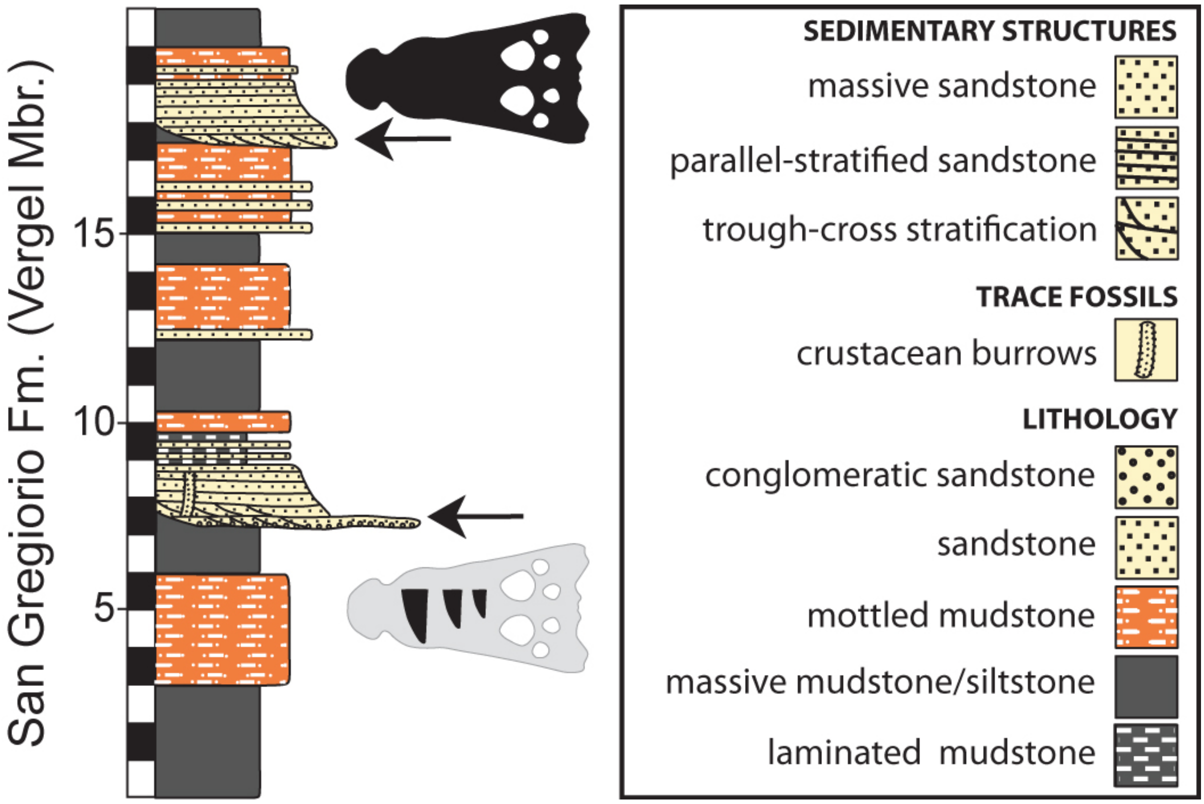
Modified from Quiroz and Jaramillo[54]. Locality names and coordinates are compiled in Supplementary Table 1. For legend see Supplementary Figure 2.

Supplementary Figure S3. Legend accompanying stratigraphic log in Figure S2.



Modified from Quiroz and Jaramillo[54].

Supplementary Figure S4. Detailed stratigraphic log of the Vergel Member of the San Gregorio Formation and its accompanying legend.



Note that the horizons where the holotype (black skull outline, adapted from Brochu[55]) and referred material (teeth in grey skull outline) were found in, are marked by black arrows.

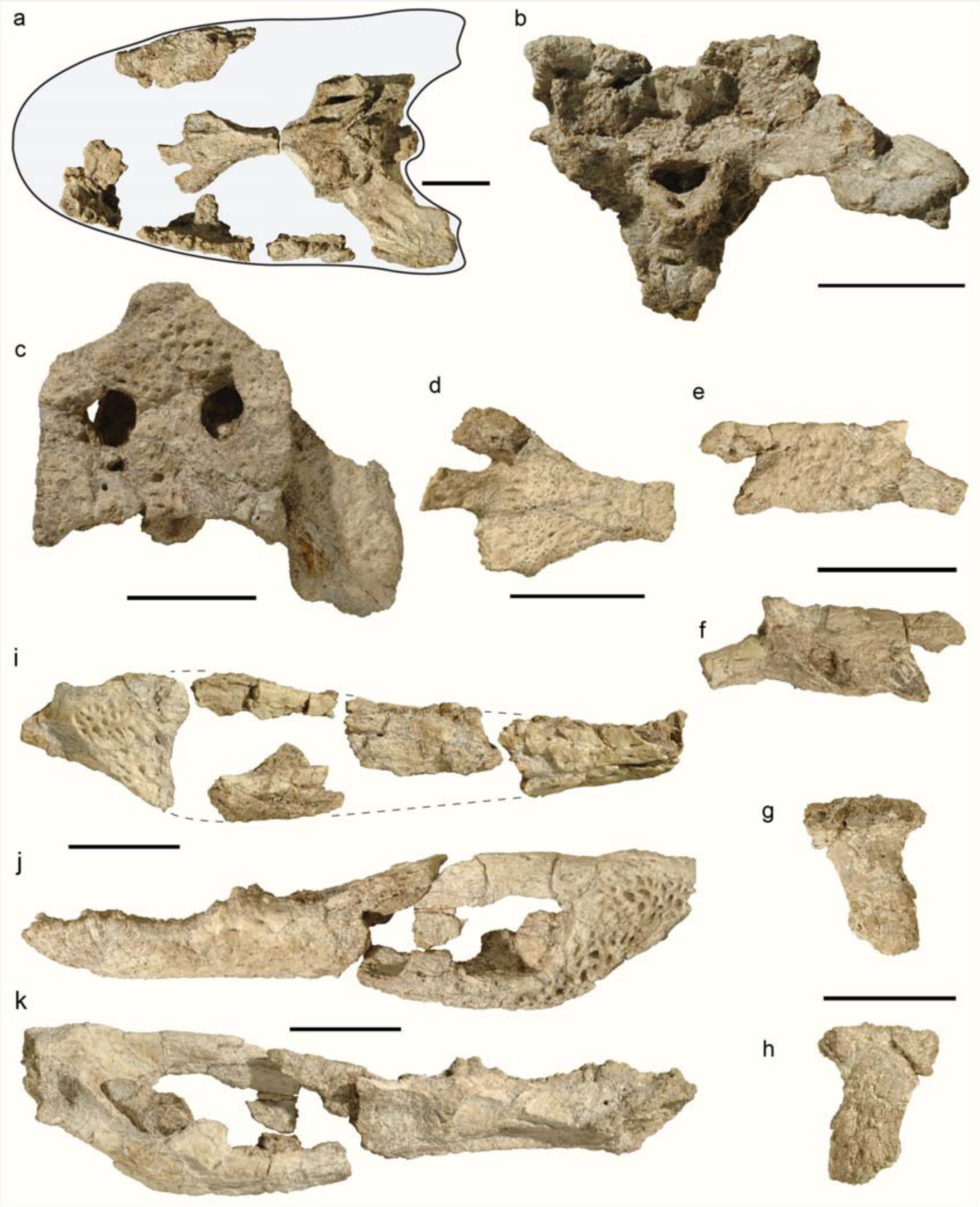
Supplementary Figure S5. Series of isolated teeth from the early Pliocene Vergel Member of the San Gregorio Formation.

The specimens (AMU-CURS-302) were collected 1 km from the holotype (11º 17’ 56.4” N, 70º 13’ 52.8” W) of *Crocodylus falconensis* sp. nov. Scale bar = 1.0 cm.

Supplementary Figure S6. Holotype skull AMU-CURS-300 of *Crocodylus falconensis* sp. nov.

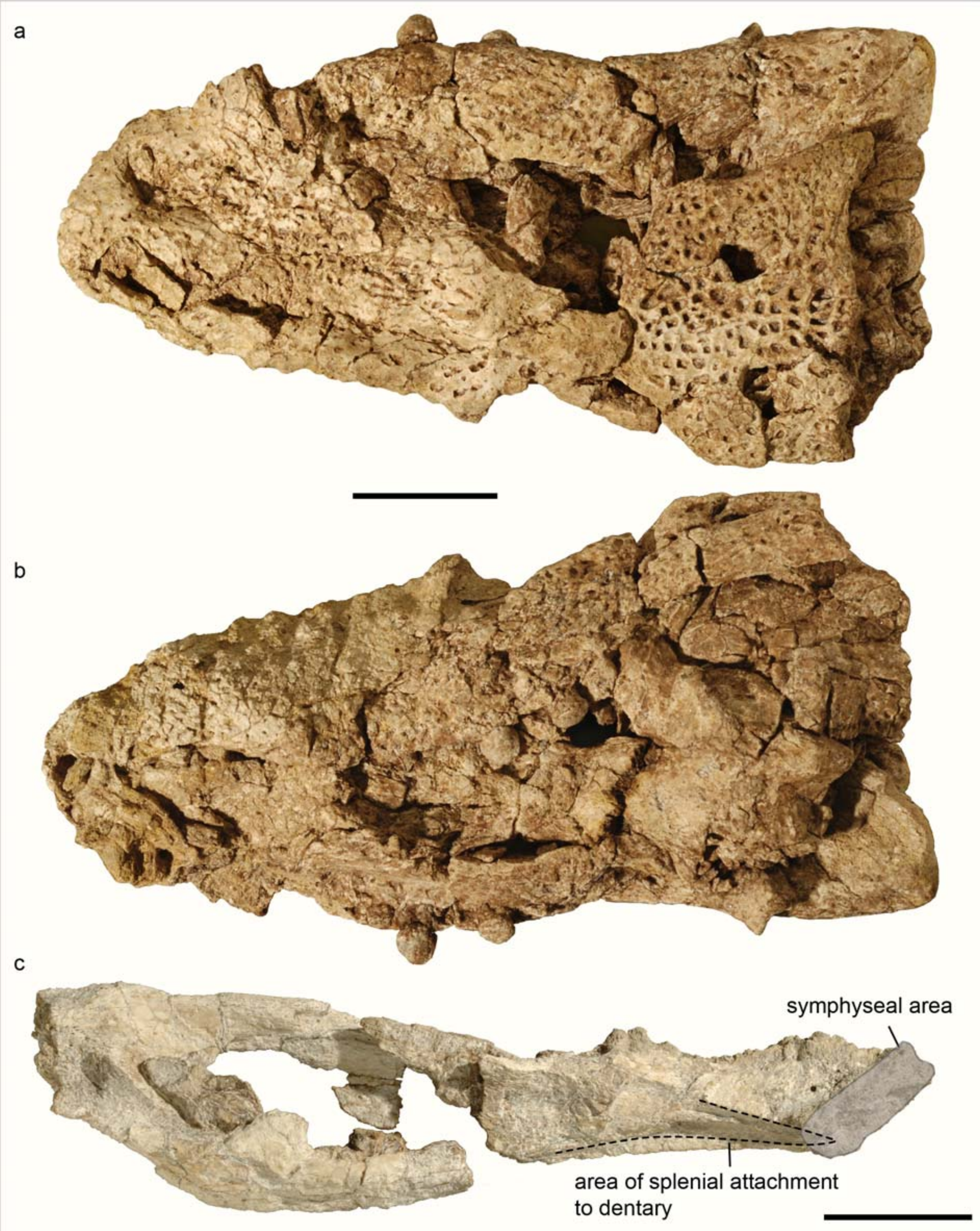
(**a**) Rostral view of skull. (**b**) Left lateral view of rostrum. (**c**) Occipital view of skull. Note that even though the skull is damaged, the ventral extension of the supraoccipital (so) is visible, reaching or almost reaching the foramen magnum (fm). Scale bars = 5.0 cm.

Supplementary Figure S7. Paratype material AMU-CURS-224 of *Globidentosuchus brachyrostris* gen. et sp. nov.



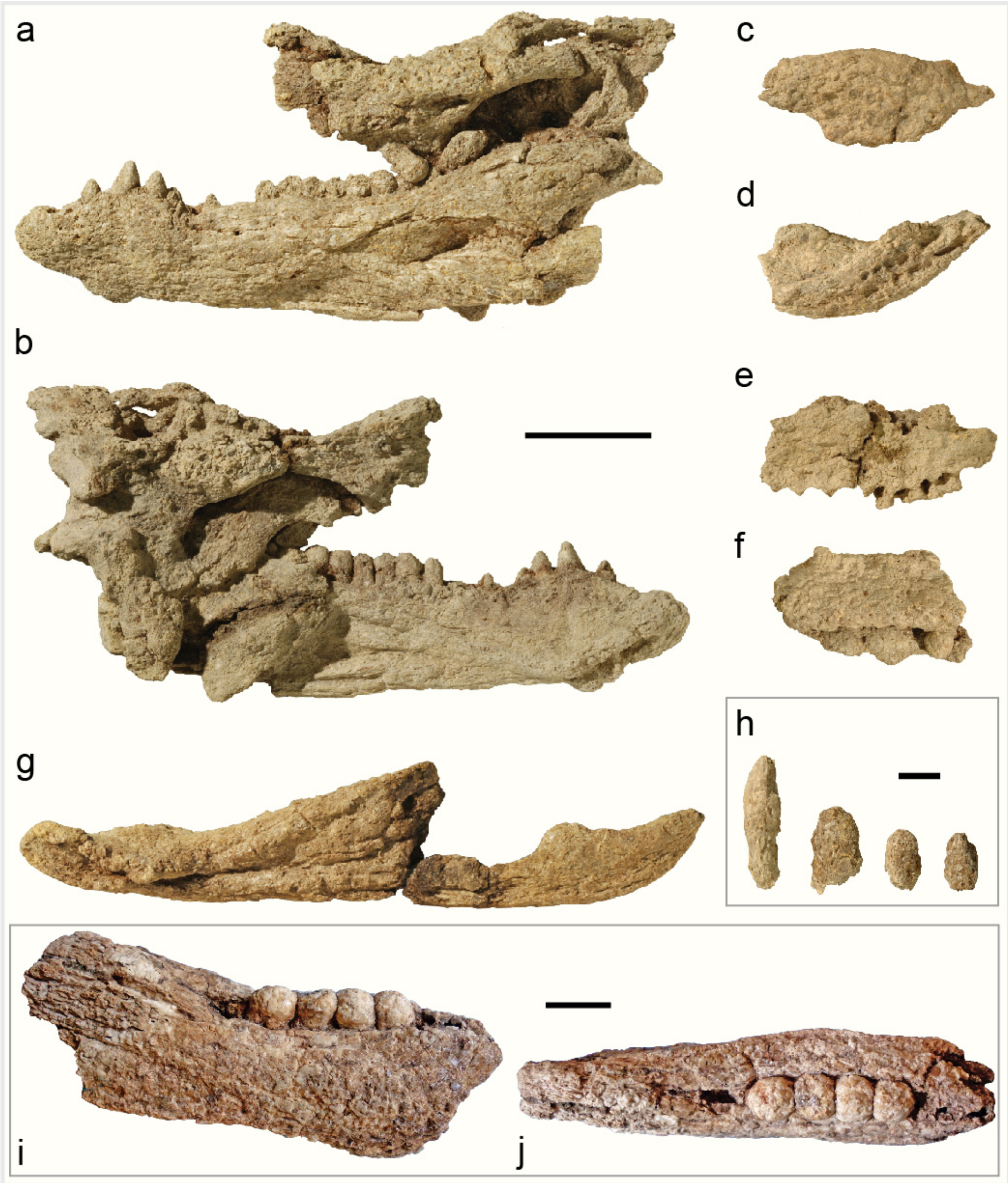
(**a**) Skull table/braincase, frontals and tooth-bearing elements and their assumed position in palatal view. (**b**) Skull table and braincase in occipital view. (**c**) Skull table and braincase in dorsal view. (**d**) Frontals in dorsal view. (**e**) Left jugal in lateral view. (**f**) Left jugal in medial view. (**g**) Left ectopterygoid in lateral view. (**h**) Left ectopterygoid in medial view. (**i**) Assembled right mandible in lateral view. (**j**) Assembled left mandible in lateral view. (**k**) Assembled left mandible in medial view. Scale bars = 5.0 cm.

Supplementary Figure S8. Selected holotype and paratype material of *Globidentosuchus brachyrostris* gen. et sp. nov.



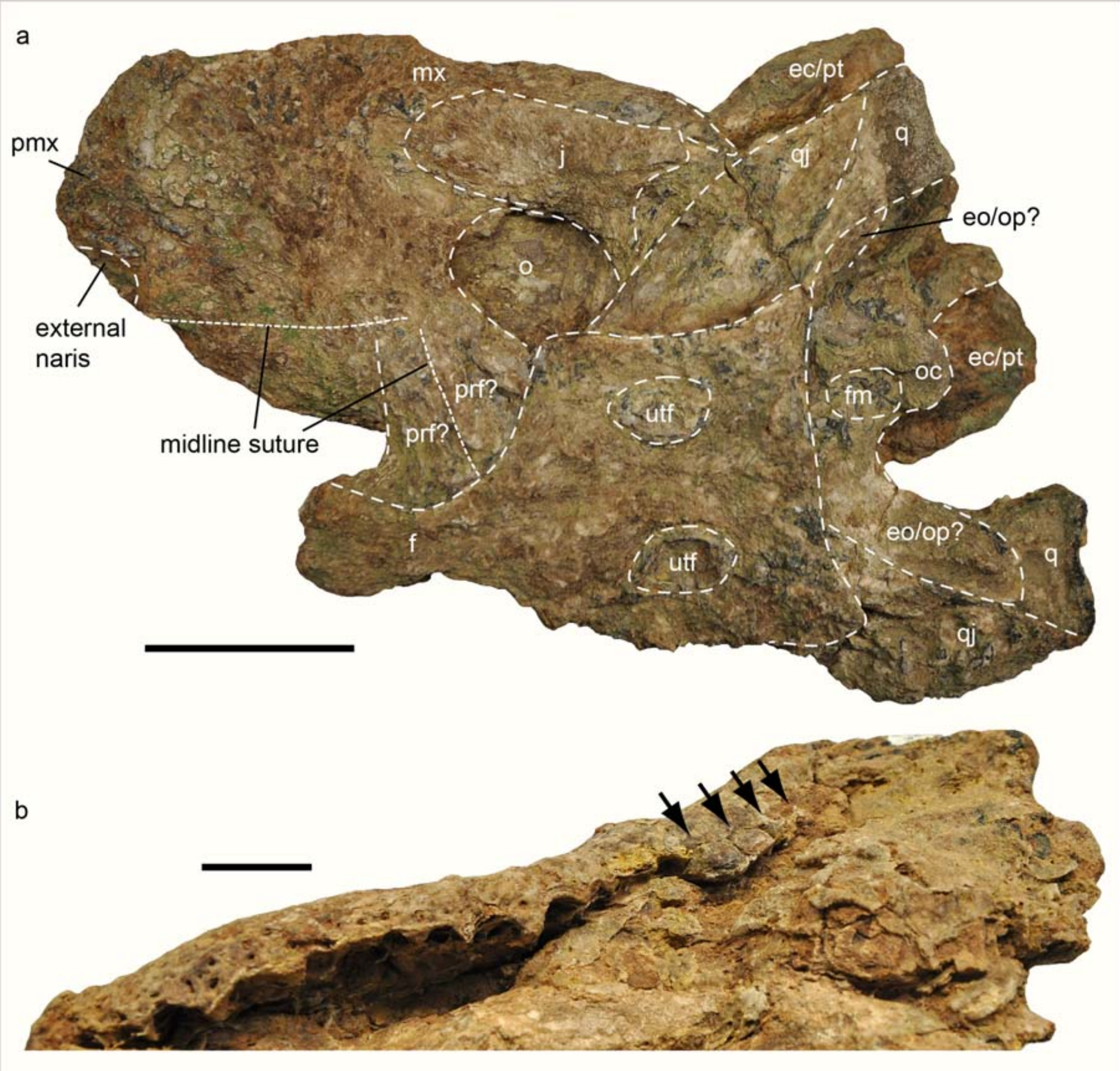
(**a**) Holotype skull (AMU-CURS-222, not mirror-imaged) in dorsal view. (**b**) Holotype skull in ventral view. (**c**) Left mandible of paratype (AMU-CURS-224) in which the extension of the splenial scar and the symphyseal area is indicated (compare to Supplementary Figure S7k). Scale bars = 5.0 cm.

Supplementary Figure S9. Referred material of *Globidentosuchus brachyrostris* gen. et sp. nov.



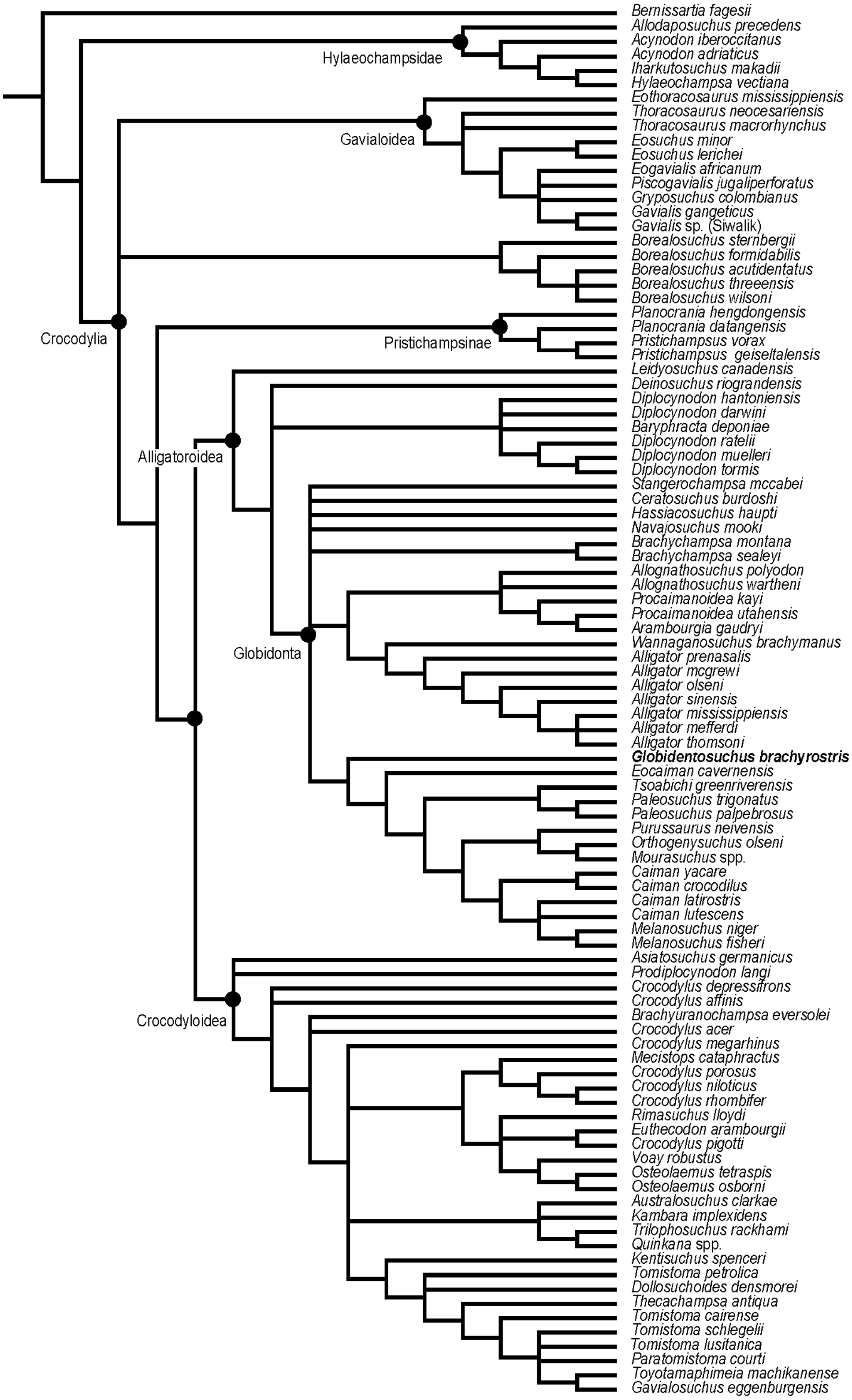
(**a-h**) Associated fragmentary cranial and mandibular remains (AMU-CURS-223). (**i, j**) Posterior part of right mandible showing four bulbous crushing teeth (AMU-CURS-301) in (**i**) lateral and (**j**) dorsal view. Part of skull roof and anterior part of left mandible in **a**) lateral view and (**b**) medial view. (**c**) Left surangular in lateral view. (**d**) Left angular in lateral view. (**e**) Maxillary fragment showing alveoli in palatal view. (**f**) Maxillary fragment with bulbous tooth in lateral view. (**g**) Assembled right mandible fragment in medial view. (**h**) Series of teeth associated with the cranial remains. Scale bars = 5.0 cm in (**a-f**), 1.0 cm in (**h**) and 2.0 cm in (**i, j**).

Supplementary Figure S10. Referred material of *Globidentosuchus brachyrostris* gen. et sp. nov.



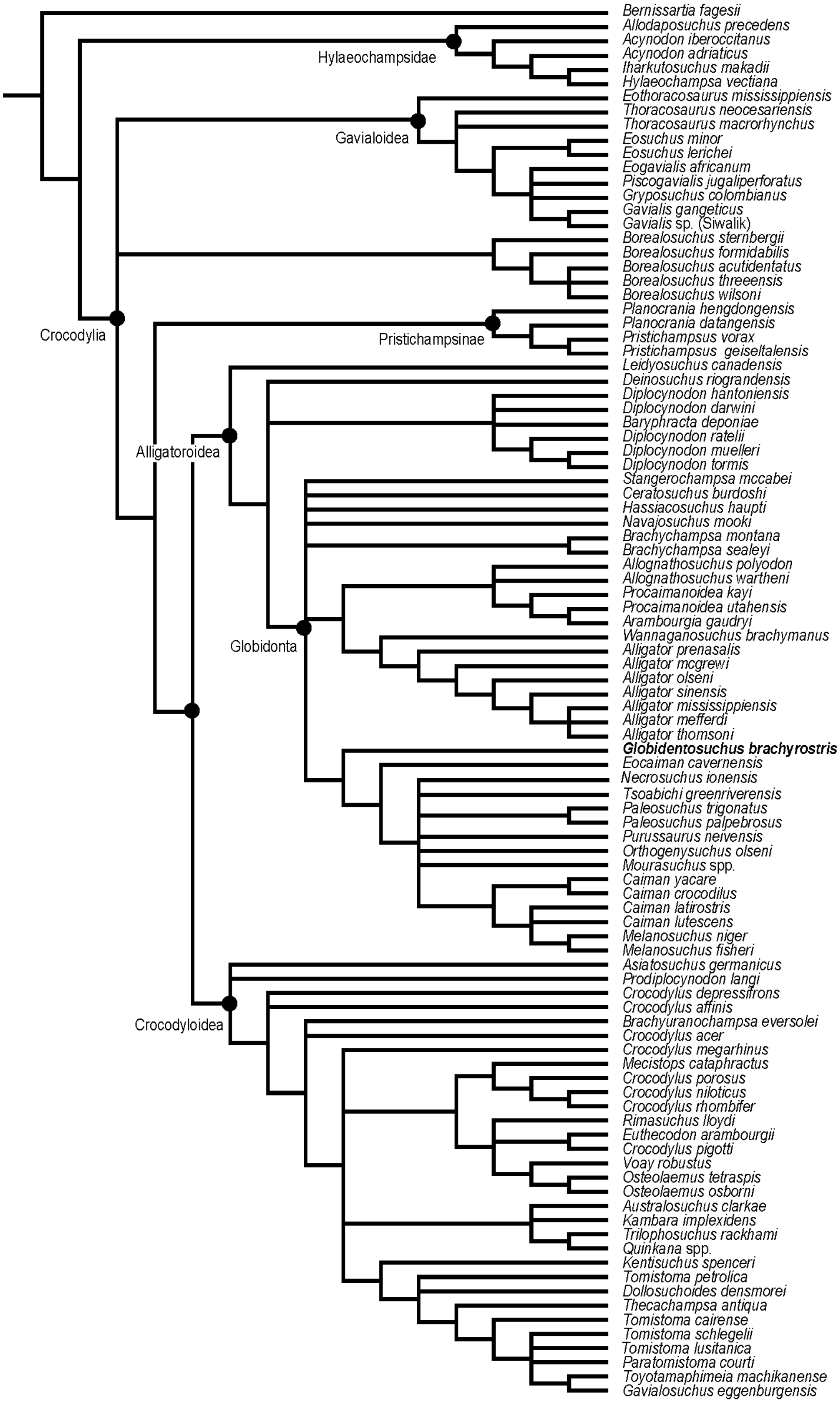
(**a**) Distorted skull (AMU-CURS-383) in dorsal view. Note that size of specimen is comparable to paratype specimen AMU-CURS 224 (based on skull table proportions). The rostrum is dislocated from the skull table and most of the tip of the snout and left side of rostrum has been folded and displaced ventrally. Due to strong weathering of the skull, most sutures are not traceable. (**b**) Left side of skull in oblique ventral view. The lateral walls of 13 alveoli of the anterior part of the left maxilla (maybe including also posterior end of premaxilla?) are visible. In the posterior part of the maxilla four closely spaced crushing teeth are still partly preserved (black arrows). Abbreviations: eo/op: exoccipital/opisthotic; f, frontal; fm, foramen magnum; j, jugal; mx, maxilla; o, orbit; oc, occipital condyle; pmx, premaxilla; prf, prefrontal; ec/pt, ectopterygoid and pterygoid; q, quadrate; qj, quadratojugal. Scale bars = 5.0 cm in (**a**) and 2.0 cm in (**b**).

Supplementary Figure S11. Phylogenetic analysis including the new caimanine taxon.



Strict consensus tree of 20160 most parsimonious trees (tree length=650 steps) recovered by TNT analysis. The new taxon is marked in bold.

Supplementary Figure S12. Phylogenetic analysis including the new caimanine taxon and *Necrosuchus ionensis*.



Strict consensus tree of 24100 most parsimonious trees (tree length=650 steps) recovered by TNT analysis. The new taxon is marked in bold. Note loss of resolution within Caimaninae.

Supplementary Table S1. Locality coordinates.

Socorro Formation localities	
Quebrada Honda (Llano Largo)	11° 11' 35.00" N; 70° 10' 49.00" W
Quebrada Honda (Cerro Maniaero)	11° 11' 00.90" N, 70° 09' 44.00" W
Quebrada Honda (Cerro Alto)	11° 12' 30.00" N; 70° 08' 12.00" W
Urumaco Formation localities	
Sur Quebrada Bejucal (1)	11° 11' 18.46" N; 70° 15' 03.00" W
Puente Río Urumaco (2)	11° 12' 24.66" N; 70° 14' 59.27" W
Playa Larga (2)	11° 10' 58.00" N, 70° 20' 50.00" W
Domo de Agua Blanca (3)	11° 13' 25.00" N; 70° 14' 50.00" W
El Hatillo (4)	11° 14' 34.00" N; 70° 14' 20.00" W
El Mamón (5)	11° 13' 60.00" N; 70° 16' 06.00" W
El Picache (6)	11° 14' 25.00" N; 70° 13' 27.00" W
Noroeste (NW) San Rafael (6)	11° 14' 52.00" N; 70° 14' 06.00" W
Corralito (7)	11° 14' 40.00" N; 70° 16' 26.00" W
Tío Gregorio (7)	11° 14' 33.13" N; 70° 18' 38.00" W
San Gregorio Formation localities	
Norte Casa Chiguaje (8)	11° 17' 52.00" N; 70° 14' 07.80" W

Numbers in brackets behind location names correspond to the number system used for the study (see locality numbers in Supplementary Figure 2). In the case of Puente Río Urumaco/Playa Larga, El Picache/ Noroeste (NW) San Rafael and Tío Gregorio/Corralito, the localities have been combined under numbers (2), (6) and (7) respectively, because of their close proximity in the stratigraphic column. Coordinates of Urumaco town for reference: 11º 17’ 53.9” N, 70º 14’ 33.7” W.

Supplementary Table S2. List of fossil material examined.

Formation/Locality	Specimen Number	Taxon	Material present
Socorro Formation (pooled localities)			
	AMU-CURS-031	*Purussaurus* sp.	Right mandible
	AMU-CURS-034	?cf. *Thecachampsa* sp. 1	Cranium and rostrum
	AMU-CURS-095	*Mourasuchus sp.*	Partial rostrum
	AMU-CURS-141	*Mourasuchus* sp.	Mandible
	AMU-CURS-151	*Caiman* sp.	Cranium
	AMU-CURS-433	*Ikanogavialis gameroi*	Rostrum
Urumaco Formation			
Sur Quebrada Bejucal (1)			
	AMU-CURS-018	*Caiman* sp.	Mandible
	AMU-CURS-020	*Purussaurus* sp.	Cranial and postcranial remains
	AMU-CURS-unnumbered	*Mourasuchus* sp.	Partial cranial remains
Puente Río Urumaco/ Playa Larga (2)			
	AMU-CURS-001	*Hesperogavialis cruxenti*	Cranium and rostrum
	AMU-CURS-113	*Caiman* sp.	Cranium
	AMU-CURS-217	*Melanosuchus fisheri*	Cranium
	AMU-CURS-218	*Mourasuchus nativus*	Cranium
	MCN-URU-2002-unnumbered	*Ikanogavialis gameroi*	Cranium and rostrum
Domo de Agua Blanca (3)			
	AMU-CURS-012	?cf. *Thecachampsa* sp. 2	Cranium and mandible
	AMU-CURS-132	*Hesperogavialis cruxenti*	Rostrum
	AMU-CURS-301	*Globidentosuchus brachyrostris* (referred material)	Posterior part of right mandible with four crushing teeth
	AMU-CURS-450	*Globidentosuchus brachyrostris* (referred material)	partial mandibular remains
El Hatillo (4)			
	AMU-CURS-134	*Gryposuchus croizati*	Rostrum
	AMU-CURS-135	*Purussaurus mirandai* (paratype)	Cranium with associated mandibles
	AMU-CURS-234	*Melanosuchus fisheri*	Cranium and mandibles (also postcranium)
	AMU-CURS-unnumbered	*Charactosuchus mendesi*	partial cranial remains

	AMU-CURS-unnumbered	*Mourasuchus arendsi*	partial cranial remains
El Mamón (5)			
	AMU-CURS-212	*Mourasuchus nativus*	Cranial fragment
	AMU-CURS-429	*Caiman brevirostris*	Cranial/mandibular fragments
	UNEFM-CIAPP-319	*Hesperogavialis cruxenti*	Rostrum
	UNEFM-CIAPP-320	*Hesperogavialis cruxenti* (holotype)	Partial cranium and rostrum
El Picache (6)			
	AMU-CURS-222	*Globidentosuchus brachyrostris* (holotype)	Cranium and mandibles
	AMU-CURS-223	*Globidentosuchus brachyrostris* (referred material)	Associated fragmentary cranial and mandibular remains
	AMU-CURS-224	*Globidentosuchus brachyrostris* (paratype)	Fragmentary cranial remains associated with mandibles
	AMU-CURS-unnumbered	*Purussaurus* sp.	Cranium and mandibular remains
	MCN- unnumbered	*Caiman brevirostris*	Cranium with associated mandibles
NW San Rafael (6)			
	AMU-CURS-383	*Globidentosuchus brachyrostris* (referred material)	Cranium and mandibles
	AMU-CURS-384	*Purussaurus* sp.	Left mandible
	AMU-CURS-390	*Mourasuchus sp.*	Mandibular fragment
	AMU-CURS-395	*Mourasuchus* sp.	Cranial fragments
	AMU-CURS-396	*Mourasuchus* sp.	Cranial fragments
	AMU-CURS-399	*Gryposuchus* sp.	Cranial fragments
Corralito (7)			
	AMU-CURS-049	*Caiman lutescens*	Partial rostrum
	AMU-CURS-090	*Caiman* sp.	Cranium and rostrum
	AMU-CURS-unnumbered	*Purussaurus* sp.	Cranial remains
	MCN-243	*Melanosuchus fisheri* (holotype)	Cranium and rostrum
	UNEFM-CIAPP-617	*Gryposuchus jessei*	Rostrum
	UNEFM-CIAPP-1297	*Mourasuchus arendsi* (holotype)	Skull and mandible
	UNEFM-CIAAP-1440	*Gryposuchus croizati* (paratype)	Mandible
Tío Gregorio (7)			
	AMU-CURS-057	*Purussaurus* sp.	Mandible
	AMU-CURS-058	*Gryposuchus croizati* (paratype)	Cranium and rostrum and postcranial material
	AMU-CURS-073	*Mourasuchus* sp.	Right mandible and incomplete rostrum and

			postcranial material
	AMU-CURS-105	*Caiman brevirostris*	Cranium
	AMU-CURS-106	*Caiman brevirostris*	Mandible
	AMU-CURS-unnumbered	*Purussaurus* sp.	partial cranial remains
	MCN-URU-2002-143	*Ikanogavialis gameroi*	Cranium and rostrum
	UCV-VF-1165	*Ikanogavialis gameroi* (holotype)	Cranium
	UCV-VF-1166	*Ikanogavialis gameroi* (holotype)	Mandible
San Gregorio Formation locality			
Norte Casa Chiguaje (8)			
	AMU-CURS-300	*Crocodylus falconensis* (holotype)	Almost complete skull with mandibles
	AMU-CURS-302	Crocodylia indet.	Series of isolated teeth

Abbreviations: UNEFM-CIAAP, Universidad Nacional Experimental Francisco de Miranda, Coro, Venezuela; MCN, Museo de Ciencias Naturales de Caracas, Venezuela; AMU-CURS, Colección de Paleontología de Vertebrados de la Alcaldía de Urumaco, Estado Falcón, Venezuela; UCV, Universidad Central de Venezuela, Maracay, Venezuela.

Supplementary Table S3. Length estimations I.

New *Crocodylus* species	DCL = 59.0 [cm], SL = 42.5 [cm], ODCL = 165.0 [mm]	
Gavialis gangeticus formula	(modif. from Sereno et al.[56])	
TL = (7.4 * DCL) – 69.369	TL = (7.4 * 59.0) – 69.369	TL = 367.23
Crocodylus porosus formula	(modif. from Sereno et al.[56])	
TL = (7.717 * DCL) – 20.224	TL = (7.717 * 59.0) – 20.224	TL = 435.08
Crocodylus moreletii formula	(modif. from Platt et al.[57])	
TL = (10.48 * SL) + 6.20	TL = (10.48 * 42.5) + 6.20	TL = 451.60
Crocodylus acutus formula	(modif. from Platt et al.[58])	
TL = (9.01 * SL) + 10.80	TL = (9.01 * 42.5) + 10.80	TL = 393.73
Alligator mississippiensis formula	(modif. from Hurlburt et al.[59])	
Log TL = (log ODCL * 1.259) + 0.793	Log TL = (log 165.0 * 1.259) + 0.793	TL = 384.43
Log TL = (log DCL * 0.970) + 0.954	Log TL = (log 590.0 * 0.970) + 0.954	TL = 438.25
		Mean = 411.72

New caimanine species	DCL = 29.0 [cm], SL = 14.0 [cm] ODCL = 150.0 [mm]	
Gavialis gangeticus formula	(modif. from Sereno et al.[56])	
TL = (7.4 * DCL) – 69.369	TL = (7.4 * 29.0) – 69.369	TL = 145.23
Crocodylus porosus formula	(modif. from Sereno et al.[56])	
TL = (7.717 * DCL) – 20.224	TL = (7.717 * 29.0) – 20.224	TL = 203.57
Crocodylus moreletii formula	(modif. from Platt et al.[57])	
TL = (10.48 * SL) + 6.20	TL = (10.48 * 14.0) + 6.20	TL = 152.92
Crocodylus acutus formula	(modif. from Platt et al.[58])	
TL = (9.01 * SL) + 10.80	TL = (9.01 * 14.0) + 10.80	TL = 136.94
Alligator mississippiensis formula	(modif. from Hurlburt et al.[59])	
Log TL = (log ODCL * 1.259) + 0.793	Log TL = (log 150.0 * 1.259) + 0.793	[TL = 340.96*]
Log TL = (log DCL * 0.970) + 0.954	Log TL = (log 290.0 * 0.970) + 0.954	TL = 220.05
		Mean = 171.74 [199.95*]

Total body length (TL) estimations in [cm] using dorsal cranial length (DCL), snout length (SL) and orbito-cranial length (ODCL). Note that for the *Alligator*-based formula[59], values have to be entered in millimeters. Results are rounded to the nearest [mm].

Supplementary Table S4. Length estimations II.

New *Crocodylus* species	DCL = 59.0, SL = 42.5	
Crocodylus porosus formula	(modif. from Webb and Messel[60])	
SVL = (3.60 * DCL) - 4.30	SVL = (3.60 * 59.0) - 4.30	SVL = 208.10
Crocodylus moreletii formula	(modif. from Platt et al.[57])	
SVL = (5.32 * SL) + 1.61	SVL = (5.32 * 42.5) + 1.61	SVL = 227.71
Crocodylus acutus formula	(modif. from Platt et al.[58])	
SVL = (4.68 * SL) + 4.57	SVL = (4.68 * 42.5) + 4.57	SVL = 203.47
		Mean = 213.09

New caimanine species	DCL = 29.0, SL = 14.0	
Crocodylus porosus formula	(modif. from Webb and Messel[60])	
SVL = (3.60 * DCL) - 4.30	SVL = (3.60 * 29.0) - 4.30	SVL = 100.10
Crocodylus moreletii formula	(modif. from Platt et al.[57])	
SVL = (5.32 * SL) + 1.61	SVL = (5.32 * 14.0) + 1.61	SVL = 76.09
Crocodylus acutus formula	(modif. from Platt et al.[58])	
SVL = (4.68 * SL) + 4.57	SVL = (4.68 * 14.0) + 4.57	SVL = 70.09
		Mean = 82.09

Snout-vent length (SVL) estimations in [cm] using dorsal cranial length (CL) and snout length (SL); results are rounded to the nearest [mm].

Supplementary Table S5. Mass estimations.

New *Crocodylus* species	mean SVL = 213.09, mean TL= 411.72	
Crocodylus porosus formula	(modif. from Webb and Messel[60])	
log BM = (3.2613 * log SVL) - 2.0894	log BM = (3.2613 * log 213.09) - 2.0894	BM = 319.70
Crocodylus moreletii formula	(modif. from Platt et al.[57])	
ln BM = (ln TL – 2.05) / 0.32	ln BM = (ln 411.72 – 2.05) / 0.32	BM = 244.58
ln BM = (ln SVL – 1.25) / 0.33	ln BM = (ln 213.09 – 1.25) / 0.33	BM = 257.75
Crocodylus acutus formula	(modif. from Platt et al.[58])	
ln BM = (ln TL – 2.06) / 0.31	ln BM = (ln 411.72 – 2.06) / 0.31	BM = 353.38
ln BM = (ln SVL – 1.27) / 0.32	ln BM = (ln 213.09 – 1.27) / 0.32	BM = 357.40
		Mean = 306.56

New caimanine species	mean SVL = 82.09, mean TL = 171.74 [mean TL = 199.95*]	
Crocodylus porosus formula	(modif. from Webb and Messel[60])	
log BM = (3.2613 * log SVL) - 2.0894	log BM = (3.2613 * log 82.09) - 2.0894	BM = 14.25
Crocodylus moreletii formula	(modif. from Platt et al.[57])	
ln BM = (ln TL – 2.05) / 0.32	ln BM = (ln 171.74 – 2.05) / 0.32	BM = 15.91 [25.59*]
ln BM = (ln SVL – 1.25) / 0.33	ln BM = (ln 82.09 – 1.25) / 0.33	BM = 14.32
Crocodylus acutus formula	(modif. from Platt et al.[58])	
ln BM = (ln TL – 2.06) / 0.31	ln BM = (ln 171.74 – 2.06) / 0.31	BM = 21.05 [34.39*]
ln BM = (ln SVL – 1.27) / 0.32	ln BM = (ln 82.09 – 1.27) / 0.32	BM = 18.14
		Mean = 16.73 [21.34*]

Body Mass (BM) estimations in [kg] using total length (TL) and snout-vent length (SVL) in [cm]; results are rounded to the nearest [mm].

Supplementary Notes

Supplementary Note 1: Stratigraphic and Palaeoenvironmental Context of New Taxa

New *Crocodylus* species

The new *Crocodylus* species comes from outcrops that have only recently been discovered to be fossiliferous and described, so we provide here a context for future reference in explorations, or in stratigraphical, taphonomical or palaeoecological studies. The San Gregorio Formation is the upper-most part of the large Urumaco sequence[54]. The contact between the Codore and San Gregorio Formations is transitional near the Urumaco River area, and the age is early Pliocene. It is exposed in the north-central area of the Falcon State coastal plain, 10 km north of the Urumaco Town. The fossiliferous outcrops are of the lower part of the Vergel Member of the San Gregorio Formation (Supplementary Figure 4), consisting of brown to dark gray, massive mudstone and mottled muddy sandstone, interbedded with massive to cross-bedded conglomeratic sandstone with lenticular geometry and erosive base, grading to parallel-stratified, fine to medium grained sandstone. This succession represents flood plain deposits and associated crevasse splays, with low sinuosity ephemeral channels mostly filled during river flooding, in an alluvial fan setting.

The lateral outflow of the channels during inundate events form a sub-aerial savannas, such as, wetlands. The results of these inundate soils are palaeosols over sandy deposits, characterized by the presence of a terrestrial and semi-aquatic fossil assemblage, including mammals[61]. The faunal assemblage represents the last testimonies of the hydrographic and climate change around the Miocene/Pliocene boundary.

New caimanine species

The type and most of the referred material of the new caimanine come from the El Picache locality, Upper Member of the Urumaco Formation, whereas the isolated mandible (AMU-CURS-223) was recovered from the Middle Member of the Urumaco Formation. The sedimentary environments of the Urumaco Formation have been described in Quiroz and Jaramillo[54] (see stratigraphic logs in Fig. 1 and Supplementary Figures 2-4). According to the authors, both the Middle and Upper Member are composed of siliciclastic sequences and intercalated limestone beds deposited in a prograding delta and strand plain environment.

Supplementary Note 2: Major Expeditions to the Fossiliferous Outcrops around Urumaco

Expeditions to the Urumaco region were conducted by Royo y Gómez from Universidad Central de Venezuela in Caracas (1958-1959), C. González de Juana at Universidad Central de Venezuela together with Bryan Patterson from Harvard University (1972), Jean Bocquentin-Villanueva (1982 and following years in the 1980s) and by Orangel Aguilera (1992-2012) at the Universidad Francisco de Miranda in Coro, R. Sánchez at Alcaldía de Urumaco and Smithonian Tropical Research Institute (1990-2012), M. Sánchez-Villagra from University of Tübingen (2002-2004), The Natural History Museum in London (2004-2006), and from University of Zürich (2007-2012).

Supplementary Note 3: Phylogenetic Analyses

New *Crocodylus* species

The dataset for the testing the position of the new *Crocodylus* species comprised 32 characters in total (coding 29 characters that vary inside Crocodylinae[62] plus two new characters), 14 ingroup taxa and the outgroup consisting of the basal crocodiline "*Crocodylus*" *megarhinus* and the three osteolaemines "*Crocodylus*" *pigotti*, *Rimasuchus lloydi* and *Voay robustus*.

Character description

1. Ventral tubercle of proatlas more than one-half (0) or no more than one half (1) the width of the dorsal crest. (Brochu et al.[62], character 1)
2. Fused proatlas boomerang-shaped (0), strap-shaped (1), or massive and block-shaped (2). (Brochu et al.[62], character 2)
3. Anterior half of axis neural spine oriented horizontally (0) or slopes anteriorly (1). (Brochu et al.[62], character 6)
4. Axis neural spine crested (0) or not crested (1). (Brochu et al.[62], character 7)
5. Posterior half of axis neural spine wide (0) or narrow (1). (Brochu et al.[62], character 8)
6. Hypapophyseal keels present on eleventh vertebra behind atlas (0), twelfth vertebra behind atlas (1), or tenth vertebra behind atlas (2). (Brochu et al.[62], character 9)
7. Third cervical vertebra (first postaxial) with prominent hypapophysis (0) or lacks prominent hypapophysis (1). (Brochu et al.[62], character 10)
8. Neural spine on third cervical long, dorsal tip at least half the length of the centrum without the cotyle (0) or short, dorsal tip acute and less than half the length of the centrum without the cotyle (1). (Brochu et al.[62], character 11)
9. Scapulocoracoid facet anterior to glenoid fossa uniformly narrow (0) or broad immediately anterior to glenoid fossa, and tapering anteriorly (1). (Brochu et al.[62], character 14)
10. Proximal edge of deltopectoral crest emerges smoothly from proximal end of humerus and is not obviously concave (0) or emerges abruptly from proximal end of humerus and is obviously concave (1). (Brochu et al.[62], character 15)
11. Dorsal margin of iliac blade rounded with smooth border (0) or rounded, with modest dorsal indentation (1) or rounded, with strong dorsal indentation ("wasp-waisted;" 2) or narrow, with dorsal indentation (3) or rounded with smooth border; posterior tip of blade very deep (4). (Brochu et al.[62], character 19)
12. Supraacetabular crest narrow (0) or broad (1). (Brochu et al.[62], character 20)

13. Dentary symphysis extends to fourth or fifth alveolus (0) or sixth through eighth alveolus (1) or behind eighth alveolus (2.) (Brochu et al.[62], character 28)

14. Angular-surangular suture contacts external mandibular fenestra at posterior angle at maturity (0) or passes broadly along ventral margin of external mandibular fenestra late in ontogeny (1). (Brochu et al.[62], character 34)

15. Dorsal surface of rostrum curves smoothly (0) or bears medial dorsal boss (1). (Brochu et al.[62], character 52)

16. Preorbital ridges absent or very modest (0) or very prominent (1) at maturity. (Brochu et al.[62], character 53)

17. Surface of maxilla within narial canal imperforate (0) or with a linear array of pits (1.) (Brochu et al.[62], character 55)

18. Anterior ectopterygoid process tapers to a point (0) or forked (1). (Brochu et al.[62], character 63)

19. Palatine process generally broad anteriorly (0) or in form of thin wedge (1). (Brochu et al.[62], character 65)

20. Palatine-pterygoid suture nearly at (0) or far from (1) posterior angle of suborbital fenestra. (Brochu et al.[62], character 67)

21. Pterygoid surface lateral and anterior to internal choana flush with choanal margin (0) or pushed inward anterolateral to choanal aperture (1) or pushed inward around choana to form “neck” surrounding aperture (2) or everted from flat surface to form “neck” surrounding aperture (3). (Brochu et al.[62], character 69)

22. Lacrimal makes broad contact with nasal; no posterior process of maxilla (0) or maxilla with posterior process within lacrimal (1) or maxilla with posterior process between lacrimal and prefrontal (2). (Brochu et al.[62], character 71)

23. Quadratojugal extends to superior angle of infratemporal fenestra (0) or does not extend to superior angle of infratemporal fenestra; quadrate participates in fenestra (1). (Brochu et al. [62], character 80; adapted from Buscalioni et al.[63] according to Brochu et al.[64])

24. Posterolateral margin of squamosal horizontal or nearly so (0) or upturned to form a discrete “horn” (1.) (Brochu et al.[62], character 86)

25. Squamosal does not extend (0) or extends (1) ventrolaterally to lateral extent of paraoccipital process. (Brochu et al.[62], character 87)

26. Supraoccipital exposure on dorsal skull table small (0), absent (1), large (2), or large such that parietal is excluded from posterior edge of table (3). (Brochu et al.[62], character 88)

27. Sulcus on anterior braincase wall lateral to basisphenoid rostrum (0) or braincase wall lateral to basisphenoid rostrum smooth; no sulcus (1). (Brochu et al.[62], character 89)
28. Extensive exposure of prootic on external braincase wall (0) or prootic largely obscured by quadrate and laterosphenoid externally (1). (Brochu et al.[62], character 91; adapted from Norell[65] according to Brochu et al.[64])
29. Lateral eustachian canals open dorsal (0) or lateral (1) to medial eustachian canal. (Brochu et al.[62], character 96; adapted from Norell [66] according to Brochu et al.[64])
30. Posterior process of palatines with nearly parallel sides (0) or expands posteriorly (1). (This character was not used by Brochu et al.[62], it is adapted, however, from character 2 of Norell[66] according to Brochu[67])
31. Posterior margin of skull roof concave (0) or with a developed medial convexity (1) late in ontogeny. (NEW)
32. Anteriormost width of the intersuborbital bar wider than (0) or as wide as (1) the posteriormost width. (NEW)

Character codings

Unknown or non-applicable characters were coded as question marks. Polymorphisms are noted in brackets.

“Crocodylus” megarhinus	????? ??0?? ??100 00001 02100 ?100? 00
“Crocodylus” pigotti	??00? ?0011 ??1?0 10111 1??01 0?100 11
Rimasuchus lloydi	????? ????? ????0 1?00? ?1101 0110? 00
Voay robustus	????? ????? 11100 10001 10111 1?100 01
Mecistops cataphractus	10000 00011 20110 00011 00100 01100 10
Crocodylus palaeindicus	????? ????? ??010 00100 00100 1011? 1?
Crocodylus porosus	11001 10101 20010 11(01)01 00100 01111 01
Crocodylus palustris	10001 01111 21010 11(01)01 00100 01111 01
Crocodylus siamensis	11111 00010 20010 11(01)01 00110 01111 00
Crocodylus johnstoni	11001 10101 20?10 11(01)11 00100 01110 00
Crocodylus mindorensis	11001 10101 20010 11(01)01 00100 01111 10
Crocodylus novaeguineae	11001 10101 20010 11(01)01 00000 01010 00
Crocodylus niloticus	10101 00111 20010 01(01)01 01100 01110 00
***Crocodylus falconensis* sp. nov.**	????? ????? ??011 01000 ?1?00 ????0 00
Crocodylus acutus	00101 00111 20011 01(01)00 21100 01111 11
Crocodylus intermedius	00101 00111 20111 01(01)00 20100 01111 11

Crocodylus moreletii	00101 00111 20011 01(01)00 21100 01111 10
Crocodylus rhombifer	00101 00111 10011 01(01)00 21110 01111 10

Apomorphy List

The apomorphy list was constructed based on the tree shown in Figure 5a. ACCTRAN optimization in bold and DELTRAN optimization <u>underlined</u>.

Osteolaeminae: 12(1), 16(1), 22(1), 26(1)

Rimasuchus lloydi: 23(1)

"Crocodylus" pigotti + *Voay robustus*: <u>21(1)</u>, 32(1)

"C". pigotti: 18(1), 19(1), 30(1)

Voay robustus: <u>12(1)</u>, 24(1), 26(1)

Mecistops cataphractus + *Crocodylus*: 11(2), 14(1), 30(1)

Mecistops cataphractus: 19(1), <u>30(1)</u>

C. palaeindicus + Crown *Crocodylus*: 5(1), 8(1), 13(0), 29(1)

C. palaeindicus: 18(1), 20(0), 26(1), 26(0), <u>30(1)</u>

Crown *Crocodylus*: 5(1), 8(1), 17(1), 30(0)

Indopacific *Crocodylus*: 16(1), 31(1)

C. palustris: 7(1), 12(1), 30(1), 32(1)

C. siamensis + *C. porosus* + *C. mindorensis* + *C. johnstoni* + *C. novaeguineae*: 2(1)

C. siamensis: 3(1), 4(1), 8(0), 10(0), 24(1)

C. porosus + *C. mindorensis* + *C. johnstoni* + *C. novaeguineae*: 6(1), 9(0)

C. porosus: 32(1)

C. mindorensis: 30(1)

C. johnstoni + *C. novaeguineae*: 31(0)

C. johnstoni: 19(1)

C. novaeguineae: 23(0), 28(0)

C. niloticus + New World *Crocodylus*: 3(1), 22(1)

C. niloticus: no autapomorphies

New world *Crocodylus*: 1(0), 15(1), 20(0), 21(2)

C. falconensis: no autapomorphies

C. moreletii + *C. rhombifer* + *C. acutus* + *C. intermedius*: <u>1(0)</u>, <u>21(2)</u>, 30(1), 31(1)

C. moreletii: no autapomorphies

C. rhombifer: 11(1), 24(1)

C. acutus + *C. intermedius*: 32(1)

C. acutus: no autapomorphies

C. intermedius: 13(1), 22(0)

New caimanine species

The phylogenetic analysis including *Globidentosuchus brachyrostris* gen. et sp. nov. resulted in a total of 20160 most parsimonious trees (minimum length=650; Fig. 5b; Supplementary Figure S11). Note that character (97) for *Alligator thomsoni* (=althom in matrix file) in the original matrix of Brochu et al.[64] was incorrectly scored with ”9“ instead of “0” and character (156) was scored with (2) in *Piscogavialis jugaliperforatus* and *Gryposuchus colombianus*, although (0) or (1) should have been the only possible character states following the character description. Both taxa are scored with (1) herein based on personal observation of holotypes by one of us (DCF). The original score (0) for character (150) and (3) for character (158) in *Eocaiman cavernensis* (=eocai in matrix file) by Brochu et al.[64] were changed to (?), based on the poor preservation of that region of the skull in the holotype specimen.

The results of the TNT analysis could be verified by a second analysis using the heuristic search option in PAUP v. 4.0b10 for Microsoft Windows[68]. For the latter, a setting of MaxTrees=15000 was enforced as previous tries with an open, step-wise automated increase of the number of trees retained led to a critical termination of the analysis. The statistics of this analysis were: tree length = 650; consistency index (CI) = 0.3477; homoplasy index (HI) = 0.6523; CI excluding uninformative characters = 0.3426; HI excluding uninformative characters = 0.6574; retention index (RI) = 0.8110; rescaled consistency index (RC) = 0.2820. The strict consensus of the first 1000 MPTs shows exactly the same topology and tree length (650 steps) as in the TNT analysis.

Re-running the analysis after incorporating *Necrosuchus ionensis*[69] in the matrix basically recovered the same results as the previous analysis (tree length remained at 650; total number of MPTs = 24100), but with less resolution among basal caimanines (see Supplementary Figure S12). The previous sister group relationship between *Tsoabichi* and *Paleosuchus* was not recovered in this second run and the tree configuration with the polytomy among caimanines resembles that of the strict consensus shown in figure 9B in Brochu[70]. Following that previous work, we thus tentatively treat *Tsoabichi* as a caimanine herein as well.

Note that fundamental differences exist between the morphology-based matrices like the one from Brochu et al.[64] used herein and molecular analyses[71-74], especially pertaining to the hotly debated relationship between true and false gharials and crocodylines. However, assuming that tomistomines (the material tentatively assigned to ?*Thecachampsa*) are included in the

Crocodylidae as suggested by anatomy and the palaeontological record[62], as well as developmental data[75], it is possible to include the latter clade in the crocodilian fauna of Urumaco as well.

Character codings

The following coding based on and modified from the matrix of Brochu et al.[64] was used (unknown or non-applicable characters were coded as question marks; the coding of *Necrosuchus ionensis* follows Brochu[69]):

Bernissartia fragesii

??????0???0111102100?00?0?000???0000?100010???0010?000???????10?0?00?001?1????000?0?0000?00030?00?????1000????1?0000?000??0100?0??000100?0?0??0?0?0010?0??00??0????????000?0000?000

Allodaposuchus precedens

???00010?000000123000000?100000????0000000101030001100010110 0???010000000011000 10000?????1??01?010001?000

Acynodon iberoccitanus

??10104101????????0???????0?0?????00010?000000106000000??00100????0000000101?00???20000?0100?110?0000??010100000?1?????????1???0????010

Acynodon adriaticus

?????1?????????????01?100?1??????????010?10?????????01????????0???0??100??00??00010?000?0?1060000?0????110????00?00011010000?1?11?0?0100???0????0??010?0?0010?????????????1???01?0

Iharkutosuchus makadii

??10124?????????110???00??10?1????0001??0000011061000?0???0110????0000001001100001201001?100?1?0?00?0???12???100?2?????1???1000000??110

Hylaeochampsa vectiana

??0?????0??????????0?0?1000?00??0110?0?0000000100100 0?0?2110000120????1?0?000010100000000????1?001001000?0110

Eothoracosaurus mississippiensis

??????0????????????01??000????????00?00???0????122???3??????0?????00?011?0????001
20?000??102500000??000000????0000101001000????00?000100???01???10000010?001?00
????????100010000000

Thoracosaurus neocesariensis

??????0??????111?1?010????0011??0??0?00???0???1122???3????????10?000?01?0?????00
120?0000?1025000000??000000?0?00001010010000?00000000110?00010??1?0000100001
00000000?00100?10000000

Thoracosaurus macrorhynchus

??????0???0?1111?1?01?????00????0????00???0???1?22???3??????0?100000001100????00
120?00?0?1025000000??000000?0?0000101001000011000000110?000100?10001010?001
0000???0??0100010000000

Eosuchus minor

??????0???0??111???01?00?0?01???0000?000??0???1122??0300?0000?10?000001100????0
0120?0000?1025?00000?000000?000000010100100000?10000000110???0100?10?10010000
1?0100??1???101010101003

Eosuchus lerichei

??????0??????01????01???????1????????0????????1122???3??????????????????0?????0012
0?0000?1025000000?0000000???0000101001000000100000?0110?000?0??10?2001000010?1
????????10?01?101003

Eogavialis africanum

????????1?????11???010??????????0?????????0???1122??03?????10?100000??1101????001
20?000?01025?00000?000000000000001010010000010000000121?000100?1001001000010
100?000??0101010100000

Piscogavialis jugaliperforatus

?????????????????????????????????1?????????????11?2???3?????0001???????10??????00120
?001001025000000?000000????0000101001000000?000000111?1?00010100200100000100?
0?1?0?0?12??1?10?000

Gryposuchus colombianus

????0?0???001??????01??000????????????????0???11223?030100?00010000001100????00
12010000?1025?00000?0?0000??0?00001010010000011000000121?000100?100110100001
00000100?00121010100000

Gavialis sp. (Siwalik)

???????????????????010???????????????????????????22???3??????0?100000??1?0?????00?3
0?0??????2??0???0?0?0000??0?0000?0?00100?0?1???0000121?000100?100??0?000010000
?????00121010100000

Gavialis gangeticus

020000000?0011110110100000001110000000?000000001122300300000000100000000110001
00001301000001025?0000000000000000000101001000001100000012100001000100110
10000100000000000121010100000

Borealosuchus threeensis

????0??????????????01???????0??????1?00??20???01002??1?????10?11?000001000???????
??
?????????????

Borealosuchus formidabilis

000?000?0?11001001001000000101000001?000?20???0110200000?000?110000000100001
??00020?0000?0023100000?00000010000000101001000101002 01?11000000?00?00001010
0101000??????00100110000000

Borealosuchus wilsoni

??????0??????????1001000000101??00?1?000?20???01002??100?0?0011000000201000????0
0020?0?0???0231000?????00001?0?0?0010100100010100201011 00?000100??00110100101
0000?00???010011?0?0000

Borealosuchus acutidentatus

?????????????????????????????0????????????????????002????????????000??????0?????00020
?0?00??0231000?????0000????0?0??0???????1??002?1?1100?0?0?0??0?011010?101000???
????010??1?0?0000

Borealosuchus sternbergii

000000000?110010?10010000000101000001?00???0???01102000000?0001000000000100000
??00020?0000000131000000001000001?0?0000011101000101000011 1100?000100?00000010
0101000000?1?00100110000000

Pristichampsus vorax

????0?0???01001001?01?00000111??0100?10???1???1110?000?????0??1000001?1?0?????2
1010?0000?0003000100?000000??0?000000100100010100001111 10???0100?01000010010
1000???01??1100110000002

Pristichampsus geiseltalensis

?????????????0?0???01?000?0??1??0100?1???1????11102000??????0?1????0??1?1?????21?
20?000000030001???000000????0000001001010??10000111110?0?0?00?0?010010?10100
?????????1???10000002

Planocrania hengdongensis

???????????????????1?????????????????????????1110???1????????1????0?01?0?????20010
?0?????01300??????0?000????0????01001???????0??1?1100????????0?0?00100?0100?????
1???1???10?10001

Planocrania datangensis

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000??1003000000??0?000???????000??01???????0??1?1110????????0?000010010??0??????
???????10??0?0?

Leidyosuchus canadensis

????0?0???????1????010000011?1??10?0?11??11???0110?00000?0?01?100000011101????0
0010?0000000030000000001000100010000111010001010000111100?010100100100010010
0100000001?00100110010001

Deinosuchus riograndensis

??????0?????????????01?????????????????00???1???0110???001?0?11?10??0??11?0?????00??
1?0??????0?0000???0??00011?00?0??????????????000111120?012210?1110001001?1000??
000?0?????1??100?1

Diplocynodon ratelii

??????0??????000???010?00?1111001400?10??21???01002101?????0111000001?1101????0
0120?000000123000000001010000??0?00000011110001010000111100??101001000000101100
100000001?10100110010001

Diplocynodon hantoniensis

100???1?1?0100001000100001111??1400?101?21???011021010????011100000111101???
?00120?0?000?11300?000?1010001?0?000000101100010100001111100?110100?001010101
101000??0?1??010011?010001

Diplocynodon muelleri

????????????????????1?01??1?????14?0?10??21???01002??2?????01110??10011100????00
120?1000001230000000101000????000001111100000100?1?1100?110??0?01?010101101
00????????0100110010001

Diplocynodon tormis

????????????????????1?????1??????????10??21???01?021?1?????01?1?00????11??????0?12
0??00000123000000?1010001???000000111100?0?10000111100?110100000101010110100
?0???1?001?0110010001

Diplocynodon darwini

100001001?010000?00010000?1111??1400?101121???011020010??0?01?10000011110100?
?00020?0000?0103000000?0??000??0?0000001111?00101000?111100?110100?0110101011
01000???????0100110010001

Baryphracta deponiae

100?0?0????????0????01?0???1?????14?0?10??21????1?02??0?????01?10??0??1110?????00
1???000??01030000?0????000?????0?0001?11000?01000?111100?110100?0??011?0?101?0
0?????????1???1??10001

Brachychampsa montana

101011001?1100???0001??000111100?000?103111???11101101?????01110?00001110100?
?00110?0002?1101000000?0010001?0?01000001111001012001111100?110200?011100101
10102000101?00100110010001

Brachychampsa sealeyi

?????????????????????????????????????10???1???11101??0???????11??0000111?1????001?
0?0002?110100000???010?????????00????????10?2001101?00???????????100????????2????
??????????1??10??1

Stangerochampsa mccabei

????110???010010?0001000001111001000?01??11???111010100????0111110000?110?????
00110?0002?1102000000?001000????00000001111001012001111100?110200?0?11001021
01000??1?1??0100110010001

Ceratosuchus burdoshi

????????????????????????????????????0?1????????11111??0?????01?10??00?11?01????0001
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?????10??10010001

Hassiacosuchus haupti

001?1?0?1??????0???01?000?1111?????0??11?11???111110?0?????01?10??0??11101????00
010?00???010?0000??????0001?0??????0?????????1100?111100?1?0200?01120010210101?
???????01???10010001

Navajosuchus mooki

??????0?1??????0???0?00???1111??1??0?111111???11111010?????01?10??00??110?????00
010?0001?01020000???0?1000??0???00?00?11100101100111110 0???020??0112?01021010
00????1??010??10010001

Allognathosuchus polyodon

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0?000??01020000?0?????00??0?00?00?0?111001?1?01?111100????????0??20010?101?????
??????1???1??1???1

Allognathosuchus wartheni

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0010?0000?01020000000010001?0?000000?0111001?11011111100?110200?01120010210
10000?1?1?0010011001?001

Procaimanoidea kayi

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010???????0100110010001

Procaimanoidea utahensis

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10?0100?01020?0000??01000????0000000?11100101101?111100?1?0200?01120010?10100
0???????0100110010001

Aramboùrgia gaudryi

???11010??0?????01?100?0??1110?????1001
??010??01020000?0???10001000??000????11?0??1101?111100?1102?0?0?1210?0210100??
???????10011?010?01

Wannaganosuchus brachymanus

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0110?0000??10200??00???1000??0?100000???1??01?1101?111100????????0?12001??1010
00????????10011?010001

Alligator sinensis

101011101?110010100010110111110011000112111110110000120?001011200000111101??
1100100001000010200000000010001100100000011110010110111111100110200101120001
021010100011110010011001 0001

Alligator mississippiensis

101011001?0100100000101101111100110001121011001100011201001011200010111101001100100001000010200000000010001110000000011110010110111111100110200101121010210101000111100100110010001

Alligator mefferdi

??????????????????????????1?????????11???????11000012010000112000101111010 0??00100?0100?0102000000?0?10001?1?0000000?1110010110111111110?110200?011210102101010??1???00100110010001

Alligator thomsoni

???????????????????01?????????1?????0?1????????110000?2?????0112000100111 01????00100?01000010200000??0010001?1?000000????1?????1011111110?1?0200101?21010210101?001?11?0100110010001

Alligator olseni

??????0?1?????10???01?10011111???100?11???????11010010?????01120000001110 1????00100?01000?10200??00???1000??0?0?000101111101011011111110?110200?011200102101010??????00100?1?010001

Alligator mcgrewi

100010001?010010?00010000111?1101??0?11???1???11110010?100?011100000111101????00000?0100?0102000000?0010001?0010000001111001011011111000110200?011200102101010?01???00100110010001

Alligator prenasalis

10001?0?1?????10?0?01000011111??1000?112111???11111010?????0111000001111010 0??00000?0100?0102000000?0010001100100000011110010110111111100?110200?011200102101000001?1?00100110010001

Eocaiman cavernensis

???1110???2?????11?1????????????????00????0??????0??????????100???0?1??0000???????0?????1??1?0?????0?????????????1????????????0??1?2??????

Tsoabichi greenriverensis

???????????????????01????????????????10??20???1100???2????????1??????11???01??00010?10????10??000????????0????????????????????000?1111?0?1?0????0??211???101?2?????????????????100??

Purussaurus neivensis

101?100?1?000010?0??1????011???????0?11???1???1?00??1?1010?111201100011001????0
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Orthogenysuchus olseni

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Mourasuchus spp.

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0121?0000?1105000100?0010001?0?0100000111101 2?1011?111110?110?00????2111??111
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Caiman yacare

101111001?100010000010101111110011000111221110110021121010111010110201100 10
111001100000000112000000000100011001000000111101211110111111001102011011201
1121010300010110010011 0210001

Caiman crocodilus

101111001?100010000010101111110011000111221110110021121010111010110201100 10
111001100000000112000000000100011001000000111101211100111111001102011011201
1121010300010110010011 0210001

Caiman latirostris

101110001?10001000001010?111110011000111221210110021121010111?10110201100???
110011000000000102001000000100011001000000111101211100111111001102011011 2111
121010300010110010011 0210001

Caiman lutescens

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Melanosuchus fisheri

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Melanosuchus niger

101111001?1?0010000010101111110011000111221210110021121010111110110201100 1??
110011000000001020010100001000110010000001111012111001111110011020110112111
121010300010110010011021000 1

Paleosuchus trigonatus

100111111?0100101000100011111121130001113211201100212221111111011000110010
111101100001000102000000000100011000100010111101111000111111011102011011211
1?210102000101100100110210001

Paleosuchus palpebrosus

100111111?0100101010100011111121130001113211201100212221111?11?10110001100?01
111011000010001020000000001000110001000101111011110001111110111020110112111
?210102000101100100110210001

Mecistops cataphractus

10?001001?00001000001110011111201200011110110111104101010001001000111010 1?1
001001200000010021000000001000001101000010110100010100001111100000101110 01200
1001010001110101111001000000 3

Crocodylus niloticus

101000001?10101000101110011111201200011120110111002101010001011000111010111
001001100000010021000000011000001101001000110100010110001111100000101110 01200
1001010001110101111001100000 3

Crocodylus porosus

111000001?00101010101110001111201200011120110111002101010001011000111010111
001001100000010021000100110000011010010001101000101000011111000001011100 1200
1001010001110101111001100000 3

Crocodylus rhombifer

001000001?10101000101110011111201100011120110111002101010001011000111010111
001001100000010021010000110000011010010001101000101100011111000001011100 1200
1001110001110101111001100000 3

Euthecodon arambourgii

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Osteolaemus tetraspis

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Osteolaemus osborni

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Voay robustus

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Rimasuchus lloydi

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Crocodylus pigotti

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Crocodylus megarhinus

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Australosuchus clarkae

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Kambara implexidens

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Trilophosuchus rackhami

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Quinkana spp.

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Tomistoma schlegelii

021000001?00101000101100011111101100010130110111 22?10400000100100000001010000100120000001102100000101000001101000100100100010110001111100000110100121010010100011001011110010000003

Tomistoma lusitanica

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0?0000?1021?00001?100000110?000010100100010100001111 10?0001?1?10121010010100
011001??1110010000003

Toyotamaphimeia machikanense

00100100??1111110010110001111110 1100?00???1?????22??04?????10010?0000?101000??
00120?00001100400000???00000????0000?010010000?10000011110??00?1??1??21010?10
10??????????110010?00003

Gavialosuchus eggenburgensis

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????11???10000003

Paratomistoma courti

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?101?0?100??00?

Tomistoma cairense

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??0???11?001?000003

Thecachampsa antiqua

02000000??001010?00011010111?1??11?0?00???1???1122???4?100????1000031?101?0???
00120?000011021000000?100000??0?0000101?01000101100001 1110???011??1012001001
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Tomistoma petrolica

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Dollosuchoides densmorei

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Kentisuchus spenceri

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Brachyuranochampsa eversolei

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Crocodylus acer

??00110?
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??0??11100010000003

Crocodylus depressifrons

???00?00??11000010011100001111??1100?10???1???11102101?????0011000000001011????
00110?0000?1011000000?1100001?0?0001001?01000101?000111100?010200?0012001001
0100011001?11100010000003

Crocodylus affinis

001001001?1000100001110000111100 1100?10???1???1110210101000001100000000101100
??00110?00001001100000 0?010000??0?00010011010001010000111100?0?010??00120010
01010001??0???1100010000003

Asiatosuchus germanicus

001?0?0?1?001010?0101?000?1111??1??0??????1???11102000?????00110000??0101?00??
00010?0000?000100000???10000??0?00010???01000101000?111100???0100?00111010010
1000???????1100?10000003

Prodiplocynodon langi

??00110?
0000??003000000??100001??000010011?1000101????111100???0?0??0?11?010?1010001??
01?01100110000003

Necrosuchus ionensis

??????0?????????????0???01?111???1300?11???1???1100???2?????????1???0?????0?????00??
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***Globidentosuchus brachyrostris* gen. et sp. nov.**

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2??000??01?20000???1?10?0??????0???0?11?????1?1??1?1100??????0?0??2011??101?3???
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