

Supplementary Material for

Sensory evolution and ecology of early turtles revealed by digital endocranial reconstructions

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Collection abbreviations.

FMNH – Field Museum of Natural History, Chicago, U.S.A.

IW – Ingmar Werneburg private collection

MB – Museum für Naturkunde Berlin, Germany

PIMUZ – Laboratory collection of the Paläontologisches Institut und Museum der Universität Zürich, Switzerland

SMF – Senckenberg Museum Frankfurt, Germany

SMNS – Staatliches Museum für Naturkunde Stuttgart, Germany

GPIT/RE – Paläontologische Sammlung Tübingen, Germany

WGJ – Walter G. Joyce private collection

ZMB – Zoologisches Museum Berlin, Germany

Table S1. Taxa used in this study for shape analysis, phylogenetic and ecological groups, and source.

Taxon	Phylogenetic group	Ecological group	Source
<i>Diadectes sp.</i>	Stem-amniote	Terrestrial	Hopson 1979
<i>Emys orbicularis</i>	Testudinata	Freshwater	This study
<i>Macrochelys temminckii</i>	Testudinata	Freshwater	This study
<i>Pelodiscus sinensis</i>	Testudinata	Freshwater	This study
<i>Podocnemis unifilis</i>	Testudinata	Freshwater	This study
<i>Chelonia mydas</i>	Testudinata	Marine	This study
<i>Bothremys cooki</i>	Testudinata	Marine	Carabajal et al. 2013
<i>Plesiochelys etalloni</i>	Testudinata	Marine	Carabajal et al. 2013
<i>Eretmochelys imbricata</i>	Testudinata	Marine	Carabajal et al. 2013
<i>Caretta caretta</i>	Testudinata	Marine	Carabajal et al. 2013
<i>Lepidochelys kemp</i>	Testudinata	Marine	Carabajal et al. 2013
<i>Dermochelys coriacea</i>	Testudinata	Marine	Carabajal et al. 2013
<i>Pseudemys concinna</i>	Testudinata	Freshwater	Carabajal et al. 2013
<i>Chelonoidis chilensis</i>	Testudinata	Terrestrial	Carabajal et al. 2013
<i>Apalone ferox</i>	Testudinata	Freshwater	Carabajal et al. 2013
<i>Malacochersus tornieri</i>	Testudinata	Terrestrial	This study
<i>Platysternon megacephalum</i>	Testudinata	Freshwater	This study
<i>Gopherus berlandieri</i>	Testudinata	Fossorial	Paulina-Carabajal et al. 2017
<i>Naomichelys speciosa</i>	Testudinata	-	This study
<i>Proganochelys quenstedti</i>	Testudinata	-	This study
<i>Desmotosuchus spurensis</i>	Archosauromorpha	Terrestrial	Hopson 1979
<i>Riojasuchus tenuisiceps</i>	Archosauromorpha	Terrestrial	Von Baczko and Desojo 2016
<i>Sebecus icaeorhinus</i>	Archosauromorpha	Terrestrial	Hopson 1979
<i>Alligator mississippiensis</i>	Archosauromorpha	Freshwater	George and Holliday 2013
<i>Melanosuchus niger</i>	Archosauromorpha	Freshwater	George and Holliday 2013
<i>Crocodylus niloticus</i>	Archosauromorpha	Freshwater	George and Holliday 2013
<i>Crocodylus johnstoni</i>	Archosauromorpha	Freshwater	George and Holliday 2013
<i>Parasuchus angustifrons</i>	Archosauromorpha	Freshwater	Lautenschlager & Butler 2016
<i>Parasuchus hislopi</i>	Archosauromorpha	Freshwater	Holloway et al. 2013
<i>Caiman crocodilus</i>	Archosauromorpha	Freshwater	Jirak and Janacek 2017
<i>Caiman gasparinae</i>	Archosauromorpha	Freshwater	Bona and Paulina-Carabajal 2013
<i>Machaeroprotopus</i>	Archosauromorpha	Freshwater	Holloway et al. 2013
<i>Cricosaurus araucanensis</i>	Archosauromorpha	Marine	Herrera et al. 2013
<i>Crocodylus moreleti</i>	Archosauromorpha	Freshwater	Franzosa 2004
<i>Gavialis gangeticus</i>	Archosauromorpha	Freshwater	Pierce et al. 2017

<i>Pelagosaurus typus</i>	Archosauromorpha	Marine	Pierce et al. 2017
<i>Pseudopalatus mccauleyi</i>	Archosauromorpha	Freshwater	Holloway et al. 2013
<i>Simosuchus clarki</i>	Archosauromorpha	Terrestrial	Holloway et al. 2013
<i>Shuvosaurus inexpectatus</i>	Archosauromorpha	Terrestrial	Holloway et al. 2013
<i>Smilosuchus gregori</i>	Archosauromorpha	Freshwater	Holloway et al. 2013
<i>Placodus gigas</i>	Lepidosauromorpha	Marine	Neenan & Scheyer 2012
<i>Platecarpus sp.</i>	Lepidosauromorpha	Marine	Hopson 1979
<i>Agama agama</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Amphisbaena alba</i>	Lepidosauromorpha	Fossorial	Digimorph
<i>Amphisbaena fuliginosa</i>	Lepidosauromorpha	Fossorial	Digimorph
<i>Anolis carolinensis</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Aspidoscelis tigris</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Callopistes maculatus</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Chalarodon madagascariensis</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Chamaeleo laevigatus</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Lacerta viridis</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Varanus salvator</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Varanus exanthematicus</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Uromastix aegyptius</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Varanus acanthurus</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Morunasaurus annularis</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Petrosaurus mearnsi</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Pogona vitticeps</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Sphenodon punctatus</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Tupinambis teguixin</i>	Lepidosauromorpha	Terrestrial	Digimorph
<i>Diictodon feliceps</i>	Synapsida	Terrestrial	Laaß et al. 2017
<i>Kawingasaurus fossilis</i>	Synapsida	Fossorial	Laaß et al. 2017
<i>Pristerodon mackayi</i>	Synapsida	Terrestrial	Laaß et al. 2017

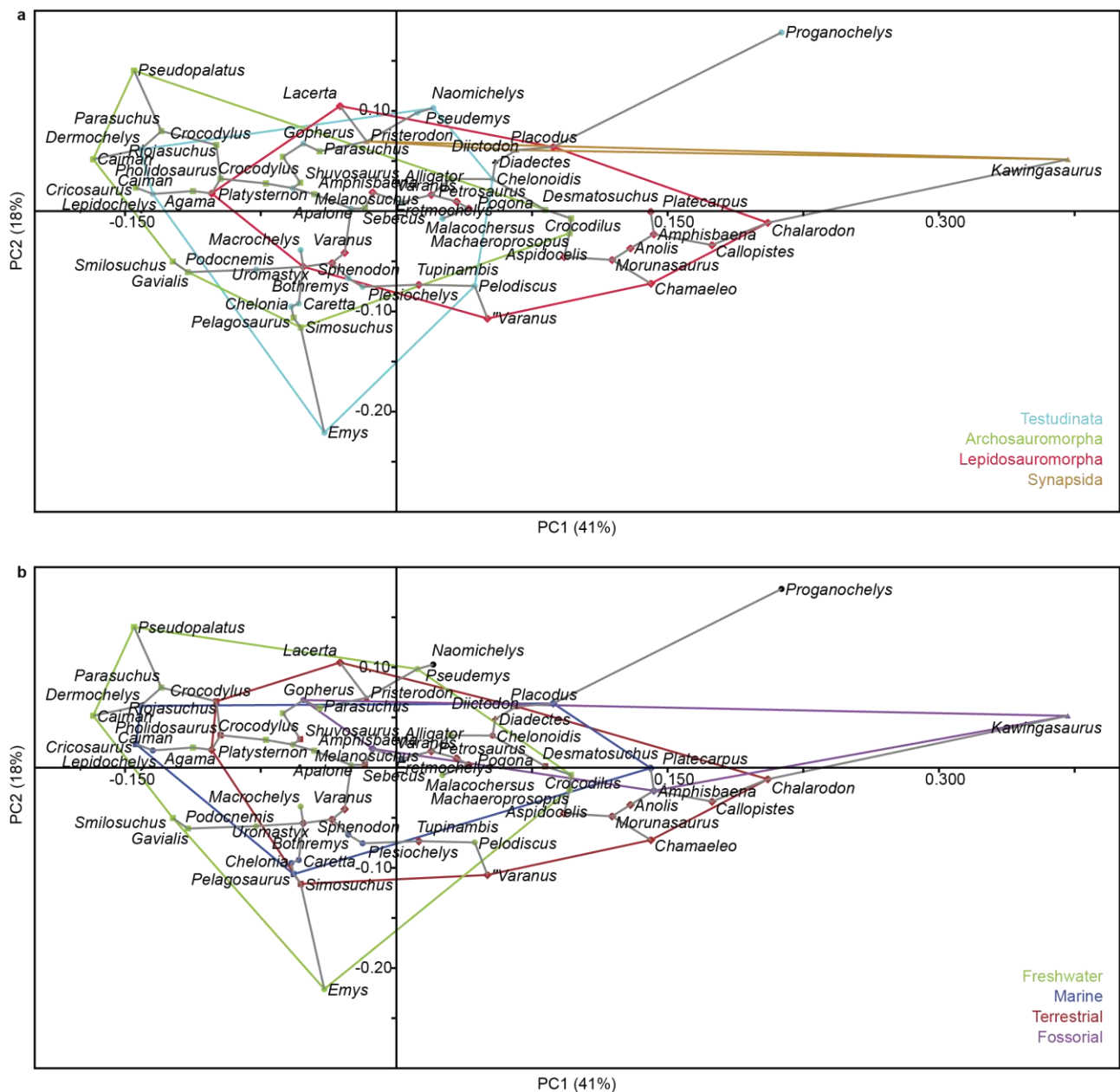


Figure S1. Related to Figures 5, 6. Two dimensional morphospace plots of brain endocast outlines based on PC1 and PC2. Phylogenetic (a) and ecological (b) groups coloured and gray lines represent the minimum spanning tree.

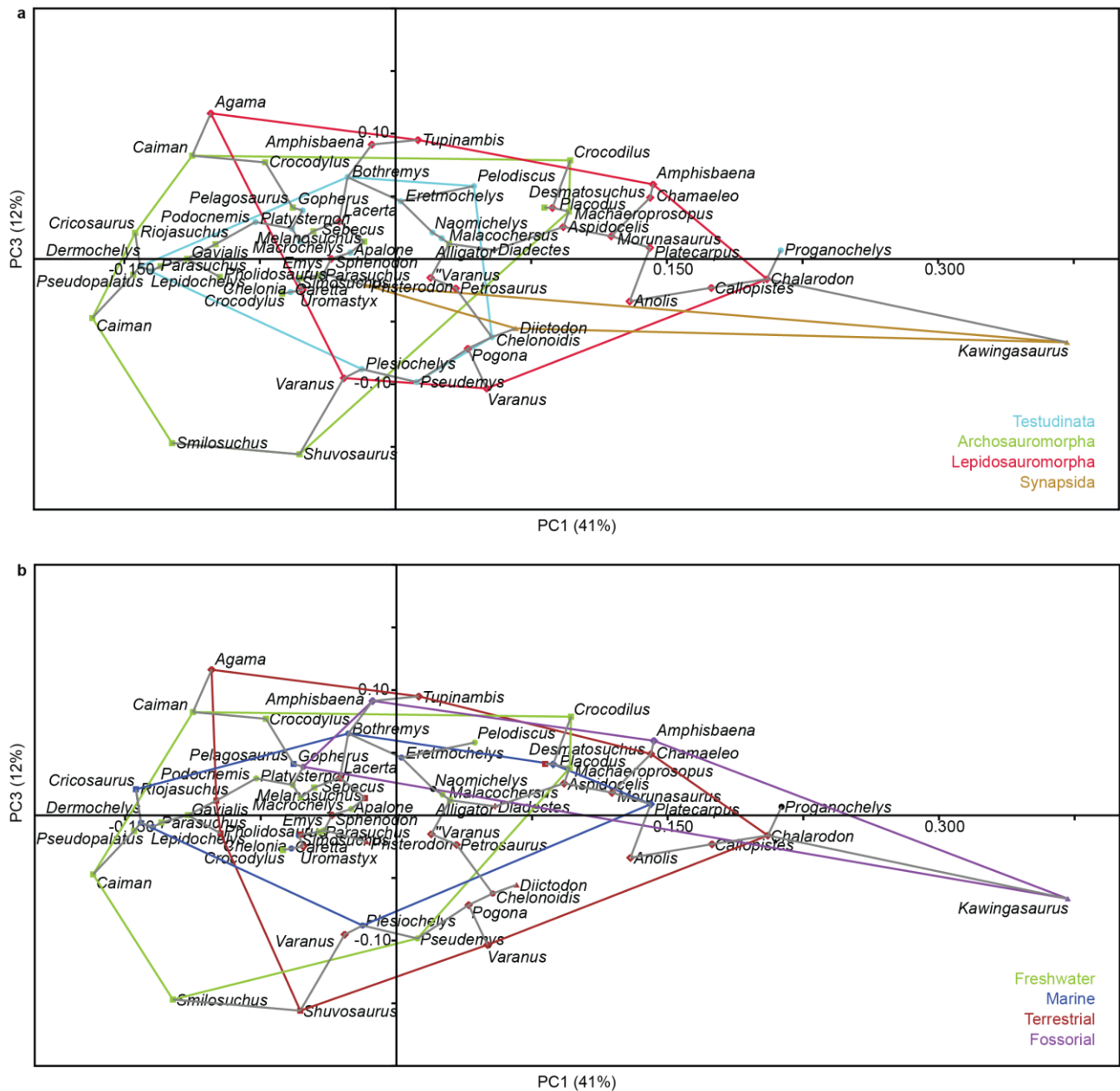


Figure S2. Related to Figures 5, 6. Two dimensional morphospace plots of brain endocast outlines based on PC1 and PC3. Phylogenetic (a) and ecological (b) groups coloured and gray lines represent the minimum spanning tree.

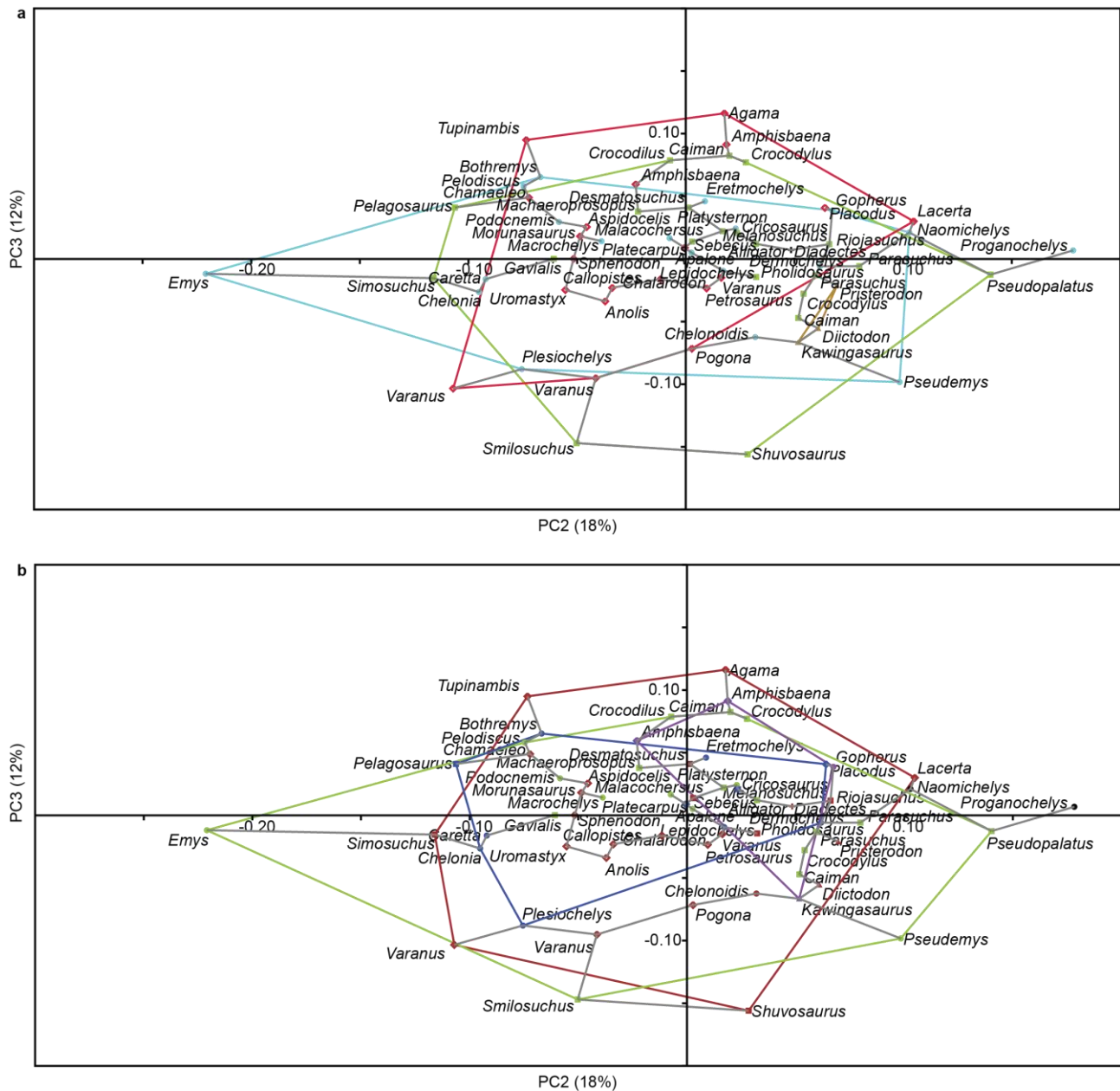


Figure S3. Related to Figures 5, 6. Two dimensional morphospace plots of brain endocast outlines based on PC2 and PC3. Phylogenetic (a) and ecological (b) groups coloured and gray lines represent the minimum spanning tree.

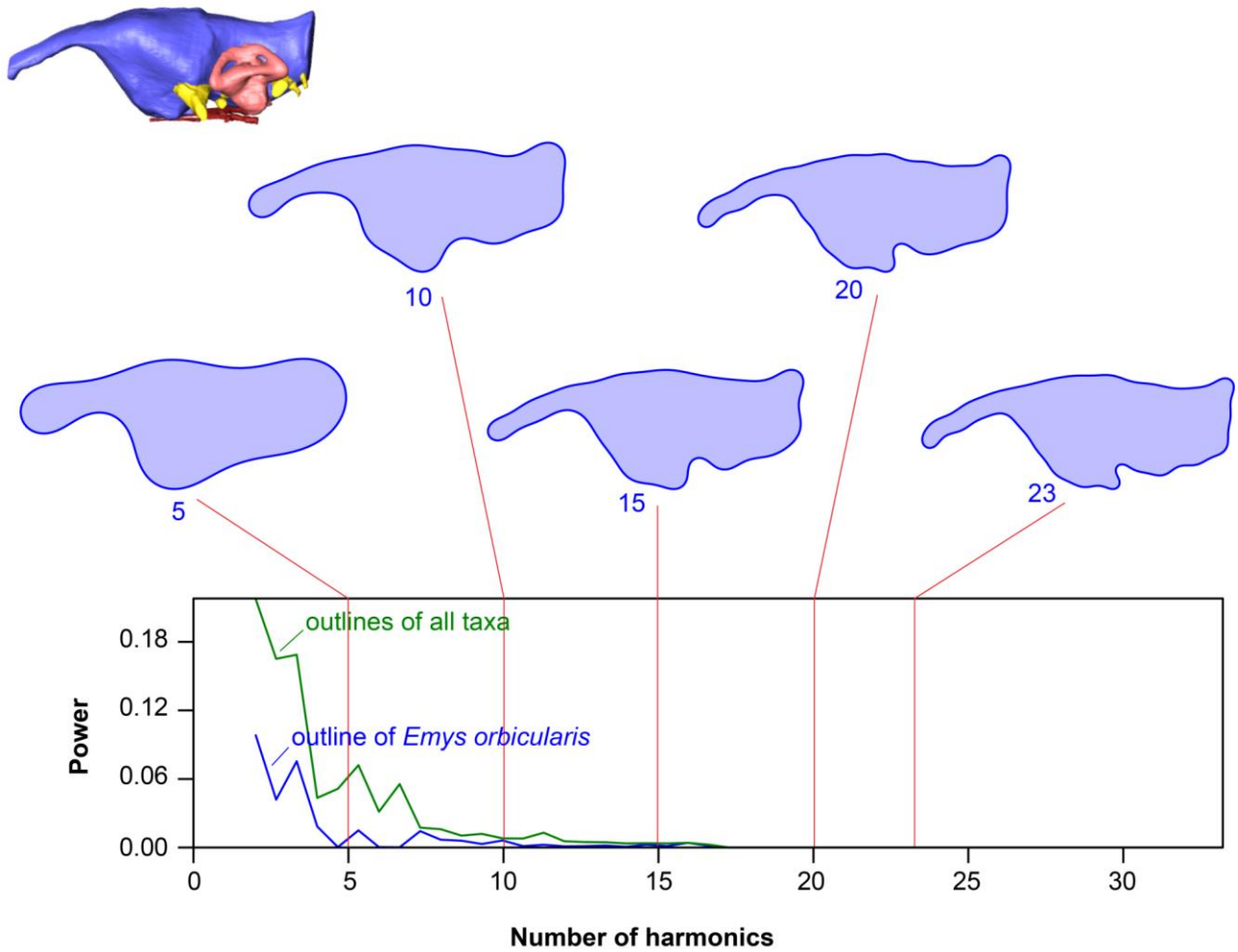


Figure S6. Comparison of outline shape using different numbers of harmonics. Shapes represent results from fast fourier transformation of endocast outline (exemplified by *Emys orbicularis*) using a different number of harmonics (as indicated by number under endocast outline). Outlines get more accurate as power approaches 0.0, shown for *Emys orbicularis* (blue line) and all taxa used in this study (green line).