

# PISIDIIDAE FROM EARLY CRETACEOUS HEKOU FORMATION OF HEKOU BASIN, NINGHUA, FUJIAN

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**Key words** Pisidiidae, Hekou Formation, Early Cretaceous

## Summary

This paper describes three new species of Pisidiidae, *Pisidium* (P.) *zhushutangense*, *Sphaerium* (S.) *pyrum* and *Sphaerium* (S.) *fujianense*, associated with very abundant *Plicatounio* (P.) *nak-tongensis* Kobayashi et Suzuki, *Plicatounio* (P.) *fujianensis* Gu et Ma and *Trigonioides* (T.) *quadratus* Gu et Ma from the Lower Cretaceous upper Hekou Formation of Zhushutang, Hekou Basin, Ninghua, Fujian. In Japan, the last two species, *Sphaerium* (S.) *pyrum* and *Sphaerium* (S.) *fujianense*, or their affinis coexist with each other in the upper Wakino Subgroup, the lower Wakamiya and upper Wakamiya Formations, and the lower Inakura Formation, Yamaji Shale, which very probably can be correlated with the upper Hekou Formation yielding these two species.

The distinction between *Pisidium* and *Sphaerium* is summarized in Table I.

**Table 1 Primary features of *Pisidium* and *Sphaerium***

Genus Primary features	<i>Pisidium</i>	<i>Sphaerium</i>
Size	minute	mostly relatively larger than <i>Pisidium</i>
Inflation	relatively smaller than <i>Sphaerium</i>	large
Umbo position	near to posterior extremity	near or anterior to median
Hinge plate	relatively stronger and more curved than <i>Sphaerium</i>	very thin
Cardinals	stronger and more curved than <i>Sphaerium</i>	delicate
Laterals	mostly not branched, but posterior ones extending postero-ventrally and rounding posterodorsal corner	distinctively thin lamella and the ends of right ones branched
Ligament	immersed in deep furrow and sometimes even extending into hinge plates, rarely external	sometimes external
Siphon	single	double
Ornamentation	concentric growth lines or coarse ridges	smooth or concentric growth striae

## DESCRIPTION OF NEW SPECIES

*Pisidium (Pisidium) zhushutangense* sp. nov.

(Pl. I, figs. 1—4)

**Material** 6 well-preserved specimens of moulds.**Etymology** Specific name derived from "Zhushutang", locality of the species.**Diagnosis** Shell suboval in outline, narrowing anteriorly.**Description** Shell small-sized, suboval in outline, narrowing anteriorly, obviously inequilateral. Anterior margin narrowly rounded; posterior margin obtusely rounded; ventral margin broadly convex and dorsal margin substraight to obtusely angular. Umbo prominent, projecting above the hinge line and placed at about one-third of shell length from the posterior extremity. Inflation medium.Hinge plate thin, with dental formula expressed as  $\frac{AIII \quad AI \quad 1 \quad PI \quad PIII}{AII \quad 2a \quad 2b \quad PII}$ .

Anterior lateral teeth shorter than posterior ones, with PI as the largest and longest tooth, extending from near the umbo to the posterodorsal corner of the shell and even around the corner. Cardinal teeth small. No crenulation preserved.

**Remarks** The present species is characterized by the suboval shape and differs from *Pisidium fujianense* (Gu et al., 1976, p. 385, pl. 103, figs. 1—5) with respect to a rounded quadrilateral shape.**Measurements (mm)**

S	L	H	D	L/H	D/L
72602	3.8	2.4	2.8	1.58	0.74
72603	4.2	3.0	3.0	1.40	0.71
72604	7.0	4.5	4.0	1.56	0.57
72605	8.5	6.5	6.0	1.31	0.71
$\bar{X}$	5.80	4.10	3.95	1.462	0.683

S = Sample; L = Length; H = Height; D = Umbonal distance from the anterior extremity to the umbo; L/H = ratio of length to height; D/L = ratio of umbonal distance from the anterior extremity to the umbo to the length,  $\bar{X}$  = Arithmetic mean of the measurements.

*Sphaerium (Sphaerium) pyrum* sp. nov.

(Pl. I, figs. 5—10)

?1960 *Sphaerium andersoni jeholense* (Grabau), Hase, p. 321, pl. 38, figs. 25—30.?1975 *Sphaerium andersoni jeholense*, Hayami, p. 143.**Material** 9 specimens of internal and external moulds.**Etymology** Specific name derived from the subpyriform outline of the shell.**Diagnosis** Shell subpyriform or subrounded triangular in outline, with height not less than length; umbo placed near midpoint of dorsal margin.**Description** Shell small-sized, subpyriform or subrounded triangular in outline, higher than long or nearly as high as long, equilateral or subequilateral. Anterior margin broad; posterior margin substraight; dorsal margin obtusely angular; ventral margin rounded to narrowly rounded. Umbo small, projecting above hinge line distinctly and placed at the midpoint or a little anterior to the midpoint of dorsal margin. Inflation fairly large. Ornament of fine and closely spaced con-

**Measurements (mm)**

S	L	H	D	L/H	D/L
72596	6.3	8.8	3.0	0.72	0.48
72597	3.0	3.3	1.5	0.91	0.50
72598	2.5	4.0	1.0	0.63	0.40
72599	6.0	8.0	3.0	0.75	0.50
72600	5.0	6.0	2.5	0.83	0.50
72601	7.0	7.5	3.0	0.93	0.43
$\bar{x}$	4.97	6.27	2.33	0.795	0.468

centric growth lines, occasionally with faintly radial ribbings on internal mould.

Hinge plate narrow. Two anterolateral teeth and two posterolateral teeth on right valve; anterolateral teeth long but narrow, extending from anterior of umbo to anterodorsal corner; lower posterolateral tooth long and robust, reaching posterodorsal area. One anterolateral tooth and one posterolateral tooth on left valve, triangularly oval-shaped; no crenulation preserved.

**Remarks** The present species characterized by subpyriform or subrounded forms not longer than high distinctly differs from the typical *Sphaerium jeholense* (Grabau) in having a subrounded quadrate to elliptical shape which is longer than high. At least some individuals of *Sphaerium andersoni jeholense* (Grabau) from Japan figured by Hase (1960, p. 321, pl. 38, figs. 25—30) are very similar to, and even the same as (e. g. Hase, 1960, pl. 38, fig. 30) those of the present species in outline; they are very probably conspecific. The present species is also more or less similar to *Sphaerium shouchangense* Ma (1980), *S. zhejiangense* Ma (1980) and *S. fulungchuanense* Suzuki (1942) in outline. However, the former is more acclinal, equilateral or subequilateral and higher in shape.

***Sphaerium* (*Sphaerium*) *fujianense* sp. nov.**

(Pl. I, figs. 11—16)

†1960 *Sphaerium andersoni andersoni* (Grabau), Hase, p. 319, pl. 38, figs. 4—24.

†1975 *Sphaerium andersoni andersoni* Hayami, p. 143.

**Material** 9 specimens mostly internal mould.

**Etymology** Specific name derived from “Fujian”, locality of the species.

**Diagnosis** Shell small, elongated and elliptical in outline; posterodorsal margin more or less truncated; ratio of length to height not less than 2.

**Description** Shell small-sized, elongated, with ratio of length to height not less than 2, elongated elliptical in outline. Anterior margin narrowly rounded, posterior margin pointed to obtusely rounded; dorsal margin feebly convex; posterodorsal margin more or less truncated, ventral

**Measurements (mm)**

S	L	H	D	L/H	D/L
72590	16.5	7.0	4.5	2.36	0.64
72591	18.0	7.0	5.0	2.57	0.28
72592	11.5	5.0	4.0	2.30	0.34
72593	11.5	5.0	4.0	2.30	0.34
72594	10.0	4.5	3.5	2.22	0.35
72595	5.0	2.5	1.5	2.00	0.30
$\bar{x}$	12.80	5.17	3.75	2.291	0.375

margin broadly convex. Umbo broad, slightly projecting above hinge line and placed at about one-fourth of the shell length from the anterior extremity.

Hinge plate narrow, with weak hinge teeth, in parallel with hinge line; two lateral teeth on anterior and two on posterior of right valve, but only one on the left. No crenulation preserved on the moulds; cardinals unexposed.

**Remarks** As compared with the typical *Sphaerium andersoni* (Grabau), the present species has a more elongated outline (with ratio of length to height not less than 2), distinct umbo and narrower rounded posterior margin. In *Sphaerium andersoni andersoni* (Grabau) from Japan figured by Hase (1960, p. 391, pl. 38, figs. 4—24), some elongated and elliptical-shaped individuals (e. g. Hase, 1960, pl. 38, figs. 10, 12) are almost the same as those of *Sphaerium* (*S.*) *fujianense* sp. nov., indicating that they are probably conspecific.

## 图 版 说 明

标本均采自福建宁化禾口盆地淮土格树塘下白垩统禾口组上部,保存在中国科学院南京地质古生物研究所。图影中除注有放大倍数外,其余均为原大。

## 图 版 I

### 1—4. *Pisidium* (*Pisidium*) *zhushutangense* sp. nov.

1. 右壳,内模侧视,×5, Holotype,示外形及后侧齿(左1右2);采集号: ADE53, 登记号: 72604。2. 左壳,内模侧视,×8,示外形及后侧齿(左1);采集号: ADE53, 登记号: 72603。3. 右壳,内模侧视,×8,示外形及后侧齿(左1右2);采集号: ADE53, 登记号: 72602。4. 右壳,内模侧视,×3,示外形及后侧齿(左1右2);采集号: ADE53, 登记号: 72605。

### 5—10. *Sphaerium* (*Sphaerium*) *pyrum* sp. nov.

5. 左壳,内模侧视,×8,示外形;采集号: ADE53, 登记号: 72598。6. 右壳,内模侧视,×5, Holotype,示外形及侧齿(右壳前、后侧齿各2,左壳各1);采集号: ADE53, 登记号: 72599。7. 左壳,内模侧视,×3,示外形;采集号: ADE53, 登记号: 72596。8. 右壳,内模侧视,×3,示外形及表面放射脊痕迹;采集号: ADE53, 登记号: 72600。9. 左壳,内模侧视,×8,示外形;采集号: ADE53, 登记号: 72597。10. 左壳,外模侧视,×3,示外形及同心状生长线痕迹;采集号: ADE53, 登记号: 72601。

### 11—16. *Sphaerium* (*Sphaerium*) *fujianense* sp. nov.

11. 右壳,内模侧视,×3, Holotype,示外形及侧齿(左壳前、后各1,右壳各2);采集号: ADE53, 登记号: 72594。12. 张开的双壳,内模侧视,×3,示外形;采集号: ADE53, 登记号: 72592。13. 右壳,内模侧视,×3,示外形;采集号: ADE53, 登记号: 72593。14. 右壳,内模侧视,×8,示外形;采集号: ADE53, 登记号: 72595。15. 左壳,内模侧视,×3,示外形;采集号: ADE53, 登记号: 72590。16. 左壳,内模侧视,×3,示外形;采集号: ADE53, 登记号: 72591。

### 17. *Plicatounio* (*Plicatounio*) *fujianensis* Gu et Ma

左壳,部分矿化壳和部分内模侧视;采集号: ADE53, 登记号: 72577。

### 18, 19. *Plicatounio* (*Plicatounio*) *nakongensis* Kobayashi et Suzuki

18. 左壳,内模侧视;采集号: ADE53, 登记号: 94898。19. 右壳,内模侧视;采集号: ADE53, 登记号: 94902。

### 20—22. *Trigonioidea* (*Trigonioidea*) *quadratus* Gu et Ma

20. 左壳,外模侧视;采集号: ADE53, 登记号: 72503。21. 左壳,内模侧视,×3;采集号: ADE53, 登记号: 72505。22. 张开的双壳,内模侧视,×2;采集号: ADE53, 登记号: 72495。

