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Article

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Twenty-seven new species and four new genera of Gastropoda (Animalia: Mollusca) from plateau lake Quaternary sediments in Yunnan, southwestern China

HONG QUAN XIANG[1*], YI ZHI LU[2], YUE MING HE[3], CHONG YE LI[4], HAN GAO[5], ANG SONG LV[6], HUI CHEN[7*]

[1]Yuxi Agriculture Vocation-Technical College Department of Animal Science, Xiangjiazhuang 41, Yanhe Street, Hongta District, Yuxi City, China. E-mail: 3044655033@qq.com; https://orcid.org/0009-0005-6737-3092
[2]Auburn University, Auburn, AL 36849, Alabama, United States of America. E-mail: yizhilu698@gmail.com; https://orcid.org/0009-0005-6054-4952
[3]College of Engineering and Technology, Tianjin Agricultural University, Tianjin 300384, China. E-mail: 1123649307@qq.com; https://orcid.org/0009-0002-9849-7977
[4] Beijing Institute of Technology, Beijing 10008, China. E-mail: LCY2395933264@163.com; https://orcid.org/0009-0009-3279-139X
[5]Fuzhou University College of Computer and Data Science/College of Software, Fuzhou 350108, China. E-mail: boxcos@foxmail.com; https://orcid.org/0009-0007-8458-7222
[6]Kuang Wei Yu Memorial Middle School, Huadu District, Guangzhou 510800, China. E-mail: 3522450979@qq.com; https://orcid.org/0009-0004-9908-0190
[7]School of Life Sciences, Nanchang University, Nanchang 330031, China. https://orcid.org/0009-0004-5222-3975
[*]Corresponding authors. Hui Chen (E-mail: nnuchenhui@163.com), Hong Quan Xiang (E-mail: 3044655033@qq.com)

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Abstract
The plateau lakes of Yunnan, China boast a high diversity of Gastropoda; however, few studies have been conducted on Gastropoda in desiccated lakes. This study conducted surveys from 2021 to 2025 on five lakes sediment in Yunnan. A total of 27 freshwater snail species and four new genera were discovered at these locations. This study provides morphological descriptions of these newly discovered freshwater snails and has proposed their taxonomic status.

Key words Yunnan-Guizhou Plateau; Extinct species; Subfossils; Lymnaeidae; Pomatiopsidae; Planorbidae.

Introduction

The ancient lakes of Yunnan Province in southwestern China harbor an exceptionally diverse freshwater gastropod fauna. While studies have documented a high degree of endemism among small freshwater snails in this lakes (Li 1987; Zhang et al. 1997; Wiese et al. 2020; Zhang and Wang 2023; Zhang et al.

2024; Chen et al. 2025; He et al. in press), research on these snails remains limited, particularly concerning small-sized species that are often overlooked. Compounding these research deficiencies, ongoing climate change and anthropogenic pressures have caused the desiccation of numerous ancient lakes (Ji 1989; Zhang 2017).

To comprehensively document the freshwater gastropod diversity in Yunnan's ancient lake systems, we conducted systematic surveys of both lacustrine sediments and desiccated lakebeds across five lakes (Lake Babuhai (dried up) and Yangzonghai Lake in Kunming City, Lake Fuxianhu in Yuxi City, Lake Lulianghai (dried up) and Qujing Basin (dried up) in Qujing City) from 2021 to 2025. Through detailed morphological analyses, our study identified 27 new species and established four new genera within the families Pomatiopsidae Stimpson, 1865, Lymnaeidae Rafinesque, 1815 and Planorbidae Rafinesque, 1815, all formally described herein.

Material and Methods

In July 2021, February 2022, June 2023, and February 2024, fieldwork was conducted four times in four different regions around Lake Lulianghai (dried up), Qujing City. In February 2024, an additional fieldwork was carried out in Qujing Basin (dried up) in Qilin District, Qujing City. In June 2024, an investigation was conducted in Lake Yangzonghai and Lake Babuhai (dried up), Kunming City. In January and February of 2025, an investigation was conducted in Lake Fuxianhu, Yuxi City (Fig 1). All specimens collected in this study were gathered from lake beds, soil cores or sediment around the lake. Shell length was measured using a vernier caliper with an accuracy of 0.1 millimeters. Specimens were consistently photographed using a Olympus OM-1 camera in a standardized orientation. The holotype specimens (Fig. 2) are deposited at the Nanchang University (NCU).

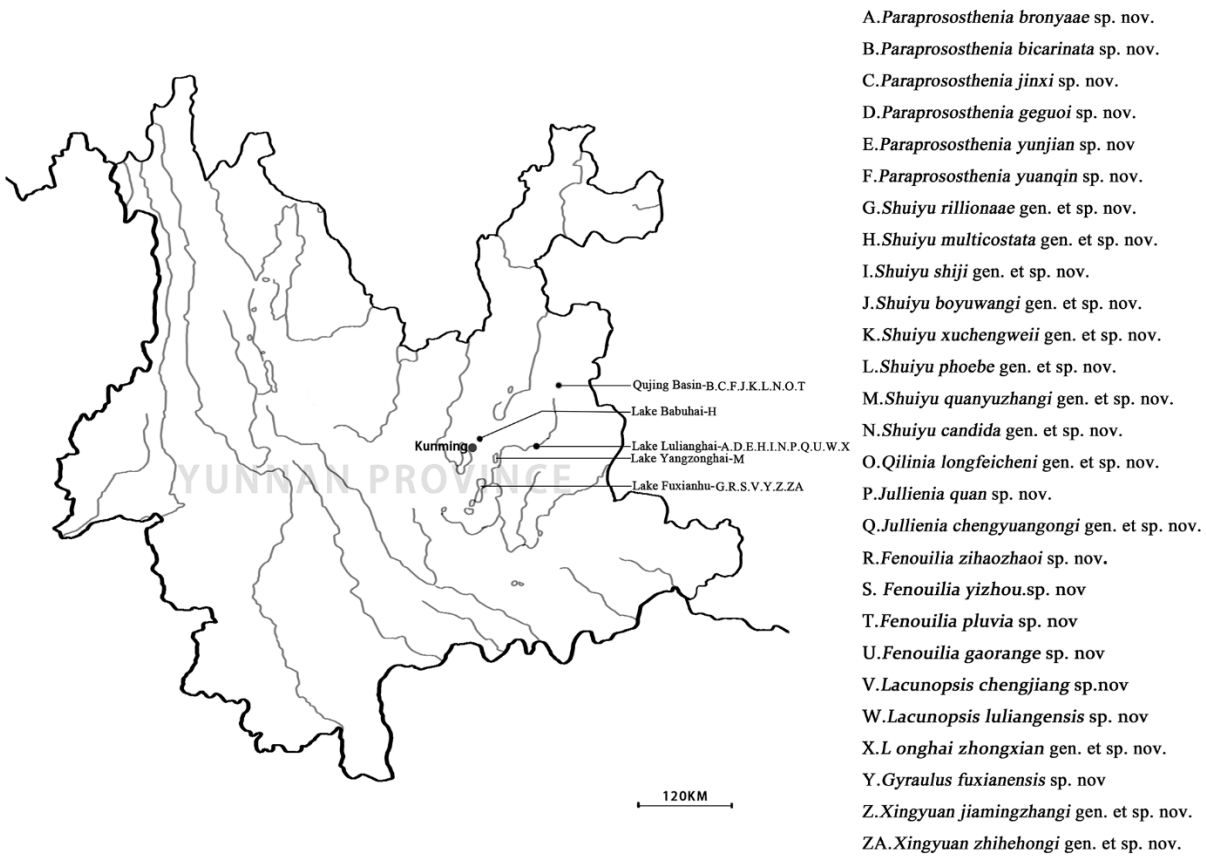

Figure 1. Map of the ancient lakes and rivers in the Yunnan Province, south-west China, showing the sampling sites.

Results

Systematics
Class Gastropoda Cuvier, 1795
Subclass Caenogastropoda L. R. Cox, 1960
Superfamily Trucatelloidea J. E. Gray, 1840
Family Pomatiopsidae Stimpson, 1865
Subfamily Triculinae Annandale, 1924

Genus *Paraprososthenia* Annandale, 1919
Type species: *Paraprososthenia minuta* Annandale, 1919

***Paraprososthenia bronyaae* Xiang, He, Lu & Chen, sp. nov.**
https://zoobank.org/urn:lsid:zoobank.org:act:753EF7A4-D8B0-49D4-82E9-54E3E8A716CD
Fig. 2 A, Fig. 3 A-C

Material examined. Holotype: XHQ 24010101, shell height 21.0 mm. Zhongshu Town[中枢镇], Luliang County[陆良县], Qujing City[曲靖市], Yunnan Province, China, 25.02°N, 103.66°E, June 2021, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 2 specimens, XHQ 24010102-03, shell height 20.2-25.0 mm, June 2023, locality and habitat same as holotype.

Diagnosis. Shell small, elongate conic, grey, with ten whorls, the whorls with very obvious keels, aperture ovate, inner lip thickened, outer lip reflexed and thickened.

Description. Shell small, but solid, elongate conic, grey, with ten whorls, including two protoconch whorls, teleoconch whorl not swollen; third to fifth whorls with very week keels; other whorls with two very obvious keels; body whorls not swollen. Shell surface with axial growth lines. Apex obtuse. Umbilicus narrow and small, base with one keel around umbilical area. Aperture ovate, inner lip thickened and smooth; outer lip thickened and reflexed.

Differential diagnosis. Compared with *P. costata* (Tchang & Tsi, 1949) and *P. constricta* (Tchang & Tsi, 1949), *Paraprososthenia bronyaae* sp. nov. shell surface lacks nodules and with two very obvious keels. Compared to *Parapyrgula coggini* (Annandale & Prashad, 1919), the shell of *Paraprososthenia bronyaae* sp. nov. is larger, with more whorls, and more pronounced keels.

Etymology. The species name "*bronyaae*" originates from female characters in the games Honkai Impact 3rd and Honkai: Star Rail. We suggest the Chinese common name as "布洛妮娅川蜷".

Distribution and ecology. This species is only found in the lake sediments of Lake Lulianghai in Luliang, Yunnan Province.

***Paraprososthenia bicarinata* Xiang, He, Lu & Chen, sp. nov.**
https://zoobank.org/urn:lsid:zoobank.org:act:27968859-1552-4BAC-903D-6652708AA905
Fig. 2 B, Fig. 3 D-E

Material examined. Holotype: XHQ 24010201, shell height 17.0 mm. Yanjiang Town[沿江镇], Qilin District[麒麟区], Qujing City, Yunnan Province, China, 25.48°N, 103.87°E, June 2024, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 1 specimen, XHQ 24010202, shell height 15.0 mm, June 2024, locality and habitat same as holotype.

Diagnosis. Shell small, elongate conic, white, with eight whorls, the whorls with keels and axial ribs, aperture ovate, inner lip thickened, outer lip reflexed and thickened.

Description. Shell small, but solid, elongate conic, white, with eight whorls, including two protoconch whorls; third to fifth whorls with two very week keels and shell surface smooth; sixth whorls with two week keels and very week axial ribs; other whorls with two very obvious keels and week axial ribs; body whorls not swollen. Shell surface with axial growth lines. Apex obtuse. Umbilicus narrow

and small, base with one keel around umbilical area. Aperture ovate, inner lip thickened and smooth; outer lip thickened and reflexed.

Differential diagnosis. Compared with *P. costata* and *P. constricta*, *Paraprososthenia bicarinata* sp. nov. shell surface lacks nodules and with two very obvious keels. Compared to *Parapyrgula coggini* and *Paraprososthenia gredleri*, *Paraprososthenia bicarinata* sp. nov. shell is larger, surface with week axial ribs. Compared with *P. bronyaae* sp. nov., *Paraprososthenia bicarinata* sp. nov. shell surface with week axial ribs and less whorls.

Etymology. The species name "*bicarinata*" originates from the characteristic of having two keels on the whorls. We suggest the Chinese common name as "双龙骨川蜷".

Distribution and ecology. This species is only found in the lake sediments of Qilin District, Yunnan Province.

***Paraprososthenia jinxi* Xiang, He, Lu & Chen, sp. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:7F8FCF68-8BEA-4926-9213-D47826BD25D6

Fig. 2 C, Fig. 3 F-G

Material examined. Holotype: XHQ 24010301, shell height 25.0 mm. Yanjiang Town, Qilin District, Qujing City, Yunnan Province, China, 25.48°N, 103.87°E, June 2024, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 1 specimen, XHQ 24010302, shell height 24.0 mm, June 2024, locality and habitat same as holotype.

Diagnosis. Shell small, elongate conic, white, with seven whorls, the whorls with two very obvious keels, aperture ovate, inner lip thickened.

Description. Shell small, but solid, elongate conic, white, with seven whorls, including two protoconch whorls, teleoconch whorl inflated; third to fifth whorls with two very week keels; other whorls with two very obvious keels; body whorls not swollen. Shell surface with very obvious axial growth lines. Apex obtuse. Umbilicus narrow and small, base with one keel around umbilical area. Aperture ovate, inner lip thickened and smooth; outer lip thickened and reflexed.

Differential diagnosis. Compared with *P. costata*, *P. constricta*, *P. gredleri* and *Parapyrgula coggini*, *Paraprososthenia jinxi* sp. nov. shell surface with very obvious axial growth lines, whorls with two very obvious keels and lacks nodules. Compared with *P. bronyaae* sp. nov., *Paraprososthenia jinxi* sp. nov. shell surface with very obvious axial growth lines and wider shell. Compared with *P. bicarinata* sp. nov., *Paraprososthenia jinxi* sp. nov. with two very obvious keels and wider shell.

Etymology. The species name "*jinxi*" is a Chinese term referring to the ebb and flow of the vast ocean, symbolizing the passage of time and the changes in the world. We suggest the Chinese common name as "今汐川蜷".

Distribution and ecology. This species is only found in the lake sediments of Qilin District, Yunnan Province.

***Paraprososthenia geguoi* Xiang, He, Lu & Chen, sp. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:D6BC9738-9550-49A9-B945-F6F674606ED4

Fig. 2 D, Fig. 3 H-J

Material examined. Holotype: XHQ 24010401, shell height 20.0 mm. Zhongshu Town, Luliang County, Qujing City, Yunnan Province, China, 25.02°N, 103.66°E, June 2021, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 2 specimens, XHQ 24010402-03, shell height 22.0-18.5 mm, June 2023, locality and habitat same as holotype.

Diagnosis. Shell small, elongate conic, white, with eight whorls, the whorls with two row of obvious nodules, aperture ovate, inner lip thickened.

Description. Shell small, but solid, elongate conic, grey, with eight whorls, including two protoconch whorls, teleoconch whorl inflated; third whorls with a weak keels; other whorls with two row of obvious nodules, nodules are composed of intersection of spiral keels and many weak axial ribs;

body whorls not swollen. Shell surface with very obvious axial growth lines. Apex obtuse. Umbilicus narrow and small, base with one keel around umbilical area. Aperture ovate, inner lip thickened and smooth; outer lip thickened and reflexed.

Differential diagnosis. Compared with *P. costata*, *P. gredleri* and *P. constricta*, *Paraprososthenia geguoi* sp. nov. shell is wider and two row of obvious nodules. Compared to *Parapyrgula coggini*, *Paraprososthenia bicarinata* sp. nov., *P. jinxi* sp. nov. and *P. bronyaae* sp. nov., *Paraprososthenia geguoi* sp. nov. shell without obvious keels and has many week axial ribs.

Etymology. The species is named after Ge Guo (Beijing, China), a conchologist and shell enthusiast. We suggest the Chinese common name as "国歌川蜷".

Distribution and ecology. This species is only found in the lake sediments of Lake Lulianghai in Luliang, Yunnan Province.

***Paraprososthenia yunjian* Xiang, He, Lv & Chen, sp. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:CDEF35B6-5F9C-4EF8-9419-F76445485069

Fig. 2 E, Fig. 3 K-M

Material examined. Holotype: XHQ 24010501, shell height 22.0 mm. Zhongshu Town, Luliang County, Qujing City, Yunnan Province, China, 25.02°N, 103.66°E, June 2021, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 2 specimens, XHQ 24010502-03, shell height 20.0-25.0 mm, June 2023, locality and habitat same as holotype.

Diagnosis. Shell small, elongate conic, white, with eleven to thirteen whorls, the whorls with very obvious keels on the shoulders, aperture ovate, inner lip thickened.

Description. Shell small, but solid, elongate conic, white, with eleven to thirteen whorls, including two protoconch whorls, teleoconch whorl inflated; third to fifth whorls with very week keels on the shoulders; other whorls with very obvious keels on the shoulders; body whorls not swollen. Apex obtuse. Shell surface with fine growth lines, the whorls with very obvious keels on the shoulders. Umbilicus narrow and small, base with one keel around umbilical area. Aperture ovate, inner lip thickened and smooth, outer lip thickened.

Differential diagnosis. Compared with *P. costata* and *P. constricta*, *Paraprososthenia yunjian* sp. nov. shell surface lacks nodules and with very obvious keels on the shoulders. Compared to *P. gredleri*, the shell of *Paraprososthenia yunjian* sp. nov. is larger, with more whorls, and more pronounced keels. Compared with *P. jinxi* sp. nov., *P. bronyaae* sp. nov. and *P. bicarinata* sp. nov., *Paraprososthenia yunjian* sp. nov. with only one keels on the shoulders.

Etymology. The species name "*yunjian*" derives from a Chinese term describing the morphological features of a cloud, typically referring to the upper edge or appearance of a cloud, especially those parts that extend outward resembling shoulders. Here, it is used to describe the keel structures of this species. We suggest the Chinese common name as "云肩川蜷".

Distribution and ecology. This species is only found in the lake sediments of Lake Lulianghai in Luliang, Yunnan Province.

***Paraprososthenia yuanqin* Xiang, He, Lu & Chen, sp. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:E7E63C90-2B39-4A8B-BBAC-317C3760E478

Fig. 2 F, Fig. 3 N

Material examined. Holotype: XHQ 24010601, shell height 14.0 mm. Yanjiang Town, Qilin District, Qujing City, Yunnan Province, China, 25.48°N, 103.87°E, June 2024, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 1 specimen, XHQ 24010602, shell height 15.2 mm, June 2024, locality and habitat same as holotype.

Diagnosis. Shell small, elongate conic, white, with seven whorls, the whorls with two row of large nodules, aperture ovate, inner lip thickened.

Description. Shell small, but solid, elongate conic, grey, with seven whorls, including two protoconch whorls, teleoconch whorl inflated; third to fourth whorls smooth; fifth whorls with a obvious keel and a row of large nodules; other whorls with two row of large nodules, nodules are composed of intersection of thick spiral keels and many axial ribs; body whorls not swollen. Shell surface with very obvious axial growth lines. Apex obtuse. Umbilicus narrow and small, base with one obvious keel around umbilical area. Aperture ovate, inner lip thickened and smooth; outer lip thickened and reflexed.

Differential diagnosis. Compared with *P. jinxi* sp. nov., *P. bronyaae* sp. nov., *P. bicarinata* sp. nov. and *P. geguoi* sp. nov., *Paraprososthenia yuanqin* sp. nov. shell is wider and two row of large nodules. Compared to *P. costata*, *P. gredleri* and *P. geguoi* sp. nov., *Paraprososthenia yuanqin* sp. nov. has less whorls, fifth whorls with a obvious keel and a row of large nodules.

Etymology. The species name "yuanqin" originates from the online handle of a freshwater snail enthusiast in Guizhou Province, China.We suggest the Chinese common name as "愿琴川蜷".

Distribution and ecology. This species is only found in the lake sediments of Qilin District, Yunnan Province.

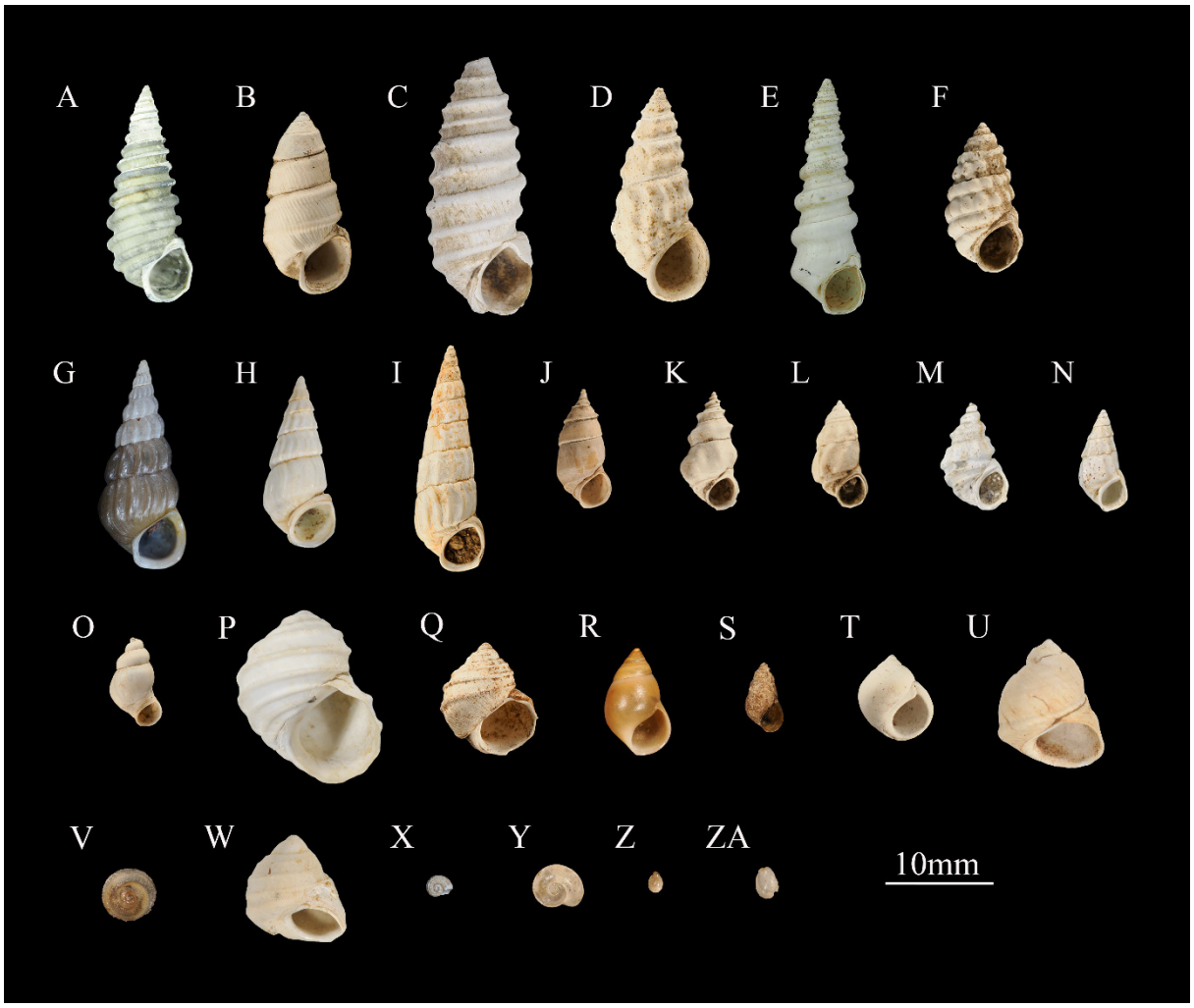

Figure 2. (A) paratype, *Paraprososthenia bronyaae* **sp. nov.** (B) holotype, *P. bicarinata* **sp. nov.** (C) holotype, *P. jinxi* **sp. nov.** (D) holotype, *P. geguoi* **sp. nov.** (E) holotype, *P. yunjian* **sp. nov.** (F) holotype, *P. yuanqin* **sp. nov.** (G) holotype, *Shuiyu rillionaae* **gen. et sp. nov.** (H) holotype, *S. multicostata* **gen. et sp. nov.** (I) holotype, *S. shiji* **gen. et sp. nov.** (J) holotype, *S. boyuwangi* **gen. et sp. nov.** (K) holotype, *S. xuchengweii* **gen. et sp. nov.** (L) holotype, *S. phoebe* **gen. et sp. nov.** (M) holotype, *S. quanyuzhangi* **gen. et sp. nov.** (N) holotype, *S. candida* **gen. et sp. nov.** (O) holotype, *Qilinia longfeicheni* **gen. et sp. nov.** (P) holotype, *Jullienia quan* **sp. nov.** (Q) holotype, *J. chengyuangongi* **sp. nov.** (R) holotype, *Fenouilia zihaozhaoi* **sp. nov.** (S) holotype, *F. yizhou* **sp. nov.** (T) holotype, *F. pluvia* **sp. nov.** (U) holotype, *F. gaorange* **sp. nov.** (V) holotype, *Lacunopsis chengjiang* **sp. nov.** (W) holotype, *L. luliangensis* **sp. nov.** (X) holotype, *Longhai zhongxian* **gen. et sp. nov.** (Y) holotype, *Gyraulus fuxianensis* **sp. nov.** (Z) holotype, *Xingyuan jiamingzhangi* **gen. et sp. nov.** (ZA) holotype, *X. zhihehongi* **gen. et sp. nov.** Scale bars = 10 mm.

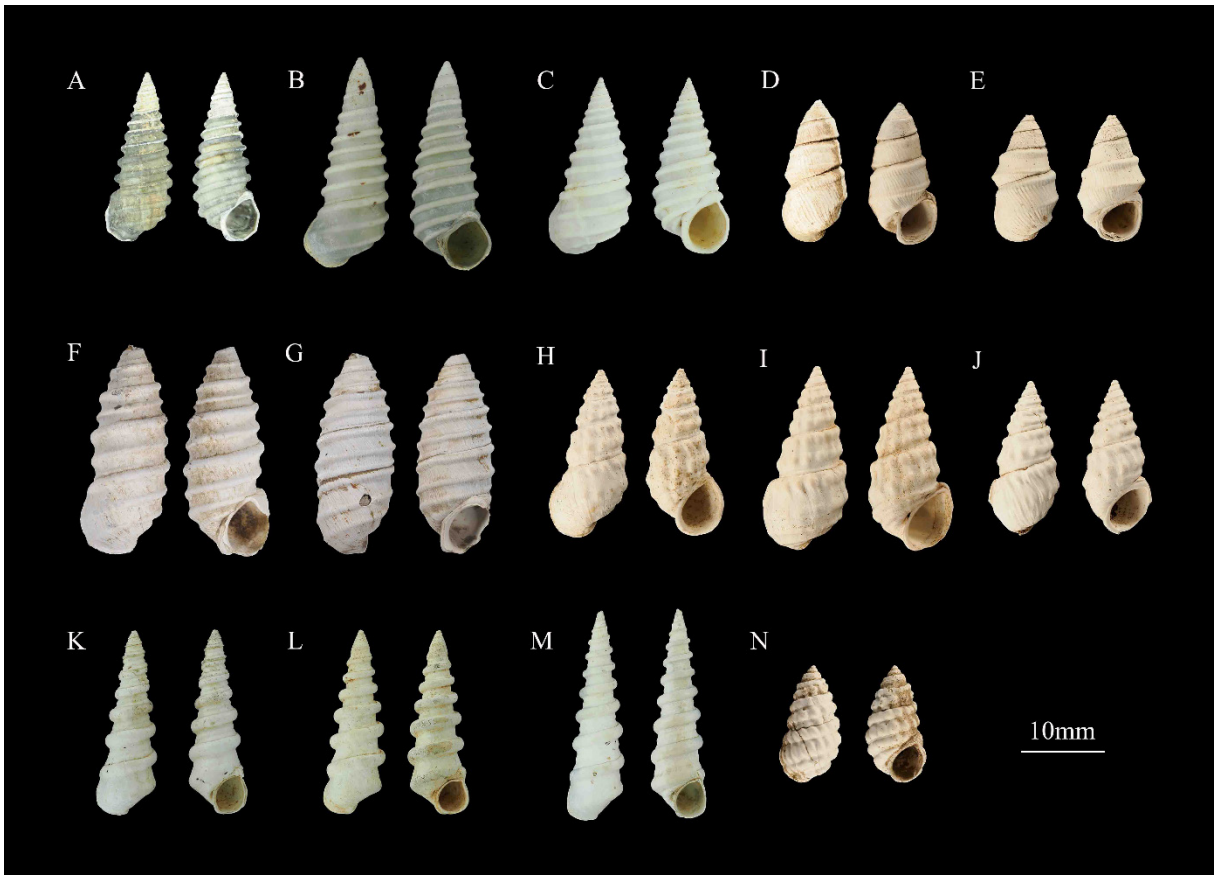

Figure 3. Shells of *Paraprososthenia bronyaae* **sp. nov.** (A, C) paratype (B) holotype. Shells of *P. bicarinata* **sp. nov.** (D) holotype (E) paratype. Shells of *P. jinxi* **sp. nov.** (F) holotype (G) paratype. Shells of *P. geguoi* **sp. nov.** (H) holotype (I-J) paratype. Shells of *P. yunjian* **sp. nov.** (K) holotype (L-M) paratype. Shells of *P. yuanqin* **sp. nov.** (N) holotype. Scale bars = 10 mm.

***Shuiyu* Xiang, He, Li & Chen, gen. nov.**
https://zoobank.org/urn:lsid:zoobank.org:act:D7A23F74-8E48-41B1-AFD9-733D7D71284C
Type species. *Shuiyu rillionaae* gen. et sp. nov.

Etymology. The genus name "Shuiyu" is derived from the ancient Chinese term for crystal. We suggest the Chinese common name as "水玉螺".

Diagnosis. Shell small, but solid, elongate conic, whorls often with some axial ribs. Umbilicus narrow, around with one keel, outer lip roll outward and thickened.

Differential diagnosis. *Shuiyu* gen. nov. only resembles *Hubendickia* (Brandt, 1968). It differs from *Hubendickia* by having one keel at the umbilicus narrow and huge shell.

Distribution and ecology. This genus has only been found in plateau lake in Yunnan Province for the time being.

***Shuiyu rillionaae* He, Xiang & Chen, gen. et sp. nov.**
https://zoobank.org/urn:lsid:zoobank.org:act:652B304D-C127-49A3-9528-6B17FDC45D1C
Fig. 2 G, Fig. 4 A-C

Material examined. Holotype: XHQ 24010701, shell height 19.5 mm, Haijing[海镜], Lake Fuxian[抚仙湖], Yuxi City[玉溪市], Yunnan Province, China, 24°37′22″N, 102°51′32″E, February 2025, collected by Yue-Ming He, Hong-Quan Xiang and Chong-Ye Li (Fig. 1).

Paratypes: 2 specimens, XHQ 24010702-03, shell height 16.3–21.0 mm, February 2025, locality and habitat same as holotype.

Diagnosis. Shell small, elongate conic, light grey, with eight to nine whorls, whorls with eleven to fourteen axial ribs. Umbilicus narrow or absent, outer lip roll outward and thickened.

Description. Shell small, thick, solid, a little transparent, elongate conic, light grey, color near the apex is lighter. Apex obtuse, with eight to nine whorls, sculptured with axial ribs, axial ribs near the outer lip are not prominent. Except for fine growth lines, there were some 11 to 14 axial ribs on the whorls, axial ribs exhibit a certain degree of curvature, axial ribs near the apex gradually weaken and disappear. Body whorl little swollen, has an inconspicuous lower keel, a few individuals with a strong keel at the bottom of near the top whorl, suture low. Umbilicus narrow or absent, base light grey, aperture ovate, less than half of shell in height, inner lip thickened and smooth, with an obtusely angles, grey-white, outer lip reflexed and thickened, with an obtusely angles, white or yellowish white.

Etymology. The specific name "*rilliona*" originates from a character “Rilliona, the Magistus of Verre” in the card game “Yu-Gi-Oh!”. We suggest the Chinese common name as "薇儿水玉螺".

Distribution and ecology. The habitat of this species has been destroyed due to the environmental pollution caused by the artificial modification of the lake shore and the impact of modern tourism. In recent surveys, no living individuals were found, only empty shells were discovered. This species may have become extinct. Based on the current findings of empty shells, we can speculate that this species may have been a large Pomatiopsidae species that inhabited sandy environments in the past.

***Shuiyu multicostata* Xiang, He, Lu & Chen, gen. et sp. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:DCB6AECE-8601-4635-9917-565A73B35662

Fig. 2 H, Fig. 4 D-G

Material examined. Holotype: XHQ 24010801, shell height 16.0 mm. Zhongshu Town, Luliang County, Qujing City, Yunnan Province, China, 25.02°N, 103.66°E, June 2022, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 3 specimens, XHQ 24010802-04, shell height 20.2-25.0 mm; 2 collected from the type locality, June 2022; 1 collected from the Lake Babuhai[八步海], Songming County[嵩明县], Kunming City[昆明市], 25.27°N, 103.11°E, June 2021.

Diagnosis. Shell small, elongate conic, grey, with nine whorls, the whorls with axial ribs, aperture ovate, inner lip thickened.

Description. Shell small, translucent, but solid, elongate conic, grey, with nine spiral whorls, including two protoconch whorls, teleoconch whorl inflated; third whorls smooth; fourth whorls with six to eight weak axial ribs; other whorls with thirteen to twenty-one axial ribs, body whorl not swollen. Apex obtuse. Umbilicus narrow and small, base white and with one weak keel around umbilical area. Aperture ovate, less than half of shell in height, inner lip thickened and smooth, outer lip reflexed and thickened.

Differential diagnosis. Compared with *S. rillionaae* gen. et sp. nov., *Shuiyu multicostata* gen. et sp. nov. has a smaller shell and less axial ribs. Additionally, the axial ribs on the body whorl of *S. multicostata* gen. et sp. nov. are less pronounced than those of *S. rillionaae* gen. et sp. nov..

Etymology. The species name "multicostata" for many ribs on shell. We suggest the Chinese common name as "多肋水玉螺".

Distribution and ecology. This species is only found in the lake sediments of Lake Lulianghai and Lake Babuhai, Yunnan Province.

***Shuiyu shiji* Xiang, He, Lu & Chen, gen. et sp. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:3A3797A3-CBA5-4D98-A78B-681B1C36AD76

Fig. 2 I, Fig. 4 H-J

Material examined. Holotype: XHQ 24010901, shell height 21.0 mm. Zhongshu Town, Luliang County, Qujing City, Yunnan Province, China, 25.02°N, 103.66°E, June 2021, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 2 specimens, XHQ 24010902-03, shell height 20.2-25.0 mm, June 2023, locality and habitat same as holotype.

Diagnosis. Shell small, elongate conic, white, with ten whorls, the whorls with axial ribs, aperture ovate, outer lip reflexed.

Description. Shell small, translucent, but solid, elongate conic, grey, with ten spiral whorls, including two protoconch whorls, teleoconch whorl inflated; third whorls smooth; other whorls with eleven axial ribs, body whorl not swollen. Apex obtuse. Umbilicus narrow and small, base white and with one weak keel around umbilical area. Aperture ovate, less than half of shell in height, inner lip thickened and smooth, outer lip reflexed and thickened.

Differential diagnosis. Compared with *S. rillionaae* gen. et sp. nov. and *S. multicostata* gen. et sp. nov., *Shuiyu. shiji* gen. et sp. nov. shells longer and with less axial ribs.

Etymology. The species name "*shiji*" originates from ancient Chinese agricultural culture, refers to the practice of using lake water for irrigating farmland. We suggest the Chinese common name as "蒔季水玉螺".

Distribution and ecology. This species is only found in the lake sediments of Lake Lulianghai in Luliang, Yunnan Province.

***Shuiyu boyuwangi* Xiang, He, Lu & Chen, gen. et sp. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:2771E1CC-1309-43B5-83C3-A4CBEDEF19CB

Fig. 2 J, Fig. 4 K

Material examined. Holotype: XHQ 24011001, shell height 11.0 mm. Yanjiang Town, Qilin District, Qujing City, Yunnan Province, China, 25.48°N, 103.87°E, June 2024, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 1 specimen, XHQ 24011002, shell height 10.5 mm, June 2024, locality and habitat same as holotype.

Diagnosis. Shell small, smooth, elongate conic, white, with seven whorls, aperture ovate, inner lip thickened.

Description. Shell small, translucent, but solid, elongate conic, white, with seven spiral whorls, including two protoconch whorls, teleoconch whorl inflated; third whorls with spiral ribs; other whorls shell surface smooth, with a keels on each whorls bottom; body whorl not swollen. Apex obtuse. Umbilicus narrow and small, base white and with one weak keel around umbilical area. Aperture ovate, less than half of shell in height, inner lip thickened and smooth, outer lip reflexed and thickened.

Differential diagnosis. Compared with *S. rillionaae* gen. et sp. nov. and *S. multicostata* gen. et sp. nov., *Shuiyu. boyuwangi* gen. et sp. nov. shell surface smooth and growth lines. Compared with *S. shiji* gen. et sp. nov., *Shuiyu boyuwangi* gen. et sp. nov. with a keels on each whorls bottom.

Etymology. The species name "boyuwang" originates from the name of a freshwater snail enthusiast in Beijing, China. We suggest the Chinese common name as "王氏水玉螺".

Distribution and ecology. This species is only found in the lake sediments of Qilin District, Yunnan Province.

***Shuiyu xuchengweii* Xiang, He, Lu & Chen, gen. et sp. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:8954CC18-0159-4F26-B4E0-7BC6E977A3A3

Fig. 2 K, Fig. 4 L

Material examined. Holotype: XHQ 24011101, shell height 11.0 mm. Yanjiang Town, Qilin District, Qujing City, Yunnan Province, China, 25.48°N, 103.87°E, June 2024, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 1 specimen, XHQ 24011102, shell height 10.8 mm, June 2024, locality and habitat same as holotype.

Diagnosis. Shell small, elongate conic, white, with eight whorls, the whorls with a row of large nodules, aperture ovate, outer lip reflexed.

Description. Shell small, translucent, but solid, elongate conic, white, with eight spiral whorls, including two protoconch whorls, teleoconch whorl inflated; third whorls with a weak keels; fourth to sixth whorls with a obviously keels; other whorls with two row of large nodules, nodules are composed

of intersection of thick spiral keels and many axial ribs, body whorl swollen. Shell surface with faint spiral ribs. Apex obtuse. Umbilicus narrow and small, base white and with one weak keel around umbilical area. Aperture ovate, less than half of shell in height, inner lip thickened and smooth, outer lip reflexed and thickened.

Differential diagnosis. Compared with *S. rillionaae* gen. et sp. nov., *S. shijiae* gen. et sp. nov. and *S. multicostata* gen. et sp. nov., *S. xuchengweii* gen. et sp. nov. with less axial ribs. Compared with *S. boyuwangi* gen. et sp. nov., *Shuiyue xuchengweii* gen. et sp. nov. shell surface with faint spiral ribs.

Etymology. The species name "*xuchengweii*" originates from a biology enthusiast in Hechi, Guangxi. We suggest the Chinese common name as "伟氏水玉螺".

Distribution and ecology. This species is only found in the lake sediments of Qilin District, Yunnan Province.

***Shuiyu phoebe* Xiang, He, Gao & Chen, gen. et sp. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:7B8F9C00-E92A-4F1E-B781-042C4509262D

Fig. 2 L, Fig. 4 M

Material examined. Holotype: XHQ 24011201, shell height 21.0 mm. Yanjiang Town, Qilin District, Qujing City, Yunnan Province, China, 25.48°N, 103.87°E, June 2022, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 2 specimens, XHQ 24011202-03, shell height 19.0-19.3 mm, June 2022, locality and habitat same as holotype.

Diagnosis. Shell small, elongate conic, white, with seven whorls, the whorls with axial ribs, aperture ovate, outer lip reflexed.

Description. Shell small, translucent, but solid, elongate conic, white, with seven spiral whorls, including two protoconch whorls, teleoconch whorl inflated; third whorls smooth; fourth to fifth whorls with a weak keels; other whorls with six axial ribs, body whorl swollen. Apex obtuse. Umbilicus narrow and small, base white and with one obviously keel around umbilical area. Aperture ovate, less than half of shell in height, inner lip thickened and smooth, outer lip reflexed and thickened.

Differential diagnosis. Compared with *S. rillionaae* gen. et sp. nov., *S. multicostata* gen. et sp. nov. and *S. boyuwangi* gen. et sp. nov., *Shuiyue phoebe* gen. et sp. nov. with less axial ribs and fourth to fifth whorls with a weak keels. Compared with *S. xuchengweii* gen. et sp. nov., *Shuiyue phoebe* gen. et sp. nov. with axial ribs and inner lip thicker.

Etymology. The species name "phoebe" originates from a plant in China called Nanmu. We suggest the Chinese common name as "楠木水玉螺".

Distribution and ecology. This species is only found in the lake sediments of Qilin District, Yunnan Province.

***Shuiyu quanyuzhangi* Xiang, He, Lu & Chen, gen. et sp. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:F6DA073A-4699-4DDF-89EE-374A054EDB89

Fig. 2 M, Fig. 4 N-P

Material examined. Holotype: XHQ 24011301, shell height 10.0 mm. Tangchi Street[汤池街道], Yiliang County[宜良县], Kunming City, Yunnan Province, China, 24.96°N, 103.00°E, June 2024, collected by Hong-Quan Xiang (Fig. 1).

Paratypes: 2 specimens, XHQ 24011302-03, shell height 9.0-10.0 mm, June 2024, locality and habitat same as holotype.

Diagnosis. Shell small, long pyramidal, white, with seven whorls, the whorls with two row of large nodules, aperture ovate, outer lip reflexed.

Description. Shell small, but solid, long pyramidal, white, with seven spiral whorls, including two protoconch whorls, teleoconch whorl inflated; third to fourth whorls with a weak keels; fifth whorls with a row of large nodules; other whorls with two row of large nodules, nodules are composed of intersection of thick spiral keels and many axial ribs, body whorl swollen. Apex obtuse. Umbilicus

narrow and small, base white and with one weak keel around umbilical area. Aperture ovate, less than half of shell in height, inner lip thickened and smooth, outer lip reflexed and thickened.

Differential diagnosis. Compared with *S. rillionaae* gen. et sp. nov., *S. shijiae* gen. et sp. nov. and *S. multicostata* gen. et sp. nov., *S. quanyuzhangi* gen. et sp. nov. with less axial ribs. Compared with *S. boyuwangi* gen. et sp. nov.and *S. phoebe* gen. et sp. nov., *S. quanyuzhangi* gen. et sp. nov. shell surface with nodules. Compared with *S. xuchengweii* gen. et sp. nov., *S. quanyuzhangi* gen. et sp. nov. with long pyramidal shell and body whorl with two row of nodules and the nodules of *S. quanyuzhangi* gen. et sp. nov. are smaller.

Etymology. The species name "*quanyuzhangi*" originates from a biology enthusiast in Xinxiang, Henan. We suggest the Chinese common name as "张氏水玉螺".

Distribution and ecology. This species is only found in the lake sediments of Lake Yangzonghai in Kunming, Yunnan Province.

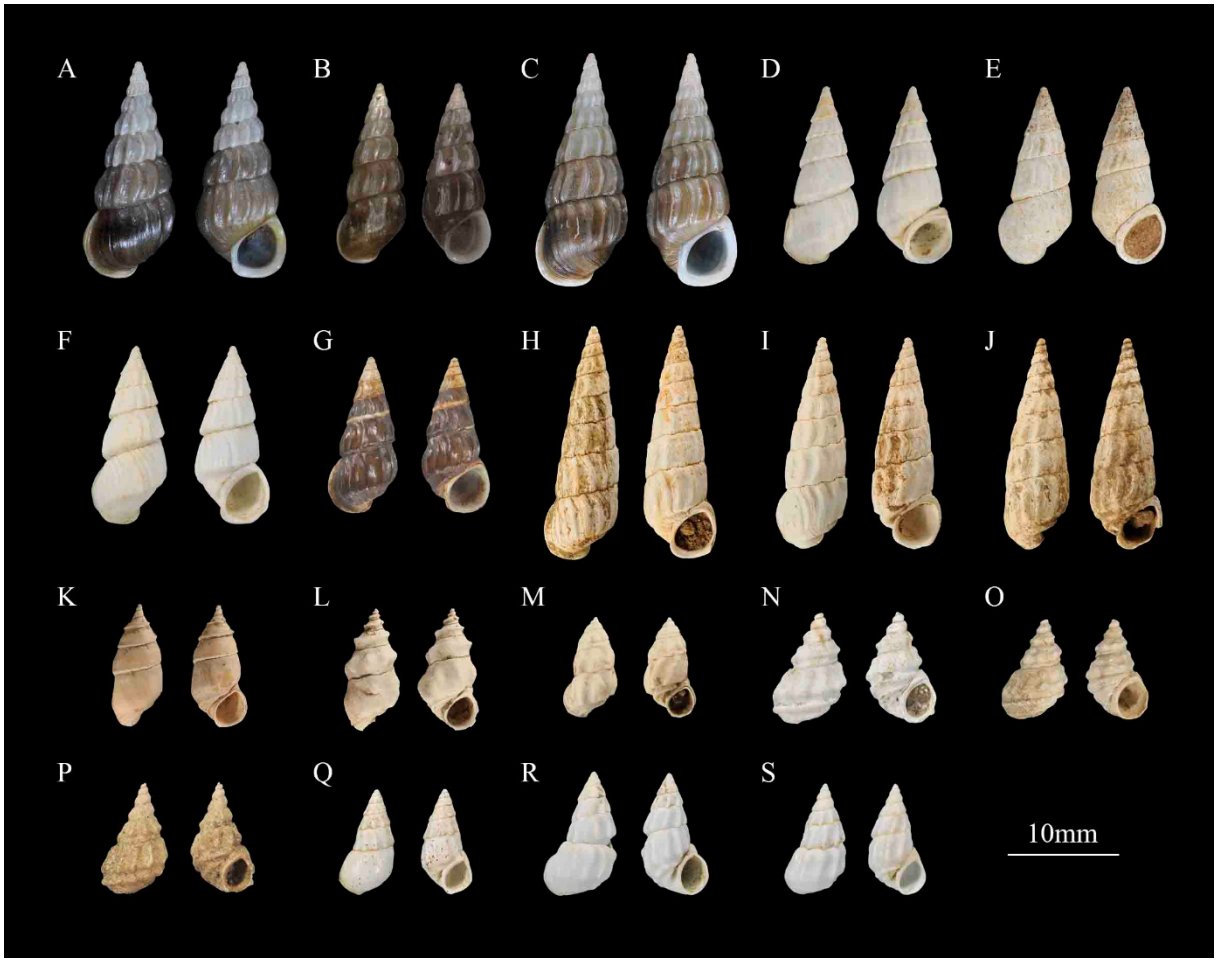

FIGURE 4. Shells of *Shuiyu rillionaae* **gen. et sp. nov.** (A) holotype (B-C) paratype. Shells of *S. multicostata* **gen. et sp. nov.** (D) holotype (E-G) paratype. Shells of *S. shiji* **gen. et sp. nov.** (H) holotype (I-J) paratype. Shells of *S. boyuwangi* **sp. nov.** (K) holotype. Shells of *S. xuchengweii* **gen. et sp. nov** (L) holotype. Shells of *S. phoebe* **gen. et sp. nov.** (M) holotype. Shells of *S. quanyuzhangi* **gen. et sp. nov.** (N) holotype. (O-P) paratype. Shells of *S. candida* **gen. et sp. nov.** (Q) holotype. (R-S) paratype. Scale bars = 10 mm.

***Shuiyu candida* Xiang, He, Lu & Chen, gen. et sp. nov.**
https://zoobank.org/urn:lsid:zoobank.org:act:44B66558-9F74-4448-BCDC-640ACD139531
Fig. 2 N, Fig. 4 Q-S

Material examined. Holotype: XHQ 24011401, shell height 9.5 mm. Zhongshu Town, Luliang County, Qujing City, Yunnan Province, China, 25.02°N, 103.66°E, June 2024, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 2 specimens, XHQ 24011402-03, shell height 11.0-10 mm; 1 collected from the type locality, June 2024; 1 collected from the Yanjiang Town, Qilin District, Qujing City, Yunnan Province, China, 25.48°N, 103.87°E, June 2022.

Diagnosis. Shell small, long pyramidal, white, with eight whorls, the whorls with nine axial ribs, aperture ovate, outer lip reflexed.

Description. Shell small, but solid, long pyramidal, white, with eight spiral whorls, including two protoconch whorls, teleoconch whorl inflated; third to fifth whorls with faint spiral ribs; other whorls with nine axial ribs, body whorl swollen. Apex obtuse. Umbilicus narrow, base white and with one keel around umbilical area. Aperture ovate, less than half of shell in height, inner lip thickened and smooth, outer lip reflexed and thickened.

Differential diagnosis. Compared with *S. rillionaae* gen. et sp. nov., *S. shijiae* gen. et sp. nov. and *S. phoebe* gen. et sp. nov., *S. candida* gen. et sp. nov. shell long pyramidal and third to fifth whorls with faint spiral ribs. Compared with *S. multicostata* gen. et sp. nov., *S. xuchengweii* gen. et sp. nov., *S. phoebe* gen. et sp. nov. and *S. quanyuzhangi* gen. et sp. nov., *S. candida* gen. et sp. nov. shell surface without nodules. Compared with *S. boyuwangi* gen. et sp. nov., *S. candida* gen. et sp. nov. with long pyramidal shell and with two row of nodules.

Etymology. The species name "candida" originates from the English word "candid," used to describe the species' immaculately white shell surface. We suggest the Chinese common name as "艾尔玛水玉螺".

Distribution and ecology. This species is only found in the lake sediments of Lake Lulianghai and Qilin District, Yunnan Province.

***Qilinia* Xiang, He, Lu & Chen, gen. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:4D987748-F42E-4216-94DC-106FE1E1151E

Type species. *Qilinia longfeicheni* gen. et sp. nov.

Etymology. The genus name "*qilinia*" is derived from the place name "Qilin District" in Qujing City. We suggest the Chinese common name as "麒麟螺".

Diagnosis. Shell small, translucent, but solid, elongate conic, white or yellow. Apex obtuse, apical whorls smooth. Shell surface with axial growth lines. Umbilicus opened, base white. Suture relatively low, aperture ovate, less than half of shell in height, inner lip thickened and smooth, outer lip thickened, lips from different growing periods little outward-folding and overlapping. The second to last whorls swollen, sometime with axial ribs. Teleoconch whorl with a shoulder that is not obviously ramp-like.

Differential diagnosis. In terms of shell morphology, *Qilinia* gen. nov. has an opened umbilicus and body whorl near the outer lip detached. This distinguishes it from all other species in the family. In addition, the characteristics of Shell surface without spiral rows of oblong pits and lips from different growing periods little outward-folding and overlapping can differentiate it from species of the family Stenothyridae.

Distribution. This genus has only been found in Lake Fuxian in Yuxi City, Yunnan Province for the time being.

Distribution and ecology.

This species is only found in the lake sediments of Lake Lulianghai in Qilin District, Qujing, Yunnan Province.

***Qilinia longfeicheni* Xiang, He, Lu & Chen, gen. et sp. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:6CC6A4E3-134D-4E84-8109-6A18E608E736

Fig. 2 O, Fig. 5 A-C

Material examined. Holotype: XHQ 24011501, shell height 8.0 mm. Yanjiang Town, Qilin District, Qujing City, Yunnan Province, China, 25.48°N, 103.87°E, June 2022, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 2 specimens, XHQ 24011502-03, shell height 8.0-8.1 mm, June 2022, locality and habitat same as holotype.

Diagnosis. Shell small, elongate conic, white, with eight whorls, body whorl and the second to whorl last big and swollen, aperture ovate, outer lip thickened.

Description. Shell small, but solid, ovate-conic, white, with eight spiral whorls, including two protoconch whorls, teleoconch whorl inflated; third to fifth spiral whorls smooth, sometimes with a keels; other whorls smooth; the second to last whorls swollen, sometime with axial ribs; body whorl big and swollen. Teleoconch whorl with a shoulder that is not obviously ramp-like. Apex obtuse. Umbilicus opened, base white. Aperture ovate, near than half of shell in height, inner lip thickened and smooth, outer lip thickened, lips from different growing periods little outward-folding and overlapping.

Etymology. The species name "longfeichen" originates from a biology enthusiast in Yantai, Shandong. We suggest the Chinese common name as "陈氏麒麟螺".

Distribution and ecology. This species is only found in the lake sediments in Qilin District, Qujing, Yunnan Province.

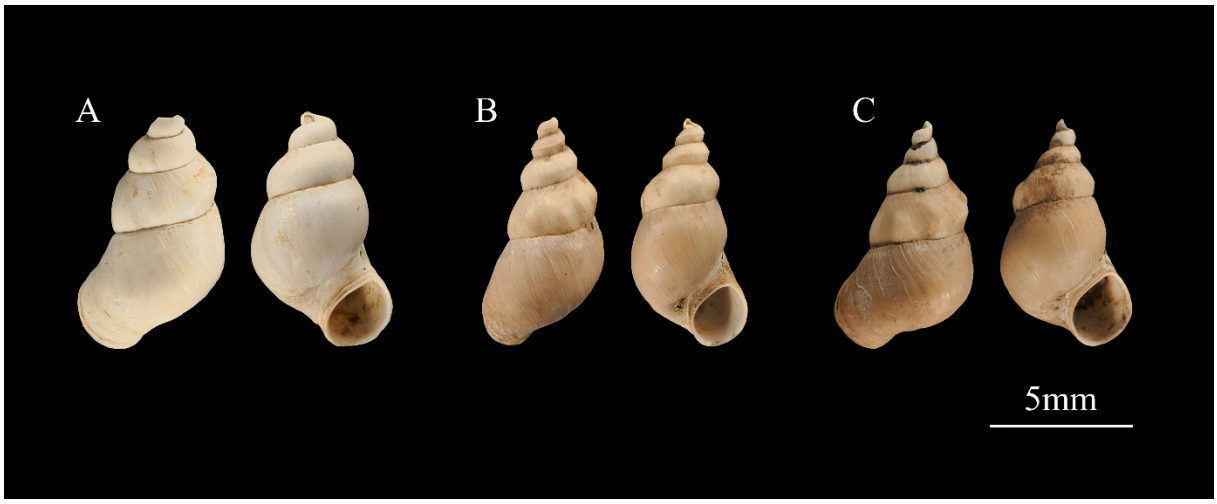

Figure 5. Shells of *Qilinia longfeicheni* **gen. et sp. nov.** (A) holotype (B-C) paratype. Scale bars = 5 mm.

Jullienia **Crosse & P. Fischer, 1876**

Type species. *Melania flava* Deshayes, 1876

Jullienia quan **Xiang, He, Lv & Chen, sp. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:D9775CB5-3CCB-4FEB-932C-AB47DF0BF815

Fig. 2 P, Fig. 6 A-C

Material examined. Holotype: XHQ 24011601, shell height 16.0 mm. Zhongshu Town, Luliang County, Qujing City, Yunnan Province, China, 25.02°N, 103.66°E, June 2022, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 2 specimens, XHQ 24011602-03, shell height 13.5-14.0 mm, June 2022, locality and habitat same as holotype.

Diagnosis. Shell small, ovate-conic, white, with five whorls, shell surface with many keels, body whorl big and swollen, aperture ovate, outer lip thined.

Description. Shell small, but solid, ovate-conic, white, with five spiral whorls, including two protoconch whorls, teleoconch whorl inflated; third spiral whorls with two keels; other whorls with a four keels, body whorl big and swollen. Apex obtuse. Umbilicus narrow, base white and with two keels around umbilical area. Aperture ovate, more than half of shell in height, inner lip thickened and smooth, outer lip thined.

Differential diagnosis. Compared to *Jullienia carinata* (Fulton, 1904) and *Jullienia harmandi* (Poirier, 1881), *Jullienia quan* sp. nov. has a larger shell and two keels on the spiral whorls. Compared to *Jullienia munensis* (Brandt, 1974), *Jullienia acuta* (Poirier, 1881), *Jullienia rolfbrandti* (Temcharoen,

1971) and *Jullienia flava* (Deshayes, 1876), *Jullienia quan* sp. nov. teleoconch whorl swollen and umbilicus with two keels around umbilical area.

Etymology. The species name "quan" originates from the shape of a fist. We suggest the Chinese common name as "拳诸氏螺".

Distribution and ecology. This species is only found in the lake sediments of Lake Lulianghai in Qujing, Yunnan Province.

***Jullienia chengyuangongi* Xiang, He, Lu & Chen, sp. nov. sp. nov.**
https://zoobank.org/urn:lsid:zoobank.org:act:E9E6EE43-7446-4527-971E-906398E4CB41
Fig. 2 Q, Fig. 6 D-F

Material examined. Holotype: XHQ 24011701, shell height 10.5 mm. Zhongshu Town, Luliang County, Qujing City, Yunnan Province, China, 25.02°N, 103.66°E, June 2022, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 2 specimens, XHQ 24011702-03, shell height 9.0-9.2 mm, June 2022, locality and habitat same as holotype.

Diagnosis. Shell small, ovate-conic, white, with five whorls, shell surface with many keels, body whorl big and swollen, aperture ovate, outer lip thickened.

Description. Shell small, but solid, ovate-conic, white, with five spiral whorls, including two protoconch whorls, teleoconch whorl inflated; third to fourth spiral whorls with two keels; other whorls with a three keels, body whorl big and swollen. Apex obtuse. Umbilicus narrow, base white. Aperture ovate, near than half of shell in height, inner lip thickened and smooth, outer lip thickened.

Differential diagnosis. Compared to *Jullienia carinata* (Fulton, 1904) and *Jullienia harmandi* (Poirier, 1881), *Jullienia chengyuangongi* sp. nov. has two keels on the spiral whorls. Compared to *Jullienia quan* sp. nov., *Jullienia chengyuangongi* sp. nov. without keel around umbilical area. Compared to *Jullienia munensis* (Brandt, 1974), *Jullienia acuta* (Poirier, 1881), *Jullienia rolfbrandti* (Temcharoen, 1971) and *Jullienia flava* (Deshayes, 1876), *Jullienia chengyuangongi* sp. nov. aperture ovate, outer lip not reflexed.

Etymology. The species name "*chengyuangongi*" originates from a biology enthusiast in Yuxi, Yunnan. We suggest the Chinese common name as "龚氏诸氏螺".

Distribution and ecology. This species is only found in the lake sediments of Lake Lulianghai in Qujing, Yunnan Province.

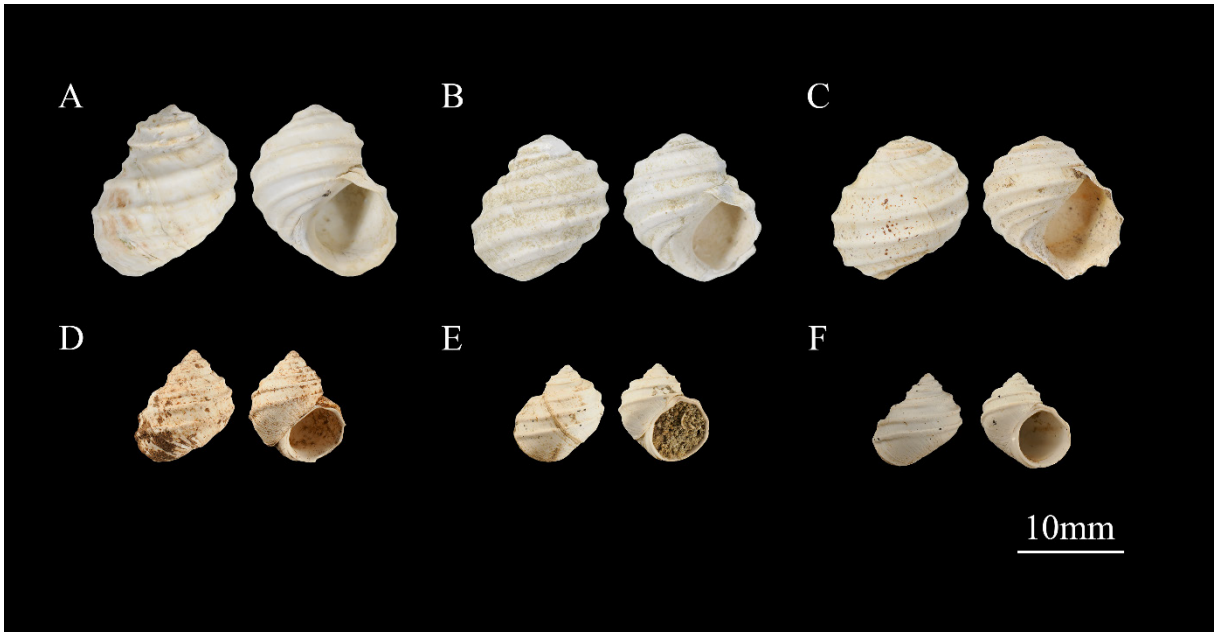

Figure 6. Shells of *Jullienia quan* **sp. nov.** (A) holotype (B-C) paratype. Shells of *J. chengyuangongi* **sp. nov.** (D) holotype (E-F) paratype. Scale bars = 10 mm.

***Fenouilia* Heude, 1889**
Type species. *Fenouilia kreitneri* Neumayr, 1880

***Fenouilia zihaozhaoi* Xiang, He, Lu & Chen, sp. nov.**
https://zoobank.org/urn:lsid:zoobank.org:act:43257A5B-AFBF-495F-BAAB-4614077A123D
Fig. 2 R, Fig. 7 A-C

Material examined. Holotype: XHQ 24011801, shell height 10.0 mm, Haijing, Lake Fuxian, Yuxi City, Yunnan Province, China, 24°37′22″N, 102°51′32″E, January 2025, collected by Yue-Ming He, Hong-Quan Xiang and Chong-Ye Li (Fig 1).

Paratypes: 2 specimens, XHQ 24011802-03, shell height 10.0–10.2 mm, January 2025, locality and habitat same as holotype.

Diagnosis. Shell small, conical, orange, with six whorls, shell surface smooth, aperture ovate, inner lip and outer lip thickened.

Description. Shell small, but solid, conical, orange, with six whorls. Shell surface smooth. Apex obtuse. Umbilicus closed. Aperture ovate. inner lip and outer lip thickened and smooth.

Differential diagnosis. Compared with *F. kreitneri*, *F. sinensis* and *F. undata*, *Fenouilia zihaozhaoi* sp. nov. shell surface smooth, without keels and axial ribs.

Etymology. The name of this species is derived from the name of Mr. He's friend, Zi-Hao Zhao. We suggest the Chinese common name as "赵氏龙骨螺".

Distribution and ecology. This species is only found in the lake sediments of Lake Fuxian in Yuxi, Yunnan Province.

***Fenouilia yizhou* Xiang, He, Lu & Chen, sp. nov.**
https://zoobank.org/urn:lsid:zoobank.org:act:2F9AE13C-403A-4142-BA67-FF158483E0A3
Fig. 2 S, Fig. 7 D-F

Material examined. Holotype: XHQ 24011901, shell height 6.5 mm, Hongshatan[红沙滩], Lake Fuxian, Yuxi City, Yunnan Province, China, 102°51′55″E, 24°37′42″N, January 2025, collected by Yue-Ming He, Hong-Quan Xiang and Chong-Ye Li (Fig 1).

Paratypes: 4 specimens (empty shell), XHQ 24011902-03, shell height 6.0–6.2 mm, January 2025, locality and habitat same as holotype.

Diagnosis. Shell small, conical, grey, with six whorls, shell surface smooth, aperture ovate, inner lip thickened.

Description. Shell small, conical, grey, with six whorls. Shell surface smooth. Apex obtuse. Umbilicus closed. Aperture ovate. inner lip thickened and smooth, and outer lip smooth.

Differential diagnosis. Compared with *F. kreitneri*, *F. sinensis* and *F. undata*, *Fenouilia yizhou* sp. nov. shell surface smooth, without axial ribs. Compared with *F. zihaozhaoi* sp. nov. sp. nov., *Fenouilia yizhou* sp. nov. shell smaller and surface grey.

Etymology. The name of this species originates from the ancient geographical name "Yizhou" during the Western Han Dynasty in China. We suggest the Chinese common name as "益州龙骨螺".

Distribution and ecology. This species is only found in the lake sediments of Lake Fuxian in Yuxi, Yunnan Province.

***Fenouilia pluvia* Xiang, He, Lu & Chen, sp. nov.**
https://zoobank.org/urn:lsid:zoobank.org:act:24699009-19AF-4A83-8B64-9C46854C2F46
Fig. 2 T, Fig. 7 G-H

Material examined. Holotype: XHQ 24012001, shell height 7.5 mm. Yanjiang Town, Qilin District, Qujing City, Yunnan Province, China, 25.48°N, 103.87°E, June 2024, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 1 specimen, XHQ 24012002, shell height 8.0 mm, June 2024, locality and habitat same as holotype.

Diagnosis. Shell small, ovate-conic, white, with five whorls, shell surface smooth, aperture ovate, outer lip thickened.

Description. Shell small, but solid, ovate-conic, white, with five spiral whorls, including two protoconch whorls, teleoconch whorl inflated; other whorls surface smooth, body whorl swollen. Apex obtuse. Umbilicus narrow, base white. Aperture ovate, more than half of shell in height, inner lip thickened and smooth, outer lip thickened.

Differential diagnosis. Compared with *F. kreitneri*, *F. sinensis* and *F. undata*, *Fenouilia pluvia* sp. nov. shell surface smooth, without keels and axial ribs. For *Fenouilia pluvia* sp. nov., its inner lip is very thick.

Etymology. The species name "pluvia" derives from the Latin word for rain, indicating that the shell of the new species resembles the shape of raindrops. We suggest the Chinese common name as "雨滴龙骨螺".

Distribution and ecology. This species is only found in the lake sediments of Qilin District, Yunnan Province.

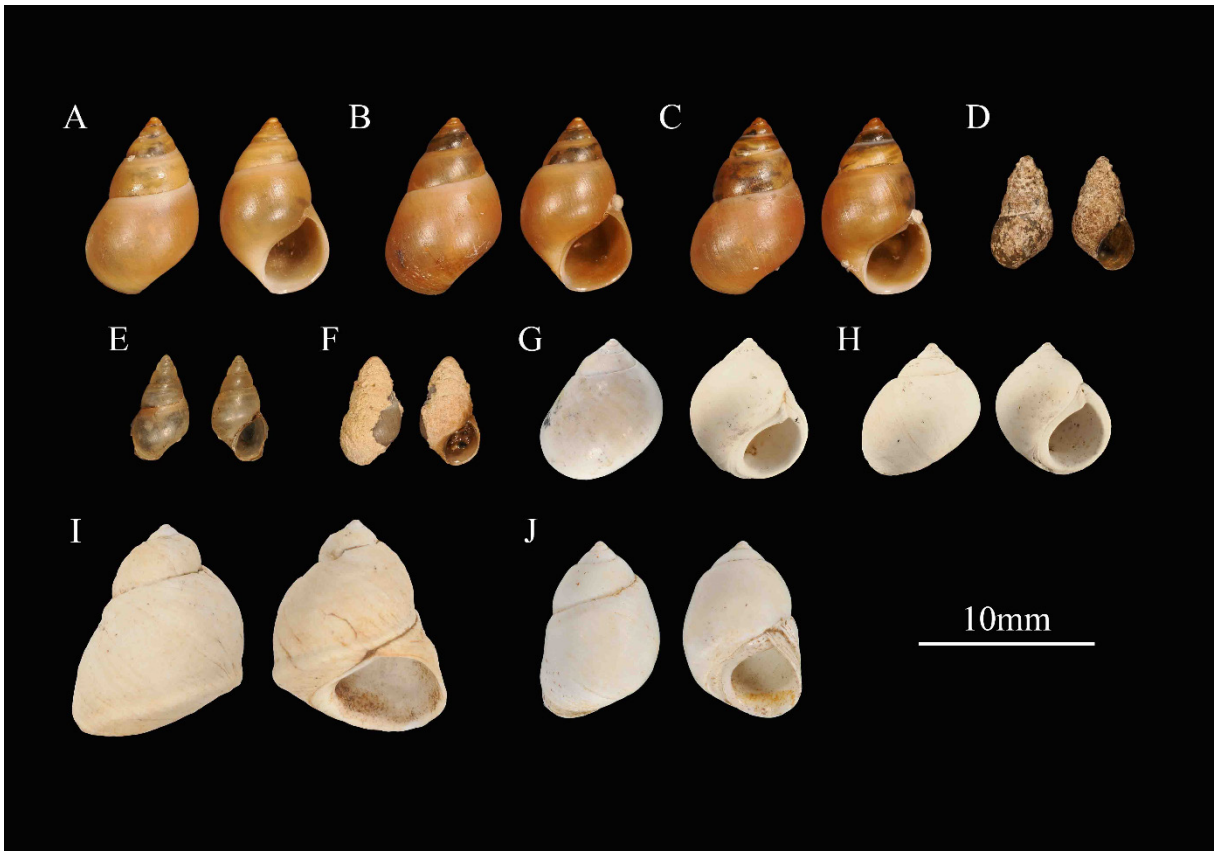

Figure 7. Shells of *Fenouilia zihaozhaoi* **sp. nov.** (A) holotype (B-C) paratype. Shells of *F. yizhou* **sp. nov.** (D) holotype (E-F) paratype. Shells of *F. pluvia* **sp. nov.** (G) holotype (H) paratype. Shells of *F. gaorange* **sp. nov.** (I) holotype (J) paratype. Scale bars = 10 mm.

***Fenouilia gaorange* Xiang, He, Gao & Chen, sp. nov.**
https://zoobank.org/urn:lsid:zoobank.org:act:B837F053-611D-4DC1-B976-1C85263D176C
Fig. 2 U, Fig. 7 I-G

Material examined. Holotype: XHQ 24012101, shell height 12.0 mm. Zhongshu Town, Luliang County, Qujing City, Yunnan Province, China, 25.02°N, 103.66°E, June 2022, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 2 specimens, XHQ 24012102-03, shell height 10.0 mm, June 2022, locality and habitat same as holotype.

Diagnosis. Shell small, ovate-conic, white, with five whorls, shell surface with a keels, body whorl big and swollen, aperture ovate, outer lip thickened.

Description. Shell small, but solid, ovate-conic, white, with five spiral whorls, including two protoconch whorls, teleoconch whorl inflated; other whorls with a keels and fine growth lines, body whorl big and swollen. Apex obtuse. Umbilicus narrow, base white. Aperture ovate, more than half of shell in height, inner lip thickened and smooth, outer lip thickened.

Differential diagnosis. Compared with *F. kreitneri*, *F. sinensis* and *F. undata*, *Fenouilia gaorange* sp. nov. shell surface smooth, without axial ribs. Compared with *Fenouilia pluvia* sp. nov., *Fenouilia gaorange* sp. nov. shell bigger and with a keels.

Etymology. The species name "gaorange" originates from the name of Han Gao's pet cat. We suggest the Chinese common name as "润吉龙骨螺".

Distribution and ecology. This species is only found in the lake sediments of Lake Lulianghai in Qujing, Yunnan Province.

***Lacunopsis* Deshayes, 1876**

Type species. *Lacunopsis monodonta* Deshayes, 1876

***Lacunopsis chengjiang* Xiang, He, Li & Chen, sp. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:BB3B5C1A-A9C7-409D-82BD-007A5CEEDABC

Fig. 2 V, Fig. 8 A-C

Material examined. Holotype: XHQ 24012201, shell height 4.8 mm, Haijing, Lake Fuxian, Yuxi City, Yunnan Province, China, 24°37′22″N, 102°51′32″E, January 2025, collected by Yue-Ming He, Hong-Quan Xiang and Chong-Ye Li (Fig 1).

Paratypes: 2 specimens, XHQ 24012202-03, shell height 5.0–6.0 mm, January 2025, locality and habitat same as holotype.

Diagnosis. Shell small, short conical, orange, with four whorls, shell surface with nodules, inner lip with not obvious prominent tooth.

Description. Shell small, but solid, short conical, orange, with four whorls, whorls flattish. Whorls sharply carinate at periphery in both young and adult shells. Shell surface with nodules. Apex obtuse. Umbilicus closed. Aperture ovate. Inner lip thickened and smooth, with not obvious prominent tooth; outer lip smooth.

Differential diagnosis. In terms of shell morphology, the new species possesses a unique shell characteristic of the *Lacunopsis*. Its resembles *L. yunnanensis* from the Yunnan, but *L. chengjiang* sp. nov. shell surface with nodules, a not obvious prominent tooth near the inner lip.

Etymology. The species name "Chengjiang" is derived from the ancient name of the lake where it is located "Chengjianghai". We suggest the Chinese common name as "澂江仿穴螺".

Distribution and ecology. This species is only found in the lake sediments of Lake Fuxian in Yuxi, Yunnan Province.

***Lacunopsis luliangensis* Xiang, He, Lu & Chen, sp. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:706BB7A1-F702-4654-8A4F-873BED5509DA

Fig. 2 W, Fig. 8 D-F

Material examined. Holotype: XHQ 24012301, shell height 10.0 mm. Zhongshu Town, Luliang County, Qujing City, Yunnan Province, China, 25.02°N, 103.66°E, June 2022, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 2 specimens, XHQ 24012302-03, shell height 10.8-11.0 mm, June 2022, locality and habitat same as holotype.

Diagnosis. Shell small, ovate-conic, white, with five whorls, the whorls with nine axial ribs, aperture ovate, outer lip thickened.

Description. Shell small, but solid, ovate-conic, white, with five spiral whorls, including two protoconch whorls, teleoconch whorl inflated; Second to third whorls smooth; other whorls with three

spiral ribs, body whorl swollen. Apex obtuse. Umbilicus narrow, base white and with one weak keel around umbilical area. Aperture ovate, less than half of shell in height, inner lip thickened and smooth, outer lip thickened.

Differential diagnosis. Compared with *L. yuxiensis*, *L. luliangensis* sp. nov. shell with less spiral ribs and whithout nodules. Compared with *L. yunnanensis*, *L. luliangensis* sp. nov. with ovate-conic and bigger shell.

Etymology. The species name "luliangensis" is derived from the Chinese name of its locality, which is Luliang County in Qujing City, Yunnan Province. We suggest the Chinese common name as "陆良仿穴螺".

Distribution and ecology. This species is only found in the lake sediments of Lake Lulianghai in Luliang, Yunnan Province.

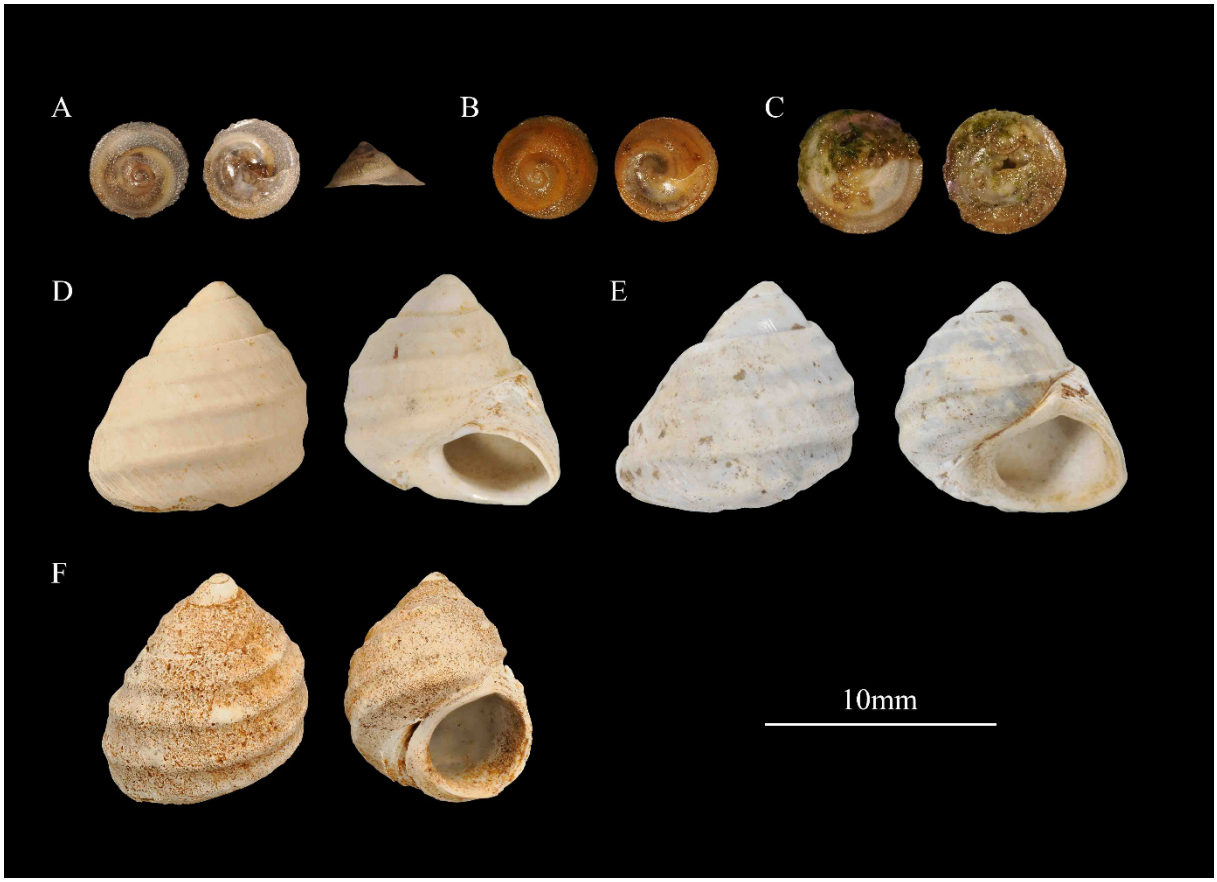

Figure 8. Shells of *Lacunopsis chengjiang* **sp. nov.** (A) holotype (B-C) paratype. Shells of *L. luliangensis* **sp. nov.** (D) holotype (E-F) paratype. Scale bars = 10 mm.

***Longhai* Xiang, He, Lv & Chen, gen. nov.**

https://zoobank.org/urn:lsid:zoobank.org:act:EE862187-0AC7-4B09-BB48-C15E21926B9B

Type species. *Longhai zhongxian* gen. et sp. nov.

Etymology. The genus name "longhai" is derived from the ancient place name "Longhai Mountain" in Qujing City. We suggest the Chinese common name as "龙海螺".

Diagnosis. Shell small, discoidal. Shell surface with spiral ribs. Apex swelling and obtuse. Umbilicus opened. Aperture ovate. Body whorl near the outer lip detached. Inner lip and outer lip thickened, reflexed and smooth.

Differential diagnosis. In terms of shell morphology, *Longhai* gen. nov. has a discoidal shell and body whorl near the outer lip detached. This distinguishes it from all other species in the family. Comparatively, only species of Saduniella Brandt, 1970 show some similarity, but *Longhai* gen. nov.

body whorl near the outer lip detached. In addition, the characteristics of lip reflexed and apex swelling can differentiate it from species of the family Valvatidae.

Distribution and ecology. This species is only found in the lake sediments of Lake Lulianghai in Qujing, Yunnan Province.

***Longhai zhongxian* Xiang, He, Lv & Chen, gen. et sp. nov.**
https://zoobank.org/urn:lsid:zoobank.org:act:77B00173-D6BC-430B-9B4A-9866FAB747D9
Fig. 2 X, Fig. 9 A-C

Material examined. Holotype:XHQ 24012401, shell height 2.0 mm. Zhongshu Town, Luliang County, Qujing City, Yunnan Province, China, 25.02°N, 103.66°E, June 2021, collected by Yue-Ming He and Hong-Quan Xiang (Fig. 1).

Paratypes: 2 specimens, XHQ 24012402-03, shell height 1.9-2.0 mm, June 2021, locality and habitat same as holotype.

Diagnosis. Shell small, discoidal, with four whorls. Shell surface with spiral ribs. Apex swelling and obtuse. Umbilicus opened. Aperture ovate. Body whorl with a keel and near the outer lip detached. Inner lip thickened and smooth, outer lip reflexed, thickened and smooth.

Description. Shell small, but solid, discoidal, with four whorls. Shell surface with spiral ribs. Apex obtuse. Umbilicus opened. Aperture ovate. Body whorl with a keel and near the outer lip detached. Inner lip and outer lip thickened, reflexed and smooth.

Etymology. The species name "Chengjiang" is derived from the ancient name of the lake where it is located "Chengjianghai" We suggest the Chinese common name as "中涎龙海螺".

Distribution and ecology. This species is only found in the lake sediments of Lake Lulianghai in Qujing, Yunnan Province.

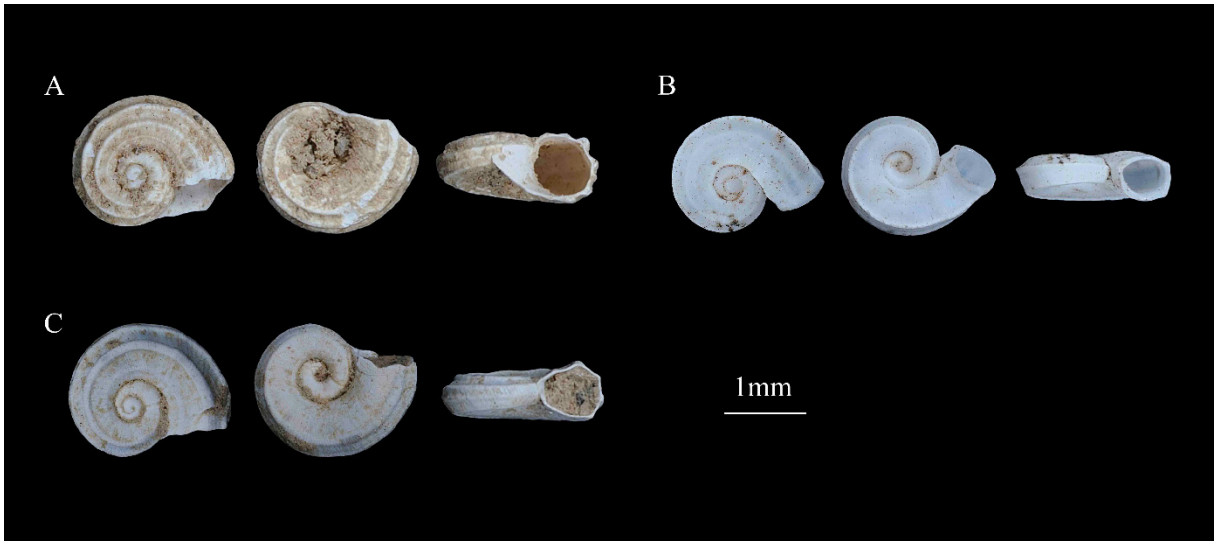

Figure 9. Shells of *Longhai zhongxian* **gen. et sp. nov.** (A) holotype (B-C) paratype. Scale bars = 1 mm.

Systematics
Subclass Heterobranchia Gray, 1840
Superfamily Lymnaeoidea Rafinesque, 1815
Family Planorbidae Rafinesque, 1815
Subfamily Planorbinae Rafinesque, 1815

Genus *Gyraulus* Charpentier, 1837
Type species. *Planorbis albus* O. F. Müller, 1774 by original designation.

***Gyraulus fuxianensis* Chen, Xiang, He, Li & Chen, sp. nov.**
https://zoobank.org/urn:lsid:zoobank.org:act:24B1068C-72E2-442B-AA34-943DE6A4B5F5
Fig. 2 Y, Fig. 10 A-C

Material examined. Holotype. XHQ 24012501, shell height: 4.0 mm. Haijing, Lake Fuxian, Yuxi City, Yunnan Province, China, 24°37′22″N, 102°51′32″E, January 2025, collected by Yue-Ming He, Hong-Quan Xiang and Chong-Ye Li.

Paratypes. 2 specimens, XHQ 24012502-03, shell height: 3.8–4.5 mm, January 2025, locality and habitat same as holotype.

Diagnosis. Shell discoidal; each teleoconch whorls with one strong keel at suture; outer lip rather thin, inner lip thickened; umbilicus opened.

Description. Shell small, thin, light gray, translucent, discoidal; apex blunt, with 3.5 whorls, each teleoconch whorls with one strong keel at suture; aperture large, ovate, outer lip rather thin, inner lip thickened; umbilicus opened.

Differential diagnosis. In terms of shell morphology, *G. fuxianensis* sp. nov. differs from all other species in the *Gyraulus*, horizontally, the protoconch of *G. fuxianensis* sp. nov. is positioned at the upper end of the teleoconch, while in *Gyraulus*, the protoconch is located lower than or at the same level as the height of the teleoconch, which effectively distinguish it from other species of the genus.

Etymology. The specific name "fuxianensis" is derived from the name of the lake where the species is found. We suggest the Chinese common name as “抚仙旋螺”.

Distribution and ecology. This species is only found in the lake sediments of Lake Fuxian in Yuxi, Yunnan Province.

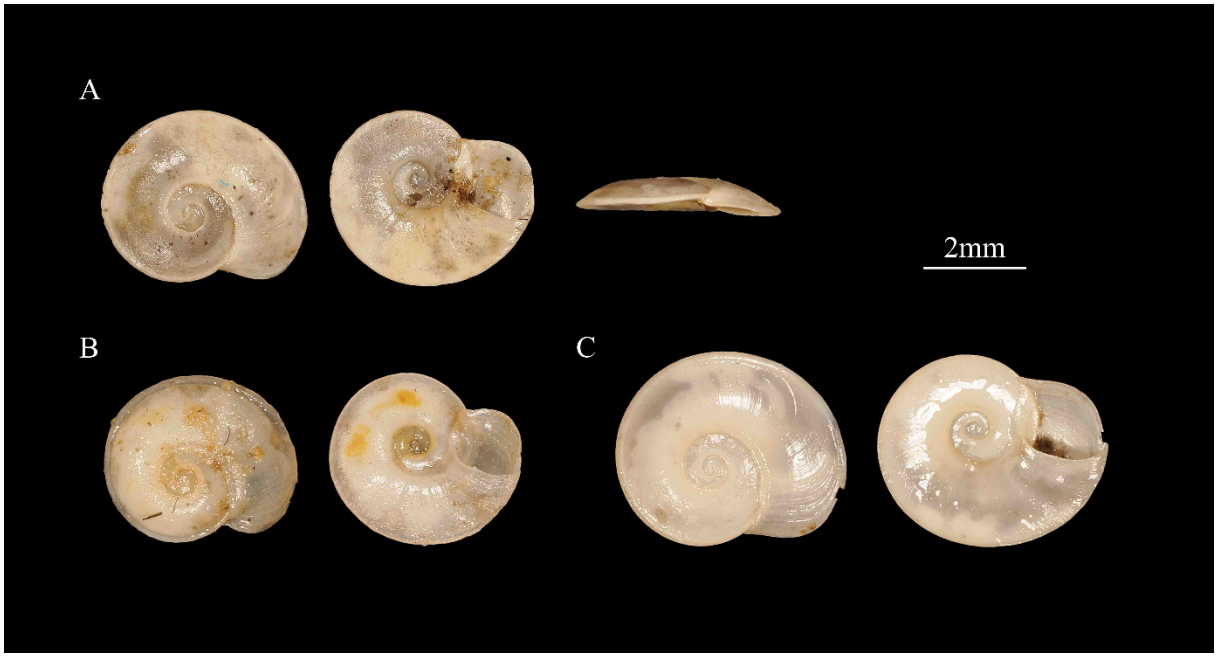

Figure 10. Shells of *Gyraulus fuxianensis* **sp. nov.** (A) holotype (B-C) paratype. Scale bars = 2 mm.

Systematics
Subclass Heterobranchia Gray, 1840
Superfamily Lymnaeoidea Rafinesque, 1815
Family Lymnaeidae Rafinesque, 1815
Subfamily Lymnaeinae Rafinesque, 1815

Genus *Xingyuan* Xiang, He, Li & Chen, gen. nov.
https://zoobank.org/urn:lsid:zoobank.org:act:AB7C731F-6A7E-404A-BE70-A1BA4EF1EF89
Type species. *Xingyuan jiamingzhangi* gen. et sp. nov.

Diagnosis. Shell patelliform; apex prominent, blunt, curves downwards to the right and rolled, surpassing the right edge of shell; a boundary between protoconch and teleoconch.

Differential diagnosis. In terms of shell morphology, *Xingyuan* gen. nov. has an apex that is prominent, curves downwards to the right, and is rolled, surpassing the right edge of the shell. This distinguishes it from all other species in the subfamily. Comparatively, only species of *Ancylastrum* Bourguignat, 1853 and *Erinna* Adams & Adams, 1855 show some similarity. The apex of *Xingyuan* gen. nov. is rolled in a manner (similar to *Gyraulus* Charpentier, 1837), with the roll extending over 1.5 whorls. In contrast, species of *Ancylastrum* either have an apex rolled by less than one whorl or a more inwardly curled rolling pattern. The protoconch of *Xingyuan* gen. nov. is positioned at the upper end of the teleoconch horizontally, while in *Ancylastrum* species, the protoconch is located lower than or at the same level as the height of the teleoconch. Athough the genus *Erinna* have a shell morphology that is relatively similar, it is noting that *Erinna* is currently endemic to Hawaiian Islands and it is not likely related to the Yunnan genus.

Etymology. The genus name "Xingyuan" is derived from the Chinese idiom "xing huo liao yuan," which is often used to describe a new phenomenon that, although initially small in strength, possesses strong vitality. This suggests the robust vitality of the species in this family. We suggest the Chinese common name as "星源螺".

Distribution and ecology. The species of this genus have currently been found only in Lake Fuxian, located in Yuxi City, Yunnan Province, China. They have been discovered exclusively in strata containing *Rhombuniopsis linan*, with no shells found in more recent strata, nor have any living individuals been observed in the lake.

***Xingyuan jiamingzhangi* Xiang, He, Li & Chen, gen. et sp. nov.**
https://zoobank.org/urn:lsid:zoobank.org:act:58F861F8-8D0B-4C5B-963C-A61E4ECA1F3D
Fig. 2 Z, Fig. 11 A-B

Material examined. Holotype. shell length: 2.20 mm. China, Yunnan, Yuxi County, Lake Fuxian, Lu Chong[禄冲]. 24.5669°N, 102.8411°E, collected by Yue-Ming He, January 2025. NCUBJ24201.

Paratypes. two shells, NCUBJ24202–03, shell length: 2.82 mm, locality and habitat same as holotype, collected by Hong-Quan Xiang and Yue-Ming He, January 2025.

Diagnosis. Shell thin, patelliform; apex prominent, curves rolled; a boundary between protoconch and teleoconch.

Description. Shell thin, pale brown, patelliform; apex prominent, blunt, curves downwards to the right and rolled, surpassing the right edge of shell; a boundary between protoconch and teleoconch. Aperture longer than wide. Teleoconch with concentric growth lines, some individuals with weak and less radial wrinkles.

Etymology. The species name "jiamingzhangi" is derived from the name of Jia-Ming Zhang a friend who assisted with the investigation. We suggest the Chinese common name as "张氏星源螺".

Distribution and ecology. The species has currently only been found in a small bay of Lake Fuxian in Yuxi City, Yunnan Province, China, buried in the sediment layers rich in Quaternary lake deposits. After conducting surveys in other areas of Lake Fuxian, the species has not been found in any other regions so far.

***Xingyuan zhihehongi* Xiang, He, Li & Chen, gen. et sp. nov.**
https://zoobank.org/urn:lsid:zoobank.org:act:FA62BAD1-B875-491C-9D50-6975DC2F75EB
Fig. 2 ZA, Fig. 11 C-D

Material examined. Holotype. shell length: 3.01 mm. China, Yunnan, Yuxi County, Lake Fuxian, Lu Chong. 24.5669°N, 102.8411°E, collected by Hong Quan Xiang and Yue Ming He, January 2025. NCUBJ24301.

Paratypes. One shells, NCUBJ24203, shell length: 3.83 mm, locality and habitat same as holotype, collected by Hong Quan Xiang and Yue Ming He, January 2025.

Diagnosis. Shell thin, patelliform; apex prominent, curves rolled; a boundary between protoconch and teleoconch; inner lip reflexed, next to the teleoconch.

Description. Shell thin, off-white, patelliform; apex little prominent, blunt, curves downwards to the right and rolled, surpassing the right edge of shell; inner lip reflexed, next to the teleoconch. Aperture longer than wide. Teleoconch with concentric growth lines, some individuals with weak and less radial wrinkles.

Differential diagnosis. Compared to *Xingyuan jiamingzhangi* gen. et sp. nov., *Xingyuan zhihehongi* gen. et sp. nov. lacks a boundary between the protoconch and teleoconch, has a reflexed inner lip next to the teleoconch, and its apex is less prominent than the former. Additionally, the shell is wider. Although only a few complete shells were excavated during this research, the numerous shell fragments found in the strata suggest that the shell shapes of these two species are stable, with no intermediate transitional form. Therefore, this study concludes that *X. zhangjiamingi* gen. et sp. nov. and *X. hongzhihei* gen. et sp. nov. are distinct separate species.

Etymology. The species name "zhihehongi" is derived from the name of Zhi-He Hong a friend who assisted with the investigation. We suggest the Chinese common name as "洪氏星源螺".

Distribution and ecology. This species, along with *Xingyuan jiamingzhangi* gen. et sp. nov., is buried in sediment layers rich in Quaternary lake deposits. It has only been found at the type locality, and no living specimens with a similar morphology have been discovered in surveys of various lake regions.

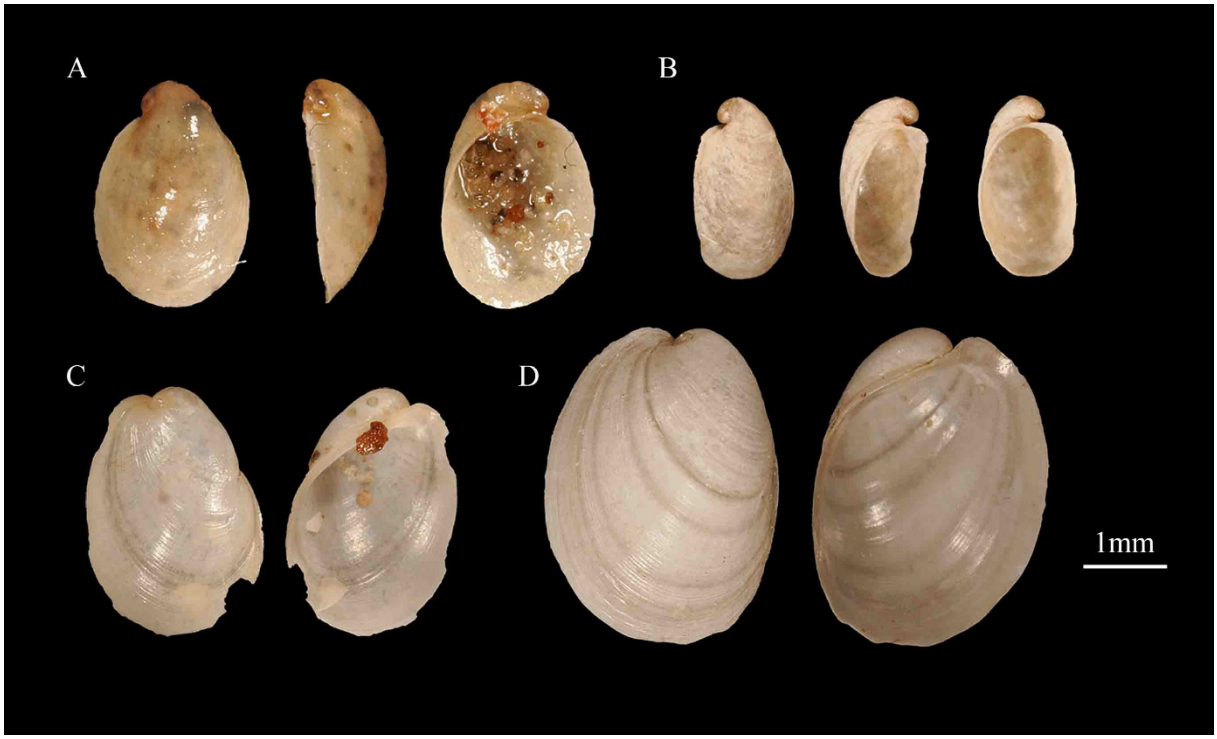

Figure 11. Shells of *Xingyuan jiamingzhangi* **gen. et sp. nov.** (A) holotype (B) paratype. Shells of *X. zhihehongi* **gen. et sp. nov.** (C) holotype (D) paratype. Scale bars = 1 mm.

Discussion

The survey of several ancient dry lakes in Yunnan has revealed an astonishing diversity of freshwater snails in ancient plateau lakes sediment, particularly within the family Pomatiopsidae. This represents the first comprehensive record of Pomatiopsidae subfossil (or empty shell) in Quaternary in Yunnan, China. The Pomatiopsidae species that once populated these ancient lakebeds, were distinguished by their unusually large shell sizes for the family, with some individuals exceeding 2 cm, making them the largest Pomatiopsidae species in the world. Unfortunately, due to prolonged drought and anthropogenic impacts affecting these ancient lakes, these species are now extinct. The study also investigated the

surrounding water bodies, such as reservoirs, ponds, springs, and rivers, but no living individuals were found. Previously, Lake Dianchi also supported a few large living Pomatiopsidae species, including *Paraprosostheniacostata* (Tchang & Tsi, 1949) and *Paraprosostheniaconstricta* (Tchang & Tsi, 1949). However, due to pollution, no living specimens have been recorded in Lake Dianchi since 2000 (Du et al. 2011). Despite Lake Fuxian's large size and depth, its high elevation results in hypoxic conditions in the water. Recent climate changes and anthropogenic nutrient enrichment have further exacerbated the reduction in oxygen levels (Zhang et al. 2023). As other lakes in Yunnan, anthropogenic pollution and tourism development have severely impacted the populations of many freshwater species (Gong et al. 2009; Du et al. 2011; Xiang et al. 2024; Zhong 2019). Strict treatment of industrial and domestic wastewater discharge around lake peripheries, enhanced protection of remaining reed wetlands (our field investigations revealed significant degradation of reed beds in Lake Fuxian), and systematic biodiversity surveys to monitor the population dynamics and conservation status of all resident species are necessary for the preservation of these unique aquatic ecosystems and their ancient biological heritage in the extant lakes.

The survey reveals consistent genus-level compositional similarities among these ancient lakes (Lake Lulianghai, Qujing Basin, Lake Yangzonghai, Lake Babuhai, Lake Fuxianhu, Lake Xingyunhu and Lake Dianchi) in Yunnan Province, as these lakes share species from one or more of the four genera that *Paraprosostheni*a, *Jullienia*, *Fenouilia*, and *Kunmingia* Davis & Kuo, 1984. This similarity is valuable for studying how the Pomatiopsidae species are dispersed within Yunnan Province. For the Lake Lulianghai, in total of 11 species across six genera within the family Pomatiopsidae were discovered during this study. This further substantiates that the recorded freshwater gastropoda fauna of the Lake Lulianghai likely represents an extinct Quaternary lake fauna, indicating that area was once a diversity hotspot with the highest rate of freshwater mollusks extictions, similar to the findings of Zhang & Wang (2023). In Qujing Basin (Qilin District, Qujing City), a total of nine Pomatiopsidae species from four genera were recorded, representing the first documented occurrence of this family in the region. Additionally, species from the genus *Tchangmargarya* He, 2013 of the family Viviparidae were also present in the basin. This strongly suggests the presence of an extensive paleolake system in the basin during the Quaternary period. For the investigation in Lake Yangzonghai, this is the first systematic of gastropod in soil samples from boreholes around this region. Notably, our analyses have identified only Pomatiopsidae specimens, with no other taxa detected in the Quaternary deposits. These species obtained from the boreholes have very unique morphological characteristics compare to extant Pomatiopsidae species in the lake (Zhang et al. 1997). Additionally, an investigation of soil left from construction sites excavations near Lake Yangzonghai revealed some subfossil shells similar to those found in the boreholes. This study reveals a significant biological extinction event in history, which may have considerably reduced the diversity of Pomatiopsidae species. Therefore, further extensive research is essential to investigate the paleo-environmental changes that have impacted Pomatiopsidae species in Yangzonghai. For Lake Babuhai, this study discovered many Pomatiopsidae species buried alongside *Tchangmargaryaziyi* Zhang, 2017. The study also examined lakes harboring extant populations of *Tchangmargaryamultilabiata* Zhang & Chen, 2015, but no Pomatiopsidae specimens were recovered. Since a large number of subfossils and empty shells have been found only in these lake deposits and not in the riverbeds, it is most likely that these species were initially originated in an ancient lake and later spread to other ancient lakes where they further evolved. It is noteworthy that no Pomatiopsidae species have been discovered among the Tertiary gastropod fossils from Qujing (Yen, 1935). The origins and evolutionary dispersion of these large Pomatiopsidae species remain unclear, necessitating extensive further research to gain a better understanding of them.

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Competing interests
The authors declare that they have no competing interests.

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