http://app.pan.pl/SOM/app64_3-Sachs_etal_SOM.pdf

SUPPLEMENTARY ONLINE MATERIAL FOR

The mystery of *Mystriosaurus*: Redescribing the poorly known Early Jurassic teleosauroid thalattosuchians *Mystriosaurus laurillardi* and *Steneosaurus brevior*

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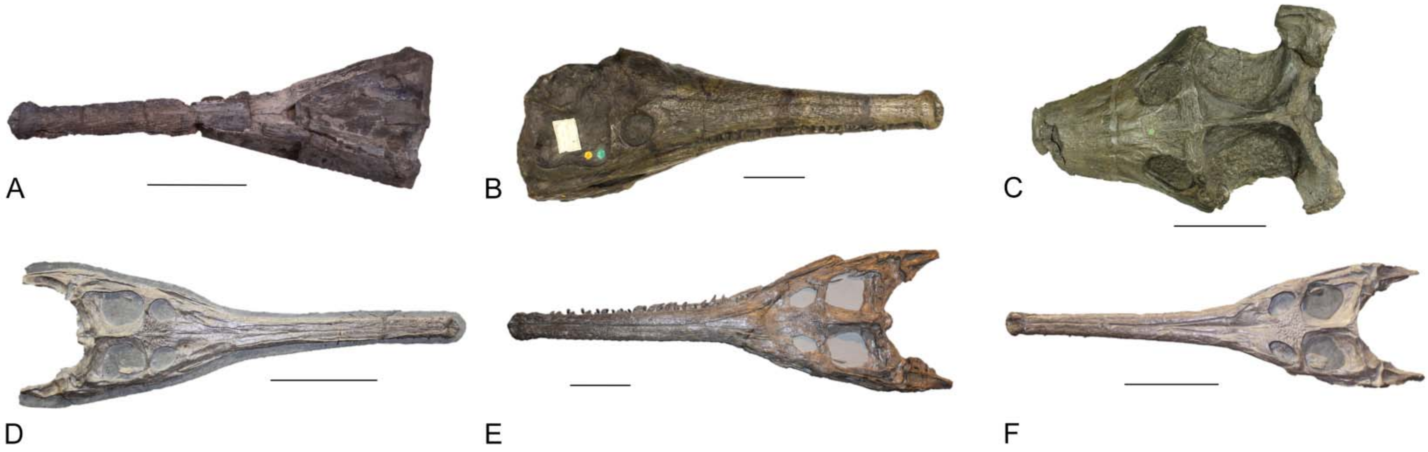
Supplementary Online Material

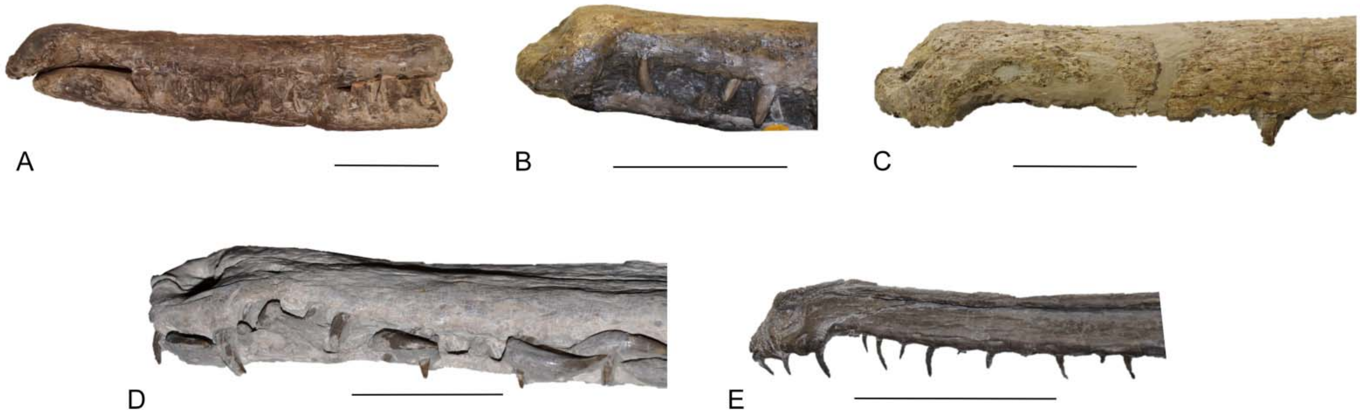
Mystriosaurus matrix data available at
http://app.pan.pl/SOM/app64_3-Sachs_etal_SOM/HY_Matrix_Mystriosaurus_1OTU.xlsx
http://app.pan.pl/SOM/app64_3-Sachs_etal_SOM/Character_matrix_Mystriosaurus_1OTU.txt
http://app.pan.pl/SOM/app64_3-Sachs_etal_SOM/Character_matrix_Mystriosaurus_2OTU.txt

SOM Fig. S1. Comparison of skulls between teleosaurid thalattosuchians *Mystriosaurus laurillardi* (HLMD V946-948) holotype, lower Toarcian of Altdorf (southern Germany) (A), *Mystriosaurus laurillardi* (NHMUK PV OR 14781, holotype of *Steneosaurus brevior*) referred specimen, lower Toarcian of Whitby (Yorkshire, UK) (B), and (C) *Steneosaurus bollensis* (RE 551.762.130 A 0248), lower Toarcian of Holzmaden (southwestern Germany), in lateral view. Scale bars equal 5 cm.

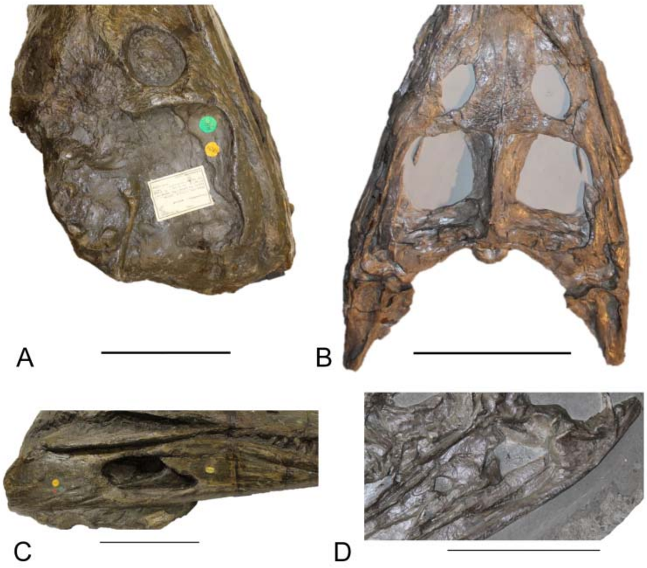
SOM Fig. S2. Comparison of skulls between teleosaurid thalattosuchians *Mystriosaurus laurillardi* (HLMD V946-948) holotype, lower Toarcian of Altdorf (southern Germany) (A), *Mystriosaurus laurillardi* (NHMUK PV OR 14781, holotype of *Steneosaurus brevior*) referred specimen, lower Toarcian of Whitby (Yorkshire, UK) (B), and (C) *Steneosaurus bollensis* (RE 551.762.130 A 0248), lower Toarcian of Holzmaden (southwestern Germany), in dorsal view. Scale bars equal 5 cm.



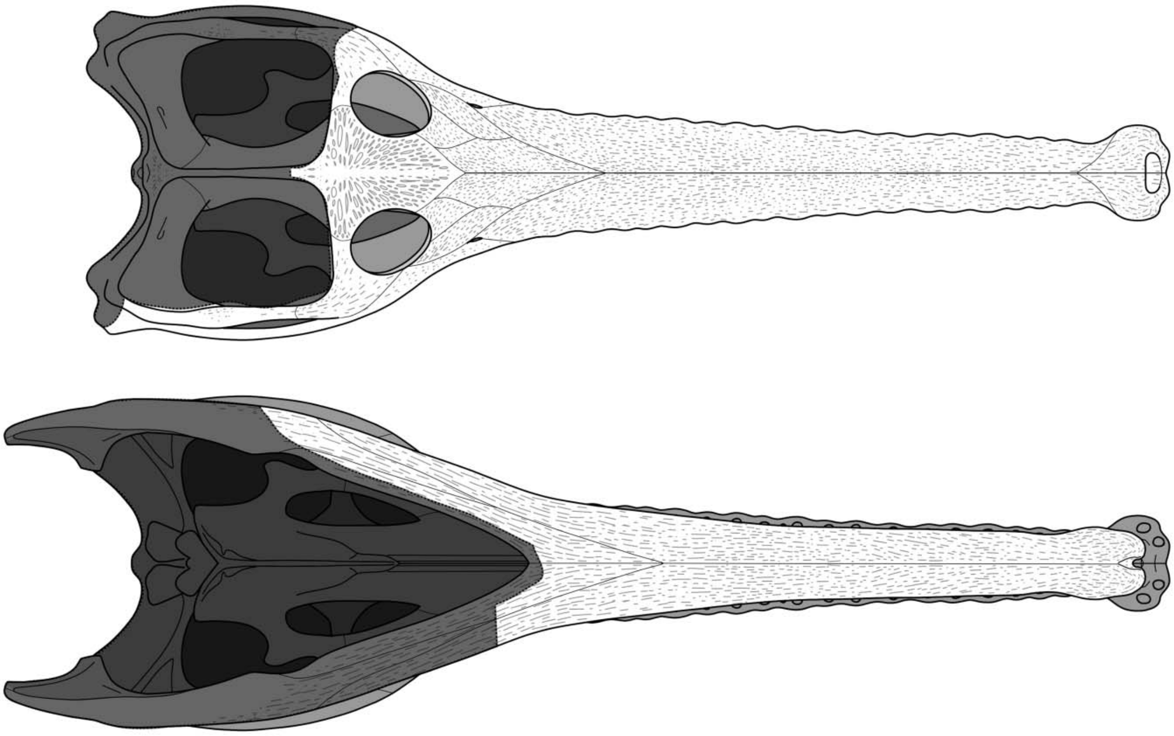
SOM Fig. S3. Comparison of skulls between teleosaurid thalattosuchians *Mystriosaurus laurillardi* (HLMD V946-948) holotype, lower Toarcian of Altdorf (southern Germany) (A), *Mystriosaurus laurillardi* (NHMUK PV OR 14781, holotype of *Steneosaurus brevior*) referred specimen, lower Toarcian of Whitby (Yorkshire, UK) (B), '*Steneosaurus* cf. *bollensis*' (NHMUK PV R 756) (C) and *Steneosaurus bollensis* ([MMG BwJ 565) (D), [GPIT-RE-9427] (E) and [SMNS 51753] (F)), all lower Toarcian of Holzmaden (southwestern Germany). Note that the nearly complete skull (NHMUK PV OR 14781) of *Mys*. *laurillardi* is much more robust and ornamented throughout, in addition to anteriorly directed external nares and circular orbits, differing from *S. bollensis*. Scale bars equal 15 cm.



SOM Fig. S4. Comparing the neurovascular foramina of teleosaurid thalattosuchians *Mystriosaurus laurillardi* holotype (HLMD V946-948), lower Toarcian of Altdorf (southern Germany) (A); *Mystriosaurus laurillardi* (NHMUK PV OR 14781, holotype of *Steneosaurus brevior*) referred specimen, lower Toarcian of Whitby (Yorkshire, UK) (B); *Machimosaurus buffetauti* (SMNS 91415), lower Kimmeridgian of Neuffen (southwestern Germany) (C), *Steneosaurus bollensis* (PMU R161) (D) and *Steneosaurus bollensis* (SMNS 80235), both lower Toarcian of Holzmaden (southwestern Germany) (E). Scale bars equal 7 cm.



SOM Fig. S5. Comparing the posterior skull of (A) *Mystriosaurus laurillardi* (NHMUK PV OR 14781, holotype of *Steneosaurus brevior*) referred specimen, lower Toarcian of Whitby (Yorkshire, UK) and (B) *Steneosaurus bollensis* (GPIT-RE-9427), lower Toarcian of Holzmaden (southwestern Germany). Note that the anterolateral margin of the supratemporal fossae in *Mys. laurillardi* are inclined anteriorly, whereas in *S. bollensis* they are inclined more posteriorly. Comparing the posterior mandible of (C) *Mystriosaurus laurillardi* (NHMUK PV OR 14781) and (D) *Steneosaurus bollensis* (SMNS 58876). Scale bars equal (A) 15 cm, (B) 21 cm and (C, D) 15 cm.



SOM Fig. S6. Illustration of the missing portions (dark) in the skull reconstruction of *Mystriosaurus laurillardi* shown in Fig. S4.

SOM 1. CrocSuperMatrix Project Overview

Thus far two datasets have been successfully merged, those of Alexander Hastings and Mark Young (see Ristevski *et al*., 2018). This has formed the Hastings and Young dataset (referred to herein as the H+Y matrix).

Currently, four datasets are in the process of being merged. The first two are the H+Y dataset and a modified version of the Andrade *et al*. (2011) dataset (herein referred to as the mA matrix). The first iteration of the H+Y and mA matrices were published in Ristevski *et al*. (2018).

The third dataset, is a modification of the dataset published by Wilberg (2017), (herein referred to as the mW matrix). Note that Ősi *et al*. (2018) was the first paper to have all three of these datasets together, however therein the Wilberg (2017) dataset had not been re-structured to be the same as H+Y and mA datasets. Note that here we have done so, and also created two new sub-sections: 1) internal neuroanatomy, sensory systems and cranial exocrine glands, and 2) craniomandibular pneumaticity.

A fourth dataset has also been added, a modification of the dataset recently published by Leardi *et al*. (2017), herein referred to as the mL matrix. This is an expansion of the dataset first published by Clark *et al*. (2000), and recently elaborated upon by Pol *et al*. (2013) and Leardi *et al*. (2017).

The characters for both datasets have been organised into a common anatomical order, and broken down into the same 20 sub-sections:

1) skull geometry and dimensions
2) craniomandibular ornamentation
3) internal neuroanatomy, sensory systems and cranial exocrine glands
4) craniomandibular pneumaticity
5) rostral neurovascular foramina
6) cranial rostrum
7) skull roof
8) orbit and temporal region
9) palate and perichoanal structures
10) occipital
11) braincase, basicranium and suspensorium
12) mandibular geometry
13) mandible
14) dentition and alveolar morphologies
15) axial post-cranial skeleton
16) appendicular skeleton: pectoral girdle and forelimbs
17) appendicular skeleton: pelvic girdle and hind limbs
18) dermal ossifications: osteoderms
19) dermal ossifications: gastralia
20) soft tissue

Herein we only use the H+Y dataset, as a larger paper on this project is currently in preparation.

SOM 2. Hastings + Young (H+Y) dataset

SOM 2.1. H+Y dataset – general information and scoring sources of the OTUs

The present list includes information for each operational taxonomic unit (OTU) included in the matrix. Fragmentary taxa (i.e. ones that are highly incomplete) are mentioned as: [fragmentary taxon].

OUTGROUP TAXON

RAUISUCHIDAE (1 OTU)

(1) *Postosuchus kirkpatricki* Chatterjee, 1985
DATA FROM: Nesbitt (2011), Weinbaum (2011), Weinbaum (2013).
LOCALITY: Post (=Miller) Quarry, Texas, USA.
FORMATION: Cooper Canyon Formation, Dockum Group.
AGE: Norian, Late Triassic.

INGROUP TAXA

BASAL CROCODYLOMORPHS (= 'SPHENOSUCHIANS' *SENSU LATO*) (5 OTUs)

(2) *Dromicosuchus grallator* Sues *et al*., 2003
DATA FROM: Sues *et al*. (2003), Nesbitt (2011).
LOCALITY: West Genlee, Durham County, North Carolina, USA.
FORMATION: Mudstone of Lithofacies Association II, Newark Super-Group. South-central region of Durham sub-basin of Deep River Basin.
AGE: upper Carnian or lower Norian, Late Triassic.

(3) *Hesperosuchus* cf. *agilis*
DATA FROM: CM 29894; Clark *et al*. (2000), Nesbitt (2011).
LOCALITY: *Coelophysis* Quarry, Ghost Ranch, northern New Mexico, USA.
FORMATION: "siltstone member", Chinle Formation.
AGE: upper Norian–?Rhaetian, Late Triassic.

(4) *Terrestrisuchus gracilis* Crush, 1984
DATA FROM: Crush (1984), Nesbitt (2011).
LOCALITY: Pant-y-ffynon Quarry, Cowbridge, Glamorgan, Wales, UK.
FORMATION: fissure fills in Carboniferous limestone.
AGE: ?Rhaetian, Late Triassic.

(5) *Dibothrosuchus elaphros* Simmons, 1965
DATA FROM: Wu (1986); Nesbitt (2011).
LOCALITY: Huangchiatien, Lufeng, Yunnan, China.
FORMATION: Zhangjiawa Formation, Lower Lufeng Group.
AGE: Sinemurian–Pliensbachian, Lower Jurassic.

(6) *Junggarsuchus sloani* Clark *et al*., 2004
DATA FROM: photographs of the holotype provided by Eric Wilberg; Clark *et al*. (2004).
LOCALITY: Wucaiwan, Altay Prefecture, Xinjiang Province, NW China.
FORMATION: lower part of the Shishugou Formation (= Wucaiwan Formation).
AGE: Bathonian–Callovian, Middle Jurassic.

BASAL CROCODYLIFORMS: 'PROTOSUCHIANS' *SENSU LATO* (4 OTUs)

(7) *Hemiprotosuchus leali* Bonaparte, 1971
DATA FROM: Bonaparte (1971).
LOCALITY: Quebrada de los Jachaleros, W La Rioja Province, Argentina.
FORMATION: Los Colorados Formation.
AGE: Coloradense, Norian, Upper Triassic.

(8) *Protosuchus richardsoni* Brown, 1933
DATA FROM: Colbert & Mook (1951), Nesbitt (2011).
LOCALITY: Ward's Terrace, Arizona, USA.
FORMATION: upper half of the Moenave Formation, Glen Canyon Group.
AGE: Hettangian, Lower Jurassic.

(9) *Protosuchus haughtoni* (Busbey & Gow, 1984)
DATA FROM: Gow (2000), Nesbitt (2011).
LOCALITY: South Africa.
FORMATION: Upper Elliot Formation.
AGE: Lower Jurassic.

(10) *Eopneumatosuchus colberti* Crompton & Smith, 1980
DATA FROM: Crompton & Smith (1980); high-resolution images of the holotype provided by Lawrence Witmer.
LOCALITY: 11 miles NE of Cameron, Coconino County, Arizona, USA.
FORMATION: 'Silty facies', Kayenta Formation, Glen Canyon Group.
AGE: Sinemurian-Pliensbachian, Lower Jurassic.

BASAL CROCODYLIFORMS: SHARTEGOSUCHIDAE (1 OTU)

(11) *Fruitachampsa callisoni* Clark, 2011
DATA FROM: Clark (2011).
LOCALITY: Fruita, Colorado, USA.
FORMATION: Morrison Formation.
AGE: Upper Jurassic.

NOTOSUCHIA: 'NOTOSUCHIDAE' (2 OTUs)

(12) *Notosuchus terrestris* Woodward, 1896
DATA FROM: MACN-Pv-N-22, MACN-Pv-N-23, MACN-Pv-N-24, MACN-Pv-N-43, MACN-Pv-N-107, MACN-Pv-RN-1015, MACNPv-RN-1037, MACN-Pv-RN-1038, MACN-Pv-RN-1039, MACN-Pv-RN-1040, MACN-Pv-RN-1041, MACN-Pv-RN-1043, MACN-Pv-RN-1044, MACN-Pv-RN-1045, MACN-Pv-RN-1046, MACN-Pv-RN-1047, MACN-Pv-RN-1048, MACN-Pv-RN-1118, MACN-Pv-RN-1119, MLP-64-IV-16-1, MLP-64-IV-16-5(253) (lectotype), MLP-64-IV-16-6(203), MLP-64-IV-16-7(219), MLP-64-IV-16-8(209), MLP-64-IV-16-9(201), MLP-64-IV-16-10(221), MLP-64-IV-16-11, MLP-64-IV-16-12, MLP-64-IV-16-13, MLP-64-IV-16-14, MLP-64-IV-16-15, MLP-64-IV-16-16, MLP-64-IV-16-17, MLP-64-IV-16-18, MLP-64-IV-16-20, MLP-64-IV-16-21, MLP-64-IV-16-22, MLP-64-IV-16-23, MLP-64-IV-16-24, MLP-64-IV-16-25, MLP-64-IV-16-28, MLP-64-IV-16-30, MLP-64-IV-16-31(206), MPCA-Pv-528; MPCA-Pv-789/1; MPCA-Pv-791; Woodward (1896), Gasparini (1971), Bonaparte (1991, 1996), Andrade & Bertini (2008b), Fiorelli & Calvo (2008).
LOCALITES: several outcrops in the Neuquén and Rio Negro provinces, Argentina
FORMATION: Bajo de La Carpa Formation, Neuquén Group. Neuquén Basin.
AGE: Santonian–Campanian, Upper Cretaceous.

(13) *Mariliasuchus amarali* Carvalho & Bertini, 1999
DATA FROM: MN-6298-V, MN-6756-V, UFRJ-DG-50-R(type), UFRJ-DG-56-R, UFRJ-DG-105-R, UFRJ-DG-106-R, UFRJ-DG-115-R, URC-R-67, URC-R-68, URC-R-69; Carvalho & Bertini (1999), Andrade (2005), Vasconcellos & Carvalho (2005).
LOCALITY: Rio do Peixe, São Paulo State, Brazil.
FORMATION: Aracatuba Formation, Bauru Group. Bauru Basin.
AGE: Campanian, Upper Cretaceous.

NOTOSUCHIA: SPHAGESAURIDAE (3 OTUs)

(14) *Adamantinasuchus navae* Nobre & Carvalho, 2006
DATA FROM: UFRJ-DG-107-R (type), UFRJ-DG-216-R; Nobre & Carvalho (2006).
LOCALITY: Rio do Peixe, São Paulo State, Brazil.

FORMATION: Aracatuba Formation, Bauru Group. Bauru Basin.
AGE: Campanian, Upper Cretaceous.

(15) *Sphagesaurus huenei* Price, 1950
DATA FROM: Pol (2003).
LOCALITY: N São Paulo State, Brazil.
FORMATION: Adamantina Formation, Bauru Group. Bauru Basin.
AGE: Campanian–Maastrichtian, Upper Cretaceous.

(16) *Caipirasuchus montealtensis* (Andrade & Bertini, 2008a)
DATA FROM: Andrade (2005), Andrade & Bertini (2008a), Iori *et al.* (2016).
LOCALITY: Monte Alto, N São Paulo State, Brazil.
FORMATION: Adamantina Formation, Bauru Group. Bauru Basin.
AGE: Campanian–Maastrichtian, Upper Cretaceous.

NOTOSUCHIA: BAURUSUCHIDAE (1 OTU)

(17) *Baurusuchus pachecoi* Price, 1945
DATA FROM: FEF-R-1-9; Price (1945), Carvalho *et al.* (2005; MPMA 62-0001-02).
LOCALITY: 72 km SW of Vila do Veadinho (type locality), Paulo de Faria city. and several other localities spread at the N-NW São Paulo State, Brazil.
FORMATION: Adamantina Formation, Bauru Group. Bauru Basin.
AGE: Campanian-Maastrichtian, Upper Cretaceous.
OBSERVATION: Here *B. salgadoensis* Carvalho *et al.* 2005 is treated as a subjective junior synonym of *B. pachecoi*.

NOTOSUCHIA: 'URUGUAYSUCHIDAE' (1 OTU)

(18) *Araripesuchus patagonicus* Ortega *et al.*, 2000
DATA FROM: MUCPv-267, MUCPv-268, MUCPv-269 (holotype); Ortega *et al.* (2000).
LOCALITY: El Chocon (Embalse Ezequiel Ramos Mexia), Neuquén Province, NW Patagonia, W Argentina.
FORMATION: Candeleros Member, Rio Limay Formation, Neuquén Group. Neuquén Basin.
AGE: Albian-Cenomanian, 'mid' Cretaceous.

NOTOSUCHIA: PEIROSAURIDAE (2 OTUs)

(19) *Montealtosuchus arrudacamposi* Carvalho *et al.*, 2007
DATA FROM: Carvalho *et al.* (2007)
LOCALITY: Monte Alto, N São Paulo State, Brazil.
FORMATION: Adamantina Formation, Bauru Group. Bauru Basin.
AGE: Campanian–Maastrichtian, Upper Cretaceous.

(20) *Uberabasuchus terreficus* Carvalho *et al.*, 2004
DATA FROM: Carvalho *et al.* (2004).
LOCALITY: Caieira outcrop, Peiropolis, Uberaba Municipality, S Minas Gerais State, SE Brazil.
FORMATION: Marilia Formation, Bauru Group. Bauru Basin.
AGE: Campanian–Maastrichtian, Upper Cretaceous.

NOTOSUCHIA: 'TREMATOCHAMPSIDAE' (1 OTU)

(21) cf. *Hamadasuchus rebouli* Buffetaut, 1994
DATA FROM: This OTU was scored for specimens referred to *H. rebouli* by Larsson & Sues (2007; mainly ROM-52620), not the type material. Therefore, the use of cf. *H. rebouli*.
LOCALITY: SE Morocco.
FORMATION: Kem Kem beds.
AGE: Albian–Cenomanian, 'mid' Cretaceous.

NOTOSUCHIA: SEBECIDAE (1 OTU)

(22) *Sebecus icaeorhinus* Simpson, 1937

DATA FROM: AMNH 3160 (cast); Larsson & Sues (2007).

LOCALITY: Canadon Hondo and Canadon Vaca, tributaries to the Rio Chico del Chubut, Chubut, Patagonia, Argentina.

FORMATION: Casamayor Formation.

AGE: early–middle Eocene, Paleogene.

NOTOSUCHIA: MAHAJANGASUCHIDAE (1 OTU)

(23) *Mahajangasuchus insignis* Buckley & Brochu, 1999

DATA FROM: Buckley & Brochu (1999), Turner & Buckley (2008).

LOCALITY: 1km SW Berivotra Village, SW Mahajanga, NW Madagascar.

FORMATION: Maevarano Formation. Mahajanga Basin.

AGE: Campanian–Maastrichtian, Upper Cretaceous.

NEOSUCHIA: ATOPOSAURIDAE (2 OTUs)

(24) *Alligatorium meyeri* Gervais, 1871

DATA FROM: photographs of the holotype provided by Jon Tennant.

LOCALITY: Cerin, France.

FORMATION: Cerin Lagerstätte.

AGE: upper Kimmeridgian, Upper Jurassic.

(25) *Theriosuchus pusillus* Owen, 1878

DATA FROM: NHMUK PV OR 48216 (lectotype), NHMUK PV OR 48330 (paratype), NHMUK PV OR 48262; Tennant *et al*. (2016).

LOCALITY: Durlston Bay, Swanage, Dorset County, Jurassic Coast, S-SW England, UK.

FORMATION: "Beccles' residuary marls" (beds 83–93; Clements, 1993), Worbarrow Tout Member (sensu Westhead & Mather, 1996), Lulworth Formation, Purbeck Limestone Group.

AGE: Berriasian, Lower Cretaceous.

NEOSUCHIA: GONIOPHOLIDIDAE (8 OTUs)

(26) *Eutretauranosuchus delfsi* Mook, 1967

DATA FROM: CM 8028 (holotype); Smith *et al*. (2010).

LOCALITY: Canon City, Colorado, USA.

FORMATION: Morrison Formation. Morrison Basin.

AGE: Kimmeridgian, Upper Jurassic.

(27) *Amphicotylus stovalli* (Mook, 1964)

DATA FROM: CMC VP7798 (cast).

LOCALITY: V97, Cimarron County, Oklahoma, USA.

FORMATION: Morrison Formation.

AGE: ?Kimmeridgian, Upper Jurassic.

(28) *Goniopholis baryglyphaeus* Schwarz, 2002

DATA FROM: Schwarz (2002).

LOCALITY: Guimarota coal mine, Leiria, Portugal.

FORMATION: Lower lignite coal layer (`Fundschichten'), `Guimarota Strata', Alcobaca Formation.

AGE: Kimmeridgian, Upper Jurassic.

(29) *Goniopholis kiplingi* Andrade *et al*., 2011.

DATA FROM: DORCM 12154 (holotype); Andrade *et al*. (2011).

LOCALITY: Durlston Bay, Swanage, Dorset County, Jurassic Coast, SSW England, UK.

FORMATION: Bed 129b (Clements 1993), Intemarine beds (sensu Wimbledon, 1995), Stair Hole Member (sensu Westhead & Mather 1996), Durlston Formation, Purbeck Limestone Group.

AGE: Berriasian, Lower Cretaceous.

(30) *Goniopholis simus* Owen, 1878
DATA FROM: NHMUK PV OR 41098 (type), NHMUK PV R 5814.
LOCALITIES: Swanage, Dorset County, Jurassic Coast, S-SW England; further referred materials from Schaumburg-Lippe Region, NW Germany.
FORMATIONS: Purbeck Limestone Group (UK) and Obernkirchen Sandstone, Buckeburg Member (Germany).
AGE: Berriasian, Lower Cretaceous.

(31) *Anteophthalmosuchus hooleyi* Salisbury & Naish, 2011
DATA FROM: NHMUK PV R 3876 (holotype); Salisbury & Naish (2011).
LOCALITY: near the "Tie Pits", Atherfield Point, Isle of Wight, UK.
FORMATION: Shepherd's Chine Member, Vectis Formation, Wealden Group.
AGE: Barremian to early Aptian, Lower Cretaceous.

(32) *Anteophthalmosuchus epikrator* Ristevski *et al*., 2018.
DATA FROM: IWCMS 2001.446, IWCMS 2005.127; Martin *et al*. (2016).
LOCALITY: Hanover Point, Isle of Wight, UK.
FORMATION: upper part of Wessex Formation, Wealden Group.
AGE: Barremian, Lower Cretaceous.

TETHYSUCHIA: PHOLIDOSAURIDAE (11 OTUs)

(33) *Elosuchus cherifensis* (Lavocat, 1955)
DATA FROM: MNHN.F MRS 340, MNHN Escuillé collection; de Lapparent de Broin (2002), Meunier & Larsson (2016).
LOCALITY: Hamadas, Morocco.
FORMATION: Kem Kem beds, Ifezouanae and Aoufous Formations.
AGE: Cenomanian, Upper Cretaceous.

(34) *Elosuchus broinae* Meunier & Larsson, 2016
DATA FROM: MNHN.F SAM 129 (holotype), de Lapparent de Broin (2002); Meunier & Larsson (2016).
LOCALITY: Gara Samani, Algeria.
FORMATION: unnamed formation.
AGE: upper Albian, Lower Cretaceous.

(35) *Vectisuchus leptognathus* Buffetaut & Hutt, 1980
DATA FROM: SMNS 50984 (holotype).
LOCALITY: Isle of Wight, UK.
FORMATION: Vectis Formation, Wealden Group. Wessex Sub-basin.
AGE: Barremian–?early Aptian, Lower Cretaceous.

(36) *Pholidosaurus schaumburgensis* von Meyer, 1841
DATA FROM: casts of the Koken (1887) specimens (including MB.R.1965, MB.R.1966, MB.R.1970.304); the natural external and internal moulds of Bückeburg specimens (MB.R.2025.1, two MB.R.unnumbered specimens); Koken, 1887.
LOCALITY: quarry near Harrel im Furstentum, Schaumburg-Lippe Region, NW Germany.
FORMATION: Obernkirchen Member, Bückeburg Formation.
AGE: Berriasian, Lower Cretaceous.
OBSERVATION: Only specimens from the Bückeburg Formation are used to score this OTU.

(37) *Pholidosaurus* sp. (Charente)
DATA FROM: Martin *et al*. (2016b).
LOCALITY: Cherves-de-Cognac, Carrière de Champblanc, Charente Department, SW France.
FORMATION: Horizon C36.
AGE: Berriasian, Lower Cretaceous.

(38) *Meridiosaurus vallisparadisi* Fortier *et al*., 2011
DATA FROM: Fortier *et al*. (2011).
LOCALITY: Valle Edén locality, near Tacuarembó city, Uruguay.
FORMATION: fluviolacustrine sandstone facies of the Batoví Member, Tacuarembó Formation
AGE: ?Kimmeridgian-Tithonian, Upper Jurassic.

(39) *Chalawan thailandicus* (Buffetaut & Ingavat, 1980)
DATA FROM: Buffetaut & Ingavat (1980), Martin *et al*. (2014).
LOCALITIES: Nong Bua Lam Phu (type locality) and Kham Phok, NE Thailand.
FORMATION: upper part of Phu Kradung Formation, Khorat Group. Khorat Basin.
AGE: Early Cretaceous.

(40) *Sarcosuchus hartti* (Marsh, 1896) [fragmentary taxon]
DATA FROM: NHMUK PV R 3423; Buffetaut & Taquet (1977).
LOCALITY: outcrop in the vicinity of Setubal, Bahia State, NE Brazil.
FORMATION: unclear.
AGE: Lower Cretaceous.
OBSERVATION: This OTU is scored solely for the lower jaw referred to *S. hartti* by Buffetaut & Taquet (1977).

(41) *Sarcosuchus imperator* de Broin & Taquet, 1966
DATA FROM: MNHN.F GDF 662; de Broin & Taquet (1966), Buffetaut & Taquet (1977), Sereno *et al.* (2001).
LOCALITY: outcrop in the vicinities of the Gadoufaoua, Agadez Province, Niger.
FORMATION: Elrhaz Formation. Tegama Basin.
AGE: Aptian, Lower Cretaceous.

(42) cf. *Terminonaris robusta* Mook, 1934
DATA FROM: Wu *et al*. (2001b), Larsson & Sues (2007).
LOCALITY: SMNH locality 63E04-001, approximately 5km east of Highway 23, the southern bank of the Carrot River, southwest of the Pasquia Hills, Saskatchewan, Canada.
FORMATION: Keld Member, Favel Formation.
AGE: upper Cenomanian? to lower Turonian, Upper Cretaceous.
OBSERVATION: This OTU is based solely on the Canadian material referred to *T. robusta*.

(43) *Oceanosuchus boecensis* Hua *et al*., 2007
DATA FROM: Hua *et al*. (2007), Lepage *et al*. (2008).
LOCALITY: La Boëce, near Mortagne-au-Perche, Orne, Vasse-Normandie, France.
FORMATION: base of hard-ground Coulimer 2.
AGE: lower Cenomanian, Upper Cretaceous.

TETHYSUCHIA: BASAL DYROSAUROIDEA (2 OTUs)

(44) *Pholidosaurus purbeckensis* (Mansel-Pleydell, 1888)
DATA FROM: DORCM G.27, DORCM G.97 (holotype), NHMUK PV OR 28432, NHMUK PV R 3414, NHMUK PV R 3956, NHMUK PV R 36721.
LOCALITY: type locality unclear, thought to be Isle of Purbeck, UK.
FORMATION: Purbeck Formation, Purbeck Limestone Group.
AGE: Berriasian, Lower Cretaceous.

(45) *Fortignathus felixi* Young *et al*., 2016 [fragmentary taxon]
DATA FROM: MNHN.F INA 21, MNHN.F INA 22, MNHN.F INA 25 (holotype).
LOCALITY: West of In Abangharit, Agadez District, Niger.
FORMATION: Echkar Formation, Tegma Series.
AGE: upper Albian to lower Cenomanian, ‘mid’ Cretaceous.

TETHYSUCHIA: DYROSAURIDAE (15 OTUs)

(46) *Acherontisuchus guajiraensis* Hastings *et al*., 2011 [fragmentary taxon]
DATA FROM: UF/IGM 34 (holotype), UF/IGM 35, UF/IGM 36, UF/IGM 37, UF/IGM 38 & UF/IGM 39; Hastings *et al*. (2011).
LOCALITY: below Coal Seam 85 in the La Puente Pit, Cerrejón coal mine, Guajira Department, north-eastern Colombia.
FORMATION: Cerrejón Formation.
AGE: middle–late Paleocene, Palaeogene.

(47) *Anthracosuchus balrogus* Hastings *et al*., 2015
DATA FROM: UF/IGM 67 (holotype), UF/IGM 68 (paratype), UF/IGM 69 & UF/IGM 70; Hastings *et al*. (2015).
LOCALITY: clay layer below Coal Seam 90 in the La Puente Pit, Cerrejón coal mine, Guajira Department, north-eastern Colombia.
FORMATION: Cerrejón Formation.
AGE: middle–late Paleocene, Palaeogene.

(48) *Arambourgisuchus khouribgaensis* Jouve *et al*., 2005a.
DATA FROM: Jouve *et al*. (2005a).
LOCALITY: Phosphate mine in 'Sidi Chenane' area, in NE part of Ouled Aboun Basin, Morocco.
FORMATION: couche (= bed/layer) 2a.
AGE: Thanetian, Paleocene, Palaeogene.

(49) *Atlantosuchus coupatezi* Buffetaut, 1979
DATA FROM: Jouve *et al*. (2008).
LOCALITY: 'Sidi Chenane' area, in NE part of Ouled Aboun Basin, Morocco.
FORMATION: not given.
AGE: Danian, Paleocene, Palaeogene.

(50) *Cerrejinosuchus improcerus* Hastings *et al*., 2010
DATA FROM: UF/IGM 29 (holotype), UF/IGM 30, UF/IGM 31 & UF/IGM 32; Hastings *et al*. (2010).
LOCALITY: clay layer below Coal Seam 90 in the La Puente Pit, Cerrejón coal mine, Guajira Department, north-eastern Colombia.
FORMATION: Cerrejón Formation.
AGE: middle–late Paleocene, Palaeogene.

(51) *Chenanisuchus lateroculi* Jouve *et al*., 2005b
DATA FROM: Jouve *et al*. (2005b).
LOCALITY: 'Sidi Chenane' area, in NE part of Ouled Aboun Basin, Morocco.
FORMATION: couche (= bed/layer) 2a.
AGE: Thanetian, Paleocene, Palaeogene.

(52) *Congosaurus bequaerti* Dollo, 1914
DATA FROM: Jouve & Schwarz (2004), Schwarz *et al.* (2006), Schwarz-Wings *et al.* (2009).
LOCALITY: Cacongo, Cabinda Province, Angola.
FORMATION: Bed no. 8.
AGE: Danian, Paleocene, Palaeogene.

(53) *Dyrosaurus maghribensis* Jouve *et al*., 2006
DATA FROM: Jouve *et al.* (2006).
LOCALITY: phosphate mine of Mera el Arech, in Oulad Abdoun Basin, Morocco.
FORMATION: couche (= bed/layer) 1.
AGE: Ypresian, lower Eocene, Palaeogene.

(54) *Dyrosaurus phosphaticus* (Thomas, 1893)

DATA FROM: MNHN.F ALG 1, MNHN.F ALG 2; Jouve (2005).
LOCALITIES: north of Djebel Teldj, near Metlaoui, Tunisia and Tébessa, north-east Algeria.
FORMATION: "phosphate layer" (Tunisia).
AGE: Ypresian, lower Eocene, Palaeogene.

(55) *Guarinisuchus munizi* Barbosa *et al*., 2008
DATA FROM: Barbosa *et al.* (2008).
LOCALITY: Poty Quarry, Paulista, NE of Pernambuco State, Brazil.
FORMATION: Maria Farinha Formation. Paraiba Basin.
AGE: upper Danian, Lower Paleocene, Palaeogene.

(56) *Hyposaurus rogersii* Owen, 1849
DATA FROM: Troxell (1925), Denton *et al*. (1997).
LOCALITIES: Numerous, including: Inversand Company Marl Pit, Gloucester County, New Jersey, USA; Santee rediversion canal, St. Stephen, Berkeley County, South Carolina, USA.
FORMATION: Hornerstown Formation (NJ), Williamsburg Formation (SC).
AGE: Maastrichtian, Upper Cretaceous (NJ), upper Paleocene, Palaeogene (SC).

(57) *Phosphatosaurus gavialoides* Bergounioux, 1955
DATA FROM: Buffetaut (1978), Hill *et al*. (2008).
LOCALITY: near Metlaoui, Tunisia and 'Mali-20', south of Tamaguélet, Tilemsi valley region, Mali.
FORMATION: "phosphate layer" (Tunisia) and unnamed formation in Taoudeni Basin (Mali).
AGE: Ypresian, lower Eocene, Palaeogene.

(58) *Rhabdognathus keiniensis* Jouve, 2007.
DATA FROM: Jouve (2007).
LOCALITY: Cheit Keini and In Farghas, Tilemsi valley region, Mali.
FORMATION: unnamed formation in Taoudeni Basin.
AGE: Paleocene, Palaeogene.

(59) *Rhabdognathus aslerensis* Jouve, 2007
DATA FROM: Brochu *et al*. (2002), Jouve (2007).
LOCALITY: 'Mali-5', near Asler, north-west of Tamaguélet, Tilemsi valley region, Mali.
FORMATION: unnamed formation in Taoudeni Basin.
AGE: Maastrichtian or Paleocene.

(60) *Sabinosuchus coahuiliensis* Shiller *et al*., 2016 [fragmentary taxon]
DATA FROM: Shiller *et al*. (2016).
LOCALITY: El Rancho Soledad, Coahuila, Mexico.
FORMATION: Escondido Formation.
AGE: Maastrichtian, Upper Cretaceous.

(61) *Sokotosuchus ianwilsoni* Halstead, 1975
DATA FROM: Buffetaut (1979).
LOCALITY: Sokoto area, NW Nigeria.
FORMATION: Dukamaje Formation.
AGE: Maastrichtian, Upper Cretaceous.

NEOSUCHIA: BERNISSARTIIDAE (2 OTUs)

(62) *Bernissartia fagesii* Dollo, 1883
DATA FROM: Norell & Clark (1990).
LOCALITY: Sainte-Barbe coal mine, Bernissart, Belgium.
FORMATION: Sainte-Barbe Clays Formation.
AGE: Berriasian–Barremian, Lower Cretaceous.

(63) *Koumpiodontosuchus aprosdokiti* Sweetman *et al.*, 2015
Data from: IWCMS 2012.203 and IWCMS 2012.204 (holotype), Sweetman *et al.* (2015).
Locality: The foreshore near Yaverland, SE coast of Isle of Wight, UK.
Formation: from one of the plant debris beds occurring between beds 26 and 38, Wessex Formation.
Age: Barremian, Lower Cretaceous.

NEOSUCHIA: SUSISUCHIDAE (2 OTUs)

(64) *Susisuchus anatoceps* Salisbury *et al.*, 2003
Data from: SMNK PAL3804 (holotype); Salisbury *et al.* (2003, 2006).
Locality: Araripe Plateau, NE Brazil.
Formation: Crato Member, Santana Formation. Araripe Basin.
Age: Aptian–Albian, Lower Cretaceous.

(65) *Isisfordia duncani* Salisbury *et al.*, 2006
Data from: Salisbury *et al.* (2006; QM-F-36211, QM-F-44320).
Locality: outcrop near Isisford, Queensland, Australia.
Formation: Winton Formation.
Age: Albian–Cenomanian, ‘mid’ Cretaceous.

EUSUCHIA: HYLAEOCHAMPSIDAE *SENSU LATO* (3 OTUs)

(66) *Iharkutosuchus makadii* Ősi *et al.*, 2007
Data from: MTM 2006.52.1 (holotype), MTM 2006.53.1, MTM PAL 2013.51.1, MTM PAL 2013.58.1; Ősi *et al.* (2007), Ősi (2008), Ősi (2014).
Locality: Iharkút, Bakony Mountains, western Hungary.
Formation: Csehbánya Formation.
Age: Santonian, Upper Cretaceous.

(67) *Pachycheilosuchus trinquei* Rogers, 2003
Data from: Rogers (2003); osteoderms re-scored based on Buscalioni *et al.* (2011).
Locality: SMU locality 331, Erath County, Texas, USA.
Formation: Glen Rose Formation.
Age: Albian, Lower Cretaceous.

(68) *Pietraroiasuchus ormezzanoi* Buscalioni *et al.*, 2011
Data from: Buscalioni *et al.* (2011).
Locality: locality of ‘Civita di Pietraroia’, Mt Matese, southern Italy.
Formation: ‘Civita di Pietraroia Cave’.
Age: lower Albian, Lower Cretaceous.

EUSUCHIA: CROCODYLIA (4 OTUs)

(69) *Gavialis gangeticus* (Gmelin, 1879)
Data from: comparative collection held in the Palaeontology and Zoology departments of NHMUK.
Distribution: river systems of Brahmaputra, Indus, Ganges, Mahanadi; Burma, Buthan, India, Nepal and Pakistan.
Age: extant – Holocene, Quaternary.

(70) *Crocodylus niloticus* (Laurenti, 1768)
Data from: comparative collection held in the Palaeontology and Zoology departments of NHMUK; and in the Life Sciences Faculty, Ohio University.
Distribution: river systems of several African countries, especially the Nile River, Egypt.
Age: extant – Holocene, Quaternary.

(71) *Crocodylus porosus* (Schneider, 1801)
Data from: comparative collection held in the Palaeontology and Zoology departments of NHMUK; and in the Life Sciences Faculty, Ohio University.

DISTRIBUTION: freshwater to brackish areas of several countries, from SE Asia to Australia.
AGE: extant – Holocene, Quaternary.

(72) *Alligator mississippiensis* (Daudin, 1802)
DATA FROM: NHMUK ZD 290, NHMUK ZD 1973-2-21-2, NHMUK ZD 1974-3010, NHMUK ZD 1975-1424, NHMUK ZD II-1-I.
DISTRIBUTION: swamp to low-energy river systems of SE USA, most noticeably in Florida.
AGE: extant – Holocene, Quaternary.

THALATTOSUCHIA: TELEOSAUROIDEA (18 OTUs)

(73) *Aeolodon priscus* (von Sömmerring, 1814)
DATA FROM: NMHUK PV R 1086 (holotype), MNHN.F CNJ 78a.
LOCALITIES: Daiting, S Germany, and Canjuers, Var, France.
FORMATION: Mörnsheim Formation (type locality) and Canjuers consveration Lagerstätte.
AGE: lower Tithonian, Upper Jurassic.

(74) *Machimosaurus buffetauti* Young *et al.*, 2015
DATA FROM: SMNS 91415 (holotype); Young *et al.* (2014).
LOCALITY: Am Hörnle Quarry, Neuffen, Baden-Württemberg, Germany.
FORMATION: Lacunosamergel Formation.
AGE: *Ataxioceras hypselocyclum* Sub-Mediterranean ammonite Zone (=Weißer Jura gamma 2), lower Kimmeridgian, Upper Jurassic.
OBSERVATION: The correct nominal authority is the short taxonomic note Young *et al.*, 2015 not Young *et al.* 2014 (where the new taxon was described).

(75) *Machimosaurus hugii* von Meyer, 1837
DATA FROM: MG-8730-1, Young *et al.* (2014).
LOCALITY: Kreuzen Quarry at St. Verena, near Solothurn, Canton Solothurn, Switzerland (lectotype locality) and Guimarota coal mine, Leiria, NW Portugal.
FORMATION: Solothurn Turtle Limestone, Reuchenette Formation (lectotype locality) and Guimarota Strata, Alcobaça Formation.
AGE: Kimmeridgian, Upper Jurassic.

(76) *Machimosaurus mosae* Sauvage & Liénard, 1879
DATA FROM: IRSNB (cast of neotype), Hua (1999), Young *et al.* (2014).
LOCALITY: beach near Ambleteuse, Boulonnais, Département du Pas-de-Calais, Nord Pas-de-Calais, France (neotype locality).
FORMATION: Argiles de Châtillon Formation (neotype locality).
AGE: From either the *Aulacostephanus autissiodorensis* Sub-Boreal ammonite Zone, uppermost Kimmeridgian, or the *Gravesia gigas*/*Pectinaties elegans* Sub-Boreal ammonite Zone, lowermost Tithonian; Upper Jurassic (neotype locality).

(77) *Machimosaurus rex* Fanti *et al.*, 2016
DATA FROM: ONM-NG-1 (holotype), Fanti *et al.* (2016).
LOCALITY: Touil el Mhahir, Tataouine Governorate, Tunisia.
FORMATION: Douiret Sand Member, Douiret Formation.
AGE: Hauterivian, Lower Cretaceous.

(78) *Mycterosuchus nasutus* Andrews, 1913
DATA FROM: NHMUK PV R 2617 (holotype), CAMSM J.1420, Andrews (1913).
LOCALITY: Peterborough, UK.
FORMATION: Peterborough Member, Oxford Clay Formation, Ancholme Group.
AGE: middle Callovian, Middle Jurassic.

(79) Chinese teleosauroid skull referred to *Peipehsuchus teleorhinus* by Li (1993)

DATA FROM: IVPP V 10098.
LOCALITY: Daxian, Szechuan, China.
FORMATION: Ziliujing Formation.
AGE: Lower Jurassic.

(80) *Platysuchus multiscrobiculatus* (Berckhemer, 1929)
DATA FROM: SMNS 9930 (holotype), MNHNL TU895.
LOCALITY: Holzmaden, Baden-Württemberg, Germany.
FORMATION: Posidonia Shale Formation.
AGE: lower Toarcian, Lower Jurassic.

(81) *Steneosaurus bollensis* (von Jäger, 1828)
DATA FROM: GPIT-RE-9427, MMG BwJ 595 (holotype), MMG BwJ 689, NHMUK PV R 324, NHMUK PV R 756, NHMUK PV R 1088, NHMUK PV R 5703, NHMUK PV OR 14436, NHMUK PV OR 14438, SMNS 849, SMNS 9427, SMNS 9428, SMNS 17484, SMNS 20280, SMNS 20283, SMNS 53422, unnumbered OUMNH partial skull.
LOCALITIES: Baden-Württemberg, Germany; Yorkshire, UK.
FORMATION: Posidonia Shale Formation (Germany) and Whitby Mudstone Formation (UK).
AGE: lower Toarcian, Lower Jurassic.

(82) *Steneosaurus brevior* Blake, 1876
DATA FROM: NHMUK PV OR 14781 (holotype).
LOCALITY: Whitby, Yorkshire, UK.
FORMATION: Mulgrave Shale Member, Whitby Mudstone Formation, Lias Group.
AGE: *Harpoceras serpentinum* Sub-Boreal ammonite Zone, lower Toarcian, Lower Jurassic.

(83) *Steneosaurus edwardsi* Eudes-Deslongchamps, 1868a
DATA FROM: NHMUK PV R 2074, NHMUK PV R 2865, NHMUK PV R 3701, PETMG R175, PETMG R178, Andrews (1913).
LOCALITY: Peterborough, UK.
FORMATION: Peterborough Member, Oxford Clay Formation, Ancholme Group.
AGE: middle Callovian, Middle Jurassic.

(84) *Steneosaurus gracilirostris* Westphal, 1961
DATA FROM: NHMUK PV OR 14792 (holotype), NHMUK PV OR 15500 (paratype), MNHNL TU515.
LOCALITY: Whitby, Yorkshire, UK.
FORMATION: Alum Shale Member, Whitby Mudstone Formation, Lias Group.
AGE: *Hildoceras bifrons* Sub-Boreal ammonite Zone, lower Toarcian, Lower Jurassic.

(85) *Steneosaurus larteti* Eudes-Deslongchamps, 1866
DATA FROM: OUMNH J.29851 (referred specimen).
LOCALITY: Enslow Bridge, Oxfordshire, UK.
FORMATION: Great Oolite Group.
AGE: Bathonian, Middle Jurassic.

(86) *Steneosaurus leedsi* Andrews, 1909
DATA FROM: NHMUK PV R 2619, NHMUK PV R 3320 (holotype), NHMUK PV R 3806.
LOCALITY: Peterborough, UK.
FORMATION: Peterborough Member, Oxford Clay Formation, Ancholme Group.
AGE: middle Callovian, Middle Jurassic.

(87) *Steneosaurus heberti* Morel de Glasville, 1876
DATA FROM: MNHN.F 13.1890 (holotype).
LOCALITY: Villers-sur-mer, Calvados, France.
FORMATION: Marnes de Dives Formation.

AGE: upper Callovian, Middle Jurassic.

(88) *Lemmysuchus obtusidens* (Andrews, 1909) Johnson *et al*., 2017
DATA FROM: NHMUK PV R 3168 (holotype), LPP.M.21, NOTNH FS3361, PETMG R39.
LOCALITY: Peterborough, UK.
FORMATION: Peterborough Member, Oxford Clay Formation, Ancholme Group.
AGE: middle Callovian, Middle Jurassic.

(89) *Teleosaurus cadomensis* (Lamouroux, 1820)
DATA FROM: MNHN.F AC 8746, MNHN.F RJN 464, NHMUK PV OR 119, NHMUK PV OR 32588, NHMUK PV OR 32657, NHMUK PV OR 32680, casts: NHMUK PV R 880 and NHMUK PV R 880a; Eudes-Deslongchamps (1867-69); Jouve (2009).
LOCALITY: Allemagne, 3km south of Caen, Calvados, Normandy, France.
FORMATION: “Calcaire de Caen”.
AGE: Bathonian, Middle Jurassic.

(90) *Teleosaurus megarhinus* Hulke, 1871
DATA FROM: NHMUK PV OR 43086 (holotype), DORCM G.05067i-v, Vignaud (1995).
LOCALITY: Kimmeridge, Dorset, UK.
FORMATION: Dorset succession, lower Kimmeridge Clay Formation, Ancholme Group.
AGE: *Aulacostephanus autossiodorensis* Sub-Boreal ammonite Zone, upper Kimmeridgian, Upper Jurassic.

THALATTOSUCHIA: BASAL METRIORHYNCHOIDAE (8 OTUs)

(91) *Eoneustes bathonicus* (Mercier, 1933) Young *et al*., 2010
DATA FROM: Mercier (1933).
LOCALITY: Port-en-Bessin, Calvados, Normandy, France.
FORMATION: “Calcaire de Caen”.
AGE: Bathonian, Middle Jurassic.

(92) *Eoneustes gaudryi* (Collot, 1905) Young *et al*., 2010
DATA FROM: NHMUK PV R 3353 (holotype).
LOCALITY: Saint-Seine-l'Abbaye, Département du Cote d'Or, Bourgogne, France.
FORMATION: “Calcaires blancs jaunâtres des de Bourgogne”.
AGE: lower Bathonian, Middle Jurassic.

(93) *Magyarosuchus fitosi* Ősi *et al*., 2018
DATA FROM: MTM V.97 (holotype).
LOCALITY: eastern Gerecse Mountains, Hungary.
FORMATION: Bed 13, uppermost Kisgerecse Marl Formation.
AGE: *Grammoceras striatulum* ammonite Subzone, *Grammoceras thouarense* ammonite Zone, upper Toarcian, Early Jurassic.

(94) Metriorhynchoidea indeterminate (Chile) [fragmentary taxon]
DATA FROM: Gasparini *et al*. (2000).
LOCALITY: Quebrada La Iglesia, Copiapo, Central-east Chile.
FORMATION: upper part of the Lautaro Formation.
AGE: lower Bajocian, Middle Jurassic.

(95) *Zoneait nargorum* Wilberg, 2015a
DATA FROM: Wilberg (2015a).
LOCALITY: near Suplee, Oregon, USA.
FORMATION: Weberg Member, Snow-shoe Formation.
AGE: uppermost Aalenian or lowermost Bajocian, Middle Jurassic.

(96) *Peipehsuchus teleorhinus* Young, 1948 [fragmentary taxon]
DATA FROM: photographs of the holotype provided by Eric Wilberg.
LOCALITY: Beipei, Szechuan, China.
FORMATION: Ziliujing Formation.
AGE: Lower Jurassic.
OBSERVATION: This OTU is solely based on the holotype, with the skull referred to *Peipehsuchus teleorhinus* treated as a separate OTU.

(97) *Pelagosaurus typus* Bronn, 1841
DATA FROM: BRLSI M.1415, BRLSI M.1416, BRLSI M.1420, MNHN.F RJN 463, MTM V.52.2516, NHMUK PV OR 19735, NHMUK PV OR 32599, SMNS 8666, SMNS 17758, SMNS 50374, SMNS 80066; Pierce & Benton (2006).
LOCALITIES: Numerous, including: Amaye-sur-Orne, Caen, and Curcy, France; Nabern near Kirchheim, S Germany; Holzmaden, Bad Boll, Ohmden and Ohmdenhausen, Swabian Jura, S Germany; Ilminster, Somerset, UK; Whitby, Yorkshire, England.
FORMATIONS: Numerous, including: Posidonia Shale Formation (Germany) and Whitby Mudstone Formation (UK).
AGE: lower Toarcian, Lower Jurassic.
OBSERVATION: this OTU includes *P. moorei* as a subjective junior synonym of *P. typus*, following Pierce & Benton (2006).

(98) *Teleidosaurus calvadosii* (Eudes-Deslongchamps, 1866)
DATA FROM: NHMUK PV R 2619 (plastoholotype); Eudes-Deslongchamps (1867-69).
LOCALITY: Allemagne, 3km south of Caen, Calvados, Normandy, France.
FORMATION: "Calcaire de Caen".
AGE: Bathonian, Middle Jurassic.

THALATTOSUCHIA: METRIORHYNCHIDAE: METRIORHYNCHINAE (19 OTUs)
(99) '*Dakosaurus*' *lissocephalus* Seeley, 1869
DATA FROM: CAMSM J29419 (holotype).
LOCALITY: Ely, Cambridgeshire, UK
FORMATION: lower Kimmeridge Clay Formation, Ancholme Group.
AGE: upper Kimmeridgian, Upper Jurassic.

(100) *Cricosaurus araucanensis* (Gasparini & Dellapé, 1976) Young & Andrade, 2009
DATA FROM: MLP-72-IV-7-1 (holotype), MLP-72-IV-7-2; Gasparini & Dellapé (1976), Fernández & Gasparini (2000, 2008), Fernández & Herrera (2009), Herrera *et al.* (2009).
LOCALITY: Argentina.
FORMATION: Vaca Muerta Formation, Mendoza Group. Neuquén Basin.
AGE: lower Tithonian, Upper Jurassic.

(101) *Cricosaurus bambergensis* sp. nov.
DATA FROM: NKMB-P-Watt14/274 (holotype); Sachs et al. (2019).
LOCALITY: Wattendorf quarry, Wattendorf, Bayern, Germany.
FORMATIONS: Wattendorf Member, Torleite Formation.
AGE: *Aulacostephanus eudoxus* Tethys ammonite Zone, upper Kimmeridgian, Upper Jurassic.

(102) *Cricosaurus elegans* (Wagner, 1852) Wagner, 1858
DATA FROM: BSPG AS I 504.
LOCALITY: Daiting, near Monheim, Bayern, Germany.
FORMATIONS: Mörnsheim Formation.
AGE: *Hybonoticeras hybonotum* Tethys ammonite Zone, lower Tithonian, Upper Jurassic.

(103) *Cricosaurus lithographicus* Herrera *et al.*, 2013
DATA FROM: Herrera *et al.* (2013).

LOCALITY: El Ministerio Quarry, Los Catutos Area, Zapala Department, Neuquén Province, Argentina.
FORMATION: Los Catutos Member, Vaca Muerta Formation, Mendoza Group. Neuquén Basin.
AGE: upper lower or middle upper Tithonian, Upper Jurassic.

(104) '*Cricosaurus*' *macrospondylus* (Koken, 1883) Young & Andrade, 2009
DATA FROM: Hua *et al*. (2000).
LOCALITY: Barret-le-Bas, Département du Hautes-Alpes, Provence-Alpes-Côte d'Azur, France.
FORMATION: not given.
AGE: *Busnardoites campylotoxus* ammonite Zone, lower Valanginian, Lower Cretaceous.
OBSERVATION: This OTU is solely based on the French referred specimen.

(105) '*Cricosaurus*' *saltillensis* (Buchy *et al*., 2006) Young & Andrade, 2009
DATA FROM: Buchy *et al*. (2006); Buchy *et al*. (2013).
LOCALITY: Sierra de Buñuelas, near Gomez Farías, State of Coahuila, Mexico.
FORMATION: La Caja Formation.
AGE: lower Tithonian, Upper Jurassic.

(106) *Cricosaurus schroederi* (Kuhn, 1936) Young & Andrade, 2009
DATA FROM: Karl *et al*. (2006b); photographs of the holotype provided by Nils Knötschke.
LOCALITY: Sachsenhagen, Lower Saxony, Germany.
FORMATION: '*Platylenticeras* beds'.
AGE: lower Valanginian, Lower Cretaceous.

(107) *Cricosaurus suevicus* (Fraas, 1901) Young & Andrade, 2009
DATA FROM: SMNS 9808 (lectotype), SMNS 90513; Fraas (1901, 1902).
LOCALITY: Nusplingen, Zollernalbkreis, Baden-Württemberg, Germany.
FORMATION: Nusplingen Plattenkalk.
AGE: *Hybonoticeras beckeri* Tethys ammonite Zone (= Malm Zeta 1), upper Kimmeridgian, Upper Jurassic.

(108) *Cricosaurus* sp. (Cuba)
DATA FROM: Gasparini & Iturralde-Vinent (2001).
LOCALITY: Viñales Valley, western Cuba.
FORMATION: Jagua Vieja Member, Jagua Vieja Formation.
AGE: middle or upper Oxfordian, Upper Jurassic.

(109) *Cricosaurus vignaudi* (Frey *et al*., 2002) Young & Andrade, 2009
DATA FROM: Frey *et al*. (2002).
LOCALITY: Mazatepec, State of Puebla, Mexico.
FORMATION: La Pimienta Formation.
AGE: 'middle' Tithonian, Upper Jurassic.

(110) *Gracilineustes acutus* (Lennier, 1887) Young *et al*., 2010
DATA FROM: Lennier (1887).
LOCALITY: Cap de la Hève, *Département du* Seine-Maritime, Haute-Normandie, France.
FORMATION: Marnes de Bléville Formation.
AGE: *Rasenia cymodoce* Sub-Boreal ammonite Zone, lower Kimmeridgian, Upper Jurassic.

(111) *Gracilineustes leedsi* (Andrews, 1913) Young *et al*., 2010
DATA FROM: CAMSM J64297, GLAHM V973, GLAHM V974, GLAHM V975, PETMG R24, PETMG R72, NHMUK PV R 2031, NHMUK PV R 2042, NHMUK PV R 3014, NHMUK PV R 3015, NHMUK PV R 3540 (holotype), NHMUK PV R 3899, NHMUK PV R 5793.
LOCALITY: Peterborough, UK.
FORMATION: Peterborough Member, Oxford Clay Formation, Ancholme Group.
AGE: middle Callovian, Middle Jurassic.

(112) *Maledictosuchus riclaensis* Parrilla-Bel *et al.*, 2013
DATA FROM: Parrilla-Bel *et al.* (2013).
LOCALITY: ‘‘Barranco de la Paridera’’, Ricla, Zaragoza, Spain.
FORMATION: Ágreda Formation.
AGE: *Erymnoceras coronatum* Sub-Mediterranean ammonite Zone, Middle Callovian, Middle Jurassic.

(113) Metriorhynchinae indeterminate (Cuba) [fragmentary taxon]
DATA FROM: USNM 419640.
LOCALITY: Viñales Valley, western Cuba.
FORMATION: Jagua Vieja Member, Jagua Vieja Formation.
AGE: middle or upper Oxfordian, Upper Jurassic.

(114) *Metriorhynchus geoffroyii* von Meyer, 1832 [fragmentary taxon]
DATA FROM: MHNG V-2232 (holotype).
LOCALITY: Le Havre, Département de Seine-Maritime, Haute-Normandie, France.
FORMATION: not given.
AGE: Kimmeridgian, Upper Jurassic.

(115) '*Metriorhynchus*' *palpebrosus* (Phillips, 1871)
DATA FROM: OUMNH J.29823 (holotype).
LOCALITY: Shotover Hill, Oxfordshire, UK.
FORMATION: Kimmeridge Clay Formation.
AGE: most likely lower Tithonian, Upper Jurassic.

(116) *Metriorhynchus superciliosus* (de Blainville, 1853)
DATA FROM: AMNH 997, GLAHM V942, GLAHM V963, GLAH V964, GLAHM V965, GLAHM V966, GLAHM V971, GLAHM V982, GLAHM V983, GLAHM V984, GLAHM V985, GLAHM V987, GLAHM V988, GLAHM V989, GLAHM V996, GLAHM V1004, GLAHM V1015, GLAHM V1027, GLAHM V1140, GLAHM V1142, GLAHM V1143, NHMUK PV R 1666, NHMUK PV R 2030, NHMUK PV R 2032, NHMUK PV R 2036, NHMUK PV R 2044, NHMUK PV R 2051, NHMUK PV R 2053, NHMUK PV R 2054, NHMUK PV R 2055, NHMUK PV R 2058, NHMUK PV R 2067, NHMUK PV R 3900, NHMUK PV R 6859, NHMUK PV R 6860, PETMG R10, PETMG R17, PETMG R18, PETMG R20, PETMG R42, PETMG R180, RMS M150, SMNS 10115, SMNS 10116, SMNS 81689; Andrews (1913).
LOCALITIES: outcrops from England and France.
FORMATIONS: Primarily: Oxford Clay Formation and Marnes de Dives Formation.
AGE: lower Callovian to lower Oxfordian, Middle-Upper Jurassic.

(117) *Rhacheosaurus gracilis* von Meyer, 1831
DATA FROM: AMNH 4804 and NHMUK PV R3961 (plastoholotypes), NHMUK PV R 3948.
LOCALITIES: Daiting (type locality) and Eichstätt, S Germany.
FORMATIONS: Mörnsheim Formation (type locality) and Solnhofen Formation.
AGE: *Hybonoticeras hybonotum* Tethys ammonite Zone, lower Tithonian, Upper Jurassic.

THALATTOSUCHIA: METRIORHYNCHIDAE: GEOSAURINAE (24 OTUs)

(118) cf. *Torvoneustes* [fragmentary taxon]
DATA FROM: MANCH J6459.
LOCALITY: Headington, Oxfordshire, UK.
FORMATION: most likely Beckley Sand Member, Kingston Formation.
AGE: middle Oxfordian, Upper Jurassic.

(119) *Dakosaurus andiniensis* Vignaud & Gasparini, 1996
DATA FROM: Gasparini *et al.* (2006), Pol & Gasparini (2009).
LOCALITIES: in the provinces of Neuquén and Mendoza, Argentina.

FORMATIONS: Vaca Muerta Formation, Mendoza Group and Neuquén Group. Neuquén Basin.
AGE: upper Tithonian, Upper Jurassic. Possibly also Berriasian, Lower Cretaceous.

(120) *Dakosaurus maximus* (Plieninger, 1846)
DATA FROM: NHMUK PV OR 33186, NHMUK PV OR 35766, NHMUK PV OR 35835-7, SMNS 8203 (neotype), SMNS 80148, SMNS 82043; Plieninger, 1846, Young & Andrade (2009), Andrade (2010), Andrade *et al.* (2010).
LOCALITIES: Numerous outcrops in England, Germany and France.
FORMATIONS: Numerous, including: Kimmeridge Clay Formation, Solnhofen Formation, Mergelstätten Formation and Nusplingen Plattenkalk.
AGE: upper Kimmeridgian-lower Tithonian, Upper Jurassic.

(121) Geosaurinae indeterminate (Argentina) [fragmentary taxon]
DATA FROM: Gasparini *et al*. (2005).
LOCALITY: Chacay Melehue, Neuquén Province, Argentina.
FORMATION: Los Molles Formation.
AGE: upper Bathonian, Middle Jurassic.

(122) *Geosaurus giganteus* (von Sömmerring, 1816)
DATA FROM: NHMUK PV R 1229 (holotype), NHMUK PV R 1230, NHMUK PV OR 37016, NHMUK PV OR 37020; Young & Andrade (2009), Andrade (2010), Andrade *et al.* (2010).
LOCALITIES: Daiting (type locality) and Eichstätt, Southern Germany.
FORMATIONS: Mörnsheim Formation (type locality) and Solnhofen Formation.
AGE: *Hybonoticeras hybonotum* Tethys ammonite Zone, lower Tithonian, Upper Jurassic.

(123) *Geosaurus grandis* (Wagner, 1858)
DATA FROM: BSPG AS-VI-1 (holotype); Young & Andrade (2009), Andrade (2010), Andrade *et al.* (2010).
LOCALITY: Daiting, near Monheim, Bayern, Germany.
FORMATIONS: Mörnsheim Formation.
AGE: *Hybonoticeras hybonotum* Tethys ammonite Zone, lower Tithonian, Upper Jurassic.

(124) *Geosaurus lapparenti* (Debelmas & Strannoloubsky, 1957)
DATA FROM: Debelmas (1952), Debelmas & Strannoloubsky (1957).
LOCALITY: La Martre, Département du Var, Provence-Alpes-Côte d'Azur, France.
FORMATION: not given.
AGE: *Neocomites peregrinus* ammonite Zone, upper Valanginian, Lower Cretaceous.

(125) *Ieldraan melkshamensis* Foffa *et al*., 2017
DATA FROM: NHMUK PV OR 46797.
LOCALITY: Melksham, Wiltshire, UK.
FORMATION: Oxford Clay Formation, Ancholme Group.
AGE: Callovian, Middle Jurassic.

(126) '*Metriorhynchus*' *brachyrhynchus* (Eudes-Deslongchamps, 1868c)
DATA FROM: GLAHM V978, GLAHM V995, NHMUK PV R 3541, NHMUK PV R 3699, NHMUK PV R 3700 (neotype), NHMUK PV R 3804, NHMUK PV R 4763, PETMG R19.
LOCALITY: Peterborough, UK.
FORMATION: Peterborough Member, Oxford Clay Formation, Ancholme Group.
AGE: middle Callovian, Middle Jurassic.

(127) '*Metriorhynchus*' *casamiquelai* Gasparini & Chong, 1977
DATA FROM: Gasparini & Chong (1977).
LOCALITY: Quebrada Sajasa, Región de Antofagasta, Chile.
FORMATION: not given.

AGE: Callovian, Middle Jurassic.

(128) Chouquet cf. '*Metriorhynchus*' *hastifer*
DATA FROM: Lepage *et al*. (2008).
LOCALITY: Octeville-sur-Mer, Département du Seine-Maritime, Haute-Normandie, France.
FORMATION: Marnes de Bléville Formation.
AGE: *Rasenia cymodoce* Sub-Boreal ammonite Zone, lower Kimmeridgian, Upper Jurassic.

(129) '*Metriorhynchus*' *westermanni* Gasparini, 1980
DATA FROM: Gasparini *et al*. (2008), Fernández *et al*. (2011).
LOCALITY: Placilla de Caracoles (type locality), and Sierra del Medio, Región de Antofagasta, Chile
FORMATION: Mina Chica Formation (type locality) and Vergara Formation.
AGE: Callovian and Oxfordian, Middle and Upper Jurassic.

(130) Mr Leeds' dakosaur
DATA FROM: NHMUK PV R 3321, NHMUK PV R 4696, NHMUK PV R 4763.
LOCALITY: Peterborough, UK.
FORMATION: Peterborough Member, Oxford Clay Formation, Ancholme Group.
AGE: middle Callovian, Middle Jurassic.

(131) Mr Passmore's Specimen
DATA FROM: OUMNH J1583.
LOCALITY: Swindon, Wiltshire, UK.
FORMATION: upper Kimmeridge Clay Formation.
AGE: lower Tithonian, Upper Jurassic.

(132) *Neptunidraco ammoniticus* Cau & Fanti, 2011
DATA FROM: Cau & Fanti (2011).
LOCALITY: unknown, but near Sant'Ambrogio di Valpolicella, Verona, Italty.
FORMATION: pseudonodular facies of lowermost Rosso Ammonitico Veronese Formation.
AGE: *Parkinsonia parkinsoni* ammonite Zone, uppermost Bajocian, Middle Jurassic.

(133) *Plesiosuchus manselii* (Hulke, 1870)
DATA FROM: NHMUK PV OR 40103 and NHMUK PV OR 40103a (holotype), NHMUK PV R 1089, MJML K181, MJML K434.
LOCALITIES: Westbury, Wiltshire; and Kimmeridge, Dorset (type locality), England, UK.
FORMATION: Kimmeridge Clay Formation, Ancholme Group.
AGE: *Aulacostephanus eudoxus* Sub-Boreal ammonite Zone, upper Kimmeridgian, to *Pectinatites wheatleyensis* Sub-Boreal ammonite Zone, lower Tithonian, Upper Jurassic.

(134) *Purranisaurus potens* Rusconi, 1948
DATA FROM: Herrera et al. (2015); high quality photographs of the holotype by Yanina Herrera.
LOCALITY: Arroyo del Arroyo del Cajón Grande, southwest Malargüe Department, Mendoza Province, Argentina.
FORMATION: Vaca Muerta Formation, Mendoza Group. Neuquén Basin.
AGE: *Substeueroceras koeneni* ammonite Zone, upper Tithonian or lower Berriasian, Upper Jurassic or Lower Cretaceous.

(135) *Suchodus durobrivensis* Lydekker, 1890
DATA FROM: NHMUK PV R 1994 (holotype), NHMUK PV R 2039
LOCALITY: Peterborough, UK.
FORMATION: Peterborough Member, Oxford Clay Formation, Ancholme Group.
AGE: middle Callovian, Middle Jurassic.

(136) *Torvoneustes carpenteri* (Wilkinson *et al*., 2008)

DATA FROM: BRSMG Ce 17365 (holotype), BRSMG Cd 7203; Wilkinson *et al.* (2008), Andrade (2010), Andrade *et al.* (2010).
LOCALITY: Westbury, Wiltshire, England, UK.
FORMATION: lower Kimmeridge Clay Formation, Ancholme Group.
AGE: *Aulacostephanus eudoxus* Sub-Boreal ammonite Zone, upper Kimmeridgian, Upper Jurassic.

(137) *Torvoneustes coryphaeus* Young *et al.*, 2013b
DATA FROM: MJML K1863 (holotype).
LOCALITY: Swindon, Wiltshire, UK.
FORMATION: lower Kimmeridge Clay Formation, Ancholme Group.
AGE: *Pictonia baylei* Sub-Boreal ammonite Zone, lower Kimmeridgian, Upper Jurassic.

(138) *Torvoneustes mexicanus* (Wieland, 1910) [fragmentary taxon]
DATA FROM: Barrientos-Lara *et al.* (2016).
LOCALITY: inprecise, but likley near Tlaxiaco, Oaxaca, Mexico.
FORMATION: suggested to be Sabinal Formation.
AGE: suggested to be Kimmeridgian, Upper Jurassic.

(139) *Torvoneustes* sp. [fragmentary taxon]
DATA FROM: MJML K1707.
LOCALITY: Kimmeridge Bay, Dorset, UK.
FORMATION: Dorset succession, lower Kimmeridge Clay Formation, Ancholme Group.
AGE: *Aulacostephanus autossiodorensis* Sub-Boreal ammonite Zone, upper Kimmeridgian, Upper Jurassic.

(140) *Tyrannoneustes lythrodectikos* Young *et al.*, 2013a
DATA FROM: GLAHM V972 (holotype), GLAHM V1145, NHMUK PV R 3939, PETMG R176.
LOCALITY: Peterborough, UK.
FORMATION: Peterborough Member, Oxford Clay Formation, Ancholme Group.
AGE: middle Callovian, Middle Jurassic.

(141) Vaches Noire dakosaur
DATA FROM: MNHN.F RJN 134a, ME 2012.4.68.
LOCALITY: Vaches Noires cliffs, Calvados, France
FORMATION: Marnes de Villers Formation (possibly also Marnes de Dives Formation).
AGE: ?Callovian and Oxfordian, Middle? and Upper Jurassic.

SOM 2.2. H+Y dataset – character list

The character list (460 characters) for the Hastings + Young (H+Y) dataset used for one of the phylogenetic analyses herein. The characters are organised into the anatomical order listed in section S1. Comments on the characters and scoring are in italics, and precede the description of states. Osteological craniomandibular and dental characters constitute 73.261% (337/460) of the character list, osteological post-cranial characters contribute 25.652% (118/460), while soft-tissue characters contribute 1.087% (5/460).

Characters that are not applicable (i.e. cannot be scored) for all taxa are marked with an asterisk **(*)** following the character description. Characters treated as additive for the ordered-character analysis are denoted by **(ORDERED)** following the character description.

Abbreviations: ch., character; **ds**, dataset; **mod.**, modified; **rev.**, revised.

Skull geometry and dimensions (Ch. 1 – 10; 2.174% of characters)

#	Description
1	**Skull height, in posterior view:** *Clark (1994, ch. 3 mod.); Andrade & Bertini (2008a, ch. 2); Andrade et al. (2011, ch. 1); Ristevski et al. (2018, ds 1, ch. 1); Smith et al. (in review, ds 2, ch. 1); Ősi et al. (2018, ds 1, ch. 1).* 0. skull higher than wide, or subequal 1. skull evidently wider than high
2	**Skull geometry, relative position of tooth row, quadrate articular facet and occipital condyle:** *Wu & Sues (1996, ch. 24 mod.); Sereno et al. (2003, ch. 46 mod.); Pol (2003, ch. 104 mod.); Turner & Buckley (2008, ch. 105 mod.); Andrade et al. (2011, ch. 2); Ristevski et al. (2018, ds 1, ch. 2); Smith et al. (in review, ds 2, ch. 2); Ősi et al. (2018, ds 1, ch. 2).* *In its original format, this character assumed that the tooth row was always below the occipital condyle, which is not always true (e.g.* Pelagosaurus typus*). The original format was modified by Andrade et al. (2011) because in Mesoeucrocodylia each of its components (height of occipital condyle, quadrate condyle and tooth row) will relate to each other independently, therefore demanding more than the original three states to reflect their geometric relationships. Note also differences from the original scorings, and also the lack of agreement on the scorings by different authors, for the original format.* 0. tooth row and quadrate condyle aligned, both at a lower level than the occipital condyle 1. tooth row at a lower level than the quadrate condyle, which is aligned to the occipital condyle 2. tooth row quadrate and occipital condyle all aligned in the same plane 3. tooth row and occipital condyle aligned, but quadrate condyle at a slightly lower level 4. tooth row and quadrate condyle unaligned and quadrate at a lower level, but both below the occipital condyle 5. tooth row and quadrate condyle unaligned and tooth row at a lower level, but both below the occipital condyle
3	**Skull geometry, relative position of tooth row and occipital condyle:** *Wu & Sues (1996, ch. 24 mod.); Sereno et al. (2003, ch. 46 mod.); Pol (2003, ch. 104 mod.); Turner & Buckley (2008, ch. 105 mod.); Andrade et al. (2011, ch. 3); Ristevski et al. (2018, ds 1, ch. 3); Smith et al. (in review, ds 2, ch. 3); Ősi et al. (2018, ds 1, ch. 3).* 0. unaligned, tooth row at a lower level than occipital condyle 1. tooth row and occipital condyle aligned in the same plane
4	**Skull geometry, relative position of quadrate condyles and occipital condyle:** *Wu & Sues (1996, ch. 24 mod.); Sereno et al. (2003, ch. 46 mod.); Pol (2003, ch. 104 mod.); Turner & Buckley (2008, ch. 105 mod.); Andrade et al. (2011, ch. 4); Young et al. (2016, ds 2, ch. 148), Ristevski et al. (2018, ds 2, ch. 6); Smith et al. (in review, ds 1, ch. 7); Ősi et al. (2018, ds 1, ch. 4).* *State (1) occurs in Neosuchia (with reversals in marine crocodyliforms, e.g. Dyrosauridae and cf.* Terminonaris robusta*).* 0. unaligned, quadrate condyles are at a lower level than the occipital condyle 1. quadrate condyles and occipital condyle aligned on the same plane
5	**Skull width to length ratio:** *Young et al. (2012, ch. 1); Young (2014, ch. 1); Young et al. (2016, ds 2, ch. 1); Ristevski et al. (2018, ds 2, ch. 1); Smith et al. (in review, ds 1, ch. 1); Ősi et al. (2018, ds 1, ch. 5).* *= maximum width between the lateral-most points of the quadrates : basicranial length* 0. 0.26 or lower 1. between 0.27 and 0.4 2. 0.4 or greater
6	**Snout elongation:** *Jouve (2005, ch. 5 mod.); Hastings et al. (2010, ch. 1 mod.); Ristevski et al. (2018, ds 2, ch. 2); Smith et al. (in review, ds 1, ch.2); Ősi et al. (2018, ds 1, ch. 6).* *State (2) can only be scored for taxa where snout elongation is the result of the anteroposterior elongation*

	of the maxilla (with the maxillae contact along their medial margins along the dorsal surface). *State (1) occurs in most pholidosaurids, most dyrosaurids and gavialoids.* *State (2) occurs in Thalattosuchia and* Meridiosaurus. 0. both the nasals and maxillae not elongated 1. nasals and maxillae both elongated (having the sublongirostrine or longirostrine condition) 2. maxillae elongated, contacting each other along their medial margins. No elongation of the nasals (having the sublongirostrine or longirostrine condition)
7	**Rostrum, relation between height and width: (ORDERED)** *Clark (1994, ch. 3 mod.); Young (2006, ch. 8 mod.); Wilkinson et al. (2008, ch. 25 mod.); Young & Andrade (2009, ch. 25 mod.); Andrade et al. (2011, ch. 6 mod.); Young et al. (2011, ch. 25 mod.); Young et al. (2013a, ch. 1 mod.); Young et al. (2012, ch. 2 mod.); Young (2014, ch. 2 mod.); Young et al. (2016, ds 2, ch. 2 mod.), Ristevski et al. (2018, ds 2, ch. 3); Smith et al. (in review, ds 1, ch.3); Ősi et al. (2018, ds 1, ch. 7).* *State (0) does not imply the platyrostral condition, although that is the most likely morphology.* *State (1) does not imply the rostrum will be tubular, although a tubular rostrum is most likely (1) in proportion.* *State (2) does not imply the oreinirostral condition, although that is the most likely morphology.* 0. wider than high (lateromedial axis greater than dorsoventral axis, by more than 10%) 1. height and width subequal (lateromedial & dorsoventral axes subequal ±10%) 2. higher than wide (dorsoventral axis greater than lateromedial axis, by more than 10%)
8	**Rostrum, in dorsal view – amblygnathy ("bullet-shaped", with the rostrum retaining its width along almost all its length):** *Young et al. (2012, ch. 3); Young (2014, ch. 3); Young et al. (2016, ds 2, ch. 3), Ristevski et al. (2018, ds 2, ch. 4); Smith et al. (in review, ds 1, ch.4); Ősi et al. (2018, ds 1, ch. 8).* *State (1) is a putative apomorphy of* Dakosaurus + *Mr Leeds' dakosaur.* 0. no 1. yes
9	**Rostrum, presence of distinct flattening of the cranial rostrum dorsal surface and symphyseal dentary ventral surface:** *Smith et al. (in review, ds 1, ch. 5); Ősi et al. (2018, ds 1, ch. 9).* *State (1) occurs in* Sarcosuchus *and* Chalawan. *This character can be scored based on either the cranial or mandibular rostrum.* *This character scores the almost planar dentary symphyseal region, and the flattening of the cranial rostrum. Note, this character does not score for the 'duck'-billed morphology seen in some crocodylomorphs, only the flattening seen in the giant pholidosaurids.* 0. no 1. yes
10	**Rostrum narrows markedly in dorsal view, immediately in front of the orbits** *Young et al. (2016, ds 2, ch. 4), Ristevski et al. (2018, ds 2, ch. 5); Smith et al. (in review, ds 1, ch. 6); Ősi et al. (20182, ds 1, ch. 10).* *In Thalattosuchia, state (1) occurs in* Aeolodon priscus, Mycterosuchus nasutus, Bathysuchus megarhinus *and* Teleosaurus cadomensis. *Note that in many* Steneosaurus bollensis *specimens the dorsoventral compression of the skulls exaggerates the width of the temporal region.* 0. no 1. yes

Craniomandibular ornamentation (Ch. 11 – 16; 1.304% of characters)

#	Description
11	**Ornamentation (maxilla in dorsal view = external surface):** *Young & Andrade (2009, ch. 84 mod.); Young et al. (2011, ch. 84 mod.); Young et al. (2013a, ch. 2 mod.); Young et al. (2012, ch. 4 mod.); Young (2014, ch. 4); Young et al. (2016, ds 2, ch. 5), Ristevski et al. (2018, ds 2, ch. 7); Smith et al. (in review, ds 1, ch. 8); Ősi et al. (2018, ds 1, ch. 11).* 0. no conspicuous ornamentation, or ornamented with an irregular pattern of ridges, rugosities and anastomosing grooves 1. conspicuous circular-to-polygonally pitted pattern 2. conspicuous grooved-ridged pattern 3. conspicuous pits and grooves
12	**Ornamentation (frontal):** *Young (2006, ch. 1 mod.); Wilkinson et al. (2008, ch. 1 mod.); Young & Andrade (2009, ch. 1 mod.); Young et al. (2011, ch. 1 mod.); Young et al. (2013a, ch. 46 mod.); Young et al. (2012, ch. 55 mod.); Young (2014, ch. 57); Young et al. (2016, ds 2, ch. 65), Ristevski et al. (2018, ds 2, ch. 8); Smith et al. (in review, ds 1, ch. 9); Ősi et al. (2018, ds 1, ch. 12).* *In metriorhynchids, the main body of the frontal can be largely or entirely 'smooth', while the anteromedial process is ornamented. If this process is ornamented, the taxon was still scored from states (0–2).*

	0. yes, with shallow to deep elliptical pits and shallow to deep grooves 1. yes, shallow to deep elliptical pits 2. yes, shallow to deep grooves 3. no
13	**Ornamentation (dorsal surface of the medial temporal region, typically the intertemporal bar):** *Jouve et al. (2005b, ch. 30 mod.); Jouve et al. (2008, ch. 30 mod.); Hastings et al. (2010, ch. 8 mod.), Ristevski et al. (2018, ds 2, ch. 9 mod.); Smith et al. (in review, ds 1, ch. 10 mod.); Ősi et al. (2018, ds 1, ch. 13).* *Note, herein we have re-worded this character to score for ornamentation along the dorsal surface of the medial temporal region, and not the intertemporal bar. This allows taxa that lack supratemporal fenestrae (such as* Iharkutosuchus*) to be scored for this character.* 0. ornamented 1. unornamented
14	**Ornamentation (parietal in dorsal view):** *Jouve et al. (2005b, ch. 27 mod.); Jouve et al. (2008, ch. 27 mod.); Hastings et al. (2010, ch. 45 mod.), Ristevski et al. (2018, ds 2, ch. 10); Smith et al. (in review, ds 1, ch. 11); Ősi et al. (2018, ds 1, ch. 14).* 0. no conspicuous ornamentation 1. slight ornamentation 2. strongly ornamented with deep and/or numerous pits
15	**Sculpturing, palatal surface of maxilla:** *Ortega et al. (2000, ch. 2); Andrade et al. (2011, ch. 20); Ristevski et al. (2018, ds 1, ch. 20); Smith et al. (in review, ds 2, ch. 20); Ősi et al. (2018, ds 1, ch. 15).* *State (1) was also registered for* Sichuanosuchus*,* Shantungosuchus *and* Fruitachampsa *by Ortega et al. (2000), but the absence (0) in* Hemiprotosuchus *cannot be confirmed, as the specimen is preserved with mandible in occlusion. Palatal sculpturing is also present in a few notosuchians.* 0. absent, palatal surface smooth 1. present, palatal surface ornamented with ridges
16	**Sculpturing, presence on the palatal surface of pterygoid:** *Clark (1994, ch. 40); Andrade et al. (2011, ch. 21); Ristevski et al. (2018, ds 1, ch. 21); Smith et al. (in review, ds 2, ch. 21); Ősi et al. (2018, ds 1, ch. 16).* *State (1) is present in Protosuchidae.* 0. absent, surface smooth 1. present

Internal neuroanatomy, sensory systems and cranial exocrine glands (Ch. 17 – 19; 0.652% of characters)

[Scoring any OTU for these characters can come from: CT scan datasets or specimens with the cranium broken showing said cavity. All characters in this section refer to internal anatomy, principally internal cavities and structures. Thus are not included in the sections referring to bones visible externally]

#	Description
17	**Enlarged paired blood vessels extending into and from the pituitary gland, presence: (NEW)** *In thalattosuchians (such as* Steneosaurus gracilirostris, Pelagosaurus typus*) the cerebral carotid and orbital arteries are hypertrophied.* *State (1) is a putative apomorphy of Thalattosuchia.* 0. absent, the cerebral carotid and orbital arteries are not enlarged 1. present, these vessels are noticeably enlarged (= hypertrophied)
18	**Enlarged paired dural venous sinus system dorsal to the hindbrain, presence: (NEW)** *In thalattosuchians (such as* Steneosaurus gracilirostris, Pelagosaurus typus, Cricosaurus araucanensis*) the posterior branch of the transverse dural venous sinus (= posterior middle cerebral vein) is hypertrophied.* *State (1) is a putative apomorphy of Thalattosuchia.* 0. absent, dural venous system system is not enlarged 1. present, these sinuses are noticeably enlarged (= hypertrophied)
19	**Internal enlarged cephalic exocrine glands, presence:** *Andrade et al. (2011, ch. 485 mod.); Ristevski et al. (2018, ds 2, ch. 386 mod.); Smith et al. (in review, ds 1, ch. 392 mod.); Ősi et al. (2018, ds 1, ch. 453).* *The evidence for internal large cephalic exocrine glands is well supported (e.g. Fernández & Gasparini, 2000, 2008; Gandola et al., 2006; Fernández & Herrera, 2009), and interpreted as structures for salt excretion. In fossil specimens, lobulations for glands must show a regular pattern, and have no trabecular bones, which otherwise indicate the presence of pneumatic cells of air sinuses (Fernández & Herrera, 2009).* *Note that in metriorhynchids the chambers housing these enlarged glands indicate their presence.* *These enlarged nasal glands are also associated with gland drainage ducts.* *State (1) occurs in Metriorhynchidae.*

	0. absent, nasal glands not enlarged 1. present, nasal glands enlarged (= hypertrophied), being bound externally by the nasal, prefrontal, lachrymal, maxilla and jugal

Craniomandibular pneumaticity (Ch. 20 – 23; 0.870% of characters)

[Scoring any OTU for these characters can come from: CT scan datasets or specimens with the cranium broken showing said cavity. All characters in this section refer to internal pneumatic cavities or the enclosure of pneumatic structures by bone. Thus are not included in the sections referring to bones visible externally]

#	Description
20	**Supraoccipital, internal presence of the cavity for the intertympantic diverticulum of the pharyngotympanic sinus system (= the "mastoid antrum"):** *Clark (1994, ch. 63 mod.); Andrade et al. (2011, ch. 282 mod.); Ristevski et al. (2018, ds 2, ch. 165); Smith et al. (in review, ds 1, ch. 169); Ősi et al. (2018, ds 1, ch. 186).* *As discussed by Wilberg (2015b), this character has been scored to unite Pholidosauridae and Dyrosauridae with Thalattosuchia. The natural external and internal mould* Pholidosaurus schaumburgensis *Bückeburg specimens held in Berlin show the cavity for this diverticulum (also see Wilberg, 2015b Figure 7c).* *Scoring any OTU as state (1) can come from CT scan datasets, or fossil specimens with a broken supraoccipital that show the cavity. However, scoring an OTU can only reliably come from CT scan datasets, or acid prepared specimens that have the braincase preserved. While this limits the number of OTUs that can be scored, it helps prevent potential mis-scorings.* *Here* Dyrosaurus, Sarcosuchus *and* Terminonaris *are scored as (?) until CT scans conclusively show the lack of this diverticulum.* *State (0) occurs in Thalattosuchia.* 0. absent (in Thalattosuchia this diverticulum is absent) 1. present
21	**Quadrate, openings on the dorsal surface at the proximal end (= subtympanic foramina; = quadrate fenestrae):** *Young & Andrade (2009, ch. 158 mod.); Young et al. (2011, ch. 158 mod.); Young et al. (2013a, ch. 104 mod.); Young et al. (2012, ch. 121 mod.); Young (2014, ch. 124 mod.); Young et al. (2016, ds 2, ch. 145 mod.); Ristevski et al. (2018, ds 2, ch. 198); Smith et al. (in review, ds 1, ch. 202); Ősi et al. (2018, ds 1, ch. 220).* *This character scores the presence of foramina on the proximal quadrate for the infundibular diverticula of the pharyngotympanic sinus system contacting the tympanum.* *State (2) occurs in Thalattosuchia.* 0. multiple subtympanic foramina 1. single subtympanic foramen 2. lacks subtympanic foramina
22	**Quadrate (and articular), foramina aërum presence:** *Ristevski et al. (2018, ds 2, ch. 199); Smith et al. (in review, ds 1, ch. 203); Ősi et al. (2018, ds 1, ch. 221).* *This character scores the presences of the aërum foramina on the dorsal or mediodorsal surface of the distal quadrate, and the associated opening on the dorsal or medial surface of the retroarticular process of the mandible. These foramina are for the siphonium connecting the quadrate and articular diverticula of the pharyngotympanic sinus system.* *Note that in large adults the articular diverticula can completely regress, thus the quadrate aërum foramen may be the best indicator of the structure's presence.* *Following Nesbitt (2011; discussion on ch. 159), basal crocodylomorphs (i.e. 'sphenosuchians') the large medial articular foramina are not considered to be articular aërum foramina. Whether basal crocodylomorphs had articular diverticula is currently unknown.* *State (0) occurs in Thalattosuchia (basal crocodylomorphs are scored as '?').* *State (1) is currently only known to occur in Crocodyliformes.* 0. absent 1. present
23	**Median pharyngeal and pharyngotympanic tubes (= "Eustachian tubes"), relation to basioccipital and basisphenoid: (ORDERED)** *Clark (1994, ch. 52 mod.); Andrade et al. (2011, ch. 290 mod.); Nesbitt (2011, ch. 121 – based on Gower 2002, ch. 13); Young et al. (2013a, ch. 108); Young et al. (2012, ch. 126); Young (2014, ch. 130); Young et al. (2016, ds 2, ch. 152); Ristevski et al. (2018, ds 2, ch. 206); Smith et al. (in review, ds 1, ch. 210); Ősi et al. (2018, ds 1, ch. 228).* *State (1) occurs in* Postosuchus *and 'sphenosuchians'.* *State (2) occurs in Crocodyliformes.*

	0. not enclosed by bone 1. partially enclosed between the basioccipital and basisphenoid 2. entirely enclosed between the basioccipital and basisphenoid

Rostral neurovascular foramina (Ch. 24 – 29; 1.304% of characters)

#	Description
24	**Neurovascular foramina, presence of an expanded network of openings on the dorsal surface of the rostrum and ventral-lateral surfaces of the mandible:** *Andrade et al. (2011, ch. 22), Ristevski et al. (2018, ds 2, ch. 11); Smith et al. (in review, ds 1, ch. 12); Ősi et al. (2018, ds 1, ch. 17).* *Based on the data by Soares (2002), where neurovascular foramina are related to the presence of dome pressure receptors (DPR).* *Three groups of teleosauroids score as state (1) – Machimosaurini,* Steneosaurus brevior*, and* Mycterosuchus nasutus*. Some other species of teleosauroids have the anterior tip of the dentary covered in numerous foramina, even though they have only the basal single line of foramina on the maxillae. In all thalattosuchians the dentary foramina are greater in number, and are easier to observe. In teleosauroids with no/little premaxillary/maxillary ornamentation, the accessory foramina are visible on the premaxilla and on the anterior maxillae. In Machimosaurini these foramina are much more numerous, and therefore easier to identify.* *Metriorhynchids however clearly have accessory foramina on the premaxillae, maxillae and dentaries, although they do not have the 'beehive-like' arrangement mentioned for extant taxa. The maxillary foramina can be observed across the element, and are not restricted to the anterior maxilla as in teleosauroids.* Pelagosaurus typus *has clear accessory foramina on the anterior dentaries, and perhaps has some on the premaxilla so it is here scored as (0).* *It is unclear whether the thalattosuchian condition is homologous to that seen in neosuchians (or whether it evolved multiple times within Thalattosuchia).* *This character might need to be re-evaluated, as George & Holliday (2013) have questioned the utility of using facial neurovascular foramina as osteological correlates for the DPR system.* 0. absent, neurovascular openings limited to a single line, near the ventral margin of the rostrum and dorsal margin of dentary 1. present at least at the premaxillae, maxillae and dentaries
25	**Neurovascular foramina (premaxilla), overall distance to the alveolar margin and teeth:** *Andrade & Bertini (2008, ch. 17 part); Andrade et al. (2011, ch. 23); Ristevski et al. (2018, ds 1, ch. 23); Smith et al. (in review, ds 2, ch. 23); Ősi et al. (2018, ds 1, ch. 18).* *Note that Andrade et al. (2011) substantially re-scored this character from the original (Andrade & Bertini 2008, ch17), and that complementary characters on neurovascular foramina are present.* 0. ventral-most foramina reach area next to the alveolar margin, close to teeth 1. ventral-most foramina clearly apart from the alveolar margin, distant to the teeth
26	**Neurovascular foramina (anterior maxilla), overall distance to the alveolar margin and teeth:** *Andrade & Bertini (2008, ch. 17 part); Andrade et al. (2011, ch. 24); Ristevski et al. (2018, ds 1, ch. 24); Smith et al. (in review, ds 2, ch. 24); Ősi et al. (2018, ds 1, ch. 19).* *State (0) is putative apomorphy of derived eusuchians, but is also present in other mesoeucrocodylian clades.* *State (1) is a common condition in Crocodylomorpha, occurring even in basal eusuchians.* 0. ventral-most foramina reach area next to the alveolar margin, close to teeth 1. ventral-most foramina clearly apart from the alveolar margin, distant to the teeth
27	**Neurovascular foramina (mid maxilla) forming a strongly arched line at mid-rostrum, at maturity:** *Andrade et al. (2011, ch. 25); Ristevski et al. (2018, ds 1, ch. 25); Smith et al. (in review, ds 2, ch. 25); Ősi et al. (2018, ds 1, ch. 20).* *State (1) is putative apomorphy of* Araripesuchus. 0. absent, line of foramina follows the overall outline of the margin 1. present, ample area of smooth margin ventral to the arched line of foramina
28	**Neurovascular foramina (posterior maxilla), distribution on the alveolar margin:** *Andrade et al. (2011, ch. 26); Young et al. (2016, ds 2, ch. 26), Ristevski et al. (2018, ds 2, ch. 12); Smith et al. (in review, ds 1, ch. 13); Ősi et al. (2018, ds 1, ch. 21).* *State (1) occurs in goniopholidids.* 0. ventral-most foramina not high on the maxillary margin, either close or next to the alveoli 1. ventral-most foramina high on the maxilla (up to twice the distance from other foramina), very distant to the alveoli
29	**Neurovascular foramina (dentary), distribution of neurovascular foramina relative to the alveolar margin, in non-tubular snouted forms: (*)** *Andrade et al. (2011, ch. 27); Ristevski et al. (2018, ds 1, ch. 27); Smith et al. (in review, ds 2, ch. 27); Ősi et al. (2018, ds 1, ch. 22).* *This character is not applicable for taxa that have tubular snouts.*

	State (1) occurs in Crocodylia. 0. foramina form a simple straight to ventrally-arched line 1. foramina form a sinusoid line, following the dorsal fluttings, when fluttings are present

Cranial rostrum (Ch. 30 – 87; 12.609% of characters)

[external nares, dermatocranial bones (= os præmaxillare, ossa nasalia, os maxillare and ossa lacrimalia), antorbital cavity]

#	Description
30	**Perinarial crests, presence and morphology:** *Andrade et al. (2011, ch. 29); Ristevski et al. (2018, ds 1, ch. 29); Smith et al. (in review, ds 2, ch. 29); Ősi et al. (2018, ds 1, ch. 23).* *State (1) is present within Goniopholididae (*Anteophthalmosuchus, Hulkeopholis, Goniopholis *and* Amphicotylus*).* 0. absent, surface even or bearing a perinarial fossa 1. present as well defined and distinct ridges, cornering the lateral to posterior borders of the naris
31	**External nares orientation:** *Turner & Pritchard (2015, ch. 6; modified from Clark 1994, ch. 6); Young et al. (2016, ds 2, ch. 8), Ristevski et al. (2018, ds 2, ch. 14); Smith et al. (in review, ds 1, ch. 15); Ősi et al. (2018, ds 1, ch. 24).* *In Thalattosuchia, state (0) occurs in the teleosauroids* Mycterosuchus nasutus, *the Chinese teleosauroid referred to* Peipehsuchus teleorhinus, Platysuchus multiscrobiculatus, Steneosaurus brevior *and* Teleosaurus megarhinus. 0. orientated anteriorly, anterodorsally, or anterolaterally 1. orientated mainly dorsally, or dorsolaterally
32	**External nares, shape in dorsal view:** *Young (2006, ch. 6 mod.); Wilkinson et al. (2008, ch. 23 mod.); Young & Andrade (2009, ch. 23 mod.); Young et al. (2011, ch. 23 mod.); Young et al. (2013a, ch. 4 mod.); Young et al. (2012, ch. 6 mod.); Young (2014, ch. 6 mod.); Young et al. (2016, ds 2, ch. 9), Ristevski et al. (2018, ds 2, ch. 15); Smith et al. (in review, ds 1, ch. 16); Ősi et al. (2018, ds 1, ch. 25).* *State (4) is a putative apomorphy of Susisuchidae.* 0. subcircular (diameter in any direction does not vary by more than ± 10%) 1. oval (dorsal width is greater than 10% longer than anteroposterior length) 2. 'D-shaped', with posterior edge straight 3. spoon-shaped elongate ellipse (dorsal width is less than 40% of anteroposterior length) 4. pear-shaped 5. external nares not exposed in dorsal view
33	**Medial tubercles of external nares on the posterior margin:** *Hastings et al. (2010, ch. 2 mod.), Ristevski et al. (2018, ds 2, ch. 16); Smith et al. (in review, ds 1, ch. 17); Ősi et al. (2018, ds 1, ch. 26).* *States (1+2) are putative apomorphies of Dyrosauridae.* 0. absent 1. dorsal 2. ventral
34	**Thickness of the anterior margin of the external nares: (*)** *Hastings et al. (2010, ch. 3 mod.), Ristevski et al. (2018, ds 2, ch. 17); Smith et al. (in review, ds 1, ch. 18); Ősi et al. (2018, ds 1, ch. 27).* *State (1) occurs in basal dyrosaurids.* *This character is not applicable for taxa that have posterodorsally retracted external nares (i.e. rhacheosaurin metriorhynchids).* 0. less than half anteroposterior length 1. greater than half anteroposterior length, or in species with a broad snout the anterior premaxilla is noticeably thick with the external nares posterior to the P1 alveoli
35	**External nares, posterodorsal retraction in relation to the tooth-row: (ORDERED)** *Young (2006, ch. 16 mod.); Wilkinson et al. (2008, ch. 38 mod.); Young & Andrade (2009, ch. 38 mod.); Young et al. (2011, ch. 38 mod.); Young et al. (2013a, ch. 5 mod.); Young et al. (2012, ch. 7 mod.); Young (2014, ch. 7 mod.); Young et al. (2016, ds 2, ch. 10), Ristevski et al. (2018, ds 2, ch. 18); Smith et al. (in review, ds1, ch. 19); Ősi et al. (2018, ds 1, ch. 28).* *This character was designed to quantify the degree of posterodorsal retraction of the external nares in Metriorhynchidae. Its level relative to the tooth-row is used in this regard.* *Previous states (4–6) of this character were removed by Young et al. (2016) as the maxillary tooth count is too variable.* 0. at the tip of the snout, with its posterior-margin not exceeding the first premaxillary alveolus 1. at the tip of the snout, but its posterior-margin does exceed the last premaxillary alveolus 2. the posterior-margin reaches to the beginning of the 1st maxillary alveolus 3. posterodorsally displaced, anterior-margin begins posterior to the 1st premaxillary alveolus while the

	posterior-margin exceeds the beginning of the 1st maxillary alveolus
36	**Postnarial fossa, presence:** *Andrade et al. (2011, ch. 41); Ristevski et al. (2018, ds 1, ch. 41); Smith et al. (in review, ds 2, ch. 41); Ősi et al. (2018, ds 2, ch. 42).* *State (1) is putative apomorphy of derived goniopholidids, but still poorly sampled in Neosuchia.* 0. absent 1. present
37	**Intranarial fossa, presence at the lateral walls, inside narial cavity, at the vestibulum:** *Andrade et al. (2011, ch. 42), Ristevski et al. (2018, ds 2, ch. 20); Smith et al. (in review, ds 1, ch. 21); Ősi et al. (2018, ds 1, ch. 30).* *State (1) is putative apomorphy of Thalattosuchia.* *The internarial fossa is an additional chamber that creates an internal border of the external naris; must not be mistaken with the naso-oral fossa, or with the perinarial fossa.* *Note, unlike Andrade et al. (2011), we consider this to present in all thalattosuchians. A distinct fossa within the nasal cavity is seen in all teleosauroids and* Pelagosaurus typus*, however due to dorsoventral crushing the fossa can be obscured.* 0. absent 1. present
38	**Premaxilla, dorsal/anterodorsal projection of the anterodorsal margin (anterior to the external nares):** *Young et al. (2016, ds 2, ch. 11), Ristevski et al. (2018, ds 2, ch. 21); Smith et al. (in review, ds 1, ch. 22); Ősi et al. (2018, ds 1, ch. 31).* *State (1) occurs in derived pholidosaurids, as well as in eusuchians.* 0. present 1. absent
39	**Premaxillae anterior to naris, morphology:** *Clark (1995, ch. 5 mod.); Andrade et al. (2011, ch. 62); Ristevski et al. (2018, ds 1, ch. 62); Smith et al. (in review, ds 2, ch. 62); Ősi et al. (2018, ds 1, ch. 32).* *State (0) is putative apomorphy of Notosuchidae + Sphagesauridae.* *State (1) is a putative apomorphy of* Araripesuchus + Libycosuchus. 0. anterior rami of premaxillae do not meet medially, anterior/ventral to naris, with both premaxillae in contact only through palatine rami 1. anterior rami of premaxillae meet anterior to naris, through a very narrow band, but not projecting vertically 2. anterior rami of premaxillae broadly meet anterior to naris, forming a vertical wall, which may be straight or slightly convex
40	**Premaxilla, lateral expansion anterior to the premaxilla-maxilla suture due to the enlargement of the P3 alveoli, with a constriction immediately posterior to the expansion:** *Hastings et al. (2010, ch. 14 mod.), Ristevski et al. (2018, ds 2, ch. 22); Smith et al. (in review, ds 1, ch. 23); Ősi et al. (2018, ds 1, ch. 33).* *State (1) occurs in basal dyrosaurids.* *Note that unlike other lateral expansions of the premaxilla, this does not correlate with a lateral expansion of the dentary.* 0. absent 1. present
41	**Premaxilla, length compared to width: (*)** *Jouve et al. (2008, ch. 41 mod.); Hastings et al. (2010, ch. 22 mod.), Ristevski et al. (2018, ds 2, ch. 23); Smith et al. (in review, ds 1, ch. 24); Ősi et al. (2018, ds 1, ch. 34).* *State (1) occurs in derived dyrosaurids.* *This character is not applicable for taxa that have posterodorsally retracted external nares.* 0. slightly longer than wide 1. nearly three times longer than wide, or more than three times longer than wide
42	**Premaxilla, ventral surface, presence of large depressions/notches for reception of the D1 teeth:** *Ristevski et al. (2018, ds 2, ch. 24); Smith et al. (in review, ds 1, ch. 25); Ősi et al. (2018, ds 1, ch. 35).* *State (1) occurs in the pholidosaurids* Terminonaris, Meridiosaurus, Sarcosuchus *and* Oceanosuchus, *goniopholidids* Anteophthalmosuchus sp., Amphicotylus stovalli *and* Calsoyasuchus, *and basal dyrosaurids* (e.g. Cerrejonisuchus). *State (2) occurs in* Elosuchus cherifiensis *and* E. broinae. 0. absent 1. occurs posterior to either the P1–P2 (or just the P2) alveoli, and are ventral to the external nares 2. occurs between, and separates, the P1–P2 alveoli from the P3–P4 alveoli
43	**Premaxilla, when seen in lateral view: (ORDERED)** *Young et al. (2016, ds 2, ch. 13 mod.), Ristevski et al. (2018, ds 2, ch. 26); Smith et al. (in review, ds 1, ch. 27); Ősi et al. (2018, ds 1, ch. 36).* *This character scores the 'pholidosaurid beak'. However,* Meridiosaurus *does not have a fully sub-vertical 'beak', but do have an intermediate morphology. This morphology is herein considered homologous to the*

	ventral alveolar row of goniopholidids and basal dyrosaurids. *State (1) occurs in* Meridiosaurus, Elosuchus, *and the French* Pholidosaurus, *and in the goniopholidids* Anteophthalmosuchus sp., Amphicotylus stovalli *and* Goniopholis kiplingi, *and the basal dyrosaurid* Cerrejonisuchus. *State (2) occurs in the pholidosaurids* Chalawan, Sarcosuchus, Terminonaris *and* Oceanosuchus, 0. the anterior and anterolateral margins are not sub-vertical, and do not extend ventrally when compared to the rest of the premaxilla (i.e. the dentigerous margins) 1. the anterior and anterolateral margins are slightly sub-vertical, and slightly extend ventrally to the rest of the element 2. the anterior and anterolateral margins are fully sub-vertical and extend ventrally to the rest of the element
44	**Premaxilla, when seen in lateral view:** *Ristevski et al. (2018, ds 2, ch. 27); Smith et al. (in review, ds 1, ch. 28); Ősi et al. (2018, ds 1, ch. 37).* *State (1) occurs in the teleosauroids* Mycterosuchus nasutus, *the Chinese teleosauroid referred to* Peipehsuchus teleorhinus, Platysuchus multiscrobiculatus, Steneosaurus brevior *and* Bathysuchus megarhinus. *This character is not homologous to the pholidosaurid ventral verticalisation of the premaxilla, as in this sub-set of teleosauroids the premaxilla is strongly orientated anteroventrally in lateral view.* 0. the anterior and anterolateral margins are either not sub-vertical, or do not extend ventrally when compared to the rest of the premaxilla (i.e. the dentigerous margins) 1. the anterior and anterolateral margins are orientated anteroventrally and extend ventrally to the rest of the element.
45	**Premaxilla, proportion of total length posterior to the external nares:** *Wilkinson et al. (2008, ch. 21); Young & Andrade (2009, ch. 21); Young et al. (2011, ch. 21); Young et al. (2013a, ch. 6); Young et al. (2012, ch. 8); Young (2014, ch. 8); Young et al. (2016, ds 2, ch. 14) Ristevski et al. (2018, ds 2, ch. 28); Smith et al. (in review, ds 1, ch. 29); Ősi et al. (2018, ds 1, ch. 38).* 0. greater than 67% of premaxilla total length is posterior to the external nares 1. between 50–65% 2. between 36–45% 3. 28% or less
46	**Premaxilla, posterodorsal (= maxillary, = subnarial) process, termination:** *Nesbitt & Desojo (2017, ch. 415); Ősi et al. (2018, ds 1, ch. 39).* *State (1) occurs in Crocodylomorpha.* 0. anterior to or at the posterior end of the external naris 1. posterior of the posterior extension of the external naris
47	**Premaxilla, posterodorsal process: (*)** *Young (2014, ch. 9); Young et al. (2016, ds 2, ch. 15); Ristevski et al. (2018, ds 2, ch. 29); Smith et al. (in review, ds 1, ch. 30); Ősi et al. (2018, ds 1, ch. 40).* *State (1) occurs in* Tyrannoneustes lythrodectikos, Torvoneustes, 'Metriorhynchus' hastifer *and Mr Passmore's specimen.* *This character is not applicable for taxa that retract their external nares (i.e. rhacheosaurin metriorhynchids).* 0. short, terminates level to the fourth maxillary alveolus, or more anteriorly 1. long, terminates level to the end of the fourth maxillary alveolus, or more posteriorly
48	**Premaxilla, development of premaxillary septum:** *Young (2006, ch. 7 mod.); Wilkinson et al. (2008, ch. 24 mod.); Young & Andrade (2009, ch. 24 mod.); Young et al. (2011, ch. 24 mod.); Young et al. (2013a, ch. 7); Young et al. (2012, ch. 9); Young (2014, ch. 10); Young et al. (2016, ds 2, ch. 16); Ristevski et al. (2018, ds 2, ch. 30); Smith et al. (in review, ds 1, ch. 31); Ősi et al. (2018, ds 1, ch. 41).* *State (1) scores the premaxillary septum of Metriorhynchidae.* *Terminonaris currently scored as '?', as it is unclear whether there was also a separating septum present.* *Young et al. (2013a) changed this character from a multi-state to its present binary form.* *Currently, only Rhacheosaurini metriorhynchids are definitively known to have had a full premaxillary septum, however specimens of* Metriorhynchus superciliosus, *'*M.*'* brachyrhynchus, *Mr Passmore's specimen and* Tyrannoneustes lythrodectikos *have preserved: the proximal end of the bar, and the raised distal articulation region on the premaxilla associated with the anterior end of the bar in Rhacheosaurini.Thus, they have been scored as (1). It is possible that only Rhacheosaurini has a fully ossified premaxillary bar, or the incomplete bar could be due to post-mortem damage.* *It is not homologous with other crocodylomorph septa, which are either partially formed by the nasals, or do not originate on the external surface of the premaxilla immediately anterior to the nasal fossa.* 0. no septum, with a single undivided external naris, or a divided external naris not formed solely by a premaxillary septum 1. external nares dorsally divided by a midline premaxillary septum
49	**Rostrum, morphology of the external surface of premaxilla and maxilla:** *based on Pol (1999, ch. 153); Andrade et al. (2011, ch. 55); Ristevski et al. (2018, ds 2, ch. 31); Smith et al. (in review, ds 1, ch. 32); Ősi et al. (2018, ds 1, ch. 42).*

	State (1) is putative apomorphy of Notosuchidae + Sphagesauridae. *Most commonly in state (1), the ventral plane will face laterally and slightly ventrally; the dorsal plane will face laterodorsally.* 0. rostrum with a continuous surface, either convex or plain 1. rostrum with distinct ventral and dorsal surfaces, plain and separated by a somewhat distinct anteroposterior ridge or edge
50	**Rostrum, type of contriction at the premaxilla-maxilla suture:** *Clark (1994, ch. 9 mod.); Wilkinson et al. (2008, ch. 20 mod.); Young & Andrade (2009, ch. 20 mod.); Andrade et al. (2011, ch. 57); Young et al. (2011, ch. 20 mod.); Young et al. (2013a, ch. 75 mod.); Young et al. (2012, ch. 88 mod.); Young (2014, ch. 90 mod.); Young et al. (2016, ds 2, ch. 108 mod.); Ristevski et al. (2018, ds 2, ch. 32); Smith et al. (in review, ds 1, ch. 33); Ősi et al. (2018, ds 1, ch. 43).* *State (0) is a putative apomorphy of* Araripesuchus. *The vast majority of crocodylomorphs can be considered as (1), but highly predaceous forms will show a well-defined notch at the premaxilla-maxilla suture (2).* 0. narrow slit 1. wide, poorly-defined concavity, or not constricted at all 2. well-defined notch
51	**Premaxillae anterior to naris, morphology:** *Clark (1995, ch. 5 mod.); Andrade et al. (2011, ch. 62); Ristevski et al. (2018, ds 2, ch. 33); Smith et al. (in review, ds 1, ch. 34); Ősi et al. (2018, ds 1, ch. 44).* *State (0) is putative apomorphy of Notosuchidae + Sphagesauridae.* *State (1) is a putative apomorphy of* Araripesuchus + Libycosuchus. 0. anterior rami of premaxillae do not meet medially, anterior/ventral to naris, with both premaxillae in contact only through palatine rami 1. anterior rami of premaxillae meet anterior to naris, through a very narrow band, but not projecting vertically 2. anterior rami of premaxillae broadly meet anterior to naris, forming a vertical wall, which may be straight or slightly convex
52	**Premaxilla, type of contact with maxilla:** *Clark (1994, ch. 8); Andrade et al. (2011, ch. 63); Ristevski et al. (2018, ds 2, ch. 34); Smith et al. (in review, ds 1, ch. 35); Ősi et al. (2018, ds 1, ch. 45).* *State (1) is a putative apomorphy of Crocodyliformes.* 0. premaxilla loosely overlies maxilla on face 1. premaxilla and maxilla suture together along butt joint
53	**Distance between premaxilla and nasal:** *Young (2006, ch. 5 mod.); Wilkinson et al. (2008, ch. 22 mod.); Young & Andrade (2009, ch. 22 mod.); Young et al. (2011, ch. 22 mod.); Young et al. (2013a, ch. 8 mod.); Young et al. (2012, ch. 10); Young (2014, ch. 11); Young et al. (2016, ds 2, ch. 17); Ristevski et al. (2018, ds 2, ch. 35); Smith et al. (in review, ds 1, ch. 36); Ősi et al. (2018, ds 1, ch. 46).* *State (2) occurs in* Meridiosaurus *and* Gavialis gangeticus. *States (1+2) are putative apomorphies of Thalattosuchia. But with reversals, some specimens of* 'Metriorhynchus' brachyrhynchus *have contact between these elements, and the posterodorsal retraction of the external nares in* 'Cricosaurus' macrospondylus *results in contact between these elements.* 0. none, premaxilla and nasal contact 1. small, less than half the midline length of the premaxilla 2. large, approximately 80% to more than 100% of the midline length of the premaxilla
54	**Nasal contribution to the margin of the external nares:** *Young et al. (2012, ch. 11); Young (2014, ch. 12); Young et al. (2016, ds 2, ch. 18); Ristevski et al. (2018, ds 2, ch. 36); Smith et al. (in review, ds 1, ch. 37); Ősi et al. (2018, ds 1, ch. 47).* 0. present 1. absent
55	**Anterior process of the nasals, anterior margin relative to the first maxillary alveoli: (*)** *Jouve et al. (2008, ch. 42 mod.); Hastings et al. (2010, ch. 33 mod.); Ristevski et al. (2018, ds 2, ch. 37); Smith et al. (in review, ds 1, ch. 38); Ősi et al. (2018, ds 1, ch. 48).* *State (0) occurs in pholidosaurids and derived dyrosaurids.* *Note that this character scores the posterior-ward position of the anterior margin of the nasal anterior process, due to the elongation of the premaxillary posterior process only.* *This character is not applicable for taxa that: 1) have posterodorsally retracted external nares (e.g. Rhacheosaurini), 2) lack a midline premaxillary posterior process (e.g.* Iharkutosuchus*) or 3) have the maxillae elongated and contacting along their midline (e.g. Thalattosuchia).* 0. posterior 1. anterior
56	**Nasals, morphology in dorsal view: (ORDERED)** *Andrade & Bertini (2008a, ch. 21); Young & Andrade (2009, ch. 160 mod.); Andrade et al. (2011, ch. 73); Young et al. (2011, ch. 160 mod.); Young et al. (2013a, ch. 9 mod.); Young et al. (2012, ch. 12 mod.); Young (2014, ch. 13 mod.); Young et al. (2016, ds 2, ch. 19 mod.); Ristevski et al. (2018, ds 2, ch. 38);*

	Smith et al. (in review, ds 1, ch. 39); Ősi et al. (2018, ds 1, ch. 49). *State (0) is a putative apomorphy of both Thalattosuchia and Notosuchia.* *State (2) is present in* Simosuchus. 0. triangular, lateral margins strongly confluent anteriorly 1. rectangular or subrectangular, lateral margins mostly parallel, or lateral margins poorly confluent anteriorly 2. triangular, lateral margins diverging anteriorly
57	**Nasal, lateroposterior processes:** *Young (2014, ch. 14); Young et al. (2016, ds 2, ch. 20); Ristevski et al. (2018, ds 2, ch. 39); Smith et al. (in review, ds 1, ch. 40); Ősi et al. (2018, ds 1, ch. 50).* *State (1) is a putative apomorphy of Metriorhynchidae.* *These processes suture with the anteroventral and anterior margin of the prefrontal, and the posterodorsal margin of the lachrymal.* 0. absent 1. present
58	**Nasals, fusion at maturity:** *Gasparini et al. (2006, ch. 257); Sereno & Larsson (2009, ch. 10); Hastings et al. (2010, ch. 32 mod.); Andrade et al. (2011, ch. 77); Tennant et al. (2016, ch. 65); Ristevski et al. (2018, ds 2, ch. 40); Smith et al. (in review, ds 1, ch. 41); Ősi et al. (2018, ds 1, ch. 51).* *State (1) is putative apomorphy of Dyrosauridae, but with some species having individuals with fused and unfused nasals, and some specimens with only the anterior nasals fused. Due to this variability, the character from Hastings et al. (2010) has been changed from an ordered multistate into the current binary character.* *In Thalattosuchia state (1) also occurs in* Lemmysuchus obtusidens. *As in Dyrosauridae, some individuals have fused nasals, while specimens have partially fused nasals. It is currently unclear whether the variation is ontogenetic or individual.* *State (1) is also present in Mahajangasuchidae.* 0. absent, nasals unfused 1. present, nasals at least partially fused (note that some species have variability in this character, such as in dyrosaurids)
59	**Nasals, posterior portion at the midline:** *Nesbitt (2011, ch. 34); Young et al. (2013a, ch. 10 mod.); Young et al. (2012, ch. 13 mod.); Young (2014, ch. 15 mod.); Young et al. (2016, ds 2, ch. 21); Ristevski et al. (2018, ds 2, ch. 41); Smith et al. (in review, ds 1, ch. 42); Ősi et al. (2018, ds 1, ch. 52).* *This character tests the homology of the metriorhynchoid and (most) teleosauroid "midline trench" and "depression" features, with a similar depression (state 1) seen in "rauisuchians" and "sphenosuchians".* *The morphology of* Calsoyasuchus *might be distinct, as it has two raised ridges running parallel, at either side of the midline depression, beginning on the frontal.* *Note that in some ‘sphenosuchians’ (i.e.* Sphenosuchus *and* Junggarsuchus*) the raised frontal ridge can continue onto the posterior nasal, and result in this depression forming around it.* 0. lacks a midline concavity or 'midline trench' - nasals are flat or convex 1. has a concavity at the midline, or a 'midline trench'
60	**Nasal contact with the prefrontal, in dorsal view: (*)** *Young & Andrade (2009, ch. 92); Young et al. (2011, ch. 92); Young et al. (2013a, ch. 11); Young et al. (2012, ch. 14); Young (2014, ch. 16); Young et al. (2016, ds 2, ch. 22); Ristevski et al. (2018, ds 2, ch. 42); Smith et al. (in review, ds 1, ch. 43); Ősi et al. (2018, ds 1, ch. 53).* *This character is not applicable for taxa that lack a sutural contact between the nasals and the prefrontals.* *State (1) is a putative apomorphy of the* Cricosaurus araucanensis. 0. irregular 1. smooth curve with a concavity directed posterolaterally
61	**Nasal-prefrontal contact:** *Young et al. (2012, ch. 15); Young (2014, ch. 17); Young et al. (2016, ds 2, ch. 23); Ristevski et al. (2018, ds 2, ch. 43); Smith et al. (in review, ds 1, ch. 44); Ősi et al. (2018, ds 1, ch. 54).* *State (1) occurs in crocodylomorphs.* 0. absent 1. present
62	**Premaxilla–maxilla lateral fossa excavating alveolus of last premaxillary tooth:** *Young & Andrade (2009, ch. 163); Young et al. (2011, ch. 163); Young et al. (2013a, ch. 12); Young et al. (2012, ch. 16); Young (2014, ch. 18); Young et al. (2016, ds 2, ch. 24); Ristevski et al. (2018, ds 2, ch. 44); Smith et al. (in review, ds 1, ch. 45); Ősi et al. (2018, ds 1, ch. 55).* 0. no 1. yes
63	**Maxilla, ventrolateral edge:** *Young & Andrade (2009, ch. 115); Young et al. (2011, ch. 115); Young et al. (2013a, ch. 13); Young et al. (2012, ch. 17); Young (2014, ch. 19); Young et al. (2016, ds 2, ch. 25); Ristevski et al. (2018, ds 2, ch. 45); Smith et al. (in review, ds 1, ch. 46); Ősi et al. (2018, ds 1, ch. 56).*

	0. straight 1. single convexity 2. double convexity ('festooned')
64	**Position of the posterior-most maxillae: (ORDERED)** *Hastings et al. (2010, ch. 29 mod.); Ristevski et al. (2018, ds 2, ch. 46); Smith et al. (in review, ds 1, ch. 47); Ősi et al. (2018, ds 1, ch. 57).* *State (1+2) are putative apomorphies of Dyrosauridae.* *State (2) is a putative apomorphy of* Cerrejonisuchus. 0. anterior to, or even with, the postorbital bars 1. even with the anteroposterior midlength of the supratemporal fenestrae 2. even with, or posterior to, the posterior margins of the supratemporal fenestrae
65	**Maxilla/jugal, presence of enlarged foramina and associated fossae on the lateral margin of the posterior maxillae and/or the anterior process of the jugal. These foramina are positioned near the maxillojugal suture. These structures are anteroposteriorly aligned (note that the foramina and associated fossae are not always contiguous):** *Ristevski et al. (2018, ds 2, ch. 47); Smith et al. (in review, ds 1, ch. 48); Ősi et al. (2018, ds 1, ch. 58).* *State (1) occurs in goniopholidids and most tethysuchians (in dyrosaurids the foramen is only present on the jugal). Note that the anterior position of the 'maxillary depressions' in* Calsoyasuchus *are not consistent with this character.* 0. absent 1. present
66	**Posterior maxilla, presence of lateral fossa/fossae next to the alveolar margin, anterior to the jugal and ventral to the lachrymal:** *Young & Andrade (2009, ch. 135 mod.); Andrade et al. (2011, ch. 87 mod.); Young et al. (2011, ch. 135 mod.); Young et al. (2013a, ch. 14 mod.); Young et al. (2012, ch. 18 mod.); Young (2014, ch. 20 mod.); Young et al. (2016, ds 2, ch. 27); Ristevski et al. (2018, ds 2, ch. 48); Smith et al. (in review, ds 1, ch. 49); Ősi et al. (2018, ds 1, ch. 59).* *This character is a modification of the goniopholidid+tethysuchian enlarged foramina + associated fossae character, in which there are paired depressions on either maxilla, which are anteroposteriorly elongated, dorsoventrally high, complex and entirely supported by the maxilla.* *State (1) occurs in Goniopholididae.* *As noted for the maxilla/jugal presence of an enlarged foramina character, the anterior position of the 'maxillary depressions' in* Calsoyasuchus *are also not consistent with this character.* 0. absent, maxillary bony surface convex or flat 1. present
67	**Maxilla, morphology of anterior border of maxillary depressions:** *Andrade et al. (2011, ch. 90); Ristevski et al. (2018, ds 2, ch. 49); Smith et al. (in review, ds 1, ch. 50); Ősi et al. (2018, ds 1, ch. 60).* *State (1) is present within Goniopholididae (*Anteophthalmosuchus *and* Goniopholis*).* 0. shallow, anterior edge of depression usually poorly defined, or maxillary depression is absent 1. deep, anterior border always well-defined relative to dermal surface of maxilla
68	**Posterior maxilla, presence of a lateral fossa/fossae that crosses the maxillojugal suture:** *Young et al. (2016, ds 2, ch. 28 mod.); Ristevski et al. (2018, ds 2, ch. 50); Smith et al. (in review, ds 1, ch. 51); Ősi et al. (2018, ds 1, ch. 61).* *This character is a modification of the goniopholidid + tethysuchian enlarged foramina + associated fossae character, in which there are paired depressions on either maxilla-jugal, which are anteroposteriorly elongated, dorsoventrally narrow, and contiguous on both the maxilla and jugal.* *State (1) occurs in Pholidosauridae* 0. absent, maxillary bony surface convex or flat 1. present
69	**Maxilla, aligned set of large foramina extending posteroventrally from the antorbital/preorbital fossa:** *Young et al. (2013a, ch. 15 mod.); Young et al. (2012, ch. 19 mod.); Young (2014, ch. 21); Young et al. (2016, ds 2, ch. 29); Ristevski et al. (2018, ds 2, ch. 51); Smith et al. (in review, ds 1, ch. 52); Ősi et al. (2018, ds 1, ch. 62).* *State (1) is a putative apomorphy of Mr Leeds dakosaur* + Dakosaurus. 0. absent 1. present
70	**Maxilla-lachrymal, contact: (*)** *Pol (1999, ch. 145); Young & Andrade (2009, ch. 141); Young et al. (2011, ch. 141); Young et al. (2013a, ch. 16); Young et al. (2012, ch. 20); Young (2014, ch. 22); Young et al. (2016, ds 2, ch. 30); Ristevski et al. (2018, ds 2, ch. 52); Smith et al. (in review, ds 1, ch. 53); Ősi et al. (2018, ds 1, ch. 63).* *This character is not applicable for taxa that lack the antorbital/preorbital fossae.* 0. partially included in antorbital/preorbital fossa 1. completely included
71	**Lachrymal, contact with the nasal:**

	Young & Andrade (2009, ch. 97); Young et al. (2011, ch. 97); Young et al. (2013a, ch. 17); Young et al. (2012, ch. 21); Young (2014, ch. 23); Young et al. (2016, ds 2, ch. 31); Ristevski et al. (2018, ds 2, ch. 53); Smith et al. (in review, ds 1, ch. 54); Ősi et al. (2018, ds 1, ch. 64). 0. nasal only contacts the dorsal margin of the lachrymal 1. nasal primarily contacts the anterior margin of the lachrymal 2. no contact between the nasals and lachrymals
72	**Nasal-lachrymal suture, length compared to nasal-prefrontal suture (in dorsal view): (*)** *Young & Andrade (2009, ch. 136 mod.); Young et al. (2011, ch. 136 mod.); Young et al. (2013a, ch. 18 mod.); Young et al. (2012, ch. 22 mod.); Young (2014, ch. 24 mod.); Young et al. (2016, ds 2, ch. 32 mod.); Ristevski et al. (2018, ds 2, ch. 54); Smith et al. (in review, ds 1, ch. 55); Ősi et al. (2018, ds 1, ch. 65).* *Ristevski et al. (2018) added a new character state.* *This character is not applicable for taxa that lack the nasal-lachrymal contact.* 0. short – nasolachrymal suture is approximately 60% of the nasoprefrontal suture 1. the two sutures are sub-equal (± 25%) 2. long – nasolachrymal suture is approximately twice the length of the nasoprefrontal suture (i.e. elongation of the lachrymals)
73	**Lachrymal, dorsal exposure:** *Young (2006, ch. 13); Wilkinson et al. (2008, ch. 33); Young & Andrade (2009, ch. 33); Young et al. (2011, ch. 33); Young et al. (2013a, ch. 19); Young et al. (2012, ch. 23); Young (2014, ch. 25); Young et al. (2016, ds 2, ch. 33); Ristevski et al. (2018, ds 2, ch. 55); Smith et al. (in review, ds 1, ch. 56); Ősi et al. (2018, ds 1, ch. 66).* 0. present, can be observed in both dorsal and lateral view 1. absent, only visible in lateral view (lachrymal vertically orientated)
74	**Lachrymal, dorsal surface lateral development:** *Ristevski et al. (2018, ds 2, ch. 56); Smith et al. (in review, ds 1, ch. 57); Ősi et al. (2018, ds 1, ch. 67).* *This character scores a slight lachrymal overhang of the orbits. These structures are the anterior palpebral sutural attachements, which are medially positioned.* *State (1) occurs in goniopholidids + tethysuchians (except dyrosaurids,* Terminonaris *and* Oceanosuchus*)* 0. flush with the rim of the orbit 1. enlarged, extending laterally over the orbit
75	**Lachrymal, size:** *Young (2006, ch. 14); Wilkinson et al. (2008, ch. 34); Young & Andrade (2009, ch. 34); Young et al. (2011, ch. 34); Young et al. (2013a, ch. 20); Young et al. (2012, ch. 24); Young (2014, ch. 26); Young et al. (2016, ds 2, ch. 34); Ristevski et al. (2018, ds 2, ch. 57); Smith et al. (in review, ds 1, ch. 58); Ősi et al. (2018, ds 1, ch. 68).* 0. large, in lateral view at least 45% of orbit height 1. small, less than 40% of orbit height
76	**Antorbital cavity, presence:** *Clark (1994, ch. 67 mod.); Young & Andrade (2009, ch. 88 part); Andrade et al. (2011, ch. 43 mod.); Young et al. (2011, ch. 88 part); Young et al. (2013a, ch. 21 part); Young et al. (2012, ch. 23 part); Young (2014, ch. 27 part); Young et al. (2016, ds 2, ch. 35 part); Ristevski et al. (2018, ds 2, ch. 58 part); Smith et al. (in review, ds 1, ch. 59 part); Ősi et al. (2018, ds 1, ch. 69).* *Antorbital cavity (CA), internal and external antorbital fenestra (FAO, FAOE, FAOI) as in Witmer (1997). The antorbital cavity or the FAOE must not be confounded with the shallow fossa located directly in front of the eyes (=prefrontal-lachymal fossa sensu Young & Andrade, 2009; =lachrymal fossa sensu Andrade et al., 2011).* *Note that here we have modified this character so that the presence of the antorbital cavity implies in the presence of a fenestra connecting the fossa with the internal antorbital sinuses (see Fernández & Herrera, 2009). We have not created a multi-state for this character with state (2) scoring for the preorbital condition, as it is unclear whether basal thalattosuchians had the antorbital fenestrae as openings for both the antorbital sinus and for the drainage duct of the hypertrophied nasal exocrine glands.* 0. absent (internalised, or the opening does not communicate with the antorbital sinus) 1. present (non-internalised, and the antorbital fenestra communicates with the antorbital sinus)
77	**Antorbital/preorbital cavity:** *Young et al. (2013a, ch. 25 mod.); Young et al. (2012, ch. 31 mod.); Young (2014, ch. 33 mod.); Young et al. (2016, ds 2, ch. 41 mod.); Ristevski et al. (2018, ds 2, ch. 64 mod.); Smith et al. (in review, ds 1, ch. 65 mod.); Ősi et al. (2018, ds 1, ch. 70).* *If hypothesis 2 of Fernández & Herrera (2009) is correct, and in metriorhynchids the antorbital cavity is internalised and the opening classically referred to as the "*antorbital fenestra*" are in fact neomorphic openings for the excretion of salt; then those taxa will score as (1) here, and (0) for the previous character on the presence/absence of the antorbital cavity.* *However, should the preorbital and antorbital fenestrae be found to be homologous, the scoring distinction currently made would still be valid. Basal metriorhynchoids which have an intermediate condition, with the openings communicating with both the antorbital sinus and for the drainage duct of the hypertrophied nasal exocrine glands would score as (1) for both characters.* *The current character construction thus does not favour one hypothesis over the other.*

	The preorbital fenestra itself is typically much smaller than realised, being a small sub-circular opening at the posterior-end of the deep fossa (where the lachrymals, nasals, jugals and maxillae converge). The deep concavity in this region can sometimes be filled with matrix, making the fenestra itself appear much larger than it really is. *Note that in Metriorhynchidae these fenestrae are set between the lachrymal, jugal and maxilla; typically, the jugal anterior ramus overlaps the maxilla externally, such that both bones contribute to the foraminal opening anteriorly. The inclusion of the nasal to the fenestra is unclear. It could be present in* Dakosaurus *and* Maledictosuchus*, but preservation in this region makes it hard to discern.* 0. absent (internalised, or the opening communicates solely with the antorbital sinus) 1. present (non-internalised, and the antorbital/preorbital fenestra communicates with the duct to the nasal exocrine gland)
78	**Antorbital cavity, relation between external and internal antorbital/preorbital fenestrae: (*)** *Andrade et al. (2011, ch. 45 mod.); Ristevski et al. (2018, ds 1, ch. 45 mod.); Smith et al. (in review, ds 2, ch. 45 mod.); Ősi et al. (2018, ds 1, ch. 71).* *State (2) is putative apomorphy of* Eoneustes + *Metriorhynchidae.* *This character is not applicable for taxa lacking antorbital/preorbital fenestrae.* 0. external and internal fenestrae subequal or not distinguishable 1. external fenestra larger than internal fenestra, but no more than twice its area 2. external fenestra much larger than internal fenestra, or external fenestra present and internal fenestra closed
79	**Antorbital/preorbital cavity, shape: (*)** *Young (2006, ch. 19 mod.); Wilkinson et al. (2008, ch. 41); Young & Andrade (2009, ch. 41); Andrade et al. (2011, ch. 46 mod.); Young et al. (2011, ch. 41); Young et al. (2013a, ch. 23); Young et al. (2012, ch. 28); Young et al. (2016, ch. 38); Ristevski et al. (2018, ch. 61); Smith et al. (in review, ch. 62); Ősi et al. (2018, ds 1, ch. 72).* *Note that this version of the character does not score for the elongate antorbital/preorbital cavity of metriorhynchoids. That morphological complex is scored by another character, relating to the presence of a sulcus anterior to the cavity. This means however, that any metriorhynchoid in which the cavity itself is elongated (such as as in the teleosauroid* Steneosaurus gracilirostris*) can be scored as state (1) for this character as well as for the sulcus character.* *This character is not applicable for taxa that lack antorbital fenestrae.* 0. subcircular, subtriangular or lozenge-shaped 1. anteroposteriorly elongated
80	**Antorbital/preorbital cavity, presence of a sulcus anterior to the cavity:** Gasparini *et al. (2006, ch. 246 mod.); Young (2006, ch. 19 mod. part); Wilkinson et al. (2008, ch. 41 mod. part); Young & Andrade (2009, ch. 41 mod. part); Andrade et al. (2011, ch. 46 mod. part); Young et al. (2011, ch. 41 mod. part); Young et al. (2013a, ch. 23 mod. part); Ősi et al. (2018, ds 1, ch. 73).* *State (1) is putative apomorphy of Metriorhynchoidea.* *In* Pelagosaurus typus *the sulcus is present (see Witmer, 1997), but it can be easily missed due to preservation as it is shallow when compared to the morphology seen in the clade* Eoneustes + *Metriorhynchidae.* *In well preserved specimens the distinction between the anterior sulcus and the external antorbital/preorbital fenestra is distinct (see* Dakosaurus andiniensis and Torvoneustes coryphaeus*).* *The external antorbital/preorbital fenestrae in the clade* Eoneustes + *Metriorhynchidae are bound by the jugal, lachrymal, nasal and maxilla. The anterior fossa continues anteriorly as a sulcus or fossa, but is largely present on the lateral surface of the maxilla.* *This character is not applicable for taxa lacking external antorbital/preorbital fenestrae.* 0. absent 1. present
81	**Antorbital cavity, size (area) of external antorbital/preorbital fenestra, relative to the orbit:** *Clark (1994, ch. 67 mod.); Andrade et al. (2011, ch. 47 mod.); Ősi et al. (2018, ds 1, ch. 74).* *States (0-1) occur in Crocodyliformes.* *State (2) occurs in non-crocodyliforms.* 0. small, being much smaller than the orbit area, or the antorbital cavity absent 1. moderately large, being at least half the diameter of the orbit 2. large, almost as large as the orbit
82	**Antorbital cavity, size (length) of internal antorbital/preorbital fenestra relative to the orbit:** *Clark (1994, ch. 67 mod.); Young & Andrade (2009, ch. 88 mod. part); Andrade et al. (2011, ch. 48); Young et al. (2011, ch. 88 mod. part); Young et al. (2013a, ch. 21 mod. part); Young et al. (2012, ch. 23 mod. part); Young (2014, ch. 27 mod. part); Young et al. (2016, ds 2, ch. 35 mod. part); Ristevski et al. (2018, ds 2, ch. 58 mod. part); Smith et al. (in review, ds 1, ch. 59 mod. part); Ősi et al. (2018, ds 1, ch. 75).* *States (0-1) occur in Crocodyliformes.* *State (2) occurs in* Junggarsuchus *(with reversals in some crocodyliforms, such as* Calsoyasuchus*).* *State (3) occurs in non-crocodyliforms.* 0. small, internal fenestra is less than 25% of the length of the orbit, or internal fenestra is absent

	1. medium, internal fenestra is approximately 25-50% of the length of the orbit 2. large, internal fenestra is more than 50% of the length of the orbit 3. very large, internal fenestra approximately the same size as the orbit
83	**Antorbital cavity, nasal participation in the internal antorbital/preorbital fenestra: (*)** *Ortega et al. (2000, ch. 70 mod.); Wilkinson et al. (2008, ch. 40); Young & Andrade (2009, ch. 40); Andrade et al. (2011, ch. 49 mod.); Young et al. (2011, ch. 40); Young et al. (2013a, ch. 22 mod.); Young et al. (2012, ch. 29 mod.); Young (2014, ch. 31 mod.); Young et al. (2016, ds 2, ch. 39 mod.); Ristevski et al. (2018, ds 2, ch. 62 mod.); Smith et al. (in review, ds 1, ch. 63 mod.); Ősi et al. (2018, ds 1, ch. 76).* *State (1) is a putative apomorphy of Metriorhynchidae. It also occurs in* Calsoyasuchus *and* Gracilisuchus. *This character is not applicable for taxa lacking antorbital/preorbital fenestrae.* 0. absent, nasals excluded from the internal fenestra by a maxillo-lachrymal contact 1. present, nasals broadly reach the internal fenestra (or reach deep into the fossa, if the internal fenestra is closed or preorbital)
84	**Antorbital cavity, jugal participation in the external antorbital/preorbital fenestra: (*)** *Wu & Sues (1996, ch. 14 rev.); Clark et al. (2000, ch. 4); Ortega et al. (2000, ch. 71 rev.); Clark & Sues (2002, ch. 4); Sues et al. (2003, ch. 4); Clark et al. (2004, ch. 4);Young (2006, ch. 17); Wilkinson et al. (2008, ch. 39); Young & Andrade (2009, ch. 39); Andrade et al. (2011, ch. 50); Young et al. (2013a ch. 24 part); Young et al. (2012, ch. 30); Pol et al. (2013, ch. 4); Young (2014, ch. 32); Young et al. (2016, ds 2, ch. 40); Leardi et al. (2017, ch. 4);Ristevski et al. (2018, ds 2, ch. 63); Smith et al. (in review, ds 1, ch. 64); Ősi et al. (2018, ds 1, ch. 77).* *Should be scored alongside the characters regarding the antorbital fenestra, not jugal, to facilitate cross-checking of inapplicable states due to the absence of the antorbital fenestra.* *This character is not applicable for taxa lacking external antorbital/preorbital fenestrae.* 0. absent, jugal excluded from the external fenestra by a maxillary-lachrymal contact 1. present, jugal takes part in the external fenestra (or reach deep into the fossa, if the internal fenestra is closed or preorbital)
85	**Antorbital cavity, position relative to the rostrum: (*)** *Andrade et al. (2011, ch. 51 mod.); Ristevski et al. (2018, ds 2, ch. 66); Smith et al. (in review, ds 1, ch. 67); Ősi et al. (2018, ds 1, ch. 78).* *State (1) is putative apomorphy of Thalattosuchia.* *Ristevski et al. (2018) modified state (1) to say 'approximately equidistant…', as in some teleosauroids (*e.g. Steneosaurus brevior, Platysuchus multiscrobiculatus*) the cavity is almost equidistant between the orbits and alveolar margin. But, these taxa still have the antorbital cavity being noticeably anterior to the orbits, as with other thalattosuchians that have not closed these cavities.* *This character is not applicable for taxa lacking external antorbital/preorbital fenestrae.* 0. closer to the orbit than to the alveolar margin 1. closer to the alveolar margin than to the orbit, or approximately equidistant (but with the cavity still noticeably anterior to the orbit)
86	**Antorbital cavity, position relative to the orbit: (*)** *Andrade et al. (2011, ch. 52); Ősi et al. (2018, ds 1, ch. 79).* *This character is not applicable for taxa lacking antorbital/preorbital fenestrae.* 0. close to the orbit, with lachrymal narrow between orbit and antorbital cavity 1. distant to the orbit, with lachrymal wide between orbit and antorbital cavity
87	**Prefrontal-lachrymal fossae:** *Young & Andrade (2009, ch. 150); Young et al. (2011, ch. 150); Young et al. (2013a, ch. 27); Young et al. (2012, ch. 33); Young (2014, ch. 35); Young et al. (2016, ds 2, ch. 43); Ristevski et al. (2018, ds 2, ch. 67); Smith et al. (in review, ds 1, ch. 68); Ősi et al. (2018, ds 1, ch. 80).* *Andrade et al. (2011, ch. 30) scores for a similar character, namely the presence of a lachrymal crest anterior to the orbit.* *The prefrontal-lachrymal fossa (sensu Young & Andrade, 2009) refers to a shallow depression immediately anterior to the orbit, present on both the prefrontal and lachyrmal. It is situated posterior to the preorbital fenestra, and never contacts the preorbital fossa. There is a crest within this fossa that is present along the prefrontal-lachrymal contact (scored for by Andrade et al. 2011, ch. 30).* *State (1) is a putative apomorphy of Metriorhynchidae.* 0. absent 1. present, with ridge following the sutural contact between these elements

Skull roof (Ch. 88 – 139; 11.304% of characters)

[skull roof proportions and arrangement, supratemporal fenestrae, dermatocranial bones (= ossa præfrontalia, os frontale, ossa postorbitalia, ossa squamosal and os parietale)]

#	Description
88	**Supratemporal skull roof, dorsal surface:** *Clark (1994, ch. 24); Young (2006, ch. 10 mod.); Wilkinson et al. (2008, ch. 29); Young & Andrade (2009, ch. 29); Andrade et al. (2011, ch. 118); Young et al. (2011, ch. 29); Young et al. (2013a, ch.*

	28); Young et al. (2012, ch. 34); Young (2014, ch. 36); Young et al. (2016, ds 2, ch. 44); Ristevski et al. (2018, ds 2, ch. 68); Smith et al. (in review, ds 1, ch. 69); Ősi et al. (2018, ds 1, ch. 81). *State (1) is a putative apomorphy of Crocodyliformes (reversal in Thalattosuchia).* 0. surface complex 1. flat skull table present, formed by flattened and levelled surfaces of frontal, postorbital, squamosal and parietal
89	**Posterior skull table:** *Young & Andrade (2009, ch. 99); Young et al. (2011, ch. 99); Young et al. (2013a, ch. 29); Young et al. (2012, ch. 35); Young (2014, ch. 37); Young et al. (2016, ds 2, ch. 45); Ristevski et al. (2018, ds 2, ch. 69); Smith et al. (in review, ds 1, ch. 70); Ősi et al. (2018, ds 1, ch. 82).* *Note that* Sphagesaurus *scores differently in this character, and for the preceding character.* 0. non-planar (squamosal ventral to horizontal level of postorbital and parietal) 1. planar (postorbital, squamosal, and parietal on same horizontal plane)
90	**Cranial table width relative to ventral portion of skull:** *Young & Andrade (2009, ch. 113); Young et al. (2011, ch. 113); Young et al. (2013a, ch. 30); Young et al. (2012, ch. 36); Young (2014, ch. 38); Young et al. (2016, ds 2, ch. 46); Ristevski et al. (2018, ds 2, ch. 70); Smith et al. (in review, ds 1, ch. 71); Ősi et al. (2018, ds 1, ch. 83).* 0. nearly as wide 1. narrower
91	**Supratemporal skull roof, dorsal curvature and elongation of squamosal prongs, at maturity:** *Brochu (1999, ch. 140); Young & Andrade (2009, ch. 148); Andrade et al. (2011, ch. 119); Young et al. (2011, ch. 148); Young et al. (2013a, ch. 31); Young et al. (2012, ch. 37); Young (2014, ch. 39); Young et al. (2016, ds 2, ch. 47); Ristevski et al. (2018, ds 2, ch. 71); Smith et al. (in review, ds 1, ch. 72); Ősi et al. (2018, ds 1, ch. 84).* 0. short posterolateral process of the squamosal 1. mature skull table with nearly horizontal sides; significant posterolateral process of the squamosal
92	**Supratemporal fenestrae, presence:** *Ősi et al. (2018, ds 1, ch. 85)* *State (1) occurs in Gobiosuchidae.* *State (2) is a putative autapomorphy of* Iharkutosuchus makadii. 0. present as an evident fenestra 1. presence variable during ontogeny, with the fenestrae possibly open during early ontogenetic stages (only closing later), or with there being a distinct 'depression' in the supratemporal region with the fenestrae themselves being reduced to a small foramen or completely closed 2. absent throughout ontogeny (i.e. supratemporal fenestrae are closed by the frontal and parietal suturing from an early ontogenetic state, with no 'depression' in the region)
93	**Supratemporal fossa, presence of "infratemporal flanges": (*)** *Young & Andrade (2009, ch. 142 mod.); Nesbitt (2011, ch. 144 mod.); Young et al. (2011, ch. 142); Young et al. (2013a, ch. 36); Young et al. (2012, ch. 44 mod.); Young (2014, ch. 46 mod.); Young et al. (2016, ds 2, ch. 48); Ristevski et al. (2018, ds 2, ch. 72); Smith et al. (in review, ds 1, ch. 73); Ősi et al. (2018, ds 1, ch. 86).* *This character tests the homology of metriorhynchid "infratemporal flanges" and the teleosauroid anteromedial supratemporal fossae, with the anterior extension seen in basal crocodylomorphs.* *State (0) is a putative apomorphy of Crocodyliformes (reversal in Thalattosuchia)* *Note, this character scores for the 'flat platform' formed by the frontal, and not the concavity that can form in neosuchians.* *This character is not applicable for taxa lacking supratemporal fenestrae.* 0. absent anterior to, and anteromedially to, the supratemporal fenestra 1. present anterior to, or anteromedially to, the supratemporal fenestra
94	**Supratemporal fossa, anterior margin in dorsal view: (*)** *Young (2006, ch. 9 mod.); Wilkinson et al. (2008, ch. 28); Young & Andrade (2009, ch. 28); Young et al. (2011, ch. 28); Young et al. (2013a, ch. 32); Young et al. (2012, ch. 38); Young (2014, ch. 40); Young et al. (2016, ds 2, ch. 49); Ristevski et al. (2018, ds 2, ch. 73); Smith et al. (in review, ds 1, ch. 74); Ősi et al. (2018, ds 1, ch. 87).* *This character was designed to quantify the anterior extent of the supratemporal fossae. In Metriorhynchidae, the fossae begin to invade the dorsal surface of the orbital region. In* Dakosaurus*,* Purranisaurus potens, Cricosaurus saltillensis, *and* C. schroederi *the supratemporal fossae extend as far anteriorly as the minimum interorbital distance (state 3).* *This character is not applicable for taxa lacking supratemporal fenestrae.* 0. anterior margin terminates posterior to the postorbital 1. anterior margin terminates between the anterior and posterior points of the frontal-postorbital suture 2. anterior margin terminates level to the postorbital anterior margin 3. anterior margin projects more anteriorly than the postorbital and reaches the interorbital minimum distance
95	**Supratemporal fossae, overall shape: (*)** *Young & Andrade (2009, ch. 110 + 120 mod. part); Andrade et al. (2011, ch. 111 mod.); Young et al.*

	(2011, ch. 110 + 120 mod. part); Young et al. (2013a, ch. 33 mod. part); Young et al. (2012, ch. 39 + 40 + 41 mod.); Young (2014, ch. 41 + 42 + 43); Young et al. (2016, ds 2, ch. 50 + 51 + 52 mod.); Ristevski et al. (2018, ds 2, ch. 74); Smith et al. (in review, ds 1, ch. 75); Ősi et al. (2018, ds 1, ch. 88). *This character is an amalgam of character 111 from Andrade et al. (2011), and characters 50, 51 and 52 from Young et al. (2016, ds 2).* *In Thalattosuchia, state (1) is a putative apomorphy for* Teleosaurus cadomensis *and* Maledictosuchus ricalensis. *State (2) occurs in* Elosuchus *and* Vectisuchus. *In Thalattosuchia, state (4) is a putative apomorphy of* Cricosaurus araucanensis *and* C. vignaudi. *State (6) is a putative apomorphy of Machimosaurini.* *This character is not applicable for taxa lacking supratemporal fenestrae.* 0. longitudinal ellipsoid/sub-rectangular (anteroposterior axis more than 10% longer than the lateromedial axis) 1. square-shaped to sub-rectangular (anteroposterior axis more than 10% longer than the lateromedial axis) 2. transverse triangle-shaped, with the axis converging medially (lateromedial axis more than 10% longer than the anteroposterior axis 3. circular to sub-circular 4. triangle-shaped, axis converging medially 5. parallelogram: lateral and medial margins, and anterior and posterior margins are sub-parallel
96	**Supratemporal fossa/fenestra, anterior margin shape, anterolateral expansion: (*)** *Ristevski et al. (2018, ds 2, ch. 75); Smith et al. (in review, ds 1, ch. 76); Ősi et al. (2018, ds 1, ch. 89).* *State (1) occurs in the teleosauroids* Mycterosuchus nasutus, Peipehsuchus teleorhinus, Platysuchus multiscrobiculatus, Teleosaurus cadomensis *and* Steneosaurus brevior. *This character is not applicable for taxa lacking supratemporal fenestrae.* 0. no anterolateral expansion of the supratemporal fenestrae/fossae 1. anterior margin of the supratemporal fossae are noticeably inclined anterolaterally, such that the anterolateral corners of the supratemporal fossae are noticeably more anterior than the anteromedial corners of the supratemporal fossae
97	**Supratemporal fenestra, overall anteroposterior elongation: (*)** *Ristevski et al. (2018, ds 2, ch. 76); Smith et al. (in review, ds 1, ch. 77); Ősi et al. (2018, ds 1, ch. 90).* *State (1) occurs in derived teleosauroids.* *This character is not homologous to the anteroposterior elongation of the supratemporal fenestrae in other clades, as it is caused by the extreme anteroposterior elongation of the proötics, laterosphenoids, postorbital posterior processes, parietal anterior process and frontal posterior process.* *This character is not applicable for taxa lacking supratemporal fenestrae.* 0. length is either less than, or approximately sub-equal to the anterior width 1. length is twice as long as the anterior width, or more. In *Machimosaurus*, the width of the supratemporal fenestrae increases, however the extreme elongation of the bones is still present.
98	**Supratemporal fenestra, overall anteroposterior elongation: (*)** *Ristevski et al. (2018, ds 2, ch. 77); Smith et al. (in review, ds 1, ch. 78); Ősi et al. (2018, ds 1, ch. 91).* *State (1) occurs in dyrosaurids.* *This character is not homologous to the anteroposterior elongation of the supratemporal fenestrae in teleosauroids, as it is caused by the anteroposterior elongation of the laterosphenoids, postorbital posterior processes, squamosal anterior processes and parietal anterior process.* *This character is not applicable for taxa lacking supratemporal fenestrae.* 0. length is either less than, or approximately sub-equal to the width at the middle of the fenestra (± 25%) 1. length is greater than the width of the fenestra (greater than 125%)
99	**Supratemporal fenestra, in dorsal view, size relative to orbits: (*)** *Young (2006, ch. 11); Wilkinson et al. (2008, ch. 30); Young & Andrade (2009, ch. 30); Young et al. (2011, ch. 30); Young et al. (2013a, ch. 34); Young et al. (2012, ch. 42); Young (2014, ch. 44); Young et al. (2016, ds 2, ch. 53); Ristevski et al. (2018, ds 2, ch. 78); Smith et al. (in review, ds 1, ch. 79); Ősi et al. (2018, ds 1, ch. 92).* *This character is not applicable for taxa lacking supratemporal fenestrae.* 0. longer in length than the orbit (supratemporal length 110% or more of orbit length) 1. subequal in length as the orbit (± 5%) 2. smaller than the orbits (supratemporal length less than 90% of orbit length)
100	**Supratemporal fenestra, in dorsal view, posterior limit: (*)** *Wilkinson et al. (2008, ch. 31 mod.); Young & Andrade (2009, ch. 31 mod.); Young et al. (2011, ch. 31 mod.); Young et al. (2013a, ch. 35 mod.); Young et al. (2012, ch. 43); Young (2014, ch. 45); Young et al. (2016, ds 2, ch. 54); Ristevski et al. (2018, ds 2, ch. 79); Smith et al. (in review, ds 1, ch. 80); Ősi et al. (2018, ds 1, ch. 93).* *State (2) is a putative apomorphy of the* Dakosaurus + Plesiosuchus *sub-clade.* *Note, scoring of this character should be done carefully, it may not be possible to score for skulls that have suffered taphonomic dorsoventral compression/shearing.*

	This character is not applicable for taxa lacking supratemporal fenestrae. 0. terminates well before the posterior-most point of the parietal 1. either terminates near the posterior-most point of the parietal or exceeds it, but never reaches the supraoccipital 2. more posterior than intertemporal bar
101	**Supratemporal fenestra/fossae, posterior margin in dorsal view: (*)** *Jouve et al. (2005b, ch. 10 mod.), Jouve (2005, ch. 6 mod.), Jouve et al. (2008, ch. 10 mod.), Hastings et al. (2010, ch. 10 mod.); Ristevski et al. (2018, ds 2, ch. 80); Smith et al. (in review, ds 1, ch. 81); Ősi et al. (2018, ds 1, ch. 94).* *State (1) occurs in derived dyrosaurids.* *This character is not applicable for taxa that lack the 'skull table' temporal morphotype, or taxa that lack supratemporal fenestrae.* 0. supratemporal fenestral posterior wall largely vertical and barely visible in dorsal view 1. supratemporal fenestral posterior wall posterodorsally inclined, creating a posterior fossa that is visible in dorsal view
102	**Supratemporal arch, medial margin in dorsal view: (*)** *Young & Andrade (2009, ch. 91); Young et al. (2011, ch. 91); Young et al. (2013a, ch. 37); Young et al. (2012, ch. 45); Young (2014, ch. 47); Young et al. (2016, ds 2, ch. 55); Ristevski et al. (2018, ds 2, ch. 81); Smith et al. (in review, ds 1, ch. 82); Ősi et al. (2018, ds 1, ch. 95).* *State (1) is a putative apomorphy of* 'Dakosaurus' lissocephalus + Cricosaurus. *This character is not applicable for taxa lacking supratemporal fenestrae.* 0. not convex 1. convex
103	**Supratemporal arch, dorsal margin in lateral view: (*)** *Young & Andrade (2009, ch. 98); Young et al. (2011, ch. 98); Young et al. (2013a, ch. 38); Young et al. (2012, ch. 46); Young (2014, ch. 48); Young et al. (2016, ds2, ch. 56); Ristevski et al. (2018, ds 2, ch. 82); Smith et al. (in review, ds 1, ch. 83); Ősi et al. (2018, ds 1, ch. 96).* *This character is not applicable for taxa lacking supratemporal fenestrae.* 0. concave 1. straight 2. convex
104	**Supratemporal arch, width in dorsal view: (*)** *Jouve et al. (2005b, ch. 16 mod.), Jouve et al. (2008, ch. 16 mod.), Hastings et al. (2010, ch. 11 mod.); Ristevski et al. (2018, ds 2, ch. 83); Smith et al. (in review, ds 1, ch. 84); Ősi et al. (2018, ds 1, ch. 97).* *State (1) scores the thin supratemporal arches of Dyrosauridae (with some reversals).* *This character is not applicable for taxa that lack the 'skull table' temporal morphotype, or taxa that lack supratemporal fenestrae.* 0. thick 1. thin
105	**Prefrontal, dorsal surface lateral development: (ORDERED)** *Gasparini et al. (2006, ch. 247 mod.); Young (2006, ch. 2 mod.); Wilkinson et al. (2008, ch. 12); Jouve (2009, ch. 255 mod.); Young & Andrade (2009, ch. 12); Andrade et al. (2011, ch. 125 mod.); Young et al. (2011, ch. 12); Young et al. (2013a, ch. 39); Young et al. (2012, ch. 47); Young (2014, ch. 49); Young et al. (2016, ds 2, ch. 57); Ristevski et al. (2018, ds 2, ch. 84); Smith et al. (in review, ds 1, ch. 85); Ősi et al. (2018, ds 1, ch. 98).* *The transverse development of the prefrontal is a classic characteristic of Metriorhynchidae.* *State (1) is a putative apomorphy of* Eoneustes*, however it could be more widespread among basal metriorhynchoids.* *State (2) is a putative apomorphy of Metriorhynchidae.* 0. reduced, flush with the rim of the orbit 1. incipient enlargement (extending laterally over the orbit by approximately 5% of its width) 2. enlarged (extending laterally over the orbit by more than 15% of its width)
106	**Prefrontal, lateral development relative to the posterolateral corner of the supratemporal fossa in dorsal view: (*)** *Wilkinson et al. (2008, ch. 13 mod.); Young & Andrade (2009, ch. 13 mod.); Young et al. (2011, ch. 13 mod.); Young et al. (2013a, ch. 40); Young et al. (2012, ch. 48); Young (2014, ch. 50); Young et al. (2016, ds 2, ch. 58); Ristevski et al. (2018, ds 2, ch. 85); Smith et al. (in review, ds 1, ch. 86); Ősi et al. (2018, ds 1, ch. 99).* *This character is not applicable for taxa lacking supratemporal fenestrae.* 0. prefrontal does not expand laterally so that it is in the same plane as the posterolateral corner of the supratemporal fossa 1. prefrontal expands further laterally than the posterolateral corner of the supratemporal fossa
107	**Prefrontal, shape in dorsal view:** *Wilkinson et al. (2008, ch. 14 mod. part); Young & Andrade (2009, ch. 14 mod. part); Young et al. (2011, ch. 14 mod. part); Young et al. (2013a, ch. 41 mod. part); Young et al. (2012, ch. 49); Young (2014, ch. 51); Young et al. (2016, ds 2, ch. 59); Ristevski et al. (2018, ds 2, ch. 86); Smith et al. (in*

	review, ds 1, ch. 87); Ősi et al. (2018, ds 1, ch. 100). *State (1) is a putative apomorphy of Metriorhynchidae.* 0. quadrilateral with irregular outline 1. teardrop-shaped
108	**Prefrontal, morphology of the lateral border in dorsal view: (*)** *Wilkinson et al. (2008, ch. 14 mod. part); Young & Andrade (2009, ch. 14 mod. part); Young et al. (2011, ch. 14 mod. part); Young et al. (2013a, ch. 41 mod. part); Young et al. (2012, ch. 50); Young (2014, ch. 52); Young et al. (2016, ds 2, ch. 60); Ristevski et al. (2018, ds 2, ch. 87); Smith et al. (in review, ds 1, ch. 88); Ősi et al. (2018, ds 1, ch. 101).* *This character describes the shape of the prefrontal in Metriorhynchidae, and thus is not applicable for taxa that do not have the lateral expansion of the prefrontal.* Eoneustes*, metriorhynchines and basal geosaurines score as state (0).* *State (1) is a putative apomorphy of Geosaurini.* *State (2) is a putative apomorphy of* Dakosaurus *(a modification of the Geosaurini condition).* 0. continuous convex curve, inflexion point approximately 80–90 degree angle from the anteroposterior axis of the skull 1. continuous convex curve, inflexion point approximately 60–70 degree angle from the anteroposterior axis of the skull 2. continuous convex curve, inflexion point approximately 50 degree angle from the anteroposterior axis of the skull
109	**Prefrontal, dimensions in dorsal view:** *Wilkinson et al. (2008, ch. 15); Young & Andrade (2009, ch. 15); Young et al. (2011, ch. 15); Young et al. (2013a, ch. 42); Young et al. (2012, ch. 51); Young (2014, ch. 53); Young et al. (2016, ds2, ch. 61); Ristevski et al. (2018, ds 2, ch. 88); Smith et al. (in review, ds 1, ch. 89); Ősi et al. (2018, ds 1, ch. 102).* 0. longer than wide 1. length/width is subequal (± 5%)
110	**Prefrontal, anterior to the orbits:** *Wilkinson et al. (2008, ch. 16); Young & Andrade (2009, ch. 16); Young et al. (2011, ch. 16); Young et al. (2013a, ch. 43); Young et al. (2012, ch. 52); Young (2014, ch. 54); Young et al. (2016, ds 2, ch. 62); Ristevski et al. (2018, ds 2, ch. 89); Smith et al. (in review, ds 1, ch. 90); Ősi et al. (2018, ds 1, ch. 103).* 0. elongate, oriented parallel to antero-posterior axis of the skull 1. short and broad
111	**Prefrontal, nasal-prefrontal suture has a pronounced, rectangular ‘concavity’ (directed posteriorly):** *Young & Andrade (2009, ch. 93); Young et al. (2011, ch. 93); Young et al. (2013a, ch. 44); Young et al. (2012, ch. 53); Young (2014, ch. 55); Young et al. (2016, ds 2, ch. 63); Ristevski et al. (2018, ds 2, ch. 90); Smith et al. (in review, ds 1, ch. 91); Ősi et al. (2018, ds 1, ch. 104).* *State (1) is a putative apomorphy of* Eoneustes. 0. absent 1. present
112	**Prefrontal, nasal-prefrontal suture has a posteriorly directed ‘V’-shape:** *Young & Andrade (2009, ch. 140); Young et al. (2011, ch. 140); Young et al. (2013a, ch. 45); Young et al. (2012, ch. 54); Young (2014, ch. 56); Young et al. (2016, ds 2, ch. 64); Ristevski et al. (2018, ds 2, ch. 91); Smith et al. (in review, ds 1, ch. 92); Ősi et al. (in review, ds 1, ch. 105).* *State (1) is a putative autapomorphy of* Cricosaurus macrospondylus. 0. absent 1. present
113	**Frontal, dorsal surface along the midline:** *Nesbitt (2011, ch. 42 mod.); Young et al. (2016, ds 2, ch. 66); Ristevski et al. (2018, ds 2, ch. 92); Smith et al. (in review, ds 1, ch. 93); Ősi et al. (2018, ds 1, ch. 106).* *State (0) is a putative apomorphy of Crocodyliformes (although there is a reversal in numerous neosuchian clades)* 0. flat 1. an incomplete longitudinal ridge along the midline 2. a longitudinal ridge that proceeds along the entire length of the midline
114	**Frontal, dorsal surface:** *Young et al. (2016, ds 2, ch. 67); Ristevski et al. (2018, ds 2, ch. 93); Smith et al. (in review, ds 1, ch. 94); Ősi et al. (2018, ds 1, ch. 107).* *State (1) occurs in* Hesperosuchus *cf.* agilis, Dromicosuchus grallator, *and among many tethysuchians (except derived dyrosaurids)* 0. slightly convex or flat 1. concave, with the medial borders of the orbit upturned
115	**Frontal, anteromedial process length: (*)** *Jouve et al. (2008, ch. 31 mod.), Hastings et al. (2010, ch. 38 mod.); Ristevski et al. (2018, ds 2, ch.*

	94); Smith et al. (in review, ds 1, ch. 95); Ősi et al. (2018, ds 1, ch. 108). *This character is not applicable for* Anthracosuchus *and* Cerrejonisuchus *as the anterior region of the frontal is elongated and the prefrontals are reduced (i.e. there is no elongation of the anteromedial process).* 0. the anteromedial process is approximately level to, or slightly posterior to, the prefrontals 1. the anteromedial process is noticeably posterior to the prefrontals
116	**Frontal, anteromedial process:** *Young et al. (2016, ds 2, ch. 68); Ristevski et al. (2018, ds 2, ch. 95); Smith et al. (in review, ds 1, ch. 96); Ősi et al. (2018, ds 1, ch. 109).* *State (1) is a putative apomorphy of Sebecia, also occurs in some basal dyrosaurids, bernissartiids and hylaeochampsids.* 0.frontal anteromedial process has an acute anterior margin, which separates the left and right nasals along their posterior margin 1. frontal anteromedial process lacks an acute anterior margin, with the nasal posterior margin with the frontal being either transversely straight, or is slightly convex or concave (in taxa where the prefrontals expand anterolaterally, there can sometimes be posteromedial processes of the nasals)
117	**Frontal, contribution to the intertemporal bar: (*)** *Smith et al. (in review, ds 1, ch. 97); Ősi et al. (2018, ds 1, ch. 110).* *This character is not applicable for taxa that lack supratemporal fenestrae.* *Note that in many crocodyliforms the frontal only forms the very anterior region of the intersupratemporal fenestral area. We only score taxa as state (1) if the frontal is clearly anterior to the bar.* *State (1) occurs in* Protosuchus, Mahajangasuchus, Elosuchus, Vectisuchus, Chalawan thailandicus, Sarcosuchus, *and Crocodylia.* 0. frontal contributes to the anterior part of the intertemporal bar 1. frontal is excluded from the intertemporal bar, with the bar being solely composed by the parietal
118	**Frontal, angle between posteromedial and posterolateral processes: (*)** *Wilkinson et al. (2008, ch. 26 mod.); Young & Andrade (2009, ch. 26 mod.); Andrade et al. (2011, ch. 98 mod.); Young et al. (2011, ch. 26); Young et al. (2013a, ch. 47); Young et al. (2012, ch. 56); Young (2014, ch. 58); Young et al. (2016, ds 2, ch. 69); Ristevski et al. (2018, ds 2, ch. 96); Smith et al. (in review, ds 1, ch. 98); Ősi et al. (2018, ds 1, ch. 111).* *See diagrammatic explanation for this character in Wilkinson et al. (2008: p.1311, Fig. 4).* *This character is not applicable for taxa that lack supratemporal fenestrae (which help form the distinct posterior processes of the frontal).* 0. approximately 90 degree angle, or obtuse 1. approximately 70–60 degree angle 2. approximately 45 degree angle, or more acute
119	**Frontal, minimum width between orbits in dorsal view compared to the supratemporal fossa: (*)** *Young & Andrade (2009, ch. 121); Young et al. (2011, ch. 121); Young et al. (2013a, ch. 48); Young et al. (2012, ch. 57); Young (2014, ch. 59); Young et al. (2016, ds 2, ch. 70); Ristevski et al. (2018, ds 2, ch. 97); Smith et al. (in review, ds 1, ch. 99); Ősi et al. (2018, ds 1, ch. 112).* *This character is not applicable for taxa that lack supratemporal fenestrae.* 0. greater than, or equal to, the width of one supratemporal fossa and the intertemporal bar 1. subequal to width of one supratemporal fossa
120	**Frontal, minimum width between orbits in dorsal view compared to the orbits:** *Young & Andrade (2009, ch. 137); Young et al. (2011, ch. 137); Young et al. (2013a, ch. 49); Young et al. (2012, ch. 58); Young (2014, ch. 60); Young et al. (2016, ds 2, ch. 71); Ristevski et al. (2018, ds 2, ch. 98); Smith et al. (in review, ds 1, ch. 100); Ősi et al. (2018, ds 1, ch. 113).* 0. broader than orbital width 1. subequal with orbital width 2. narrower than orbital width
121	**Frontal-parietal, between supratemporal fossa in dorsal view (intertemporal bar): (*)** *Wilkinson et al. (2008, ch. 2); Young & Andrade (2009, ch. 2); Young et al. (2011, ch. 2); Young et al. (2013a, ch. 50); Young et al. (2012, ch. 59); Young (2014, ch. 61); Young et al. (2016, ds 2, ch. 72); Ristevski et al. (2018, ds 2, ch. 99); Smith et al. (in review, ds 1, ch. 101); Ősi et al. (2018, ds 1, ch. 114).* *This character is not applicable for taxa that lack supratemporal fenestrae (as there is no intertemporal bar).* 0. frontal and parietal subequal in width (± 5%) 1. frontal width is wider than the parietal. Can be extreme (greater than 75%)
122	**Frontal-postorbital suture: (*)** *Wilkinson et al. (2008, ch. 27 mod.); Young & Andrade (2009, ch. 27 mod.); Young et al. (2011, ch. 27); Young et al. (2013a, ch. 51); Young et al. (2012, ch. 60); Young (2014, ch. 62); Young et al. (2016, ds 2, ch. 73); Ristevski et al. (2018, ds 2, ch. 100); Smith et al. (in review, ds 1, ch. 102); Ősi et al. (2018, ds 1, ch. 115).* *This character is not applicable for taxa that lack supratemporal fenestrae (as there is no*

	intertemporal bar). 0. level with the intertemporal bar 1. lower than the intertemporal bar
123	**Frontal-postorbital suture, in dorsal view:** *Wilkinson et al. (2008, ch. 3 mod.); Young & Andrade (2009, ch. 3 mod.); Hastings et al. (2010, ch. 40 mod.); Young et al. (2011, ch. 3 mod.); Young et al. (2013a, ch. 52 mod.); Young et al. (2012, ch. 61 mod.); Young (2014, ch. 63 mod.); Young et al. (2016, ds 2, ch. 74 mod.); Ristevski et al. (2018, ds 2, ch. 101); Smith et al. (in review, ds 1, ch. 103); Ősi et al. (i2018, ds 1, ch. 116).* *This character is an amalgam of the Hastings et al. (2010, ch. 40) and Young et al. (2016, ds 2, ch. 74) characters.* *State (1) is a putative apomorphy of Metriorhynchidae.* *State (2) scores the dyrosaurid morphotype.* 0. irregular and straight or gently curved 1. frontal overlaps the postorbital, creating a ‘V’-shape directed posteriorly. 2. strongly interdigitating in dorsal view (largely in one plane)
124	**Postorbital, shape in dorsal view:** *Young & Andrade (2009, ch. 118); Young et al. (2011, ch. 118); Young et al. (2013a, ch. 53); Young et al. (2012, ch. 62); Young (2014, ch. 64); Young et al. (2016, ds 2, ch. 75); Ristevski et al. (2018, ds 2, ch. 102); Smith et al. (in review, ds 1, ch. 104); Ősi et al. (2018, ds 1, ch. 117).* 0. the outer margin is convex where the postorbital curves posteriorly forming the supratemporal arch 1. forms a 90 degree angle 2. anterior extension from the corner
125	**Postorbital, anterolateral extension:** *Young & Andrade (2009, ch. 138); Young et al. (2011, ch. 138); Young et al. (2013a, ch. 54); Young et al. (2012, ch. 63); Young (2014, ch. 65); Young et al. (2016, ds 2, ch. 76); Ristevski et al. (2018, ds 2, ch. 103); Smith et al. (in review, ds 1, ch. 105); Ősi et al. (2018, ds 1, ch. 118).* *State (1) of this character, and state (2) of the character “anterior extension from the postorbital corner” do not necessarily occur in the same taxon (e.g.* Oceanosuchus*).* 0. small or absent 1. very large, appearing in lateral view to contact the dorsal surface of the jugal
126	**Postorbital and squamosal, relative lengths in dorsal view:** *Young (2006, ch. 15); Wilkinson et al. (2008, ch. 37); Young & Andrade (2009, ch. 37); Young et al. (2011, ch. 37); Young et al. (2013a, ch. 55); Young et al. (2012, ch. 64); Young (2014, ch. 66); Young et al. (2016, ds 2, ch. 77); Ristevski et al. (2018, ds 2, ch. 104); Smith et al. (in review, ds 1, ch. 106); Ősi et al. (2018, ds 1, ch. 119).* *State (1) is a putative apomorphy of Thalattosuchia.* 0. squamosal is longer 1. postorbital is longer
127	**Supratemporal arch (= upper temporal bar), relative participation of the postorbital:** *Ortega et al. (2000, ch. 33 mod.); Andrade et al. (2011, ch. 151); Ristevski et al. (2018, ds 2, ch. 105); Smith et al. (in review, ds 1, ch. 107); Ősi et al. (2018, ds 1, ch. 120).* *Young & Andrade (2009, ch. 127); Young et al. (2011, ch. 127); Young et al. (2013a, ch. 57); Young et al. (2012, ch. 66); Young (2014, ch. 68) and Young et al. (2016, ch. 79) score for the same morphology, however they used the squamosal contribution to the supratemporal arch.* *State (1) is putative apomorphy of Thalattosuchia.* *Note that a similar morphology also evolves in some derived dyrosaurids (elongatation of the postorbital posterior processes). In these taxa however, the character relating to the relative participation of the postorbital is not affected (i.e. the squamosal in dorsal view is still longer anteroposteriorly than the postorbital). The postorbital being longer overall, and makes a greater proportional contribution to the supratemporal arch than the squamosal, only co-occurs in Thalattosuchia.* 0. small, postorbital represents approximately 30% of the bar 1. extensive, postorbital represents approximately 50% (or more) of the bar
128	**Posterior margin of the squamosal lateral to post-temporal fenestrae:** *Jouve et al. (2005b, ch. 29), Jouve et al. (2008, ch. 29), Hastings et al. (2010, ch. 48); Ristevski et al. (2018, ds 2, ch. 106); Smith et al. (in review, ds 1, ch. 108); Ősi et al. (2018, ds 1, ch. 121).* *State (1) occurs in derived dyrosaurids.* 0. straight 1. anteriorly concave
129	**Squamosal, projects further posteriorly than the occipital condyle:** *Young & Andrade (2009, ch. 125); Young et al. (2011, ch. 125); Young et al. (2013a, ch. 56); Young et al. (2012, ch. 65); Young (2014, ch. 67); Young et al. (2016, ds 2, ch. 78); Ristevski et al. (2018, ds 2, ch. 107); Smith et al. (in review, ds 1, ch. 109); Ősi et al. (2018, ds 1, ch. 122).* 0. no 1. yes
130	**Squamosal dorsolateral edge, longitudinal groove:**

	Young & Andrade (2009, ch. 112 part); Nesbitt (2011, ch. 53); Young et al. (2011, ch. 112 part); Young et al. (2013a, ch. 58 part); Young et al. (2012, ch. 67 part); Young (2014, ch. 69 part); Young et al. (2016, ds 2, ch. 80); Ristevski et al. (2018, ds 2, ch. 108); Smith et al. (in review, ds 1, ch. 110); Ősi et al. (2018, ds 1, ch. 123). *State (1) is a putative apomorphy of Crocodyliformes (reversals in Thalattosuchia and* Iharkutosuchus makadii*), but also occurs in some ‘sphenosuchians’.* 0. absent 1. present
131	**Squamosal dorsolateral edge, longitudinal groove margins: (*)** *Young & Andrade (2009, ch. 112 part); Young et al. (2011, ch. 112 part); Young et al. (2013a, ch. 58 part); Young et al. (2012, ch. 67 part); Young (2014, ch. 69 part); Young et al. (2016, ds 2, ch. 81); Ristevski et al. (2018, ds 2, ch. 109); Smith et al. (in review, ds 1, ch. 111); Ősi et al. (2018, ds 1, ch. 124).* *This character is not applicable for taxa that lack the squamosal longitudinal groove.* 0. ventral margin of the groove projects more laterally than the dorsal margin 1. ventral margin is directly underneath the dorsal margin
132	**Parietals, in presumed adults:** *Nesbitt (2011, ch. 58); Young et al. (2016, ds 2, ch. 82); Ristevski et al. (2018, ds 2, ch. 110); Smith et al. (in review, ds 1, ch. 111); Ősi et al. (2018, ds 1, ch. 125).* 0. separate 1. interparietal suture partially or completely absent (i.e. surface fusion)
133	**Parietals, supratemporal (= dorsotemporal) fenestrae separated by: (*)** *Clark et al. (2000, ch. 17 mod.); Clark & Sues (2002, ch. 18 mod.); Sues et al. (2003, ch. 18 mod.); Clark et al. (2004, ch. 18 mod.); Nesbitt (2011, ch. 59 mod.); Pol et al. (2013, ch. 18 mod.); Young et al. (2016, ds 2, ch. 83 mod.); Leardi et al. (2017, ch. 18 mod.); Ristevski et al. (2018, ds 2, ch. 111); Smith et al. (in review, ds 1, ch. 113); Ősi et al. (2018, ds 1, ch. 126).* *Ősi et al. (2018) added state (3).* *State (3) occurs in* Dromicosuchus *and* Hesperosuchus *cf.* agilis. *This character is not applicable for taxa that lack the supratemporal fenestrae.* 0. broad, flat area 1. supratemporal fossa separated by a mediolaterally thin strip of flat bone 2. supratemporal fossa separated by a ‘‘sagittal crest’’ (which may be divided by the interparietal suture) 3. supratemporal fossa separated by a median longitudinal groove between paired parietal crests
134	**Intertemporal bar (= frontoparietal), modification of the “sagittal crest”: (*)** *Ristevski et al. (2018, ds 2, ch. 112); Smith et al. (in review, ds 1, ch. 114); Ősi et al. (2018, ds 1, ch. 127).* *Character following Jouve et al. (2005a: figure 8), Hastings et al. (2010, ch. 9).* *Note this character scores the distinct thin intertemporal bar of derived dyrosaurids. In Thalattosuchia the bar is not consistently thin along its entire length (being noticeably broad anteriorly).* *This character is not applicable for taxa that lack the supratemporal fenestrae.* 0. either not a “sagittal crest”, or does not have the derived dyrosaurid morphotype 1. has the derived dyrosaurid morphotype: the intertemporal bar is composed of the frontal posterior process anteriorly and the parietal anterior process in the middle-and-posterior region, with a consistently thin bar along its entire length, and lateral margins deeply excavated creating a broad lateral supratemporal fossa
135	**Parietal, bifurcation of the parietal in dorsal view, immediately posterior to the intertemporal bar:** *Young et al. (2016, ds 2, ch. 84); Ristevski et al. (2018, ds 2, ch. 113); Smith et al. (in review, ds 1, ch. 115); Ősi et al. (2018, ds 1, ch. 128).* *State (1) is found in* ‘Dakosaurus’ lissocephalus, Cricosaurus araucanensis, C. elegans, C. lithographicus, C. schroederi *and* C. vignaudi. *This character replaces the character that described the posterior margin of the parietal-squamosal in dorsal view – Wilkinson et al. (2008, ch. 42); Young & Andrade (2009, ch. 42); Young et al. (2011, ch. 42); Young et al. (2013a, ch. 59); Young et al. (2012, ch. 68); Young (2014, ch. 70).* 0. absent 1. present
136	**Parietals, posterodorsal margin:** *Jouve (2005, ch. 7 mod.), Jouve et al. (2005b, ch. 11 mod.), Jouve et al. (2008, ch. 11 mod.), Hastings et al. (2010, ch. 42 mod.); Ristevski et al. (2018, ds 2, ch. 114); Smith et al. (in review, ds 1, ch. 116); Ősi et al. (2018, ds 1, ch. 129).* *State (1) occurs in derived dyrosaurids.* 0. transversely oriented 1. indented anteriorly
137	**Parietals, posteroventral edge:** *Nesbitt (2011, ch. 60); Young et al. (2016, ds 2, ch. 85); Ristevski et al. (2018, ds 2, ch. 115); Smith et*

	al. (in review, ds 1, ch. 117); Ősi et al. (2018, ds 1, ch. 130). *State (1) is a putative apomorphy of Crocodyliformes.* 0. extending more than half the width of the occiput 1. extending less than half the width of the occiput
138	**Post-temporal fenestrae obscured in dorsal view by an overhanging posterior extension of the parietal:** *Jouve et al. (2008, ch. 34 mod.); Hastings et al. (2010, ch. 46 mod.); Ristevski et al. (2018, ds 2, ch. 116); Smith et al. (in review, ds 1, ch. 118); Ősi et al. (2018, ds 1, ch. 131).* *State (1) occurs in derived dyrosaurids.* 0. absent 1. present
139	**Parietal in occipital view:** *Jouve et al. (2008, ch. 32 mod.); Hastings et al. (2010, ch. 44 mod.); Ristevski et al. (2018, ds 2, ch. 117); Smith et al. (in review, ds 1, ch. 119); Ősi et al. (2018, ds 1, ch. 132).* 0. ‘W-shaped’ 1. concave 2. flat or convex

Orbit and temporal region (Ch. 140 – 168; 6.304% of characters)

[orbit, circumorbital contributions, ossa palpebralia, ossa scleroticalia, dermatocranial bones (= ossa jugalia, ossa postfrontalia, postorbital bars and ossa quadratojugalia), infratemporal fenestrae]

#	Description
140	**Orbit, position:** *Young (2006, ch. 3 mod.); Wilkinson et al. (2008, ch. 18 mod.); Young & Andrade (2009, ch. 18 mod.); Andrade et al. (2011, ch. 157 mod.); Young et al. (2011, ch. 18); Young et al. (2013a, ch. 60); Young et al. (2012, ch. 69); Young (2014, ch. 71); Young et al. (2016, ds 2, ch. 86); Ristevski et al. (2018, ds 2, ch. 118); Smith et al. (in review, ds 1, ch. 120); Ősi et al. (2018, ds 1, ch. 133).* *Note, when scoring the orientation of the orbits, the palpebrals must not be considered.* 0. fully dorsal 1. mainly dorsal, but with slight inclination 2. lateral, but slightly inclined dorsally, usually visible in dorsal view 3. fully lateral with orbit shape only clear in lateral view
141	**Orbit, shape:** *Young & Andrade (2009, ch. 96); Young et al. (2011, ch. 96); Young et al. (2013a, ch. 61); Young et al. (2012, ch. 70); Young (2014, ch. 72); Young et al. (2016, ds 2, ch. 87); Ristevski et al. (2018, ds 2, ch. 119); Smith et al. (in review, ds 1, ch. 121); Ősi et al. (2018, ds 1, ch. 134).* 0. circular, anteroposterior and dorsoventral axes subequal (± 5%) 1. longitudinal ellipsoid, anteroposterior axis more than 10% longer than mediolateral axis 2. transverse ellipsoid, mediolateral axis more than 10% longer than anteroposterior axis
142	**Circumorbital dorsal margin, shape:** *Brochu (1999, ch. 103 mod.); Salas-Gismondi et al. (2016, ch. 137 mod.); Smith et al. (in review, ds 1, ch. 122); Ősi et al. (2018, ds 1, ch. 135).* *For an explanation of this character see Figure 7 in Salas-Gismondi et al. (2016).* *State (1) occurs in the French* Pholidosaurus specimen*,* Elosuchus*,* Teleosaurus cadomensis*,* Mycterosuchus nasutus*.* *State (2) occurs in* Vectisuchus*,* Sarcosuchus*,* Gavialis gangeticus*.* Chalawan thailandicus *has evidence of the dorsal medial margin being upturned, but the posterior margins of the orbits are not preserved (Martin et al., 2014).* *Note this character is not equivalent to having a concave frontal, as here it is the upturning of the orbital margins that are being scored. Among many taxa with ‘telescoped’ orbits the frontal is also concave, but not all tethysuchians with concave frontals have the ‘telescoped’ orbit condition.* *This character helps to quantify the ‘telescoped’ orbit morphology.* 0. dorsal margins of orbits are flush with the skull dorsal surface 1. dorsal margins of orbits upturned (prominent along the orbital medial margin in dorsal view, with the frontal interorbital margins being upturned) 2. dorsal and posterior margins are upturned (the frontal lateral process anterior margins are also upturned)
143	**Circumorbital ventral margin, shape:** *Salas-Gismondi et al. (2016, ch. 138 mod.); Smith et al. (in review, ds 1, ch. 123); Ősi et al. (i2018, ds 1, ch. 136).* *State (1) occurs in* Vectisuchus*,* Sarcosuchus*,* Gavialis gangeticus*.* Chalawan thailandicus *has evidence of the dorsal medial margin being upturned, but the anterior margins of the orbits are not preserved (Martin et al., 2014).* *State (1) is caused by the ‘upturning’ of the preorbital bones (in particular the lachrymals), changing*

	the shape of the anterior orbit margin. As shown by Salas-Gismondi et al. (2016) the accumulation of characters relating to orbital 'telescoping' is gradual, thus not all taxa will score for all character states relating to this morphofunctional complex. *This character helps to quantify the 'telescoped' orbit morphology.* 0. ventral margin of the orbit is either concave or sub-straight 1. ventral margin of the orbit has a prominent notch
144	**Orbit, anterodorsal margin and the lachrymal:** *Young & Andrade (2009, ch. 124 part); Young et al. (2011, ch. 124 part); Young et al. (2013a, ch. 62 part); Young et al. (2012, ch. 71); Young (2014, ch. 73); Young et al. (2016, ds 2, ch. 88); Ristevski et al. (2018, ds 2, ch. 120); Smith et al. (in review, ds 1, ch. 124); Ősi et al. (2018, ds 1, ch. 137).* *In Thalattosuchia, state (1) is a putative autapomorphy of* Teleidosaurus calvadosii 0. lachrymal is excluded from the orbit anterodorsal margin 1. lachrymal reaches the orbit anterodorsal margin
145	**Orbit, posterodorsal margin and the postorbital:** *Young & Andrade (2009, ch. 124 part); Young et al. (2011, ch. 124 part); Young et al. (2013a, ch. 62 part); Young et al. (2012, ch. 72); Young (2014, ch. 74); Young et al. (2016, ds 2, ch. 89); Ristevski et al. (2018, ds 2, ch. 121); Smith et al. (in review, ds 1, ch. 125); Ősi et al. (2018, ds 1, ch. 138).* *In Thalattosuchia, state (1) is a putative apomorphy of the clade* Teleidosaurus + *Metriorhynchidae* 0. postorbital is excluded from the orbit posterodorsal margin 1. postorbital reaches the orbit posterodorsal margin
146	**Orbit, anteroventral margin and the lachrymal:** *Young & Andrade (2009, ch. 95 part); Young et al. (2011, ch. 95 part); Young et al. (2013a, ch. 63 part); Young et al. (2012, ch. 73); Young (2014, ch. 75); Young et al. (2016, ds 2, ch. 90); Ristevski et al. (2018, ds 2, ch. 122); Smith et al. (in review, ds 1, ch. 126); Ősi et al. (2018, ds 1, ch. 139).* 0. lachrymal is excluded from the orbit anteroventral margin 1. lachrymal reaches the orbit anteroventral margin
147	**Orbit, anterior margin and the jugal anterior process:** *Ristevski et al. (2018, ds 2, ch. 123); Smith et al. (in review, ds 1, ch. 127); Ősi et al. (2018, ds 1, ch. 140).* *State (1) is a putative apomorphy of* Goniopholis *and* Anteophthalmosuchus. 0. the jugal anterior process does not contribute to the anterior margin of the orbit 1. the jugal anterior process, along with the lachrymal, forms the anterior margin of the orbit. Note that the broad anterior expansion of the jugal anterior process only occurs in *Goniopholis*, as *Anteophthalmosuchus* has a narrow jugal anterior process.
148	**Orbit, anterior margin and the broadening of the jugal anterior process:** *Ristevski et al. (2018, ds 2, ch. 124); Smith et al. (in review, ds 1, ch. 128); Ősi et al. (2018, ds 1, ch. 141).* *State (1) is a putative apomorphy of* Goniopholis 0. the jugal anterior process does not help form the anterior margin of the orbit, or as in *Anteophthalmosuchus*, it does help for the anterior margin of the orbit – but the jugal anterior process is still narrow 1. the jugal anterior process, along with the lachrymal, forms the anterior margin of the orbit, but it is distinctly broad dorsoventrally – expanded having a broad contact with the lachrymal dorsally and the maxilla anteriorly, much more so than in other derived goniopholidids.
149	**Orbit, posteroventral margin and the postorbital:** *Young & Andrade (2009, ch. 95 part); Young et al. (2011, ch. 95 part); Young et al. (2013a, ch. 63 part); Young et al. (2012, ch. 74); Young (2014, ch. 76); Young et al. (2016, ds 2, ch. 91); Ristevski et al. (2018, ds 2, ch. 125); Smith et al. (in review, ds 1, ch. 129); Ősi et al. (2018, ds 1, ch. 142).* *In Thalattosuchia, state (1) occurs in basal teleosauroids (*Steneosaurus brevior, *the Chinese skull referred to* Peipehsuchus teleorhinus, Platysuchus multiscrobiculatus *and* Teleosaurus cadomensis). *Note that some dorsoventral crushed skulls also look as though they have state (1), e.g.* S. bollensis. 0. postorbital is excluded from the orbit posteroventral margin, or only present in the posteroventral margin 1. postorbital reaches the orbit posteroventral margin (with the postorbital overlapping the jugal), and extensively forms part of the orbit ventral margin (in some instances excluding the jugal)
150	**Orbit, ventral margin and the jugal:** *Mueller-Töwe (2006, ch. 139 mod.); Young & Andrade (2009, ch. 95 part); Andrade et al. (2011, ch. 171 mod.); Young et al. (2011, ch. 95 part); Young et al. (2013a, ch. 63 part); Young et al. (2012, ch. 75); Young (2014, ch. 77); Young et al. (2016, ds 2, ch. 92); Ristevski et al. (2018, ds 2, ch. 126); Smith et al. (in review, ds 1, ch. 130); Ősi et al. (2018, ds 1, ch. 143).* *In Thalattosuchia, state (1) is a putative autapomorphy of* Platysuchus multiscrobiculatus 0. jugal participates in the orbit ventral margin 1. jugal excluded from the orbit by lachrymal-postorbital contact
151	**Supraorbital notch in dorsal view, deeply excavated creating an approximately semi-circular shape, resulting in the frontal being broadly exposed along the lateral margin of the orbits: (*)** *Young et al. (2016, ds 2, ch. 93); Ristevski et al. (2018, ds 2, ch. 127); Smith et al. (in review, ds 1, ch.*

	131); Ősi et al. (2018, ds 1, ch. 144). *State (1) is a putative apomorphy of a subclade within Rhacheosaurini.* *This character is not applicable for non-metriorhynchids, due to the unique formation of the supraorbital notch in Metriorhynchidae.* 0. absent 1. present
152	**Supraorbital notch in dorsal view, very small, being a tight "U"-shape, created by the prefrontal being expanded posteriorly. This results in the prefrontal making a larger contribution to the orbit dorsal margin and the frontal contribution to the orbit dorsal margin is greatly reduced, and in some taxa being excluded from the centre of the orbital dorsal margin: (*)** *Young et al. (2016, ds 2, ch. 94); Ristevski et al. (2018, ds 2, ch. 128); Smith et al. (in review, ds 1, ch. 132); Ősi et al. (2018, ds 1, ch. 145).* *State (1) is occurs in* Metriorhynchus palpebrosus, Cricosaurus saltillensis *and* C. macrospondylus. *This character is not applicable for non-metriorhynchids, due to the unique formation of the supraorbital notch in Metriorhynchidae.* 0. absent 1. present
153	**Palpebrals, presence and number:** *Clark (1994, ch. 65 mod.); Young (2006, ch. 52 mod.); Turner & Buckley (2008, ch. 65); Wilkinson et al. (2008, ch. 17 mod.); Young & Andrade (2009, ch. 17 mod.); Andrade et al. (2011, ch. 186); Young et al. (2011, ch. 17 mod.); Young et al. (2013a, ch. 64 mod.); Young et al. (2012, ch. 76 mod.); Young (2014, ch. 78 mod.); Young et al. (2016, ds2, ch. 95 mod.); Ristevski et al. (2018, ds 2, ch. 129); Smith et al. (in review, ds 1, ch. 133); Ősi et al. (2018, ds 1, ch. 146).* *Andrade et al. (2011) modified this character to exclude information about size, which can be sampled as a separate character. The presence and morphology of palpebrals is here considered to be highly devious within the analysis, always poorly sampled and including assumptions (e.g., putative fusion with prefrontals vs putative loss in thalattosuchians). Preservation and incomplete descriptions contribute to a poor use of information as a character. Scores were considered only for taxa that actually show meaningful information. The putative absence of palpebrals in thalattosuchians has long been assumed (e.g., Fraas, 1901; Andrews, 1913), but it is actually not possible to exclude that this element may be deeply fused with prefrontal, leading to this modified version of state (0).* *Can be determined by the sutural contacts along the periorbital margin.* 0. absent, or (anterior) palpebral is deeply fused with prefrontal 1. one large (anterior) palpebral present 2. two large palpebrals (anterior and posterior) present
154	**Orbits, presence of sclerotic ossicles (composing the sclerotic ring):** *Young (2006, ch. 4); Wilkinson et al. (2008, ch. 19); Young & Andrade (2009, ch. 19); Andrade et al. (2011, ch. 159); Young et al. (2011, ch. 19); Young et al. (2013a, ch. 65); Young et al. (2012, ch. 77); Young (2014, ch. 79); Young et al. (2016, ds 2, ch. 96); Ristevski et al. (2018, ds 2, ch. 130); Smith et al. (in review, ds 1, ch. 134); Ősi et al. (2018, ds 1, ch. 147).* *Within Thalattosuchia, state (1) is a putative apomorphy of* Pelagosaurus + *Metriorhynchidae.* 0. absent 1. present
155	**Jugal, width of anterior process relative to posterior process:** *Young & Andrade (2009, ch. 111); Young et al. (2011, ch. 111); Young et al. (2013a, ch. 66); Young et al. (2012, ch. 78); Young (2014, ch. 80); Young et al. (2016, ds 2, ch. 97); Ristevski et al. (2018, ds 2, ch. 131); Smith et al. (in review, ds 1, ch. 135); Ősi et al. (2018, ds 1, ch. 148).* 0. subequal 1. about twice as broad
156	**Jugal, anterior process is sigmoidal with a noticeable convexity along its dorsal margin:** *Ristevski et al. (2018, ds 2, ch. 132); Smith et al. (in review, ds 1, ch. 136); Ősi et al. (2018, ds 1, ch. 149).* *State (1) is found in* Dakosaurus + *the Vaches Noire dakosaur.* 0. absent 1. present
157	**Jugal, extends anteriorly in front of the prefrontal:** *Young & Andrade (2009, ch. 94); Young et al. (2011, ch. 94); Young et al. (2013a, ch. 67); Young et al. (2012, ch. 79); Young (2014, ch. 81); Young et al. (2016, ds 2, ch. 98); Ristevski et al. (2018, ds 2, ch. 133); Smith et al. (in review, ds 1, ch. 137); Ősi et al. (2018, ds 1, ch. 150).* 0. no 1. yes
158	**Postorbital bar, inclination:** *Jouve et al. (2008, ch. 35 mod.); Young & Andrade (2009, ch. 85 mod.); Hastings et al. (2010, ch. 50 mod.); Young et al. (2011, ch. 85 mod.); Young et al. (2013a, ch. 68 mod.); Young et al. (2012, ch. 80 mod.); Young (2014, ch. 82 mod.d); Ristevski et al. (2018, ds 2, ch. 134); Smith et al. (in review, ds 1, ch. 138); Ősi et al. (2018, ds 1, ch. 151).*

	0. strongly anterodorsally inclined 1. slightly anterodorsally inclined 2. nearly vertical 3. posterodorsally inclined
159	**Jugal, well-developed (i.e. greatly enlarged) foramen on the anterior ramus:** *Ristevski et al. (2018, ds 2, ch. 135); Smith et al. (in review, ds 1, ch. 139); Ősi et al. (2018, ds 1, ch. 152).* *State (1) occurs in derived dyrosarids.* 0. no 1. yes
160	**Postfrontal:** *Nesbitt (2011, ch. 44); Young et al. (2012, ch. 81); Young (2014, ch. 83); Young et al. (2016, ds 2, ch. 100); Ristevski et al. (2018, ds 2, ch. 136); Smith et al. (in review, ds 1, ch. 140); Ősi et al. (2018, ds 1, ch. 153).* *State (1) is a putative apomorphy of Crocodylomorpha.* 0. present 1. absent
161	**Postorbital bar, morphology of dorsal end:** *Young & Andrade (2009, ch. 90); Young et al. (2011, ch. 90); Young et al. (2013a, ch. 69); Young et al. (2012, ch. 82); Young (2014, ch. 84); Young et al. (2016, ds 2, ch. 101); Ristevski et al. (2018, ds 2, ch. 137); Smith et al. (in review, ds 1, ch. 141); Ősi et al. (2018, ds 1, ch. 154).* 0. dorsal end of the postorbital bar broadens dorsally, continuous with dorsal part of the postorbital 1. dorsal part of the postorbital bar constricted, distinct from the dorsal part of the postorbital
162	**Postorbital bar (postorbital), presence of a vascular opening at the lateral edge of the bar, close to the dorsal surface of the postorbital:** *Clark (1994, ch. 27); Young & Andrade (2009, ch. 114); Andrade et al. (2011, ch. 202); Young et al. (2011, ch. 114); Young et al. (2013a, ch. 70); Young et al. (2012, ch. 83); Young (2014, ch. 85); Young et al. (2016, ds 2, ch. 102); Ristevski et al. (2018, ds 2, ch. 138); Smith et al. (in review, ds 1, ch. 142); Ősi et al. (2018, ds 1, ch. 155).* *Note that scoring of state (0) can be highly influenced by preservation.* 0. absent 1. present
163	**Postorbital bar, morphology of postorbital-jugal contact:** *Wilkinson et al. (2008, ch. 35); Young & Andrade (2009, ch. 35); Young et al. (2011, ch. 35); Young et al. (2013a, ch. 71); Young et al. (2012, ch. 84); Young (2014, ch. 86); Young et al. (2016, ds 2, ch. 103); Ristevski et al. (2018, ds 2, ch. 139); Smith et al. (in review, ds 1, ch. 143) Ősi et al. (2018, ds 1, ch. 156).* 0. postorbital medial to jugal 1. postorbital lateral to jugal
164	**Postorbital bar, structure:** *Clark (1994, ch. 26 mod.); Wilkinson et al. (2008, ch. 36 mod.); Young & Andrade (2009, ch. 36 mod.); Young et al. (2011, ch. 36 mod.); Young et al. (2013a, ch. 72 mod.); Young et al. (2012, ch. 85 mod.); Young (2014, ch. 87 mod.); Young et al. (2016, ds 2, ch. 104 mod.); Ristevski et al. (2018, ds 2, ch. 140); Smith et al. (in review, ds 1, ch. 144); Ősi et al. (2018, ds 1, ch. 157).* *State (1) occurs in Metasuchia.* *State (2) describes the flattened morphology of tethysuchians.* 0. dermal bar that is either not columnal or transversely flattened 1. subdermal bar that is distinctly columnar and cylindrical or oval-shaped 2. subdermal bar that is distinctly columnar and transversely flattened
165	**Postorbital bar, composition of lateral surface:** *Gasparini et al. (2006, ch. 244); Andrade et al. (2011, ch. 199); Ristevski et al. (2018, ds 2, ch. 141); Smith et al. (in review, ds 1, ch. 145); Ősi et al. (2018, ds 1, ch. 158).* *State (1) is putative apomorphy of Thalattosuchia* 0. lateral surface formed by the postorbital and jugal 1. lateral surface formed by solely by the postorbital, with the jugal only exposed on the medial face of the bar
166	**Quadratojugal-postorbital, contact:** *Ortega et al. (2000, ch. 49); Nesbitt (2011, ch. 64); Young et al. (2016, ds 2, ch. 105); Ristevski et al. (2018, ds 2, ch. 142); Smith et al. (in review, ds 1, ch. 146); Ősi et al. (2018, ds 1, ch. 159).* *State (1) is a putative apomorphy of Crocodyliformes.* 0. absent 1. present
167	**Infratemporal fenestra (= laterotemporal fenestra), in lateral view:** *Young (2006, ch. 12); Wilkinson et al. (2008, ch. 32); Young & Andrade (2009, ch. 32); Young et al. (2011, ch. 32); Young et al. (2013a, ch. 73); Young et al. (2012, ch. 86); Young (2014, ch. 88); Young et al. (2016, ds 2, ch. 106); Ristevski et al. (2018, ds 2, ch. 143); Smith et al. (in review, ds 1, ch. 147);*

	Ősi et al. (2018, ds 1, ch. 160). 0. considerably longer in length than the orbit (greater than 25%) 1. equal/subequal in length than the orbit (± 10%) 2. shorter in length than the orbit (less than 25%)
168	**Quadratojugal, spine (= spina quadratojugalis):** *Brochu (1999, ch. 114); Young & Andrade (2009, ch. 133); Young et al. (2011, ch. 133); Young et al. (2013a, ch. 74); Andrade et al. (2011, ch. 167 + 170). Young et al. (2012, ch. 87); Young (2014, ch. 89); Young et al. (2016, ds 2, ch. 107); Ristevski et al. (2018, ds 2, ch. 144); Smith et al. (in review, ds 1, ch. 148); Ősi et al. (2018, ds 1, ch. 161).* 0. absent 1. either small or low crest 2. prominent

Palate and perichoanal structures (Ch. 169 – 191; 5.000% of characters)

[palate contribution of the dermatocranium facial series (= os præmaxillare and os maxillare), and dermatocranium palatal series (= ossa palatina, ossa pterygoidea, ossa ectopterygoidea and ossa vomeria)]

#	Description
169	**Premaxillae, presence of a subelliptic naso-oral fossa (= incisive foramen, = fossa premaxillaris) at medial contact of ventral rami:** *Brochu (1999, ch. 124 part); Andrade et al. (2011, ch. 66); Young et al. (2012, ch. 89 mod.); Young (2014, ch. 91 part); Young et al. (2016, ds 2, ch. 109 mod.); Ristevski et al. (2018, ds 2, ch. 145); Smith et al. (in review, ds 1, ch. 149); Ősi et al. (2018, ds 1, ch. 162).* *When the palate does not close completely, the passage will involve both premaxilla and maxilla, assuming a diamond-shaped profile, with edges straight to irregular, but never rounded and smooth. When the palate is incompletely closed, it is most likely that the vomer is also exposed at the opening; however, the vomer may not be preserved; or may be covered by sediment and not evident. The use of 'sub-elliptic' allows that simple openings on the palatal surface, considered as non-homologous to the naso-oral fossa, to be scored as (0).* 0. absent, premaxillae fully in contact medially along the palate 1. present as a discrete fossa or foramen, less than half the greatest width of premaxillae 2. large, more than half the greatest width of premaxillae
170	**Premaxillae, shape of naso-oral fenestra (= incisive foramen): (*)** *Young et al. (2016, ds 2, ch. 7 mod.); Ristevski et al. (2018, ds 2, ch. 146); Smith et al. (in review, ds 1, ch. 150); Ősi et al. (2018, ds 1, ch. 163).* *In Metriorhynchidae, state (1) occurs in* Torvoneustes, *Mr Passmore's specimen* + 'M.' hastifer. *This character is not applicable for taxa that lack the naso-oral fenestra.* 0. subcircular or longer than wide (but not an elongate oval) 1. elongate anteroposterior oval-shape (can be as long or longer than the premaxillary alveoli, but not as mediolaterally broad)
171	**Suborbital fenestrae, presence and size: (ORDERED)** *Andrade et al. (2011, ch. 206); Ristevski et al. (2018, ds 1, ch. 206); Smith et al. (in review, ds 2, ch. 206); Ősi et al. (2018, ds 1, ch. 164).* 0. absent 1. present, much smaller than orbits 2. present, subequal or larger than orbits
172	**Suborbital fenestrae, shape of anterior border: (*)** *Andrade & Bertini (2008, ch. 86); Andrade et al. (2011, ch. 207); Ristevski et al. (2018, ds 1, ch. 207); Smith et al. (in review, ds 2, ch. 207); Ősi et al. (2018, ds 1, ch. 165).* *The original scoring in Andrade & Bertini (2008) for* Malawisuchus *and* Candidodon *was state (1), but this could be due to taphonomic deformation, therefore both taxa should be scored as (?) until a detailed description is provided for each taxon.* *Nonetheless, state (1) is present in Thalattosuchia.* *This character is not applicable for taxa that lack suborbital fenestrae.* 0. rounded, smooth 1. in sharp angle, forming a notch, fissure-like
173	**Maxilla, palatal processes: (ORDERED)** *Nesbitt (2011, ch. 32); Ristevski et al. (2018, ds 2, ch. 147); Smith et al. (in review, ds 1, ch. 151); Ősi et al. (2018, ds 1, ch. 166).* *Character helps to quantify the development of the secondary palate.* *State (2) occurs in crocodylomorphs.* 0. do not meet at the midline 1. meet at the midline 2. meet at the midline and expand anteriorly and posteriorly
174	**Maxilla, posterior margin of palatal processes contact with the anterior margin of palatine**

	anterior processes: *Young et al. (2012, ch. 90 mod.); Young (2014, ch. 92 mod.); Young et al. (2016, ds 2, ch. 110 mod.); Ristevski et al. (2018, ds 2, ch. 148); Smith et al. (in review, ds 1, ch. 152); Ősi et al. (2018, ds 1, ch. 167).* *Character helps to quantify the development of the secondary palate.* *State (1) occurs in Mesoeucrocodylia.* *Note, for* Calsoyasuchus *we interpret the 'primary choanae' as maxillo-palatine fenestrae.* 0. the maxilla-palatine contact only along a margin medial to the alveolar row 1. the maxilla posterior palatal margin has an extensive contact with the palatine anterior palatal margin. This results in either the vomer being excluded from the palatal surface, or if maxillo-palatine fenestrae are present, the vomer is visible within. The maxillo-palatine contact forms a continuous surface as the two elements contact one another, or when maxillo-palatine fenestrae are present, the anterior-most region of the contact is interrupted.
175	**Palate canals, presence: (*)** *Andrade et al. (2011, ch. 220); Ristevski et al. (2018, ds 2, ch. 149); Smith et al. (in review, ds 1, ch. 153); Ősi et al. (2018, ds 1, ch. 168).* *State (1) is a putative apomorphy of Thalattosuchia.* *This character is not applicable for taxa that lack maxillary and palatine palatal processes which meet along the skull midline.* *Palate canals are a paired, parallel, elongated, tubular ducts connecting the internal nasal cavity to the oral cavity, through the palatines. The orientation is almost coincident with the horizontal plane and longitudinal axis, with very little deviation (0-5 degrees). The internal openings are located anterior to the internal end of the nasopharyngeal duct. The external openings are located at the anterior end of palatines and, because of its sub-horizontal orientation, they progress as paired shallow (but well-defined) gutter-like grooves through the palatine laminae of the maxillae, at least to mid-rostrum. In teleosauroids (the Chinese teleosauroid,* Steneosaurus leedsi, S. edwardsi, *specimens attributed to* Steneosaurus latifrons*) and basal metriorhynchoids (*Pelagosaurus typus *and* Eoneustes gaudryi*) these passages are located next to the medial line of the palate, very close to each other, while in Metriorhynchidae the grooves diverge anteriorly (e.g. see Andrews, 1913; Young et al. 2013).* *This anterior divergence is also seen in some well preserved teleosauroids (MTY pers. obs).* *It is unclear if these canals constitute passages for nerves, vessels, or gland ducts.* *In specimens which have experienced dorsoventral compression, and/or are highly broken, these canals can be very hard to discern.* 0. absent 1. present
176	**Palate longitudinal depressions, presence: (NEW)** *State (1) is a putative apomorphy of* Cricosaurus bambergensis. *Palate longitundinal depressions are paired, parallel and elongate depressions that are situated on the palatal surface of the palatines. Between the depressions, the palatines are reduced to a midline crest. Along the anterior margin of these depressions is a cluster of foramina.* *It is unclear if these canals constitute passages for nerves, vessels, or gland ducts.* *It is also unclear whether these depressions are related to the thalattosuchian palate canals, being a modification of the same soft-tissue morphology, or unrelated.* *This structure can be determind as palatine and not pterygoid (i.e. the internal choana) in origin, as the anterior margins are level to the end of the maxillary tooth row and the depressions themselves are ventral to the orbits. Thus, they are too anterior to be the internal choana.* 0. absent 1. present
177	**Palatine, anterior extent of the palatine relative to the maxillary tooth row:** *Young (2014, ch. 93); Young et al. (2016, ds 2, ch. 111); Ristevski et al. (2018, ds 2, ch. 150); Smith et al. (in review, ds 1, ch. 154); Ősi et al. (2018, ds 1, ch. 169).* *State (5) is a putative autapomorphy of* Plesiosuchus manselii. 0. palatine anterior margin terminates level to 20th maxillary alveoli, or more distal alveoli 1. palatine anterior margin terminates level to 15th to 19th maxillary alveoli 2. palatine anterior margin terminates level to 11th to 14th maxillary alveoli 3. palatine anterior margin terminates level to 8th to 10th maxillary alveoli 4. palatine anterior margin terminates level to 5th to 7th maxillary alveoli 5. palatine anterior margin terminates level to 4th maxillary alveoli, or more anterior alveoli
178	**Palatine, anterior margin has a mid-line anterior process:** *Wilkinson et al. (2008, ch. 6 part); Young & Andrade (2009, ch. 6 part); Young et al. (2011, ch. 6 part); Young et al. (2013a, ch. 76 part); Young et al. (2012, ch. 91); Young (2014, ch. 94); Young et al. (2016, ds 2, ch. 112); Ristevski et al. (2018, ds 2, ch. 151); Smith et al. (in review, ds 1, ch. 155); Ősi et al. (2018, ds 1, ch. 170).* 0. present 1. absent
179	**Palatine, mid-line anterior process shape, in palatal view: (*)**

	Wilkinson et al. (2008, ch. 6 part); Young & Andrade (2009, ch. 6 part); Young et al. (2011, ch. 6 part); Young et al. (2013a, ch. 76 part); Young et al. (2012, ch. 92); Young (2014, ch. 95); Young et al. (2016, ds 2, ch. 113); Ristevski et al. (2018, ds 2, ch. 152); Smith et al. (in review, ds 1, ch. 156); Ősi et al. (2018, ds 1, ch. 171). *This character is not applicable for taxa that lack mid-line palatine palatal processes.* 0. lateral margins of the mid-line anterior process converge: anteriorly orientated “V”-shape 1. lateral margins of the mid-line anterior process largely parallel: anteriorly orientated “U”-shape
180	**Palatine, anterior margin has two non-midline anterior processes:** *Wilkinson et al. (2008, ch. 6 part); Young & Andrade (2009, ch. 6 part); Young et al. (2011, ch. 6 part); Young et al. (2013a, ch. 76 part); Young et al. (2012, ch. 93); Young (2014, ch. 96); Young et al. (2016, ds 2, ch. 114); Ristevski et al. (2018, ds 2, ch. 153); Smith et al. (in review, ds 1, ch. 157); Ősi et al. (2018, ds 1, ch. 172).* *In Thalattosuchia, state (1) is a putative apomorphy of Metriorhynchinae.* *In* Montealtosuchus *and* Hamadasuchus *the mid-line anterior process has a concave anterior margin, creating two “non-midline” processes.* 0. absent 1. present
181	**Palatine, at the suborbital fenestrae the palatine anterior margin curves anterolaterally towards it, creating two “small processes” projecting laterally:** *Young & Andrade (2009, ch. 161); Young et al. (2011, ch. 161); Young et al. (2013a, ch. 77); Young et al. (2012, ch. 94); Young (2014, ch. 97); Young et al. (2016, ds 2, ch. 115); Ristevski et al. (2018, ds 2, ch. 154); Smith et al. (in review, ds 1, ch. 158); Ősi et al. (2018, ds 1, ch. 173).* *This morphology is variably observed in derived neosuchians and eusuchians.* 0. absent 1. present
182	**Palate, presence of palatal shelves of palatines, and their relation with the narial passage: (ORDERED)** *Clark (1994, ch. 37 part); Wilkinson et al. (2008, ch. 8 part); Young & Andrade (2009, ch. 8 part); Andrade et al. (2011, ch. 212); Young et al. (2011, ch. 8 part); Young et al. (2013a, ch. 78 part); Young et al. (2012, ch. 95 part); Pol et al. (2013, ch. 67 part); Young (2014, ch. 98 part); Young et al. (2016, ds 2, ch. 116 part); Leardi et al. (2017, ch. 67 part); Ristevski et al. (2018, ds 1, ch. 212; ds 2, ch. 155 part); Smith et al. (in review, ds 1, ch. 159 part; ds 2, ch. 212); Ősi et al. (2018, ds 1, ch. 174).* *Character helps to quantify the development of the secondary palate.* *State (2) occurs in Mesoeucrocodylia, and in some more basal taxa.* *Note that in state (2) the palatal laminae may not be in contact for taxa with extensive maxillopalatine fenestrae and elongate choanae (e.g.* Eutretauranosuchus*).* 0. palatal shelves of palatine absent, narial passage only bounded dorsally, by the pterygoid 1. narial passage at least partially bounded by palatal shelves of the palatine, laterally, creating the choanal grove 2. narial passage at least mostly bounded by palatal shelves of the palatine, laterally and ventrally, forming the nasopharyngeal duct
183	**Palatine, presence of a posterior extension to the choanae:** *Jouve et al. (2005b, ch. 4); Jouve et al. (2008, ch. 4); Hastings et al. (2010, ch. 61); Ristevski et al. (2018, ds 2, ch. 156); Smith et al. (in review, ds 1, ch. 160); Ősi et al. (2018, ds 1, ch. 175).* 0. do not contact or only contact along the anterior margin 1. contact along the anterior and medial margins
184	**Palatine-pterygoid suture, lateral protrusions by palatine into the pterygoids:** *Young & Andrade (2009, ch. 132); Young et al. (2011, ch. 132); Young et al. (2013a, ch. 80); Young et al. (2012, ch. 97); Young (2014, ch. 100); Young et al. (2016, ds 2, ch. 118); Ristevski et al. (2018, ds 2, ch. 157); Smith et al. (in review, ds 1, ch. 161); Ősi et al. (2018, ds 1, ch. 176).* 0. absent 1. present
185	**Ectopterygoid, presence of broad contact with palatine ramus of maxilla:** *Ristevski et al. (2018, ds 2, ch. 158); Smith et al. (in review, ds 1, ch. 162); Ősi et al. (2018, ds 1, ch. 177).* *Character based on Brochu (1997, ch. 91 mod.); Andrade et al. (2011, ch. 253).* *Basal forms within Sphenosuchia will show no (or very limited) contact between ectopterygoid and maxilla (0). As* Fruitachampsa *has a jugal-ectopterygoid contact (Clark, 2011), here we find this character to be a putative apomorphy of Mesoeucrocodylia* +Hsisosuchus*, rather than Crocodyliformes as in Andrade et al. (2011). Note,* Hsisosuchus *is not in our matrix, but scores as (1) in Andrade et al. (2011)* *State (1) is putative apomorphy of Mesoeucrocodylia* + Hsisosuchus *(reversals in: French* Pholidosaurus*, and* Zoneait + *Metriorhynchidae – the ectopterygoid solely contacts the jugal).* *Note that in metriorhynchids the ectopterygoid is rarely preserved, and thus hard to score. It can be scored for* Metriorhynchus superciliosus *as it has what looks like the jugal-ectopterygoid articulation in NHMUK PV R 6860. However, the ectopterygoids are complete and in articulation in both* Zoneait

	and Maledictosuchus. 0. absent, ectopterygoid does not contact maxilla, or barely contacts its caudal end, medial to jugal 1. present
186	**Ectopterygoid, morphology of the distal ramus: (*)** *Andrade et al. (2011, ch. 256); Ristevski et al. (2018, ds 1, ch. 256); Smith et al. (in review, ds 2, ch. 256); Ősi et al. (2018, ds 1, ch. 178).* *Based on description by Pol & Apesteguia (2005: p. 8), where the subcylindrical profile of the distal ramus (1) was noted in* Araripesuchus buitreraensis. *The condition is shared at least by other* Araripesuchus*,* Montealtosuchus *and a few other basal notosuchians.* *This character is not applicable for taxa in which the ectopterygoid does not extend over the pterygoid wing.* 0. laminar, extending as a flattened sheet over the pterygoid wing 1. robust, extending as a rod over most of the pterygoid wing, with subcircular cross-section through most of its length
187	**Pterygoid flange, orientation (in palatal view):** *Young et al. (2011, ch. 186); Young et al. (2013a, ch. 81); Young et al. (2012, ch. 98); Young (2014, ch. 101); Young et al. (2016, ds 2, ch. 119); Ristevski et al. (2018, ds 2, ch. 159); Smith et al. (in review, ds 1, ch. 163); Ősi et al. (2018, ds 1, ch. 179).* 0. horizontal 1. largely horizontal, but with a distinct posterolateral orientation 2. strongly orientated posteriorly
188	**Choanae, participation of pterygoid in the choanal border: (*)** *Clark (1994, ch. 43 mod.); Brochu (1999, ch. 71 mod.); Jouve et al. (2005, ch. 4 mod.); Turner & Buckley (2008, ch. 43 mod.); Young & Andrade (2009, ch. 131 + 139 mod.); Andrade et al. (2011, ch. 242); Young et al. (2011, ch. 131 + 139 mod.); Young et al. (2013a, ch. 79 + 82 mod.); Young et al. (2012, ch. 96 + 99 mod.); Young (2014 ch. 99 + 102); Young et al. (2016, ds 2, ch. 117 + 120 mod.); Ristevski et al. (2018, ds 2, ch. 160); Smith et al. (in review, ds 1, ch. 164); Ősi et al. (2018, ds 1, ch. 180).* *Note that the palatines may be excluded from the choanal border either in states (2) and (3), but the eusuchian condition is only achieved in state (3). State (2) corresponds directly to state (1) of Jouve et al. (2005, ch. 4), apomorphic for* Elosuchus, Terminonaris, Pholidosaurus purbeckensis + *dyrosaurids. Note that we do not consider* Koumpiodontosuchus *or* Isisfordia *to have the eusuchian condition. Our interpretation for* Isisfordia *follows Turner & Pritchard (2015), and* Koumpiodontosuchus *has a similar morphology (MTY pers. obs.).* *This character is not applicable for taxa that lack the development of the secondary palate.* 0. pterygoid only bounds the posterior border of the choanae 1. pterygoid forms at least the posterior and lateral choanal borders 2. anterolateral rami of pterygoid embrace most of the choanae, but do not meet medially, at the anterior choanal border (either by the presence of palatine or ventral exposure and expansion of interchoanal septum) 3. anterolateral rami of pterygoid completely embrace the choanae, meeting medially at its anterior border (eusuchian choanae)
189	**Pterygoids, fusion posterior to choanae:** *Clark (1994, ch. 41); Andrade et al. (2011, ch. 258); Ristevski et al. (2018, ds 2, ch. 161); Smith et al. (in review, ds 1, ch. 165); Ősi et al. (2018, ds 1, ch. 181).* *State (1) is putative apomorphy of* Zosuchus + *Mesoeucrocodylia.* 0. not fused 1. fused
190	**Choanal opening, in palatal view:** *Wilkinson et al. (2008, ch. 9 part); Young & Andrade (2009, ch. 9 part); Young et al. (2011, ch. 187); Young et al. (2013a, ch. 83); Young et al. (2012, ch. 100); Young (2014, ch. 103); Young et al. (2016, ch. 121); Ristevski et al. (2018, ds 2, ch. 162); Smith et al. (in review, ds 1, ch. 166); Ősi et al. (2018, ds 1, ch. 182).* *State (1) is observed in extant species.* 0. choanal opening orientated posteriorly, enclosed ventrally by the palatine and by either the pterygoid dorsally or the maxilla 1. choana opens into palate through a deep midline depression (choanal groove)
191	**Choana, anterior margin shape:** *Wilkinson et al. (2008, ch. 9 part); Young & Andrade (2009, ch. 9 part); Young et al. (2011, ch. 9); Young et al. (2013a, ch. 84); Young et al. (2012, ch. 101); Young (2014, ch. 104); Young et al. (2016, ds 2, ch. 122); Ristevski et al. (2018, ds 2, ch. 163); Smith et al. (in review, ds 1, ch. 167); Ősi et al. (2018, ds 1, ch. 183).* 0. semicircular or elliptical 1. 'V'-shaped with its base directed anteriorly 2. broad 'U'-shaped with its base directed anteriorly

	3. ‘W’-shaped with its base directed anteriorly

Occipital (Ch. 192 – 206; 3.261% of characters)

[Partial chondrocranium = os supraoccipitale, ossa exoccipitalia + ossa opisthotica (= os otoccipitale)]

#	Description
192	**Occipital tuberosities:** *Jouve (2005, ch. 1 mod.), Jouve et al. (2005b, ch. 3 mod.), Jouve et al. (2008, ch. 3 mod.), Hastings et al. (2010, ch. 53 mod.); Young et al. (2011, ch. 188); Young et al. (2013a, ch. 85); Young et al. (2012, ch. 102 mod.); Young (2014, ch. 105 mod.); Young et al. (2016, ds 2, ch. 123 mod.); Ristevski et al. (2018, ds 2, ch. 164); Smith et al. (in review, ds 1, ch. 168); Ősi et al. (2018, ds 1, ch. 184).* *State (1) occurs in teleosauroids, basal dyrosaurids and in the pholidosaurids* Sarcosuchus *and* Chalawan. *State (2) occurs in most dyrosaurids and the teleosauroid* Steneosaurus heberti. 0. absent 1. small and reduced 2. large and well-developed
193	**Supraoccipital, presence:** *Leardi et al. (2017, ch. 97); Ősi et al. (2018, ds 1, ch. 185).* *State (1) occurs in Crocodylomorpha.* 0. fused with the exoccipital 1. present as a separate ossification
194	**Exoccipitals, presence of medial contact between both elements:** *Clark (1994, ch. 62); Ortega et al. (2000, ch. 63); Gower (2002, ch. 19 mod.); Andrade et al. (2011, ch. 270); Nesbitt (2011, ch. 126); Young et al. (2013a, ch. 86); Young et al. (2012, ch. 103); Young (2014, ch. 106); Tennant et al. (2016, ch. 198); Young et al. (2016, ds 2, ch. 124); Ristevski et al. (2018, ds 2, ch. 166); Smith et al. (in review, ds 1, ch. 170); Ősi et al. (2018, ds 1, ch. 187).* *Can also be defined as the participation of supraoccipital in the foramen magnum.* 0. do not meet in midline 1. meet on the midline, dorsal to the basioccipital, excluding the supraoccipital from the foramen magnum
195	**Paroccipital processes of the opisthotic, orientation in occipital view:** *Wilkinson et al. (2008, ch. 7); Young & Andrade (2009, ch. 7); Young et al. (2011, ch. 7); Young et al. (2013a, ch. 87); Young et al. (2012, ch. 104); Young (2014, ch. 107); Young et al. (2016, ds 2, ch. 125); Ristevski et al. (2018, ds 2, ch. 167); Smith et al. (in review, ds 1, ch. 171); Ősi et al. (2018, ds 1, ch. 188).* *State (1) is a putative apomorphy of Rhacheosaurini.* *State (2) is a putative apomorphy of Geosaurinae.* *State (3) is a putative apomorphy of Dyrosauridae +* Pholidosaurus purbeckensis, *and also for* 'Dakosaurus' lissocephalus 0. horizontal 1. dorsolaterally orientated, at a 45 degree angle 2. ventral-edge horizontal, then terminal third sharply inclined dorsolaterally at a 45 degree angle 3. ventrally arched
196	**Paroccipital processes of the opisthotic, large ventrolateral region (i.e. the distal lower border is convex and bulges ventrally):** *Young & Andrade (2009, ch. 116); Young et al. (2011, ch. 116); Young et al. (2013a, ch. 88); Young et al. (2012, ch. 105); Young (2014, ch. 108); Young et al. (2016, ds 2, ch. 126); Ristevski et al. (2018, ds 2, ch. 168); Smith et al. (in review, ds 1, ch. 172); Ősi et al. (2018, ds 1, ch. 189).* *State (1) occurs in Crocodyliformes.* 0. present 1. absent
197	**Paroccipital process, overlap by the squamosal:** *Young & Andrade (2009, ch. 119); Young et al. (2011, ch. 119); Young et al. (2013a, ch. 89); Young et al. (2012, ch. 106); Young (2014, ch. 109); Young et al. (2016, ds 2, ch. 127); Ristevski et al. (2018, ds 2, ch. 169); Smith et al. (in review, ds 1, ch. 173); Ősi et al. (2018, ds 1, ch. 190).* 0. small: the squamosal does not extend more posteriorly than the paroccipital process 1. large: it extends further posteriorly than the paroccipital process
198	**Foramen for cranial nerve XII (hypoglossal), position on occipit:** *Wilkinson et al. (2008, ch. 10); Young & Andrade (2009, ch. 10); Young et al. (2011, ch. 10); Young et al. (2013a, ch. 90); Young et al. (2012, ch. 107); Young (2014, ch. 110); Young et al. (2016, ds 2, ch. 129); Ristevski et al. (2018, ds 2, ch. 170); Smith et al. (in review, ds 1, ch. 174); Ősi et al. (2018, ds 1, ch. 191).* 0. above the occipital condyle in line with the foramen magnum 1. below the foramen magnum

199	**Foramen for cranial nerve XII (hypoglossal), sits in the dorsomedial corner of ‘occipital fossae’ – concave depressions on the exoccipital on either side of the skull midline:** *Ristevski et al. (2018, ds 2, ch. 171); Smith et al. (in review, ds 1, ch. 175); Ősi et al. (2018, ds 1, ch. 192).* *State (1) occurs in* Torvoneustes. 0. absent 1. present
200	**Foramen for the cerebral carotid artery, external margin of the foramen is raised relative to the posterior face of the basioccipital, forming a sub-rectangular shape:** *Ristevski et al. (2018, ds 2, ch. 172); Smith et al. (in review, ds 1, ch. 176); Ősi et al. (2018, ds 1, ch. 193).* *State (1) occurs in* Torvoneustes. 0. no 1. yes
201	**Foramen for the cerebral carotid artery, size:** *Wilkinson et al. (2008, ch. 11); Young & Andrade (2009, ch. 11); Young et al. (2011, ch. 11); Young et al. (2013a, ch. 91); Young et al. (2012, ch. 108); Young (2014, ch. 111); Young et al. (2016, ds 2, ch. 130); Ristevski et al. (2018, ds 2, ch. 173); Smith et al. (in review, ds 1, ch. 177); Ősi et al. (2018, ds 1, ch. 194).* *State (1) is a putative apomorphy of* Pelagosaurus + *Metriorhynchidae.* 0. similar in size to the openings for cranial nerves IX–XI 1. extremely enlarged
202	**Exoccipital, presence of descending flange ventral to subcapsular process:** *Clark (1994, ch. 58); Andrade et al. (2011, ch. 273); Ristevski et al. (2018, ds 2, ch. 174); Smith et al. (in review, ds 1, ch. 178); Ősi et al. (2018, ds 1, ch. 195).* *State (1) is putative apomorphy of protosuchids, but also present at least in* Araripesuchus tsangatsangana. 0. absent 1. present, laterally concave
203	**Exoccipital, extent of contact with the quadrate:** *Clark (1994, ch. 48 mod. + 51); Andrade et al. (2011, ch. 274); Ristevski et al. (2018, ds 2, ch. 175); Smith et al. (in review, ds 1, ch. 179); Ősi et al. (2018, ds 1, ch. 196).* *Andrade et al. (2011) merged characters 48 and 51 of Clark (1994), into one ordered series, as both refer to the contact between exoccipitals and quadrate.* *Following the present format, state (1) is a putative apomorphy of Gobiosuchidae + Mesoeucrocodylia.* 0. absent or narrow 1. broad contact present, stabilising the quadrate
204	**Exoccipital, presence of ventrolateral contact with the ventromedial part of quadrate:** *Clark (1994, ch. 51 mod.); Andrade et al. (2011, ch. 275); Ristevski et al. (2018, ds 1, ch. 275); Smith et al. (in review, ds 2, ch. 275); Ősi et al. (2018, ds 1, ch. 197).* *Focus of character (51) modified from quadrate to exoccipital, to make evident its relation with character 48 (original numbers of Clark, 1994). Note that both characters may be fused into one ordered series, as they refer to the contact between both elements.* *Following the present format, (1) is putative apomorphy of* Junngarsuchus + *Crocodyliformes.* 0. absent, quadrate does not contact exoccipital 1. present, exoccipital and quadrate enclosing carotid artery and forming passage for cranial nerves IX-XI
205	**Exoccipital, participation in the occipital condyle:** *Jouve (2004, ch. 96 mod.); Jouve et al. (2005b, ch. 5 mod.); Jouve et al. (2006, ch. 104 mod.); Jouve et al. (2008, ch. 5 mod.); Hastings et al. (2010, ch. 52 mod.); Ristevski et al. (2018, ds 2, ch. 176); Smith et al. (in review, ds 1, ch. 180); Ősi et al. (2018, ds 1, ch. 198).* *This scores the large contribution of the otoccipitals to the occipital condyle seen in dyrosaurids, where the otoccipitals broadly contact the lateral margins of the condyle.* 0. slight to moderate 1. large, such that only a thin strip of the basioccipital is visible between the exoccipitals on the dorsal surface of the occipital condyle
206	**Occipital surface ventral to occipital condyle:** *Young & Andrade (2009, ch. 143); Young et al. (2011, ch. 143); Young et al. (2013a, ch. 92); Young et al. (2012, ch. 109); Young (2014, ch. 112); Young et al. (2016, ds 2, ch. 131); Ristevski et al. (2018, ds 2, ch. 177); Smith et al. (in review, ds 1, ch. 181); Ősi et al. (2018, ds 1, ch. 199).* *State (1) is a putative apomorphy of Crocodylia.* 0. slopes anteroventrally 1. sub-parallel or parallel to the transverse plane

Braincase, basicranium and suspensorium (Ch. 207 – 232; 5.652% of characters)

[Partial chondrocranium (= ossa laterosphenoidea, ossa prootica, os basioccipitale, os basisphenoideum); partial splanchnocranium (= ossa quadrata); pneumatic foramina; cranioquadrate canal]

#	Description
207	**Trigeminal fossa (= fossa for cranial nerve V), development on quadrate and laterosphenoid:** *Young et al. (2013a, ch. 93); Young et al. (2012, ch. 110); Young (2014, ch. 113); Young et al. (2016, ds 2, ch. 132); Ristevski et al. (2018, ds 2, ch. 178); Smith et al. (in review, ds 1, ch. 182); Ősi et al. (2018, ds 1, ch. 200).* *Character based on the discovery by Fernández et al. (2011).* *State (1) is a putative apomorphy of Metriorhynchidae.* 0. developed anteriorly and posteriorly to the trigeminal fenestra (i.e. fossa present on both laterosphenoid and quadrate) 1. fossa is mainly developed posteriorly to the fenestra (i.e. fossa present on quadrate)
208	**Laterosphenoids, sutures with parietal:** *Hastings et al. (2010, ch. 63 mod.); Ristevski et al. (2018, ds 2, ch. 179); Smith et al. (in review, ds 1, ch. 183); Ősi et al. (2018, ds 1, ch. 201).* 0. parallel to the skull table 1. descends posteriorly, relative to the skull table
209	**Laterosphenoids, fossae for the *m. pseudotemporalis superficialis*:** *Young et al. (2013a, ch. 94 mod.); Young et al. (2012, ch. 111 mod.); Young (2014, ch. 114 mod.); Young et al. (2016, ds 2, ch. 133 mod.); Ristevski et al. (2018, ds 2, ch. 180); Smith et al. (in review, ds 1, ch. 184); Ősi et al. (2018, ds 1, ch. 202).* *Character based upon data from Holliday & Witmer (2009) and Fernández et al. (2011).* *State (1) is a putative apomorphy of Metasuchia.* 0. presence of a *pseudotemporalis* fossa on the dorsal surface of the laterosphenoid, and/or continuing on to the frontal 1. either an absence of the pseudotemporalis fossa on the dorsal surface of the laterosphenoid (i.e. only the *m. adductor mandibulae externus profundus* is within the supratemporal fenestra), or scorable by the presence of the fossa on the posteroventral surface of the laterosphenoid (the “subfenestral position”)
210	**Parasphenoid ridge/rostrum (?), in palatal view:** *Wilkinson et al. (2008, ch. 4); Young & Andrade (2009, ch. 4); Young et al. (2011, ch. 4); Young et al. (2013a, ch. 95); Young et al. (2012, ch. 112); Young (2014, ch. 115); Young et al. (2016, ds 2, ch. 134); Ristevski et al. (2018, ds 2, ch. 181); Smith et al. (in review, ds 1, ch. 185); Ősi et al. (2018, ds 1, ch. 203).* *The homology of this ridge is unknown. Andrews (1913) considered the midline pterygoid ridge to be the parasphenoid. However, the pterygoids are poorly known for metriorhynchids, and we cannot discount this as a purely pterygoid structure. Until this structure has undergone CT scanning we will provisionally use the term parasphenoid.* 0. not visible 1. forms a midline ridge along the pterygoids
211	**Basisphenoid, paired ridges located medially on the ventral surface:** *Young & Andrade (2009, ch. 83); Young et al. (2011, ch. 83); Young et al. (2013a, ch. 96); Young et al. (2012, ch. 113); Young (2014, ch. 116); Young et al. (2016, ds 2, ch. 135); Ristevski et al. (2018, ds 2, ch. 182); Smith et al. (in review, ds 1, ch. 186); Ősi et al. (2018, ds 1, ch. 204).* *State (1) occurs in Teleosauroidea.* 0. absent 1. present
212	**Basisphenoid, ventral exposure in adults and young individuals, but not immature or hatchlings: (ORDERED)** *Clark (1994, ch. 55 rev. + 56 rev.); Ortega et al. (2000, ch. 68 mod.); Young & Andrade (2009, ch. 87 mod.); Andrade et al. (2011, ch. 286 mod.); Young et al. (2011, ch. 87 mod.); Young et al. (2013a, ch. 97 mod.); Young et al. (2012, ch. 114 mod.); Young (2014, ch. 117 mod.); Young et al. (2016, ds 2, ch. 136 mod.); Ristevski et al. (2018, ds 2, ch. 183); Smith et al. (in review, ds 1, ch. 187); Ősi et al. (2018, ds 1, ch. 205).* *Original characters by Clark (1994, ch. 55-56) actually reflect the size of basisphenoid and here were combined into one character by Andrade et al. (2011). Note disagreement in the scorings from previous works, e.g., Clark (1994) considered thalattosuchians as (0) and Turner & Buckley (2008) considers them as (1); Turner & Buckley (2008) considers* Mahajangasuchus *as (2), whereas here it is considered as (1). Most authors consider "Sphenosuchians" as (1), but the basisphenoid is well exposed at least in* Gracilisuchus, Sphenosuchus *and possibly in* Pseudhesperosuchus *(see Bonaparte, 1971; Romer, 1972; Walker, 1990). Further scorings by Turner & Buckley (2008).* *Note Ristevsski et al. (2018, ds 2) re-ordered the character from Andrade et al. (2011). State (2) is now (0), and state (0) is now (2). State (1) is unaffected.* 0. ample surface exposed ventrally, basisphenoid at least as long as the basioccipital, or longer 1. well-exposed, although basisphenoid surface clearly smaller than basioccipital surface

	2. extremely reduced surface, exposed as a transversal slit, almost obliterated ventrally by the basioccipital and the pterygoids
213	**Basisphenoid, exposure anterior to the quadrates in palatal view:** *Wilkinson et al. (2008, ch. 5 mod.); Young & Andrade (2009, ch. 5 mod.); Young et al. (2011, ch. 5 mod.); Young et al. (2013a, ch. 98); Young et al. (2012, ch. 115); Young (2014, ch. 118); Young et al. (2016, ds 2, ch. 137); Ristevski et al. (2018, ds 2, ch. 184); Smith et al. (in review, ds 1, ch. 188); Ősi et al. (2018, ds 1, ch. 206).* *State (1) is a putative apomorphy of a teleosaurid subclade. This character state is caused by the posterior expansion of the pterygoid's posterior margin, so that the anterior portion of the quadrates is obscured, as are the lateral margins of the basisphenoid. However, there is a distinct basisphenoid 'rostrum' that in some taxa continue to bifurcate the ptergoids anteriorly. This morphology is not observed in* Teleosaurus cadomensis*, the skull referred to* Peipehsuchus teleorhinus, Steneosaurus brevior, Pelagosaurus typus *or Metriorhynchidae.* 0. basisphenoid terminates approximately level to the anterior extent of the quadrates 1. basisphenoid 'rostrum'/cultriform process exposed along the palatal surface anterior to the quadrates, continuing to bifurcate the pterygoids
214	**Basisphenoid rostrum (= cultriform process):** *Jouve (2005, ch. 2), Jouve et al. (2005b, ch. 7), Jouve et al. (2008, ch. 7), Hastings et al. (2010, ch. 54); Ristevski et al. (2018, ds 2, ch. 185); Smith et al. (in review, ds 1, ch. 189); Ősi et al. (2018, ds 1, ch. 207).* *State (1) is observed in some derived dyrosaurids. This character is not homologous with the anterior projection of the basisphenoid oberserved in teleosaurids. Here, the basisphenoid projects anteriorly between the pterygoids and laterosphenoids, rather than bifurcating the former.* 0. short 1. extremely long anteriorly
215	**Basisphenoid, exposure ventral to the basioccipital at maturity in occipital aspect:** *Young & Andrade (2009, ch. 144); Young et al. (2011, ch. 144); Young et al. (2013a, ch. 99); Young et al. (2012, ch. 116); Young (2014, ch. 119); Young et al. (2016, ds 2, ch. 138); Ristevski et al. (2018, ds 2, ch. 186); Smith et al. (in review, ds 1, ch. 190); Ősi et al. (2018, ds 1, ch. 208).* *State (1) is a putative apomorphy of Eusuchia.* 0. absent, pterygoid dorsoventrally short ventral to median pharyngeal opening (= "medial Eustachain foramen") 1. present, pterygoid dorsoventrally tall ventral to median pharyngeal opening
216	**Basisphenoid, development of basipterygoid processes:** *Clark (1994, ch. 54 rev.); Andrade et al. (2011, ch. 289 mod.); Ristevski et al. (2018, ds 2, ch. 187); Smith et al. (in review, ds 1, ch. 191); Ősi et al. (2018, ds 1, ch. 209).* *State (1) occurs in Crocodyliformes.* 0. prominent, forming a movable joint with pterygoid, and with basisphenoid joint suturally closed 1. small or absent
217	**Basioccipital, single wide rugosity oriented anteroposteriorly along the midline of the ventral surface of the occipital condyle:** *Hastings et al. (2010, ch. 55 mod.); Ristevski et al. (2018, ds 2, ch. 188); Smith et al. (in review, ds 1, ch. 192); Ősi et al. (2018, ds 1, ch. 210).* 0. absent 1. present
218	**Basioccipial, presence of tuberosities (= basal tubera):** *Clark (1994, ch. 57); Lauprasert et al. (2007, ch. 46); Young & Andrade (2009, ch. 151); Andrade et al. (2011, ch. 288); Young et al. (2011, ch. 151); Young et al. (2013a, ch. 100); Young et al. (2012, ch. 117); Young (2014, ch. 120); Young et al. (2016, ds 2, ch. 139); Ristevski et al. (2018, ds 2, ch. 189); Smith et al. (in review, ds 1, ch. 193); Ősi et al. (2018, ds 1, ch. 211).* *State (1) occurs in longirostrine taxa.* 0. reduced 1. large and pendulous
219	**Basioccipital tuberosities, in ventral view:** *Hastings et al. (2010, ch. 56 mod.); Ristevski et al. (2018, ds 2, ch. 190); Smith et al. (in review, ds 1, ch. 194); Ősi et al. (2018, ds 1, ch. 212).* 0. oblong-shaped 1. 'V'-shaped or tear-drop shaped
220	**Paired grooves along ventral surface, extending from base of the occipital condyle to the basioccipital tuberosities:** *Hastings et al. (2010, ch. 57 mod.); Ristevski et al. (2018, ds 2, ch. 191); Smith et al. (in review, ds 1, ch. 195); Ősi et al. (2018, ds 1, ch. 213).* 0. absent 1. present
221	**Ventral part of the basioccipital:** *Jouve et al. (2005b, ch. 13), Jouve et al. (2008, ch. 13), Hastings et al. (2010, ch. 59); Ristevski et al.*

	(2018, ds 2, ch. 192); Smith et al. (in review, ds 1, ch. 196); Ősi et al. (2018, ds 1, ch. 214). 0. vertical, largely visible in occipital view 1. strongly inclined, weakly visible in occipital view
222	**Quadrate, prominent crest on dorsal surface of distal quadrate extending proximally to lateral extent of quadrate–exoccipital contact:** *Young & Andrade (2009, ch. 101); Young et al. (2011, ch. 101); Young et al. (2013a, ch. 101); Young et al. (2012, ch. 118); Young (2014, ch. 121); Young et al. (2016, ds 2, ch. 140); Ristevski et al. (2018, ds 2, ch. 193); Smith et al. (in review, ds 1, ch. 197); Ősi et al. (2018, ds 1, ch. 215).* *State (1) occurs in Metasuchia (with reversals, such as in Crocodylia).* 0. absent 1. present
223	**Quadrate, contact with the proötics:** *Clark et al. (2000, ch. 14); Clark & Sues (2002, ch. 15); Sues et al. (2003, ch. 15); Clark et al. (2004, ch. 15); Nesbitt (2011, ch. 76); Pol et al. (2013, ch. 15); Young et al. (2016, ds 2, ch. 141); Leardi et al. (2017, ch. 15); Ristevski et al. (in review, ds 2, ch. 194); Smith et al. (2018, ds 1, ch. 198); Ősi et al. (2018, ds 1, ch. 216).* *State (1) is a putative apomorphy of Crocodylomorpha.* 0. does not contact the proötic 1. contacts the proötic
224	**Quadrate, articulation of dorsal head contact:** *Clark (1994, ch. 47); Young & Andrade (2009, ch. 102 mod.); Andrade et al. (2011, ch. 298); Young et al. (2011, ch. 102 mod.); Young et al. (2013a, ch. 102 mod.); Young et al. (2012, ch. 119 mod.); Young (2014, ch. 122 mod.); Young et al. (2016, ds 2, ch. 142); Ristevski et al. (2018, ds 2, ch. 195); Smith et al. (in review, ds 1, ch. 199); Ősi et al. (2018, ds 1, ch. 217).* *State (1) is a putative apomorphy of* Junggarsuchus + *Crocodyliformes.* 0. squamosal and exoccipital/opisthotic/otoccipital (can have medial contact with proötics and laterosphenoids) 1. proötic and laterosphenoid
225	**Quadrate, posterior margin:** *Nesbitt (2011, ch. 77); Young et al. (2016, ds 2, ch. 143); Ristevski et al. (2018, ds 2, ch. 196); Smith et al. (in review, ds 1, ch. 200); Ősi et al. (2018, ds 1, ch. 218).* *State (1) is a putative apomorphy of Metasuchia – note that the ventral/anteroventral margins of the distal ends of the paroccipital processes have a strong sutural contact with the quadrates.* 0. does not have a sutural contact with the paroccipital process of the opisthotic, or the anterior margin of the paroccipital process has a simple contact with the posterior margin of the quadrate 1. has a robust sutural contact with the paroccipital process of the opisthotic
226	**Quadrate, anteroventral process suturing to the braincase:** *Young et al. (2013a, ch. 103 mod.); Young et al. (2012, ch. 120 mod.); Young (2014, ch. 123 mod.); Young et al. (2016, ds 2, ch. 144 mod.); Ristevski et al. (2018, ds 2, ch. 197); Smith et al. (in review, ds 1, ch. 201); Ősi et al. (2018, ds 1, ch. 219).* *The scores for the contact of the anteroventral process (referred to as the 'orbital' and 'pterygoid' processes by different authors).* *State (2) represents the 'quadrate incompletely sutured to the braincase' statement in Holliday & Witmer (2009), Jouve (2009) and Fernández et al. (2011).* *The current version of this character aims to quantify two trends: 1) the contact between the quadrate and the laterosphenoid (as part of the stabilisation of the crocodylomorph skull), and 2) the thalattosuchian modification of this trend. In Thalattosuchia, it appears as though the anteromedial region of this process no longer articulates with the lateral surface of the neurocranium, but it is still elongated enough to have, and seems to sit lateral to the laterosphenoid. Perhaps suggesting a soft-tissue contact.* *State (1) occurs in Crocodyliformes.* *State (2) occurs in Thalattosuchia.* 0. this process contacts the pterygoid, but little to no contact with the neurocranium 1. this process has extensive contact with the laterosphenoid, basisphenoid and pterygoid (i.e. stabilises the splanchnocranium with the palate and neurocranium) 2. this process is free of bony attachment along its anteromedial surface, but ventrally contacts the pterygoid. Process likely has a posteromedial contact with the basisphenoid, but is free of contact with the laterosphenoid
227	**Quadrate, distal articular surface separated into two condyles:** *Young (2014, ch. 126); Young et al. (2016, ds 2, ch. 147); Ristevski et al. (2018, ds 2, ch. 200); Smith et al. (in review, ds 1, ch. 204); Ősi et al. (2018, ds 1, ch. 222).* *State (1) is a putative apomorphy of Plesiosuchina.* *Character can be scored if the articular is preserved, and no ridge that supports the intercondylar sulcus is present.* 0. yes 1. no

228	**Quadrate-quadratojugal, quadratojugal contributes to the upper jaw joint along with the quadrate (i.e. helps to form the lateral hemicondyle):** *Jouve et al. (2005b, ch. 19 mod.); Jouve et al. (2008, ch. 19 mod.); Hastings et al. (2010, ch. 60 mod.); Ristevski et al. (2018, ds 2, ch. 201); Smith et al. (in review, ds 1, ch. 205); Ősi et al. (2018, ds 1, ch. 223).* 0. lateral hemicondyle soley formed by the quadrate 1. lateral hemicondyle has a quadratojugal contribution
229	**Fossa for the tympanic membrane, anterior extension:** *Ristevski et al. (2018, ds 2, ch. 202); Smith et al. (in review, ds 1, ch. 206); Ősi et al. (2018, ds 1, ch. 224).* *State (1) occurs in Notosuchia and Sebecia.* *State (2) occurs in Neosuchia.* 0. limited to the squamosal 1. reaches the posterior margin of the postorbital 2. broadly exposed on the postorbital (covering the anterolateral margin) 3. crosses the postorbital and reaches the orbit
230	**Cranioquadrate canal, contact between the quadrate and exoccipital around the opening: (ORDERED)** *Clark (1994, ch. 49 mod.); Andrade et al. (2011, ch. 306 mod. + ch. 308 mod.); Ristevski et al. (2018, ds 2, ch. 203); Smith et al. (in review, ds 1, ch. 207); Ősi et al. (2018, ds 1, ch. 225).* *Cranioquadrate canal (=quadratosquamosootoccipitalis, in Salisbury et al., 1999; or =quadratosquamosoexoccipitalis, in Delfino et al., 2008).* *State (1) occurs in Hallopodidae (e.g.* Almadasuchus*) and Mesoeucrocodylia.* *In derived forms the squamosal will also help enclose the cranioquadrate canal.* *Contact between quadrate and exoccipital is extensive (2) in all crown crocodylians, but in all stem metasuchians this contact is feeble (1).* 0. absent (and the quadrate and exoccipital do not meet to enclose the cranioquadrate canal) 1. lateral contact between the quadrate and exoccipital is feeble, but these bones do meet to enclose the cranioquadrate canal 2. lateral contact between the quadrate and exoccipital is broad, and these bones do meet to enclose the cranioquadrate canal
231	**Cranioquadrate canal, bones enclosing:** *Ristevski et al. (2018, ds 2, ch. 204); Smith et al. (in review, ds 1, ch. 208); Ősi et al. (2018, ds 1, ch. 226).* *Scores for a similar morphology as Andrade et al. (2011, ch. 307), but with distinct differences. Cranioquadrate canal does not imply in the presence of a passage, and therefore may be opened laterally. The canal is only considered absent (0) in basal crocodylomorphs and basal crocodyliformes.* *Note at present state (0) here correlates with the state (0) in character quantifying the contact between the quadrate and exoccipital around the cranioquadrate canal. However, here a taxon with an enclosed cranioquadrate canal which does not have a squamosal participation would be scored as (0).* *State (1) occurs in Thalattosuchia.* *State (2) is common among goniopholidids and pholidosaurids.* *State (3) occurs in Metasuchia, but with some losses (especially in Neosuchia).* 0. quadrate, squamosal and exoccipital do not enclose the cranioquadrate canal along its length 1. squamosal laterally encloses the cranioquadrate canal, the quadrate ventrally, and the exoccipital posteriorly, medially and partly ventrally encloses the canal. This results in the canal opening laterally and/or posterolaterally 2. quadrate and squamosal do not laterally enclose the cranioquadrate canal, and it is laterally exposed but still exits on the occipital surface. *This looks to be a modification of state (3), where there is no ossified lateral enclosure, resulting in the 'open morphotype'.* 3. quadrate and squamosal laterally enclose the cranioquadrate canal, and the exoccipital helps enclose it dorsally. This results in the canal opening on the occipital surface
232	**Cranioquadrate canal, presence of a squamosal descending process separating the cranioquadrate canal from the external auditory meatus:** *Ristevski et al. (2018, ds 2, ch. 205); Smith et al. (in review, ds 1, ch. 209); Ősi et al. (2018, ds 1, ch. 227).* *State (1) occurs in thalattosuchians. Note that the* Teleosaurus cadomensis *specimen figured by Jouve (2009) had a broken squamosal descending lamina, and that the skull had been acid prepared. Here it is scored as (1).* Pelagosaurus typus *is also scored as (1), as the skull NHMUK PV OR 32599 is also acid prepared and many of the thin laminae are broken.* 0. absent, no clear separation of these structures 1. present, the cranioquadrate canal and the external auditory meatus are distinct openings, sharing a common wall (squamosal descending process)

Mandibular geometry (Ch. 233 – 240; 1.739% of characters)

#	Description
233	**Mandible geometry, relative positions of the dentary tooth-row and coronid process, and development of dorsal curvature of the posterior-end of the mandible:** *Young et al. (2011, ch. 167); Young et al. (2013a, ch. 109); Young et al. (2012, ch. 127); Young (2014, ch. 131); Young et al. (2016, ds 2, ch. 153); Ristevski et al. (2018, ds 2, ch. 207); Smith et al. (in review, ds 1, ch. 211); Ősi et al. (2018, ds 1, ch. 229).* *State (1) is a putative apomorphy of Metriorhynchidae.* *Quantifies the incipient increase of gape at the base of Metriorhynchidae.* 0. gentle curvature in the dorsal margin of the mandible, from the coronoid process to the end of the tooth-row 1. strong curvature, raising the coronoid process considerably above the tooth-row
234	**Mandible geometry, relative positions of coronoid process, retroarticular process and glenoid fossa:** *Young et al. (2011, ch. 168); Young et al. (2013a, ch. 110); Young et al. (2012, ch. 128); Young (2014, ch. 132); Young et al. (2016, ds 2, ch. 154); Ristevski et al. (2018, ds 2, ch. 208); Smith et al. (in review, ds 1, ch. 212); Ősi et al. (2018, ds 1, ch. 230).* *State (1) is a putative apomorphy of Geosaurini.* *This character quantifies the greater increase in gape associated with macrophagous geosaurines.* 0. coronoid process level to both the retroarticular process and glenoid fossa 1. coronoid process ventral to both the retroarticular process and glenoid fossa
235	**Mandibular rami, presence of a sharp dorsal inclination:** *Ristevski et al. (2018, ds 2, ch. 209); Smith et al. (in review, ds 1, ch. 213); Ősi et al. (2018, ds 1, ch. 231).* *State (1) is a putative apomorphy of Plesiosuchina.* 0. absent 1. present - immediately posterior to the mandibular symphysis the mandible sharply rises dorsally such that the ventral margin of the dentary (along with angular) is dorsally deflected (resulting in a distinct 'kink' along the mandibular ventral margin)
236	**Mandible, orientation of hemimandibles at their medial contact:** *Andrade et al. (2011, ch. 320); Ristevski et al. (2018, ds 1, ch. 320); Smith et al. (in review, ds 2, ch. 320); Ősi et al. (2018, ds 1, ch. 232).* 0. evidently acute angle, hemimandibles meet at approximately 45 degrees of each other, or less 1. broad angle, hemimandibles meet at approximately 70 degrees of each other, or more
237	**Mandible, morphology of distal rami in dorsal/ventral views:** *Andrade et al. (2011, ch. 321); Ristevski et al. (2018, ds 2, ch. 210); Smith et al. (in review, ds 1, ch. 214); Ősi et al. (2018, ds 1, ch. 233).* *Note that the broad-Y shape in (1) is not the result of elongation of the symphysis (which is present, but not exclusively in these forms), but by the arched distal rami, meeting at mid-mandible.* *State (1) is putative apomorphy of Notosuchidae + Sphagesauridae.* 0. distal rami mostly straight or poorly curved 1. distal rami strongly curved medially at mid-mandible, giving the mandible a broad-Y shape
238	**Mandible, ventral border at angular, in lateral view: (ORDERED)** *Andrade et al. (2011, ch. 322); Ristevski et al. (2018, ds 1, ch. 322); Smith et al. (in review, ds 2, ch. 322); Ősi et al. (2018, ds 1, ch. 234).* *This character, created by Andrade et al. (2011), is potentially co-dependent with Pol et al. (2012, ch. 280), which is not included here (see also Turner & Buckley 2008, ch. 280)* *State (0) is based on descriptions by Woodward (1896), Price (1945) and Andrade & Bertini (2008b).* *State (2) is originally based on descriptions by Hooley (1907), Schwarz (2002) and Ősi et al. (2007).* 0. angular straight and mostly horizontal, or poorly curved, from the anterior to the posterior end 1. angular evidently (but gently) curved 2. angular abruptly curved, always below glenoid fossa, with mid-posterior sections of angular sub-vertical, facing posteriorly
239	**Mandible, morphology of ventral margin, in lateral view:** *Andrade et al. (2011, ch. 323); Ristevski et al. (2018, ds 1, ch. 323); Smith et al. (in review, ds 2, ch. 323); Ősi et al. (2018, ds 1, ch. 235).* *The triple contact between dentary, angular and surangular can be taken as reference, if mandibular fenestra is absent* 0. mandible is curved ventrally, with maximum curvature at anterior section of angular, below the mandibular fenestra (when present), or not curved at all 1. mandible is curved posteroventrally, with maximum curvature at posterior section of angular, below (or almost below) the mandibular glenoid fossa, usually posterior to mandibular fenestra (when present)
240	**Mandible, dorsal border at dentary-surangular contact, in lateral view:** *Clark (1994, ch. 74); Sereno et al. (2003, ch. 41); Andrade et al. (2011, ch. 324); Ristevski et al. (2018, ds 1, ch. 324); Smith et al. (in review, ds 2, ch. 324); Ősi et al. (2018, ds 1, ch. 236).*

	State (2) is putative apomorphy of Notosuchidae + Sphagesauridae + Comahuesuchidae. 0. mostly straight 1. gently arched dorsally 2. strongly arched dorsally

Mandible (Ch. 241 – 272; 6.957% of characters)

[Dermatocranium mandibular series (= ossa dentalia, ossa splenialia, ossa angularia, ossa supraangularia, ossa prœarticularia, ossa coronoidea); and the mandibular contribution of the splanchnocranium (= ossa articularia and cartilagines meckeli)]

#	Description
241	**Anterior mandible (dentary), dorsal margin of the anterior portion compared to the dorsal margin of the posterior portion:** *Nesbitt (2011, ch. 154); Young et al. (2012, ch. 129); Young (2014, ch. 133); Young et al. (2016, ds 2, ch. 155); Ristevski et al. (2018, ds 2, ch. 211); Smith et al. (in review, ds 1, ch. 215); Ősi et al. (2018, ds 1, ch. 237).* 0. horizontal (in the same plane) 1. ventrally deflected 2. dorsally expanded
242	**Anterior mandible (dentary), in dorsal or ventral view:** *Young et al. (2011, ch. 181 mod.); Young et al. (2013a, ch. 111 mod.); Young et al. (2012, ch. 130 mod.); Young (2014, ch. 135 mod.); Young et al. (2016, ds 2, ch. 156 mod.); Ristevski et al. (2018, ds 2, ch. 212); Smith et al. (in review, ds 1, ch. 216); Ősi et al. (2018, ds 1, ch. 238).* *Note, Ristevski et al. (2018, ds 2) added two new character states. These where added to determine whether the 'spatulate' anterior dentary morphotypes would homologous.* *State (1) occurs in most pholidosaurids, and in some dyrosaurids and eusuchians.* *State (2) is a putative apomorphy of Teleosauridae.* *State (3) is a putative apomorphy of* Sarcosuchus *and* Chalawan. 0. outer margin converging towards tip or parallel 1. distinct spatulate shape, with the maximum transverse width at the D2 alveoli 2. distinct spatulate shape, with the maximum transverse width at the D3-D4 couplet 3. distinct spatulate shape, with the maximum transverse width at the D4 alevoli
243	**Anterior mandible (dentary), in dorsal or ventral view:** *Young et al. (2016, ds 2, ch. 157 + 158); Ristevski et al. (2018, ds 2, ch. 213); Smith et al. (in review, ds 1, ch. 217); Ősi et al. (2018, ds 1, ch. 239).* *State (1) occurs in basal dyrosaurids and tomistomine crocodyloids.* *State (2) occurs in* Hamadasuchus, *Peirosauridae and* Baurusuchus. *States (1) and (2) differ in that the 'trowel'-shape has a shorter, broader and deeper symphyseal region; the anteriorly tapering maximal anterior width is more pronounced, and the width at the posterior symphyseal region is greater than the maximal anterior width.* 0. non-'gladius', or 'trowel'-shaped 1. 'gladius'-shaped - i.e. a long symphyseal region with the anterior maximal width near the D3–D5 region, with the dentaries tapering anteriorly. Immediately posterior to the maximal width, the dentaries begin to narrow until they reach a minimal width, and begin expanding again. At the end of the symphyseal region the breadth is now wider than the anterior maximal width 2. 'trowel'-shaped - i.e. a moderate to short symphyseal region with the anterior maximal width near the D3–D5 region, with the dentaries tapering strongly anteriorly. Immediately posterior to the maximal width the dentaries begin to narrow until they reach a minimal width, and begin expanding again. At the end of the symphyseal region the breadth is either narrower or subequal to the anterior maximal width
244	**Mandibular symphysis, length:** *Young (2006, ch. 20 mod.); Wilkinson et al. (2008, ch. 43 mod.); Young & Andrade (2009, ch. 43 mod.); Young et al. (2011, ch. 43 mod.); Young et al. (2013a, ch. 112 mod.); Young et al. (2012, ch. 132); Young (2014, ch. 136); Young et al. (2016, ds 2, ch. 159); Ristevski et al. (2018, ds 2, ch. 214); Smith et al. (in review, ds 1, ch. 218); Ősi et al. (2018, ds 1, ch. 240).* 0. symphysis less than a third of mandible length (lower than 0.3) 1. symphysis less than half and more than a third of mandible length (between 0.3 and 0.45) 2. symphysis under half of mandible length (between 0.45 and 0.5) 3. symphysis greater than half of mandible length (more than 0.5)
245	**Mandibular symphysis, depth:** *Young (2006, ch. 21); Wilkinson et al. (2008, ch. 44); Young & Andrade (2009, ch. 44); Young et al. (2011, ch. 44); Young et al. (2013a, ch. 113); Young et al. (2012, ch. 133); Young (2014, ch. 137); Young et al. (2016, ds 2, ch. 160); Ristevski et al. (2018, ds 2, ch. 215); Smith et al. (in review, ds 1, ch. 219); Ősi et al. (2018, ds 1, ch. 241).* 0. deep (9% or more of mandible length)

	1. moderate (6.5–8% of mandible length) 2. narrow (4.5–6% of mandible length) 3. very narrow (4% or less of mandible length)
246	**External mandibular fenestra, presence:** *Clark (1994, ch. 75 mod.d); Ortega et al. (2000, ch. 80 rev.); Young (2006, ch. 22 part); Wilkinson et al. (2008, ch. 45 part); Young & Andrade (2009, ch. 45 part); Andrade et al. (2011, ch. 312); Young et al. (2011, ch. 45 part); Young et al. (2013a, ch. 114 part); Young et al. (2012, ch. 134 part); Young (2014, ch. 138 part); Young et al. (2016, ds 2, ch. 161 part); Ristevski et al. (2018, ds 1, ch. 312); Smith et al. (in review, ds 2, ch. 312); Ősi et al. (2018, ds 1, ch. 242).* *State (0) occurs in Gobiosuchidae, Hylaeochampsidae, Bernissartiidae, Paralligatoridae and Metriorhynchidae. Also in derived goniopholidids (e.g.* Anteophthalmosuchus *and* Goniopholis *sensu stricto – Andrade et al., 2011), derived pholidosaurids (*Oceanosuchus *and* Terminonaris browni*), and within Dyrosauridae (*Sabinosuchus*).* 0. absent 1. present as a diminutive passage 2. present as an evident fenestra
247	**External mandibular fenestra, shape: (*)** *Andrade et al. (2011, ch. 315); Ristevski et al. (2018, ds 1, ch. 315); Smith et al. (in review, ds 2, ch. 315); Ősi et al. (2018, ds 1, ch. 243).* *This character is not applicable for taxa that lack external mandibular fenestrae.* 0. subcircular to poorly elliptic 1. highly elliptic, anteroposterior axis much longer than dorso-ventral axis, three time or more, but both ends rounded 2. slit-like, proportionally very long and both ends acute 3. broad teardrop-like 4. narrow teardrop-like 5. triangle
248	**External mandibular fenestra, morphology of anterior margin: (*)** *Andrade et al. (2011, ch. 316); Ristevski et al. (2018, ds 1, ch. 316); Smith et al. (in review, ds 2, ch. 316); Ősi et al. (2018, ds 1, ch. 244).* *State (1) is present in peirosaurids,* Araripesuchus *and closely related taxa.* *Note that* Baurusuchus *was reconstructed as (1), but is actually (0).* *This character is not applicable for taxa that lack external mandibular fenestrae.* 0. curved, with a broad arched margin anteriorly 1. anterodorsal and anteroventral margins poorly arched, meeting at an acute angle anteriorly, anterior end is wedge-like
249	**Surangular foramen, presence:** *Clark et al. (2004 mod.); Nesbitt (2007 mod.); Nesbitt (2011, ch. 163); Ősi et al. (2018, ds 1, ch. 245).* *State (1) is a putative apomorphy of* Junggarsuchus. *The foramen is located posterior to the external mandibular fenestra, and is surrounded by the surangular.* 0. present and small 1. present and large 2. absent
250	**Dentary, ventral margin strongly curved:** *Young et al. (2016, ds 2, ch. 162 + 163); Ristevski et al. (2018, ds 2, ch. 217); Smith et al. (in review, ds 1, ch. 221); Ősi et al. (2018, ds 1, ch. 246).* *State (1) occurs in* Junggarsuchus, Dakosaurus, Baurusuchus, *and in 'trematochampsids' and peirosaurids.* *State (2) occurs in* Pachycheilosuchus + Pietraroiasuchus. 0. no 1. yes, ventral margin is distinctly curved (convex). It rises sharply dorsally towards the anterior tip (this curvature occurs along the anterior ventral margin of the dentary) 2. yes, ventral margin is curved (concave). It rises dorsally towards the anterior tip (this curvature occurs along the anterior ventral margin of the dentary, from a dorsoventrally deepened region of the dentary, immediately anterior to the dentary-splenial suture)
251	**Dentary foramina, lateral and dorsal surface of the anterior (symphyseal) region of the dentary:** *Young et al. (2016, ds 2, ch. 164); Ristevski et al. (2018, ds 2, ch. 218); Smith et al. (in review, ds 1, ch. 222); Ősi et al. (2018, ds 1, ch. 247).* *State (1) is a putative apomorphy of* Dakosaurus. 0. foramina either small or variable in size. Number is variable. 1. has numerous small to medium-sized foramina
252	**Surangulodentary groove, morphology:** *Young (2006, ch. 23 mod.); Wilkinson et al. (2008, ch. 46 part); Young & Andrade (2009, ch. 46 part); Young et al. (2011, ch. 46 part); Young et al. (2013a, ch. 115 part); Young et al. (2012, ch. 135); Young (2014, ch.139); Young et al. (2016, ds 2, ch. 166); Ristevski et al. (2018, ds 2, ch. 220); Smith et*

	al. (in review, ds 1, ch. 224); Ősi et al. (2018, ds 1, ch. 248). *Note taphonomic or preservational damage can obscure state (1).* *State (2) is a putative apomorphy of the clade Geosaurini. Previously it was considered an apomorphy of* Dakosaurus; *however, the type specimens for the genera* Dakosaurus, Plesiosuchus *and* Geosaurus *share this morphology. The deep groove is also observed in the holotype of* Torvoneustes coryphaeus, *and large specimens of* Tyrannoneustes lythrodectikos. 0. absent 1. present as a subtle, shallow groove 2. deeply excavated
253	**Surangulodentary groove, relative length on both elements: (*)** *Young et al. (2013a, ch. 115 part); Young et al. (2012, ch. 136); Young (2014, ch. 140); Young et al. (2016, ds 2, ch. 167); Ristevski et al. (2018, ds 2, ch. 221); Smith et al. (in review, ds 1, ch. 225); Ősi et al. (2018, ds 1, ch. 249).* *This character is not applicable for taxa that lack the surangulodentary groove.* 0. groove is longer on the dentary than on the surangular 1. groove is as long on the dentary as on the surangular
254	**Surangulodentary groove, large foramen present at the dentary terminus: (*)** *Wilkinson et al. (2008, ch. 46 part); Young & Andrade (2009, ch. 46 part); Young et al. (2011, ch. 190); Young et al. (2013a, ch. 116); Young et al. (2012, ch. 137); Young (2014, ch. 141); Young et al. (2016, ds 2, ch. 168); Ristevski et al. (2018, ds 2, ch. 222); Smith et al. (in review, ds 1, ch. 226); Ősi et al. (2018, ds 1, ch. 250).* *This character is not applicable for taxa that lack the surangulodentary groove.* *State (1) is a putative apomorphy of* Dakosaurus. 0. absent 1. present
255	**Mandibular grooves, morphology along the dentary in lateral view: (*)** *Smith et al. (in review, ds 1, ch. 227); Ősi et al. (2018, ds 1, ch. 251).* *This character is not applicable for taxa that lack the surangulodentary groove.* *State (1) occurs in basal metriorhynchoids.* 0. the surangulodentary and angulodentary grooves are either poorly developed, not elongate, converge towards one another (i.e. they are not parallel, and close to one another ventral to the dentary rami tooth row 1. the surangulodentary and angulodentary grooves are parallel and positioned close to one another ventral to the dentary rami tooth row
256	**Splenial, involvement in mandibular symphysis:** *Young (2006, ch. 25 mod.); Wilkinson et al. (2008, ch. 49 mod.); Young & Andrade (2009, ch. 49 mod.); Young et al. (2011, ch. 49 mod.); Young et al. (2013a, ch. 117 mod.); Young et al. (2012, ch. 138 mod.); Young (2014, ch. 142); Young et al. (2016, ds 2, ch. 169 mod.); Ristevski et al. (2018, ds 2, ch. 223); Smith et al. (in review, ds 1, ch. 228); Ősi et al. (2018, ds 1, ch. 252).* 0. slight (less than 10% of symphysis length) 1. extensive (greater than, or equal to, 15% of symphysis length) 2. not involved
257	**Angular, in lateral view, extension of the anterior lateral ramus:** *Young (2006, ch. 24 part); Wilkinson et al. (2008, ch. 47 part); Young & Andrade (2009, ch. 47 part); Young et al. (2011, ch. 47 part); Young et al. (2013a, ch. 118 part); Young et al. (2012, ch. 139); Young (2014, ch. 143); Young et al. (2016, ds 2, ch. 170); Ristevski et al. (2018, ds 2, ch. 224); Smith et al. (in review, ds 1, ch. 229); Ősi et al. (2018, ds 1, ch. 253).* 0. short, does not extend beyond the orbits 1. long, does extend anteriorly beyond the orbits
258	**Angular, in lateral view, posterodorsal extension:** *Jouve et al. (2008, ch. 39 mod.); Hastings et al. (2010, ch. 79 mod.); Ristevski et al. (2018, ds 2, ch. 225); Smith et al. (in review, ds 1, ch. 230); Ősi et al. (2018, ds 1, ch. 254).* 0. reaches the retroarticular process 1. does not reach the retroarticular process
259	**Surangular, in lateral view, extension of the anterior lateral ramus:** *Young (2006, ch. 24 part); Wilkinson et al. (2008, ch. 47 part); Young & Andrade (2009, ch. 47 part); Andrade et al. (2011, ch. 346 mod.); Young et al. (2011, ch. 47 part); Young et al. (2013a, ch. 118 part); Young et al. (2012, ch. 140); Young (2014, ch. 144); Young et al. (2016, ds 2, ch. 171); Ristevski et al. (2018, ds 2, ch. 226); Smith et al. (in review, ds 1, ch. 231); Ősi et al. (2018, ds 1, ch. 255).* 0. short, does not extend anteriorly beyond the orbit 1. long, extends anteriorly beyond the orbit
260	**Surangular, along the dorsal margin of the mandible:** *Wilkinson et al. (2008, ch. 48); Young & Andrade (2009, ch. 48); Young et al. (2011, ch. 48); Young et al. (2013a, ch. 119); Young et al. (2012, ch. 141); Young (2014, ch. 145); Young et al. (2016, ds 2, ch. 172); Ristevski et al. (2018, ds 2, ch. 227); Smith et al. (in review, ds 1, ch. 232); Ősi et al. (2018, ds 1, ch. 256).*

	This character does not always covary with the previous character, as in non-Rhacheosaurini metriorhynchines the dentary extensively overlaps the surangular (particularly in lateral view), obscuring its anterior development. The full extent of the surangular anterior development can only be determined by examining the dorsal margin in those taxa (e.g., Metriorhynchus superciliosus*).* 0. does not extend anteriorly beyond the orbit 1. does extend anteriorly beyond the orbit
261	**Surangular, presence of a distinct coronoid process:** *Young & Andrade (2009, ch. 155); Young et al. (2011, ch. 155); Young et al. (2013a, ch. 120); Young et al. (2012, ch. 142); Young (2014, ch. 146); Young et al. (2016, ds 2, ch. 173); Ristevski et al. (2018, ds 2, ch. 228); Smith et al. (in review, ds 1, ch. 233); Ősi et al. (2018, ds 1, ch. 257).* *In Crocodyliformes, state (1) occurs in Thalattosuchia and* Iharkutosuchus*.* *In Thalattosuchia it appears as though all taxa have a coronoid process. In teleosauroids the coronoid process is medially orientated and is not visible in lateral view, unlike in* Pelagosaurus + *Metriorhynchidae.* 0. absent 1. present
262	**Surangular, presence of extension to the retroarticular process:** *Norell (1988, ch. 42 mod.); Brochu (1999, ch. 51 rev.); Young & Andrade (2009, ch. 103); Andrade et al. (2011, ch. 350); Young et al. (2011, ch. 103); Young et al. (2013a, ch. 121); Young et al. (2012, ch. 143 mod.); Young (2014, ch. 147); Young et al. (2016, ds 2, ch. 174 mod.); Ristevski et al. (2018, ds 2, ch. 229); Smith et al. (in review, ds 1, ch. 234); Ősi et al. (2018, ds 1, ch. 258).* 0. absent, pinched off anterior to tip of retroarticular process, or surangular excluded from process 1. present, extends to posterior end of retroarticular process
263	**Prearticulars, presence:** *Clark (1994, ch. 72 rev.); Sereno et al. (2003, ch. 39); Young & Andrade (2009, ch. 89); Andrade et al. (2011, ch. 354); Young et al. (2011, ch. 89); Young et al. (2013a, ch. 122); Young et al. (2012, ch. 144); Young (2014, ch. 148); Young et al. (2016, ds 2, ch. 175); Ristevski et al. (2018, ds 2, ch. 230); Smith et al. (in review, ds 1, ch. 235); Ősi et al. (2018, ds 1, ch. 259).* *Note, here we follow Andrade et al. (2011) in scoring* Pholidosaurus schaumburgensis *and* Sarcosuchus imperator *as lacking prearticulars (as MTY also could not find these elements in first-hand observations). As such they are scored as (?).* *It is not possible to verify the potential prearticular in* Oceanosuchus *(Hua et al., 2007, Fig. 4U) as too much of the angular is not preserved. Thus, this OTU is scored as (?).* *State (1) occurs in Metasuchia.* 0. present 1. absent
264	**Coronoids:** *Jouve et al. (2005b, ch. 6 mod.); Jouve et al. (2008, ch. 6 mod.); Young & Andrade (2009, ch. 157 part); Hastings et al. (2010, ch. 77 mod.); Young et al. (2011, ch. 157 part); Young et al. (2013a, ch. 124 part); Young et al. (2012, ch. 146 part); Young (2014, ch. 150 part); Young et al. (2016, ds 2, ch. 177 part); Ristevski et al. (2018, ds 2, ch. 231); Smith et al. (in review, ds 1, ch. 236).* *This character is an amalgam of those in Hastings et al. (2010, ch. 77) and Young et al. (2016, ch. 177); Ősi et al. (2018, ds 1, ch. 260).* *State (1) occurs in derived Rhacheosaurini metriorhynchids.* *Dyrosaurids have state (2). However, to evaluate the presence of the coronoids requires well preserved specimens.* 0. present, but not exposed on the external (= lateral) surface of the mandible 1. present, and exposed on the external surface of the mandible 2. absent
265	**Coronoid, anterior development along the dorsal margin:** *Wilkinson et al. (2008, ch. 51 mod.); Young & Andrade (2009, ch. 51 mod.); Young et al. (2011, ch. 51 mod.); Young et al. (2013a, ch. 123 mod.); Young et al. (2012, ch. 145 mod.); Young (2014, ch. 149); Young et al. (2016, ds 2, ch. 176 mod.); Ristevski et al. (2018, ds 2, ch. 232); Smith et al. (in review, ds 1, ch. 237); Ősi et al. (2018, ds 1, ch. 261).* 0. does not project as far as the dentary tooth row, or coronoid absent 1. projects further anteriorly than the posterior-most alveoli
266	**Articular, glenoid fossa orientation:** *Young & Andrade (2009, ch. 154); Young et al. (2011, ch. 154); Young et al. (2013a, ch. 125); Young et al. (2012, ch. 147); Young (2014, ch. 151); Young et al. (2016, ds 2, ch. 178); Ristevski et al. (2018, ds 2, ch. 233); Smith et al. (in review, ds 1, ch. 238); Ősi et al. (2018, ds 1, ch. 262).* 0. anterodorsally 1. dorsally
267	**Retroarticular process, development:** *Clark (1994, ch. 71 part); Andrade et al. (2011, ch. 358); Ristevski et al. (2018, ds 2, ch. 234); Smith et al. (in review, ds 1, ch. 239); Ősi et al. (2018, ds 1, ch. 263).* *For practical purposes, a retroarticular process is here considered as (1) when its orientation can be*

	established. *State (1) occurs in Mesoeucrocodylia.* 0. absent or poorly developed 1. present and evidently projecting posterior to glenoid fossa
268	**Retroarticular process, length of the attachment surface for the adductor muscles relative to its width: (*) (ORDERED)** *Jouve et al. (2005, ch. 1 mod.); Jouve et al. (2008, ch. 1 mod.), Andrade et al. (2011, ch. 359); Hastings et al. (2010, ch. 75 mod.); Ristevski et al. (2018, ds 2, ch. 235); Smith et al. (in review, ds 1, ch. 240); Ősi et al. (2018, ds 1, ch. 264).* *State (2) is a putative apomorphy of Dyrosauridae. Note, that in dyrosaurids the retroarticular processes also have a strong posterodorsal curvature.* *This character is not applicable for taxa that lack retroarticular processes.* 0. short, subequal 1. moderately elongated, evidently longer than wide 2. extremely elongate, more than twice its width
269	**Retroarticular process, morphology of the surface for the attachment of adductor muscles: (*)** *Wilkinson et al. (2008, ch. 50 mod.); Young & Andrade (2009, ch. 50 mod.); Andrade et al. (2011, ch. 363); Young et al. (2011, ch. 50 mod.); Young et al. (2013a, ch. 126 mod.); Young et al. (2012, ch. 148 mod.); Young (2014, ch. 152 mod.); Young et al. (2016, ds 2, ch. 179 mod.); Ristevski et al. (2018, ds 2, ch. 236); Smith et al. (in review, ds 1, ch. 241); Ősi et al. (2018, ds 1, ch. 265).* *This character is not applicable for taxa that lack retroarticular processes.* 0. trianglular 1. ellipsoid, rectangular or spoon-shaped 2. shovel-shaped (or paddle-shaped)
270	**Retroarticular process, width: (*)** *Young & Andrade (2009, ch. 152); Young et al. (2011, ch. 152); Young et al. (2013a, ch. 127); Young et al. (2012, ch. 149); Young (2014, ch. 153); Young et al. (2016, ds 2, ch. 180); Ristevski et al. (2018, ds 2, ch. 237); Smith et al. (in review, ds 1, ch. 242); Ősi et al. (2018, ds 1, ch. 266).* *This character is not applicable for taxa that lack retroarticular processes.* 0. narrower than the glenoid fossa 1. wider than the glenoid fossa (projecting medially past the glenoid fossa)
271	**Retroarticular process, length: (*)** *Young & Andrade (2009, ch. 153); Young et al. (2011, ch. 153); Young et al. (2013a, ch. 128); Young et al. (2012, ch. 150); Young (2014, ch. 154); Young et al. (2016, ds 2, ch. 181); Ristevski et al. (2018, ds 2, ch. 238); Smith et al. (in review, ds 1, ch. 243); Ősi et al. (2018, ds 1, ch. 267).* *This character is not applicable for taxa that lack retroarticular processes.* 0. long (longer than wide, and longer than the glenoid fossa width) 1. short (wider than long, and shorter than the glenoid fossa width)
272	**Retroarticular process, position of the posteromedial wing: (*)** *Jouve et al. (2005b, ch. 2); Jouve et al. (2008, ch. 2); Hastings et al. (2010, ch. 76); Andrade et al. (2011, ch. 365); Ristevski et al. (2018, ds 2, ch. 239); Smith et al. (in review, ds 1, ch. 244); Ősi et al. (2018, ds 1, ch. 268).* *State (1) is a putative apomorphy of Dyrosauridae.* *This character is not applicable for taxa that lack retroarticular processes.* 0. posteromedial wing dorsally situated, or at mid height on the retroarticular process 1. posteromedial wing ventrally situated on the retroarticular process

Dentition and alveolar morphologies (Ch. 273 – 337; 14.130% of characters)

[Note abbreviations used in this section: P = premaxilla, M = maxilla, D = dentary. Thus, D1 would refer to the first dentary alveolus, while M4 would be the fourth maxillary alveolus, etc. Tooth count numbering starts from the anterior-most alveolus.]

#	Description
273	**Tooth row, premaxillary alveoli and posterior maxillary alveoli:** *Young & Andrade (2009, ch. 129); Young et al. (2011, ch. 129); Young et al. (2013a, ch. 3); Young et al. (2012, ch. 5); Young (2014, ch. 5); Young et al. (2016, ds 2, ch. 6), Ristevski et al. (2018, ds 2, ch. 13); Smith et al. (in review, ds 1, ch. 14); Ősi et al. (2018, ds 1, ch. 269).* *State (1) is a putative apomorphy of Metriorhynchidae.* *Note that the ventral offset scored by this character is formed by the dorsoventral expansion of the orbits, this results in the ventroposterior curvature of the posterior maxillae (and thus the concave maxillary tooth row).* 0. upper tooth row largely in the same plane (excludes maxillary deflections) 1. posterior maxillary alveoli ventral to all other alveoli (caused by the ventroposterior curvature of the posterior maxillae)
274	**Premaxilla, alveolar count:**

	Young (2006, ch. 26 mod.); Wilkinson et al. (2008, ch. 52 mod.); Young & Andrade (2009, ch. 52 mod.); Nesbitt (2011, ch. 6 mod.); Young et al. (2011, ch. 52 mod.); Young et al. (2013a, ch. 129 mod.); Young et al. (2012, ch. 151 mod.); Young (2014, ch. 155 mod.); Young et al. (2016, ds 2, ch. 182 mod.); Ristevski et al. (2018, ds 2, ch. 240 mod.); Smith et al. (in review, ds 1, ch. 245 mod.); Ősi et al. (2018, ds 1, ch. 270). *State (0) occurs in* Anatosuchus. 0. six or more alveoli 1. five alveoli 2. four alveoli 3. three or fewer alveoli
275	**Maxilla, alveolar count:** *Young (2006, ch. 27 mod.); Wilkinson et al. (2008, ch. 53 mod.); Young & Andrade (2009, ch. 53 mod.); Young et al. (2011, ch. 53 mod.); Young et al. (2013a, ch. 130 mod.); Young et al. (2012, ch. 152 mod.); Young (2014, ch. 156); Young et al. (2016, ds 2, ch. 183); Ristevski et al. (2018, ds 2, ch. 241); Smith et al. (in review, ds 1, ch. 246); Ősi et al. (2018, ds 1, ch. 271).* 0. 11 or fewer alveoli 1. 12–16 alveoli 2. 17–20 alveoli 3. 21–28 alveoli 4. 29 or more alveoli
276	**Maxilla, end of the alveolar row:** *Ristevski et al. (2018, ds 2, ch. 242); Smith et al. (in review, ds 1, ch. 247); Ősi et al. (2018, ds 1, ch. 272).* *State (0) occurs in Dyrosauridae.* *State (2) occurs in the metriorhynchid subclade* Tyrannoneustes lythrodectikos, Purranisaurus, Torvoneustes, 'Metriorhynchus' hastifer *+ Mr. Passmore's specimen. It also occurs in* C. elegans *and* C. suevicus. *It also occurs in Baurusuchidae,* Stolokrosuchus *and* Kaprosuchus + Mahajangasuchus. 0. maxillary tooth row terminates posterior to the posterior margin of the orbit, but does not extend beyond the anteroposterior mid-length of the supratemporal fenestrae 1. maxillary tooth row terminates level to, or posterior to, the anterior margin of the orbit 2. maxillary tooth row terminates prior to the anterior margin of the orbit
277	**Third premaxillary alveoli, relative size when more than three premaxillary alveoli are present: (*)** *Hastings et al. (2010, ch. 16 mod.); Ristevski et al. (2018, ds 2, ch. 243); Smith et al. (in review, ds 1, ch. 248); Ősi et al. (2018, ds 1, ch. 273).* *This character is not applicable for taxa that have fewer than four premaxillary alveoli.* 0. not enlarged relative to both the second and fourth premaxillary alveoli 1. third alveoli are enlarged relative to both adjacent alveoli
278	**Premaxilla, tooth row: (ORDERED)** *Sereno et al. (2001, ch. 69 mod.); Turner & Buckley (2008, ch. 240 mod.); Andrade et al. (2011, ch. 390 mod.); Young et al. (2016, ds 2, ch. 12 mod.), Ristevski et al. (2018, ds 2, ch. 25); Smith et al. (in review, ds 1, ch. 26); Ősi et al. (2018, ds 1, ch. 274).* *State (2) occurs in the pholidosaurids* Chalawan, Sarcosuchus, Pholidosaurus schaumburgensis *(based on the German natural mould specimens) and* Meridiosaurus. *The morphology in* Elosuchus *and the French* Pholidosaurus *approaches this condition, however the P5 is directed posteriorly and the premaxilla has definitive lateral margins rather than a curved anterolateral curve (however, this could be due to the enlargement of the P3 alveoli). Here, we have created a new character state (1) to accommodate this morphology.* *State (3) is a modification seen in* Terminonaris *and* Oceanosuchus. 0. alveoli along the anterior and lateral margins 1. in a slight semi-circle, (similar to state 2), but the P5 alveolar are directly posteriorly, and the premaxilla still has definitive lateral margins rather than a true anterolateral curve 2. in a slight semi-circle, resulting in the premaxillary alveoli being restricted to the anterior and anterolateral margins 3. the premaxillary tooth row is restricted to an even tighter curve, resulting in the P5 alveoli being lateral to the P4 alveoli and being somewhat laterally oriented (compared to the other four alveoli). The tighter curve means the normally very transversely wide premaxilla of pholidosaurids is now much less wide (with the maximal width at the P5)
279	**Number of teeth partially supported by both the premaxilla and maxilla:** *Young & Andrade (2009, ch. 162); Young et al. (2011, ch. 162); Young et al. (2013a, ch. 131); Young et al. (2012, ch. 153); Young (2014, ch. 157); Young et al. (2016, ds 2, ch. 184); Ristevski et al. (2018, ds 2, ch. 244); Smith et al. (in review, ds 1, ch. 249); Ősi et al. (2018, ds 1, ch. 275).* *State (1) occurs in* Mariliasuchus *and* Notosuchus. 0. none 1. one
280	**Presence of a premaxillary lamina extending posteriorly along the palatal surface that overlaps**

	the anterior margin of the first maxillary alveoli: *Ristevski et al. (2018, ds 2, ch. 245); Smith et al. (in review, ds 1, ch. 250); Ősi et al. (2018, ds 1, ch. 276).* *State (1) occurs in* Tyrannoneustes lythrodectikos, Torvoneustes, 'Metriorhynchus' hastifer *and Mr. Passmore's specimen.* 0. absent 1. present
281	**Anterior margin of maxillary alveolus one:** *Ristevski et al. (2018, ds 2, ch. 246); Smith et al. (in review, ds 1, ch. 251); Ősi et al. (2018, ds 1, ch. 277).* *State (1) occurs in* Metriorhynchus superciliosus *and* M. geoffroyii. 0. lacks an interdigitating suture with the premaxilla 1. has an interdigitating suture with the premaxilla, restricted to the anterior margin of the first maxillary alveolus
282	**Dentary, alveolar count:** *Young (2006, ch. 28 mod.); Wilkinson et al. (2008, ch. 54 mod.); Young & Andrade (2009, ch. 54 mod.); Young et al. (2011, ch. 54 mod.); Young et al. (2013a, ch. 132 mod.); Young et al. (2012, ch. 154); Young (2014, ch. 158); Young et al. (2016, ds 2, ch. 185); Ristevski et al. (2018, ds 2, ch. 247); Smith et al. (in review, ds 1, ch. 252); Ősi et al. (2018, ds 1, ch. 278).* *This character does not covary with the maxillary alveolar count character, as some taxa (e.g.* 'Metriorhynchus' casamiquelai*) have more teeth in the dentary than in the maxilla.* 0. 30 or more alveoli per rami 1. 20–29 alveoli 2. 19–15 alveoli 3. 14 or fewer alveoli
283	**Maxillary anterior alveoli shape:** *Young et al. (2016, ds 2, ch. 186); Ristevski et al. (2018, ds 2, ch. 248); Smith et al. (in review, ds 1, ch. 253); Ősi et al. (2018, ds 1, ch. 279).* *In Thalattosuchia, state (1) is a putative apomorphy of the clade* 'Metriorhynchus' hastifer *and Mr. Passmore's specimen.* *Note that shearing or crushing of the snout can make this character hard to discern.* 0. sub-circular 1. sub-oval, being wider transversely than anteroposteriorly
284	**Maxillary interalveolar spaces, relative size:** *Young (2014, ch. 159); Young et al. (2016, ds 2, ch. 187); Ristevski et al. (2018, ds 2, ch. 249); Smith et al. (in review, ds 1, ch. 254); Ősi et al. (2018, ds 1, ch. 280).* *State (1) is a putative apomorphy of* Dakosaurus + Plesiosuchus *sub-clade and* Gracilineustes leedsi. *This character correlates with the dentary interalveolar space character for the metriorhynchids* Gracilineustes leedsi and *the* Dakosaurus + Plesiosuchus *sub-clade*; *however, the maxillary interalveolar spacing does not correlate with the dentary character for the teleosaurid* Machimosaurus hugii. *State (1) does not occur in* Torvoneustes carpenteri, 'Metriorhynchus' hastifer *and Mr. Passmore's specimen as some interalveolar spaces are large, over half the length of the adjacent alveoli and they do not alway share the same alveolar lamina. They appear to evolve an analogous, but slightly different morphology, which has not yet been scored.* *State (1) also occurs in* Iharkutosuchus makadii. 0. Interalveolar spaces are variable in size, some are similar in length to the adjacent alveoli, while others are approximately half the length of the immediately adjacent alveoli (especially towards the end of the maxillary tooth row) 1. Interalveolar spaces are/almost completely uniformly narrow, being approximately one quarter the length of the adjacent alveoli (or even smaller). The adjacent alveoli share the same alveolar lamina.
285	**Dentary tooth-row, distinctly sigmoidal:** *Young et al. (2016, ds 2, ch. 165); Ristevski et al. (2018, ds 2, ch. 219); Smith et al. (in review, ds 1, ch. 223); Ősi et al. (2018, ds 1, ch. 281).* *State (1) occurs in Hylaeochampsidae.* 0. no 1. yes, with the anterior alveoli orientated slightly anterolaterally and the posterior alveoli orientated posteromedially, between these two orientations the mid-region alveoli become dorsally orientated
286	**Dentary alveoli one, orientation:** *Young et al. (2016, ds 2, ch. 188); Ristevski et al. (2018, ds 2, ch. 250); Smith et al. (in review, ds 1, ch. 255); Ősi et al. (2018, ds 1, ch. 282).* *State (1) occurs in Tethysuchia (e.g. dyrosaurids,* Sarcosuchus, Chalawan) *and* Hamadasuchus. *State (2) occurs in the* Pachycheilosuchus + Pietraroiasuchus *clade,* Iharkutosuchus makadii, Dakosaurus *and* Maledictosuchus riclaensis. *This morphology differs from the procumbency of the first dentary alveolus seen in* Cricosaurus aracuanensis, *as they are also partially laterally orientated.*

	0. dorsally orientated 1. mainly dorsally orientated, but with a slight anterior orientation 2. strongly anteriorly orientated (procumbent), resulting in the first dentary tooth being directed anteriorly from the mouth, along anteroposterior axis of the skull
287	**Dentary interalveolar spaces, relative size:** *Young (2014, ch. 160); Young et al. (2012, ch. 131 mod.); Young et al. (2016, ds 2, ch. 189); Ristevski et al. (2018, ds 2, ch. 251); Smith et al. (in review, ds 1, ch. 256); Ősi et al. (2018, ds 1, ch. 283).* *State (1) occurs in the thalattosuchians* Dakosaurus + Plesiosuchus *sub-clade,* Gracilineustes leedsi *and* Machimosaurus hugii. *It also occurs in* Iharkutosuchus makadii. *This character correlates with the maxillary interalveolar space character for the metriorhynchids* Gracilineustes leedsi *and the* Dakosaurus + Plesiosuchus *sub-clade, and for the hylaeochampsid* Iharkutosuchus makadii*, but does not for the teleosaurid* Machimosaurus hugii. 0. interalveolar spaces are variable in size, some are similar in length to the adjacent alveoli, while others are approximately half the length of the immediately adjacent alveoli 1. interalveolar spaces are/almost completely uniformly narrow, being approximately one quarter the length of the immediately adjacent alveoli (or even smaller)
288	**Dentary alveoli, diastema between the first and second alveoli:** *Young et al. (2016, ds 2, ch. 190); Ristevski et al. (2018, ds 2, ch. 252); Smith et al. (in review, ds 1, ch. 257) Ősi et al. (2018, ds 1, ch. 284).* *State (1) is a putative apomorphy of* Dakosaurus maximus. 0. absent 1. present
289	**Dentary alveoli 1–2, confluence:** *Andrade et al. (2011, ch. 402); Young et al. (2016, ds 2, ch. 191); Ristevski et al. (2018, ds 2, ch. 253); Smith et al. (in review, ds 1, ch. 258); Ősi et al. (2018, ds 1, ch. 285).* *State (1) is a putative apomorphy of Goniopholis.* 0. well-separated, usually as much distant from each other as from other dentary teeth 1. alveoli 1–2 confluent, separated by a thin alveolar wall, and clearly apart from neighbouring alveoli
290	**D2 alveoli, size relative to D1 alveoli:** *Hastings et al. (2010, ch. 64 mod.); Young et al. (2016, ds 2, ch. 192); Ristevski et al. (2018, ds 2, ch. 254); Smith et al. (in review, ds 1, ch. 259); Ősi et al. (2018, ds 1, ch. 286).* 0. similar in size 1. reduced in size relative to both adjacent alveoli
291	**D3 alveoli, position:** *Hastings et al. (2010, ch. 66 mod.); Ristevski et al. (2018, ds 2, ch. 255); Smith et al. (in review, ds 1, ch. 260); Ősi et al. (2018, ds 1, ch. 287).* 0. interalveolar space between D2 and D3 is approximately equal to that between D3 and D4 1. closer to the D4 alveoli
292	**Interalveolar space between the D2 and D3 alveoli relative to that of the D1 and D2 alveoli:** *Hastings et al. (2010, ch. 65 mod.); Young et al. (2016, ds 2, ch. 193); Ristevski et al. (2018, ds 2, ch. 256); Smith et al. (in review, ds 1, ch. 261); Ősi et al. (2018, ds 1, ch. 288).* 0. approximately equal in proportion 1. the D2–D3 interalveolar space is longer than the interalveolar space between the D1 and D2
293	**D4 alveolar wall:** *Hastings et al. (2010, ch. 68 mod.); Young et al. (2016, ds 2, ch. 194); Ristevski et al. (2018, ds 2, ch. 257); Smith et al. (in review, ds 1, ch. 262); Ősi et al. (2018, ds 1, ch. 289).* 0. level with the adjacent alveoli 1. raised relative to the adjacent alveoli
294	**Dentary alveoli, diastema present between the fourth and fifth alveoli:** *Young (2014, ch. 161); Young et al. (2016, ds 2, ch. 195); Ristevski et al. (2018, ds 2, ch. 258); Smith et al. (in review, ds 1, ch. 263); Ősi et al. (2018, ds 1, ch. 290).* *State (1) is a putative apomorphy of Thalattosuchia and* Sarcosuchus. *Within Thalattosuchia: state (0) is a putative apomorphy of the* Dakosaurus + Plesiosuchus *sub-clade. Note that while the very small dentary interalveolar spaces are putative apomorphies of* Dakosaurus, Plesiosuchus *and* Gracilineustes leedsi*, the D4–D5 diastema is still present in* Gracilineustes leedsi. 0. absent 1. present
295	**D7 alveoli, size:** *Jouve (2004, ch. 153 mod.); Jouve (2005, ch. 3 mod.); Jouve et al. (2005b, ch. 8 mod.); Jouve et al. (2006, ch. 164 mod.); Jouve et al. (2008, ch. 8 mod.); Hastings et al. (2010, ch. 73 mod.); Young et al. (2016, ds 2, ch. 196 mod.); Ristevski et al. (2018, ds 2, ch. 259); Smith et al. (in review, ds 1, ch. 264); Ősi et al. (2018, ds 1, ch. 291).* *State (1) occurs in Dyrosauridae.* 0. comparable in size to the adjacent alveoli 1. reduced in size compared to the adjacent alveoli
296	**D7 alveoli, position:**

	Jouve (2004, ch. 153 mod.); Jouve (2005a, ch. 3 mod.); Jouve et al. (2005b, ch. 8 mod.); Jouve et al. (2006, ch. 164 mod.); Jouve et al. (2008, ch. 8 mod.); Hastings et al. (2010, ch. 73 mod.); Young et al. (2016, ds 2, ch. 197 mod.); Ristevski et al. (2018, ds 2, ch. 260); Smith et al. (in review, ds 1, ch. 265); Ősi et al. (2018, ds 1, ch. 292). *State (1) occurs in Dyrosauridae.* 0. comparable in size to the adjacent alveoli 1. close in position to the eighth alveoli
297	**Dentary alveoli, number of alveoli adjacent to the mandibular symphysis:** *Young (2014, ch. 162); Young et al. (2016, ds 2, ch. 198); Ristevski et al. (2018, ds 2, ch. 261); Smith et al. (in review, ds 1, ch. 266); Ősi et al. (2018, ds 1, ch. 293).* *Within Thalattosuchia: state (3) is a putative apomorphy of* Dakosaurus. 0. 15 or more 1. 10 to 14 2. 7 to 9 3. 4 to 6 4. fewer than 4
298	**Premaxilla-anterior maxillary tooth crown apicobasal length to basal width ratio:** *Young et al. (2012, ch. 155); Young (2014, ch. 163); Young et al. (2016, ds 2, ch. 199); Ristevski et al. (2018, ds 2, ch. 262); Smith et al. (in review, ds 1, ch. 267); Ősi et al. (2018, ds 1, ch. 294).* 0. 3 or greater 1. 2.5 or less
299	**Anterior maxilla, crown size:** *Wilkinson et al. (2008, ch. 56); Young & Andrade (2009, ch. 56); Young et al. (2011, ch. 56); Young et al. (2013a, ch. 133); Young et al. (2012, ch. 156); Young (2014, ch. 164); Young et al. (2016, ds 2, ch. 200); Ristevski et al. (2018, ds 2, ch. 263); Smith et al. (in review, ds 1, ch. 268); Ősi et al. (2018, ds 1, ch. 295).* *It is currently unknown if this character correlates with the character quantifying mandibular symphysis depth across Crocodylomorpha. However, in Geosaurinae this is not the case, as shown by Young et al. (2013), the symphysis is deeper in* 'Metriorhynchus' brachyrhynchus *than* Tyrannoneustes lythrodectikos*, but the latter has tooth crowns with a greater apicobasal length. Moreover, the symphyseal depth of* Dakosaurus maximus *and* Plesiosuchus manselii *noticeably differ, but both taxa have tooth crowns similar in apicobasal length (Young et al., 2012).* *Anterior maxilla = tooth crowns of the anterior half of the maxillary tooth row.* 0. crowns not enlarged (typically less than 3cm in apicobasal length) 1. moderately enlarged (between 3 and 4 cm in apicobasal length) 2. enlarged (apicobasal length 5 cm or greater)
300	**Anterior maxilla, mediolateral compression/crown cross section:** *Young (2006, ch. 30); Wilkinson et al. (2008, ch. 57); Young & Andrade (2009, ch. 57); Young et al. (2011, ch. 57); Young et al. (2013a, ch. 134 mod.); Young et al. (2012, ch. 157); Young (2014, ch. 165); Young et al. (2016, ds 2, ch. 201); Ristevski et al. (2018, ds 2, ch. 264); Smith et al. (in review, ds 1, ch. 269); Ősi et al. (2018, ds 1, ch. 296).* 0. no mediolateral compression 1. weak mediolateral compression (crown midpoint labiolingual width 60–90% distal-medial width) 2. strong mediolateral compression (crown midpoint labiolingual width less than 60% distal-medial width)
301	**Anterior maxilla, constriction at base of crowns:** *Young (2006, ch. 32); Wilkinson et al. (2008, ch. 59); Young & Andrade (2009, ch. 59); Young et al. (2011, ch. 59); Young et al. (2013a, ch. 135); Young et al. (2012, ch. 159); Young (2014, ch. 167); Young et al. (2016, ch. 203); Ristevski et al. (2018, ds 2, ch. 266); Smith et al. (in review, ds 1, ch. 271); Ősi et al. (2018, ds 1, ch. 297).* 0. absent 1. present
302	**Maxillary teeth, orientation of the anterior to mid-snout crowns:** *Young & Andrade (2009, ch. 123); Young et al. (2011, ch. 123); Young et al. (2013a, ch. 136); Young et al. (2012, ch. 160); Young (2014, ch. 168); Young et al. (2016, ds 2, ch. 204); Ristevski et al. (2018, ds 2, ch. 267); Smith et al. (in review, ds 1, ch. 272); Ősi et al. (2018, ds 1, ch. 298).* 0. not procumbent 1. procumbent
303	**Posterior maxilla, presence of enamel bands:** *Gasparini et al. (2006, ch. 242); Andrade et al. (2011, ch. 418); Young et al. (2011, ch. 167); Young et al. (2013a, ch. 137); Young et al. (2012, ch. 161); Young (2014, ch. 169); Young et al. (2016, ds 2, ch. 205); Ristevski et al. (2018, ds 2, ch. 268); Smith et al. (in review, ds 1, ch. 273); Ősi et al. (2018, ds 1, ch. 299).* *'Enamel bands' follow the definition by Brusatte et al. (2007).* *Posterior maxilla = tooth crowns in the posterior half of the maxillary tooth row.* *State (1) occurs in* Dakosaurus *and* Geosaurus.

	0. absent 1. present
304	**Anterior maxilla, tooth crown tip:** *Young et al. (2011, ch. 183); Young et al. (2013a, ch. 138); Young et al. (2012, ch. 162); Young (2014, ch. 170); Young et al. (2016, ds 2, ch. 206); Ristevski et al. (2018, ds 2, ch. 269); Smith et al. (in review, ds 1, ch. 274); Ősi et al. (2018, ds 1, ch. 300).* 0. sharp or worn apex 1. blunt and rounded at the tips
305	**Dentary tooth opposite to premaxilla-maxilla contact, isometry:** *based on Clark (1994, ch. 80); Wilkinson et al. (2008, ch. 60); Young & Andrade (2009, ch. 60); Andrade et al. (2011, ch. 408); Young et al. (2011, ch. 60); Young et al. (2013a, ch. 139); Young et al. (2012, ch. 163); Young (2014, ch. 171); Young et al. (2016, ds 2, ch. 207); Ristevski et al. (2018, ds 1, ch. 408); Smith et al. (in review, ds 2, ch. 408); Ősi et al. (2018, ds 1, ch. 301).* *Alveolar size may be used as a reasonable proxy for crown size, when teeth are not preserved.* 0. subequal to other neighbouring teeth 1. tooth is at least evidently enlarged, anisometric relative to other neighbouring teeth
306	**Dentary tooth opposite to premaxilla-maxilla contact, length:** *Clark (1994, ch. 80); Sereno et al. (2003, ch. 54); Andrade & Bertini (2008a, ch. 142); Andrade et al. (2011, ch. 409); Ristevski et al. (2018, ds 1, ch. 409); Smith et al. (in review, ds 2, ch. 409); Ősi et al. (2018, ds 1, ch. 302).* *Alveolar size may be used as a reasonable proxy for crown size, when teeth are not preserved.* 0. small to medium sized, but length is no more than twice the length of other neighbouring teeth 1. hypertrophied, at least twice longer than neighboring teeth
307	**Dentary tooth opposite to premaxillary-maxillary suture, occlusion:** *Norell (1988, ch. 29); Brochu (1999, ch. 77 mod.); Andrade et al. (2011, ch. 410); Ristevski et al. (2018, ds 1, ch. 410); Smith et al. (in review, ds 2, ch. 410); Ősi et al. (2018, ds 1, ch. 303).* *The series cannot be ordered, as a transition between states (0) - (2) is possible without intermediate steps.* 0. occludes either in notch at premaxilla and maxilla early in ontogeny, or lateral to premaxilla-maxilla suture, when the notch is absent or poorly defined 1. occludes in a pit between premaxilla and maxilla; no notch early in ontogeny 2. occludes medial to premaxilla-maxilla suture, but not in a pit or a notch
308	**Dentary tooth occluding against premaxillary-maxillary suture:** *based on Norell (1988, ch. 29) and Clark (1994, ch. 80) and Brochu (1999, ch. 77); Andrade et al. (2011, ch. 411); Ristevski et al. (2018, ds 1, ch. 411); Smith et al. (in review, ds 2, ch. 411); Ősi et al. (2018, ds 1, ch. 304).* *The tooth occluding to the premaxillomaxillary suture is usually seen as the fourth dentary tooth, but in Crocodylomorpha this may be another tooth due to the loss of anterior teeth or other morphological adaptation. The tooth is not necessarily enlarged, and may be isometric to neighbouring teeth.* *State (0) is putative apomorphy of* Mahajangasuchus, *Sphagesauridae, and Teleosauridae.* *State (2) is putative apomorphy of* Sarcosuchus. *Note that in teleosaurids, the D3 tooth contacts the premaxilla-maxilla suture, not the D4 tooth, due to the orientation of the D3-D4 couplet.* 0. third, or anterior 1. fourth 2. fifth, or posterior
309	**Dentition, relation between tooth rows on both sides of the skull:** *Novas et al. (2009); Andrade et al. (2011, ch. 367); Ristevski et al. (2018, ds 1, ch. 367); Smith et al. (in review, ds 2, ch. 367); Ősi et al. (2018, ds 1, ch. 305).* *State (1) is putative autapomorphy of* Yacarerani*, where maxillary tooth rows converge at mid-palate, the same occurring with the dentition in the mandible. As a consequence, anterior teeth (pairs 1-4) both in the upper and lower dentition constitute functionally distinct sets, one anterior and one posterior. Teeth at the posterior set (mid-dentition) are located close to the median line of the skull, with first tooth at least almost in contact with its complementary tooth.* 0. forming one continuous set of teeth, both in the cranium and mandible 1. forming two distinct sets, tooth rows at posterior set convergent rostrally and almost in touch each other, at mid-palate and mandible
310	**Posterior maxillary teeth, transverse section:** *Buckley et al. (2000, ch. 116 mod.); Ortega et al. (2000, ch. 104 mod.); Andrade & Bertini (2008, ch. 135); Andrade et al. (2011, ch. 368); Ristevski et al. (2018, ds 1, ch. 368); Smith et al. (in review, ds 2, ch. 368); Ősi et al. (2018, ds 1, ch. 306).* 0. evident lateral compression affecting both edges of the crown, making both edges evident regardless of the presence/absence of carinae/keel 1. transverse section circular to subcircular, without significant lateral compression 2. transverse section ‘teardrop-like’ (= triangular), with asymmetric lateral compression occurring on the distal margin only

311	**Mid to posterior mandibular teeth, transverse section:** *Buckley et al. (2000, ch. 116 mod.); Ortega et al. (2000, ch. 104 mod.); as in Andrade & Bertini (2008, ch. 146); Andrade et al. (2011, ch. 369); Ristevski et al. (2018, ds 1, ch. 369); Smith et al. (in review, ds 2, ch. 369); Ősi et al. (2018, ds 1, ch. 307).* 0. evident lateral compression affecting the entire crown, making evident both mesial and distal edges, regardless of the presence/absence of carinae/keel 1. transverse section circular to subcircular, without significant lateral compression 2. transverse section 'teardrop-like' (= triangular), with asymmetric lateral compression occurring on the mesial margin only
312	**Dentition, presence of apicobasal facets on the labial sufrace:** *Young & Andrade (2009, ch. 130); Andrade et al. (2011, ch. 370); Young et al. (2011, ch. 130); Young et al. (2013a, ch. 140); Young et al. (2012, ch. 164); Young (2014, ch. 172); Young et al. (2016, ds 2, ch. 208); Ristevski et al. (2018, ds 2, ch. 271); Smith et al. (in review, ds 1, ch. 276); Ősi et al. (2018, ds 1, ch. 308).* *State (1) is a putative apomorphy of* Geosaurus giganteus, G. grandis + Ieldraan melkshamensis. 0. absent, either lacking facets, or facetted into 4–5 indistinct planes 1. present, most crowns have the labial surface distinctly facetted into three planes (one large medial one, and two smaller planes either side)
313	**Dentition, presence of laminar teeth:** *Andrade et al. (2011, ch. 371); Young et al. (2011, ch. 170); Young et al. (2013a, ch. 141); Young et al. (2012, ch. 165); Young (2014, ch. 173); Young et al. (2016, ds 2, ch. 209); Ristevski et al. (2018, ds 2, ch. 272); Smith et al. (in review, ds 1, ch. 277); Ősi et al. (2018, ds 1, ch. 309).* *State (1) is a putative apomorphy of Geosaurina (*Geosaurus + Ieldraan*).* *For practical purposes, 'laminar tooth' are here considered as teeth with cross-section highly elliptical at the base of crown, with mesial-distal axis approximately twice the labial-lingual axis, or greater.* 0. absent 1. present, laminar teeth dominate dentition
314	**Dentition, presence of spatulated teeth:** *Buckley et al. (2000, ch. 116 mod.); Andrade et al. (2011, ch. 372); Ristevski et al. (2018, ds 1, ch. 372); Smith et al. (in review, ds 2, ch. 372); Ősi et al. (2018, ds 1, ch. 310).* *The spatulated morphology refers to the morphology of the crown, not simply its compression, number of cusps or presence of cingula. Therefore, it is considered as a different character, and treated separately. However, all spatulated teeth are considered as laterally compressed.* *State (1) occurs in* Candidodon, Malawisuchus *and* Uruguaysuchus. 0. absent 1. present
315	**Dentition, presence of tribodont teeth in both the posterior maxillae and dentaries:** *Ristevski et al. (2018, ds 2, ch. 274); Smith et al. (in review, ds 1, ch. 279); Ősi et al. (2018, ds 1, ch. 311).* *State (1) occurs in Bernissartiidae and in some alligatoroids.* *For practical purposes, 'tribodont teeth' are here considered as teeth that are 'low crowned', bulbous, mesiodistally compressed, single cusped, and lack carinae.* 0. absent 1. present
316	**Mid to posterior dentition, presence of pebbled ornamentation on tooth crown surface:** *Andrade et al. (2011, ch. 374); Ristevski et al. (2018, ds 1, ch. 374); Smith et al. (in review, ds 2, ch. 374); Ősi et al. (2018, ds 1, ch. 312).* *State (1) is putative apomorphy of Sphagesauridae.* 0. absent 1. present, enamel ornamented with a peebled pattern
317	**Mid to posterior dentition, presence of accessory ridges on labial-lingual surfaces of crown:** *Andrade et al. (2011, ch. 376); Ristevski et al. (2018, ds 1, ch. 376); Smith et al. (in review, ds 2, ch. 376); Ősi et al. (2018, ds 1, ch. 313).* *The ridges present in* Notosuchus *and sphagesaurids do involve enamel and dentine, therefore should not be considered as superficial ornamentation.* *State (1) occurs in* Notosuchus *and in derived sphagesaurids (i.e. not* Adamantinasuchus *and* Yacareni*).* 0. absent 1. present, apicobasal, evident and well-spaced, formed by enamel and dentine
318	**Mid to posterior dentition, number of cusps per tooth:** *Gomani (1997, ch. 46 mod.); Buckley et al. (2000, ch. 113 mod.); Pol (2003, ch. 162 mod.); Turner & Buckley (2008, ch. 188 mod.); Andrade et al. (2011, ch. 377); Ristevski et al. (2018, ds 1, ch. 377); Smith et al. (in review, ds 2, ch. 377); Ősi et al. (2018, ds 1, ch. 314).* *This character was modified by Andrade et al. (2011), and here only the main crown is evaluated, not the presence of accessory cusps in cingula. This is considered as a separate character. However, note that states (2) and (3) sample teeth where primary and secondary rows of cusps are present, while in*

	states (0) and (1) there is only one row. *State (1) occurs in* Malawisuchus. *State (2) occurs in* Iharkutosuchus. *State (3) occurs in* Edentosuchus *and* Kayentasuchus, *not sampled in this analysis.* 0. each crown has single apical cusp, regardless of presence of accessory cusps in cingula 1. each crown has one main cusp aligned with smaller cusps, arranged in a single row 2. several cusps, unequal in size, arranged in more than one row 3. multiple small cusps, subequal in size, along edges of occlusal surface
319	**Tooth wear, macroscopic wear along the carinae/mesiodistal margins:** *Young et al. (2016, ds 2, ch. 211); Ristevski et al. (2018, ds 2, ch. 275); Smith et al. (in review, ds 1, ch. 280); Ősi et al. (2018, ds 1, ch. 315).* *State (1) is a putative apomorphy of* Dakosaurus + *Mr Leeds dakosaur.* 0. absent 1. present
320	**Anterior–middle dentition, tooth crown curvature:** *Young (2006, ch. 31); Wilkinson et al. (2008, ch. 58); Young & Andrade (2009, ch. 58); Young et al. (2011, ch. 58); Young et al. (2013a, ch. 142); Young et al. (2012, ch. 166); Young (2014, ch. 174); Young et al. (2016, ds 2, ch. 212); Ristevski et al. (2018, ds 2, ch. 276); Smith et al. (in review, ds 1, ch. 281); Ősi et al. (2018, ds 1, ch. 316).* 0. none, crown apical/subapical (between 91 – 89 degrees) 1. weakly recurved (between 88 – 82 degrees) 2. strongly recurved (less than 80 degrees)
321	**Carinae, presence of keel at the edge of tooth crown:** *Young (2006, ch. 29 mod., part); Wilkinson et al. (2008, ch. 55 mod., part); Young & Andrade (2009, ch. 55 mod., part); Andrade et al. (2011, ch. 378); Young et al. (2011, ch. 55 mod., part); Young et al. (2013a, ch. 143 mod., part); Young et al. (2012, ch. 167 mod.); Young (2014, ch. 175); Young et al. (2016, ds 2, ch. 213 mod.); Ristevski et al. (2018, ds 2, ch. 277); Smith et al. (in review, ds 1, ch. 282); Ősi et al. (2018, ds 1, ch. 317).* *Currently, no data suggests differential presence of keels in antero-posterior or upper-lower dentition, therefore a single character is used. Mesial-distal keels may occur independently from denticles in the mesial and distal carinae; denticulated carinae may or may not have keel on denticles.* 0. absent (i.e. lacks keeled carinae) 1. present (i.e. carinated sensu stricto, created by a smooth keel [raised ridge] on the crown edges, typically on the mesial and distal margins)
322	**Carinae, presence of 'carinal flanges': (*)** *Ristevski et al. (2018, ds 2, ch. 278); Smith et al. (in review, ds 1, ch. 283); Ősi et al. (2018, ds 1, ch. 318).* *State (1) occurs in* Plesiosuchus, Suchodus *and Mr Leeds Dakosaur*. *State (2) occurs in* Dakosaurus. *This character is not applicable for taxa that lack carinae on all tooth crowns.* 0. absent - the external surfaces of the tooth crowns are still convex/straight when they approach the carinae 1. poorly-developed - the external surface of the tooth crown becomes concave immediately adjacent to the carinae. However, they are unequally expressed on the labial and lingual surfaces, and are rarely expressed along the entire carina 2. well-developed - the external surface of the tooth crown becomes concave immediately adjacent to the carinae. They are present on both the labial and lingual surfaces, being most noticeably developed at the mid-crown and apex
323	**Carinae, height of the keel in the apical region:** *Ristevski et al. (2018, ds 2, ch. 279); Smith et al. (in review, ds 1, ch. 284); Ősi et al. (2018, ds 1, ch. 319).* *State (1) occurs in* Torvoneustes. 0. keel is either absent, or not greatly enlarged 1. keel is greatly enlarged in height
324	**Carinae, presence of false zipdont serrations at crown edges: (*)** *Young et al. (2011, ch. 172 part); Young et al. (2013a, ch. 144 part); Young et al. (2012, ch. 168 part); Young (2014, ch. 176 part); Young et al. (2016, ds 2, ch. 214 part); Ristevski et al. (2018, ds 2, ch. 280); Smith et al. (in review, ds 1, ch. 285); Ősi et al. (2018, ds 1, ch. 320).* *This character is not applicable for taxa that lack carinae on all tooth crowns.* *False ziphodonty (= conspicuous superficial enamel ornamentation contacting the keel) herein follows the definition described in Prasad & de Lapparent de Broin (2002).* *State (1) occurs in* Theriosuchus pusillus. *State (2) occurs in* Goniopholis, Anteophthalmosuchus, Torvoneustes*, and Machimosaurini.* 0. absent across the dentition 1. present, but restricted to the tooth crowns in the posterior end of the tooth row 2. present across the dentition

325	**Carinae, presence and development of true denticles at crown edges: (*)** *Young (2006, ch. 29 part); Wilkinson et al. (2008, ch. 55 part); Young & Andrade (2009, ch. 53 part); Young et al. (2011, ch. 53 part); Young et al. (2012, ch. 169); Young (2014, ch. 177); Young et al. (2016, ds 2, ch. 215); Ristevski et al. (2018, ds 2, ch. 281); Smith et al. (in review, ds 1, ch. 286); Ősi et al. (2018, ds 1, ch. 321).* *In Thalattosuchia, basal geosaurines are scored as state (1).* *Derived genera within Geosaurini are scored as state (2).* *This character is not applicable for taxa that lack carinae on all tooth crowns.* *True ziphodonty herein follows the definition described in Prasad & de Lapparent de Broin (2002).* 0. absent 1. incipient denticles that are poorly defined (hard to discern, in some cases even under Scanning Electron Microscopy). Typically, they either alter the height of the carinal keel very little or not at all (definition described in Young *et al*., 2013) 2. well-defined denticles (can be discerned with or without optical aids)
326	**Carinae (mid-posterior dentition), presence and morphology of denticles at crown edges:** *Buckley et al. (2000, ch. 104 mod.); Sereno et al. (2003, ch. 53 mod.); Andrade & Bertini (2008a, ch. 132 rev.); Andrade et al. (2011, ch. 379 mod. – character states re-ordered); Young et al. (2011, ch. 172 mod.); Young et al. (2013a, ch. 145 mod.); Young et al. (2012, ch. 170 mod.); Young (2014, ch. 178 mod.); Young et al. (2016, ds 2. ch. 216 mod. – new character state added); Ristevski et al. (2018, ds 2, ch. 282); Smith et al. (in review, ds 1, ch. 287); Ősi et al. (2018, ds 1, ch. 322).* *State (1) is putative apomorphy of Notosuchidae + Sphagesauridae.* *In Thalattosuchia, basal geosaurines score as state (2).* *Derived genera within Geosaurini score as state (3).* *Note that this character and the character describing the presence of true denticles appear to correlate. However, the two morphologies are not the same, and it is possible that taxa can score differently for these two characters (i.e., the ziphomorphy condition – see Andrade & Bertini, 2008a). Moreover, in Metriorhynchidae the development of the denticles, and whether they form a contiguous row along the carina is highly variable. Some taxa have contiguous and well-defined denticles (e.g.* Dakosaurus, Plesiosuchus, Geosaurus*) while some taxa have contiguous but incipient denticles (*Torvoneustes*), others non-contiguous incipient denticles (*Tyrannoneustes, 'M.' brachyrhynchus*).* 0. carinae and/or denticles are absent (non-ziphodont), or homogenous carina where serrations may appear as the result of superficial enamel ornamentation (false ziphodont) 1. heterogeneous carina, tubercle-like true denticles that do not form a series (ziphomorph) 2. heterogeneous carina, cuneiform or ripple-like true denticles form short rows of 2–10 denticles and do not proceed contiguously along the entire carina (incipient ziphodont) 3. homogeneous carina, cuneiform or ripple-like true true denticles form a contiguous, or near contiguous, series along the entire carina (ziphodont)
327	**Carinae, true denticle shape when observed in lingual or labial view: (*)** *Young et al. (2012, ch. 171); Young (2014, ch. 179); Young et al. (2016, ds 2, ch. 217); Ristevski et al. (2018, ds 2, ch. 283); Smith et al. (in review, ds 1, ch. 288); Ősi et al. (2018, ds 1, ch. 323).* *In Thalattosuchia, Plesiosuchina (*Plesiosuchus *and* Suchodus*)* are *scored as state (0).* *This character is not applicable for taxa that lack carinae on all tooth crowns, and for those that lack denticles.* 0. "chisel"-shaped or rectangular 1. rounded
328	**Carinae, denticle distribution across the dentition:** *Young et al. (2012, ch. 172); Young (2014, ch. 180); Young et al. (2016, ds 2, ch. 218); Ristevski et al. (2018, ds 2, ch. 284); Smith et al. (in review, ds 1, ch. 289); Ősi et al. (2018, ds 1, ch. 324).* *In Thalattosuchia, state (2) occurs in* Dakosaurus. *At present no taxon is known to combine the microziphodont and macroziphodont conditions. However, it is entirely possible that such a taxon could occur. As such, state (3) was created.* *In Thalattosuchia,* Dakosaurus *scores as (2), while* 'Metriorhynchus' brachyrhynchus, Tyrannoneustes lythrodectikos, Torvoneustes, Geosaurus *and* Plesiosuchus *score as (1).* *Note that this character appears to correlate with the characters describing the incipient/well-developed denticles) and homogeneous/heterogenous carinae. However, these morphologies are not the same, and it is possible that taxa can score differently for these three characters.* *In Metriorhynchidae the development of the macroscopic denticles is a putative apomorphy of* Dakosaurus*, giving this genus macroscopic, well-defined contiguous denticles. In contrast,* Plesiosuchus *and* Geosaurus *have microscopic, well-defined contiguous denticles;* Torvoneustes *has microscopic, incipient contiguous denticles; while* Tyrannoneustes *and* 'M.' brachyrhynchus *have microscopic, incipient, non-contiguous denticles.* *Thus, these three characters are describing a different aspect of denticle development and arrangement.* 0. all or most teeth lack denticles 1. all teeth are microziphodont (*sensu* Andrade *et al*., 2010) 2. all teeth are macroziphodont (*sensu* Andrade *et al*., 2010)

	3. teeth show variation in denticle size (with both microziphodonty and macroziphodonty)
329	**Carinae (maxillae), distribution of denticles at crown edges:** *based on Price (1950) and Pol (2003); Andrade & Bertini (2008a, ch. 132 mod.); Andrade et al. (2011, ch. 380); Ristevski et al. (2018, ds 1, ch. 380); Smith et al. (in review, ds 2, ch. 380); Ősi et al. (2018, ds 1, ch. 325).* *This character samples presence of true denticles only, not all serrated carinae or ziphomorph denticles.* *State (1) is putative apomorphy of Notosuchidae + Sphagesauridae (but note that* Adamantinasuchus *and* Mariliasuchu*s do not share the character).* 0. mesial and distal crown edges with the same morphology, either with or without true denticles 1. mesial carina absent and distal carina present
330	**Carinae (mid-posterior mandible), distribution of denticles at crown edges:** *Andrade & Bertini (2008a, ch. 132 mod.); Andrade et al. (2011, ch. 381); Ristevski et al. (2018, ds 1, ch. 381); Smith et al. (in review, ds 2, ch. 381); Ősi et al. (2018, ds 1, ch. 326).* *State (1) is putative apomorphy of Sphagesaurus, but unknown in* Armadillosuchus. 0. mesial and distal crown edges with the same morphology, either with or without true denticles 1. mesial carina present and distal carina absent, with mid-posterior teeth ocluding as opposing blades
331	**Occlusion, relation between maxillary and dentary series:** *Young et al. (2011, ch. 173); Young et al. (2013a, ch. 146); Young et al. (2012, ch. 173); Young (2014, ch. 181); Young et al. (2016, ds 2, ch. 219); Ristevski et al. (2018, ds 2, ch. 285); Smith et al. (in review, ds 1, ch. 290); Ősi et al. (2018, ds 1, ch. 327).* 0. in-line or interlocked 1. maxillary dentition overbites dentary dentition
332	**Morphology of enamel surface ornamentation, apicobasal ridges:** *Young et al. (2011, ch. 174); Young et al. (2013a, ch. 147); Young et al. (2012, ch. 174 mod.); Young (2014, ch. 182 mod.); Young et al. (2016, ds 2, ch. 220 mod.); Ristevski et al. (2018, ds 2, ch. 286 mod.); Smith et al. (in review, ds 1, ch. 291 mod.); Ősi et al. (2018, ds 1, ch. 328).* *In Thalattosuchia,* Geosaurus*,* Dakosaurus, Rhacheosaurus *and* Cricosaurus *score as state (0).* *State (1) occurs in* Ieldraan melkshamensis. *State (2) occurs in* Tyrannoneustes lythrodectikos. *State (3) occurs in Mr Leeds dakosaur,* Suchodus durobrivensis, Plesiosuchus manselii. *State (4) is the standard, ridged crocodylomorph morphotype.* *State (5) occurs in Mr Passmore's specimen.* 0. enamel ornamentation absent macroscopically (although under SEM microscopic ripples may be present) 1. enamel ornamentation present macroscopically, but largely looks like an enlarged version of the 'rippled' morphology seen under the SEM in 'smooth specimens'. There may also be the occasional poorly defined apicobasal ridge 2. enamel ornamentation largely inconspicuous, being composed of short, well-spaced, well-defined apicobasally aligned ridges on at least the basal half of the crown 3. enamel ornamentation composed of numerous apicobasally aligned ridges that are of low-relief (can only be properly viewed with visual aids), set close to each other, but become shorter and well-spaced towards the carinae 4. enamel ornamentation composed of well-defined apicobasally aligned ridges that are conspicuous and are elongate; being continuous, or having long discontinuous ridges 5. noticeable disparity between the labial and lingual surfaces: lingual surface changes from the standard apicobasal ridge morphology basally, to having shorter ridges which create almost reticulating pattern in the mid-crown region on the lingual surface; on the labial surface, basally the crown is largely smooth, and nearer the mid-crown and up towards the apex the crown is ornamented with numerous short ridges that similarly can make a reticulating pattern
333	**Morphology of apical enamel surface ornamentation, macroscopic anastomosed pattern:** *Young et al. (2012, ch. 175); Young (2014, ch. 183); Young et al. (2016, ds 2, ch. 221); Ristevski et al. (2018, ds 2, ch. 287); Smith et al. (in review, ds 1, ch. 292); Ősi et al. (2018, ds 1, ch. 329).* *State (1) occurs in Machimosaurini (e.g.* Machimosaurus, Lemmysuchus), Torvoneustes, *and Goniopholididae (e.g.* Anteophthalmosuchus *and* Goniopholis*).* 0. absent 1. present and strongly developed, but only in the apical region of the crown
334	**Maxillary teeth, occurrence of bilateral paramesial rotation: (ORDERED)** *Pol (2003, ch. 137 mod.); Andrade & Bertini (2008a, ch. 133); Andrade et al. (2011, ch. 414); Ristevski et al. (2018, ds 1, ch. 414); Smith et al. (in review, ds 2, ch. 414); Ősi et al. (2018, ds 1, ch. 330).* *State (1) occurs in* Mariliasuchus *and* Notosuchus. *State (2) is a putative apomorphy of Sphagesauridae.* 0. absent 1. bilateral paramesial rotation up to 30 degrees from the original plane 2. bilateral paramesial rotation clearly over 30 degrees from the original plane

335	**Middle and posterior mandibular teeth, occurrence of bilateral paramesial rotation:** *Andrade & Bertini (2008a, ch. 144); Andrade et al. (2011, ch. 415); Ristevski et al. (2018, ds 1, ch. 415); Smith et al. (in review, ds 2, ch. 415); Ősi et al. (2018, ds 1, ch. 331).* *State (2) is a putative apomorphy of Sphagesauridae.* 0. not oblique or slightly altered 1. oblique (more than 30 degrees).
336	**Middle and posterior teeth, presence of cingula with accessory cusps:** *Andrade & Bertini (2008a, ch. 149 mod.); Andrade et al. (2011, ch. 417); Ristevski et al. (2018, ds 1, ch. 417); Smith et al. (in review, ds 2, ch. 417); Ősi et al. (2018, ds 1, ch. 332).* *State (1) occurs in* Candidodon *and* Malawisuchus*.* 0. absent 1. present, cingulum bearing a series small of cusps, set labial/lingual to the main body of crown
337	**Morphology of enamel surface ornamentation, 'pseudodenticles':** *Ristevski et al. (2018, ds 2, ch. 288); Smith et al. (in review, ds 1, ch. 293); Ősi et al. (2018, ds 1, ch. 333).* *State (1) occurs in* Machimosaurus hugii *and* M. rex*. The 'pseudodenticles' are denticle-like structures that occur on the enamel ridges, but not on the carinae.* 0. absent 1. present

Axial post-cranial skeleton (Ch. 338 – 372; 7.174% of characters)

[*Vertebrae (= cervicale, thoracicae, lumbales, sacrales and caudal), costae (= cervicales, thoracicae, sacrales and arcus hæmales)*]

#	Description
338	**Atlas, hypocentrum length:** *Young & Andrade (2009, ch. 122); Young et al. (2011, ch. 122); Young et al. (2013a, ch. 148); Young et al. (2012, ch. 176); Young (2014, ch. 184); Young et al. (2016, ds 2, ch. 222); Ristevski et al. (2018, ds 2, ch. 289); Smith et al. (in review, ds 1, ch. 294); Ősi et al. (2018, ds 1, ch. 334).* 0. long: greater than 15% of odontoid process length 1. short: subequal to odontoid process length (± 5%)
339	**Axis, neural arch diapophysis:** *Young & Andrade (2009, ch. 104); Young et al. (2011, ch. 104); Young et al. (2013a, ch. 149); Young et al. (2012, ch. 177); Young (2014, ch. 185); Young et al. (2016, ds 2, ch. 223); Ristevski et al. (2018, ds 2, ch. 290); Smith et al. (in review, ds 1, ch. 295); Ősi et al. (2018, ds 1, ch. 335).* 0. absent 1. present
340	**Presacral vertebrae number:** *Young & Andrade (2009, ch. 156); Young et al. (2011, ch. 156); Young et al. (2013a, ch. 150); Young et al. (2012, ch. 178); Young (2014, ch. 186); Young et al. (2016, ds 2, ch. 224); Ristevski et al. (2018, ds 2, ch. 291); Smith et al. (in review, ds 1, ch. 296); Ősi et al. (2018, ds 1, ch. 336).* 0. 24 1. 25
341	**Number of cervico-dorsal vertebrae where the parapophyses are borne on the centrum ('cervical vertebrae'), including the atlas-axis:** *Young (2006, ch. 35 mod.); Wilkinson et al. (2008, ch. 63 mod.); Young & Andrade (2009, ch. 63 mod.); Young et al. (2011, ch. 63 mod.); Young et al. (2013a, ch. 151); Young et al. (2012, ch. 179); Young (2014, ch. 187); Young et al. (2016, ds 2, ch. 225); Ristevski et al. (2018, ds 2, ch. 292); Smith et al. (in review, ds 1, ch. 297); Ősi et al. (2018, ds 1, ch. 337).* 0. 9 or 10 1. 8 2. 7
342	**Cervical vertebrae, hypapophyses:** *Ristevski et al. (2018, ds 2, ch. 293 mod.); Smith et al. (in review, ds 1, ch. 298 modfied); Ősi et al. (2018, ds 1, ch. 338).* *This character scores the presence of distinct hypapophyses on the ventral surface of the cervical centra.* *State (1) is a putative apomorphy of Thalattosuchia.* 0. present 1. reduced, distinct ventral processes are absent, but a reduced anteroposterior keel is still present
343	**Cervical vertebrae, shape:** *Clark (1994, ch. 92 mod.); Young & Andrade (2009, ch. 145 mod.); Young et al. (2011, ch. 145 mod.); Young et al. (2013a, ch. 152 mod.); Young et al. (2012, ch. 180 mod.); Young (2014, ch. 188 mod.); Young et al. (2016, ds 2, ch. 226); Ristevski et al. (2018, ds 2, ch. 294); Smith et al. (in review, ds 1, ch. 299); Ősi et al. (2018, ds 1, ch. 339).*

	Designed to test the homology of repeated procoely evolution in Crocodylomorpha. *State (2) is occurs in Eusuchia.* 0. amphicoelous or amphyplatian 1. weakly procoelous (i.e. the *Isisfordia* and *Junggarsuchus* morphotype – posterior condyle is poorly developed, with the rim of the posterior face of the centrum still distinct from the convexity of the condyle) 2. strongly procoelous (i.e. the eusuchian morphotype – well-developed posterior condyle, which is formed by the entire posterior face of the centrum)
344	**Posterior cervical vertebrae, centrum length vs centrum width:** *Young (2006, ch. 34); Wilkinson et al. (2008, ch. 62); Young & Andrade (2009, ch. 62); Young et al. (2011, ch. 62); Young et al. (2013a, ch. 153); Young et al. (2012, ch. 181); Young (2014, ch. 189); Young et al. (2016, ds 2, ch. 227); Ristevski et al. (2018, ds 2, ch. 295); Smith et al. (in review, ds 1, ch. 300); Ősi et al. (2018, ds 1, ch. 340).* *State (1) occurs in Geosaurinae.* *State (2) is a putative apomorphy of Metriorhynchidae.* 0. long (centrum length more than 1.5 times the centrum width) 1. moderate (centrum length to width subequal, ± 5%) 2. short (centrum length less than 95% of the centrum width)
345	**Middle cervical vertebrae, neural spine height relative to centrum height:** *Young et al. (2012, ch. 182); Young (2014, ch. 190); Young et al. (2016, ds 2, ch. 228); Ristevski et al. (2018, ds 2, ch. 296); Smith et al. (in review, ds 1, ch. 301); Ősi et al. (2018, ds 1, ch. 341).* *Currently, there is not the information needed to score for most crocodylomorphs. Within Thalattosuchia* Steneosaurus edwardsi *is (0),* St. leedsi *is (1), and metriorhynchids are state (2).* 0. neural spine height is greater than centrum height 1. neural spine and centrum heights are approximately equal 2. neural spine height is less than centrum height
346	**Number of cervico-dorsal vertebrae where the parapophyses are borne partially, or solely, on the neural arch ('thoracic vertebrae'):** *Young et al. (2011, ch. 175); Young et al. (2013a, ch. 154); Young et al. (2012, ch. 183); Young (2014, ch. 191); Young et al. (2016, ds 2, ch. 229); Ristevski et al. (2018, ds 2. ch. 297); Smith et al. (in review, ds 1, ch. 302); Ősi et al. (2018, ds 1, ch. 342).* *This character, (along with the character categorising lumbar vertebrae) was formulated to help understand the regionalisation of the presacral column. Currently, there is not the information needed to score for most crocodylomorphs.* 0. 12 1. 13 2. 14 3. 15
347	**Number of cervico-dorsal vertebrae posterior to the "thoracic vertebrae" and anterior to the sacral vertebrae where the parapophyses are no longer borne on the neural arch ('lumbar vertebrae'):** *Young et al. (2011, ch. 176); Young et al. (2013a, ch. 155); Young et al. (2012, ch. 184); Young (2014, ch. 192); Young et al. (2016, ds 2, ch. 230); Ristevski et al. (2018, ds 2, ch. 298); Smith et al. (in review, ds 1, ch. 303); Ősi et al. (2018, ds 1, ch. 343).* *This character, (along with the character categorising thoracic vertebrae) was formulated to help understand the regionalisation of the presacral column. Currently, there is not the needed information to score for most crocodylomorphs.* 0. 2 1. 3 2. 4
348	**Thoracic and lumbar vertebrae, shape:** *Clark (1994, ch. 93 mod.); Young & Andrade (2009, ch. 146 mod.); Young et al. (2011, ch. 146 mod.); Young et al. (2013a, ch. 156 mod.); Young et al. (2012, ch. 185 mod.); Young (2014, ch. 193 mod.); Young et al. (2016, ds 2, ch. 231); Ristevski et al. (2018, ds 2, ch. 299); Smith et al. (in review, ds 1, ch. 304); Ősi et al. (2018, ds 1, ch. 344).* *State (2) is a putative apomorphy of Eusuchia.* 0. amphicoelous or amphyplatian 1. weakly procoelous (i.e. the *Isisfordia* and *Junggarsuchus* morphotype – posterior condyle is poorly developed, with the rim of the posterior face of the centrum still distinct from the convexity of the condyle) 2. strongly procoelous (i.e. the eusuchian morphotype – well-developed posterior condyle, which is formed by the entire posterior face of the centrum)
349	**Thoracic vertebrae, shallow fossa on the anterior margin of the diapophysis immediately lateral to the parapophysis:** *Young & Andrade (2009, ch. 165); Young et al. (2011, ch. 165); Young et al. (2013a, ch. 157); Young et al. (2012, ch. 186 mod.); Young (2014, ch. 194); Young et al. (2016, ds 2, ch. 232); Ristevski et al.*

	(2018, ds 2, ch. 300); Smith et al. (in review, ds 1, ch. 305); Ősi et al. (2018, ds 1, ch. 345). *State (1) is a putative apomorphy of Metriorhynchidae, best observed in thoracic vertebrae mid-to-late in the series.* 0. present 1. absent
350	**Thoracic vertebrae, orientation of parapophysis:** *Young & Andrade (2009, ch. 166); Young et al. (2011, ch. 166); Young et al. (2013a, ch. 158); Young et al. (2012, ch. 187); Young (2014, ch. 195); Young et al. (2016, ds 2, ch. 233); Ristevski et al. (2018, ds 2, ch. 301); Smith et al. (in review, ds 1, ch. 306); Ősi et al. (2018, ds 1, ch. 346).* *State (1) is a putative apomorphy of Metriorhynchidae.* 0. posteriorly or horizontally 1. anteriorly
351	**Anterior thoracic vertebrae, parapophysis in relation to the diapophysis:** *Young et al. (2012, ch. 188); Young (2014, ch. 196); Young et al. (2016, ds 2, ch. 234); Ristevski et al. (2018, ds 2, ch. 302); Smith et al. (in review, ds 1, ch. 307); Ősi et al. (2018, ds 1, ch. 347).* *Currently, there is not the information needed to score for most crocodylomorphs.* *Within Thalattosuchia,* Steneosaurus edwardsi *and* St. leedsi *are state (0), and metriorhynchids score as state (1).* 0. parapophysis ventral to, or level with, diapophysis (when observed in lateral view) 1. parapophysis dorsal to diapophysis (when observed in lateral view)
352	**Anterior thoracic vertebrae, neural spine height relative to centrum height:** *Young et al. (2012, ch. 189); Young (2014, ch. 197); Young et al. (2016, ds 2, ch. 235); Ristevski et al. (2018, ds 2, ch. 303); Smith et al. (in review, ds 1, ch. 308); Ősi et al. (2018, ds 1, ch. 348).* *Currently, there is not the needed information to score for most crocodylomorphs.* *Within Thalattosuchia,* Machimosaurus mosae *and* Steneosaurus edwardsi *are state (0), and* St. leedsi *and metriorhynchids score as state (1).* 0. neural spine and centrum heights are approximately equal 1. neural spine height is less than centrum height
353	**Dorsal vertebrae, shape and relative positions of the neural spines: (NEW)** *State (1) is a putative apomorphy of* Cricosaurus suevicus *(based on the lectotype and all referred specimens from the Nusplingen Plattenkalk).* 0. neural spines have the 'normal' shape – elongated, dorsal margin convex to weakly convex, and the neural spines of adjacent dorsals clearly separated from one another 1. neural spines are all rectangular when seen in lateral view, a flat dorsal margin is most prevalent, and the neural spines of adjacent dorsal vertebrae are very close to one another
354	**Sacral vertebra, number (= sacralisation of the first caudal vertebra):** *Buscalioni & Sanz (1988, ch. 44 mod.); Pol & Apesteguia (2005, ch. 115 mod.); Andrade et al. (2011, ch. 432); Ristevski et al. (2018, ds 2, ch. 304); Smith et al. (in review, ds 1, ch. 309); Ősi et al. (2018, ds 1, ch. 349).* *The number of sacral vertebrae can be increased by the addition of last dorsal/lumbar or the first caudal, which constitute two divergent conditions, both leading to the total number of three sacral vertebrae (R. M. Santucci, pers. comm. 2004). Andrade et al. (2011) modified this character from the original to reflect this problem, although only the latter condition (addition of first caudal) has been reported so far (see for example, description in Pol 2005: p. 7-8). Note that the fusion of sacrals observed in* Alligatorellus *and* Montsecosuchus *(1st+2nd sacrals) is not homologous to the one reported by Pol (2005) for* Notosuchus *(2nd sacral+1st caudal).* *This character scores for a similar character as: Nesbitt (2011, ch. 207); Young et al. (2013a, ch. 159); Young et al. (2012, ch. 190); Young (2014, ch. 198); Young et al. (2016, ds 2, ch. 236). However, those characters referred to an "insertion" of a sacral vertebra between the first and second primordial sacral vertebrae.* *This character scores for the "third" sacral found in certain taxa (e.g.* Machimosaurus, Notosuchus, Mariliasuchus *and* Baurusuchus*).* *Within Thalattosuchia, evidence for three sacral vertebrae is found in Machimosaurini (*Lemmysuchus *and* Machimosaurus*).* 0. two 1. three, with the third being the first caudal vertebra
355	**Sacral vertebrae, shape of centra posterior face:** *Young (2014, ch. 199); Young et al. (2016, ds 2, ch. 237); Ristevski et al. (2018, ds 2, ch. 305); Smith et al. (in review, ds 1, ch. 310); Ősi et al. (2018, ds 1, ch. 350).* *State (1) is a putative apomorphy of* Pelagosaurus + *Metriorhynchidae.* *Note that this character has a wider distribution than Young (2014) and Young et al. (2016, ds 2) thought (i.e. not restricted to Geosaurini).* 0. circular to sub-circular, with- or without an equatorial bulge 1. distinctly oval, transverse width noticeably greater than dorsoventral height
356	**Caudal vertebra, shape of caudal vertebra 1:** *Ristevski et al. (2018, ds 2, ch. 306); Smith et al. (in review, ds 1, ch. 311); Ősi et al. (2018, ds 1, ch.*

	351). *Character based on Clark (1994, ch. 94).* *State (1) occurs in* Theriosuchus, *bernissartids and eusuchians.* 0. amphicoelous or amphyplatian 1. biconvex 2. procoelous
357	**Caudal vertebra, shape of the caudal vertebrae posterior to the first caudal:** *Ristevski et al. (2018, ds 2, ch. 307); Smith et al. (in review, ds 1, ch. 312); Ősi et al. (2018, ds 1, ch. 352).* *Character based on Clark (1994, ch. 94).* 0. all are amphicoelous or amphyplatian 1. mixture of semi-procoelous, amphicoelous or amphyplatian 2. all are procoelous
358	**Caudal vertebrae, number:** *Young (2006, ch. 36 mod.); Wilkinson et al. (2008, ch. 64); Young & Andrade (2009, ch. 64); Young et al. (2011, ch. 64); Young et al. (2013a, ch. 160); Young et al. (2012, ch. 191); Young (2014, ch. 200); Young et al. (2016, ds 2, ch. 239); Ristevski et al. (2018, ds 2, ch. 308); Smith et al. (in review, ds 1, ch. 313); Ősi et al. (2018, ds 1, ch. 353).* 0. less than 46 1. 50 or more
359	**Caudal vertebrae, relative height of neural spine:** *Andrade et al. (2011, ch. 435); Ristevski et al. (2018, ds 2, ch. 309); Smith et al. (in review, ds 1, ch. 314); Ősi et al. (2018, ds 1, ch. 354).* *State (1) occurs in Dyrosauridae.* 0. larger spines are up to 2.5 times the height of vertebral body 1. spines are typically 2.5–4 times the height of vertebral body
360	**Caudal vertebrae, shape and orientation of the neural spines immediately in front of the flexural caudal vertebrae: (NEW) (*) (ORDERED)** *State (1) occurs in* Gracilineustes. *State (2) occurs in* Rhacheosaurus *and* Cricosaurus. *This character is not applicable for taxa that do not have a 'tail fluke'.* 0. the neural spines are largely similar in shape to the other preflexural caudal vertebrae, although with some slight posterior orientation 1. the neural spines of the vertebrae immediately in front of the tail bend have a distinct morphology: the are dorsoventrally low, strongly inclined posteriorly such that the tips of the neural spines are slightly dorsal to the immediately posterior centrum 2. 1. the neural spines of the five-to-six vertebrae immediately in front of the tail bend have a distinct morphology: the are dorsoventrally very low, strongly inclined posteriorly such that the tips of the neural spines are clearly dorsal to the immediately posterior centrum
361	**Caudal vertebrae, abrupt change in centrum cross-section at the distal end of the column:** *Andrade et al. (2011, ch. 436 part); Young et al. (2013a, ch. 161 part); Young et al. (2012, ch. 192 part); Young (2014, ch. 201 part); Young et al. (2016, ds 2, ch. 240 part); Ristevski et al. (2018, ds 2, ch. 310 part); Smith et al. (in review, ds 1, ch. 315 part); Ősi et al. (2018, ds 1, ch. 355).* *State (1) is a putative apomorphy of Metriorhynchidae, but also occurs in* Magyarosuchus fitosi. *This suggests this character may have a wider distribution in Metriorhynchoidea.* *This character is an osteological correlate relating to the increase in distal tail lateral surface area. In taxa with a tail fin, this shape change is seen in both 'flexural', and post-flexural caudal vertebrae.* *All the characters relating to the tail fin morphological complex are present in known metriorhynchids; however, in plesiosaurians the presence of these characters is variable between taxa, with no taxon having all the character states (Smith, 2013). Moreover, ichthyosaurs also show a gradual evolution of the tail bend and fin (see Motani, 2005). It is likely the morphological adaptations for a tail fin evolved in a mosaic manner in basal metriorhynchoids as well.* *This character helps score the modification of the distal caudal vertebrae into a hypocercal tail.* 0. centra retain a sub-circular to sub-oval cross-section the same as, or similar to, that seen in proximal caudal vertebrae (i.e. the caudal vertebrae are isomorphic or poorly heteromorphic) 1. abrupt change in centrum shape, with strong mediolateral compression (distal vertebrae are clearly heteromorphic)
362	**Caudal vertebrae, shift in neural spine inclination near distal end:** *Andrade et al. (2011, ch. 436 part); Young et al. (2013a, ch. 161 part); Young et al. (2012, ch. 192 part); Young (2014, ch. 201 part); Young et al. (2016, ds 2, ch. 240 part); Ristevski et al. (2018, ds 2, ch. 310 part); Smith et al. (in review, ds 1, ch. 315 part); Ősi et al. (2018, ds 1, ch. 356).* *State (1) is a putative apomorphy of Metriorhynchidae.* *The neural spines of the distal caudal vertebrae are unknown in* Magyarosuchus fitosi. *This character is an osteological correlate for a soft tissue structure along the dorsal margin of the distal tail, as the thickening and re-orientation of the neural spines support this structure. However, this structure need not be very large (i.e. a true upper lobe of a hypocercal tail).*

	All the characters relating to the tail fin morphological complex are present in known metriorhynchids; however, in plesiosaurians the presence of these characters is variable between taxa, with no taxon having all the character states (Smith, 2013). Moreover, ichthyosaurs also show a gradual evolution of the tail bend and fin (see Motani, 2005). It is likely the morphological adaptations for a tail fin evolved in a mosaic manner in basal metriorhynchoids as well. *This character helps score the modification of the distal caudal vertebrae into a hypocercal tail.* 0. no, distal caudal vertebral neural spines do not have a shift in orientation (being sub-vertical and/or posteriorly inclinded) 1. yes, there is a distinct region of the distal caudal vertebrae that have a shift in neural spine orientation, changing from: a posterior inclination, to being sub-vertical, to having an anterior inclination
363	**Caudal vertebrae, ventral deflection of the distal end: (ORDERED)** *Young (2006, ch. 33 part); Wilkinson et al. (2008, ch. 61 part); Young & Andrade (2009, ch. 61 part); Young et al. (2011, ch. 61 part); Ősi et al. (2018, ds 1, ch. 357).* *State (2) is a putative apomorphy of Metriorhynchidae.* *The presence of a ventral deflection of the distal caudal vertebrae is unknown in* Magyarosuchus fitosi. *This character helps define the lower lobe of a hypocercal tail. Note that in ichthyosaurs (Motani, 2005), the presence of a ventral deflection does not always mean there would have been a true upper lobe.* *All the characters relating to the tail fin morphological complex are present in known metriorhynchids; however, in plesiosaurians the presence of these characters is variable between taxa, with no taxon having all the character states (Smith, 2013). Moreover, ichthyosaurs also show a gradual evolution of the tail bend and fin (see Motani, 2005). It is likely the morphological adaptations for a tail fin evolved in a mosaic manner in basal metriorhynchoids as well.* *This character helps score the modification of the distal caudal vertebrae into a hypocercal tail.* *Note, most preserved metriorhynchid tails give an exaggerated angle, either due to how the vertebrae have been arranged (in disarticulated specimens) or the vertebrae are not fully in* in vivo *conditions (for specimens preserved in limestone). The* in vivo *condition is shown by retaining the curvature of the post-flexural caudal vertebrae.* *Note that juvenile specimens cannot be used to score this character (e.g.* Rhacheosaurus gracilis*) as there may be an ontogenetic increase in the angle, such as in ichthyosaurs.* 0. absent 1. present, tail bend angle is less than 10 degrees 2. present, tail bend angle is between 10-40 degrees 3. present, tail bend angle is greater than 40 degrees
364	**Caudal vertebrae, number of vertebrae involved in the tail deflection:** *Ősi et al. (2018, ds 1, ch. 358).* *State (2) is a putative apomorphy of Metriorhynchidae.* *The presence of a ventral deflection of the distal caudal vertebrae is unknown in* Magyarosuchus fitosi. *This character helps define the lower lobe of a hypocercal tail. Note that in ichthyosaurs (Motani, 2005) the abruptness of the caudal series deflection varies between basal and derived clades, and in mosasaurids the tail bend is spread out across multiple vertebrae, similarly to basal ichthyosaurs (Lindgren et al. 2008, 2010). Therefore, a multi-state was created here to accommodate potential basal metriorhynchoids with a tail bend spread across a high number of caudal vertebrae.* *This character helps score the modification of the distal caudal vertebrae into a hypocercal tail.* *Note that juvenile specimens cannot be used to score this character (e.g.* Rhacheosaurus gracilis*) as there may be an ontogenetic increase in the angle, such as in ichthyosaurs.* 0. no ventral deflection of the distal caudal series 1. deflection is large, occurring over 15 to 30 vertebrae 2. deflection is abrupt, occurring over 5 to 10 vertebrae
365	**Caudal vertebrae, rapid centrum anteroposterior length reduction in postflexural caudal vertebrae: (NEW) (*)** *State (1) occurs in* Cricosaurus *sp*. *This character is not applicable for taxa that do not have a 'tail fluke'.* 0. the centra become progressively 'smaller' in anteroposterior length and dorsoventral height as the neural arches regress 1. the centra rapidly become 'smaller' as the neural arches regress
366	**Axis rib:** *Young et al. (2012, ch. 193); Young (2014, ch. 202); Young et al. (2016, ds 2, ch. 241); Ristevski et al. (2018, ds 2, ch. 311); Smith et al. (in review, ds 1, ch. 316); Ősi et al. (2018, ds 1, ch. 359).* *State (1) is a putative apomorphy of* Pelagosaurus *+ Metriorhynchidae.* *Callovian teleosaurids have a distinct 'bump' or 'process' where a second articular head would be (see Andrews, 1913). However, in no specimen is there a second articular head preserved.* 0. holocephalous (rib elongate, with one articular head) 1. dichocephalous (rib triradiate, with two articular heads)
367	**Axis rib, tuberculum:**

	Young & Andrade (2009, ch. 149); Young et al. (2011, ch. 149); Young et al. (2013a, ch. 162); Young et al. (2012, ch. 194); Young (2014, ch. 203); Young et al. (2016, ds 2, ch. 242); Ristevski et al. (2018, ds 2, ch. 312); Smith et al. (in review, ds 1, ch. 317); Ősi et al. (2018, ds 1, ch. 360). 0. wide with broad dorsal tip 1. narrow with acute dorsal tip
368	**Atlantal ribs, presence of very thin medial laminae at anterior end:** *Brochu (1999, ch. 16); Andrade et al. (2011, ch. 437); Ristevski et al. (2018, ds 1, ch. 437); Smith et al. (in review, ds 2, ch. 437); Ősi et al. (2018, ds 1, ch. 361).* *State (1) is a putative apomorphy of Caimaninae.* 0. absent 1. present
369	**Sacral vertebrae, relative position of lateral end of the transverse processes (= sacral ribs): (ORDERED)** *Young (2006, ch. 53 + 54); Wilkinson et al. (2008, ch. 81 + 82); Young & Andrade (2009, ch. 81 + 82); Andrade et al. (2011, ch. 433 + 434); Young et al. (2011, ch. 81 + 82); Young et al. (2013a, ch. 163 + 164); Young et al. (2012, ch. 195 + 196); Young (2014, ch. 204 + 205); Young et al. (2016, ds 2, ch. 243 + 244); Ristevski et al. (2018, ds 2, ch. 313); Smith et al. (in review, ds 2, ch. 318); Ősi et al. (2018, ds 1, ch. 362).* *In Thalattosuchia the first sacral (as often the second) has its transverse processes at least poorly arched ventrally (see Andrews, 1913). In* Pelagosaurus typus *and metriorhynchids the transverse processes are strongly arched ventrally projecting the head for head contact with the ilium below the level of the cervical centrum (1), contrasting with teleosaurids (e.g.,* Steneosaurus*). However, in* Pelagosaurus typus*, the transverse processes are not as slender and does not project as ventrally.* *States (1+2) occur in Thalattosuchia.* *State (1) occurs in teleosauroids.* *State (2) is a putative apomorphy of* Pelagosaurus + *Metriorhynchidae.* 0. level with the vertebral centrum 1. transverse processes of sacral vertebra one lateroventrally directed, ventral relative to the vertebral centrum 2. transverse processes of both sacral vertebrae are lateroventrally directed, ventral relative to the vertebral centrum. In these taxa, the lateral ends of the transverse processes of both sacral vertebrae are typically significantly ventrally arched.
370	**Chevrons (= haemal arches), shape near the distal end of the caudal series:** *Young & Andrade (2009, ch. 164 mod.); Young et al. (2011, ch. 164 mod.); Young et al. (2013a, ch. 165 mod.); Young et al. (2012, ch. 197 mod.); Young (2014, ch. 206 mod.); Young et al. (2016, ds 2, ch. 245 mod.); Ristevski et al. (2018, ds 2, ch. 314 mod.); Smith et al. (in review, ds 1, ch. 319 mod.); Ősi et al. (2018, ds 1, ch. 363).* *State (1) is a putative apomorphy of Metriorhynchidae.* *The distal chevrons are unknown in* Magyarosuchus fitosi. *This character defines the change to the chevrons that stiffen the distal tail (seen ventral to ‘flexural’ and anterior post-flexural vertebrae).* *All the characters relating to the tail fin morphological complex are present in known metriorhynchids; however, in plesiosaurians the presence of these characters is variable between taxa, with no taxon having all the character states (Smith, 2013). Moreover, ichthyosaurs also show a gradual evolution of the tail bend and fin (see Motani, 2005). It is likely the morphological adaptations for a tail fin evolved in a mosaic manner in basal metriorhynchoids as well.* *This character helps score the modification of the distal tail into a tail fin.* 0. in lateral view they are either sub-triangular in shape or rod-like, in anterior view they are either ‘V’ or ‘Y’ shaped 1. in lateral view the main body of the chevron is mediolaterally compressed, deepening it dorsoventrally. In anterior view, some chevrons will have a slight ‘W’ shape, created by the midline anterior process being oriented anterodorsally
371	**Chevrons (= haemal arches), presence of a notch on the ventral margin of the distal chevrons:** *Ősi et al. (2018, ds 1, ch. 364).* *State (1) is a putative apomorphy of* Metriorhynchus superciliosus. *However, note few metriorhynchids are known to preserve all/most of the flexural and postflexural chevrons. All studied metriorhynchid specimens preserved in limestone from the Late Jurassic of Germany lack these notches.* *This character can only be scored if there are multiple distal chevrons preserved, and they have the complete ventral margin.* 0. absent 1. present
372	**Chevrons (= haemal arches), nature of contact in distal chevrons: (NEW)** *State (1) occurs in* Cricosaurus suevicus *and* C. sp. *However, note few metriorhynchids are known to preserve all/most of the flexural and postflexural chevrons.* *This character can only be scored if there are multiple distal chevrons preserved, and they have the complete anterior and posterior margins.*

	0. if adjacent chevrons contact, they do so along their posterior-anterior margins 1. adjacent chevrons contact along the posteroventral-anterodorsal margins

Appendicular skeleton: pectoral girdle and forelimbs (Ch. 373 – 395; 5.000% of characters) *[pectoral elements (ossa coracoidea & ossa scapula); stylopodia (ossa humeri), zeugopodia (ossa radii & ossa ulnae), autopodia (ossa radialia/ulnaria, ossa metacarpalia, & ossa digitorum manus)]*

#	Description
373	**Coracoid, shape:** *Young (2006, ch. 40); Wilkinson et al. (2008, ch. 69); Young & Andrade (2009, ch. 69); Young et al. (2011, ch. 69); Young et al. (2013a, ch. 166); Young et al. (2012, ch. 198); Young (2014, ch. 207); Young et al. (2016, ds 2, ch. 246); Ristevski et al. (2018, ds 2, ch. 315); Smith et al. (in review, ds 1, ch. 320); Ősi et al. (2018, ds 1, ch. 365).* *State (1) occurs in teleosauroids.* *State (2) occurs in Metriorhynchoidea.* 0. neither proximal (i.e. glenoid region) nor distal (i.e. postglenoid process) ends are fan-shaped, having angular margins 1. distal end convex, forming a gentle fan-shape while the proximal end is triangular in shape with blunt ends 2. both proximal and distal ends are convex
374	**Coracoid, postglenoid process:** *Nesbitt (2011, ch. 223); Young et al. (2016, ds 2, ch. 247); Ristevski et al. (2018, ds 2, ch. 316); Smith et al. (in review, ds 1, ch. 321); Ősi et al. (2018, ds 1, ch. 366).* *State (0) occurs in non-crocodylomorphs.* *State (1) occurs in 'sphenosuchians'.* *Sstate (2) is a putative apomorphy of Crocodyliformes.* 0. short 1. elongate and expanded posteriorly only 2. elongate and expanded anteriorly and posteriorly
375	**Coracoid, posteroventral edge, deep groove:** *Nesbitt (2011, ch. 224); Young et al. (2016, ds 2, ch. 248); Ristevski et al. (2018, ds 2, ch. 317); Smith et al. (in review, ds 1, ch. 322); Ősi et al. (2018, ds 1, ch. 367).* *State (1) occurs in Rauisuchiae and most 'sphenosuchians'.* 0. absent 1. present
376	**Scapula blade:** *Young et al. (2012, ch. 199 mod.); Young (2014, ch. 208, mod.); Young et al. (2016, ds 2, ch. 249 mod.); Ristevski et al. (2018, ds 2, ch. 318 mod.); Smith et al. (in review, ds 1, ch. 323 mod.); Ősi et al. (2018, ds 1, ch. 368).* *State (1) is a putative apomorphy of Teleosauroidea.* *State (2) is a putative apomorphy of Metriorhynchidae.* 0. scapula blade large: approximately twice the width of the scapular shaft, and generally wider than the distal glenoid region 1. scapula blade reduced: being as wide as, or narrower than, the glenoid region; and the scapular blade is less than 1.5 times the width of the scapular shaft. 2. scapula blade reduced: blade broadens both anteriorly and posteriorly, but is still as wide as, or narrower than, the glenoid region.
377	**Scapula, anterior and posterior margins in lateral aspect:** *Young & Andrade (2009, ch. 105 mod.); Young et al. (2011, ch. 105 mod.); Young et al. (2013a, ch. 167 mod.); Young et al. (2012, ch. 200); Young (2014, ch. 209); Young et al. (2016, ds 2, ch. 250); Ristevski et al. (2018, ds 2, ch. 319); Smith et al. (in review, ds 1, ch. 324); Ősi et al. (2018, ds 1, ch. 369).* 0. symmetrically concave in lateral view 1. anterior edge more strongly concave than posterior edge 2. posterior edge more strongly concave than anterior edge
378	**Scapula, deltoid crest:** *Young & Andrade (2009, ch. 106); Young et al. (2011, ch. 106); Young et al. (2013a, ch. 168); Young et al. (2012, ch. 201); Young (2014, ch. 210); Young et al. (2016, ds 2, ch. 251); Ristevski et al. (2018, ds 2, ch. 320); Smith et al. (in review, ds 1, ch. 325); Ősi et al. (2018, ds 1, ch. 370).* 0. present 1. absent
379	**Scapula/Humerus, size:** *Young (2006, ch. 39); Wilkinson et al. (2008, ch. 68); Young & Andrade (2009, ch. 68); Young et al. (2011, ch. 68); Young et al. (2013a, ch. 169); Young et al. (2012, ch. 202); Young (2014, ch. 211); Young et al. (2016, ds 2, ch. 252); Ristevski et al. (2018, ds 2, ch. 321); Smith et al. (in review, ds 1, ch.*

	326); Ősi et al. (2018, ds 1, ch. 371). 0. humerus longer than scapula (greater than 15%) 1. humerus and scapula subequal in length (± 13%) 2. humerus shorter in length than scapula (less than 15%)
380	**Limb bones (forelimbs), proportional length of ulna relative to the humerus: (ORDERED)** *Andrade et al. (2011, ch. 452); Ristevski et al. (2018, ds 2, ch. 322); Smith et al. (in review, ds 1, ch. 327); Ősi et al. (2018, ds 1, ch. 372).* *State (2) is a putative apomorphy of Thalattosuchia (not Teleosauridae as putatively put forward by Andrade et al., 2011).* *In Thalattosuchia the ulna is typically between 48%–72% of the length of the humerus (perhaps being longer in juvenile specimens).* *State (2) also occurs in the* Pachycheilosuchus + Pietraroiasuchus *clade.* 0. ulna clearly longer than humerus 1. ulna subequal to humerus (distal/proximal = 75–125%) 2. ulna clearly shorter than the humerus
381	**Humerus, proximal region:** *Nesbitt (2011, ch. 232 mod.); Young et al. (2013a, ch. 170); Young et al. (2012, ch. 203 mod.); Young (2014, ch. 212); Young et al. (2016, ds 2, ch. 253 - added state 2); Ristevski et al. (2018, ds 2, ch. 323); Smith et al. (in review, ds 1, ch. 328); Ősi et al. (2018, ds 1, ch. 373).* *In Thalattosuchia, derived teleosaurids (*Aeolodon priscus, S. bollensis, S. leedsi, S. edwardsi*) have state (2) - the posterior deflection being much more pronounced than in other thalattosuchians.* *In Geosaurini and Rhacheosaurini taxa change to state (0).* 0. confined to the proximal surface 1. posteriorly expanded and hooked 2. very strongly posteriorly deflected and hooked, with the proximal epiphysis noticeably posterior to the distal epiphysis
382	**Humerus, proximomedial articular surface:** *Young & Andrade (2009, ch. 107); Young et al. (2011, ch. 107); Young et al. (2013a, ch. 171); Young et al. (2012, ch. 204); Young (2014, ch. 213); Young et al. (2016, ds 2, ch. 254); Ristevski et al. (2018, ds 2, ch. 324); Smith et al. (in review, ds 1, ch. 329); Ősi et al. (2018, ds 1, ch. 374).* *State (1) occurs in* Rhacheosaurus *and* Cricosaurus. 0. strongly convex 1. weakly convex
383	**Humerus, deltopectoral crest:** *Young (2006, ch. 38 modfied); Wilkinson et al. (2008, ch. 66 mod.); Young & Andrade (2009, ch. 66 mod.); Young et al. (2011, ch. 66 mod.); Young et al. (2013a, ch. 172); Young et al. (2012, ch. 205); Young (2014, ch. 214); Young et al. (2016, ds 2, ch. 255); Ristevski et al. (2018, ds 2, ch. 325); Smith et al. (in review, ds 1, ch. 330); Ősi et al. (2018, ds 1, ch. 375).* *State (1) is a putative apomorphy of Metriorhynchidae.* *Young et al. (2013a) removed state (2) (absent/vestigial) as metriorhynchids of the subclade Rhacheosaurini do indeed have a deltopectoral crest on their humeri.* 0. present and distinct from the proximal surface 1. present, but continuous with the proximal surface
384	**Humerus, shape:** *Young et al. (2012, ch. 206); Young (2014, ch. 215); Young et al. (2016, ds 2, ch. 256); Ristevski et al. (2018, ds 2, ch. 326); Smith et al. (in review, ds 1, ch. 331); Ősi et al. (2018, ds 1, ch. 376).* *State (1) is a putative apomorphy of Metriorhynchidae.* *This character helps score the modification of the manus into paddles, and the general reduction of the forelimbs, in Metriorhynchidae.* 0. has typical long bone morphology (longer than wide at distal end) 1. broadly expanded and plate-like
385	**Humerus, length of the diaphysis relative to total humerus length:** *Wilkinson et al. (2008, ch. 67); Young & Andrade (2009, ch. 67); Young et al. (2011, ch. 67); Young et al. (2013a, ch. 173); Young et al. (2012, ch. 207); Young (2014, ch. 216); Young et al. (2016, ds 2, ch. 257); Ristevski et al. (2018, ds 2, ch. 327); Smith et al. (in review, ds 1, ch. 332); Ősi et al. (2018, ds 1, ch. 377).* *This character quantifies the reduction in humeral shaft size in Metriorhynchidae.* *This character helps score the modification of the manus into paddles, and the general reduction of the forelimbs, in Metriorhynchidae.* 0. diaphysis contributing more than 50% of total humeral length 1. diaphysis contributes 35–38% of total humeral length 2. diaphysis contributes less than 25% of total humeral length
386	**Humerus-antebrachium joint surface:** *Young et al. (2011, ch. 180); Young et al. (2013a, ch. 174); Young et al. (2012, ch. 208); Young (2014, ch. 217); Young et al. (2016, ds 2, ch. 258); Ristevski et al. (2018, ds 2, ch. 328); Smith et al. (in review, ds 1, ch. 333); Ősi et al. (2018, ds 1, ch. 378).*

	State (1) is a putative apomorphy of Metriorhynchidae. *This character helps score the modification of the manus into paddles, and the general reduction of the forelimbs, in Metriorhynchidae.* 0. complex, allowing one degree of motion – i.e. the humeral epiphyses are ossified 1. planar, limiting possible motion – i.e. the humeral epiphyses are unossified
387	**Radius and/or ulna, shape:** *Young (2006, ch. 37); Wilkinson et al. (2008, ch. 65); Young & Andrade (2009, ch. 65); Young et al. (2011, ch. 65 + 176); Young et al. (2013a, ch. 175 + 177); Young et al. (2012, ch. 209 + 211); Young (2014, ch. 218 + 220); Young et al. (2016, ds 2, ch. 259 + 261); Ristevski et al. (2018, ds 2, ch. 329); Smith et al. (in review, ds 1, ch. 334); Ősi et al. (2018, ds 1, ch. 379).* *State (1) is a putative apomorphy of Metriorhynchidae.* *This character helps score the modification of the manus into paddles, and the general reduction of the forelimbs, in Metriorhynchidae.* 0. typical long bone morphology (proximodistal length noticeably greater than width at distal end) 1. broadly expanded and plate-like
388	**Ulna, axis length:** *Ősi et al. (2018, ds 1, ch. 380).* *State (1) is a putative apomorphy of Rhacheosaurini.* *This character helps score the modification of the manus into paddles, and the general reduction of the forelimbs, in Metriorhynchidae.* 0. the proximodistal axis length of the ulna is greater than the length of the anteroposterior axis 1. the anteroposterior axis length of the ulna is greater than the length of the proximodistal axis
389	**Ulna, morphology of olecranon process:** *Brochu (1999, ch. 27); Turner & Buckley (2008, ch. 260); Andrade et al. (2011, ch. 457); Ristevski et al. (2018, ds 1, ch. 459); Smith et al. (in review, ds 2, ch. 459); Ősi et al. (2018, ds 1, ch. 381).* 0. narrow and subangular 1. wide and rounded
390	**Ulna, olecranon process mediolaterally compressed and greatly expanded, creating a very broad proximal ulna:** *Ősi et al. (2018, ds 1, ch. 382).* *State (1) occurs in derived teleosaurids.* *Basal teleosauroids (such as* Platysuchus multiscorbiculatus *and* Steneosaurus bollensis*) score as (0).* 0. no 1. yes
391	**Radiale and/or ulnare, shape:** *Young et al. (2011, ch. 177 + 179); Young et al. (2013a, ch. 176 + 178); Young et al. (2012, ch. 210 + 212); Young (2014, ch. 219 + 221); Young et al. (2016, ds 2, ch. 260 + 262); Ristevski et al. (2018, ds 2, ch. 330); Smith et al. (in review, ds 1, ch. 335); Ősi et al. (2018, ds 1, ch. 383).* *State (1) is a putative apomorphy of Metriorhynchidae.* *This character helps score the modification of the manus into paddles, and the general reduction of the forelimbs, in Metriorhynchidae.* 0. typical long bone morphology (proximodistal length noticeably greater than width at distal end) 1. broadly expanded and plate-like
392	**Manus, metacarpal general structure: (*)** *Buscalioni (2017, ch. 424 mod., part); Ősi et al. (2018, ds 1, ch. 384).* *Ősi et al. (2018) modified the character from Buscalioni (2017) to help quantify the manus morphological changes occurring at the transition from basal crocodyliforms to metasuchians. Here it samples overall robustness, not relative length.* *This character is not applicable for taxa that do not have all five manual digits.* 0. metacarpals IV and V not strongly differentiated from II-III in terms of overall robusticity 1. metacarpals II-III are noticeably more robust than those of IV-V (due to metacarpal I being greatly enlarged relative to all other metacarpals in some clades, it is not used in this character)
393	**Manus, shape of metacarpal I: (*)** *Young (2006, ch. 41); Wilkinson et al. (2008, ch. 70); Young & Andrade (2009, ch. 70); Young et al. (2011, ch. 70); Young et al. (2013a, ch. 179); Young et al. (2012, ch. 213); Young (2014, ch. 222); Young et al. (2016, ds 2, ch. 263); Ristevski et al. (2018, ds 2, ch. 331); Smith et al. (in review, ds 1, ch. 336); Ősi et al. (2018, ds 1, ch. 385).* *State (1) is a putative apomorphy of Metriorhynchidae.* *This character helps score the modification of the manus into paddles, and the general reduction of the forelimbs, in Metriorhynchidae.* *This character is not applicable for taxa that lack digit I.* 0. elongate, more than twice as long as wide 1. broadly expanded, maximum width at least 60% of total length
394	**Manus, digit I:** *Ősi et al. (2018, ds 1, ch. 386).* *State (1) is a putative apomorphy of* Junggarsuchus.

	This character helps score the modification of the manus into being functionally tridactyl. 0. present 1. absent
395	**Manus, relative length of digit V: (*)** *Buscalioni (2017, ch. 424 mod., part); Ősi et al. (2018, ds 1, ch. 387).* *Ősi et al. (2018) modified the character from Buscalioni (2017) to help quantify the manus morphological changes occurring at transition from basal crocodyliforms to metasuchians.* *This character is not applicable for taxa that do not have all five manual digits.* 0. digit V longer than digit I, being comparable in length to digits II-IV 1. digit V reduced in length, being evidently shorter than digits II-IV and comparable in length to digit I

Appendicular skeleton: pelvic girdle and hind limbs (Ch. 396 – 432; 8.043% of characters)

[pelvic elements (ossa pubes, ossa ilia, & ossa ischia); stylopodia (ossa femora), zeugopodia (ossa tibiae), autopodia (ossa calcis, ossa metatarsalia, & ossa digitorum pedis)]

#	Description
396	**Pubis, exclusion from acetabulum:** *Turner & Sertich (2010, ch. 86 part); Andrade et al. (2011, ch. 445); Young et al. (2013a, ch. 180 part); Young et al. (2012, ch. 214 part); Young (2014, ch. 223 part); Young et al. (2016, ds 2, ch. 264 part); Ristevski et al. (2018, ds 2, ch. 332); Smith et al. (in review, ds 1, ch. 337); Ősi et al. (2018, ds 1, ch. 388).* *Following Claesson (2004) state (1) occurs in Crocodyliformes.* *This character scores the pubis articulation with the acetabulum (state 0), and the mobile pubis articulating with the ischium anterior process (state 1).* 0. pubis not excluded, participating at least marginally to the anteroventral rim of the acetabulum 1. pubis excluded, acetabulum composed exclusively by the ischium and illium
397	**Pubis, presence of exclusive proximal contact with ischium:** *Andrade et al. (2011, ch. 446) – based on Andrews (1913) and Clark (1994, ch. 86); Ristevski et al. (2018, ds 2, ch. 333); Smith et al. (in review, ds 1, ch. 338); Ősi et al. (2018, ds 1, ch. 389).* *Note that in Metasuchia this character correlates with the pubic exclusion from the acetabulum; however, thalattosuchians also have the pubis excluded from the acetabulum, but the pubis articulates between the ischium pubic process and the ilium anterior peduncle.* 0. absent, pubis supported by both ilium and ischium 1. present, proximal head of pubis contacts only the ischium
398	**Pubis, length:** *Nesbitt (2011, ch. 278); Young et al. (2016, ds 2, ch. 265); Ristevski et al. (2018, ds 2, ch. 334); Smith et al. (in review, ds 1, ch. 339); Ősi et al. (2018, ds 1, ch. 390).* *State (0) is a putative apomorphy of Crocodyliformes.* 0. less than 70% of femoral length 1. 70% or more of femoral length
399	**Pubis, expansion of distal end** *Clark (1994, ch. 85 mod.); Andrade et al. (2011, ch. 447 mod.); Nesbitt (2011, ch. 283 mod.); Ristevski et al. (2018, ds 2, ch. 335); Smith et al. (in review, ds 1, ch. 340); Ősi et al. (2018, ds 1, ch. 391).* *Note that* Postosuchus *has a pubic boot (along with other non-crocodylomorph pseudosuchians; Nesbitt, 2011; Weinbaum, 2013). Here we test the homology of this pubic boot with that seen in crocodylomorphs (the* Protosuchus *distal expansion, and the 'fan'-like pubic blade seen in other crocodyliforms). Nesbitt (2011) reports that a small posterior expansion is present in the holotype of* Hesperosuchus agilis*, suggesting the lack of an expansion in* Terristrisuchus *is apomorphic.* *State (2) is a putative apomorphy of Mesoeucrocodylia.* 0. absent 1. expanded relative to the shaft (= pubic boot) 2. a "fan-like" expansion creating a distinct pubic blade
400	**Pubis, presence of an obturator foramen:** *Leardi et al. (2017, ch. 126); Ősi et al. (2018, ds 1, ch. 392).* *State (1) occurs in Crocodyliformes.* 0. present 1. absent
401	**Ilium, presence of a distinct anterior acetabular flange, created by the anterior acetabular margin projecting anteriorly such that it is anterior to the iliac anterior margin:** *Smith et al. (in review, ds 1, ch. 341); Ősi et al. (2018, ds 1, ch. 393).* *State (1) occurs in basal metriorhynchoids.* *Note, this condition is different from that of* Dyrosaurus maghribensis*, as there the entire anterior margin of the ilium bulges anteriorly, not just the acetabular margin (which in* Pelagosaurus typus *creates the thin acetabular flange).* 0. absent 1. present

402	**Ilium, relative length of anterior and posterior processes: (*)** *Clark (1994, ch. 84); Lauprasert et al. (2007, ch. 68); Andrade et al. (2011, ch. 441); Ristevski et al. (2018, ds 1, ch. 441); Smith et al. (in review, ds 2, ch. 441); Ősi et al. (2018, ds 1, ch. 394).* *This character is not applicable for taxa that lack the posterior process of the ilium.* 0. subequal, anterior and posterior processes similar in length 1. unequal, with anterior process relatively small, one quarter or less than the length of the posterior process
403	**Ilium, presence of indentation at the dorsal margin of iliac blade:** *Brochu (1999, ch. 28 mod., part); Andrade et al. (2011, ch. 442); Ristevski et al. (2018, ds 1, ch. 442); Smith et al. (in review, ds 2, ch. 442); Ősi et al. (2018, ds 1, ch. 395).* *Andrade et al. (2011) divded this character to separate diverse aspects of the morphology of the anterior end of iliac blade. This character samples the indentation at the dorsal edge of the anterior process.* 0. absent, dorsal edge convex or straight in lateral view 1. present as a shallow or modest dorsal indentation 2. present as a strong dorsal indentation ("wasp-waisted")
404	**lium, presence of a distinct 'bulge' that fuses the anterior regions of the supraacetabular and dorsal iliac crests: (*)** *Ristevski et al. (2018, ds 2, ch. 336); Smith et al. (in review, ds 1, ch. 342); Ősi et al. (in review, ds 1, ch. 396).* *State (1) occurs in* Anteophthalmosuchus hooleyi *and* Crocodylus. *This character is not applicable for taxa that lack the dorsal iliac crest.* 0. anterior region of the supraacetabular crest does not fuse with the anterior margin of the iliac dorsal crest, as there is no anterior 'bulge' 1. anterior region of the crest bulges laterally (slightly overhanging the acetabular fossa), and is contiguous with the anterior margin of the iliac dorsal crest
405	**Ilium, postacetabular (= posterior) process presence:** *Young & Andrade (2009, ch. 128 mod.), Young et al. (2011, ch. 128 mod.); Young et al. (2013a, ch. 181 mod.); Young et al. (2012, ch. 215 mod.); Young (2014, ch. 224); Wilberg (2015b, ch. 368); Young et al. (2016, ds 2, ch. 266 mod.); Ristevski et al. (2018, ds 2, ch. 337); Smith et al. (in review, ds 1, ch. 343); Ősi et al. (2018, ds 1, ch. 397).* *State (1) is a putative apomorphy of Metriorhynchidae.* 0. present 1. absent/extremely reduced
406	**Ilium, postacetabular (= posterior) process expanded into a thin "fan"-shape: (*)** *Young et al. (2012, ch. 216); Young (2014, ch. 225); Wilberg (2015b, ch. 369); Young et al. (2016, ds 2, ch. 267); Ristevski et al. (2018, ds 2, ch. 338); Smith et al. (in review, ds 1, ch. 344); Ősi et al. (2018, ds 1, ch. 398).* *State (1) is a putative apomorphy of derived teleosauroids (not seen in basal taxa* Platysuchus multiscrobiculatus, Teleosaurus cadomensis, Steneosaurus gracilirostris *and* S. bollensis *where the process is still elongate and distinctly process-like). This structure is a modification of the postacetabular (=posterior) process in these taxa.* *This character is not applicable for taxa that lack the postacetabular process.* 0. no 1.yes, posterior margin is expanded (typically resembling a "fan"-shape), being mediolaterally compressed and extends from the iliac crest towards the posterior peduncle
407	**Ilium, postacetabular (= posterior) process, presence of constrictions ('wasp-waisting') on both the dorsal and ventral margins near the distal terminus: (*)** *Ristevski et al. (2018, ds 2, ch. 339); Smith et al. (in review, ds 1, ch. 345); Ősi et al. (2018, ds 1, ch. 399).* *State (1) occurs in* Anteophthalmosuchus epikrator *and* Crocodylus. *This character is not applicable for taxa that lack the postacetabular process.* 0. absent 1. present
408	**Illium, size:** *Young (2006, ch. 42); Wilkinson et al. (2008, ch. 71); Young & Andrade (2009, ch. 71); Young et al. (2011, ch. 71); Young et al. (2013a, ch. 182); Young et al. (2012, ch. 217); Young (2014, ch. 226); Young et al. (2016, ds 2, ch. 268); Ristevski et al. (2018, ds 2, ch. 340); Smith et al. (in review, ds 1, ch. 346); Ősi et al. (2018, ds 1, ch. 400).* *State (1) is a putative apomorphy of Metriorhynchidae.* 0. large (length of dorsal border more than 28%, and typically at least 30% of femur length) 1. small (length of dorsal border less than 21% of femur length)
409	**Ilium, in lateral view, the orientation of the dorsal margin of the articulation facet that contributes to the acetabulum is:** *Young (2014, ch. 227); Young et al. (2016, ds 2, ch. 269); Ristevski et al. (2018, ds 2, ch. 341); Smith et al. (in review, ds 1, ch. 347); Ősi et al. (in review, ds 1, ch. 401).* *State (1) is a putative autapomorphy of* Tyrannoneustes lythdrodectikos. 0. ventrally orientated 1. horizontally orientated
410	**Ilium, dorsal border length in lateral view:** *Young (2014, ch. 228); Young et al. (2016, ds 2, ch. 270); Ristevski et al. (2018, ds 2, ch. 342); Smith et al. (in review, ds 1, ch. 348); Ősi et al. (2018, ds 1, ch. 402).* *State (1) is a putative autapomorphy of* Tyrannoneustes lythdrodectikos.

	0. long, terminates at least level to the articulation facet that contributes to the acetabulum 1. short, terminates prior to the articulation facet that contributes to the acetabulum
411	**Ilium, ventral margin:** *Ristevski et al. (2018, ds 2, ch. 343); Smith et al. (in review, ds 1, ch. 349); Ősi et al. (2018, ds 1, ch. 403).* *State (1) is a putative apomorphy of Metriorhynchidae.* 0. distinct ilium and ischium peduncles separated by an acetabular incision/depression 1. lacks an acetabular depression, with the peduncles being contiguous with the ventral margin
412	**Ischium, presence of pubic (= anterior) process:** *Andrade et al. (2011, ch. 444) – reformulated from Clark (1994, ch. 86) and Andrews (1913); Ristevski et al. (2018, ds 1, ch. 446); Smith et al. (in review, ds 2, ch. 446); Ősi et al. (2018, ds 1, ch. 404).* 0. pubic process absent, or incipient and small, not restricting the participation of the pubis to the acetabulum 1. anterior process well developed, robust and with a round head, at least partially restricting the participation of pubis in the acetabulum
413	**Ischium, morphology of pubic (= anterior) process: (*)** *Young (2006, ch. 43); Wilkinson et al. (2008, ch. 72); Young & Andrade (2009, ch. 72); Young et al. (2011, ch. 72); Young et al. (2013a, ch. 183); Young et al. (2012, ch. 218); Young (2014, ch. 229); Young et al. (2016, ds 2, ch. 271); Ristevski et al. (2018, ds 2, ch. 344); Smith et al. (in review, ds 1, ch. 350); Ősi et al. (2018, ds 1, ch. 405).* *State (1) is a putative apormorphy of Metriorhynchidae.* *State (2) is a putative apomorphy of* Cricosaurus. *This character is not applicable for taxa that lack, or have incipient pubic processes.* 0. developed – with clearly defined articulation facets for pubis and ilium; additionally, anterior process is at least half as wide as the posterior process 1. reduced – lacks both articulation facets, and is between 30–50% as wide as the posterior process 2. highly reduced – lacking both articulation facets, and is less than 25% as wide as the posterior process
414	**Ischium, morphology of anterior process of iliac blade, in lateral view:** *Brochu (1999, ch. 28 mod., part); Andrade et al. (2011, ch. 443); Ristevski et al. (2018, ds 1, ch. 443); Smith et al. (in review, ds 2, ch. 443); Ősi et al. (2018, ds 1, ch. 406).* *Andrade et al. (2011) divded this character to separate diverse aspects of the morphology of the anterior end of iliac blade. This character samples the morphology of the anterior process. Among eusuchians, state (1) is a somewhat generalised condition; state (0) is putative apomorphy of* Paleosuchus*; and state (2) is putative apomorphy of* Diplocynodon. 0. very narrow relative the main body of the iliac blade 1. rounded and moderately broad relative the main body of the iliac blade 2. very broad and deep, at least half the height of the main body of the iliac blade
415	**Limb bones, length relative to trunk, at maturity: (ORDERED)** *Brochu (1999, ch. 33 mod.); Andrade et al. (2011, ch. 448); Ristevski et al. (2018, ds 1, ch. 450); Smith et al. (in review, ds 2, ch. 450); Ősi et al. (2018, ds 1, ch. 407).* *Andrade et al. (2011) modified this character to sample length relative to trunk, not overall robustness.* *Within Eusuchia, Brochu (1999) considers that state (2) only occurs in* Borealosuchus. 0. limb bones relatively short 1. limb bones moderately long 2. limb bones very long
416	**Limb bones, general structure:** *Brochu (1999, ch. 33 part); Andrade et al. (2011, ch. 449); Ristevski et al. (2018, ds 1, ch. 451); Smith et al. (in review, ds 2, ch. 451); Ősi et al. (2018, ds 1, ch. 408).* *Andrade et al. (2011) modified this character was to sample overall robustness, not relative length. Within Eusuchia, Brochu (1999) considers that state (2) only occurs in* Borealosuchus. 0. limb bones robust 1. limb bones overall slender, but not weak 2. gracile
417	**Limb bones, relative length of forelimbs/hindlimbs (= *humerus* + *radius : femur* + *tibia*):** *Brochu (1999, ch. 33 part); Young & Andrade (2009, ch. 109 mod.); Andrade et al. (2011, ch. 450 mod.); Nesbitt (2011, ch. 212 mod.); Young et al. (2011, ch. 109 mod.); Young et al. (2013a, ch. 195 mod.); Young et al. (2012, ch. 230 mod.); Young (2014, ch. 241 mod.); Young et al. (2016, ds 2, ch. 284 mod.); Ristevski et al. (2018, ds 2, ch. 345); Smith et al. (in review, ds 1, ch. 351); Ősi et al. (2018, ds 1, ch. 409).* *Andrade et al. (2011) modified the crocodylomorph variant of this character to sample relative length of limbs, not robustness or limb/trunk relative length. This version of the character is an amalgam of the ones in Andrade et al. (2011) and Nesbitt (2011), the latter which Young et al. (2016, ds 2) modified to include extra states to reflect the forelimb reduction in Thalattosuchia.* *This character does not consider the autopodia (manus and pes), only the relation between the stylopodia and zeugopodia (humerus + ulna and femur + tibia, respectively).* *States (3 + 4) reflects the extreme conditions found in Thalattosuchia. State (4) evolved twice, once in Metriorhynchidae, and also in derived teleosauroids (the Middle Jurassic* 'Steneosaurus' *clade).* *Note that basal thalattosuchians (e.g.* Steneosaurus bollensis, Platysuchus multiscrobiculatus *and* Pelagosaurus typus*) have state (2).* *State (2) also occurs in* Gavialis *and* Terminonaris.

	State (3) also evolved in the Pachycheilosuchus + Pietraroiasuchus *clade.* *Basal crocodylomorphs also share state (2), while state (3) occurs in* Postosuchus. *Within Eusuchia, Brochu (1999) considers that state (0) only occurs in* Borealosuchus. 0. forelimb and hindlimb subequal in length at maturity 1. forelimb slightly shorter than hindlimb at maturity 2. forelimb shorter than hindlimb at maturirty (between 90 and 55%) 3. forelimb noticeably shorter than hindlimb at maturity (between 45 and 55%) 4. forelimb significantly shorter than hindlimb at maturity (less than 45%)
418	**Limb bones (hindlimbs), proportional length of tibia relative to the femur: (ORDERED)** *Clark et al. (2000, ch. 31 mod.); Clark & Sues (2002, ch. 32 mod.); Sues et al. (2003, ch. 32 mod.); Clark et al. (2004, ch. 32 mod.); Young (2006, ch. 44 mod.); Wilkinson et al. (2008, ch. 73 mod.); Young & Andrade (2009, ch. 73 mod.); Andrade et al. (2011, ch. 453 mod.); Young et al. (2012, ch. 225 + 231 mod.); Pol et al. (2013, ch. 32 mod.); Young et al. (2016, ds 2, ch. 278 mod.); Leardi et al. (2017, ch. 32 mod.); Ristevski et al. (2018, ds 1, ch. 455 mod.); Smith et al. (in review, ds 2, ch. 455 mod.); Ősi et al. (2018, ds 1, ch. 410).* *This version of the character is an amalgam of the ones in Andrade et al. (2011), Young et al. (2016) and Leardi et al. (2017).* *This character is designed to help elucidate variation in the proportions of the hind limb, and the changes that occur in Thalattosuchia (where the femur can be almost twice the size of tibia, i.e. in Metriorhynchidae). Thus states (2-5) are putative apomorphies of Thalattosuchia.* *State (0) occurs in* Terrestrisuchus, *Hallopodidae, and* Gobiosuchus. *In Thalattosuchia, state (4) is a putative apomorphy of both Metriorhynchinae and* Aeolodon priscus*, with derived metriorhynchines being state (5). Middle Jurassic teleosauroids (and the Late Jurassic genus* Machimosaurus*) and Geosaurinae score as state (3).* *Thus, this character is scoring for the independent regression of the tibia (as a proportion of the hind limb) in Teleosauroidea and Metriorhynchidae.* *State (2) also occurs in Dyrosauridae and* Terminonaris. 0. length uneven, tibia slightly longer than the femur (distal/proximal more than 105%) 1. tibia subequal to femur, or only slightly shorter (distal/proximal c. 75-100%) 2. length uneven, tibia evidently shorter than the femur (distal/proximal c. 50-74%) 3. length uneven, tibia evidently shorter than the femur (distal/proximal c. 40-50%) 4. length uneven, tibia evidently shorter than the femur (distal/proximal c. 30-40%) 5. length uneven, tibia evidently shorter than the femur (distal/proximal less than 30%)
419	**Femur, relative orientation between the proximal and distal heads:** *Ortega et al. (2000, ch. 149), Andrade et al. (2011, ch. 455); Ristevski et al. (2018, ds 1, ch. 457); Smith et al. (in review, ds 2, ch. 457); Ősi et al. (2018, ds 1, ch. 411).* 0. femur with light torsion, proximal and distal articulation facets approximately at 30 degrees or less from each other 1. femur with evident torsion, proximal and distal articulation facets approximately at 60 degrees from each other
420	**Femur, general shape:** *Andrade et al. (2011, ch. 464 mod.); Ristevski et al. (2018, ds 2, ch. 347 mod.); Smith et al. (in review, ds 1, ch. 353 mod.); Ősi et al. (2018, ds 1, ch. 412).* *State (1) is a putative apomorphy of Thalattosuchia.* 0. sigmoidal shape formed by either an unequal proximal and distal curvature, or a strong sigmoidal shape 1. sigmoidal shape formed by comparable curvatures proximally and distally, and forms a shallow 'S'-shape
421	**Femur, proximal portion, posteromedial tuber:** *Nesbitt (2011, ch. 301 mod. – character states re-ordered); Young et al. (2013a, ch. 184); Young et al. (2012, ch. 219); Young (2014, ch. 230); Young et al. (2016, ds 2, ch. 272); Ristevski et al. (2018, ds 2, ch. 348); Smith et al. (in review, ds 1, ch. 354); Ősi et al. (2018, ds 1, ch. 413).* *State (2) is a putative apomorphy of Metriorhynchoidea.* *State (2) also occurs in non-paracrocodylomorph pseudosuchians.* 0. absent 1. present, and small 2. present, and largest of the proximal tubera
422	**Femur, proximal condylar fold:** *Nesbitt (2011, ch. 312); Young et al. (2013a, ch. 185); Young et al. (2012, ch. 220); Young (2014, ch. 231); Young et al. (2016, ds 2, ch. 273); Ristevski et al. (2018, ds 2, ch. 349); Smith et al. (in review, ds 1, ch. 355); Ősi et al. (2018, ds 1, ch. 414).* *State (1) occurs in Paracrocodylomorpha.* *The proximal condylar fold is a straight ridge that connects the medioventral portion of the ventral head with the shaft on the anterolateral surface of the femur (Nesbitt 2011: p. 149).* *Note that this fold can be hard to discern in Metriorhynchidae. It is possible that derived species of* Cricosaurus *lack this fold.* 0. absent 1. present
423	**Femur, ridge of attachment for the *M. caudofemoralis*:** *Young & Andrade (2009, ch. 108 mod.); Nesbitt (2011, ch. 315 mod.); Young et al. (2011, ch. 108 mod.); Young et al. (2013a, ch. 186); Young et al. (2012, ch. 221); Young (2014, ch. 232); Young et al. (2016, ds 2, ch. 274); Ristevski et al.*

	(2018, ds 2, ch. 350); Smith et al. (in review, ds 1, ch. 356); Ősi et al. (2018, ds 1, ch. 415). *We follow Young et al. (2016, ds 2) in scoring thalattosuchians as state (0). Thalattosuchians lack a fourth trochanter sensu stricto, as they only have a large flattened rugose area for the muscle attachment, not a distinct process. Thus state (0) is a putative apomorphy of Thalattosuchia.* 0. absent, flattened rugose area 1. low and without a distinct medial asymmetrical apex (= fourth trochanter) 2. bladelike with a distinct asymmetric apex located medially
424	**Lateral edge of proximal articular surface of femur (lesser trochanter):** *Young & Andrade (2009, ch. 117); Young et al. (2011, ch. 117); Young et al. (2013a, ch. 187); Young et al. (2012, ch. 222); Young (2014, ch. 233); Young et al. (2016, ds 2, ch. 275); Ristevski et al. (2018, ds 2, ch. 351); Smith et al. (in review, ds 1, ch. 357); Ősi et al. (2018, ds 1, ch. 416).* *State (1) occurs in Metasuchia.* 0. rounded 1. ‘squared’ with enlarged scar for *Musculus ischiotrochantericus*
425	**Femur, medial condyle of the distal portion:** *Nesbitt (2011, ch. 320 mod.); Young et al. (2013a, ch. 188 mod.); Young et al. (2012, ch. 223 mod.); Young (2014, ch. 234 mod.); Young et al. (2016, ds 2, ch. 276 mod.); Ristevski et al. (2018, ds 2, ch. 352 mod.); Smith et al. (in review, ds 1, ch. 358); Ősi et al. (2018, ds 1, ch. 417).* *State (0) occurs in basal pseudosuchians.* *State (1) occurs in Postosuchidae + Crocodylomorpha.* *State (2) occurs in Metriorhynchidae.* 0. tapers to a point on the medial portion in distal view 1. smoothly rounded in distal view 2. condyle incompletely ossified, and typically poorly developed
426	**Femur, distal surface between the lateral and medial condyles:** *Nesbitt (2011, ch. 321); Young et al. (2013a, ch. 189); Young et al. (2012, ch. 224); Young (2014, ch. 235); Young et al. (2016, ds 2, ch. 277); Ristevski et al. (2018, ds 2, ch. 353); Smith et al. (in review, ds 1, ch. 359); Ősi et al. (2018, ds 1, ch. 418).* *State (1) occurs in crocodyliforms, and some ‘sphenosuchians’.* *Within Crocodyliformes, state (0) is a putative apomorphy of Metriorhynchidae.* 0. nearly flat or flat 1. groove separating the medial condyle from the lateral condyle
427	**Calcaneum tuber, development:** *Young (2006, ch. 45 mod.); Wilkinson et al. (2008, ch. 74 mod.); Young & Andrade (2009, ch. 74 mod.); Andrade et al. (2011, ch. 466); Young et al. (2011, ch. 74 mod.); Young et al. (2013a, ch. 191 mod.); Young et al. (2012, ch. 226 mod.); Young (2014, ch. 237 mod.); Young et al. (2016, ds 2, ch. 279 - rephrased); Ristevski et al. (2018, ds 2, ch. 354); Smith et al. (in review, ds 1, ch. 360); Ősi et al. (2018, ds 1, ch. 419).* *This character scores the regression of the tuber in metriorhynchines. Whether the calcaneal tuber regresses in geosaurine metriorhynchids is currently unknown.* 0. well developed with a long neck (typically subequal in length to main body of calcaneum) 1. poorly developed with a short neck (less than half length of calcaneum main body, and projects out in one plane from the calcaneum main body)
428	**Pes, length of metatarsals: (ORDERED)** *Young (2006, ch. 46 mod.); Wilkinson et al. (2008, ch. 75 mod.); Young & Andrade (2009, ch. 75 mod.); Young et al. (2011, ch. 75 mod.); Young et al. (2013a, ch. 192 mod.); Young et al. (2012, ch. 227 mod.); Young (2014, ch. 238 mod.); Young et al. (2016, ds 2, ch. 280 mod.); Ristevski et al. (2018, ds 2, ch. 355 mod.); Smith et al. (in review, ds 1, ch. 361 mod.); Ősi et al. (2018, ds 1, ch. 420).* *States (1-2) occur in Metriorhynchoidea.* *State (2) occurs in Metriorhynchidae.* *This character helps score the modification of the pes into paddles in Metriorhynchoidea.* 0. metatarsals I–IV longer than their repective digit phalanges (greater than 20%) 1. metatarsals II–IV sub-equal in length to their repspective digit phalanges (± 10%) 2. metatarsals II–IV shorter than their respective digit phalanges (less than 90%)
429	**Pes, proximal morphology of metatarsal I: (ORDERED)** *Young (2006, ch. 47 mod.); Wilkinson et al. (2008, ch. 76 mod.); Young & Andrade (2009, ch. 76 mod.); Andrade et al. (2011, ch. 467 mod.); Young et al. (2011, ch. 76 mod.); Young et al. (2013a, ch. 193 mod.); Young et al. (2012, ch. 228 mod.); Young (2014, ch. 239 mod.); Young et al. (2016, ds 2, ch. 281 mod.); Ristevski et al. (2018, ds 2, ch. 356 mod.); Smith et al. (in review, ds 1, ch. 362 mod.); Ősi et al. (2018, ds 1, ch. 421).* *States (1-3) occur in Metriorhynchoidea.* *This character scores the broadening of metatarsal I seen in metriorhynchines. The pes of geosaurine metriorhynchid is currently unknown.* *This character helps score the modification of the pes into paddles in Metriorhynchoidea.* 0. proximal end not enlarged (typically no more than 10%, but depending on preservation up to 20%, wider than any other metatarsal) 1. proximal end enlarged (25-30% wider)

	2. proximal end moderately enlarged (45-55% wider) 3. proximal end greatly enlarged (more than 75% wider)
430	**Pes, relative length of digits III and IV:** *Young (2006, ch. 48); Wilkinson et al. (2008, ch. 77); Young & Andrade (2009, ch. 77); Andrade et al. (2011, ch. 465); Young et al. (2011, ch. 77); Young et al. (2013a, ch. 194); Young et al. (2012, ch. 229); Young (2014, ch. 240); Young et al. (2016, ds 2, ch. 283); Ristevski et al. (2018, ds 2, ch. 357); Smith et al. (in review, ds 1, ch. 363); Ősi et al. (2018, ds 1, ch. 422).* *In crocodyliforms, the digits are usually in the following descending order: III-IV-II-I.* *State (1) is putative apomorphy of Metriorhynchoidea, and with digit length arranged as IV-III-II-I (see Young & Andrade 2009, Appendix 2). Previously this has been considered to be a metriorhynchid apomorphy.* *This character helps score the modification of the pes into paddles in Metriorhynchoidea.* 0. digit III is longer than digit IV 1. digit IV is longer than digit III (digit IV elongated, helping to create a paddle)
431	**Pes, digit IV, number of phalanges: (ORDERED)** *Nesbitt (2011, ch. 396 mod.); Ristevski et al. (2018, ds 2, ch. 358); Smith et al. (in review, ds 1, ch. 364); Ősi et al. (2018, ds 1, ch. 423).* *State (0) is a putative apomorphy of* Postosuchus. *State (1) occurs in most archosauriforms.* *State (2) is a putative apomorphy of Crocodylomorpha.* *Ristevski et al. (2018, ds 2) added state (0) as six pedal digit IV phalanges have been reported for specimens of* P. alisonae *Peyer et al. (2008) and* P. kirkpatricki *(Weinbaum, 2013).* 0. six 1. five 2. four or fewer
432	**Pes, digit V, metatarsals and phalanges:** *Clark (1994, ch. 88 mod.); Nesbitt (2011, ch. 399 re-phrased); Young et al. (2016, ds 2, ch. 282); Ristevski et al. (2018, ds 2, ch. 359); Smith et al. (in review, ds 1, ch. 365); Ősi et al. (2018, ds 1, ch. 424).* *State (0) occurs in non-crocodylomorphs.* *State (1) occurs in 'sphenosuchians'.* *State (2) is a putative apomorphy of Crocodyliformes.* 0. present and ''fully'' developed first phalanx 1. present and ''poorly'' developed first phalanx 2. without phalanges and metatarsal tapers to a point

Dermal ossifications: osteoderms (Ch. 433 – 456; 5.217% of characters)

#	Description
433	**Ornamentation (dorsal osteoderms), type of sculpture: (*)** *Ortega et al. (2000, ch. 111); Andrade et al. (2011, ch. 19); Ristevski et al. (2018, ds 2, ch. 360); Smith et al. (in review, ds 1, ch. 366); Ősi et al. (2018, ds 1, ch. 425).* *Ornamentation on the osteoderms is always present, and only in two possible forms. Note that Turner & Buckley (2008) considered that* Araripesuchus gomesii *and (possibly)* A. tsangatsangana *displayed the 'fleur de lys' pattern (anterolaterally and anteromedially directed "ridges"; Osmólska et al., 1997), according to the character by Pol & Norell (2004b, ch188). We consider that this pattern regards the disposition of the sculpturing (fabric), not the type of sculpturing.* *This character is not applicable for taxa that lack dorsal osteoderms.* 0. vermiform-dendritic pattern 1. pitted pattern
434	**Ornamentation (dorsal osteoderms), distribution of pits on dorsal surface: (*)** *Young et al. (2011, ch. 185 mod.); Young et al. (2013a, ch. 201 mod.); Young et al. (2012, ch. 239 mod.); Young (2014, ch. 250 mod.); Young et al. (2016, ds 2, ch. 297 mod.); Ristevski et al. (2018, ds 2, ch. 361 mod.); Smith et al. (in review, ds 1, ch. 367); Ősi et al. (2018, ds 1, ch. 426).* *State (2) is a putative autapomorphy of* Magyarosuchus fitosi. *State (3) is a putative apomorphy of Machimosaurini.* *Ősi et al. (2018) added state (2) to accommsueviodate the unusual osteoderm pit morphology seen in* Magyarosuchus fitosi. *This character is not applicable for taxa that lack dorsal osteoderms, or pitted ornamentation.* 0. small round to ellipsoid pits, very densely distributed 1. large round to ellipsoid pits, well separated from one another 2. irregularly shaped pits (including circular, ellipsoid, bean-shaped, triangular and quadrangular shapes), with an extreme variation in size (from small to very large), with elongate pits present on the ventrolateral surface running from the keel to the lateral margin 3. pits variable in size and length, from small to large, but on osteoderms with a keel, the pits can become elongate grooves, especially along the lateral margins
435	**Presacral osteoderms, dorsal to the vertebral column:** *Clark (1994, ch. 100 mod.); Brochu (1999, ch. 39 part); Young (2006, ch. 51); Wilkinson et al. (2008,*

	ch. 80); Young & Andrade (2009, ch. 80); Andrade et al. (2011, ch. 468 part); Nesbitt (2011, ch. 401); Young et al. (2011, ch. 80); Young et al. (2013a, ch. 196 part); Young et al. (2012, ch. 232 part); Young (2014, ch. 243 part); Wilberg (2015b, ch. 382); Young et al. (2016, ds 2, ch. 285); Wilberg (2017, ch. 394); Ristevski et al. (2018, ds 2, ch. 362); Smith et al. (in review, ds 1, ch. 368); Ősi et al. (2018, ds 1, ch. 427). *State (0) occurs in* Junggarsuchus *and Metriorhynchidae.* 0. absent 1. present
436	**Presacral ventral osteoderms (= gastral osteoderms), form a carapace in the trunk region:** *Young (2006, ch. 50 mod.); Wilkinson et al. (2008, ch. 79 mod.); Young & Andrade (2009, ch. 79 mod.); Andrade et al. (2011, ch. 468 part); Nesbitt (2011, ch. 409 re-phrased); Young et al. (2011, ch. 79 mod.); Young et al. (2013a, ch. 199); Young et al. (2012, ch. 236 mod.); Young (2014, ch. 247 mod.); Young et al. (2016, ds 2, ch. 294); Ristevski et al. (2018, ds 2, ch. 374); Smith et al. (in review, ds 1, ch. 380); Ősi et al. (2018, ds 1, ch. 428).* *Crocodyliformes have state (1), although with reversions.* 0. absent 1. present
437	**Nuchal armour, relation of nuchal osteoderms with the remaining dorsal armour and skull: (*)** *Brochu (1999, ch. 38 mod., part); Andrade et al. (2011, ch. 469); Ristevski et al. (2018, ds 2, ch. 363); Smith et al. (in review, ds 1, ch. 369); Ősi et al. (2018, ds 1, ch. 429).* *Note that a similar character was devised by Ortega et al. (2000, ch. 109), but to unite the undescribed Itaborai form and* Sebecus*. See also McAliley et al. (2006) for discussion on eusuchians.* *This character is not applicable for taxa that lack dorsal osteoderms.* 0. large nuchal shields continuous from postoccipital region to trunk armour, with any given osteoderm contacting the anterior and posterior elements (except for the first postoccipital shield) 1. large nuchal shields continuous with trunk armour, but not reaching the postoccipital region 2. large nuchal shields discontinuous with dorsal trunk armour and absent from postoccipital region
438	**Nuchal armour, number and arrangement of nuchal shields: (*)** *Brochu (1999, ch. 38 mod. & rev. in part); Andrade et al. (2011, ch. 470); Ristevski et al. (2018, ds 2, ch. 364); Smith et al. (in review, ds 1, ch. 370); Ősi et al. (2018, ds 1, ch. 430).* *State (3), and the terminology 'cervical shield' is according to Marinho & Carvalho (2009). See also McAliley et al. (2006) for discussion on eusuchians.* *This character is not applicable for taxa that lack dorsal osteoderms, or that lack a distinct nuchal shield (i.e. thalattosuchians).* 0. four paramedian nuchal shields, sided by two accessory shields, all enlarged relative to the remaining neck dermal armour 1. four paramedian nuchal shields enlarged relative to remaining neck shields, and no accessory shield enlarged 2. eight (or more) shields, arranged in two paramedian rows, enlarged relative to remaining neck shields, with no accessory shield enlarged 3. ten or more median osteoderms, combined with several lateral osteoderms, composing a distinct cervical shield
439	**Nuchal armour, morphology of nuchal shields relative to the remaining trunk dermal armour: (*)** *Brochu (1999, ch. 38 mod. in part); Andrade et al. (2011, ch. 471); Ristevski et al. (2018, ds 2, ch. 365); Smith et al. (in review, ds 1, ch. 371); Ősi et al. (2018, ds 1, ch. 431).* *State (1) occurs in* Armadilosuchus *and Susisuchidae + Eusuchia (with a reversal in gavialoids).* *This character is not applicable for taxa that lack dorsal osteoderms.* 0. nuchal and dorsal trunk shields undifferentiated, morphology grading continuously 1. nuchal shields clearly differentiated from dorsal trunk shields by size and general morphology (regardless of contact between nuchal and trunk series)
440	**Presacral dorsal armour, presence of an anterior process (= anterolateral process, = stylofoveal process) to articulate with the anterior adjacent osteoderm, in medial dorsal elements: (*)** *Norell & Clark (1990, ch. 13 rev.); Clark (1994, ch. 96 mod.); Brochu (1999, ch. 40 rev.); Ortega et al. (2000, ch. 113 rev.); Andrade et al. (2011, ch. 477 mod.); Young et al. (2011, ch. 184); Young et al. (2013a, ch. 198); Young et al. (2012, ch. 233 mod.); Young (2014, ch. 244); Young et al. (2016, ds 2, ch. 286); Ristevski et al. (2018, ds 1, ch. 483; ds 2, ch. 366 mod.); Smith et al. (in review, ds 1, ch. 372 mod.; ds 2, ch. 483 mod.); Ősi et al. (2018, ds 1, ch. 432).* *Scores for a similar morphology as Nesbitt (2011, ch. 403).* *Note that this process does not include the lateral processes seen in dyrosaurids, as they articulate with the accessory osteoderms.* *State (2) is a putative apomorphy of* Magyarosuchus fitosi. *Ősi et al. (2018) modified this character by adding state (2), which is a modification of the distinct 'peg-like' anterolateral process seen in* Magyarosuchus fitosi. *This character is not applicable for taxa that lack dorsal osteoderms.* 0. absent

	1. present, as a distinct ‘peg-like’ process 2. present, but as an indistinct process, no longer being distinctly ‘peg-like’, as their lateral margin is contiguous with that of the osteoderm ventrolateral surface
441	**Presacral dorsal armour, surface of only the paravertebral osteoderms: (*)** *Andrade et al. (2011, ch. 476); Nesbitt (2011, ch. 404); Young et al. (2012, ch. 235); Young (2014, ch. 246); Young et al. (2016, ds 2, ch. 287); Ristevski et al. (2018, ds 2, ch. 367); Smith et al. (in review, ds 1, ch. 373); Ősi et al. (2018, ds 1, ch. 433).* *Crocodile-line archosaurs including, basal crocodylomorphs, have state (1).* *In Thalattosuchia* Teleosaurus cadomensis *and* Platysuchus multiscrobiculatus *also have state (1).* *This character is not applicable for taxa that lack dorsal osteoderms.* 0. either weakly arched or mostly straight, forming a flat osteoderm, either keeled or not 1. osteoderm either strongly curved, with convex surface, partially embracing the vertebrae from side to side, or the curvature is restricted to a distinct bend near the lateral edge
442	**Presacral dorsal armour, biserial or tetraserial dorsal shield: (*)** *Young & Andrade (2009, ch. 147 part); Young et al. (2011, ch. 147 part); Young et al. (2013a, ch. 197 part); Young et al. (2012, ch. 232 part); Young (2014, ch. 243 part); Young et al. (2016, ds 2, ch. 289); Ristevski et al. (2018, ds 2, ch. 368); Smith et al. (in review, ds 1, ch. 374); Ősi et al. (2018, ds 1, ch. 434).* *State (1) occurs in Susisuchidae + Eusuchia.* *This character is not applicable for taxa that lack dorsal osteoderms.* 0. biserial dorsal shield (one pair of paramedian osteoderms per row) 1. tetraserial dorsal shield (two pairs of paramedian osterderms per row)
443	**Presacral dorsal armour, presence of accessory osteoderm columns that do not have a peg-like articulation with the paramedian column, and which are smaller in size than the paramedian column(s): (*) (ORDERED)** *Ristevski et al. (2018, ds 2, ch. 369); Smith et al. (in review, ds 1, ch. 375); Ősi et al. (2018, ds 1, ch. 435).* *This character is an amalgam of Andrade et al. (2011, ch. 472 + 473) and Young et al. (2016, ds 2, ch. 290).* *Similar to the character in: Norell & Clark (1990, ch. 12 mod.); Brochu (1999, ch. 37 mod.); Ortega et al. (2000, ch. 107).* *This character does not consider the accessory osteoderms of dyrosaurids to be homologous (see character relating to the ‘lateral process’).* *This character does not consider the accessory osteoderms of notosuchians to be homologous, as their accessory osteoderms can retain the same size and shape as the paramedian column.* *State (1) occurs in Bernissaartidae, Susisuchidae, and Eusuchia.* *State (2) occurs in* Brachychampsa *and* Alligator mississippiensis. *This character is not applicable for taxa that lack dorsal osteoderms.* 0. absent (either has: two paravertebral medial columns, the gobiosuchid, or notosuchian. or dyrosaurid morphology) 1. present, a lateral accessory column on either of the paramedian columns 2. present, two lateral accessory columns on either of the paramedian columns
444	**Presacral dorsal armour, presence of accessory osteoderm column that has a peg-like articulation with the paramedian column (through a ‘lateral process’ derived from the anterolateral margin of the paramedian osteoderms): (*)** *Jouve et al. (2008, ch. 37 mod.); Hastings et al. (2010, ch. 82 mod.); Young et al. (2016, ds 2, ch. 291); Ristevski et al. (2018, ds 2, ch. 370); Smith et al. (in review, ds 1, ch. 376); Ősi et al. (2018, ds 1, ch. 436).* *State (1) occurs in dyrosaurids.* *This character was applied to test the homology of accessory osteoderms in dyrosaurids.* *This character is not applicable for taxa that lack dorsal osteoderms.* 0. absent (either has: two paravertebral medial columns, the gobiosuchid or notosuchian or the advanced neosuchian morphology) 1. present, a lateral accessory column on either side of the paramedian columns, with articulations
445	**Presacral dorsal armour, presence of accessory osteoderm columns, anteriorly two lateral accessory columns which increase to four accessory columns in the trunk region: (*)** *Ristevski et al. (2018, ds 1, ch. 477); Smith et al. (in review, ds 2, ch. 477); Ősi et al. (2018, ds 1, ch. 437).* *State (1) occurs in* Gobiosuchus. *This character is not applicable for taxa that lack dorsal osteoderms.* 0. absent (either has: two paravertebral medial columns, only two accessory columns, or the notosuchian morphology) 1. present
446	**Presacral dorsal armour, dimensions of the thoracic osteoderms: (*)** *Clark (1994, ch. 95 mod.); Nesbitt (2011, ch. 407); Young et al. (2012, ch. 234); Young (2014, ch. 245); Young et al. (2016, ds 2, ch. 292); Wilberg (2017, ch. 395 part); Ristevski et al. (2018, ds 2, ch.*

	371); Smith et al. (in review, ds 1, ch. 377); Ősi et al. (2018, ds 1, ch. 438). *Crocodile-line archosaurs, including basal crocodylomorphs, have state (1).* *In Thalattosuchia, cervical osteoderms can be either state (0) or (1), so Young et al. (2016, ds 2) altered this character not to include the cervical osteoderms.* *Crocodyliformes have state (2).* *This character is not applicable for taxa that lack dorsal osteoderms.* 0. square shaped, length and width approximately equal 1. longer than wide 2. wider than long
447	**Presacral dorsal armour, transverse elongation of the thoracic osteoderms: (*)** *Wilberg (2017, ch. 395 part); Ristevski et al. (2018, ds 2, ch. 372); Smith et al. (in review, ds 1, ch. 378); Ősi et al. (2018, ds 1, ch. 439).* *State (1) occurs in goniopholidids and pholidosaurids (reversal in dyrosaurids).* *This character can only be scored for those osteoderms that overlay the thoracic vertebrae, and come from the middle region of the trunk.* *This character is not applicable for taxa that lack dorsal osteoderms.* 0. transverse width of these osteoderms is either small or sub-equal to the anteroposterior length, or only slightly wider 1. considerably wider than long, such that the transverse width is approximately three times the anteroposterior length
448	**Presacral dorsal armour, type of contact between elements in a row: (*)** *Clark (1994, ch. 98); Andrade et al. (2011, ch. 474); Ristevski et al. (2018, ds 2, ch. 373); Smith et al. (in review, ds 1, ch. 379); Ősi et al. (2018, ds 1, ch. 440).* *State (1) occurs in crown-group Crocodylia.* *This character is not applicable for taxa that lack dorsal osteoderms.* 0. imbricated, any given anterior trunk osteoderm partially overlays its following element 1. sutured, osteoderms do not cover adjacent dermal elements, and are sutured if in contact
449	**Presacral dorsal armour, presence of an anteroposteriorly directed keel on the dorsal surface of paramedial elements: (*)** *Buscalioni et al. (1992, ch. 22); Clark (1994, ch. 101 rev., part); Brochu (1999, ch. 35); Andrade et al. (2011, ch. 478); Young et al. (2012, ch. 240 mod.); Young (2014, ch. 251 mod.); Young et al. (2016, ds 2, ch. 298 mod.); Ristevski et al. (2018, ds 2, ch. 378 mod.); Smith et al. (in review, ds 1, ch. 384); Ősi et al. (2018, ds 1, ch. 441).* *State (0) occurs in* Pelagosaurus typus. *In Thalattosuchia the cervical and anterior dorsal osteoderms can have reduced keels, which can make it look as though they are absent. However, in* Pelagosaurus typus*, the anterior dorsal osteoderms lack keels, while the mid dorsal osteoderms are very poorly keeled (hard to discern from the interpit laminae). In Thalattosuchia the sacral and anterior-mid caudal osteoderms have raised keels, which along with the ventral caudal osteoderms are the most readily identifiable.* *This character is not applicable for taxa that lack dorsal osteoderms.* 0. absent on approximately half to all of the paravertebral osteoderms, or if present in the anterior half of the presacral dorsal armour hard to discern from the interpit laminae 1. present along more than half, to all, of the paravertebral osteoderms
450	**Presacral ventral armour, presence of ventral collar scales: (*)** *Poe (1997); Brochu (1999, ch. 156); Andrade et al. (2011, ch. 479); Ristevski et al. (2018, ds 2, ch. 379); Smith et al. (in review, ds 1, ch. 385); Ősi et al. (2018, ds 1, ch. 442).* *This character is not applicable for taxa that lack osteoderms.* 0. absent, no shield enlarged relative to other ventral scales 1. present, forming a single row of enlarged scales 2. present, forming two parallel rows of enlarged scales
451	**Presacral ventral armour, presence of paired ossifications:** *Buscalioni et al. (1992, ch. 21); Brochu (1999, ch. 39); Andrade et al. (2011, ch. 480); Ristevski et al. (2018, ds 2, ch. 380); Smith et al. (in review, ds 1, ch. 386); Ősi et al. (2018, ds 1, ch. 443).* 0. single or absent 1. present, pairs sutured together
452	**Postsacral (= caudal) armour, distribution of dorsal tail osteoderms:** *Clark (1994, ch. 99 mod.); Young (2006, ch. 49 part); Wilkinson et al. (2008, ch. 78 part); Young & Andrade (2009, ch. 78 part); Young et al. (2011, ch. 78 part); Young et al. (2013a, ch. 200 part); Young et al. (2012, ch. 237 mod.); Young (2014, ch. 248 mod.); Young et al. (2016, ds 2, ch. 295 mod.); Ristevski et al. (2018, ds 2, ch. 375 mod.); Smith et al. (in review, ds 1, ch. 381 mod.); Ősi et al. (2018, ds 1, ch. 444).* *Young et al. (2012) split the dorsal and ventral tail osteoderm character as* Pelagosaurus *and* Pietraroiasuchus *lack ventral tail osteoderms, but have dorsal tail osteoderms.* 0. present 1. absent
453	**Postsacral (= caudal) armour, distribution of ventral tail osteoderms:**

	Young (2006, ch. 49 part); Wilkinson et al. (2008, ch. 78 part); Young & Andrade (2009, ch. 78 part); Young et al. (2011, ch. 78 part); Young et al. (2013a, ch. 200 part); Young et al. (2012, ch. 238); Young (2014, ch. 249); Young et al. (2016, ds 2, ch. 296); Ristevski et al. (2018, ds 2, ch. 376); Smith et al. (in review, ds 1, ch. 382); Ősi et al. (2018, ds 1, ch. 445). *State (1) is a putative apomorphy of* Pelagosaurus + *Metriorhynchidae, and also occurs in* Pietraroiasuchus. 0. present 1. absent
454	**Postsacral (= caudal) armour, distribution when present: (*)** *Clark (1994, ch. 99 mod.); Young (2006, ch. 49 part); Wilkinson et al. (2008, ch. 78 part); Young & Andrade (2009, ch. 78 part); Andrade et al. (2011, ch. 481); Ristevski et al. (2018, ds 2, ch. 377); Smith et al. (in review, ds 1, ch. 383); Ősi et al. (2018, ds 1, ch. 446).* *This character is not applicable for taxa that lack caudal osteoderms.* 0. a pair of rows, covering the vertebral column 1. several rows, enclosing the tail surface
455	**Postsacral (= caudal) armour, presence of an anteroposteriorly directed keel on the dorsal surface of paramedial elements: (*)** *Clark (1994, ch. 101 rev., part); Andrade et al. (2011, ch. 482); Ristevski et al. (2018, ds 2, ch. 381); Smith et al. (in review, ds 1, ch. 387); Ősi et al. (2018, ds 1, ch. 447).* *This character is not applicable for taxa that lack dorsal osteoderms.* 0. absent 1. present
456	**Appendicular armour, presence of osteoderms on the limbs (at least in part):** *Pol & Norell (2004b, ch. 190); Nesbitt (2011, ch. 405); Young et al. (2016, ds 2, ch. 288); Wilberg (2017, ch. 406); Ristevski et al. (2018, ds 2, ch. 382); Smith et al. (in review, ds 1, ch. 388); Ősi et al. (2018, ds 1, ch. 448).* *Crocodyliformes have state (1), but perhaps with reversals in some clades.* *Limb osteoderms are rarely preserved, but have been mentioned for some dyrosaurids and advanced neosuchians.* 0. absent 1. present

Dermal ossifications: gastralia (Ch. 457; 0.217% of characters)

#	Description
457	**Gastralia:** *Nesbitt (2011, ch. 412); Ristevski et al. (2018, ds 2, ch. 383); Smith et al. (in review, ds 1, ch. 389); Ősi et al. (2018, ds 1, ch. 449).* *State (0) occurs in Postosuchus, 'sphenosuchians', and* Protosuchus. *State (1) occurs in crocodyliforms more derived than* Protosuchus. *State (2) occurs in* Simosuchus. 0. forming extensive ventral basket with closely packed elements 1. well-separated 2. absent

Soft tissue (Ch. 458 – 462; 1.087% of characters)

[Herein soft tissue characters are only scorable for extant taxa]

#	Description
458	**Iris colour: (*)** *Brochu & Storrs (2012, ch. 182); Narváez et al. (2015, ch. 182); Ősi et al. (2018, ds 1, ch. 450).* *State (0) occurs in* Mecistops, Crocodylus, Caiman, Melanosuchus, Gavialis *and* Alligator mississippiensis. *State (1) occurs in* Osteolameus, Tomistoma, Paleosuchus *and* Alligator sinensis. *This character cannot be scored for fossil taxa.* *All data from Brochu & Storrs (2012) and Narváez et al. (2015).* 0. greenish/yellowish 1. brown
459	**Tongue, presence of keratinised surface: (*)** *Brochu (1999, ch. 159); Andrade et al. (2011, ch. 483); Ristevski et al. (2018, ds 2, ch. 384); Smith et al. (in review, ds 1, ch. 390); Ősi et al. (2018, ds 1, ch. 451).* *State (1) is a putative apomorphy of Alligatoridae/Alligatoroidea.* *This character cannot be scored for fossil taxa.* *Originally based on Taplin & Grigg (1989), apud Brochu (1999).* 0. absent

	1. presence
460	**Functional lingual salt glands, presence: (*)** *based on Taplin (1985); Taplin & Grigg (1989); Brochu (2007); Andrade et al. (2011, ch. 484); Ristevski et al. (2018, ds 2, ch. 385); Smith et al. (in review, ds 1, ch. 391); Ősi et al. (2018, ds 1, ch. 452).* *State (0) is a putative apomorphy of Alligatoridae.* *This character cannot be scored for fossil taxa.* 0. absent 1. present
461	***M. caudofemoralis*, morphology: (*)** *Frey et al. (1989); Brochu (1999, ch. 160); Andrade et al. (2011, ch. 486); Brochu & Storrs (2012, ch. 37); Narváez et al. (2015, ch. 37); Ristevski et al. (2018, ds 2, ch. 387); Smith et al. (in review, ds 1, ch. 393); Ősi et al. (2018, ds 1, ch. 454).* *State (0) occurs in* Gavialis. *State (1) is known for all other extant crocodylians.* *This character cannot be scored for fossil taxa.* 0. with single head 1. with double head (*longus* and *brevis*)
462	**Skin colour, response to environmental colour conditions: (*) (NEW)** *State (0) occurs in Alligatoridae (i.e.* Caiman, Melanosuchus, Paleosuchus *and* Alligator*),* Mecistops *and* Osteolameus. *State (1) occurs in the genus* Crocodylus *(i.e.* C. rhombifer, C. moreletti, C. acutus, C. intermedius, C. niloticus, C. suchus, C. siamensis, C. palustris, C. porosus, C. mindorensis, C. novaeguineae, C. johnsoni*).* *State (2) occurs in* Gavialis *and* Tomistoma. *This character cannot be scored for fossil taxa.* *All data from Merchant et al. (2018).* 0. no, or very little, skin colouration change 1. dorsolateral skin surfaces change to a lighter colour in a light environment 2. dorsolateral skin surfaces change to a darker colour in a lighter environment

SOM 3. Character and OTUs breakdowns of the merged, and parent, datasets

Table 3.1. Character break-down from the iterations of the Hastings dataset, ultimately merged into the Hastings and Young (H+Y) matrix. Hastings *et al*. (2015) utilised two datasets: 1) Hastings *et al*. (2010, 2011); and 2) adapted from Jouve *et al*. (2006). Young *et al*. (2016) utilised two datasets: 1) first iteration of a merged dataset, an updated version of the matrix of Hastings *et al*. (2015) with characters used by Young; and 2) an updated version of Young (2014) matrix.

Type of characters	Hastings *et al*. (2010, 2011, 2015, ds 1-Hastings)	Hastings *et al*. (2015, ds 2-Jouve)	Young *et al*. (2016, ds 1-Hastings)
Skull geometry & dimensions	1	3	1
Craniomandibular ornamentation	2	3	2
Cranial rostrum	17	32	19
Skull roof	11	24	21
Orbit & temporal region	7	30	7
Palate & perichoanal structures	4	27	4
Occipital	5	9	5
Braincase, basicranium & suspensorium	8	28	14
Mandibular geometry	-	2	-
Mandible	9	22	9
Dental & alveolar	17	20	22
Vertebrae & ribs	-	6	5
Pectoral girdle & forelimbs	-	11	2
Pelvic girdle & hind limbs	-	7	1
Osteoderms	1	10	8
Total character number	**82**	**234**	**120**
Total dental+craniomandibular	**81**	**200**	**104**
Total post-cranial	**1**	**34**	**16**
Dental+craniomandibular osteology %	***98.8***	***85.47***	***86.667***
Post-cranial osteology%	***1.2***	***14.53***	***13.333***

Table 3.2. Character break-down from the major different iterations of the Young dataset, ultimately merged into the Hastings and Young (H+Y) matrix. Young *et al*. (2016) utilised two datasets: 1) first iteration of a merged dataset, an updated version of the matrix of Hastings *et al*. (2015) with characters used by Young; and 2) an updated version of Young (2014) matrix. * note, the analysis for Young *et al*. (2013a) is actually a precursor to the Young *et al*. (2012) paper, which ended up being published first.

Type of characters	Young (2006)	Wilkinson *et al*. (2008)	Young (2009) / Young & Andrade (2009)	Young *et al*. (2011)	Young *et al*. (2013a) *	Young *et al*. (2012)	Young *et al*. (2013b) / Young (2014)	Young *et al*. (2016, ds2-Young)
Skull geometry & dimensions	1	1	1	1	1	3	3	5
Craniomandibular ornamentation	1	1	2	2	2	2	2	2
Craniomandibular pneumaticity	-	-	2	2	2	3	3	3
Rostral neurovascular foramina	-	-	-	-	-	-	-	1
Cranial rostrum	9	11	21	22	25	29	31	35
Skull roof	5	14	33	33	31	34	34	41
Orbit & temporal region	4	7	16	16	15	19	19	22
Palate & perichoanal structures	-	3	7	10	9	13	14	15
Occipital	-	3	6	7	8	8	8	9
Braincase, basicranium & suspensorium	-	2	10	10	13	14	15	17
Mandibular geometry	-	-	-	2	2	2	2	2
Mandible	6	9	16	18	18	22	22	26
Dental & alveolar	7	9	13	20	20	26	30	43
Vertebrae & ribs	6	6	15	17	18	22	23	24
Pectoral girdle & forelimbs	5	6	9	13	14	16	16	18
Pelvic girdle & hind limbs	7	7	11	11	16	18	20	21
Osteoderms	3	3	4	6	6	9	9	14
Total character number	**54**	**82**	**166**	**190**	**201**	**240**	**251**	**298**
Total dental+craniomandibular	**33**	**60**	**127**	**143**	**147**	**175**	**183**	**221**
Total post-cranial	**21**	**22**	**39**	**47**	**54**	**65**	**68**	**77**
Dental+craniomandibular osteology %	***61.111***	***73.171***	***76.506***	***75.263***	***73.134***	***72.917***	***72.908***	***74.161***
Post-cranial osteology%	***38.889***	***26.829***	***23.494***	***24.737***	***26.866***	***27.083***	***27.092***	***25.839***

Table 3.3. Character break-down from the different iterations of the merged Hastings + Young (H+Y) matrix.

Type of characters	Ristevski *et al.* (2018)	Smith *et al.* (in review)	Ősi *et al.* (2018)	Sven *et al.* (in prep.)	Current
Skull geometry & dimensions	6	7	10	10	10
Craniomandibular ornamentation	4	4	6	6	6
Internal neuroanatomy & sensory systems	1	1	1	3	3
Craniomandibular pneumaticity	4	4	4	4	4
Rostral neurovascular foramina	2	2	6	6	6
Cranial rostrum	53	53	58	58	58
Skull roof	50	51	52	52	52
Orbit & temporal region	27	29	29	29	29
Palate & perichoanal structures	19	19	22	23	23
Occipital	13	13	15	15	15
Braincase, basicranium & suspensorium	26	26	26	26	26
Mandibular geometry	4	4	8	8	8
Mandible	28	29	32	32	32
Dental & alveolar	52	52	65	65	65
Vertebrae & ribs	26	26	31	33	35
Pectoral girdle & forelimbs	17	17	23	23	23
Pelvic girdle & hind limbs	28	29	37	37	37
Osteoderms	23	23	24	24	24
Gastralia	1	1	1	1	1
Soft tissue	3	3	4	5	5
Total character number	**387**	**393**	**454**	**460**	**462**
Total dental+craniomandibular	***289***	***294***	***334***	***337***	***337***
Total post-cranial	***95***	***96***	***116***	***118***	***120***
Total soft tissue	***3***	***3***	***4***	***5***	***5***
Dental+craniomandibular osteology %	***74.677***	***74.809***	***73.568***	***73.261***	***72.944***
Post-cranial osteology%	***24.548***	***24.427***	***25.551***	***25.652***	***25.974***
Soft tissue %	***0.775***	***0.763***	***0.881***	***1.087***	***1.082***

Table 3.4. Break-down of the OTUs per clade from iterations of the Hastings dataset, ultimately merged into the Hastings and Young (H+Y) matrix. Hastings *et al*. (2015) utilised two datasets: 1) matrix of Hastings *et al*. (2010, 2011); and 2) adapted from Jouve *et al*. (2006). Young *et al*. (2016) utilised two datasets: 1) first iteration of a merged dataset, an updated version of the matrix of Hastings *et al*. (2015) with characters used by Young; and 2) an updated version of Young (2014) matrix. Note, the taxonomic break-down is based on the current topology, which for some OTUs will differ from the position they had in earlier less complete analyses.

Clades of OTUs	Hastings *et al*. (2010)	Hastings *et al*. (2011)	Hastings *et al*. (2015, ds 1-Hastings)	Hastings *et al*. (2015, ds 2-Jouve)	Young *et al*. (2016, ds 1-Hastings)
Non-crocodylomorph outgroup	-	-	-	-	1
‘Sphenosuchia’ s. l.	-	-	-	2	2
Basal crocodyliforms	-	-	-	7	1
Notosuchia s. l.	-	-	-	15	-
Teleosauroidea	-	-	-	1	1
Basal metriorhynchoids	-	-	-	1	1
Basal metriorhynchines	-	-	-	1	1
Indet. Neosuchia	-	-	-	1	-
Atoposauridae	-	-	-	1	-
Bernissartiidae	-	-	-	1	-
Paralligatoridae	-	-	-	2	-
Hylaeochampsidae	-	-	-	1	-
Crown-Crocodylia	-	-	-	3	2
Goniopholididae	-	-	-	4	2
Pholidosauridae	3	3	3	5	8
Basal to dyrosaurids	-	-	-	-	3
Dyrosauridae	13	14	15	4	15
Total number of OTUs	**16**	**17**	**18**	**49**	**37**
Total character number	**82**	**82**	**82**	**234**	**120**
OTU # / Characters #	***5.125 : 1***	***4.824 : 1***	***4.556 : 1***	***4.776 : 1***	***3.243 : 1***

Table 3.5. Break-down of the OTUs per clade from the major different iterations of the Young dataset, ultimately merged into the Hastings and Young (H+Y) matrix. Young *et al*. (2016) utilised two datasets: 1) first iteration of a merged dataset, an updated version of the matrix of Hastings *et al*. (2015) with characters used by Young; and 2) an updated version of Young (2014) matrix. Note, the taxonomic break-down is based on the current topology, which for some OTUs will differ from the position they had in earlier less complete analyses. * note, the analysis for Young *et al*. (2013a) is actually a precursor to the Young *et al*. (2012) paper, which ended up being published first.

Clades of OTUs	Young (2006)	Wilkinson *et al*. (2008)	Young (2009) / Young & Andrade (2009)	Young *et al.* (2011)	Young *et al.* (2013a) *	Young *et al*. (2012)	Young *et al*. (2013) / Young (2014)	Young *et al*. (2016, ds2-Young)
Non-crocodylomorph outgroup	-	-	1	1	1	1	1	1
‘Sphenosuchia’ s. l.	-	2	3	1	1	3	3	4
Basal crocodyliforms	1	1	1	1	1	1	1	1
Notosuchia s. l.	-	-	11	-	-	11	11	12
Atoposauridae	1	1	2	-	-	2	2	2
Goniopholididae	1	1	5	3	3	4	4	5
Susisuchidae	-	-	2	1	1	2	2	2
Hylaeochampsidae	-	-	-	-	-	-	-	2
Crown-Crocodylia	-	2	4	3	3	3	3	4
Pholidosauridae	-	-	6	1	1	1	1	7
Basal to dyrosaurids	-	-	-	-	-	-	-	3
Dyrosauridae	-	-	7	-	-	-	-	8
Teleosauroidea	1	1	4	1	1	9	9	12
Basal metriorhynchoids	2	2	6	6	6	6	6	6
Basal metriorhynchines	4	5	6	5	5	5	5	3
Rhacheosaurini	4	5	12	11	11	11	11	13
Basal geosaurines	3	3	5	5	5	5	5	5
Geosaurini	4	5	11	11	12	9	11	14
Total number of OTUs	**21**	**28**	**86**	**50**	**51**	**73**	**75**	**104**
Total character number	**54**	**82**	**166**	**190**	**201**	**240**	**251**	**298**
OTU # / Characters #	***2.571 : 1***	***2.929 : 1***	***1.930 : 1***	***3.800 : 1***	***3.941 : 1***	***3.288 : 1***	***3.467 : 1***	***2.865 : 1***

Table 3.6. Break-down of the OTUs per clade from the different iterations of the merged Hastings + Young (H+Y) matrix. Note, the taxonomic break-down is based on the current topology, which for some OTUs will differ from the position they had in earlier less complete analyses.

Clades of OTUs	Ristevski *et al*. (2018)	Smith *et al*. (in review)	Ősi *et al*. (2018)	Sven *et al*. (in prep.)	Current
Non-crocodylomorph outgroup	1	1	1	1	1
‘Sphenosuchia’ s. l.	5	5	5	5	5
Basal crocodyliforms	5	5	5	5	5
Notosuchia s. l.	12	12	12	12	12
Atoposauridae	2	2	2	2	2
Goniopholididae	8	6	7	7	7
Bernissartiidae	2	2	2	2	2
Susisuchidae	2	2	2	2	2
Hylaeochampsidae	2	2	2	2	2
Crown-Crocodylia	4	4	4	4	4
Pholidosauridae	10	11	11	11	11
Basal to dyrosaurids	1	2	2	2	2
Dyrosauridae	16	17	17	17	17
Teleosauroidea	18	18	18	18	18
Basal metriorhynchoids	7	7	8	8	8
Basal metriorhynchines	4	4	4	4	4
Rhacheosaurini	14	14	14	15	16
Basal geosaurines	5	5	5	5	5
Geosaurini	19	19	19	19	19
Total number of OTUs	**137**	**138**	**140**	**141**	**142**
Total character number	**387**	**393**	**454**	**460**	**462**
OTU # / Characters #	***2.825 : 1***	***2.848 : 1***	***3.243 : 1***	***3.262 : 1***	***3.254***

SOM 4. Supplementary references

Aguilera E, Salas H, Peña E. 1989. La Formación Cajones: Cretácico terminal del subandino central de Bolivia. *Revista Técnica YPFB* **10**: 131–148.

Allen ER. 2012. *Analysis of North American goniopholidid crocodyliforms in a phylogenetic context.* Unpublished MS (Master of Science) thesis. University of Iowa, 100 pp.

Andrade MB. 2005. *Revisão sistemática e taxonômica dos Notosuchia (Metasuchia, Crocodylomorpha).* Unpublished MS (Master of Science) thesis. Universidade Estadual Paulista, Rio Claro, 239 pp.

Andrade MB. 2009. Solving a century-old mystery: the structure and function of the maxillary depressions of *Goniopholis* (Crocodylomorpha, Neosuchia). *Journal of Vertebrate Paleontology* **29** (3): 54A–55A.

Andrade MB. 2010. *The evolution of Gondwanan Mesoeucrocodylia (Crurotarsi, Crocodylomorpha) from Jurassic to Cretaceous*. Unpublished PhD thesis, University of Bristol, Bristol, 256 pp.

Andrade MB, Bertini RJ. 2005. Bibliographic revision of *Uruguaysuchus* (Mesoeucrocodylia: Crocodylomorpha): is *Uruguaysuchus terrai* a valid species?. Pp. 21–22 in Congresso Latino Americano de Paleontologia de Vertebrados, 2. *Boletim*, Rio de Janeiro, Museu Nacional/UFRJ.

Andrade MB, Bertini RJ. 2008a. A new *Sphagesaurus* (Mesoeucrocodylia: Notosuchia) from the Upper Cretaceous of Monte Alto City (Bauru Group, Brazil), and a revision of the Sphagesauridae. *Historical Biology* **20** (2): 101–136. DOI: 10.1080/08912960701642949.

Andrade MB, Bertini RJ. 2008b. Morphological and anatomical observations about *Mariliasuchus amarali* and *Notosuchus terrestris* (Mesoeucrocodylia), and their phylogenetical relationships with other South American notosuchians. *Arquivos do Museu Nacional* **66** (1): 5–62.

Andrade MB, Bertini RJ. 2008c. Morphology of the dental carinae in *Mariliasuchus amarali* (Crocodylomorpha, Notosuchia) and the pattern of tooth serration among basal Mesoeucrocodylia. *Arquivos do Museu Nacional* **66** (1): 63–82.

Andrade MB, Bertini RJ. 2008d. The *Chimaerasuchus* paradox: critical revision of a poorly known fossil crocodylomorph. Pp. 13 in Calvo, JO, Valieri, RJ, Porfiri, JD, Santos, D. Congreso Latino-Americano de Paleontologia de Vertebrados, 3. *Actas*, Neuquén, Universidad Nacional del Comahue.

Andrade MB, Edmonds R, Benton MJ, Schouten R. 2011. A new Berriasian species of *Goniopholis* (Mesoeucrocodylia, Neosuchia) from England, and a review of the genus. *Zoological Journal of the Linnean Society* **163**: 66–108.

Andrade MB, Hornung JJ. 2011. A new look into the periorbital morphology of *Goniopholis* (Mesoeucrocodylia, Neosuchia) and related forms. *Journal of Vertebrate Paleontology* **31**: 352–368.

Andrade MB, Young MT, Desojo JB, Brusatte SL. 2010. The evolution of extreme hypercarnivory in Metriorhynchidae (Mesoeucrocodylia: Thalattosuchia) based on evidence from microscopic denticle morphology. *Journal of Vertebrate Paleontology* **30** (5): 1451–1465.

Andrews CW. 1909. XXXVIII. - On some new Steneosaurs from the Oxford Clay of Peterborough. *Annals and Magazine of Natural History* **3**: 299–308.

Andrews CW. 1913. *A descriptive catalogue of the marine reptiles of the Oxford Clay based on the Leeds Collection in the Brittish Museum (Natural History), London – Part II.* London: Taylor, Francis. 206 pp.

Arruda JT, Carvalho IS, Vasconcellos FM. 2004. Baurusuquídeos da Bacia Bauru (Cretáceo Superior, Brasil). *Anuário do Instituto de Geociências* **27**: 65–75.

Averianov AO. 2000. *Sunosuchus* sp. (Crocodylomorpha, Goniopholididae) from the Middle Jurassic of Kirghisia. *Journal of Vertebrate Paleontology* **20**: 776–779.

Avilla LS, Fernandes R, Ramos DFB. 2004. Bite marks on a crocodylomorph from the Upper Cretaceous of Brazil: evidence of social behavior? *Journal of Vertebrate Paleontology* **24**: 971–973.

Barbosa JA, Kellner, AWA, Viana MSS. 2008. New dyrosaurid crocodylomorph and evidences for faunal turnover at the K–P transition in Brazil. *Proceeding of the Royal Society B* **275** (1641): 1385–1391.

Barrientos-Lara JI, Herrera Y, Fernández MS, Alvarado-Ortega, J. 2016. Occurrence of *Torvoneustes* (Crocodylomorpha, Metriorhynchidae) in marine Jurassic deposits of Oaxaxa, Mexico. *Revista Brasileira de Paleontologia* **19** (3): 415–424.

Benton MJ, Clark JM. 1988. Archosaur phylogeny and the relationships of the Crocodylia. Pp. 295–338 in Benton, M. J. (ed.) *The phylogeny and classification of the Tetrapods, Volume 1: Amphibians, Reptiles, Birds*. Clarendon Press, Oxford.

Benton MJ, Walker AD. 2002. *Erpetosuchus*, a crocodile-like basal archosaur from the Late Triassic of Elgin, Scotland. *Zoological Journal of the Linnean Society* **136**: 25–47.

Berckhemer F. 1929. Beiträge zur Kenntnis der Krokodilier des schwäbischen oberen Lias. *Neues Jahrbuch für Mineralogie* **64**:1–59.

Bergounioux FM. 1955. Les crocodiliens fossiles des dépôts phosphatés du sud-Tunisien, *Comptes Rendus de l'Academie des Sciences de Paris* **240**: 1917–1918.

de Blainville HD. 1853. Letter by H. D. de Blainville. In: Eudes-Deslongchamps JA, ed. Lettres sur les crocodiles vivants et fossiles. *Bulletin de la Société Linnéenne de Normandie* (Années 1849–1853) **IX**: 109–120.

Blake JF. 1876. Reptilia; pp. 243-254. In: R. Tate and J.F. Blake (eds.) *The Yorkshire Lias*. John van Voorst, London, 475 pp.

Bonaparte JF. 1971. Los tetrapodos del sector superior de la Formacion Los Colorados, La Rioja, Argentina. (Triásico Superior). *Opera Lilloana* **22**: 1–184.

Bonaparte JF. 1991. Los vertebrados fosiles de la Formación Rio Colorado, de la Ciudad de Neuquen y cercanias, Cretácico Superior, Argentina. *Revista del Museo Argentino de Ciências Naturales* **4** (3): 31–63.

Bonaparte JF. 1996. Cretaceous tetrapods of Argentina. *Münchner Geowissenschaften* **30**: 73–130.

Brochu CA. 1997a. Morphology, fossils, divergence timing, and the phylogenetic relationships of *Gavialis*. *Systematic Biolology* **46**: 479–522.

Brochu CA. 1997b. A review of '*Leidyosuchus*' (Crocodyliformes, Eusuchia) from the Cretaceous through Eocene of North America. *Journal of Vertebrate Paleontology* **17**: 679–697.

Brochu CA. 1999. Phylogenetics, taxonomy, and historical biogeography of Alligatoroidea. *Journal of Vertebrate Paleontology – Supplement (Society of Vertebrate Paleontology Memoir 6)*, **19**: 9–100.

Brochu CA. 2001. Crocodylian snouts in space and time: phylogenetic approaches toward adaptive radiation. *American Zoologist* **41**: 564–585.

Brochu CA. 2007. Morphology, relationships, and biogeographical significance of an extinct horned crocodile (Crocodylia, Crocodylidae) from the Quaternary of Madagascar. *Zoological Journal of the Linnean Society* **150**: 835–863.

Brochu CA, Bouare ML, Sissoko F, Roberts EM, O'Leary MA. 2002. A dyrosaurid crocodyliform braincase from Mali. *Journal of Paleontology* **76**: 1060–1071.

Brochu CA, Storrs GW. 2012. A giant crocodile from the Plio-Pleistocene of Kenya, the phylogenetic relationships of Neogene African crocodylines, and the antiquity of *Crocodylus* in Africa. *Journal of Vertebrate Paleontology* **32** (3): 587–602.

de Broin F, Taquet P. 1966. Découverte d'un crocodilien nouveau dans le Crétacé inférieur du Sahara. *Comptes Rendus de l'Académie des Sciences de Paris – Ser. D*, **262** (22): 2326–2329.

Bronn HG. 1841. Untersuchung zweier Gavial-Skelette und der Gaumen zweier andern aus den *Boller* Lias-Schiefen, mit Rücksicht auf Geoffroy's genus *Teleosaurus*. pp. 5–30 In: H.G. Bronn and J.J. Kaup (eds). *Abhandlungen uber die Gavial-artigen Reptilien der Lias-Formation*. E. Schweizerbart'sche Verlagshandlung, Stuttgart, 47 pp.

Buchy M-C, Vignaud P, Frey E, Stinnesbeck W, González AHG. 2006. A new thalattosuchian crocodyliform from the Tithonian (Upper Jurassic) of northeastern Mexico. *Comptes Rendus Palevol* **5**: 785–794.

Buchy M-C, Young MT, Andrade MB. 2013. A new specimen of *Cricosaurus saltillensis* (Crocodylomorpha: Metriorhynchidae) from the Upper Jurassic of Mexico: evidence for craniofacial convergence within Metriorhynchidae. *Oryctos* **10**: 9–21.

Buckley GA, Brochu CA. 1996. Campanian (Upper Cretaceous) crocodyliforms from Madagascar and their biogeographic implication. *Journal of Vertebrate Paleontology* **16** (3): 24A.

Buckley GA, Brochu CA. 1999. An enigmatic new crocodile from the Upper Cretaceous of Madagascar. In: Unwin D. (ed.), *Cretaceous Fossil Vertebrates: Special Papers in Palaeontology* **60**: 149–175. London: The Palaeontological Association.

Buckley GA, Brochu CA, Krause DW, Pol D. 2000. A pug-nosed crocodyliform from the Late Cretaceous of Madagascar. *Nature* **405** (6765): 91–94.

Buffetaut E. 1975. Sur l'anatomie et la position systématique de *Bernissartia fagesii* Dollo, L., 1883, Crocodilien du Wealdien de Bernissart, Belgique. *Bulletin de l'Insitut Royal des Sciences Naturalles de Belgique* **51** (2): 1–20.

Buffetaut E. 1977. Sur un crocodilien marin *Metriorhynchus superciliosus*, de l'Oxfordien supérieur (Rauracien) de l'Ile de Ré (Charente-Maritime). *Annales de la Société des Sciences Naturelles de la Charente-Maritime* **4**: 252–266.

Buffetaut E. 1978. Les Dyrosauridae (Crocodylia, Mesosuchia) des phosphates de l'Eocène inférieur de Tunisie: *Dyrosaurus*, *Rhabdognathus*, *Phosphatosaurus*. *Géologie Méditerranéenne* **5**: 237–256.

Buffetaut E. 1979. *Sokotosuchus ianwilsoni* and the evolution of the dyrosaurid crocodilians. *The Nigerian Field Monograph* **1**: 31–41.

Buffetaut E. 1980. Les crocodiliens Paléogènes du Tilemsi (Mali): Un aperçu systématique. *Palaeovertebrata*, Mémoire jubilaire en homage à René Lavocat, p.15–35.

Buffetaut E. 1981. Die biogeographische Geschichte der Krokodilier, mit Beschreibung einer neuen Art, *Araripesuchus wegeneri*. *Sonderdruck aus der Geologischen Rundschau* **70** (2): 611–624.

Buffetaut E. 1982. Radiation evolutive, paléoécologie et biogéographie des crocodiliens mésosuchiens. *Memoires de la Societé Géologique de France* **142**: 1–88.

Buffetaut E. 1991. *Itasuchus* Price, 1955. *In*: Maisey JG (ed.). *Santana fossils*. New York: T. F. H. p.348–350.

Buffetaut E. 1994. A new crocodilian from the Cretaceous of Southern Morocco. *Compte Rendus de l'Académie des Sciences — Series II* **319** (12): 1563–1568.

Buffetaut E, Taquet P. 1977. The giant crocodilian *Sarcosuchus* in the Early Cretaceous of Brazil and Niger. *Palaeontology* **20**: 203–208.

Buffetaut E, Hutt S. 1980. *Vectisuchus leptognathus*, n. g. n sp., a slender-snouted goniopholid crocodilian from the Wealden of the Isle of Wight: *Neues Jahrbuch fur Geologie und Palaeontologie – Monatshefte* **7**: 385–390.

Buffetaut E, Ingavat R. 1980. A new crocodilian from the Jurassic of Thailand, *Sunosuchus thailandicus* n. sp. (Mesosuchia, Goniopholididae), and the palaeogeographical history of South-East Asia in the Mesozoic. *Geobios* **13**: 879–889.

Buffetaut E, Ingavat R. 1983. *Goniopholis phuwiangensis* nov. sp., a new mesosuchian crocodile from the Mesozoic of North-Eastern Thailand. *Geobios* **16**: 79–91.

Buffetaut E, Ingavat R. 1984. The lower jaw of *Sunosuchus thailandicus*, a mesosuchian crocodilian from the Jurassic of Thailand. *Palaeontology* **27**: 199–206.

Buffetaut E, Taquet P. 1977. The giant crocodilian *Sarcosuchus* in the Early Cretaceous of Brazil and Niger. *Palaeontology* **20** (1): 203–208.

Buffrénil V. 1982. Morphogenesis and bone ornamentation in extant and extinct crocodilians. *Zoomorphology* **99**: 155–166.

Busbey AB, Gow C. 1984. A new protosuchian crocodile from the Upper Triassic Elliot Formation of South Africa. *Palaeontologia Africana* **25**: 127–149.

Buscalioni ÁD. 2017. The Gobiosuchidae in the early evolution of Crocodyliformes. *Journal of Vertebrate Paleontology*, doi: 10.1080/02724634.2017.1324459

Buscalioni ÁD, Alcalá L, Espílez E, Mampel L. 2013. European Goniopholididae from the Early Albian Escucha Formation in Ariño (Teruel, Aragón, España). *Spanish Journal of Paleontology* **28**: 103–122.

Buscalioni ÁD, Ortega F, Weishampel DB, Jianu CM. 2001. A revision of the crocodyliform *Allodaposuchus precedens* from the Upper Cretaceous of the Hateg Basin, Romania. Its relevance in the phylogeny of Eusuchia. *Journal of Vertebrate Paleontology* **21**: 74–86.

Buscalioni ÁD, Piras P, Vullo R, Signore M, Barbera C. 2011. Early eusuchia crocodylomorpha from the vertebrate-rich Plattenkalk of Pietraroia (Lower Albian, southern Apennines, Italy). *Zoological Journal of the Linnean Society* **163**: S199–S227.

Buscalioni ÁD, Sanz JL. 1988. Phylogenetic relationships of the Atoposauridae (Archosauria, Crocodylomorpha). *Historical Biology* **1**: 233–250.

Buscalioni ÁD, Sanz JL. 1990. *Montsecosuchus depereti* (Crocodylomorpha, Atoposauridae), new denomination for *Alligatorellus depereti* Vidal, 1915 (Early Cretaceous, Spain): redescription and phylogenetic relationships. *Journal of Vertebrate Paleontology* **10**: 244–254.

Buscalioni ÁD, Sanz JL, Casanovas ML. 1992. A new species of the eusuchian crocodile *Diplocynodon* from the Eocene of Spain. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* **187** (1): 1–29.

Butler RJ, Sullivan C, Ezcurra MD, Liu J, Lecuona A, Sookias RB. 2014. New clade of enigmatic early archosaurs yields insights into early pseudosuchian phylogeny and the biogeopgraphy of the archosaur radiation. *BMC Evolutionary Biology* **14**: 128.

Campos DA, Suarez JM. Riff D, Kellner AWA. 2001. Short note on a new Baurusuchidae (Crocodyliformes, Metasuchia) from the Upper Cretaceous of Brazil. *Boletim do Museu Nacional — Nova Série Geologia* **57**: 1–7.

Carvalho IS. 1994. *Candidodon*: um crocodilo com heterodontia (Notosuchia, Cretáceo inferior - Brasil). *Anais da Academia Brasileira de Ciências* **66** (3): 331–446.

Carvalho IS, Bertini RJ. 1999. *Mariliasuchus*: um novo Crocodylomorpha (Notosuchia) do Cretáceo da Bacia Bauru, Brasil. *Geologia Colombiana* **24**: 83–105.

Carvalho IS, Campos DA. 1988. Um mamífero triconodonte do Cretáceo Inferior do Maranhão, Brasil. *Anais da Academia Brasileira de Ciências* **60** (4): 437–446.

Carvalho IS, Campos ACA, Nobre PH. 2005. *Baurusuchus salgadoensis*, a new Crocodylomorpha from the Bauru Basin (Cretaceous), Brazil. *Gondwana Research* **8** (1): 11–30.

Carvalho IS, Ribeiro LCB, Avilla LS. 2004. *Uberabasuchus terrificus* sp. nov. a new Crocodylomorpha from the Bauru Basin (Upper Cretaceous), Brazil. *Gondwana Research* **7** (4): 975–1002.

Carvalho IS, Vasconcellos FM, Tavares SAS. 2007. *Montealtosuchus arrudacamposi*, a new peirosaurid crocodile (Mesoeucrocodylia) from the Late Cretaceous Adamantina Formation of Brazil. *Zootaxa* **1607**: 35–46.

Cau A, Fanti F. 2011. The oldest known metriorhynchid crocodylian from the Middle Jurassic of North-eastern Italy: *Neptunidraco ammoniticus* gen. et sp. nov. Gondwana Research **19**: 550–565.

Chatterjee S. 1985. *Postosuchus*, a new thecodontian reptile from the Triassic of Texas and the origin of tyrannosaurs. *Philosophical Transactions of the Royal Society of London B* 309: 395–460.

Clark JM. 1986. Phylogenetic relationships of the crocodylomorph archosaurs. Unpublished Ph.D. Dissertation. University of Chicago 556 pp.

Clark JM. 1994. Patterns of evolution in Mesozoic Crocodyliformes. Pp. 84–97 in N. C. Fraser & H. D. Sues (eds). *In the shadows of dinosaurs: early Mesozoic tetrapods*. London: Cambridge University Press.

Clark JM. 2011. A new shartegosuchid crocodyliform from the Upper Jurassic Morrison Formation of western Colorado. *Zoological Journal of the Linnean Society* **163**: S152–S172.

Clark JM, Norell MA. 1992. The Early Cretaceous Crocodylomorph *Hylaeochampsa vectiana* from the Wealden of the Isle of Wight. *American Museum Novitates* **3032**: 1–19.

Clark JM, Sues H-D. 2002. Two new basal crocodylomorph archosaurs from the Lower Jurassic and the monophyly of the Sphenosuchia. *Zoological Journal of the Linnean Society* **136**: 77–95.

Clark JM, Sues H-D, Berman DS. 2000. A new specimen of *Hesperosuchus agilis* from the Upper Triassic of New Mexico and the interrelationships of basal crocodylomorph archosaurs. *Journal of Vertebrate Paleontology* **20**: 683–704.

Clark JM, Xu X, Forster CA, Wang Y. 2004. A Middle Jurassic ‘sphenosuchian’ from China and the origin of the crocodylian skull. *Nature* **430**: 1021–1024.

Clements RG. 1993. Type-section of the Purbeck Limestone Group, Durlston Bay, Swanage, Dorset. *Proceedings of the Dorset Natural History and Archaeological Society* **114**: 181–206.

Colbert EH. 1946. *Sebecus*, representative of a peculiar suborder of fossil Crocodylia from Patagonia. *Bulletin of the American Museum of Natural History* **87** (4): 219–271.

Colbert EH. 1952. A pseudosuchian reptile from Arizona. *Bulletin of the American Museum of Natural History* **99**: 561–592.

Colbert EH, Mook CC. 1951. The ancestral crocodilian *Protosuchus*. *Bulletin of the American Museum of Natural History* **97** (3): 143–182.

Collot L. 1905. Reptile Jurassique (*Teleidosaurus gaudryi*) trouvé à Saint-Seine l’Abbaye (Côte-d’or). *Mémoire Academy de Sciences, Arts et Belles-Lettres Dijon, (4th series)* **10**: 41–45.

Cope ED. 1878. Descriptions of new extinct Vertebrata from the Upper Tertiary and Dakota Formations. *Bulletin of the United States Geological and Geographical Survey of the Territories* **4**: 379–396.

Crompton AW, Smith KK. 1980. A new genus and species from the Kayenta Formation (Late Triassic?) of Northern Arizona. In: Jacobs, L (ed.), Aspects of Vertebrate History Flagstaff: Museum of Northern Arizona Press, pp. 193–217.

Crush PJ. 1984. A late Upper Triassic sphenosuchid crocodilian from Wales. *Palaeontology* **27**: 131–157.

Daudin FM. 1802. Le crocodile du Mississipi, p. 412–416. In : Histoire Naturelle, Générale et Particulière des Reptiles; ouvrage faisant suit à l'Histoire Naturelle générale et particulière, composée par LECLERC DE BUFFON; et rédigée par C. S. SONNINI, membre de plusieurs Sociétés savantes. Tome Second. F. Dufart, Paris.

Debelmas J. 1952. Un crocodilien marin dans l’Hauterivien des environs de Comps (Var) *Dacosaurus maximus* Plieninger var. *gracilis* Quenstedt. *Travaux Laboratoire de Géologie l’université de Grenoble* **29**: 101–116.

Debelmas J, Strannoloubsky A. 1957. Découverte d'un crocodilien dans le Néocomien de La Martre (Var) *Dacosaurus lapparenti* n. sp. *Travaux Laboratoire de Géologie de l'université de Grenoble* **33**: 89–99.

Delfino M, Codrea V, Folie A, Dica P, Godefroit P, Smith T. 2008. A complete skull of *Allodaposuchus precedens* Nopcsa, 1928 (Eusuchia) and a reassessment of the morphology of the taxon based on the Romanian remains. *Journal of Vertebrate Paleontology* **28** (1): 111–122.

Delfino M, Piras P, Smith T. 2005. Anatomy and phylogeny of the gavialoid crocodylian *Eosuchus lerichei* from the Paleocene of Europe. *Acta Palaeontologica Polonica* **50** (3): 565–580.

Denton RKJ, Dobie JL, Parris DC. 1997. The marine crocodilian *Hyposaurus* in North America. In: Ancient Marine Reptiles (eds. Callaway JM, Nicholls EL), pp. 375–397. Academic Press, San Diego, USA.

Dollo L. 1883. Première note sur les crocodilians de Bernissart. *Bulletin du Musée Royal d'Histoire Naturelle de Belgique* **2**: 309-338.

Dollo L. 1914. Sur la découverte de Téléosauriens tertiaires au Congo. *Bulletin de l'Académie Royale de Belgique* **7**: 288–298.

Dyrmala SA, Zanno LE. 2016. Osteology of *Carnufex carolinensis* (Archosauria: Pseudosuchia) from the Pekin Formation of North Carolina and its implications for Early Crocodylomorph Evolution. *PLoS ONE* **11** (6): e0157528. doi: 10.137/journal.pone.0157528.

Erickson BR. 1976. Osteology of the early Eusuchian crocodile *Leidyosuchus formidabilis*, sp. nov. *Monograph Science Museum of Minnesota (Paleontology)* **2**: 1–61.

Eudes-Deslongchamps E. 1867–1869. Notes paléontologiques. Caen and Paris: F. le Blanc-Hardel and Savy, 24 pl.

Eudes-Deslongchamps E. 1868a. Note sur le squelette et la restauration du *Teleosaurus cadomensis*. *Bulletin de la Société Linnéenne de Normandie 2e série 2* **1868**: 381–473.

Eudes-Deslongchamps J-A. 1868b. Note sur un tronçon de mâchoire supérieure d'une espèce nouvelle de Téléosaure. *Bulletin de la Société Linnéenne de Normandie, 2 e série 1* **1868**: 121–129.

Eudes-Deslongchamps J-A. 1868c. Remarques sur l'os de la mâchoire inférieure des téléosauriens désigné sous le nom de complémentaire. *Bulletin de la Société Linnéenne de Normandie, 2 e série 1* **1868**: 112–118.

Eudes-Deslongchamps J-A. 1868d. Note sur un groupe de vertèbres et d'écailles rapportées au *Teleosaurus hastifer* et provenant des argiles kimméridgiennes du Cap de la Hève (près le Havre). *Bulletin de la Société Linnéenne de Normandie, Caen, 1866 (1868), 2e série 1* **1868**: 146–156, pl. 5.

Efimov MB. 1975. Late Cretaceous crocodiles of Soviet Central Asia and Kazakhstan [in Russian]. *Paleontologičeskij žurnal* **9**: 417–420.

Efimov MB. 1988. On the fossil crocodiles of Mongolia and the Soviet Union [in Russian]. *Trudy Sovmestnaâ Sovetsko-Mongolskaâ Paleontologičeskaâ Ekspediciâ* **34**: 81–90.

Fanti F, Miyashita T, Cantelli L, Mnasri F, Dridi J, Contessi M, Cau A. 2016. The largest thalattosuchian (Crocodylomorpha) supports teleosaurid survival across the Jurassic-Cretaceous boundary. *Cretaceous Research* **61**: 263–274.

Fernández M, Gasparini Z. 2000. Salt glands in a Tithonian metriorhynchid crocodyliform and their physiological significance. *Lethaia* **33**: 269–276.

Fernández M, Gasparini Z. 2008. Salt glands in the Jurassic metriorhynchid *Geosaurus*: implications for the evolution of osmoregulation in Mesozoic marine crocodyliforms. *Naturwissenschaften* **95**: 79–84.

Fernández M, Herrera Y. 2009. Paranasal sinus system of *Geosaurus araucanensis* and the homology of the antorbital fenestra of metriorhynchids (Thalattosuchia: Crocodylomorpha). *Journal of Vertebrate Paleontology* **29**: 702–714.

Figueiredo R, Kellner AWA. 2009. A new crocodylomorph specimen from the Araripe Basin (Crato Member, Santana Formation), northeastern Brazil. *Paläontologische Zeitschrift* **88**: 323–331.

Figueiredo R, Saraiva A, Kellner AWA. 2009. New susisuchid remains from the Crato Formation (Santana Group, Araripe Basin) Northestern Brazil. *Journal of Vertebrate Paleontology* **29** (3): 95A.

Fiorelli LE, Calvo JO. 2008. New remains of *Notosuchus terrestris* Woodward, 1896 (Crocodyliformes: Mesoeucrocodylia) from the Late Cretaceous of Neuquén, Argentina. *Arquivos do Museu Nacional* **66**: 83–124.

Foffa D, Young MT, Brusatte SL, Graham MR, Steel L. 2017. A new metriorhynchid crocodylomorph from the Oxford Clay Formation (Middle Jurassic) of England, with implications for the origin and diversification of Geosaurini. *Journal of Systematic Palaeontology*, DOI: 10.1080/14772019.2017.1367730.

Fortier D, Perea D, Schultz C. 2011. Redescription and phylogenetic relationships of *Meridiosaurus vallisparadisi*, a pholidosaurid from the Late Jurassic of Uruguay. *Zoological Journal of the Linnean Society* **163**: S257–S272.

Fraas E. 1901. Die Meerkrokodile (Thalattosuchia n. g.) eine neue Sauriergruppe der Juraformation. *Jahreshefte de Vereins für vaterländische Naturkunde in Württemberg* **57**: 409–418.

Fraas E. 1902. Die Meer-Krocodilier (Thalattosuchia) des oberen Jura unter specieller Berücksichtigung von *Dacosaurus* und *Geosaurus*. *Palaeontographica*, **49**: 1–72.

Frey E, Buchy M-C, Stinnesbeck W, López-Oliva JG. 2002. *Geosaurus vignaudi* n. sp. (Crocodylia, Thalattosuchia), first evidence of metriorhynchid crocodilians in the Late Jurassic (Tithonian) of central-east Mexico (State of Puebla). *Canadian Journal of Earth Sciences* **39**: 1467–1483.

Frey E, Riess J, Tarsitano SF. 1989. The axial tail musculature of recent crocodiles and its phyletic implications. *American Zoologist* **29**: 857–862.

Frey E, Salisbury SW. 2007. Crocodilians of the Crato Formation: evidence for enigmatic species. Pp. 463-474, pls 20–21 in D. M. Martill, G. Bechly & R. F. Loveridge (eds). *The Crato Fossil Beds of Brazil: window into an ancient world*. Cambridge University Press, Cambridge.

Galton PM. 1976. Prosauropod dinosaurs (Reptilia: Saurischia) of North America. *Postilla* **169**: 1–98.

Gandola R, Buffetaut E, Monaghan N, Dyke G. 2006. Salt glands in the fossil Crocodile *Metriorhynchus*. *Journal of Vertebrate Paleontology* **26** (4): 1009–1010.

Gao Y. 2001. [A new species of *Hsisosuchus* (Mesoeucrocodylia) from Dashanpu, Zigong Municipality, Sichuan Province]. *Vertebrata Palasiatica* **39** (3): 177–184. [in Chinese]

Gasparini ZB. 1971. Los Notosuchia del Cretacico de America del Sur como un nuevo infraorden de los Mesosuchia (Crocodilia). *Ameghiniana* **8:** 83–103.

Gasparini Z, Chiappe LM, Fernández M. 1991. A new Senonian peirosaurid (Crocodylomorpha) from Argentina and a synopsis of the South American Cretaceous crocodilians. *Journal of Vertebrate Paleontology* **11**: 316–333.

Gasparini Z, Chong G. 1977. *Metriorhynchus casamiquelai* n. sp. (Crocodilia, Thalattosuchia) a marine crocodile from the Jurassic (Callovian) of Chile, South America. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* **153**: 341–360.

Gasparini Z, Cichowolski M, Lazo DG. 2005. First record of *Metriorhynchus* (Reptilia: Crocodyliformes) in the Bathonian (Middle Jurassic) of the Eastern Pacific. *Journal of Paleontology* 79: 801–805.

Gasparini Z, Dellapé D. 1976. Un nuevo cocodrilo marino (Thalattosuchia, Metriorhynchidae) de la Formacion Vaca Muerta (Jurasico, Tithoniano) de la Província de Neuquén (República Argentina). *In*: Congreso Geologico Chileno, 1., 1976, Santiago. *Resumos.* Santiago: c1– c21.

Gasparini Z, Iturralde-Vinent M. 2001. Metriorhynchid crocodiles (Crocodyliformes) from the Oxfordian of Western Cuba. *Neues Jahrbuch für Geologie und Paläontologie, Monatshefte* **9**: 534–542.

Gasparini Z, Pol D, Spalletti LA. 2006. An unusual marine crocodyliform from the Jurassic–Cretaceous boundary of Patagonia. *Science* **311**: 70–73.

Gasparini Z, Vignaud P, Chong, G. 2000. The Jurassic Thalattosuchia (Crocodyliformes) of Chile: a paleobiogeographic approach. *Bulletin de la Société Géologique de France* **171**: 657–664.

George ID, Holliday CM. 2013. Trigeminal nerve morphology in *Alligator mississippiensis* and its significance for crocodyliform facial sensation and evolution. *The Anatomical Record* **296** (4): 670–680.

Georgi JA, Krause DW. 2010. Postcranial axial skeleton of *Simosuchus clarki* (Crocodyliformes: Notosuchia) from the Late Cretaceous of Madagascar. *Society of Vertebrate Paleontology Memior* **10**: 99–121.

Gervais P. 1871. Remarques au sujet des Reptiles provenant des calcaires lithographiques de Cerin, dans le Bugey, qui sont conservés au Musée de Lyon. *Comptes Rendus des Séances de l'Academie de Sciences* **73**: 603–607.

Gmelin JF. 1789. Caroli a Linné, Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Tomus 1 Pars 3, p. 1057–1058. G.E. Beer, Lipsiae.

Gomani EM. 1997. A Crocodiliform from the Early Cretaceous Dinosaur Beds, Northern Malawi. *Journal of Vertebrate Paleontology* **17** (2): 280–294.

Gow CE. 2000. The skull of *Protosuchus haughtoni*, an Early Jurassic crocodyliform from Southern Africa. *Journal of Vertebrate Paleontology* **20**: 49–56.

Gower DJ. 2002. Braincase evolution in suchian archosaurs (Reptilia: Diapsida): evidence from the rauisuchian *Batrachotomus kupferzellensis*. *Zoological Journal of the Linnean Society* **136**: 49–76.

Göhlich UB, Chiappe LM, Clark JM, Sues H-D. 2005. The systematic position of the Late Jurassic alleged dinosaur *Macelognathus* (Crocodylomorpha: Sphenosuchia). *Canadian Journal of Earth* Sciences **42**: 307–321.

Grange DR, Benton MJ. 1996. Kimmeridgian metriorhynchid crocodiles from England. *Palaeontology* **39** (2): 497–514.

Halliday TJ, Andrade MB, Benton MJ, Efimov MB. 2013. A re-evaluation of goniopholidid crocodylomorph material from Central Asia: Biogeographic and phylogenetic implications. *Acta Palaeontologica Polonica* **60**: 291–312.

Halstead LB. 1975. *Sokotosuchus ianwilsoni* n. g., n. sp., a new teleosaur crocodile from the Upper Cretaceous of Nigeria. *Journal of Mining and Geology* **11**: 101–103.

Hastings AK, Bloch JI, Cadena EA, Jaramillo CA. 2010. A new small short-snouted dyrosaurid (Crocodylomorpha, Mesoeucrocodylia) from the Paleocene of northeastern Colombia. *Journal of Vertebrate Paleontology* **30**: 139–162.

Hastings AK, Bloch JI, Jaramillo CA. 2011. A new longirostrine dyrosaurid (Crocodylomorpha, Mesoeucrocodylia) from the Paleocene of north-eastern Colombia: biogeographic and behavioural implications for New-World Dyrosauridae. *Palaeontology* **54**: 1095–1116.

Hastings AK, Block JI, Jaramillo CA. 2015. A new blunt-snouted dyrosaurid, *Anthracosuchus balrogus* gen. et sp. nov. (Crocodylomorpha, Mesoeucrocodylia) from the Palaeocene of Colombia. *Historical Biology* **27**: 998–1020.

Haughton SH. 1915. Investigations in South African fossil reptiles and Amphibia. 9. A new thecodont from the Stormberg Beds (*Sphenosuchus acutus* g. et sp. nov). *Annals of the South African Museum* **12**: 98–105.

Haughton SH. 1924. The fauna and stratigraphy of the Stormberg Series. *Annals of the South African Museum* **12**: 323–497.

Hecht MK. 1991. *Araripesuchus* Price, 1959. Pp. 340-347 in J. G. Maisey (ed) *Santana fossils*. New York: T. F. H.

Herrera Y, Fernández M, Varela JA. 2009. Morfología del miembro anterior de *Geosaurus araucanensis* Gasparini y Dellapé, 1976 (Crocodyliformes: Thalattosuchia). *Ameghiniana* **46** (4): 657–667.

Herrera Y, Gasparini Z, Fernández MS. 2013. A new Patagonian species of *Cricosaurus* (Crocodyliformes, Thalattosuchia): first evidence of *Cricosaurus* in middle-upper Tithonian lithographic limestone from Gondwana. *Palaeontology* **56**: 663–678.

Hill RV. 2010. Osteoderms of *Simosuchus clarki* (Crocodyliformes: Notosuchia) from the Late Cretaceous of Madagascar. *Society of Vertebrate Paleontology Memior* **10**: 154-176.

Hill RV, McCartney JA, Roberts E, Bouaré M, Sissoko F, O'Leary MA. 2008. Dyrosaurid (Crocodyliformes: Mesoeucrocodylia) fossils from the Upper Cretaceous and Paleogene of Mali: Implications for phylogeny and survivorship across the K/T Boundary. *American Museum Novitates* **3631**: 1–19.

Hooley RW. 1907. On the skull and greater portion of the skeleton of *Goniopholis crassidens* from the Wealden Shales of Atherfield (Isle of Wight). *Quarterly Journal of the Geological Society*, *London* **63**: 50–63.

Hornung JJ, Andrade MB, Reich, M. 2009. Are *Goniopholis crassidens* and *G. simus* different species of crocodilians? New postcranial evidence solving a taxonomic riddle. *Journal of Vertebrate Paleontology*, **29**(3):117A.

Hua S. 1999. Le crocodilien *Machimosaurus mosae* (Thalattosuchia, Teleosauridae) du Kimmeridgien du Boulonnais (Pas de Calais, France). Palaeontographica Abteilung A 252: 141–170.

Hua S, Buffetaut E, Legall C, Rogron P. 2007. *Oceanosuchus boecensis* n. gen, n. sp., a marine pholidosaurid (Crocodylia, Mesosuchia) from the Lower Cenomanian of Normandy (western France). *Bulletin de la Société Géologique de France* **178**: 503–513.

Hua S, Jouve S. 2004. A primitive marine gavioaloid from the Paleocene of Morocco. *Journal of Vertebrate Paleontology* **24**: 342–350.

Hua S, Vignaud P, Atrops F, Clément A. 2000. *Enaliosuchus macrospondylus* Koken, 1883 (Crocodylia, Metriorhynchidae) du Valanginien de Barret-le-Bas (Hautes Alpes, France): un cas unique de remontée des narines externs parmi les crocodiliens. *Géobios* **33**: 467–474.

Hulke JW. 1870. Note on a crocodilian skull from Kimmeridge Bay, Dorset. *Quarterly Journal of the Geological Society, London* **26**: 167–172.

Hulke JW. 1871. Note on a fragment of a teleosaurian snout from Kimmeridige Bay, Dorset. *Quarterly Journal of the Geological Society, London* 27: 442–443.

Hulke JW. 1878. Note on the two skulls from the Wealden and Purbeck formations indicating a new subgroup of Crocodilia. *Quarterly Journal of the Geological Society* **34**: 377–382.

von Jäger GF. 1828. Über die fossile Reptilien, welche in Würtemberg aufgefunden worden sind. Verlag der J. B. Metzler'schen Buchhandlung, Stuttgart, 48 pp.

Joffe J. 1967. The dwarf crocodiles of the Purbeck Formation, Dorset: a reappraisal. *Palaeontology* **10**: 629–639.

Jouve S. 2004. Etude des Crocodyliformes fini Crétacé-Paléogène du Bassin des Oulad Abdoun (Maroc) et comparaison avec les faunes africaines contemporaines: systématique, phylogénie et paléobiogéographie. Unpublished DPhil Thesis. Paris: Muséum National d'Histoire Naturelle.

Jouve S. 2005. A new description of the skull of *Dyrosaurus phosphaticus* (Thomas, 1893) (Mesoeucrocodylia: Dyrosauridae) from the Lower Eocene of North Africa. *Canadian Journal of Earth Science* **42**: 323–337.

Jouve S. 2007. Taxonomic revision of the dyrosaurid assemblage (Crocodyliformes: Mesoeucrocodylia) from the Paleocene of the Iullemmeden Basin, West Africa. *Journal of Paleontology* **81**: 163–175.

Jouve S. 2009. The skull of *Teleosaurus cadomensis* (Crocodylomorpha; Thalattosuchia), and phylogenetic analysis of Thalattosuchia. *Journal of Vertebrate Paleontology* **29**: 88–102.

Jouve S, Bouya B, Amaghzaz M. 2005b. A short-snouted dyrosaurid (Crocodyliformes, Meoseucrocodylia) from the Palaeocene of Morocco. *Palaeontology* **4**: 359–369.

Jouve S, Bouya B, Amaghzaz M. 2008. A long-snouted dyrosaurid (Crocodyliformes, Mesoeucrocodylia) from the Palaeocene of Morocco: phylogenetic and palaeobiogeographic implications. *Palaeontology* **51**: 281–294.

Jouve S, Iarochène M, Bouya B, Amaghzaz M. 2005a. A new dyrosaurid crocodyliform from the Palaeocene of Morocco and a phylogenetic analysis. *Acta Palaeotologica Polonica* **50**: 581–594.

Jouve S, Iarochène M, Bouya B, Amaghzaz M. 2006. A new species of *Dyrosaurus* (Crocodylomorpha, Dyrosauridae) from the early Eocene of Morocco: phylogenetic implications. *Zoological Journal of the Linnean Society* **148**: 603–656.

Jouve S, Schwarz, D. 2004. *Congosaurus bequaerti*, a Paleocene dyrosaurid (Crocodyliformes; Mesoeucrocodylia) from Landana (Angola). *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Sciences de la Terre* **74**: 129–146.

Karl HV, Gröning E, Brauckmann C, Knötschke N. 2006b. Revision of the genus *Enaliosuchus* Koken, 1883 (Archosauromorpha: Metriorhynchidae) from the Early Cretaceous of northwestern Germany. *Studio Geologica Salmanticensia* **42**: 49–59.

Karl H-V, Gröning E, Brauckmann C, Schwarz D, Knötschke N. 2006a. The Late Jurassic crocodiles of the Langenberg near Oker, Lower Saxony (Germany), and description of related materials (with remarks on the history of quarrying the "Langenberg Limestone" and "Obernkirchen Sandstone"). *Clausthaler Geowissenschaften* **5**: 59–77.

Kellner AWA. 1987. Ocorrência de um novo crocodiliano no Cretáceo Inferior da Bacia do Araripe, Nordeste do Brasil. *Anais da Academia Brasileira de Ciências* **59**: 219–232.

Kellner AWA, Campos DA, Riff D, Andrade MB. 2011. A new crocodylomorph (Sphagesauridae, Notosuchia) with horn-like tubercles from Brazil. *Zoological Journal of the Linnean Society* **163** (s1): S57–S65.

Khosla A, Sertich JJW, Prasad GVR, Verma O. 2009. Dyrosaurid remains from the intertrappean beds of India and the Late Cretaceous distribution of Dyrosauridae. *Journal of Vertebrate Paleontology* **29** (4): 1321–1326.

Klembara J. 2001. Postparietal and prehatching ontogeny of the supraoccipital in *Alligator mississippiensis* (Archosauria, Crocodylia) *Journal of Morphology* **249**: 147–153.

Kley NJ, Sertich JJW, Turner AH, Krause DW, O'Connor PM, Georgi JA. 2010. Craniofacial morphology of *Simosuchus clarki* (Crocodyliformes: Notosuchia) from the Late Cretaceous of Madagascar. *Society of Vertebrate Paleontology Memior* **10**: 13–98.

Koken E. 1883. Die reptilian der norddeutschen unteren Kreide. *Zeitschrift deutschen Geologischen Gesellschaft* **35**: 735–827.

Koken E. 1887. Die Dinosaurier, Crocodiliden und Sauropterygier des norddeutschen Wealden. *Geologische und Palaeontologische Abhandlungen* **3**: 309–419.

Kraus R. 1998. The cranium of *Piscogavialis jugaliperforatus* n. gen., n. sp. (Gavialidae, Crocodylia) from the Miocene of Peru. *Paläontologische Zeitschrift* **72**(3-4): 389–406.

Krause DW, Kley NJ. 2010. *Simosuchus clarki* (Crocodyliformes: Notosuchia) from the Late Cretaceous of Madagascar. *Memoirs of the Society of Vertebrate Paleontology* **10**: 1–236.

Kuhn O. 1936. *Crocodilia*. Fossilium Catalogus I: Animalia 75. Gracenhage: Junk.

Lamouroux JVF. 1820. Sur le crocodile fossile trouvé dans les carrière du bourg. *Annales Générales des Sciences Physiques* **3**: 160–163.

de Lapparent de Broin F. 2002. *Elosuchus*, a new genus of crocodile from the Lower Cretaceous of the North of Africa. *Comptes Rendus Palevol* **2002** (1): 275–285.

Larsson HCE, Gado B. 2000. A new Early Cretaceous crocodyliform from Niger. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* **217**: 131–141.

Larsson HCE, Sues H.-D. 2007. Cranial osteology and phylogenetic relationships of *Hamadasuchus rebouli* (Crocodyliformes: Mesoeucrocodylia) from the Cretaceous of Morocco. *Zoological Journal of the Linnean Society* **149**: 533–567.

Lauprasert K, Cuny G, Buffetaut E, Suteethorn V, Thirakhupt K. 2007. *Siamosuchus phuphokensis*, a new goniopholidid from the Early Cretaceous (ante-Aptian) of North-Eastern Thailand. *Bulletin de la Société Géologique de France* **178**: 201–216.

Lavocat R. 1955. Découverte d'un Crocodilien du genre *Thoracosaurus* dans le Crétacé supérieur d'Afrique. *Bulletin du Muséum National D'Histoire Naturelle, 2e série* **27**: 338– 340.

Leardi JM, Pol D, Clark JM. 2017. Detailed anatomy of the braincase of *Macelognathus vagans* Marsh, 1884 (Archosauria, Crocodylomorpha) using high resolution tomography and new insights on basal crocodylomorph phylogeny. *PeerJ* **5**: e2801. doi: 10.7717/peerj.2801

Lecuona A, Desojo JB. 2011. Hind limb osteology of *Gracilisuchus stipanicicorum* (Archosauria: Pseudosuchia). *Earth and Environmental Science Transactions of the Royal Society of Edinburgh* **102**: 105–128.

Lennier G. 1887. Description des fossils du Cap de la Heve. *Bulletin de la Société Géologique de Normandie, Le Harve* **12**: 17–98.

Lepage Y, Buffetaut E, Hua S, Martin JE, Tabouelle J. 2008. Catalogue descriptif, anatomique, géologique et historique des fossiles présentés à l'exposition « Les Crocodiliens fossiles de Normandie » (6 novembre - 14 decembre 2008). *Bulletin de la Société Géologique de Normandie et des Amis du Muséum du Havre* **95**: 5–152.

Li J. 1993. A new specimen of *Peipehsuchus teleorhinus* from Ziliujing Formation of Daixan, Sichuan. *Vertebrata PalAsiatica* **31**: 85–94.

Li JL, Wu XC. 2008. Crocodylomorpha. Pp. 183–214 in J. L. Li, X. C. Wu & F. Zhang (eds) *The Chinese fossil reptiles and their kin*. Beijing: Science Press.

Li JL, Wu XC, Li XM. 1994. [New material of *Hsisosuchus chungkingensis* from Sichuan, China]. *Vertebrata Palasiatica* **32** (2): 107–126. [In Chinese]

Long RA, Murry PA. 1995. Late Triassic (Carnian and Norian) tetrapods from the southwestern United States. *New Mexico Museum of Natural History and Science* **4**: 1–254.

López RM. 1975. Informe estratigráfico de los ríos Alto Moile, Alto Isarsama, Ichoa, Alto Beni y Tequeje. *Informe YPFB GXG-2600.*

Lucas SG, Sullivan RM. 2003. A new crocodilian from the Upper Cretaceous of the San Juan Basin, New Mexico. *Neues Jahrbuch fur Geologie und Palaontologie, Monatshefte* **2**: 109–119.

Lydekker R. 1890. On a crocodilian jaw from the Oxford Clay of Peterborough. *Quarterly Journal of the Geological Society, London* **46**: 284–288.

Mansel-Pleydell JC. 1888. Fossil reptiles of Dorset. *Proceedings of the Dorset Natural History and Antiquarian Field Club* **9**: 1–40.

Marinho TS, Carvalho IS. 2009. An armadillo-like sphagesaurid crocodyliform from the Late Cretaceous of Brazil. *Journal of South American Earth Sciences* **27**: 36–41.

Marsh OC. 1869. Notice of some new reptilian remains from the Cretaceous of Brazil. *American Journal of Science* **47**: 390–392.

Marsh OC. 1884. A new order of extinct Jurassic reptile (Macelognatha). *American Journal of Science* **27** (3): 341.

Martin JE, Deesri U, Liard R, Wattanapituksakul A. 2016c. Strontium isotopes and the long-term residency of thalattosuchians in the freshwater environment. *Palaeobiology* **42** (1): 143–156.

Martin JE, Delfino M, Smith T. 2016a. Osteology and affinities of Dollo's goniopholidid (Mesoeucrocodylia) from the Early Cretaceous of Bernissart, Belgium. *Journal of Vertebrate Paleontology* DOI: 10.1080/02724634.2016.1222534.

Martin JE, Lauprasert K, Buffetaut E, Liard R, Suteethorn V. 2014. A large pholidosaurid in the Phu Kradung Formation of north-eastern Thailand. *Palaeontology*, **57** (4): 757–769.

Martin JE, Raslan-Loubatié J, Mazin JM. 2016b. Cranial anatomy of *Pholidosaurus purbeckensis* from the Lower Cretaceous of France and its bearing on pholidosaurid affinities. *Cretaceous Research* **66**: 43–59.

Martinelli A. 2003. New cranial remains of the bizarre notosuchid *Comahuesuchus brachybuccalis* (Archosauria, Crocodyliformes) from the Late Cretaceous of Rio Negro Province (Argentina). *Ameghiniana* **40**: 559–572.

Mawson J, Woodward AS. 1907. On the Cretaceous formation of Bahia (Brazil) and on vertebrate fossil collections therein. *Quarterly Journal of the Geological Society* **63**: 28–139.

Merchant M, Hale A, Brueggen J, Harbsmeier C, Adams C. 2018. Crocodiles alter skin color in response to environmental color conditions. *Scientific Reports* **8**: 6174. doi: 10.1038/s41598-018-24579-6

Mercier J. 1933. Contribution à l'étude des Métriorhynchidés (crocodiliens). *Annales de Paléontologie* **22**: 99–119.

Meunier LV, Larsson HC. 2016. Revision and phylogenetic affinities of *Elosuchus* (Crocodyliformes). *Zoological Journal of the Linnean Society* DOI: 10.1111/zoj.12448.

von Meyer CEH. 1831. Neue fossile Reptilien, aus der Ordnung der Sauier. *Nova acta physico-medica Academiae Caesareae Leopoldino-Carolinae Naturae Curiosum* **15**: 171–200.

von Meyer CEH. 1832. Paleologica zur Geschichte der Erde. Franfurt am Main, 560 pp.

von Meyer CEH. 1837. Mittheilungen, an Professor Bronn gerichtet. *Neues Jahrbuch für Mineralogie, Geognosie, Geologie und Petrefaktenkunde* **1837**: 557–562.

Montefeltro FC, Larsson HCE, Langer MC. 2011. A new baurusuchid (Crocodyliformes, Mesoeucrocodylia) from the Late Cretaceous of Brazil and the phylogeny of Baurusuchidae. *PLoS ONE* **6**: e21916. doi:10.1371/journal.pone.0021916

Mook CC. 1924. A new crocodilian from Mongolia. *American Museum Novitates* **117**: 1–5.

Mook CC. 1933. A new species of *Teleorhinus* from the Benton shales. *American Museum novitates* **702**: 1–11.

Mook CC. 1942. Skull characters of *Amphicotylus lucasii* Cope. *American Museum novitates* **1165**: 1–5.

Mook CC. 1967. Preliminary description of a new goniopholidid crocodilian. *Kirtlandia* **2**: 1–10.

Motani R. 2005. Evolution of fish-shaped reptiles (Reptilia: Ichthyopterygia) in their physical environments and constraints. *Annual Review in Earth and Plantetary Sciences* **33**: 395–420.

Mueller-Töwe, J. 2006. *Anatomy, phylogeny, and palaeoecology of the basal thalattosuchians (Mesoeucrocodylia) from the Liassic of Central Europe*. Unpublished PhD thesis. Johannes Gutenberg-Universität Mainz, Mainz, 369 pp.

Narváez I, Brochu CA, Escaso F, Pérez-García A, Ortega F. 2015. New crocodyliforms from Southwestern Europe and definition of a diverse clade of European Late Cretaceous basal eusuchians. *PLoS ONE* **10** (11): e0140679. doi: 10.1371/journal.pone.0140679

Nascimento PM, Zaher H. 2010. A new species of *Baurusuchus* (Crocodyliformes, Mesoeucrocodylia) from the Upper Cretaceous of Brazil, with the first complete postcranial skeleton described for the family Baurusuchidae. *Papéis Avulsos de Zoologia (São Paulo)* **50**: 323–361.

Nash D. 1968. A crocodile from the Upper Triassic of Lesotho. *Journal of Zoology, London* **156**: 163–179.

Nash DS. 1975. The morphology and relationships of a crocodilian, *Orthosuchus stormbergi*, from the upper Triassic of Lesotho. *Annals of the South African Museum* **67**: 227–329.

Nesbitt NJ. 2011. The early evolution of archosaurs: relationships and the origin of major clades. *Bulletin of the American Museum of Natural History* **352**: 1–292.

Nesbitt NJ, Desojo JB. 2017. The osteology and phylogenetic position of *Luperosuchus fractus* (Archosauria: Loricata) from the latest Middle Triassic or earliest Late Triassic of Argentina. *Ameghiniana* **54** (3): 261–282.

Nesbitt SJ, Irmis RB, Lucas SG, Hunt AP. 2005. A giant crocodylomorph from the Upper Triassic of New Mexico. *Paläontologische Zeitschrift* **79** (4): 471–478.

Nobre PH, Carvalho IS. 2002. Osteologia do crânio de *Candidodon itapecuruense* (Crocodylomorpha, Mesoeucrocodylia) do Cretáceo do Brasil. In: Simpósio sobre o Cretáceo no Brasil, 6 / Simpósio sobre el Cretácico de América del Sur, 2. *Boletim*, São Pedro, UNESP/Rio Claro, p.77–82.

Nobre PH, Carvalho IS. 2006. *Adamantinasuchus navae*, a new Gondwanan Crocodylomorpha (Mesoeucrocodylia) from the Late Cretaceous of Brazil. *Gondwana Research* **10**: 370–378.

Nobre PH, Carvalho IS. 2013. Postcranial skeleton of *Mariliasuchus amarali* Carvalho and Bertini, 1999 (Mesoeucrocodylia) from the Bauru Basin, Upper Cretaceous of Brazil. *Ameghiniana* **50**: 98–113.

Norell MA, Clark JM. 1990. A reanalysis of *Bernissartia fagesii,* with comments on its phylogenetic position and its bearing on the origin and diagnosis of the Eusuchia. *Bulletin de l'Insitut Royal des Sciences Naturalles de Belgique* **60**: 115–128.

Ortega F. 2004. *Historia evolutiva de los cocodrilos Mesoeucrocodylia*. Unpublished PhD theis. Universidad Autónoma de Madrid, Madrid, 350 pp.

Ortega F, Gasparini Z, Buscalioni ÁD, Calvo JO. 2000. A new species of *Araripesuchus* (Crocodylomorpha, Mesoeucrocodylia) from the Lower Cretaceous of Patagonia (Argentina). *Journal of Vertebrate Paleontology* **20** (1): 57–76.

Osmólska H. 1972. Preliminary note on a crocodilian from the Upper Cretaceous of Mongolia. *Palaeontologia Polonica* **27**: 43–47.

Osmólska H, Hua S, Buffetaut E. 1997. *Gobiosuchus kielanae* (Protosuchia) from the Late Cretaceous of Mongolia: anatomy and relationships. *Acta Palaeontologica Polonica* **42**: 257–289.

Ősi A. 2008. Cranial osteology of *Iharkutosuchus makadii*, a Late Cretaceous basal eusuchian crocodyliform from Hungary. *Neues Jahrbuch für Geologie und Palaontologie, Abhandlungen* **248**: 279–299.

Ősi A. 2014. The evolution of jaw mechanism and dental function in heterodont crocodyliforms. *Historical Biology* **24**(3): 279–414.

Ősi A, Clark JM, Weishampel DB. 2007. First report on a new basal eusuchian crocodyliform with multicusped teeth from the Upper Cretaceous (Santonian) of Hungary. *Neues Jahrbuch für Geologie und Palaontologie, Abhandlungen* **243**: 169–177.

Ostrom JH. 1971. On the systematic position of *Macelognathus vagans*. *Postilla* **153**: 1–10.

Owen R. 1849. Notes on remains of fossil reptiles discovered by Prof. HENRY ROGERS of Pennsylania, U.S., in greensand formations of NEW JERSEY. *Quarterly Journal of the Geological Society of London* **5** (1–2): 380–383.

Owen R. 1874. Monograph of the fossil Reptilia of the Wealden and Purbeck formations. Supplement No. IV (*Hylaeochampsa*). *Monograph of the Palaeontolographical Society* **27**: 1–7.

Owen R. 1878. Monograph on the fossil Reptilia of the Wealden and Purbeck Formations – Crocodilia (*Goniopholis*, *Pterosuchus*, and *Suchosaurus*). *Palaeontolographical Society Monograph* **7**: 1–15.

Owen R. 1879. Monograph on the fossil Reptilia of the Wealden and Purbeck Formations – Crocodilia (*Goniopholis*, *Brachydectes*, *Nannosuchus*, *Theriosuchus*, and *Neuthetes*). *Palaeontolographical Society Monograph* **9**: 1–19.

Parrilla-Bel J, Young MT, Moreno-Azanza M, Canudo JI. 2013. The first metriorhynchid crocodyliform from the Middle Jurassic of Spain, with implications for evolution of the subclade Rhacheosaurini. *PLOS ONE* **8** (1): e54275. (doi: 10.1371/journal.pone.0054275)

Parrish JM. 1994. Cranial osteology of *Longosuchus meadei* and the phylogeny and distribution of the Aetosauria. *Journal of Vertebrate Paleontology* **14** (2): 196–209.

Peng G-Z, Shu C-K. 2005. A new species of *Hsisosuchus* from the Late Jurassic of Zigong, Sichuan, China. *Vertebrata PalAsiatica* **43**: 312–324.

Peyer K, Carter JG, Sues H-D, Novak SE, Olsen PE. 2008. A new suchian archosaur from the Upper Triassic of North Carolina. *Journal of Vertebrate Paleontology* **28**: 363–81.

Phillips J. 1871. Geology of Oxford and the Valley of the Thames. Clarendon Press, Oxford, 523 pp.

Pierce SE, Benton MJ. 2006. *Pelagosaurus typus* Bronn, 1841 (Mesoeucrocodylia: Thalattosuchia) from the Upper Lias (Toarcian, Lower Jurassic) of Somerset, England. *Journal of Vertebrate Paleontology* **26** (3): 621–635.

Pinheiro AEP, Bertini RJ, Andrade MB, Martins Neto RG. 2008. New specimen of *Stratiotosuchus maxhechti* (Baurusuchidae, Crocodyliformes) from the Adamantina Formation (Upper Cretaceous), Southeastern Brazil. *Revista Brasileira de Paleontologia*, **11**, 37-50.

Plieninger T. 1846. Prof. Dr. Th. Plieninger hielt nachstehenden vortrag über ein neues Sauriergenus und die Einreihung der Saurier mit flachen, schneidenden Zähnen in eine Familie. Pp. 148–154 in: Zweite Generalversammlung am 1. Mai 1846 zu Tübingen. *Württembergische naturwissenschaftliche Jahreshefte* **2**: 129–183.

Pol D. 1999. El esqueleto postcraneano de *Notosuchus terrestris* (Archosauria: Crocodyliformes) del Cretácico Superior de la Cuenca Neuquina y su información filogenética. Tesis de Licenciatura, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina, 158 pp.

Pol D. 2003. New remains of *Sphagesaurus* (Crocodylomorpha: Mesoeucrocodylia) from the Upper Cretaceous of Brazil. *Journal of Vertebrate Paleontology* **23** (4): 817–831.

Pol D. 2005. Postcranial remains of *Notosuchus terrestris* Woodward (Archosauria: Crocodyliformes) from the upper Cretaceous of Patagonia, Argentina. Ameghiniana **42**: 1–21.

Pol D, Apesteguia S. 2005. New *Araripesuchus* remains from the early Late Cretaceous (Cenomanian–Turonian) of Patagonia. *American Museum Novitates* **3490**: 1–38.

Pol D, Gasparini Z. 2009. Skull anatomy of *Dakosaurus andiniensis* (Thalattosuchia: Crocodylomorpha) and the phylogenetic position of Thalattosuchia. *Journal of Systematic Palaeontology* **7**: 163–197.

Pol D, Leardi JM, Lecuona A, Krause M. 2012. Postcranial anatomy of *Sebecus icaeorhinus* (Crocodyliformes, Sebecidae) from the Eocene of Patagonia. *Journal of Vertebrate Paleontology* **32**: 328–354.

Pol D, Norell MA. 2004a. A new crocodyliform from Zos Canyon, Mongolia. *American Museum Novitates* **3445**: 1–36.

Pol D, Norell MA. 2004b. A new gobiosuchid crocodyliform taxon from the Cretaceous of Mongolia. *American Museum Novitates* **3458**: 1–31.

Pol D, Rauhut OWM, Leucona A, Leardi JM, Xu X, Clark JM. 2013. A new fossil from the Jurassic of Patagonia reveals the early basicranial evolution and the origins of Crocodyliformes. *Biological Reviews* **4**: 862–872.

Pol D, Turner AH, Norell MA. 2009. Morphology of the Late Cretaceous crocodylomorph *Shamosuchus djadochtaensis* and a discussion of neosuchian phylogeny as related to the origin of Eusuchia. *Bulletin of the American Museum Natural History*. **324**: 1–103.

Prasad GVR, de Lapparent de Broin F. 2002. Late Cretaceous crocodile remains from Naskal (India): comparisons and biogeographic affinities. *Annales de Paléontologie* **88**: 19–71.

Price LI. 1945. A new reptile from the Cretaceous of Brazil. *Notas Preliminares e Estudos – DGM* **25**: 1–8.

Price LI. 1950. On a new crocodilian, *Sphagesaurus*, from the Cretaceous of the State of São Paulo, Brazil. *Anais da Academia Brasileira de Ciências* **22** (1): 77–85.

Price LI. 1955. Novos crocodilídeos dos arenitos da Série Bauru, Cretáceo do Estado de Minas Gerais. *Anais da Academia Brasileira de Ciências* **27**: 487–498.

Price LI. 1959. Sobre um crocodilídeo notossúquio do Cretáceo brasileiro. *Boletim do Departamento Nacional de Produção Mineral* **188**: 1–55.

Pritchard AC, Turner AH, Allen ER, Norell MA. 2013. Osteology of a North American goniopholidid (*Eutretauranosuchus delfsi*) and palate evolution in Neosuchia. *American Museum novitates* **3783**: 1–56.

Puértolas-Pascual E, Canudo JI, Sender LM. 2015. New material from a huge specimen of *Anteophthalmosuchus* cf. *escuchae* (Goniopholididae) from the Albian of Andorra (Teruel, Spain): Phylogenetic implications. *Journal of Iberian Geology* **41**: 41–56.

Reig OA. 1963. La presencia de dinosaurios saurisquios en los "estratos de Ischigualasto" (Mesotriásico Superior) de las provincias de San Juan y La Rioja (República Argentina). *Ameghiniana* **3**: 3–20.

Riff D. 2003. *Descrição morfológica do crânio e mandíbula de* Stratiotosuchus maxhechti *(Crocodylomorpha, Cretáceo Superior do Brasil) e seu posicionamento filogenético*. Unpublished MSc (Master of Science) thesis. Universidade Federal do Rio de Janeiro, Rio de Janeiro, 133 pp.

Riff D. 2007. *Anatomia apendicular de* Stratiotosuchus maxhechti *(Baurusuchidae, Cretáceo Superior do Brasil) e análise filogenética dos Mesoeucrocodylia*. Unpublished PhD thesis. Universidade Federal do Rio de Janeiro, Rio de Janeiro, 395 pp.

Riff D, Kellner AWA. 2001. On the dentition of *Baurusuchus pachecoi* (Crocodyliformes, Metasuchia) from the Upper Cretaceous of Brazil. *Boletim do Museu Nacional – Nova Série Geologia* **59**: 1–15.

Riff D, Kellner AWA. 2011. Baurusuchid crocodyliforms as theropod mimics: clues from the skull and appendicular morphology of *Stratiotosuchus maxhechti* (Upper Cretaceous of Brazil). *Zoological Journal of the Linnean Society* **163**: S37–S56.

Ristevski J, Young MT, Andrade MB, Hastings AK. 2018. A new species of *Anteophthalmosuchus* (Crocdoylomorpha, Goniopholididae) from the Lower Cretaceous of the Isle of Wight, United Kingdom, and a review of the genus. *Cretaceous Research* **84**: 340–383.

Rossmann T, Rauhe M, Ortega F. 2000. Studies on Cenozoic crocodiles: 8. *Bergisuchus dietrichbergi* Kuhn (Sebecosuchia: Bergisuchidae n. fam.) from the Middle Eocene of Germany, some new systematic and biological conclusions. *Paläontologische Zeitschrift* **74**: 379–392.

Romer AS. 1972. The Chañares (Argentina) Triassic reptile fauna. XIII. An early ornithosuchid pseudosuchian, *Gracilisuchus stipanicicorum*, gen. et sp. nov. *Breviora* **389**: 1–24.

Rogers II, JV. (2003). *Pachycheilosuchus trinquei*, a new procoelous crocodyliform from the Lower Cretaceous (Albian) Glen Rose Formation of Texas. *Journal of Vertebrate Paleontology* **23** (1): 128–145.

Rusconi C. 1933. Sobre reptiles cretáceos del Uruguay (*Uruguaysuchus aznarezi*, n.g. n. sp.) y sus relaciones com los notosúchidos de Patagonia. *Boletin del Instituto de Geologia y Perforaciones* **19** (8): 1–64.

Rusconi C. 1948. Nuevo plesiosaurio pez y Langostas del mar Jurassico de Mendoza. *Revista del Museo de Historia Natural de Mendoza* **2**: 3–12.

Rusconi C. 1955. Acerca del plesiosaurio '*Purranisaurus*' del Jurasico de Mendoza. *Anales de la Sociedad Científica Argentina* **160**: 71–77.

Sachs, S., Young, M.T., Abel, P., Mallison, H. 2019. A new species of metriorhynchid crocodylomorph *Cricosaurus* from the Upper Jurassic of southern Germany. *Acta Palaeontologica Polonica* 64

Salas-Gismondi R, Flynn JJ, Baby P, Tejada-Lara JV, Claude J, Antoine P-O. 2016. A new 13 million year old gavialoid crocodylian from Proto-Amazonian mega-wetlands reveals parallel evolutionary trends in skull shape linked to longirostry. *PLOS ONE* **11** (4): e0152453.

Salih KAO, Evans DC, Bussert R, Klein N, Nafi M, Müller J. 2015. First record of *Hyposaurus* (Dyrosauridae, Crocodyliformes) from the Upper Cretaceous Shendi Formation of Sudan. *Journal of Vertebrate Paleontology* DOI: 10.1080/02724634.2016.1115408

Salisbury SW. 1998. The long-lost crocodilian of Mr. Willett. Symposium of Vertebrate Palaeontology and Comparative Anatomy, 46. *Abstracts*, Bournemouth University, Bournemouth.

Salisbury SW. 2002. Crocodilians from the Lower Cretaceous (Berriasian) Purbeck Limestone Group of Dorset, Southern England. *Special Papers in Palaeontology* **68**: 121–144.

Salisbury SW, Frey E, Martill DM, Buchy M-C. 2003. A new crocodilian from the Lower Cretaceous Crato Formation of north-eastern Brazil. *Palaeontographica Abteilung A* **270**: 3–47.

Salisbury SW, Molnar RE, Frey E, Willis P. 2006. The origin of modern crocodyliforms: new evidence from the Cretaceous of Australia. *Proceedings of the Royal Society B* **273**: 2439–2448.

Salisbury SW, Naish D. 2011. Crocodilians. In: Batten D, Lane PD. (eds). *English Wealden fossils*. Palaeontological Association, Aberystwyth, 305–369.

Salisbury SW, Willis PMA, Peitz S, Sander PM. 1999. The crocodilian *Goniopholis simus* from the Lower Cretaceous of North-Western Germany. *Special Papers in Palaeontology* **60**: 121–148.

Sauvage H-E, Liénard F. 1879. Mémoire sur le genre *Machimosaurus*. *Mémoires de la Société Géologiques de France* **3**: 1–31.

Schellhorn R, Schwarz-Wings D, Maisch MW, Wings O. 2009. Late Jurassic *Sunosuchus* (Crocodylomorpha, Neosuchia) from the Qigu Formation in the Junggar Basin (Xinjiang, China). *Fossil Record-Mitteilungen aus dem Museum für Naturkunde in Berlin* **12**: 59–69.

Schneider G. 1801. Historiae Amphibiorum naturalis et literariae. Fasciculus secundus continens Crocodilos, Scincos, Chamaesauras, Boas. Pseudoboas, Elapes, Angues. Amphisbaenas et Caecilias, p. 159–160. Friederici Frommanni, Jena.

Schwarz D. 2002. A new species of *Goniopholis* from the Upper Jurassic of Portugal. *Palaeontology* **45**: 185–208.

Schwarz D, Frey E, Martin T. 2006. The postcranial skeleton of the Hyposaurinae (Dyrosauridae; Crocodyliformes). *Palaeontology* **49**: 695–718.

Schwarz D, Raddatz M, Wings O. 2017. *Knoetschkesuchus langenbergensis* gen. nov. sp. nov., a new atoposaurid crocodyliform from the Upper Jurassic Langenberg Quarry (Lower Saxony, northwestern Germany), and its relationships to *Theriosuchus*. *PLoS ONE* **12** (2): e0160617. doi:10.1371/journal.pone.0160617.

Schwarz D, Salisbury SW. 2005. A new species of *Theriosuchus* (Atoposauridae, Crocodylomorpha) from the Late Jurassic (Kimmeridgian) of Guimarota, Portugal. *Geobios* **38**: 779–802.

Schwarz-Wings D, Frey E, Martin, T. 2009. Reconstruction of the bracing system of the trunk and tail in Hyposaurine dyrosaurids (Crocodylomorpha; Mesoeucrocodylia). *Journal of Vertebrate Paleontology* **29** (2): 453–472.

Seeley HG. 1869. Discovery of *Dakosaurus* in England. *Geological Magazine* **6**: 188–189.

Sereno PC, Larsson HCE. 2009. Cretaceous Crocodyliforms from the Sahara. *ZooKeys* **28**: 1–143.

Sereno PC, Larsson HCE, Sidor CA, Gado B. 2001. The giant crocodyliform *Sarcosuchus* from the Cretaceous of Africa. *Science* **294**: 1516–1519.

Sereno PC, Sidor CA, Larsson HCE, Gado B. 2003. A new notosuchian from the Early Cretaceous of Niger. *Journal of Vertebrate Paleontology* **23** (2): 477–482.

Sereno PC, Wild R. 1992. *Procompsognathus*: theropod, “thecodont” or both? *Journal of Vertebrate Paleontology* **12**: 435–458.

Sertich JJW, Groenke JR. 2010. Appendicular skeleton of *Simosuchus clarki* (Crocodyliformes: Notosuchia) from the Late Cretaceous of Madagascar. *Society of Vertebrate Paleontology Memior* **10**: 122–153.

Shiller TA II, Porras-Muzquiz HG, Lehman TM. 2016. *Sabinosuchus coahuilensis*, a new dyrosaurid crocodyliform from the Escondido Formation (Maastrichtian) of Coahuila, Mexico. *Journal of Vertebrate Paleontology* DOI: 10.1080/02724634.2016.1222586.

Smith AS. 2013. Morphology of the caudal vertebrae in *Rhomaleosaurus zetlandicus* and a review of the evidence for a tail fin in Plesiosauria. *Paludicola* **9** (3): 144–148.

Smith DK, Allen ER, Sanders RK, Stadtman KL. 2010. A new specimen of *Eutretauranosuchus* (Crocodyliformes; Goniopholididae) from Dry Mesa, Colorado. *Journal of Vertebrate Paleontology* **30**: 466–1477.

Soares D. 2002. An ancient sensory organ in crocodilians. *Nature* **417**: 241–242.

von Sömmerring ST. 1814. Über den *Crocodilus priscus*, oder ein in Baiern versteint gefundenes schmalkie-feriges Krokodil, Gavial der Vorwelt. *Denkschriften der Königlichen Akademie der Wisseschaften zu Münch* **5**: Classe der Mathematik und Naturwissenschaften 9–82.

von Sömmerring ST. 1816. Ueber die *Lacerta gigantea* der vorwelt. *Denkschriften der Königlichen Akademie der Wisseschaften zu Münch* **6**: Classe der Mathematik und Naturwissenschaften 37–59.

Soto M. 2005. Especulaciones sobre *Uruguaysuchus* (Crocodyliformes, Mesoeucrocodylia). In: Jornadas de Zoología del Uruguay, 8. Montevideo, Actas. P. 108.

Soto M, Pol D, Perea D. 2008a. A new specimen of *Uruguaysuchus aznarezi* Rusconi, 1933. In: Congreso Latino-Americano de Paleontología de Vertebrados, 3. *Resúmenes*, Neuquén, Universidad Nacional del Comahue.

Soto M, Perea D, Pol D. 2008b. The phylogenetic relationships of *Uruguaysuchus* Rusconi, 1933 (Mesoeucrocodylia, Notosuchia). In: Jornadas de Zoología del Uruguay, 9 Actas.

Storrs GW, Efimov MB. 2000. Mesozoic crocodyliforms of north-central Eurasia. In: Benton MJ, Shishkin MA, Unwin DM, Kurochkin EN (eds). *The age of dinosaurs in Russia and Mongolia*. Cambridge University Press, Cambridge, 402–419

Stromer E. 1914. Ergebnissemder forschungsreisen Prof. E. Stromer in der wusten Aegyptiens. II. Wirbeltierreste der Baharije-Stufe (unterstes Cenoman). 1. Einleitung und *Libyosuchus*. *Abhandlungen der Bayerischen Akademie der Wissenschaften, Mathematische-physikalische Klasse* **27** (3): 1–16.

Sues H-D, Olsen PE, Carter JG, Scott DM. 2003. A new crocodylomorph archosaur from the Upper Triassic of North Carolina. *Journal of Vertebrate Paleontology* **23**: 329–343.

Sweetman SC, Pedreira-Segade U, Vidovic SU. 2015. A new bernissartiid crocodyliform from the Lower Cretaceous Wessex Formation (Wealden Group, Barremian) of the Isle of Wight, southern England. *Acta Palaeontologica Polonica* **60**: 257–268.

Swinton WE. 1950. On *Congosaurus bequaerti* Dollo. *Annales du Musée du Congo Belge* **13**: 1–60.

Tanner LH, Lucas S. 2007. The Moenave Formation: sedimentologic and stratigraphic context of the Triassic–Jurassic boundary in the Four Corners area, southwestern U.S.A. *Palaeogeography, Palaeoclimatology, Palaeoecology* **244**: 111–125.

Taplin LE. 1985. Sodium and water budgets of the fasted esturarine crocodile, *Crocodylus porosus*, in sea water. *Journal of Comparative Physiology B: Biochemical, Systematic, and Environmental Physiology* **155**: 501–513.

Taplin LE, Grigg GC. 1989. Historical zoogeography of the eusuchian crocodilians: a physiological perspective. *American Zoologist* **29**: 885–901.

Taquet P. 1976. Géologie et paléontologie du gisement de Gadoufaoua (Aptien du Niger). Centre National de la Recherche Scientifique, Paris, France. 191 p.

Tennant JP, Mannion PD, Upchurch P. 2016. Evolutionary relationships and systematics of Atoposauridae (Crocodylomorpha: Neosuchia): implications for the rise of Eusuchia. *Zoological Journal of the Linnean Society* **177**: 854–936.

Thomas P. 1893. Description de quelques fossiles nouveaux ou critiques des terrains tertiaires et secondairesde la Tunisie recueillis en 1885 et 1886 par M. Philippe Thomas. Exploration Scientifique de la Tunisie. Paris: Imprimerie Nationale.

Troxell EL. 1925. *Hyposaurus*, a marine crocodilian. *American Journal of Science* **54**: 489–514.

Turner AH. 2006. Osteology and phylogeny of a new species of *Araripesuchus* (Crocodyliformes: Mesoeucrocodylia) from the Late Cretaceous of Madagascar. *Historical Biology* **18** (3): 255–369.

Turner AH, Buckley GA. 2008. *Mahajangasuchus insignis* (Crocodyliformes: Mesoeucrocodylia) cranial anatomy and new data on the origin of the eusuchian-style palate. *Journal of Vertebrate Paleontology* **28**: 382–408.

Turner AH, Pritchard AC. 2015. The monophyly of Susisuchidae (Crocodyliformes) and its phylogenetic placement in Neosuchia. *PeerJ* **3**: e759; DOI 10.7717/peerj.759

Turner AH, Sertich JJW. 2010. Phylogenetic history of *Simosuchus clarki* (Crocodyliformes: Notosuchia) from the Late Cretaceous of Madagascar. *Journal of Vertebrate Paleontology*, **30** (supplement to issue 6): 177–236. Society of Vertebrate Paleontology Memoir 10.

Tykoski RS, Rowe TB, Ketcham RA, Colbert MW. 2002. *Calsoyasuchus valliceps*, a new crocodyliform from the Early Jurassic Kayenta Formation of Arizona. *Journal of Vertebrate Paleontology* **22**: 593–611.

Vasconcellos FM. 2006. *Descrição do pós-crânio de* Uberabasuchus terrificus *Carvalho, Ribeiro, Avilla, 2004 (Crocodyliformes, Peirosauridae) do Cretáceo Superior da Bacia Bauru: inferências morfofuncionais e paleoautoecológicas*. Unpublished MSc (Master of Science) thesis. Universidade Federal do Rio de Janeiro, Rio de Janeiro, 158 pp.

Vasconcellos FM, Carvalho IS. 2005. Estágios de desenvolvimento de *Mariliasuchus amarali*, Crocodyliformes Mesoeucrocodylia da Formação Adamantina, Cretáceo Superior da Bacia Bauru, Brasil. *Anuário do Instituto de Geociências* **28**: 49–69.

Vasconcellos FM, Carvalho IS. 2007. Cranial features of *Baurusuchus salgadoensis* Carvalho, Campos, Nobre 2005, a Baurusuchidae (Mesoeucrocodylia) from the Adamantina Formation, Bauru Basin, Brazil: paleoichnological, taxonomic and systematic implications. In: Carvalho IS (org). *Paleontologia: cenários de vida*. Rio de Janeiro: Interciência **1**: 319–332.

Vignaud P. 1995. Les Thalattosuchia, crocodiles marins du Mésozöique: Systématique, phylogénie, paléoécologie, biochronologie et implications paléogéographiques. Unpublished Ph.D. thesis. Université de Poitiers, Poitiers.

Vignaud P, Gasparini Z. 1996. New *Dakosaurus* (Crocodylomorpha, Thalattosuchia) from the Upper Jurassic of Argentina. *Comptes Rendus de l'Académie des Sciences, Paris* **2**: 245–250.

Wagner A. 1852. Neu-aufgefundene saurier-veberreste aus den lithographischer Schiefern ind den obern Juralke. *Abhandlungen der Mathemat.-Physikalischen Classe der Königlich Bayerischen Akademie der Wissenschaften* **6**: 661–710.

Wagner A. 1858. Zur Kenntniss der Sauier aus den lithographischen Schiefen. *Abhandlungen der Mathemat.-Physikalischen Classe der Königlich Bayerischen Akademie der Wissenschaften* **8**: 415–528.

Walker AD. 1961. Triassic reptiles from the Elgin area: *Stagonolepis*, *Dasygnathus* and their allies. *Philosophical Transactions of the Royal Society of London, B* **244**: 103–204.

Walker AD. 1968. *Protosuchus, Proterochampsa,* and the origin of phytosaurs and crocodiles. *Geological Magazine* **105**: 1–14.

Walker AD. 1970. A revision of the Jurassic reptile *Hallopus victor* (Marsh) with remarks on the classification of the crocodiles. *Philosophical Transactions of the Royal Society of London, B* **257**: 323–372.

Walker AD. 1990. A revision of *Sphenosuchus acutus* Haughton, a crocodylomorph reptile from the Elliot Formation (Late Triassic or Early Jurassic) of South Africa. *Philosophical Transactions of the Royal Society of London* **330**: 1–120.

Weinbaum JC. 2002. Osteology and relationships of *Postosuchus kirkpatricki* (Archosauria: Crurotarsi). Unpublished M.S. thesis, Texas Tech University, Lubbock, Texas, USA. 78 pp.

Weinbaum JC. 2011. The skull of *Postosuchus kirkpatricki* (Archosauria: Paracrocodyliformes) from the Upper Triassic of the United States. *PaleoBios* **30**: 18–44.

Weinbaum JC. 2013. Postcranial skeleton of *Postosuchus kirkpatricki* (Archosauria: Paracrocodylomorpha), from the upper Triassic of the United States. *Geological Society, London, Special Publications (Anatomy, Phylogeny and Palaeobiology of Early Archosaurs and their Kin)* **379**: 525–553.

Westhead RK, Mather AE. 1996. An updated lithostratigraphy for the Purbeck Limestone Group in the Dorset type area. *Proceedings of the Geologists' Association* **77**: 117–128.

Westphal F. 1961. Zu Systematik der deutschen und englischen Lias-Krokodilier. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* **113**: 207–218.

Wieland GR. 1910. *Plesiosaurus* (*Polyptychodon*) *mexicanus* Wieland. *Parergones del Instituto Geológico de México* **3** (6): 359–365.

Wilberg EW. 2015a. A new metriorhynchoid (Crocodylomorpha, Thalattosuchia) from the Middle Jurassic of Oregon and the evolutionary timing of marine adaptations in thalattosuchian crocodylomorphs. *Journal of Vertebrate Paleontology* **35**: e902846.

Wilberg EW. 2015b. What's in an outgroup? The Impact of outgroup choice on the phylogenetic position of Thalattosuchia (Crocodylomorpha) and the origin of Crocodyliformes. *Systematic Biology* **64**: 621–637.

Wilberg EW. 2017. Investigating patterns of crocodyliform cranial disparity through the Mesozoic and Cenozoic. *Zoological Journal of the Linnean Society* **181**: 189–208.

Wilkinson LE, Young MT, Benton MJ. 2008. A new metriorhynchid crocodile (Mesoeucrocodylia: Thalattosuchia) from the Kimmeridgian (Upper Jurassic) of Wiltshire, UK. *Palaeontology* **51** (6): 1307–1333.

Wiman C. 1932. *Goniopholis kirtlandicus* n. sp. aus der oberen Kreide in New Mexico. *Bulletin of the Geological Institution of the University of Uppsala* **23**: 181–189.

Woodward AS. 1896. On two Mesozoic crocodilians, *Notosuchus* (*genus novum*) and *Cynodontosuchus* (*genum novum*) from the red sandstones of the Territory of Néuquen (Argentine Republic). *Anales del Museo de La Plata — Série Paleontologia Argentina* **4** (1–2): 1–20.

Wu X. 1986. A new species of *Dibothrosuchus* from Lufeng Basin. *Vertebrata PalAsiatica* **24** (1): 43–62.

Wu X-C, Brinkman W, Lu JC. 1994. A new species of *Shantungosuchus* from the Lower Cretaceous of Inner Mongolia (China), with comments on *S. chuhsienensis* Young, 1961 and the phylogenetic position of the genus. *Journal of Vertebrate Paleontology* **14**: 210–229.

Wu X-C, Brinkman DB, Russell AP. 1996. *Sunosuchus junggarensis* sp. nov. (Archosauria: Crocodyliformes) from the Upper Jurassic of Xinjiang, People's Republic of China. *Canadian Journal of Earth Sciences* **33**: 606–630.

Wu X-C, Chatterjee S. 1993. *Dibothrosuchus elaphros*, a crocodylomorph from the lower Jurassic of China and the phylogeny of the Sphenosuchia. *Journal of Vertebrate Paleontology* **13:** 58–89.

Wu X-C, Cheng ZW, Russell AP, Cumbaa SL. 2001a. Cranial anatomy of a new crocodyliform (Archosauria: Crocodylomorpha) from the Lower Cretaceous of Song-Liao Plain, northeastern China. *Canadian Journal of Earth Sciences* **38**: 1653–1663.

Wu X-C, Russell AP, Cumbaa SL. 2001b. *Terminonaris* (Archosauria: Crocodyliformes): new material from Saskatchewan, Canada, and comments on its phylogenetic relationships. *Journal of Vertebrate Paleontology* **21**: 492–514.

Wu X-C, Sues H-D. 1996. Anatomy and phylogenetic relationships of *Chimaerasuchus paradoxus*, an unusual crocodyliform reptile from the Lower Cretaceous of Hubei, China. *Journal of Vertebrate Paleontology* **16** (4): 688–702.

Wu X-C, Sues H-D, Dong ZM. 1997. *Sichuanosuchus shuhanensis*, a new ?Early Cretaceous protosuchian (Archosauria: Crocodyliformes) from Sichuan (China), and the monophyly of Protosuchia. *Journal of Vertebrate Paleontology* **17:** 89–103.

Wu X-C, Sues H-D, Sun A. 1995. A plant-eating crocodiliform reptile from the Cretaceous of China. *Nature* **376** (6542): 678–680.

Young CC. 1948. Fossil crocodiles in China, with notes on dinosaurian remains associated with the Kansu crocodiles. *Bulletin of the Geological Society of China* **28** (3–4): 255–288.

Young CC. 1973. A new fossil crocodile from Wuerho. *Memoirs of the Institute of Vertebrate Paleontology and Paleoanthropology Academia Sinica* **11**: 37–44

Young CC, Chow MC. 1953. [New discovery of Reptilia from the Mesozoic of Sichuan]. *Acta Paleontologica Sinica* **1** (3): 87–109. [In Chinese]

Young MT. 2006. Evolution and taxonomic revision of the Mesozoic marine crocodyliforms Metriorhynchidae, a phylogenetic and morphometric approach. Unpublished MSc (Master of Science) thesis, University of London Imperial College, London, 140 pp.

Young MT. 2009. Quantifying macroevolutionary patterns in highly specialised clades of archosaurs. Unpublished PhD thesis, University of Bristol, Bristol, 350 pp.

Young MT. 2014. Filling the "Corallian Gap": re-description of a metriorhynchid crocodylomorph from the Oxfordian (Late Jurassic) of Headington, England. *Historical Biology* **26** (1): 80–90.

Young MT, Andrade MB. 2009. What is *Geosaurus*? Redescription of *G. giganteus* (Thalattosuchia: Metriorhynchidae) from the Upper Jurassic of Bayern, Germany. *Zoological Journal of the Linnean Society* **157** (3): 551–585.

Young MT, Andrade MB, Brusatte SL, Sakamoto M, Liston J. 2013. The oldest known metriorhynchid super-predator: a new genus and species from the Middle Jurassic of England, with implications for serration and mandibular evolution in predacious clades. *Journal of Systematic Palaeontology* **11** (4): 475–513.

Young MT, Bell MA, Andrade MB, Brusatte SL. 2011. Body size estimation and evolution in metriorhynchid crocodylomorphs: implications for species diversification and niche partitioning. *Zoological Journal of the Linnean Society* **163**: 1199–1216.

Young MT, Brusatte SL, Andrade MB, Desojo JB, Beatty BL, Steel L, Fernández MS, Sakamoto M, Ruiz-Omeñaca JI, Schoch RR. 2012. The cranial osteology and feeding ecology of the metriorhynchid crocodylomorph genera *Dakosaurus* and *Plesiosuchus* from the Late Jurassic of Europe. *PLOS ONE*, **7**: e44985.

Young MT, Brusatte SL, Ruta M, Andrade MB. 2010. The evolution of Metriorhynchoidea (Mesoeucrocodylia, Thalattosuchia): an integrated approach using geometrics morphometrics, analysis of disparity and biomechanics. *Zoological Journal of the Linnean Society* **158** (4): 801–859.

Young MT, Hastings AK, Allain R, Smith TJ. 2016. Revision of the enigmatic crocodyliform *Elosuchus felixi* de Lapparent de Broin, 2002 from the Lower-Upper Cretaceous boundary of Niger: potential evidence for an early origin of the clade Dyrosauridae. *Zoological Journal of the Linnaean Society*
DOI: 10.1111/zoj.12452.

Young MT, Hua S, Steel L, Foffa D, Brusatte SL, Thüring S, Mateus O, Ruiz-Omeñaca JI, Havlik P, Lepage Y, Andrade MB. 2014. Revision of the Late Jurassic teleosaurid genus *Machimosaurus* (Crocodylomorpha, Thalattosuchia. *Royal Society Open Science* 1: 140222. http://dx.doi.org/10.1098/rsos.140222.

Young MT, **Hua S, Steel L, Foffa D, Brusatte SL, Thüring S, Mateus O, Ruiz-Omeñaca JI, Havlik P, Lepage Y, Andrade MB. 2015.** Addendum to 'Revision of the Late Jurassic teleosaurid genus *Machimosaurus* (Crocodylomorpha, Thalattosuchia)'. *Royal Society Open Science* **2** (2): 150024. http://dx.doi.org/10.1098/rsos.150024

Zaher H, Pol D, Carvalho AB, Ricomini C, Campos D, Nava W. 2006. Redescription of the cranial morphology of *Mariliasuchus amarali*, and its phylogenetic affinities (Crocodyliformes, Notosuchia). *American Museum Novitates* **3512**: 1–40.

Zanno LE, Drymala S, Nesbitt SJ, Schneider VP. 2015. Early crocodylomorph increases top tier predator diversity during rise of dinosaurs. *Scientific Reports* **5**: 9276. doi:10.1038/srep09276

SOM 5. List of institutional abbreviations

AMNH, American Museum of Natural History, New York City, NY, USA
BPI, Bernard Price Institute, Johannesburg, South Africa
BRLSI, Bath Royal Literary and Scientific Institute, Bath, England, UK
BRSMG, Bristol City Museum & Art Gallery, Bristol, England, UK
BSPG, Bayerische Staatssammlung für Paläontologie und Historische Geologie, München, Germany
CAMSM, Sedgwick Museum of Earth Science, University of Cambridge, England, UK
CM, Carnegie Museum of Natural History, Pittsburgh, PA, USA
CMC, Cincinnati Museum Center, Cincinnati, OH, USA
DORCM, Dorchester County Museum, Dorchester, United Kingdom
DGM, Departamento Nacional de Produção Mineral, Rio de Janeiro, Brazil
FEF, Fundação Educacional de Fernandópolis, Fernandópolis, Brazil
FMNH, Field Museum of Natural History, Chicago, Illinois, USA
GLAHM, Hunterian Museum, Glasgow, Scotland, UK
IGM, Mongolian Institute of Geology, Ulaan Bataar, Mongolia
IRSNB, Institut Royal des Sciences Naturelles de Bruxelles, Belgium
IVPP, Institute of Vertebrate Paleontology and Paleoanthropology, Beijing, China
IWCMS, Isle of Wight County Museums Services (Dinosaur Isle Museum and visitor attraction) Sandown, UK
LACM, Natural History Museum of Los Angeles County, Los Angeles, California, USA
MACN, Museo Argentino de Ciências Naturales ‘Bernardino Rivadavia’, Buenos Aires, Argentina
MANCH, Manchester Museum, Manchester, United Kingdom
MB, Museum für Naturkunde der Humboldt Universität, Berlin, Germany
MCZ, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA
ME, Musée d’Elbeuf, Elbeuf, Normandie, France
MHNG, Muséum d'histoire Naturelle de la Ville de Genève, Switzerland
MHNSR, Museo de Historia Natural de San Rafael, San Rafael, Argentina
MJML, Museum of Jurassic Marine Life, Kimmeridge, Dorset, England, UK
MLP, Museo de La Plata, La Plata, Argentina
MNHN.F, fossil collection of the Muséum national d’Histoire naturelle, Paris, France (ALG, Algiers locality; CNJ, Canjeurs locality; GDF, Gadoufaoua (Tegema Beds); INA, In Abangharit locality; MRS, Maroc Sud, i.e. Kem Kem localities; SAM, Gara Samani locality)
MN-UFRJ, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil
MOZ, Museo Profesor J. Olsacher, Zapala, Argentina
MPCA, Museo Provincial “Carlos Ameghino”, Cipolletti, Rio Negro, Argentina
MPEF, Museo Paleontologico Egidio Feruglio, Trelew, Argentina
MPMA, Museu de Paleontologia de Monte Alto, Monte Alto, Brazil
MTM, Magyar Természettudományi Múzeum, Budapest, Hungary
MUCPv, Museo de la Universidad Nacional del Comahue, Neuquén, Argentina
NHMUK PV, vertebrate palaeontology collection of the Natural History Museum, London, England, UK (OR, old register; R, reptiles)
NJSM, New Jersey State Museum, Trenton, New Jersey, USA
OMN, Musée de l'Office National Des Mines, Tunis, Tunisia
OUMNH, Oxford University Museum of Natural History, Oxford, England, UK
PETMG, Peterborough Museum & Art Gallery, Peterborough, England, UK
PVL, Instituto Miguel Lillo, Tucuman, Argentina
RCL, Museu de Ciências Naturais da Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte, Brazil
RMS, Royal Museum Scotland, Edinburgh, Scotland, UK
SAM, Iziko-South African Museum, Cape Town, South Africa
SMNK, Staatliches Museum für Naturkunde Karlsruhe, Germany
SMNS, Staatliches Museum für Naturkunde Stuttgart, Germany
UA, University of Antananarivo, Madagascar
UCMP, University of California Museum of Paleontology, Berkeley, California, USA

UF/IGM, University of Florida, Florida Museum of Natural History, Gainesville, Florida, USA / Museo Geológico, at the Instituto Nacional de Investigaciones en Geociencias, Minería y Quimica, Bogotá, Colombia
UFRJ-DG, Departamento de Geologia, Universidade Federal do Rio de Janeiro, Brazil
URC, IGCE-UNESP, Museu "Paulo Milton Barbosa Landim", Instituto de Geociências e Ciências Exatas, Universidade Estadual Paulista, Rio Claro, Brazil
USNM, National Museum of Natural History, Washington DC, USA
YPM, Peabody Museum of Natural History, Yale University, New Haven, Connecticut, USA
ZPAL, Instytut Paleobiologii PAN, Warszawa, Poland