

Classification of Japanese *Pisidium*

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With Plates VII-XI and 1 Text-figure

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I. Introduction

Only two species and two subspecies of *Pisidium* have hitherto been recorded from Japan: viz. *Pisidium japonicum* PILSBRY et HIRASE (1908), *P. casertanum lacustre* WOODWARD (1916), *P. amnicum etorohuense* MORI (1935), and *P. (Neopisidium) cavernicum* MORI (1937). Of these, the second species, *P. casertanum lacustre* is more properly called *P. cinereum lacustre*, for POLI's *casertanum* (1791) has not been accepted as the binominal one, and the third species, *P. amnicum etorohuense* is treated in this paper as a subspecies of *P. baicalense*.

This paper describes thirteen species and eleven subspecies including six new species and eight new subspecies of *Pisidium* collected from Tisima, Karahuto, Hokkaidô, Honsyû, Kyûsyû, and Okinawa; they are as follows:

- 1a *Pisidium baicalense etorohuense* MORI
- b *P. baicalense complanatum* LINDHOLM
- 2a *P. (Eupisidium) kawamurai* nov.
- b *P. kawamurai hukuiense* nov.
- 3 *P. (Eup.) kurdai* nov.
- 4 *P. amnicum nipponense* (HIRASE MS) nov.
- 5 *P. (Eup.) uejii* (KURODA MS) nov.
- 6 *P. (Neopisidium) cavernicum* MORI
- 7 *P. (Eup.) nitidum* JENYNS
- 8 *P. (Eup.) uénoi* nov.
- 9 *P. (Eup.) ponderosum* STELFOX
- 10 *P. (Eup.) humeriforme* STELFOX
- 11a *P. pulchellum* JENYNS
- b *P. pulchellum kunasiriense* nov.
- 12 *P. (Eup.) subtruncatum altum* nov.
- 13 *P. ellipticum* nov.
- 14a *P. (Eup.) cinereum* ALDER
- b *P. (Eup.) cinereum lacustre* WOODWARD

- c *P. (Eup.) cinereum nikkōense* nov.
 d *P. (Eup.) cinereum inflatum* nov.
 e *P. (Eup.) cinereum subinflatum* nov.
 15 *P. conventus akkesiense* nov.
 16 *P. (Eup.) japonicum* PILSBRY et HIRASE
 17 *P. (Neop.) parvum* nov.

The above are, up to this date, all the species of *Pisidium* known to me from the Japanese Empire, and this paper furnishes a view of them all.

The materials were collected chiefly by Dr. D. MIYADI but partly by Prof. T. KAWAMURA, Dr. M. UENO, Mr. T. KURODA, and others.

The system of classification adopted in the present work is principally that of EHRMANN (1933), which so far as my knowledge goes, seems to me most suitable, for *Pisidium*.

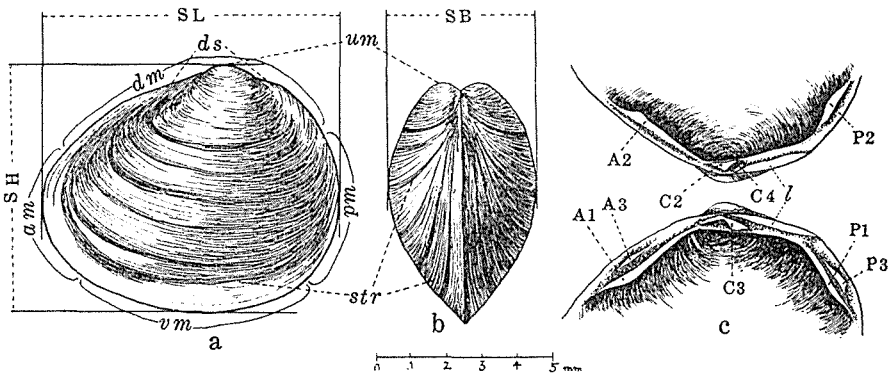
Types, cotypes and the specimens here described, are deposited in the Ôtu Hydrobiological Station, but some specimens from topotypes have also been presented to the Museums in the Geological Institute and also to the Zoological Institute of Kyôto Imperial University.

Grateful acknowledgement is hereby made to Prof. T. KAWAMURA, Mr. T. KURODA, and Assist. Prof. IW. TAKI for their kindness in reading the manuscript and for very helpful criticisms and advice; and also to Dr. D. MIYADI, Dr. M. UENO, Mr. K. OKADA, Mr. K. OKUGAWA, and Mr. K. SINNO for their kindness in giving me many valuable specimens.

II. On the technical terms used in the present paper

Some technical terms such as shell length, height, breadth, etc. are indicated in Text-Fig. 1 a and b.

The value of α is (length : breadth) and γ is (length : height); these two values are very important keys for the classification of *Pisidium* in my system.



Text-Fig. 1. *Pisidium baicalense etorohuense* MORI

a: side view, b: hind view, c: hinge. SL: length, SH: height, SB: breadth, ds: dorsal shoulder, dm: dorsal margin, am: anterior margin, pm: posterior margin, vm: ventral margin, um: umbo, str: striations, l: ligament, A1•A2•A3: anterior lateral teeth, P1•P2•P3: posterior lateral teeth, C2•C3•C4: cardinal teeth.

Normally, *Pisidium* has two cardinal teeth in the left valve (C2 and C4), and one cardinal tooth in the right valve (C3); and has one anterior lateral tooth (A2) and one posterior lateral tooth (P2) in the left valve, two anterior lateral teeth (A1 and A3) and two posterior lateral teeth (P1 and P3) in the right valve (Text-Fig. 1 c).

III. Remarks on the classification of *Pisidium*

ODHNER (1929) divided the genus *Pisidium* into two subgenera, *Eupisidium* and *Neopisidium*. The former has two gill-laminae on each side and has a special branchial opening in front of the anal siphon, but the latter has only one gill-lamina on each side and has no branchial opening in front of the anal siphon. Thus, the anatomy of the animal body is the criterion for the classification of *Pisidium*, so that the shell should be preserved in alcohol after collecting.

It is necessary to remove the animal from the shell to examine the colour of the cuticle, because some pisidian shells are too thin to conceal the yellowish colour of the animal.

A conspicuous difference is often seen between the shape of the adult shell and the young shell. For example, the young shell of *Pisidium cinereum* ALDER and its subspecies bear a striking resemblance to *Pisidium nitidum* JENYNS. The adult shell may be distinguished from the juveniles by the existence of several embryonic valves in the branchial cavities.

IV. Key to the Japanese species and subspecies of *Pisidium*

- 1 a) Shell large, grows usually over 7 mm. 2
- b) Shell length usually from 3 mm. to 6 mm. 5
- c) Shell small, generally grows not over 2.7 mm. 21
- 2 a) Subtriangular in outline, somewhat roughly and irregularly striated, umbones smaller and less projected 3
- b) Oval in outline, somewhat finely and regularly striated, umbones larger and more projected 4
- 3 a) The value of γ is 1.03-1.2 (Length 8 mm., Height 6.3 mm., Breadth 4.1 mm.) *baicalense etorohuense* MORI
- b) The value of γ is 1.25-1.32 (Length 7.5 mm., Height 6 mm., Breadth 3.75 mm.) *baicalense complanatum* LINDHOLM
- 4 a) Shell thin, compressed, the value of α is 2.0-2.15 (Length 7.2 mm., Height 5.9 mm., Breadth 3.5 mm.) (*Eupisidium*) *kawamurai* nov.
- b) Shell somewhat thickened, more rounded in outline, more inflated, the value of α is 1.7-1.77 (Length 7.3 mm., Height 6.4 mm., Breadth 4.3 mm.) *kawamurai hukuense* nov.
- 5 a) The fore extremity of the shell lies below the middle of the shell height; profile of the shell subtrapezoid or subtriangular; often with large umbones 6
- b) The fore extremity of the shell lies at about the middle of the shell height; profile of the shell rounded oval or elliptical, umbones generally small, less projected 15
- 6 a) Outline rounded oval; anterior part broad, its margin regularly and smoothly curved, not pointed; without a shouldered appearance; umbones large, highly projected 7

- b) Outline subtrapezoid or subtriangular, anterior part narrower, its margin irregularly curved, bluntly pointed; shoulder and umbo more or less developed 8
- 7 a) Cardinal teeth in the left valve situated parallel to each other; the value of α is 1.22-1.4 and γ is 1.02-1.06; cuticle bright yellowish brown (Length 4.2 mm., Height 3.8 mm., Breadth 3 mm.) (*Eupisidium*) *kurodai* nov.
- b) Cardinal teeth in the left valve not parallel to each other; the value of α is 1.24-1.28 and γ is 1.19-1.22; cuticle light grayish yellow, umbones larger and more rounded than in the above species (Length 5.7 mm., Height 4.65 mm., Breadth 4.45 mm.) *amicum nipponense* (HIRASE MS) nov.
- 8 a) Cardinal tooth in the right valve semicircular, well arcuate, conspicuously projected or elevated from the interior margin of the hinge to the inside of the shell 9
- b) Cardinal tooth in the right valve Δ -shaped or slightly bent, projection inconspicuous 10
- 9 a) Shell globose; both ends of cardinal tooth in the right valve thickened, inner cardinal tooth in the left valve characteristic, being \odot -shaped; cuticle snowy white; striation shallow and indistinct near the umbones; the value of α smaller, 1.45-1.57 (Length 3.1 mm., Height 2.8 mm., Breadth 2 mm.) (*Eupisidium*) *uejii* (KURODA MS) nov.
- b) Shell compressed; both ends of cardinal tooth in the right valve not specially thickened, inner cardinal tooth in the left valve Δ -shaped, the anterior part thickened; cuticle light yellowish; striation distinct, fine and regular; the value of α greater, 1.82-2 (Length 3 mm., Height 2.7 mm., Breadth 1.5 mm.) (*Neopisidium*) *cavernicum* MORI
- 10 a) Cardinal teeth in the left valve situated parallel to each other; the value of α usually over 1.7 (Length 3.3 mm., Height 2.77 mm., Breadth 1.94 mm.) (*Eupisidium*) *nitidum* JENYNS
- b) Cardinal teeth in the left valve situated not parallel to each other; the value of α usually under 1.6 11
- 11 a) Striation deep, distinct, coarse, but very regular; cuticle light, bright yellowish brown; distinct differences in some characters of the shell are seen between the normal (more or less younger) shell and the full grown shell, viz. the outline of the normal (more or less younger) shell subtrapezoid, having a distinctly shouldered appearance, the value of α generally small (about 1.45); while the outline of the full grown shell is somewhat subtriangular, without the shoulder (especially the anterior shoulder), the value of α generally over 1.55; inner cardinal tooth of the left valve triangular (Length 4.3 mm., Height 4.2 mm., Breadth 3 mm.) (*Eupisidium*) *u'noi* nov.
- b) Striation irregular, finer and shallower than the above species; cuticle not light, bright yellowish brown; no remarkable differences between the normal (more or less younger) shell and the full grown shell 12
- 12 a) Outline subtriangular; without a distinctly shouldered appearance; shell thickened, stout; teeth very stout, hinge thick (Length 4.25 mm., Height 3.86 mm., Breadth 2.81 mm.) (*Eupisidium*) *ponderosum* STELFOX
- b) Outline subtrapezoid, with a more or less shouldered appearance; shell thinner than in the above species; teeth more acute, hinge thinner 13
- 13 a) Cardinal tooth of the right valve and inner cardinal tooth of the left valve both Δ -shaped, posterior end of the former not bifid; striation fine, shallow;

- umbones small, projection not conspicuous; ligament pit broad (Length 3.42 mm., Height 3.03 mm., Breadth 2.03 mm.) (*Eupisidium*) *humeriforme* STELFOX
- b) Cardinal tooth of the right valve A-shaped, its posterior end bifid, inner cardinal tooth of the left valve elongated subtriangular; striation coarser; umbones large, moderately projected; ligament pit small and narrow 14
- 14 a) The value of α is about 1.6 (Length 4.03 mm., Height 3.5 mm., Breadth 2.66 mm.) *pulchellum* JENYNS
- c) The value of α is 1.38 (Length 3.12 mm., Height 2.78 mm., Breadth 2.24 mm.) *pulchellum kunasiriense* nov.
- 15 a) Outer cardinal tooth of the left valve situated above inner one and the two parallel to each other; umbones situated quite behind, at about the posterior third of the shell length (Length 3.64 mm., Height 3.08 mm., Breadth 2.32 mm.) (*Eupisidium*) *subtruncatum altum* nov.
- b) Inner and outer cardinal teeth of the left valve not parallel to each other; umbones situated at about the posterior three-fifths of the shell length 16
- 16 a) Profile elliptical; anterior part of shell wide (Length 3.5 mm., Height 3 mm., Breadth 1.9 mm.) *ellipticum* nov.
- b) Profile oval; anterior part of shell narrower 17
- 17 a) The value of γ is over 1.22 18
- b) The value of γ is under 1.2 19
- 18 a) The value of α is under 1.85 (Length 4.2 mm., Height 3.4 mm., Breadth 2.31 mm.) (*Eupisidium*) *cinereum* ALDER
- b) The value of α is over 1.9 (Length 4.4 mm., Height 3.6 mm., Breadth 2.2 mm.) (*Eupisidium*) *cinereum lacustre* WOODWARD
- 19 a) The value of α is over 1.7 (generally over 1.8) (Length 4 mm., Height 3.5 mm., Breadth 2.18 mm.) (*Eupisidium*) *cinereum nikkoense* nov.
- b) The value of α is under 1.7 (generally under 1.65) 20
- 20 a) The value of γ is under 1.15; anterior part of shell very narrow; umbones conspicuously projected; inner cardinal tooth of the left valve thin, curved (Length 4.1 mm., Height 3.6 mm., Breadth 2.54 mm.) (*Eupisidium*) *cinereum inflatum* nov.
- b) The value of γ is over 1.18; anterior part of shell wider; umbones less projected; inner cardinal tooth of the left valve triangular (Length 3.92 mm., Height 3.32 mm., Breadth 2.39 mm.) (*Eupisidium*) *cinereum subinflatum* nov.
- 21 a) Shell length 2.6-2.7 mm.; shell compressed, the value of α is over 2.04 (Length 2.66 mm., Height 2.24 mm., Breadth 1.27 mm.) *conventus akkesiense* nov.
- b) Shell length not over 2.4 mm.; the value of α is usually under 1.85 22
- 22 a) Outline oval, globose, very tumid (the value of α is 1.29-1.36), umbones very large, conspicuously projected, striation fine and irregular; animal with two gill-laminae on each side (Length 2.37 mm., Height 2.16 mm., Breadth 1.87 mm.) (*Eupisidium*) *japonicum* PILSBRY et HIRASE
- b) Outline subtrapezoid, shouldered, moderately compressed (the value of α is 1.75-1.84), umbones small, projection inconspicuous, striation coarse but very regular; animal with only one gill-lamina on each side (Length 2.24 mm., Height 1.9 mm., Breadth 1.25 mm.) (*Neopisidium*) *parvum* nov.

V. Descriptions

1 a. *Pisidium baicalense etorohuense* MORI
(Text-Fig. 1; Pl. VII. Fig. 1 b)

1935: *Pisidium amnicum etorohuense*, MORI, Venus, Vol. 5, p. 194, fig. 1.

Shell large, triangular, laterally compressed. Striae somewhat coarse and irregular; umbones small, slightly projected. The value of α 1.9-2.33, γ 1.08-1.2. Anatomy of the animal is not known.

Length 8 mm., height 6.8 mm., breadth 4.1 mm.; α 1.95, γ 1.17.

Localities—Tôro-Numa, Etorohu-Zima (MIYADI), *Type*; Sibetori-Ko, Etorohu-Zima (MIYADI), Syana-Numa, Etorohu-Zima (MIYADI).

This was at first described by the author as a subspecies of *P. amnicum* O. F. MÜLLER; but further study led me to the conclusion that it has closer relation to DYBOWSKI's *P. baicalense*,¹⁾ than to the former.

The characters of this subspecies discriminating it from *P. baicalense* s. s. are its greater value of α and smaller value of γ (viz. the value of α of *baicalense* s. s. is 1.8 and that of γ is 1.5). This subspecies is closely related to *P. baicalense complanatum* LINDHOLM (see next paragraph), but easily distinguished by its smaller value of γ . Also it may be easily distinguished from *P. amnicum* s. s. by its subtriangular outline, greater value of α , smaller value of γ (viz. the mean value of α of *amnicum* s. s. is 1.88 and that of γ is 1.29), and smaller and less projected umbones.

1 b. *Pisidium baicalense complanatum* LINDHOLM
(Pl. VII, Fig. 1 a)

1909: *Pisidium baicalense* var. *complanatum*, LINDHOLM, Die Mollusken des Baikalsees, S. 84.

This subspecies is closely related to the above species, but the shell is more depressed (the value of γ is greater) and the anterior part more elongated.

Length 7.5 mm., height 6 mm., breadth 3.75 mm.; α 2.05, γ 1.25.

Locality—Syana-Numa, Etorohu-Zima (MIYADI).

Among numerous specimens of *P. baicalense etorohuense* MORI, several specimens collected from Syana-Numa seemed to me to have the characters of LINDHOLM's *P. baicalense complanatum*; viz. the value of γ of *complanatum* is 1.25-1.32, while that of *etorohuense* is 1.08-1.2. This subspecies may be easily distinguished from *P. baicalense* s. s. by its greater value of α and smaller value of γ (viz. the value of α of *baicalense* s. s. is 1.8 and γ is 1.5); and from *baicalense decurtatum* LINDHOLM²⁾ by its greater value of α and γ (viz. the value of α of *decurtatum* is about 1.67 and γ is about 1.16).

1) 1902: *P. baicalense* DYBOWSKI, Nachr'bl. d. Deut. Malak. Ges., Jahrg. 34, p. 93.

2) 1909: *P. baicalense* var. *decurtatum*, LINDHOLM, Die Mollusken des Baikalsees, p. 83, Pl. 2, figs. 43, 44.

2 a. *Pisidium* (*Eupisidium*) *kawamurai* sp. nov.

(Pl. VII, Fig. 2)

Shell large, roundly ovate in outline, laterally compressed, thin, some specimens translucent; the value of α is 2.03 and γ is 1.22. Nepionic valve distinct. Shell subequilateral, slightly shouldered on the posterior margin; anterior margin roundly arcuated, the fore extremity lies nearly at the middle of the shell height; posterior margin subtruncated; ventral margin smoothly curved. Umbones small in proportion to the shell, moderately projected, without appendiculae, situated at about the middle of the shell length. Striae very fine, closely sculptured, somewhat regular. Cuticle light grayish yellow, tinged with purple; surface with pearly gloss. Teeth somewhat thin or ordinarily thickened. Teeth in the right valve:—cardinal Δ -shaped, the anterior part short and thin, the posterior part thickened, somewhat triangular; inner anterior lateral moderately stout, well developed; outer anterior lateral, inner and outer posterior laterals somewhat thin, but well developed. Teeth in the left valve:—inner cardinal stands erect, small, triangular; outer cardinal small, thin, nearly straight; anterior and posterior laterals somewhat stout, well developed, greatly elevated. Hinge arched, very thin at the middle part (about the cardinals), thickened at the anterior and posterior parts (especially at the anterior part); interior outline well curved under the cardinals. Ligament pit large, elongated. The animal having two gill-laminae on each side, belongs to the subgenus *Eupisidium*.

Length 7.2 mm., height 5.9 mm., breadth 3.5 mm.; α 2.03, γ 1.22.

Locality—South part of Biwa-Ko¹, Siga Ken (MORI), *Type*.

The mean value of α of seven specimens is 2.05 and γ is 1.19.

This resembles European *P. (Eup.) cinereum intermedium* GASSIES.²) but is distinguished by its smaller value of γ (viz. the value of γ of *intermedium* is 1.33).

2 b. *Pisidium kawamurai hukuiense* subsp. nov.

(Pl. VII, Fig. 3)

Shell more inflated, more rounded, and stouter than the above species. Nepionic valve not conspicuous. Shell rounded in profile, dorsal margin scarcely shouldered; posterior margin subtruncated, more smoothly arcuated than the above species. Umbones somewhat large, projected. Striae coarse, deep, distinct and regular. Cuticle light grayish yellow or light gray yellowish brown. Surface glossy. Teeth moderately stout. Teeth in the right valve:—cardinal J-shaped, anterior part thin, short, low, posterior part long, high and somewhat thickened; inner anterior lateral large, long, stout; inner posterior lateral short, stout; outer anterior and posterior laterals short, small, but moderately elevated. Teeth in the left valve:—outer cardinal thin, straight; inner cardinal thin, elongate sigmoid, the two cardinals parallel

1) 琵琶湖.

2) 1855: *P. intermedium*, GASSIES, *Descrip. Pis. Aquit.*, p. 11, T. 1, fig. 4.

to each other. Hinge smoothly arched, anterior part thickened; interior margin with an obtuse angle just in front of the cardinals. Anatomy of the animal is not known. Other characters closely resemble *kawamurai* s. s.

Length 7.3 mm., height 6.4 mm., breadth 4.3 mm.; α 1.7, γ 1.15.

Locality—Kairu¹⁾, Hukui Ken (collected by a teacher of the Kairu Elementary School), *Type*.

The mean value of α of four specimens is 1.74 and γ is 1.17.

This subspecies may be easily distinguished from *kawamurai* s. s. by its more roundly oval outline, larger and more projected umbones, smaller value of α , etc.

3. *Pisidium* (*Eupisidium*) *kurodai* sp. nov.
(Pl. VII, Fig. 4)

Shell rounded oval, subglobose, very tumid, thickened, and stout; the value of α is 1.4, γ is 1.06. Nepionic valve distinct. Shell subequilateral, dorsal margin not shouldered; anterior margin circularly arcuated, the fore extremity lies below the middle of the shell height; posterior margin faintly angular; ventral margin arcuated. Umbones large, rounded, highly projected, without appendiculae. Striae very coarse, deep, distinct, and quite regularly spaced. Cuticle light bright yellowish brown; surface dull glossy. Teeth somewhat stout, but small owing to the short hinge. Teeth in the right valve:—cardinal small, thickened, slightly curved, low; outer anterior lateral very small, nearly obsolete; inner anterior lateral and inner and outer posterior laterals somewhat small, low. Teeth in the left valve:—both inner and outer cardinals very small, straight, and situated parallel to each other; inner cardinal thinner and elevated. Hinge greatly arched, very short, so that the lateral teeth lie close to the cardinal teeth and are small; width of the hinge is thin about the cardinals; the interior margin bent obtusely between cardinals and anterior laterals. Ligament pit small for the same reason mentioned above. The animal having two gill-laminae on each side, belongs to the subgenus *Eupisidium*.

Length 4.2 mm., height 3.8 mm., breadth 3 mm.; α 1.4, γ 1.06.

Locality—Tôro-Numa²⁾, Etorohu-Zima (MIYADI), *Type*.

The mean value of α of four specimens is 1.32 and that of γ is 1.04.

This is related to *P. (Eup.) uénoi*, but may be distinguished by having no shoulder, more rounded outline (especially in the anterior margin), larger and greatly projected umbones, smaller value of α and γ , and very short hinge.

4. *Pisidium amnicum nipponense* (HIRASE MS) subsp. nov.
(Pl. VIII, Fig. 5)

Shell rounded oval, stout, thickened, very tumid; profile closely resembling European *P. (Eup.) amnicum* O. F. MÜLLER.³⁾ Nepionic valve distinct

1) 鹿森.

2) ト一口沼.

3) 1774: *Tellina amnica*, MÜLLER, Verm. hist., II, p. 205.

in young specimens, indistinct in adult. Dorsal margin not shouldered, sloping gently in front of the umbo, and abruptly inclined behind the umbo; anterior margin smoothly rounded, the fore extremity lies below the middle of the shell height; posterior end irregularly rounded; ventral margin nearly straight. Umbones roundish, very large, without appendiculae. Striae distinct, deep, and regular. Cuticle light grayish yellow, with light coloured basal band; surface glossy. Teeth very stout, thickened. Teeth in the right valve:—cardinal Δ -shaped, the anterior part thin and low, the posterior part thickened and elevated; inner anterior and posterior laterals very stout, thickened, but somewhat low; outer anterior and posterior laterals stout, well elevated. Teeth in the left valve:—inner cardinal small, thin, Δ -shaped; outer cardinal thin, small, somewhat bent; anterior and posterior laterals very stout, thickened, well developed. Hinge thick, gently arched in front, well arched behind; width of the hinge line is thinner in the middle part than in the anterior and posterior parts (especially in the right valve). Ligament pit large and wide. Anatomy of the animal is not known.

Length 5.7 mm., height 4.65 mm., breadth 4.45 mm.; α 1.28, γ 1.22.

Locality—A small river at Atumi¹⁾, Yamagata Ken (Y. HIRASE), *Type*.

This species was collected by a collector of the late Mr. Y. HIRASE, and was named by the latter, but has never been described. The profile of this subspecies resembles *P. (Eup.) amnicum* s. s. O. F. MÜLLER, but may be easily distinguished by its larger umbones, smaller size of the shell, more rounded outline, and smaller value of α (viz. length of *amnicum* s. s. is over 8 mm. and the value of α is 1.83-1.95).

5. *Pisidium (Eupisidium) uejii* (KURODA MS) sp. nov.
(Pl. VIII, Fig. 7)

Shell roundish trapezoid, somewhat small, tumid, very thin, moderately fragile, somewhat translucent. Nepionic valve not distinct. Dorsal margin having a shouldered appearance, sloping quickly behind the umbo and gently in front of the umbo; anterior margin well rounded, the fore extremity lies below the middle of the shell height; posterior margin gently rounded or subtruncated; ventral margin arcuated. Umbones ordinary, projection not conspicuous. Striae fine, very shallow, indistinct near the umbones. Cuticle snowy white or light grayish white. Surface glossy, often with pearly gloss. Teeth thin and weak. Teeth in the right valve:—cardinal is characteristic, being Ω -shaped, much elevated, projected from the inner margin of the hinge; inner anterior lateral somewhat thickened, stout; outer anterior lateral and inner and outer posterior laterals small. Teeth in the left valve:—inner cardinal somewhat thickened, \odot -shaped, projected from the inner margin of the hinge; outer cardinal thin, long, low, smoothly and gently curved along inner cardinal; both anterior and posterior laterals ordinary. Hinge very thin (especially about cardinals), bent obtusely between the

1) 温海.

cardinals and the ligament pit. Ligament pit elongated triangular, relatively large, situated very close to the cardinals. The animal, having two gill-laminae on each side, belongs to the subgenus *Eupisidium*.

Length 3.1 mm., height 2.8 mm., breadth 2 mm.; α 1.55, γ 1.1.

Locality—A spring at Ôsimizu¹⁾, Tazima, Hyôgo Ken (UEDA), *Type*.

The mean value of α of seven specimens is 1.51 and γ is 1.08. This species was named by T. KURODA, but has never been described.

The profile of this species resembles *P. (Eup.) nitidum* JENYNS and *P. (Eup.) pulchellum* JENYNS. But it is distinguished from the former by its smaller value of α and γ , absence of deep, distinct lines around the embryonic shell, characteristic Ω -shaped cardinal of right valve, \circ -shaped inner cardinal of left valve; and from the latter by its smaller value of α and γ , fine and even indistinct striation, smaller and less projected umbones, whitish colour of cuticle, characteristic Ω -shaped cardinal of right valve, \circ -shaped inner cardinal of left valve.

6. *Pisidium (Neopisidium) cavernicum* MORI

(Pl. XI, Fig. 22)

1938: *Pisidium (Neopisidium) cavernicum*, MORI, Biogeographica, Vol. 3, No. 1.

Shell small, roundish subtrapezoid in outline, thin, translucent, but not very fragile, laterally compressed. Anterior extremity of the shell lies below the middle of the shell height. Anterior margin well arcuate, dorsal side subtruncate; posterior margin somewhat arcuate, dorsal side also subtruncate; ventral margin wide, smoothly and semicircularly arcuate; dorsal margin short, shouldered. Umbones quite small, slightly projected. Nepionic valve indistinct. Surface minutely, but distinctly and quite regularly striated. Surface opaque, colouration light yellowish, interior light pale yellowish. Hinge line with an obtuse angle. Teeth rather stout. Teeth in the right valve:—cardinal smoothly and well arcuate, Ω -shaped, thin, prominently projected; inner anterior lateral long, thick; outer anterior lateral thin, small; inner posterior lateral long, elevated, stout, thick; outer posterior lateral minute, thin. Teeth in the left valve:—inner cardinal Δ -shaped, the anterior part thickened; outer cardinal arcuate, thin; anterior lateral long, thick, stout, elevated; posterior lateral thick, stout. The animal, having only inner gill-lamina on each side, and lacking the outer one, belongs to the subgenus *Neopisidium*.

Length 3 mm., height 2.7 mm., breadth 1.5 mm.; α 2, γ 1.11.

Locality—Cave No. 3 (Muikagâ) in Miyako-Zima²⁾ (MIYADI and OKUGAWA), *Type*.

This is a small, shouldered *Pisidium*, having fine, distinct, regularly spaced growth-striae, and is known only from the small pond in the limestone cave in Miyako-Zima.

1) 大清水.

2) 宮古島洞窟 No. 3 (ムイカガ-).

This species resembles *P. (Eup.) nitidum* JENYNS, but may be distinguished by its Ω -shaped, projected cardinal of right valve, smaller value of γ , and regularly spaced, distinct growth striae, but the most characteristic point of demarcation is its single gill-lamina on each side, inner one being present and the outer one absent; and also in this point the species is clearly distinct from other bivalves which have a similar appearance to this species such as *P. pulchellum*, *P. humeriforme*, etc.

7. *Pisidium (Eupisidium) nitidum* JENYNS
(Pl. VIII, Fig. 6)

1832: *Pisidium nitidum*, JENYNS, Trans. Camb. Phil. Soc., Vol. 4, p. 304, Pl. 20, figs. 7-8.

Shell somewhat small, roundish subtrapezoid or distorted oval, thin, fragile, some specimen even translucent, outline somewhat resembles *P. (Eup.) pulchellum* JENYNS. Nepionic valve distinct in some specimens and indistinct in others. Dorsal margin distinctly shouldered, subequilateral; anterior margin bluntly pointed, the fore extremity lying below the middle of the shell height; posterior margin subtruncated; ventral margin gently rounded. Cuticle light grayish yellow or light gray. Surface glossy. Umbones ordinary in size and in projection. Striae fine, somewhat regular; young specimens have generally several distinct deep grooves around the nepionic valve or umbo. Teeth thin and weak. Teeth in the right valve:—cardinal gently curved, thin, both ends slightly thickened; lateral teeth thin, small. Teeth in the left valve:—inner cardinal small, thin, slightly arcuate; outer cardinal thin, slightly curved and situated parallel to inner one; laterals thin, elevated. Hinge arched, the middle part thinner than the anterior and posterior parts; the interior outline bent obtusely just in front of the cardinals. Ligament pit short, but wide. The animal, having two gill-laminae on each side, belongs to the subgenus *Eupisidium*.

Length 3.31 mm., height 2.77 mm., breadth 1.94 mm.; α 1.71, γ 1.19.

Localities—Tôro-Ko (Hokkaido, MIYADI), Asino-Ko (Kanagawa Ken, KURODA), Aoki-Ko (Nagano Ken, MIYADI).

The mean value of α of four specimens is 1.72 and that of γ is 1.17.

This species may be separated from *P. (Eup.) pulchellum* JENYNS by its more compressed shell (the value of α is greater), thinner shell, and generally having several distinct, deep growth lines around the nepionic shell or umbo (especially distinct in young specimens); also it is distinguished easily from *P. (Eup.) uejii* by its greater value of α and γ , and many other characters.

8. *Pisidium (Eupisidium) uénoi* sp. nov.
(Pl. VIII, Fig. 8)

Adult shell differs in shape conspicuously from full grown shell; viz. normal adult shell is subtrapezoid in outline, having a distinctly shouldered appearance, while full grown shell is generally subtriangular in outline, missing the anterior shoulder and more tumid than the former [the value

of α of normal adult shell (about 3.5 mm. in length) is about 1.6 and that of full grown shell (over 4.3 mm. in length) is about 1.43]. Shell very thickened, stout. Nepionic valve distinct. Dorsal margin of normal adult shell distinctly shouldered, equilateral, but that of full grown shell generally missing the anterior shoulder, anterior slope steeper than behind; anterior margin bluntly pointed, the fore extremity lies below the middle of the shell height; posterior margin somewhat truncated; ventral margin of normal adult shell rounded more gently than in full grown shell. Umbones moderately large, projected, without appendiculae. Striae coarse, deep, distinct, quite regularly spaced. Cuticle light, bright yellowish brown, and coloured thinner in normal adult shell and young shell than in full grown shell; interior whitish. Surface dull glossy. Teeth stout, thickened. Teeth in the right valve:—1) of the normal adult shell—cardinal J-shaped, the anterior part short, end somewhat thickened, the posterior part long, end thickened and bifid; inner anterior and posterior laterals stout, but somewhat low; outer anterior lateral low, small, nearly obsolete; outer posterior lateral small, low;—2) of full grown shell—cardinal J-shaped, the anterior part nearly obsolete, the posterior part very much thickened, very low, prostrated, end not bifid; inner anterior lateral very stout, large, but low; inner posterior lateral stout but low; outer anterior lateral nearly obsolete; outer posterior lateral very low, straight, nearly obsolete. Teeth in the left valve:—1) of normal adult shell—inner cardinal thickened, somewhat triangular, connected with anterior lateral by a low ridge; outer cardinal thin, nearly straight; both anterior and posterior laterals blunt but highly elevated;—2) of full grown shell—inner cardinal thickened, triangular; outer cardinal thin, very small, short, low, nearly obsolete; both anterior and posterior laterals elevated, very stout, but blunt. Hinge well arched, thinner about the cardinals; the interior outline with two obtuse angles, one just in front of and the other just behind the cardinals (the angle of the latter more obtuse). Ligament pit somewhat small; width is narrower in normal adult shell than in full grown shell. The animal, having two gill-laminae on each side, belongs to the subgenus *Eupisidium*.

Length 4.3 mm., height 4.2 mm., breadth 3 mm.; α 1.43, γ 1.02.

Localities—Yanke-Numa¹⁾, Etorohu-Zima (MIYADI), *Type*; Rebun-Numa, Etorohu-Zima (MIYADI); Seseki-Numa, Etorohu-Zima (MIYADI); Syana-Numa, Etorohu-Zima (MIYADI).

The mean value of γ of ten specimens is about 1.07.

The specimens from Seseki-Numa are somewhat dorso-ventrally depressed, viz. the mean value of γ of three specimens is 1.13. An abnormal full grown shell, of which profile is rhomboidal, is found from Syana-Numa (Pl. IX, Fig. 8 g).

The deep, regular striation and the external outline of this species somewhat resembles *P. (Eup.) pulchellum* JENYNS, but it may be easily dis-

1) ヤンケ沼.

tinguished by its larger shell, more developed shoulder in the normal adult shell, more rounded ventral margin, deeper and more regular striation, smaller value of γ , light, bright yellowish brown colouration of the cuticle, low and thickened cardinal of the right valve, and obsolete outer anterior lateral of the right valve in the full grown shell, etc. Also, it may be separated from *P. (Eup.) kurodai* by the distinctly shouldered appearance of the normal adult shell, subtriangular form of the full grown shell, bluntly pointed anterior margin, smaller and less projected umbones, more elongated hinge, larger and more developed teeth, etc. Further, it may be distinguished from *P. (Eup.) ponderosum* STELFOX by its deep, distinct, regular sculptures, distinctly shouldered appearance of the normal adult shell, light bright yellowish brown colouration of the cuticle, etc.

9. *Pisidium (Eupisidium) ponderosum* STELFOX
(Pl. IX, Fig. 9)

1918: *Pisidium casertanum* var. *ponderosa*, STELFOX, Jour. Conch., Vol. 15, p. 294, Pl. 7, figs. 31-34.

1933: *Pisidium ponderosum*, EHRMANN, "Mollusken" in "Die Tierwelt Mitteleuropas," Bd. II. Lief. I, S. 242, fig. 140.

Shell subtriangular, moderately tumid, very much thickened. Nepionic valve distinct. Dorsal margin scarcely shouldered (posterior shoulder slightly observable), anterior slope smoother than posterior; anterior margin bluntly pointed, the fore extremity lies below the middle of the shell height; posterior margin subtruncated; ventral margin gently rounded. Umbones lie behind the middle, moderately large, projected, without appendiculae. Striae fine, shallow, somewhat irregular. Cuticle gray yellowish brown, with a few dark lines along the growth lines, interior whitish. Surface glossy. Teeth very stout, blunt. Teeth in the right valve:—cardinal large, J-shaped, the dorsal corner very low, the posterior end thickened; inner anterior lateral and both inner and outer posterior laterals ordinary; outer anterior lateral very small. Teeth in the left valve:—inner cardinal somewhat small, but stout, triangular in outline; outer cardinal thin, somewhat long, nearly straight; both anterior and posterior laterals very stout, well developed, thickened, bluntly pointed. Hinge well arched, very thick; the interior margin bent obtusely both just in front of the cardinals and just in front of the posterior laterals. Ligament pit short, but very wide. The animal, having two gill-laminae on each side, belongs to the subgenus *Eupisidium*.

Length 4.25 mm., height 3.86 mm., breadth 2.81 mm., α 1.51, γ 1.1.

Localities—Sibetori-Gawa, Etorohu-Zima (TANAKA and HOSINO); Nisino-Umi, Yamanashi Ken (MIYADI), Kizaki-Ko, Nagano Ken (KAWAMURA).

This species is distinguished from *P. (Eup.) humeriforme* STELFOX by its larger shell, more tumid form (the value of α is smaller), subtriangular outline, not-shouldered appearance, more arched and broad hinge, etc. The profile of this species resembles the full grown shell of *P. (Eup.) uénoi*, but may be easily identified by several characters as mentioned in the foregoing

paragraph 8. Also, it may be easily distinguished from *P. (Eup.) cinereum inflatum* by its subtriangular outline, smaller value of α , thickened, not divaricated, J-shaped cardinal of the right valve, triangular inner cardinal of the left valve, etc.

10. *Pisidium (Eupisidium) humeriforme* STELFOX
(Pl. IX, Fig. 10)

1918: *Pisidium casertanum* var. *humeriforme*, STELFOX, Jour. Conch., Vol. 15, p. 294, Pl. 7, figs. 24, 25.

Shell subtrapezoid moderately tumid, moderately thickened. Nephonic valve not distinct. Dorsal margin distinctly shouldered, anterior slope smoother than posterior; anterior margin well arcuate, the fore extremity lying below the middle of the shell height; posterior margin truncated; ventral margin gently rounded. Umbones bluntly projected, without appendiculae. Striae somewhat coarse, shallow and irregular. Cuticle gray yellowish white or light yellowish brown. Surface glossy, often with pearly gloss. Teeth generally stout and thickened. Teeth in the right valve:—cardinal gently curved, very thin, posterior end slightly thickened; anterior and posterior laterals blunt, stout, thickened, among them outer posterior lateral somewhat large, elevated. Teeth in the left valve:—inner cardinal somewhat thickened, J-shaped; outer cardinal nearly straight, thin; anterior and posterior laterals stout, elevated. Hinge thick, arched, the anterior part thicker than the posterior part; the interior margin bent obturely just in front of the cardinals. Ligament pit broad, but somewhat short. The animal, having two gill-laminae on each side, belongs to the subgenus *Eupisidium*.

Length 3.42 mm., height 3.08 mm., breadth 2.03 mm.; α 1.66, γ 1.11.

Localities—Urumo-Ko, Etorohu-Zima (MIYADI), Seseki-Numa, Etorohu-Zima (MIYADI); Tôro-Ko, Hokkaidô (UÉNO); Aoki-Ko, Nagano Ken (KAWAMURA); Kizaki-Ko, Nagano Ken (KAWAMURA, MIYADI).

This species was at first described by STELFOX (1918) as a variety of *P. (Eup.) cinereum* ALDER. But I think it is more suitable to treat this specimen as an independent species.

Outline of this species is somewhat similar to *P. (Eup.) nitidum* JENYNS and *P. (Eup.) pulchellum* JENYNS. From the former it may be distinguished by its irregular striation, having no deep, distinct grooves around the umbo, J-shaped inner cardinal of left valve which is not situated parallel to outer one, etc.; and from the latter it may be distinguished by the shape of the inner cardinal of left valve and the cardinal of right valve (of which posterior end is not bifid), finer striation, smaller umbo, broader ligament pit, etc.

11 a. *Pisidium (Eupisidium) pulchellum* JENYNS
(Pl. IX, Fig. 11 e)

1833: *Pisidium pulchellum*, JENYNS, Monogr. of Cycl. in Trans. Phil. Soc. Cambridge, IV, p. 306, t. 10, figs. 8-12.

Shell roundish subtrapezoid, moderately tumid, moderately thickened;

Nepionic valve often distinct. Dorsal margin moderately shouldered, sub-equilateral; anterior margin well curved, bluntly pointed, the fore extremity lying below the middle of the shell height; posterior margin gently rounded, somewhat truncated; ventral margin gently curved. Umbones large, roundish, moderately projected, without appendiculae. Striae coarse, somewhat irregular. Cuticle gray yellowish brown, with light coloured basal band; interior whitish or bluish. Surface glossy. Teeth stout, thickened. Teeth in the right valve:—cardinal J-shaped, the anterior part small, thin, short, and the posterior part large and thickened, end bifid; inner anterior lateral stout, blunt; outer anterior lateral small; both inner and outer posterior laterals ordinary. Teeth in the left valve:—inner cardinal somewhat elongated triangular; outer cardinal thin, scarcely bent; both anterior and posterior laterals stout, elevated, bluntly pointed. Hinge arched, anterior part thicker than the middle and posterior parts; the interior margin with an obtuse angle just in front of the cardinals. Ligament pit very small, narrow, short. The animal, having two gill-laminae on each side, belongs to the subgenus *Eupisidium*.

Length 4.03 mm., height 3.5 mm., breadth 2.66 mm.; α 1.54, γ 1.15.

Localities—Etorohu-Zima (SUGITANI and SASAMORI), Abasiri-Ko, Hokkaidô (UENO).

This species is somewhat similar to *P. (Eup.) nitidum* JENYNS, *P. (Eup.) humeriforme* STELFOX, and *P. (Eup.) uénoi*; but the differences among them have already been mentioned.

11 b. *Pisidium pulchellum kunasiriense* subsp. nov.

(Pl. IX, Fig. 11 a-d)

Shell more tumid than *pulchellum* s. s.; viz. the value of α is much smaller. Nepionic valve indistinct. Other characters all closely resemble *pulchellum* s. s. Anatomy of the animal is not known.

Length 3.12 mm., height 2.78 mm., breadth 2.24 mm.; α 1.38, γ 1.12.

Locality—Tôhutu-Ko¹⁾, Kunasiri-Zima (MIYADI), *Type*.

Only one specimen was collected.

12. *Pisidium (Eupisidium) subtruncatum altum* subsp. nov.

(Pl. IX, Fig. 12)

Shell distorted, roundish oval, moderately thin, fragile. Nepionic valve distinct. Dorsal margin smoothly and gently curved, without shouldered appearance, slopes from the umbo smooth; anterior margin well curved, bluntly pointed, the fore extremity lying at about the middle of the shell height; posterior margin smoothly and regularly rounded. Umbones moderately large, highly projected, situated at about the posterior fourth of the shell length. Striae fine, somewhat regular. Cuticle light grayish yellow or light horny yellow. Surface glossy. Teeth in the right valve:—cardinal thin, nearly straight, elevated; inner anterior lateral large; outer anterior

1) 東沸湖.

lateral very small; both inner and outer posterior laterals ordinary. Teeth in the left valve:—inner cardinal nearly straight, thin, situated parallel to outer cardinal; outer cardinal thin, straight; anterior lateral ordinary, connected with inner cardinal by a low ridge; posterior lateral thin, but elevated. Hinge gently arched, the anterior part thicker than the posterior part. Ligament pit small and short. The animal, having two gill-laminae on each side, belongs to the subgenus *Eupisidium*.

Length 3.64 mm., height 3.08 mm., breadth 2.32 mm.; α 1.57, γ 1.18.

Localities—Akan-Ko¹⁾, Hokkaidô (MIYADI), *Type*; Hyôtan-Numa, Hokkaidô (MIYADI); Abasiri-Ko, Hokkaidô (UENO).

The position of umbones of this subspecies is characteristic, indicating that it is related to European *P. (Eup.) subtruncatum* MALM.²⁾ But this new subspecies is easily distinguished from *subtruncatum* s. s. by its smaller value of γ , since the value of γ of European species is 1.22-1.25.

13. *Pisidium ellipticum* sp. nov.

(Pl. X, Fig. 13)

The outline of the shell is characterized by the elliptical form, the anterior part is even wider than the posterior part (the anterior part of most pisidian shells is narrower than the posterior part); moderately compressed, somewhat thin. Nepionic valve indistinct. Shell subequilateral, dorsal margin not shouldered, slope from umbo smooth; anterior margin smoothly and regularly rounded, forming a semicircular line, the fore extremity lying at about the middle of the shell height; posterior margin much more rounded than the anterior margin, yet smooth and regular; ventral margin curved smoothly, regularly, rather gently. Umbones somewhat large, bluntly projected, roundish, lie at about the middle of the shell length. Striae somewhat coarse, distinct, but irregular, and several deep lines are conspicuously sculptured along the growth lines. Cuticle light grayish yellow or light gray yellowish brown; the interior whitish. Surface dull glossy. Teeth generally small, and low. Teeth in the right valve:—cardinal bent like a hook, the anterior part thin, the posterior part thickened; anterior and posterior laterals small low (especially inner posterior lateral), but somewhat stout. Teeth in the left valve:—inner cardinal somewhat thickened, straight; outer cardinal very thin, obtusely bent, the anterior part longer than the posterior part; both anterior and posterior laterals small and low. Hinge very gently and smoothly arched, the interior outline is also smooth. Ligament pit long, but somewhat narrow, more thickened in the posterior part than in the anterior part. Anatomy of the animal is not known.

Length 3.5 mm., height 3 mm., breadth 1.9 mm.; α 1.84, γ 1.17.

Locality—Nôga-Ike³⁾ near the summit of Mt. Kisokoma, Nagano Ken (MORI), *Type*.

1) 阿寒湖.

2) 1855: *P. subtruncatum*, MALM, Göt. Handl., III, S. 92, cum. fig.

3) 濃ヶ池.

The mean value of α of seven specimens is 1.82 and γ is 1.18. The largest specimen was 4 mm. in length, 3.4 mm. in height, 2.4 mm. in breadth.

The general outline somewhat resembles European *P. (Eup.) personatum* MALM,¹⁾ but may be easily identified by its coarse striation and the absence of the "callus" in front of posterior lateral of left valve and outer posterior lateral of right valve (N. B. the presence of the "callus" in front of the posterior laterals is the most remarkable characteristic of *personatum*).

14 a. *Pisidium (Eupisidium) cinereum* ALDER

(Pl. X, Fig. 14 a-b)

1791: *Cardium casertanum*, POLI, Test. utr. Siciliae, i, ord. II, p. 65, Pl. 16, fig. 1. (not a binominal work!).

1838: *Pisidium cinereum*, ALDER, Trans. Nat. Hist. Soc. Northumb., ii, p. 341.

1921: "*Pisidium cinereum* ALDER, vice *Pisidium casertanum* POLI," B. B. WOODWARD, Proc. Malac. Soc. London, Vol. 14, p. 209.

Shell oval, without any angular portion in outline (except umbones), moderately tumid, generally thin, fragile, some specimens translucent. Nephronic valve distinct or indistinct. Dorsal margin scarcely shouldered, sloping gently; anterior margin well rounded, the fore extremity lying at about the middle of the shell height; posterior margin gently curved; ventral margin smoothly and gently rounded. The size of umbones ordinary and ordinarily projected. Striae fine, shallow, close, and somewhat irregular. Cuticle light grayish yellow. Surface glossy, some specimens with pearly gloss. Teeth in the right valve:—cardinal Δ -shaped, the anterior part thin, the posterior part thickened and end often bifid; inner anterior lateral well developed; outer anterior lateral and inner and outer posterior laterals ordinary. Teeth in the left valve:—inner cardinal thickened, somewhat triangular, connected with anterior lateral by a low ridge; outer cardinal thin, straight; anterior and posterior laterals well developed, elevated. Hinge arched, thickened about the anterior laterals (especially in the right valve). Ligament pit moderately wide. The animal, having two gill-laminae on each side, belongs to the subgenus *Eupisidium*.

Length 4.2 mm., height 3.4 mm., breadth 2.31 mm.; α 1.82, γ 1.23.

Localities—Akan-Ko, Hokkaidô (MIYADI, UENO); Yuno-Ko, Totigi Ken (KAWAMURA).

This species is the most widely distributed Palæarctic *Pisidium*, having remarkable adaptability and variability.

14 b. *Pisidium (Eupisidium) cinereum lacustre* WOODWARD

(Pl. X, Fig. 15)

1916: *Pisidium casertanum* (POLI) forma *lacustris*, PRESTON, Ann. Mag. Nat. Hist., Ser. 8, Vol. 17, p. 162.

1916: *Pisidium casertanum* (POLI), ANNANDALE, Mem. Asiat. Soc. Bengal, Vol. 6, p. 53, Pl. 3, fig. 14.

1) 1855: *P. personatum*, MALM, Göt. Handl., III, S. 107, cum. fig.

Shell rounded, elongated oval, more laterally compressed, more dorso-ventrally depressed, thinner and more fragile, and having more rounded outline and narrower, longer anterior part of the shell than *cinereum* s. s. Other characters all closely resemble *cinereum* s. s.

Length 4.4 mm., height 3.6 mm., breadth 2.2 mm.; α 2, γ 1.22.

Localities—Biwa-Ko, Siga Ken (ANNANDALE, KAWAMURA, MIYADI, YAMAZAKI and OKUGAWA), *Type*; Tôro-Ko, Hokkaidô (MIYADI, UÉNO); Kamino-Tambo at Mt. Hakuba, Nagano Ken (MIYADI).

The mean value of α of six specimens is 2.01 and γ is 1.25. In Lake Biwa, this species is usually collected at depths of more than 17 fathoms, and is not found in shallower water.

14 c. *Pisidium* (*Eupisidium*) *cinereum nikkôense* subsp. nov.
(Pl. X, Fig. 14 c, 16)

General appearance of the shell is closely similar to *cinereum* s. s. ALDER, but more oval in outline, coarser and more regular in striation, and having smaller value of γ . The animal, having two gill-laminae on each side, belongs to the subgenus *Eupisidium*.

Length 4 mm., height 3.5 mm., breadth 2.18 mm.; α 1.83, γ 1.14.

Localities—Kôtoku-Numa¹⁾ near Nikkô, Totigi Ken (MIYADI), *Type*; Sigi-no-Su Daira, Paramusiru-Zima (MIYADI); Urumo-Ko, Etorohu-Zima (MIYADI); Kimon-Numa, Etorohu-Zima (MIYADI); Abasiri-Ko, Hokkaidô (UÉNO); Oirase-Gawa, Aomori Ken (collector unknown), Kamaga-Ike near the summit of Kiriga-Mine, Nagano Ken (MORI, TUTIYA, UÉNO); Aoki-Ko, Nagano Ken (KAWAMURA), A small drain at Narai, Naragawa-Mura in Nagano Ken (collector unknown), A small pond at Mt. Bunasaka, Tate-Yama, Toyama Ken (SINDÔ), A small pond near the summit of Mt. Hôki-Daisen, Tottori Ken (KAWAMURA).

The value of α is always 1.7-1.95 and γ is always 1.1-1.2. So far as I know, this subspecies is the most widely distributed *Pisidium* in Japan.

The outline of this subspecies also resembles that of *P. cinereum lacustre* WOODWARD, but it may be surely distinguished by its smaller value of α and γ .

14 d. *Pisidium* (*Eupisidium*) *cinereum inflatum* subsp. nov.
(Pl. XI, Fig. 19)

(This subspecies is more differentiated in several characters from *cinereum* s. s. than *cinereum lacustre* and *cinereum nikkôense* are. The description is as follows:)

Shell distorted oval, without any conspicuous angular portion in outline (except umbones), moderately tumid, moderately thickened. Nepionic valve usually distinct. Shell subequilateral, dorsal margin not having a distinctly shouldered appearance, slope from umbo steep; anterior margin well rounded, bluntly pointed, the fore extremity lying at about the middle of the shell

1) 光徳沼.

height; posterior margin gently rounded; ventral margin well rounded, smoothly and circularly. Umbones large, projected, roundish. Striae coarse, distinct, somewhat irregular. Cuticle gray yellowish brown, some specimens tinged with purple about the umbones; interior whitish or bluish white. Surface glossy. Teeth thick, stout, blunt. Teeth in the right valve;—cardinal large, Δ -shaped, the anterior part thin, and the posterior part thickened, end bifid; both inner anterior and posterior laterals well developed, stout; outer anterior lateral very small, low; outer posterior lateral small. Teeth in the left valve:—inner cardinal Δ -shaped, somewhat thickened; outer cardinal very thin, bent near the anterior end; both anterior and posterior laterals short, stout, blunt, elevated. Hinge very much thickened, greatly arched; the interior margin without any distinct angular portions, but greatly curved. Ligament pit short, somewhat wide. The animal, having two gill-laminae on each side, belongs to the subgenus *Eupisidium*.

Length 4.1 mm., height 3.6 mm., breadth 2.54 mm.; α 1.61, γ 1.14.

Localities—Tadeno-Umi¹⁾ near Nikkô, Totigi Ken (MIYADI), *Type*; Urumo-Ko, Etorohu-Zima (MIYADI); Rebun-Numa, Etorohu-Zima (MIYADI); Yanke-Numa, Etorohu-Zima (MIYADI); Tôro-Ko, Hokkaidô (UENO); Nemuro, Hokkaidô (KINOSITA); Akimoto-Ko, Hukusima Ken (MIYADI); Yuno-Ko, Totigi Ken (KAWAMURA); Simidu-Numa, Gunma Ken (MIYADI).

The mean value of α of five specimens is 1.6 and γ is 1.12.

This species may be easily distinguished from *P. (Eup.) cinereum* s. s., *cinereum lacustre*, and *cinereum nikkôense* by its distorted, oval outline, smaller value of α and γ (the value of γ is nearly equal to that of *nikkôense*), somewhat coarse striation, larger and more projected umbones, Δ -shaped inner cardinal of left valve, broader and more arched hinge, more thickened and stout teeth, etc. Further, the profile of this subspecies somewhat resembles *P. (Eup.) ponderosum* STELFOX, but may be easily distinguished by its greater value of α , more oval outline, thinner cardinal of right valve of which the posterior end is bifid, and the position of the anterior extremity which is situated nearly at the middle of the shell height, etc.

14 e. *Pisidium (Eupisidium) cinereum subinflatum* subsp. nov.
(Pl. XI, Fig. 20)

Shell somewhat resembles *cinereum inflatum*, but may be distinguished by its oval outline, greater value of γ (more depressed), less projected and more flattened umbones, triangulated inner cardinal of left valve, not divaricated and J-shaped cardinal of right valve, indistinct nepionic valve, finer and shallower striation, more gently and smoothly arched hinge. Cuticle gray or grayish yellow. Outer cardinal of left valve is characteristic, being thickened in the anterior part (the anterior part of this cardinal of most pisidian shells is thinner than the posterior part). The animal, having two gill-laminae on each side, belongs to the subgenus *Eupisidium*.

1) 蓼ノ海.

Length 3.92 mm., height 3.32 mm., breadth 2.39 mm.; α 1.64, γ 1.18.

Localities—Siritori¹⁾, Karahuto (YOSIKURA), *Type*; Oze-Numa (Gunma Ken, HIRAOKA).

The mean value of α of four specimens is 1.63 and γ is 1.19. The specimens from Oze-Numa somewhat differ from those of the type locality, being more inflated in the marginal part.

This subspecies may be easily distinguished from *P. (Eup.) cinereum* s. s. and *cinereum lacustre* by its smaller value of α and γ , larger umbones, J-shaped cardinal of right valve, characteristic outer cardinal of left valve, etc.; and from *cinereum nikkōense* by its smaller value of α , greater value of γ , characteristic outer cardinal of left valve, larger umbones, etc.

15. *Pisidium conventus akkesiense* subsp. nov.

(Pl. XI, Fig. 18 a-d)

Shell small (length generally under 2.7 mm.), distorted, angulated oval, very thin, fragile, and laterally compressed. Nepionic valve indistinct. Dorsal margin distinctly shouldered, anterior slope smooth, but posterior steep; anterior margin well rounded, the fore extremity lying at about the middle of the shell height, posterior margin almost vertically truncated, postero-dorsal margin with an obtuse angle; ventral margin gently rounded. Umbones flat, very small, scarcely projected over the dorsal margin, without appendiculae. Striae fine and irregular. Cuticle light yellowish brown. Surface glossy. Teeth thin and weak. Teeth in the right valve:—cardinal gently curved, thin, the posterior end thickened, bifid; lateral teeth thin and weak. Teeth in the left valve:—inner cardinal small, slightly bent, somewhat thickened; outer cardinal thin, bent; anterior lateral somewhat stout, elevated; posterior lateral elevated. Hinge gently arched, thinner in the middle part than in the anterior and posterior parts; the interior outline somewhat smoothly arched, without any conspicuous angular portions. Ligament pit short but wide. Anatomy of the animal is not known.

Length 2.66 mm., height 2.24 mm., breadth 1.27 mm.; α 2.09, γ 1.19.

Locality—Akkesi²⁾, Hokkaidō (Y. HIRASE), *Type*.

European *P. conventus* CLESSIN³⁾ belongs to ODHNER's subgenus *Neopisidium*, having only one gill-lamina on each side; but the specimens in my hand are dried and unfortunately it is impossible to determine whether they belong to the subgenus *Eupisidium* or *Neopisidium*; yet the general characteristics of the shell agree with those of European species, except the greater value of γ (viz. the value of γ of *conventus* s. s. is 1.13) and somewhat wider, longer posterior part of the shell. Also, this subspecies may be distinguished from *P. (Eup.) nitidum* JENYNS by the situation of the fore extremity, greater value of α , less projected, smaller and more flattened umbones, and absence of distinct grooves around the umbones.

1) 知取.

2) 厚岸.

3) 1877: *P. conventus*, CLESSIN, Malak. Blätt., Bd. 24, S. 181, T. 3, fig. 5.

16. *Pisidium* (*Eupisidium*) *japonicum* PILSBRY et HIRASE
(Pl. X, Fig. 17)

1908: *Pisidium japonicum*, PILSBRY et HIRASE, Proc. Acad. Nat. Sci. Phila., Vol. 60, p. 35, fig. 1.

Shell very small, length not over 2.5 mm., very tumid (α is 1.26-1.36), subglobose, rounded oval (γ is 1.05-1.16), somewhat fragile (but some specimens moderately stout). Nepionic valve not conspicuous. Dorsal margin not shouldered, subequilateral; the fore extremity of the shell lies somewhat below the middle of the shell height; both ends smoothly rounded, the posterior shorter; ventral margin smoothly arcuate. Umbones large, very wide, moderately projected, roundish, without appendiculae. Striae somewhat fine, irregular. Cuticle gray yellowish brown or light yellow. Surface glossy. Teeth moderately stout. Teeth in the right valve:—cardinal thin, gently and smoothly arcuate; both inner anterior and posterior laterals ordinary; outer anterior lateral often obsolete; outer posterior lateral very small, low. Teeth in the left valve:—inner cardinal small, triangular in outline, connected with anterior lateral by a low ridge; outer cardinal thin, straight, the anterior part somewhat thickened; both anterior and posterior laterals well developed. Hinge arched, the interior margin bent obtusely behind the cardinals. Ligament pit small. The animal, having two gill-laminae on each side, belongs to the subgenus *Eupisidium*.

Length 2.37 mm., height 2.16 mm., breadth 1.87 mm.; α 1.26, γ 1.09.

Localities—Akkesi, Hokkaidô (Y. HIRASE), *Type*; Sigino-Su Daira, Paramusiru-Zima (MIYADI); Kussyaro-Ko, Hokkaidô (MIYADI); A small drain at Ôtu-Si, Siga Ken (KURODA).

This *Pisidium* was the first species described from Japan, and yet is one of the smallest ones of this genus in Japan.

This species somewhat resembles European *P. (Eup.) obtusale* PFEIFFER¹⁾, but may be easily distinguished by its greater value of α (viz. the mean value of *obtusale* is 1.19), more globose outline, larger and less projected umbones, etc. Only one specimen was collected from Ôtu-Si and it has generally the same characters as those of the bivalves from Northern Japan, except the shell is more compressed (the value of α is 1.53).

17. *Pisidium* (*Neopisidium*) *parvum* sp. nov.
(Pl. XI, Fig. 21)

Shell very small, length not over 2.3 mm., moderately compressed, subtrapezoid [outline somewhat resembles European *P. (Neop.) moitessierianum* PALADILHE.²⁾]. Shell thin, fragile; Nepionic valve not distinct. Dorsal margin

1) 1821: *P. obtusale*, PFEIFFER, Naturgesch. Deutsch. Mollusken, I, S. 125, T. 5, figs. 21, 22.

2) 1866: *P. moitessierianum*, PALADILHE, Rev. & Mag. Zool., sér. II, tom. xviii, p. 172, Pl. xiii, figs. 11-17.

distinctly shouldered, sloping steeply on both sides of the umbo (steeper on the hind side); anterior margin well rounded, bluntly pointed, the fore extremity lying below the middle of the shell height; posterior margin truncated; ventral margin smoothly and regularly rounded. Umbones moderately small, flat, projection not conspicuous. Surface characterized by coarse but very regularly spaced and distinct striations. Cuticle light yellowish white, interior whitish. Teeth thin, but elevated. Teeth in the right valve:—cardinal thin, well elevated, nearly straight, somewhat large; inner anterior lateral well developed; inner posterior lateral thin, nearly straight; outer posterior lateral well developed, thin, nearly straight. Teeth in the left valve:—both cardinals thin, straight, moderately elevated, situated nearly parallel to each other; anterior lateral well developed, large; posterior lateral ordinary. Hinge arched, very thick at about the anterior and posterior lateral teeth and thin at the middle part, so that cardinal of right valve and inner cardinal of left valve are projected towards the inside of the shell. Ligament pit wide, but short, O-shaped. The animal, having only one gill-lamina on each side, belongs to the subgenus *Neopisidium*.

Length 2.24 mm., height 1.9 mm., breadth 1.25 mm.; α 1.79, γ 1.18.

Localities—Unagi-Ike¹⁾, Kagosima Ken (collector unknown), *Type*; Ikeda-Ko, Kagosima Ken (UÉNO).

This species somewhat resembles *P. conventus akkesiense*, but may be distinguished from it by its smaller and more compressed shell (the value of α is smaller), coarse and very regular striation. In outline this species also resembles European *P. (Neop.) moitessierianum* PALADILHE, but it may be distinguished by its larger shell (viz. *moitessierianum* grows not over 2 mm. in length), greater value of α and γ (viz. the value of α of *moitessierianum* is 1.5 and γ is 1.11), coarse and very regular striation, and umbones without appendiculae.

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1) 鯉池.

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Explanation of Plates

Plate VII

- Fig. 1a *Pisidium baicalense complanatum* LINDHOLM. Syana-Numa. L. 7.5 mm., H. 6 mm., B. 3.75 mm.
- b *P. baicalense etorohuense* MORI. Tôro-Numa. Type. L. 8 mm., H. 6.8 mm., B. 4.1 mm.
- Fig. 2 *P. (Eupisidium) kawamurai* sp. nov. Biwa-Ko. Type. L. 7.2 mm., H. 5.9 mm., B. 3.5 mm. a—side view, b—dorsal view, c—rear view, d—hinge.
- Fig. 3 *P. kawamurai hukuiense* subsp. nov. Kairu. Type. L. 7.3 mm., H. 6.4 mm., B. 4.3 mm. a—side view, b—dorsal view, c—rear view, d—hinge.
- Fig. 4 *P. (Eup.) kurodai* sp. nov. Tôro-Numa. Type. L. 4.2 mm., H. 3.8 mm., B. 3 mm. a—side view, b—dorsal view, c—rear view, d—hinge.

Plate VIII

- Fig. 5 *P. amnicum nipponense* (HIRASE MS) sp. nov. Atumi. Type. L. 5.7 mm., H. 4.65 mm., B. 4.45 mm. a—side view, b—dorsal view, c—rear view, d—hinge.
- Fig. 6 *P. (Eup.) nitidum* JENYNS. Tôro-Ko. L. 3.31 mm., H. 2.77 mm., B. 1.94 mm. a—side view, b—dorsal view, c—rear view, d—hinge.
- Fig. 7 *P. (Eup.) uejii* (KURODA MS) sp. nov. Ôsimidu. Type. L. 3.1 mm., H. 2.8 mm., B. 2 mm. a—side view, b—dorsal view, c—rear view, d—hinge and viscera (aa and pa—adductor muscles, es—embryonic shell, ft—foot, ig—inner gill-lamina, og—outer gill-lamina, k—kidney).
- Fig. 8 *P. (Eup.) uenoi* sp. nov. Yanke-Numa. Type. L. 4.3 mm., H. 4.2 mm., B. 3 mm.
- a-d full grown shell. a—side view, b—dorsal view, c—rear view, d—hinge.
e-f normal adult shell. e—side view, f—hinge.

Plate IX

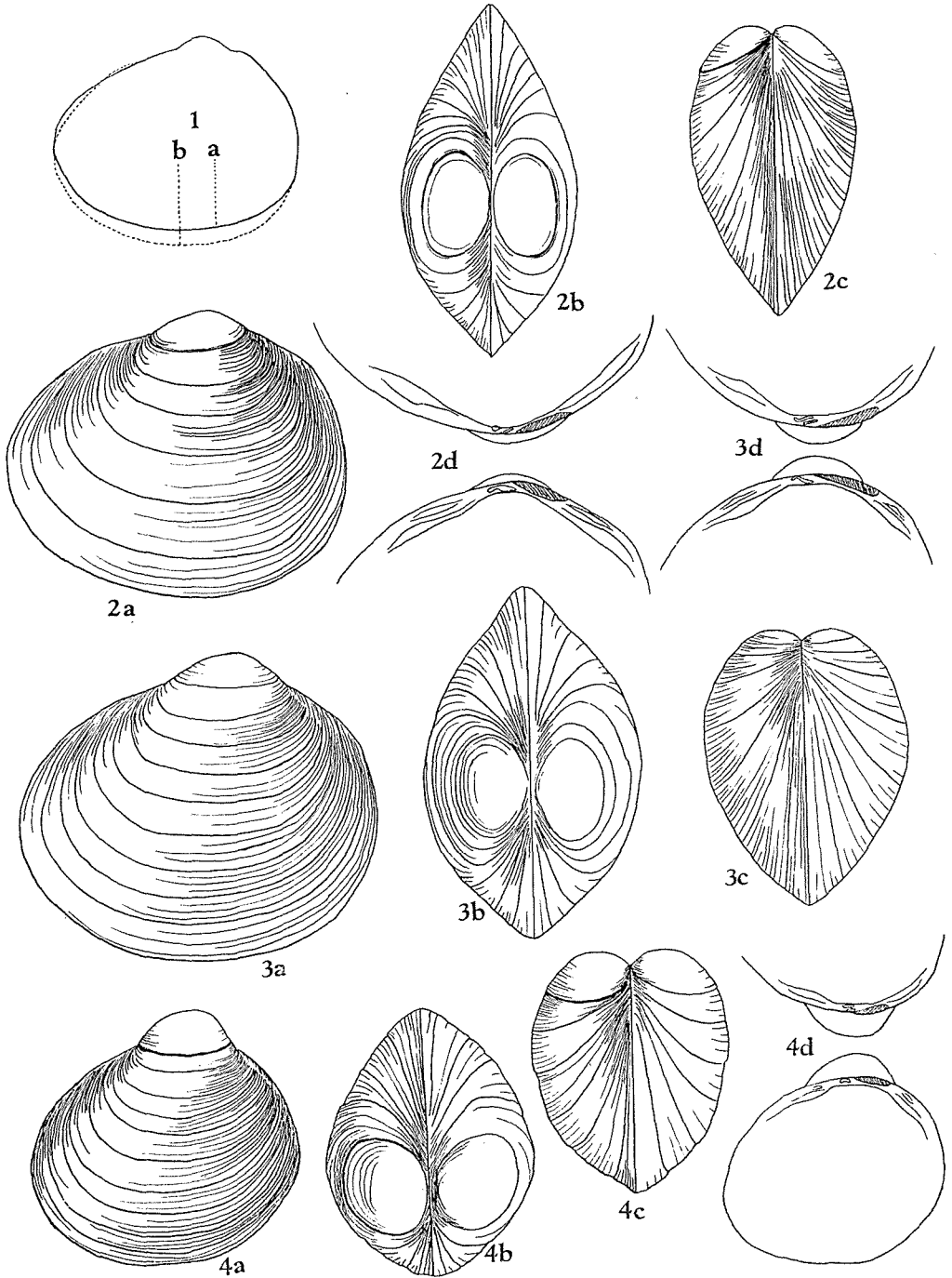
- Fig. 8g *P. (Eup.) uénoi* sp. nov. Abnormal full grown shell.
- Fig. 9 *P. (Eup.) ponderosum* STELFOX. Sibetori-Gawa. L. 4.25 mm., H. 3.86 mm., B. 2.81 mm. a—side view, b—dorsal view, c—rear view, d—hinge.
- Fig. 10 *P. (Eup.) humeriforme* STELFOX. Urumo-Ko. L. 3.42 mm., H. 3.08 mm., B. 2.03 mm. a—side view, b—dorsal view, c—rear view, d—hinge.
- Fig. 11a-d *P. pulchellum kunasiriense* subsp. nov. Tôhutu-Ko. Type. L. 3.12 mm., H. 2.78 mm., B. 2.24 mm. a—side view, b—dorsal view, c—rear view, d—hinge.
- e *P. pulchellum* JENYNS. Etorohu-Zima. Rear view. L. 4.03 mm., H. 3.5 mm., B. 2.66 mm.
- Fig. 12 *P. (Eup.) subtruncatum altum* subsp. nov. Akan-Ko. Type. L. 3.64 mm., H. 3.03 mm., B. 2.32 mm. a—side view, b—dorsal view, c—rear view, d—hinge.

Plate X

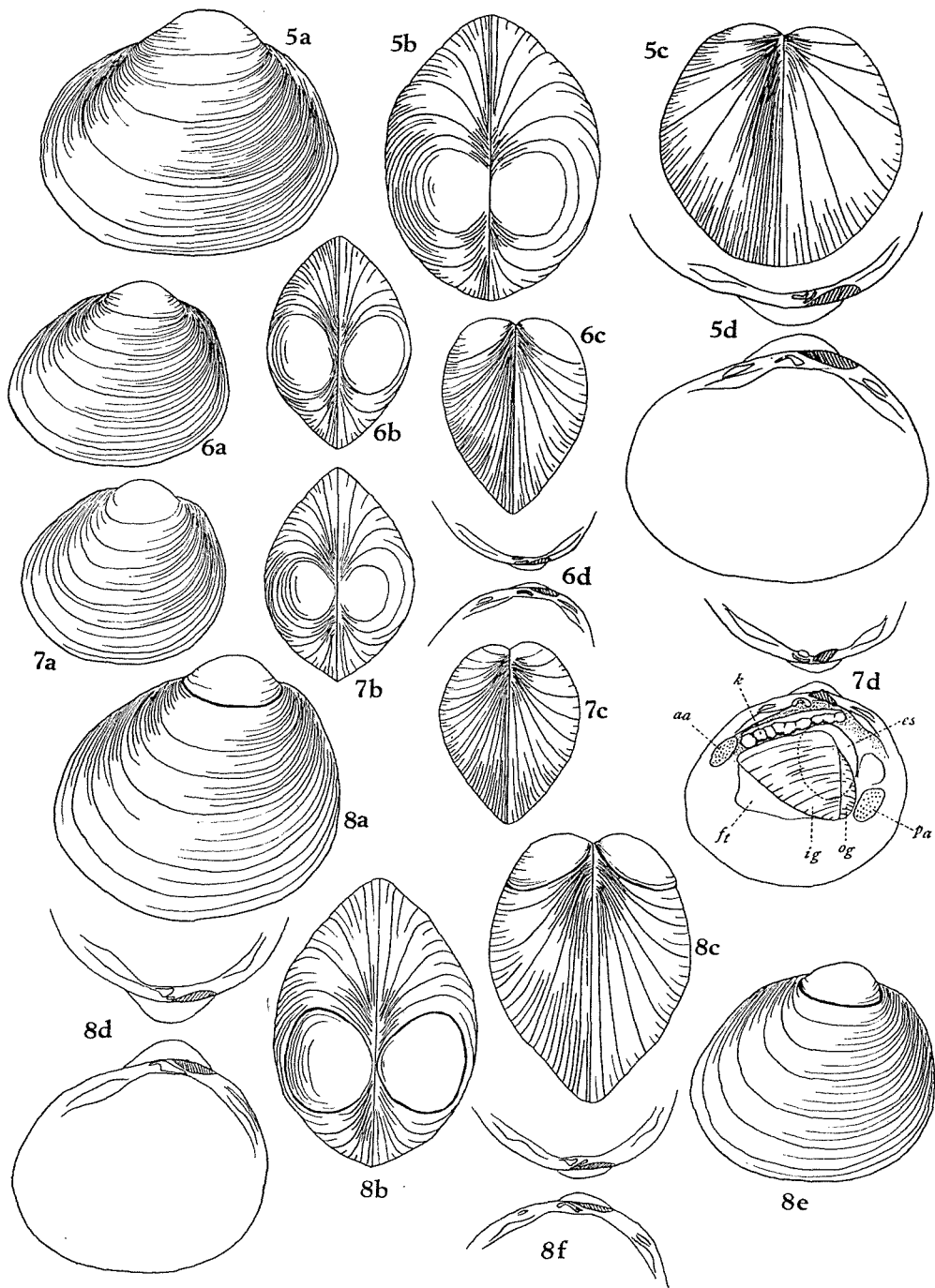
- Fig. 13 *P. ellipticum* sp. nov. Nôga-Ike. Type. L. 3.5 mm., H. 3 mm., B. 1.9 mm. a—side view, b—dorsal view, c—rear view, d—hinge.
- Fig. 14a-b *P. (Eup.) cinereum* ALDER. Akan-Ko. L. 4.2 mm., H. 3.4 mm., B. 2.31 mm. a—side view, b—hinge.
- c *P. (Eup.) cinereum nikkôense* subsp. nov.
- Fig. 15 *P. (Eup.) cinereum lacustre* WOODWARD. Biwa-Ko. L. 4.4 mm., H. 3.6 mm., B. 2.2 mm. a—side view, b—dorsal view, c—rear view, d—hinge.
- Fig. 16 *P. (Eup.) cinereum nikkôense* subsp. nov. Kôtoku-Numa. Type. L. 4 mm., H. 3.5 mm., B. 2.18 mm. a—side view, b—dorsal view, c—rear view, d—hinge.
- Fig. 17 *P. (Eup.) japonicum* PILSBRY et HIRASE. Siginosu-Daira. L. 2.37 mm., H. 2.16 mm., B. 1.87 mm. a—side view, b—dorsal view, c—rear view, d—hinge.

Plate XI

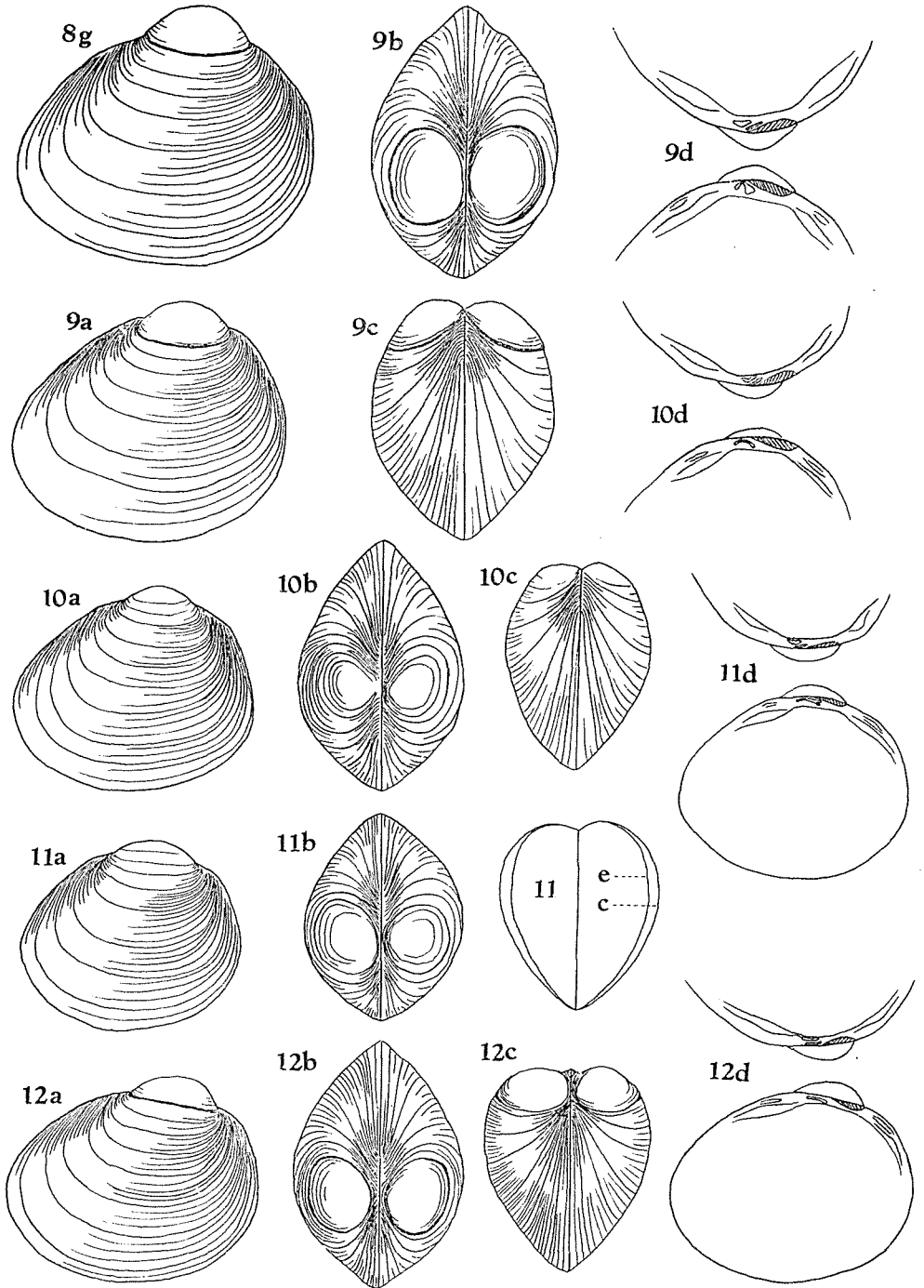
- Fig. 18a-d *P. conventus akkesiense* subsp. nov. Akkesi. Type. L. 2.66 mm., H. 2.24 mm., B. 1.27 mm. a—side view, b—dorsal view, c—rear view, d—hinge.
- e *P. conventus*, CLESSIN. Side view.
- Fig. 19 *P. (Eup.) cinereum inflatum* subsp. nov. Tadenou-Umi. Type. L. 4.1 mm., H. 3.6 mm., B. 2.54 mm. a—side view, b—dorsal view, c—rear view, d—hinge.
- Fig. 20 *P. (Eup.) cinereum subinflatum* subsp. nov. Siritori. Type. L. 3.92 mm., H. 3.32 mm., B. 2.39 mm. a—side view, b—dorsal view, c—rear view, d—hinge.
- Fig. 21 *P. (Neopisidium) parvum* sp. nov. Unagi-Ike. Type. L. 2.24 mm., H. 1.9 mm., B. 1.25 mm. a—side view, b—dorsal view, c—rear view, d—hinge and viscera (es—embryonic shell, ig—inner gill-lamina, ft—foot).
- Fig. 22 *P. (Neop.) cavernicum* MORI. Miyako-Zima. Type. L. 3 mm., H. 2.7 mm., B. 1.5 mm. a—side view, b—dorsal view, c—rear view, d—hinge and viscera (ft—foot, ig—inner gill-lamina, k—kidney).



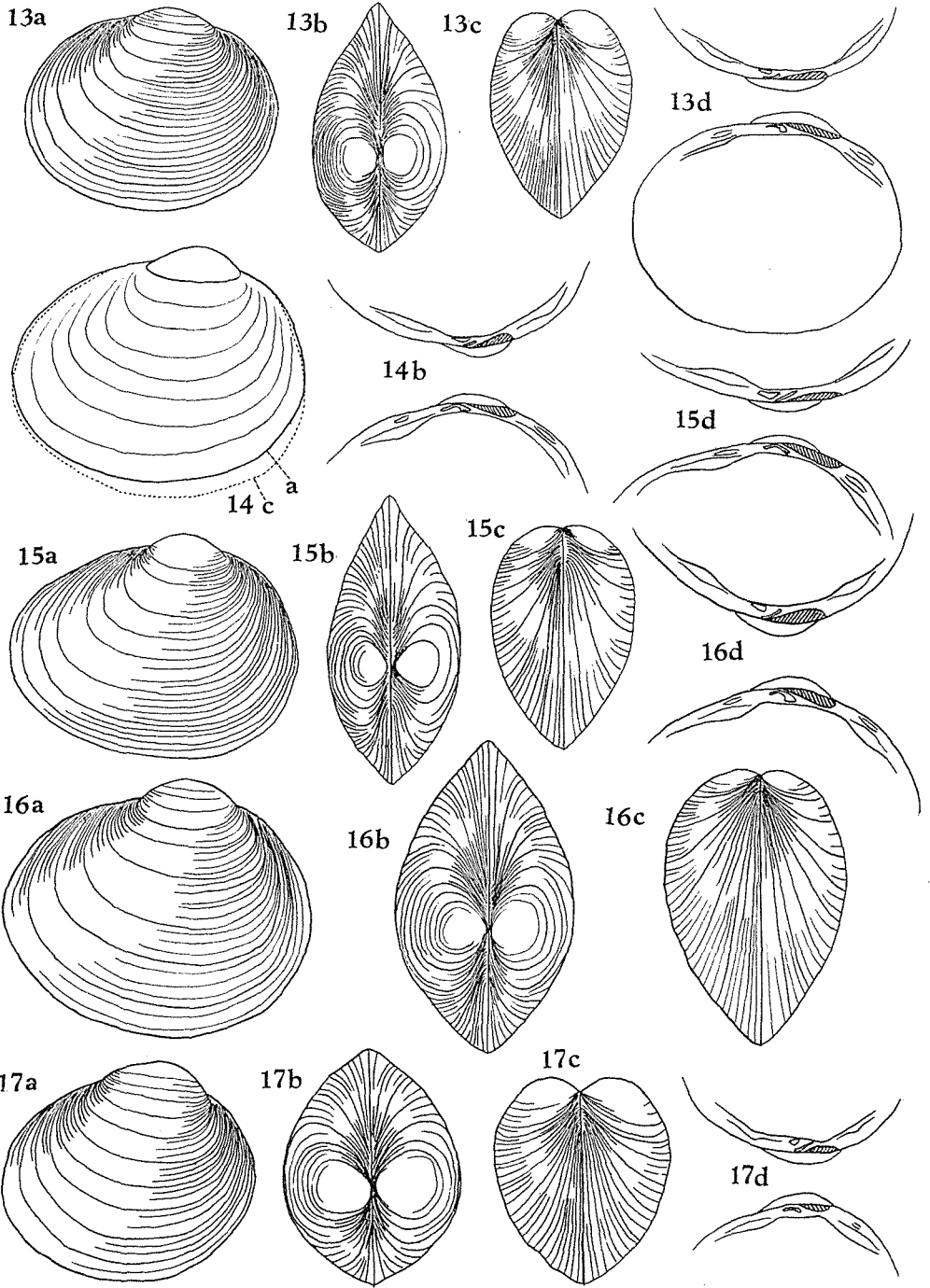
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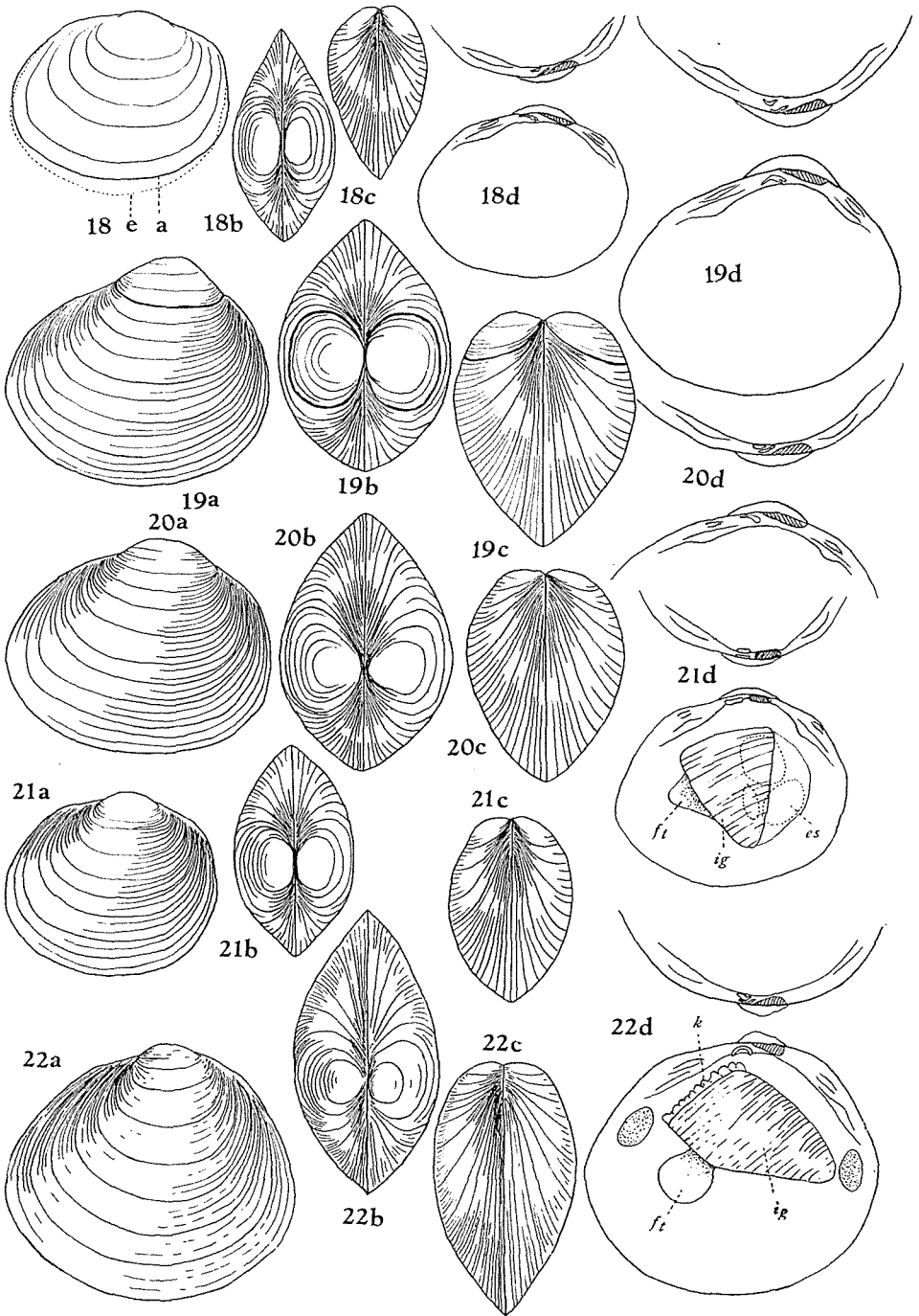
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