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SUPPLEMENTARY ONLINE MATERIAL FOR

Paedomorphosis and neurocranial ossification in two Devonian lungfishes

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Supplementary Online Material

SOM 1. Character/taxa matrix.

SOM 2. Character list.

SOM 3. Screenshot of *Scaumenacia curta*, specimen MHNM 04-267.

SOM 4. Screenshots of *Pentlandia macroptera*, specimen NMS G.2022.10.436.1.

3D model of *Scaumenacia* MHNM04728

available at http://app.pan.pl/SOM/app67-Boirot_etal_SOM/MHNM04728.ply

SOM 1. Character/taxa matrix from Clement et al. (2016) modified by Henderson and Challands (2018). Character 21, *Scaumenacia curta* and *Griphognathus whitei* are new additions.

Taxon \ Character	Character																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
<i>Chirodipterus wildungensis</i>	2	1	1	1	1	?	1	1	?	1	1	1	1	1	?	1	0	?	?	0	
<i>Dipnorhynchus sussmilchi</i>	2	1	0	0	0	0	?	0&1	0	1	1	?	1	1	1	?	1	0	?	?	0
<i>Dipterus valenciennesi</i>	2	1	0&1	0	1	1	1	1	0	1	1	0&1	1	1	1	0	1	1	0	?	0
<i>Rhinodipterus kimberleyensis</i>	2	1	1	1	1	1	0	1	0	1	1	1	1	1	2	0	1	1	0	?	0
<i>Youngolepis praecursor</i>	1	1	0	0	0	1	1	?	0	1	0	0	1	0	0	0	1	0	0	0	0
<i>Diplocercides kayseri</i>	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	?	0
<i>Gogonasmus andrewsae</i>	1	0	0	1	0	0	?	0	0	0	0	?	1	?	0	0	?	?	0	?	0
<i>Eusthenopteron foordi</i>	1	0	0	1	0	0	?	1	0	0	0	0	1	1	0	0	1	0	0	?	0
<i>Neoceratodus forsteri</i>	2	0	1	1	0	1	0	1	0	1	1	1	1	2	2	1	1	0	1	?	2
<i>Qingmenodus yui</i>	0	1	0	1	0	1	1	1	?	0	0	0	0	1	1	0	?	1	?	0	0
<i>Chirodipterus australis</i>	2	1	1	0	1	1	0	1	0	1	1	0	1	1	1	0	1	0	1	1	0
<i>Scaumenacia curta</i>	2	0	1	?	1	1	1	1	?	1	1	?	?	?	?	?	?	?	?	?	2
<i>Griphognathus whitei</i>	2	1	1	?	0	1	0	1	0	1	1	1	?	1	1	?	1	0	1	?	1

SOM 2. Character list from Clement et al. (2016), modified by Henderson and Challands (2018). Character 21 is new.

1. Nasal capsule ventral face

- 0. wholly ossified
- 1. perforated
- 2. unossified

2. Ossified rostral tubuli developed in ethmoid region

- 0. no
- 1. yes

3. Buccohypophysial canal pierces parasphenoid

- 0. yes
- 1. no

4. Hypophyseal chamber orientation

- 0. posteroventrally
- 1. ventrally or anteroventrally

5. Separate foramina for internal carotid artery and efferent pseudobranchial artery

- 0. no
- 1. yes

6. Pineal foramen

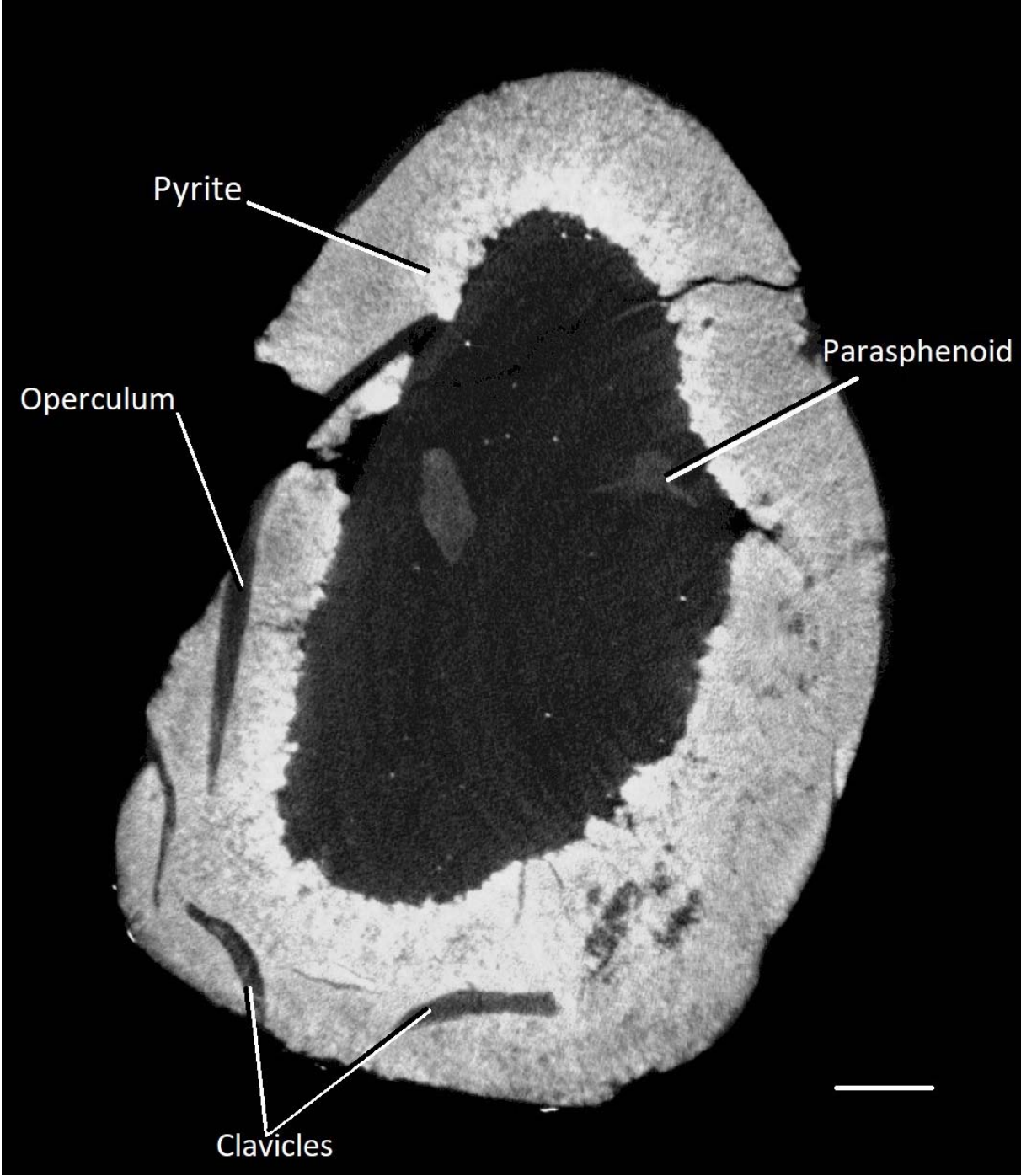
- 0. open/present
- 1. closed/absent

7. Pineal eminence

- 0. absent
- 1. present

- 8. Pineal/parapineal in separate ossified canals**
 0. yes
 1. no
- 9. Optic lobes**
 0. narrower than cerebellum
 1. equal or greater width than cerebellum
- 10. Endoskeletal intracranial joint**
 0. present
 1. absent
- 11. Notochord extends to or beyond level of n.V**
 0. yes
 1. no
- 12. Ampulla expansion in posterior semicircular canal**
 0. large
 1. reduced or absent
- 13. Crus commune of anterior and posterior semicircular canals**
 0. does not reach level of endocranial roof
 1. extends dorsal to endocranial roof
- 14. Utricular recess**
 0. indistinct or only a very slight protrusion
 1. (obviously) differentiated from sacculolagenar pouch
 2. highly differentiated and anteriorly extended
- 15. Telencephalon expansion**
 0. Narrow and with a flat ventral margin
 1. Small ventral expansion
 2. Large ventral and lateral expansion
- 16. Olfactory bulbs**
 0. sessile
 1. pedunculate
- 17. Sacculolagenar pouch**
 0. separate
 1. common pouch
- 18. Angle between anterior and posterior semi-circular canals**
 0. High angle ($>100^\circ$)
 1. Low angle ($<99^\circ$)
- 19. Median dorsal canals posterior to the pineal-parapineal recess**
 0. One or more extra canals
 1. No canals
- 20. Canal for anterior cerebral vein**
 0. Bifuricates within cranial cavity
 1. Single canal in cranial cavity
- 21. Neurocranium ossification degree**
 0. Ossified
 1. Lightly ossified
 2. Cartilaginous

SOM 3. Screenshot of *Scaumenacia curta*, specimen MHNM 04-267, transverse cut, from Drishti Paint. Dermal bones are well visible. No neurocranium is observed, most of the skull is filled with aggregated pyrite. Scale bar: 3 mm



SOM 4. Screenshots of *Pentlandia macroptera*, specimen NMS G.2022.10.436.1, from Dristhi Paint, showing different densities. A: sagittal cut. B: transverse cut. Scale bar: 1 cm.

