

ONLINE SUPPLEMENTARY MATERIAL

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Taxonomic revision of *Plesiofuro mingshuica* from the Lower Triassic of northern Gansu, China, and the relationships of early neopterygian clades

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(a) Characters and character states used in the phylogenetic analysis.

The characters are mainly adopted or modified from previous publications on the phylogenetic relationships of the Neopterygii (GS, Gardiner and Schaeffer, 1989; B rigin, 1992; GML, Gardiner, Maisey and Littlewood, 1996; GSM, Gardiner, Schaeffer and Masserie, 2005); P, Pinna, 1996; GB, Grande and Bemis, 1998; G, Grande, 2010; C, Coates, 1999; CA, Cloutier and Arraita, 2004; LZ, L pez-Arbarello and Zavattieri, 2008; XG, Xu and Gao, 2011; XW, Xu and Wu, 2012; X, Xu et al., 2012; XGF, Xu, Gao and Finarelli, 2014; Lane and Ebert, 2012; Arratia, 2013).

- (1) Post-temporal fossa: absent (0); present (1). (GS28)
- (2) Sub-temporal fossa: absent (0); present (1). (GS29)
- (3) Dilator fossa: absent (0); present (1). (GS31)
- (4) Parasphenoid: short, terminates at otic fissure (0); medium, extends across otic fissure but not contact basioccipital (1); long, extends to basioccipital (2). (Modified from GSM8)
- (5) Basipterygoid process: present (0); absent (1). (GSM12)
- (6) Frontal: elongated (0); laterally expanded (1). (X33)
- (7) Supraorbital sensory canal ending at anterior half of frontal: absent (0); present (1). (X34)
- (8) Number of extrascapulars: more than one pair (0); one pair (1). (Modified from X16)
- (9) Posttemporal: contacting extrascapular posteriorly (0); contacting extrascapular posteromedially and separating this bone from contact with its counterpart (1); lost (2). (Modified from X27)
- (10) Intertemporal: present (0); absent (1). (Modified from GSM17)
- (11) Dermosphenotic/nasal contact: present (0); absent (1). (Modified from GS19)
- (12) Shape of dermosphenotic: elongate (0); keystone-shaped (1).
- (13) Dermosphenotic attachment to skull roof in adult-sized individuals: loosely attached on the skull roof or hinged to the side of skull roof (0); firmly sutured into skull roof, forming part of it (1). (GB56)
- (14) Distinct premaxilla: absent (0); present as a pair of elements (1) fused as a median element (2). (Modified from X30)
- (15) Distinct nasal process of premaxilla: absent (0); present (1). (GS24)
- (16) Number of infraorbitals between antorbital and dermosphenotic: two or three (0); four or more (1). (Modified from GS21)
- (17) Supraorbital: absent (0); single (1) two or more (2). (GS14)
- (18) Suborbital: present (0); absent (1). (Modified from GS9)
- (19) Dermohyal: present (0); absent (1). (Modified from GSM24)
- (20) Maxilla free from preopercle: absent (0); present (1). (C15)
- (21) Supramaxilla: absent (0); present (1). (Modified from GS22)
- (22) Mobile maxilla in cheek: absent (0); present (1). (C16)
- (23) Coronoid process: absent (0); present (1). (GS17)
- (24) Suspensorium angle: acute, 30–50 , hyoid facet directed posteroventrally (0);

- moderately acute, 60–80° (1); nearly vertical, 80–90°, hyoid facet horizontal (2). (Modified from GSM29)
- (25) Hyomandibular with canal for hyoid branch of nerve VII: absent (0); present (1). (Modified from C22)
- (26) Quadratojugal: plate-like, overlying quadrate (0); much reduced or lost (1). (Modified from GSM26; C20)
- (27) Symplectic: absent (0); present, contacting quadrate (1); present, separated from quadrate by quadratojugal (2). (Modified GSM13)
- (28) Symplectic/articular contact: absent (0); present (1). (GB61; G49; XW37)
- (29) Elongated posteroventral process of quadrate: absent (0); present (1). (Modified from GML24)
- (30) Uncinate processes on epibranchials: absent (0); present (1). (C25)
- (31) Interopercle: absent (0); present (1). (GS18)
- (32) Pectoral fins enlarged as wings: absent (0); present (1). (X66)
- (33) Pelvic fins enlarged as auxiliary wings: absent (0); present (1). (X70)
- (34) Median fins (except caudal fin): rays more numerous than radials (0); rays and radials nearly equal in number (1). (GSM31)
- (35) Dorsal and anal fin rays: segmented throughout the length (0); segmented distally (1). (Modified from XG62)
- (36) Caudal fin rays: terminate at caudal extremity of body axis (0); extend beyond termination of body axis (1). (Modified from GSM32)
- (37) Dense lepidotrichial segments of pectoral fin rays between innermost principle pectoral fin ray and body: absent (0); present (1). (X71)
- (38) Peg-and-socket articulation on flank scales: present (0); absent (1). (GS3)
- (39) Clavicle: present as a broad plate (0); much reduced or lost (1). (Modified from GML37)
- (40) Number of lachrymal bone(s): single (0); two or more (1). (G21; XW24)
- (41) Sphenotic with small dermal component: absent (0); present (1). (G23; XW16)
- (42) Postrostral bone(s): absent (0); present (1). (Modified from GML19; XW17)
- (43) Tube-like canal bearing anterior arm of antorbital: absent (0); present (1). (G12; XW19)
- (44) Antorbital: small and low (0); enlarged and deep (1); lost (2). (Modified from X26)
- (45) Premaxilla immovably attached to braincase by means of a long nasal process tightly sutured to frontals: absent (0); present (1). (G6; XW30)
- (46) Foramen for olfactory nerve on premaxilla: absent (0); present (1). (Modified from G8; XW20)
- (47) Pterotic: present (0); absent (1). (GML2)
- (48) Opisthotic: present (0); absent (1). (G33)
- (49) Supraoccipital: absent (0); present (1). (G28)
- (50) A gap between hypurals 2 and 3: absent (0); present (1). (Arratia, 2013)
- (51) Rostral(s): cap-like, partially or wholly separating nasals (0); much reduced or lost by fusion with other elements (1). (XW17; modified from GML19)
- (52) Postrostral: absent (0); present (1).

- (53) Internal carotid foramen on parasphenoid: absent (0); present (1). (GML14)
- (54) Efferent pseudobranchial foramen on parasphenoid: absent (0); present (1). (GML15)
- (55) Intercalar: present (0); absent (1). (GML4)
- (56) Suborbital/maxilla contact: present (0); absent (1). (Modified from CA88)
- (57) Posterior margin of maxilla: straight or slightly convex (0); concave with a posterior maxillary notch (1). (GB62; XW46)
- (58) Quadratomandibular articulation: behind or below posterior border of orbit (0); anterior to posterior border of orbit (1). (Modified from LZ2; X56)
- (59) Accessory dermopterotic: absent (0); present (1). (Hutchinson, 1973b)
- (60) Number of hypobranchials: three (0); four (1). (G99; XW42)
- (61) Median gular: present (0); absent (1). (Modified from C11)
- (62) Size of median gular relative to lateral gular: median gular smaller than lateral gular (0); median gular larger than lateral gular (1). (Modified from XGF98)
- (63) Antorbital process on maxilla: absent (0); present (1).
- (64) Uronerual: absent (0); present (1). (XW56)
- (65) Opercle: larger than subopercle (0); roughly equal to or smaller than subopercle (1). (XW43)
- (66) Maxillary process on preopercle: present (0); absent (1).
- (67) Teeth on maxilla: present (0); absent (1). (Modified from LZ11)
- (68) Solid vertebral centra of adult-sized individuals: absent (0); present (1). (Modified from GB4)
- (69) Rudimentary fin rays near dorsal margin of caudal fin in adults: absent (0); present (1). (Modified from LZ19)
- (70) Scales in anterior flank region: present (0); absent (1). (Modified XGF67)
- (71) Shape of scales: rhomboid (0); amioid-type, subrectangular to elongate oval (1); circular. (X80)
- (72) Posteriorly inclined scales in pectoral region: absent (0); present (1). (LZ24)
- (73) Dorsal ridge of spine-like scales: absent (0); present (1). (LZ22)
- (74) Caudal fin: forked, lower lobe slightly shorter than or equal to upper lobe (0); forked, lower lobe longer than upper lobe (1); unforked (2). (Modified from X76)
- (75) Fringing fulcra: present (0); absent (1). (XGF50)

(b) Data matrix of taxa and characters.

Pteronisculus stensiöi

000000000000?00000000010000000000000000000000?000000?00000000000000
000000

Acipenser brevirostrum

1001100001100000111--000000000000000010001020-0000-1001--0000000---00000
001

Australosomus kochi

1110100101---??00000000100000100000100000000000?000?00?100000000000010

00001

Platysiagum minus

????00101000??01000002????0000010000000000??0?00???1000?010?1000000
0000

Polzbergia brochatus

????001211101?02?000012????0000010000000?00?0?0????1010???0?10001000
000

Cleithrolepidina minor

????00121110?0020000002?0???00000100?0000000?0?00???1001?0?0?1010100
1000

Cleithrolepis granulate

????0002111010020000002?0???00000100?0000000?0?00???1001?0?0?1010100
1000

Perleidus madagascariensis

11110001011101002000000211??0100011100?00000000?0?0000?100000100100010
00000

Plesiofuro mingshuica

????0010111010020000002?1???00011100?0000000?0?00???1000?010?1000100
0000

Pseudobeaconia elegans

????0000111010021000002????00011100?0010000?0?01???1000?010?1000100
0100

Peltoperleidus macrodontus

????00?0111010020000002?1???00011100?0000000?0?00???1000???0?1000100
0000

Peltopleurus rugosus

????0000111010020000002?1???00011100?0000000?0?00???1000?010?0000100
0001

Peripeltopleurus hypsisomus

???2?111111010020000002?1???00011100?0000100?0?00???1000?0?0?0000100
0011

Thoracopterus niederristi

????1111111010010000002????01111110?0000100?0000???1000?0?0?00001000
011

Potanichthys xingyiensis

???2?1111111020020000002???0?01111111?0000100?000000?100000?000000110
0011

Gigntopterus telleri

????11111110?0020000002????01111111?0000100?0000???1000???0?0000?100
011

Luganoia lepidosteoides

???2?00001110200200001121????00011100?0000200?0?10???1010?011?1000100
0021

Habroichthys minius

????00101110?0001110112????0?00011100?000010??0?10???1010?0?0?01101000
001

Furo muensteri

???2?001011111120111112?1110?100111001010111???0010???1100?01000101000
0000

Amia calva

1012000101111111011111121111011001110110101111110010000110010100010100
10021

Lepisosteus osseus

0012000101110111201110121120010001110011101111110010001101011200010100
00020

Semionotus elegans

???2?001011101112011111211200110011100111011111100100011010112000100000
0100

Leptolepis coryphaenoides

1112000101110111201111121110111001110000000100001110110100000101010100
20000

Hiodon tergisus

1?12100101110111011110121110111001110110000100011110000100001201010100
20001

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