

The genus *Krithe* Brady, Crosskey & Robertson, 1874 (Crustacea: Ostracoda) in the Pliocene – Early Pleistocene of the M. San Nicola Section (Gela, Sicily)

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SUMMARY – The genus *Krithe* has been studied in the section of Monte S. Nicola (Sicily) represented by the top few meters of the Trubi and the overlying Monte Narbone Formations. The section represents the Pliocene from M Pl 3 up to the Early Pleistocene. Thirteen species of *Krithe* have been identified, 7 of which are described as new. The description and illustrations of the new species, the illustration and additional remarks on the previously known ones, and the distribution in the section of all the species is given.

RIASSUNTO – [Il genere *Krithe* Brady, Crosskey & Robertson, 1874 (Crustacea: Ostracoda) nel Pliocene – Pleistocene Inferiore della Sezione di M. San Nicola (Gela, Sicilia)] – Si è affrontato lo studio sistematico del genere *Krithe* nella sezione di M. San Nicola, rappresentata alla base da pochi metri della Formazione Trubi, dalla sovrastante Formazione Monte Narbone e da circa 35 m di sedimenti del Pleistocene Inferiore in continuità di sedimentazione. La base della sezione è attribuita a M Pl 3. Si sono identificate 13 specie di *Krithe* di cui 7 descritte come nuove: *Krithe anomala* n. sp., *Krithe exigua* n. sp., *Krithe frutex* n. sp., *Krithe iniqua* n. sp., *Krithe marialuisae* n. sp., *Krithe parvipora* n. sp., *Krithe perpulchra* n. sp. Oltre alla descrizione e illustrazione delle specie nuove ed all'illustrazione delle specie note, di tutte viene fornita la distribuzione nell'ambito della sezione.

INTRODUCTION

The genus *Krithe* Brady, Crosskey & Robertson, 1874, (new name for *Ilyobates*, preoccupied by *Ilyobates* Kraatz, 1858 - Insecta), is based on the type-species *Krithe praetexta* (Sars, 1866).

The genus (*Podocopida* - *Krithidae*) is characterized by valves with the anterior broadly rounded, posterior obliquely truncated, dorsal margin from convex to nearly straight, ventral margin faintly concave. Surface of the valves smooth and carapaces from thick to thin-shelled. Inner lamella wide anteriorly forming a vestibule of varying shape and size and narrower posteriorly.

Hinge simple, eye spot absent, marginal pore-canals relatively numerous sometimes branching, normal pore-canal sieve-type and central muscle-scars arranged in a vertical row of 4 generally with the upper one U-shaped, and an anterior scar kidney or heart-shaped or subdivided into 2 scars. Sexual dimorphism and asymmetry of the RV and LV generally pronounced.

The valves show at the posterior extremity a peculiar «indentation» which is absent in the allied genus *Parakrithe* van den Bold, 1958. Another previously accepted difference between the two genera (Van Morkhoven, 1963), namely the absence of an anterior vestibule in the genus *Parakrithe*, after

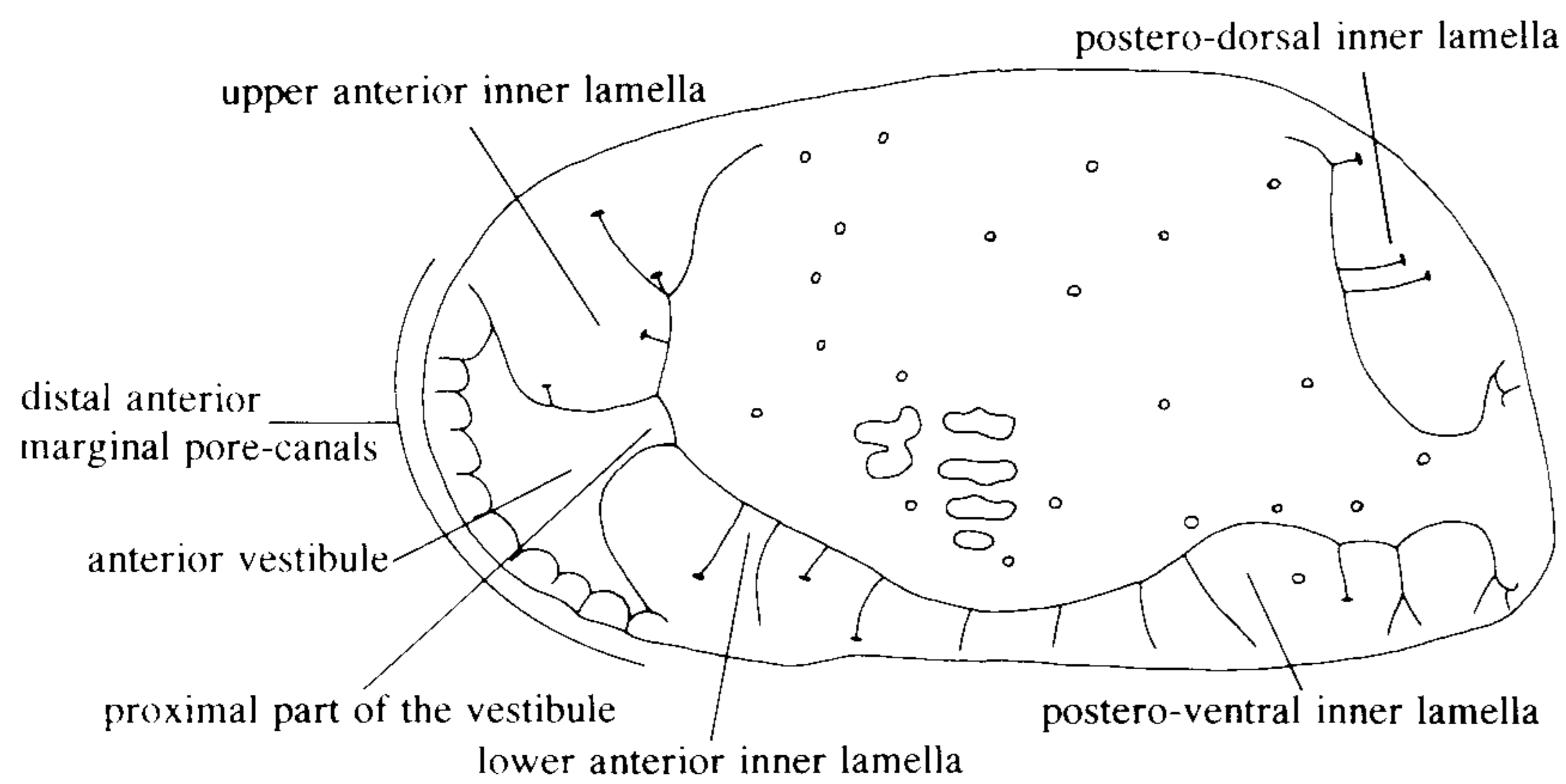
the finding of some species of *Parakrithe* showing the presence of this feature, e. g. *Parakrithe ariminen-sis* (Ruggieri, 1967), has to be considered not diagnostic.

For a detailed study of the *Krithe* species we introduce a terminology close to that of Peypouquet (1975) to define the different parts especially for the inner lamella and type of vestibule. Text-fig. 1 shows a schematic transparency drawing for a better understanding.

DIAGNOSTIC SPECIFIC CHARACTERS

After a careful examination of the populations of all the species of *Krithe* found we defined the characters considered stable within each species. They are the following:

- 1 - Shape and L/H ratio within the same sex.
- 2 - Number of the anterior marginal pore-canals departing from the vestibule.
- 3 - General shape of the anterior vestibule.
- 4 - Sexual dimorphism.
- 5 - Thickness of the valves.
- 6 - Running of the ventral lamella
- 7 - Running and position of the marginal pore-canals (in most of the species).
- 8 - Shape of the postero-dorsal inner lamella.



Text-fig. 1 - Schematic drawing of a *Krithe* with the utilized terminology.

9 - Marginal pore-canals of the postero-dorsal inner lamella.

The characters which appear variable are the following:

- 1 - Size of the valves up to about 15% (within the same sex).
- 2 - Development of the vestibule's surface.
- 3 - Length of the false marginal pore-canals.
- 4 - Development of the anterior inner lamella at the boundary between its inner margin and the line of concrescence at the upper and lower extremities.
- 5 - Running of the anterior inner lamella.

The character of uncertain diagnostic value is the following:

- 1 - Marginal pore-canals bifurcating or separated into 2 independent pores.

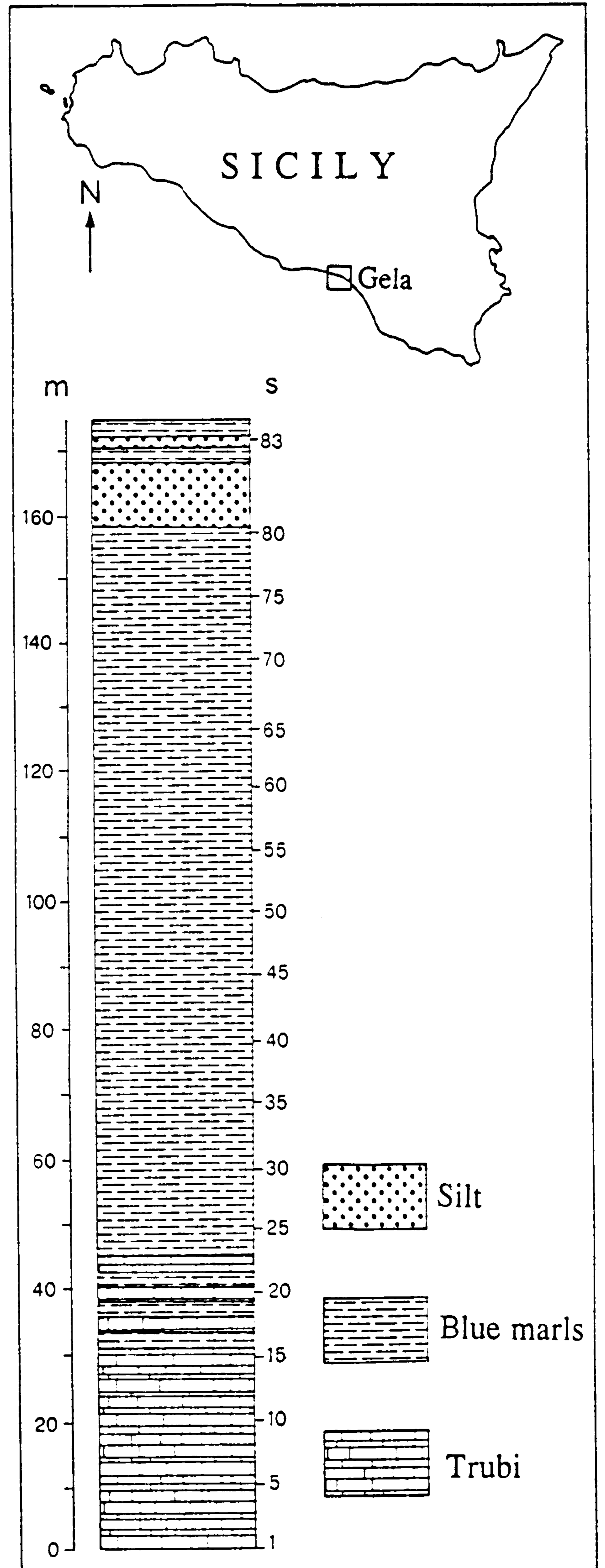
MATERIAL AND METHODS

For the present study 83 samples collected along the M. San Nicola Section (Gela, Sicily) have been used. The section shows at the base a few meters of the Trubi and continues with the Monte Narbone Formations and ends at the top with the Early Pleistocene (Text-fig. 2). Text-figure 3 shows the sampling location, the lithostratigraphy, the biostratigraphy obtained by the use of the planktonic Foraminifera (Sprovieri *in* Bonaduce & Sprovieri, 1985) and the distribution of all the taxa of *Krithe* in the section.

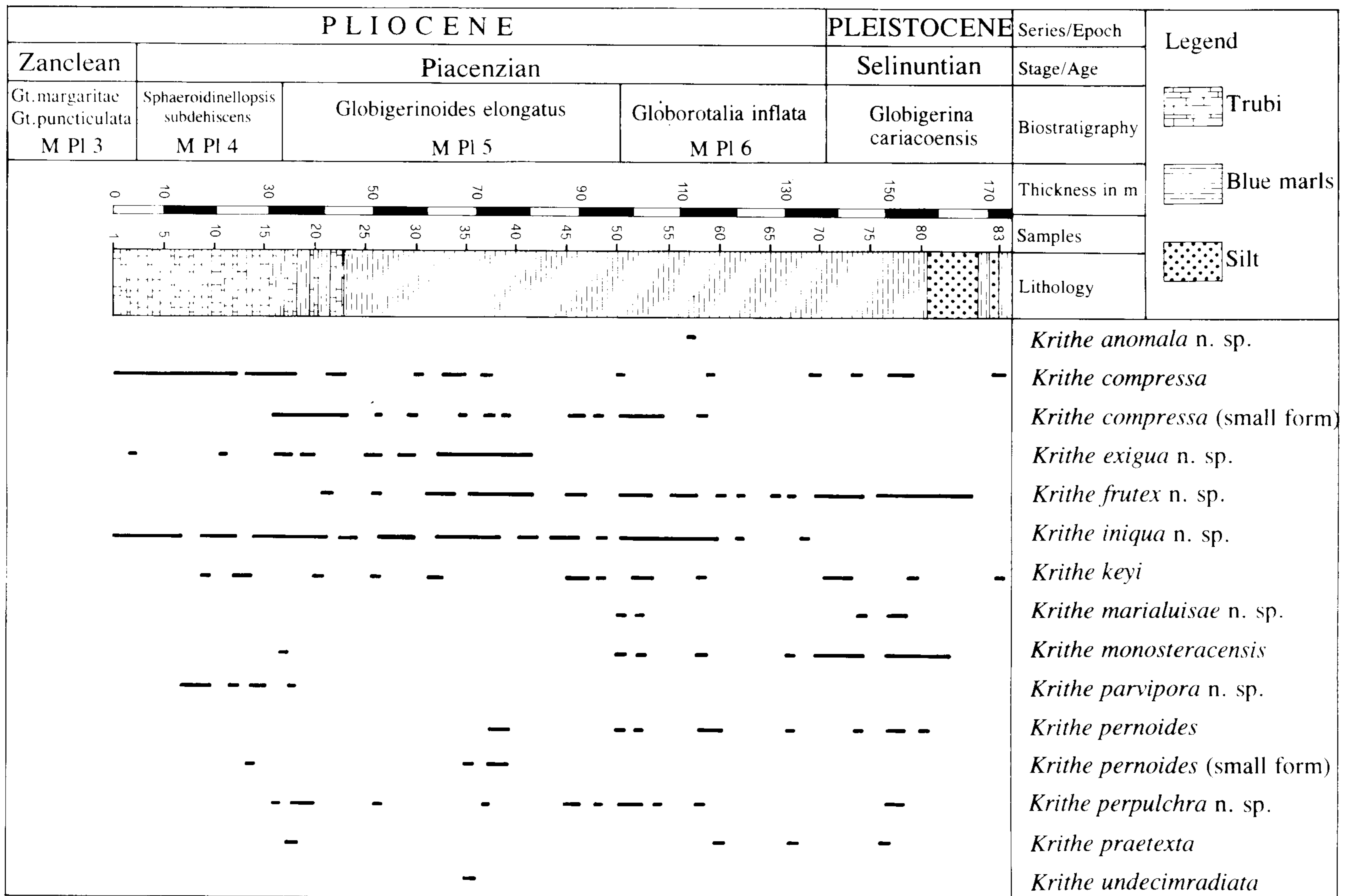
All the specimens figured are stored in the Bonaduce Ostracode Collection (B.O.C.), Department of Paleontology, University of Naples.

SYSTEMATICS

The literature related to the genus *Krithe* is relatively poor as far as the Mediterranean Basin is



Text-fig. 2 - Lithostratigraphy of the Monte San Nicola Section (m = meters; s = samples).

Text-fig. 3 - Monte San Nicola Section: Lithostratigraphy, biostratigraphy and distribution of the *Krithe* species.

concerned. Moreover part of the literature cannot be taken into consideration because of the incomplete descriptions mostly due to the bad preservation of the material (e.g. Oertli, 1961) which does not allow for the necessary information on the internal characters, and sometimes to the insufficiently detailed illustrations. The last problem is related with the difficulty in obtaining original or topotypic material for most of the species previously described. We consequently decided to describe as new all the species of uncertain identification, with the future risk of falling into synonymy, a risk of which we are perfectly conscious.

For the time being, the valuable paper of Pokorný (1980) on the *Krithe* of the Paleogene of the Southern Moravia is not taken into consideration because of the quite different ages dealt with also if some species appear close to part of those illustrated in the present paper.

We consider anyway that the illustrations will be of help also for the previously described and illustrated species. The illustration of different specimens of each species is intended to show the

range of variability in each sex especially as far as the anterior vestibule is concerned.

KRITHE PRAETEXTA (Sars, 1866)

Pl. 1, figs. 1-7; Pl. 6, fig. 3

1866 *Ilyobates praetexta* Sars, pp. 60-61.

1928 *Krithe bartonensis* (Jones) - Sars, pp. 165-166, pl. 76.

1941 *Krithe bartonensis* (Jones) - ELOFSON, p. 44.

1975 *Krithe* aff. *praetexta* (Sars, 1866) - RUGGIERI, pp. 436-438, fig. 9.

1976 *Krithe* aff. *K. praetexta* (Sars) - BONADUCE, CIAMPO & MASOLI, p. 67, text-fig. 31.

1982 *Krithe praetexta* (Sars) - ATHERSUCH, pp. 242-243, pl. 7, fig. 6; pl. 8, figs. 5-8.

1989 *Krithe praetexta* (Sars) - ATHERSUCH, HORNE & WHITTAKER, p. 130, text-fig. 51; pl. 3, fig. 9.

Remarks - This species has been originally described but not figured from the Recent of Norway. From the description it is impossible to define its internal characters especially as far as the vestibule and the anterior marginal pore-canals are concerned. The same A. (1928) redescribes and illustrates the species from topotypic material con-

sidering it a junior synonym of *K. bartonensis* (Jones, 1857) described from the Eocene of the «Barton clays» of Barton. Keij (1957), who had at disposal eocenic topotypic material of *K. bartonensis* redescribes and illustrates the species. From a comparison of his drawings and those of the Recent form figured by Sars (1928), *K. praetexta* differs from *K. bartonensis* in the higher L/H ratio, in the less developed vestibule especially antero-dorsally, its different shape, in the more arched dorsal margin and the posterior being generally less truncated. Van den Bold (1946; 1963) believes that *K. bartonensis* has to be considered a different species from *K. praetexta*. Ruggieri (1975) in his study on the Quaternary ostracode fauna of Imola (Italy) attributes a form to *K. aff. K. praetexta* and points out that *K. praetexta* and *K. bartonensis* have to be considered different species. Moreover this A. suggests the possibility that *K. praetexta* from the Recent of the North Sea could be considered slightly different from his Mediterranean *K. aff. praetexta*. After a careful examination of the illustrations of Keij (1957), of Sars (1928) and of Ruggieri (1975), we agree with Van den Bold and Ruggieri in considering both species valid. We had also the occasion to examine the material of Elofson (gift to G. Bonaduce in 1963) from Recent sediments of the North Sea, material which is considered topotypic of *K. praetexta*. The related drawings (Pl. 1, figs. 1-8) show that the forms of the North Sea and of the Mediterranean are almost identical. The length of the North Sea form of Elofson and that of the Mediterranean one of Ruggieri (0.77 mm and 0.78 mm respectively) and their L/H ratio agree almost perfectly. Consequently in our opinion the two forms cannot be split into different subspecies or even varieties.

Level of the figured specimens – M Pl 5, Stn. 35, Stn. 39; M Pl 6, Stn. 67; Early Pleistocene, Stn. 76, Stn. 77.

Size (in mm) – LV ♀: L = 0.83; H = 0.46 (Pl. 1, fig. 5).
LV ♂: L = 0.81; H = 0.38 (Pl. 1, fig. 7).

Variability – The variability of the shape of the anterior vestibule is almost absent. Very reduced differences in the development of the upper and lower inner lamella have been observed. We found a single relatively large specimen (Pl. 3, fig. 10) at the Stn. 76 (Early Pleistocene) which differs in the presence of longer distal anterior marginal pore-canals within the vestibule. The related sizes are the following: LV: L = 0.88 mm; H = 0.46 mm (Pl. 3, fig. 10).

Distribution – This species, cited from the Early Quaternary up to Recent, occurs in our section from the base of M Pl 5 to the top (Early Pleistocene) with scattered presence.

KRITHE ANOMALA n. sp.
Pl. 4, fig. 12

Etymology – From latin *anomalus* = anomalous.

Holotype – RV (Pl. 4, fig. 12). Stn. 57. B.O.C. 2025.

Type-level – M Pl 6.

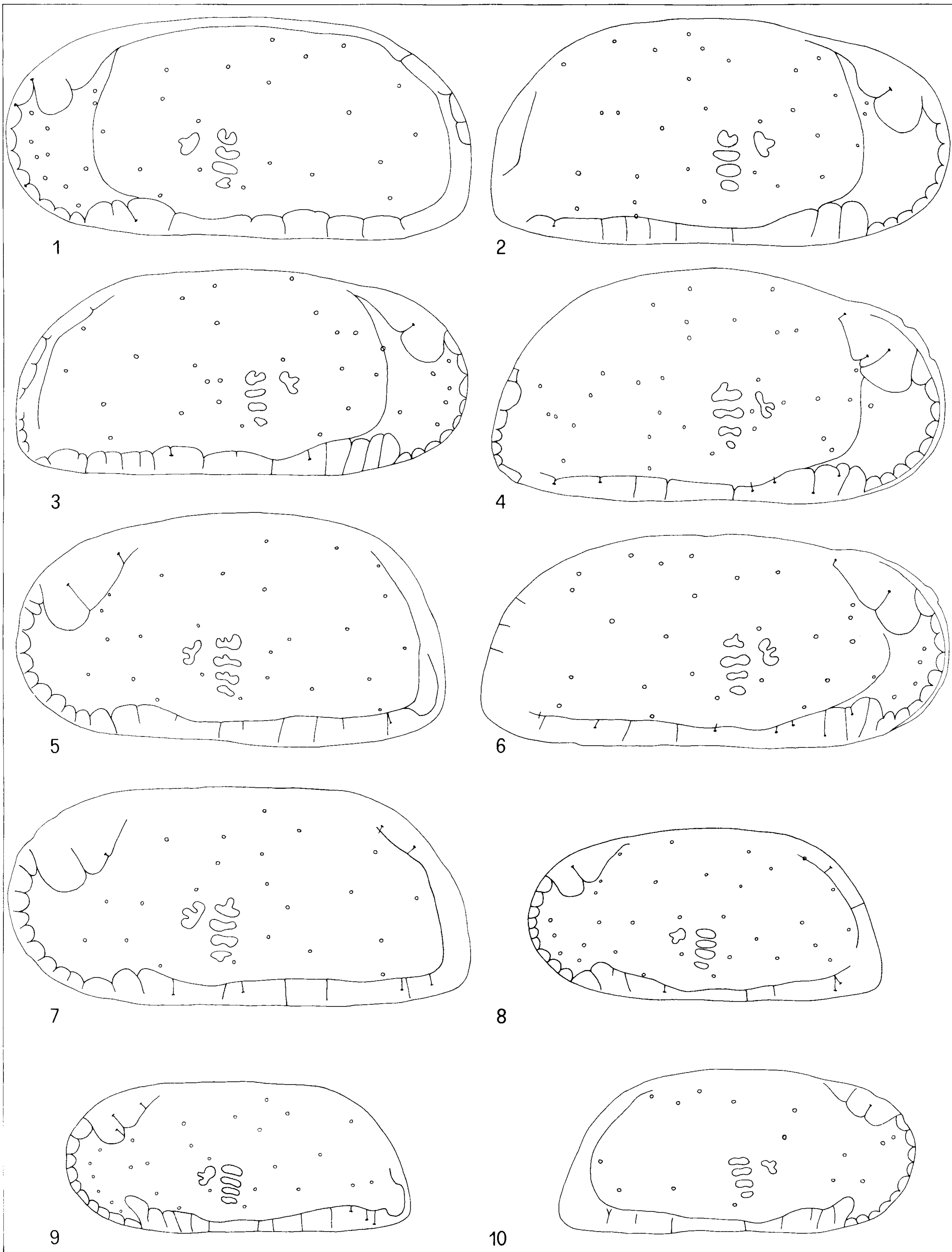
Diagnosis – This species is characterized by the very elongated shape in lateral view, the dorsal and ventral margins slightly converging backwards and the acuminate posterior extremity. Maximum height anterior. Anterior inner lamella poorly developed and anterior vestibule regularly arched and very reduced.

Description – The description is based on the single specimen found. In lateral view valve subtriangular elongated with dorsal and ventral margins gently converging backwards. Extremity acuminate. Inner lamella narrow and parallel to the anterior margin. Presence of a narrow semilunar vestibule. The inner lamella is ventrally very narrow and parallel to the margin. Two short marginal pore-canals occur in the highest part of the anterior inner lamella and 11 in the area confined by the vestibule. In the same area 4 false marginal pore-canals occur mostly bifurcating from the regular ones.

EXPLANATION OF PLATE 1

- Figs 1-7 - *Krithe praetexta* (Sars). 1) LV ♂, North Sea, Coll. Elofson, B.O.C. 2004a; 2) RV ♀, North Sea, Coll. Elofson, B.O.C. 2004b; 3) RV ♂, North Sea, Coll. Elofson, B.O.C. 2004c; 4) RV ♀, Stn. 76. B.O.C. 2005; 5) LV ♀, Stn. 67, B.O.C. 2006; 6) RV ♀, Stn. 76, B.O.C. 2005; 7) LV ♂, Stn. 67, B.O.C. 2006.
Figs. 8-10 - *Krithe exigua* n. sp. 8) Holotype LV ♀, Stn. 39, B.O.C. 2007; 9) Paratype LV ♂, Stn. 39 B.O.C. 2073; 10) Hypotypes RV ♀, Stn. 35, B.O.C. 2008.

All magnifications x 100. The transparence drawings done by Visopan Reichert. RV = right valve; LV = left valve; CC = complete carapace.



Size (in mm) – RV: L = 0.64; H = 0.25 (Pl. 4, fig. 12).

Affinities – This species in lateral view is vaguely similar in shape to *Krithe compressa* (Seguenza) but the very narrow and reduced vestibule seems to us sufficient to erect a new species.

Distribution – This rare species occurs only in one sample, 10 m above the boundary M Pl 5 - M Pl 6.

KRITHE COMPRESSA (Seguenza, 1880)
Pl. 3, figs. 1-5; Pl. 6, figs. 6-8

- 1880 *Ilyobates compressa* SEGUENZA, p. 325, pl. 17, figs. 30, 30 a.
1986 *Krithe aequabilis* CIAMPO, p. 87, pl. 17, figs. 1, 2.
1991 *Krithe compressa* (Seguenza) - RUGGIERI, pp. 60, 61, figs. 5-7.

Remarks – This species has been redescribed and carefully illustrated by Ruggieri (1991) from topotypic material of the Early Pleistocene of Monasterace (Calabria, Southern Italy). Ciampo (1986) reports it (as *K. aequabilis* n. sp.) from the Tortonian – Messinian boundary of different Italian Sections. Our specimens show generally the upper part of the line of concrescence more feebly arched in the female and more developed and arched in the male. In both sexes the vestibule appears wider. We suspect that the observed differences are related to ecological factors (see Peypouquet, 1975). Moreover our specimens appear relatively smaller than those figured by Ruggieri (L ♀ = 0.77 - 0.83 mm). The previous observations could suggest a relatively higher temperature (smaller size) and a reduced O₂ content (more developed vestibule).

EXPLANATION OF PLATE 2

- Figs. 1-5 - *Krithe marialuisae* n. sp. 1) Holotype, LV ♀, Stn. 74, B.O.C. 2009; 2) Paratype, RV ♀, B.O.C. 2012; 3) Paratype, LV ♂, B.O.C. 2010; 4) Paratype, RV ♂, B.O.C. 2010; 5) Paratype, RV ♂, B.O.C. 2010.
Figs. 6-12 - *Krithe pernoides* (Bornemann). 6) LV ♀, large form, Stn. 58, B.O.C. 2178; 7) LV ♂, large form, Stn. 37, B.O.C. 2032; 8) LV ♂, small form, Stn. 39, B.O.C. 2014; 9) LV ♀, small form, Stn. 39, B.O.C. 2033; 10) RV ♀, small form, Stn. 39, B.O.C. 2034; 11) RV ♀ small form with moved vestibular ventral pore-canal, Stn. 35; B.O.C. 2035; 12) RV ♂ large form with moved vestibular ventral pore-canal, Stn. 60, B.O.C. 2036.

All magnifications x 100. The transparence drawings done by Visopan Reichert. RV = right valve; LV = left valve; CC = complete carapace.

EXPLANATION OF PLATE 3

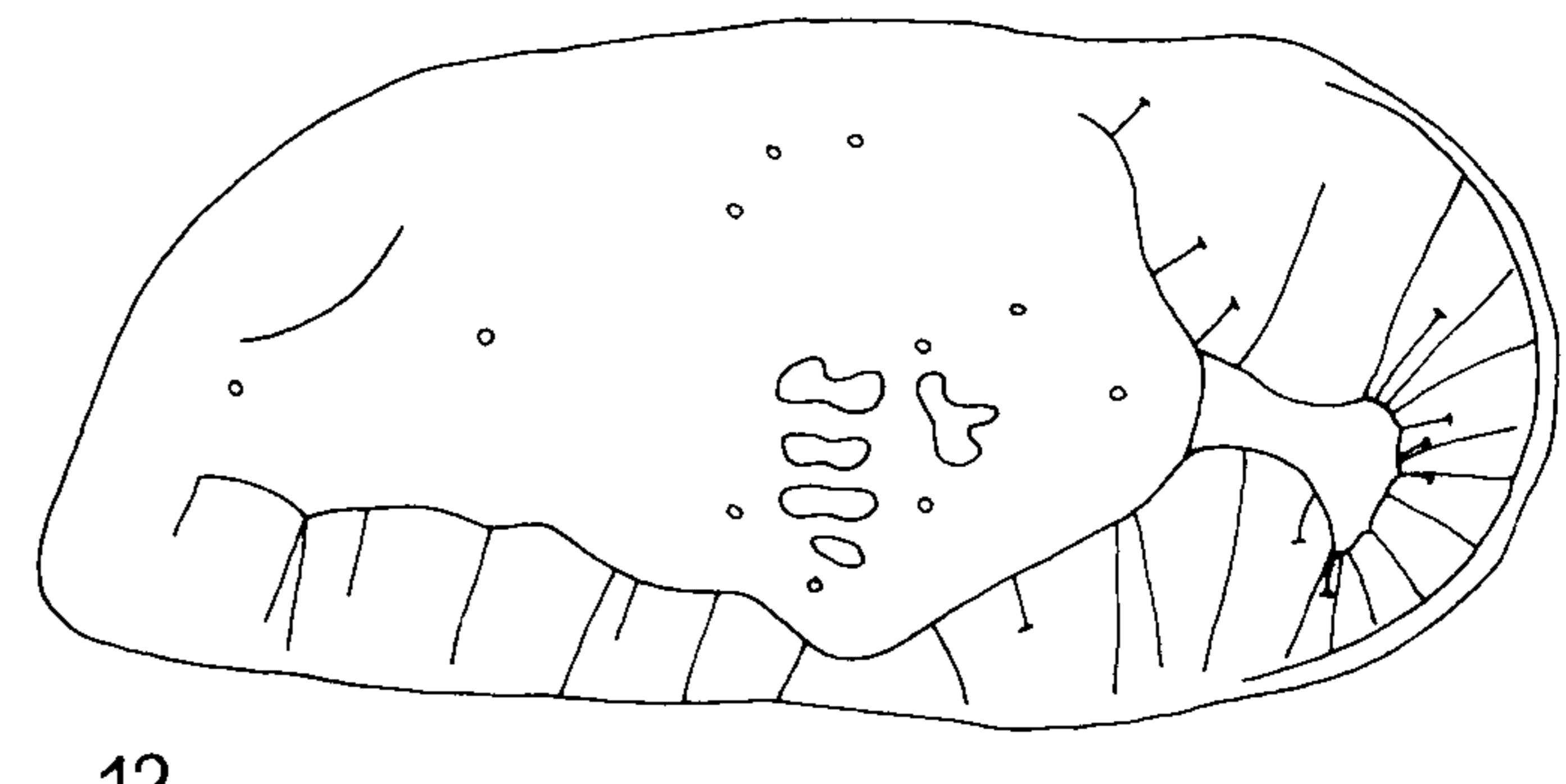
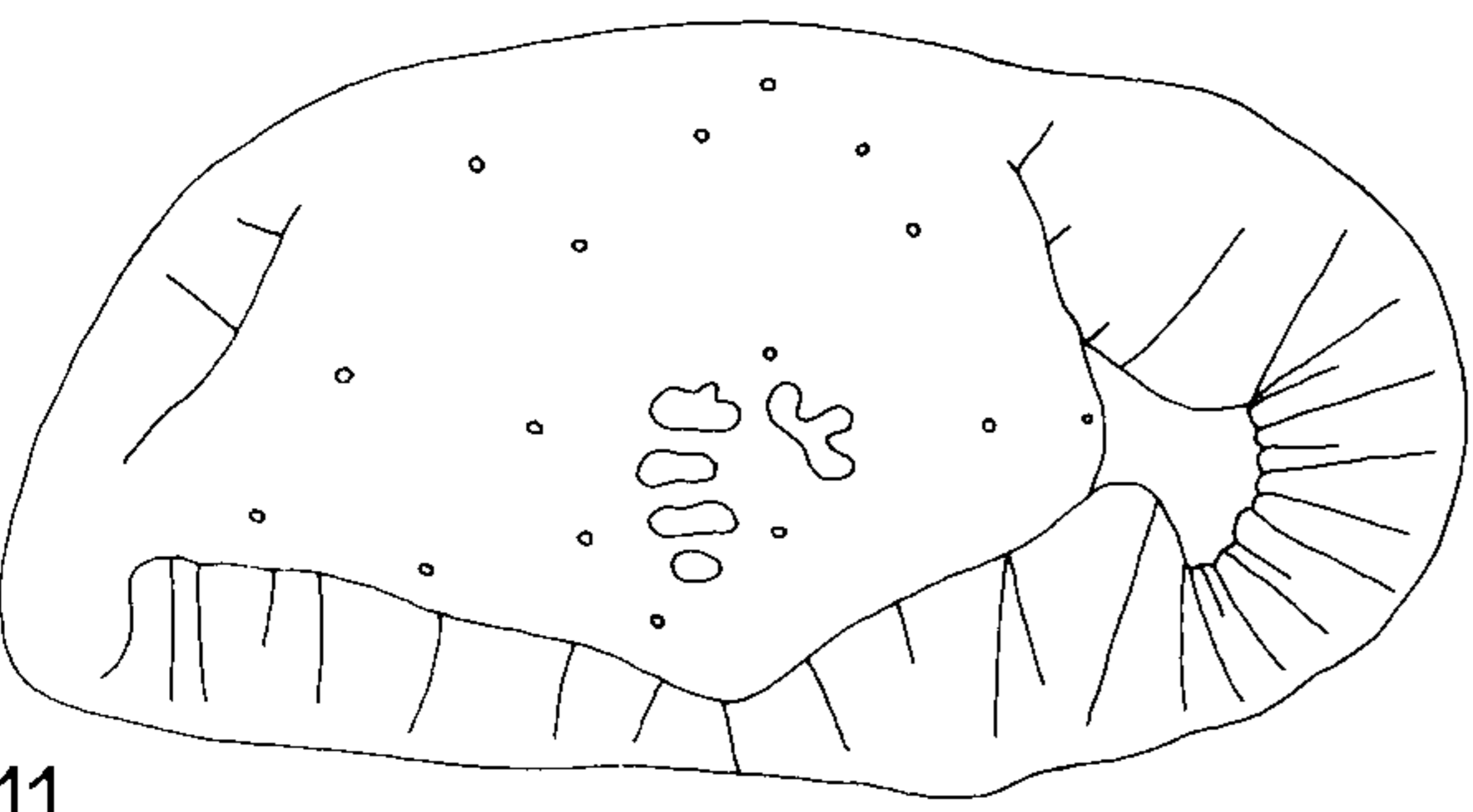
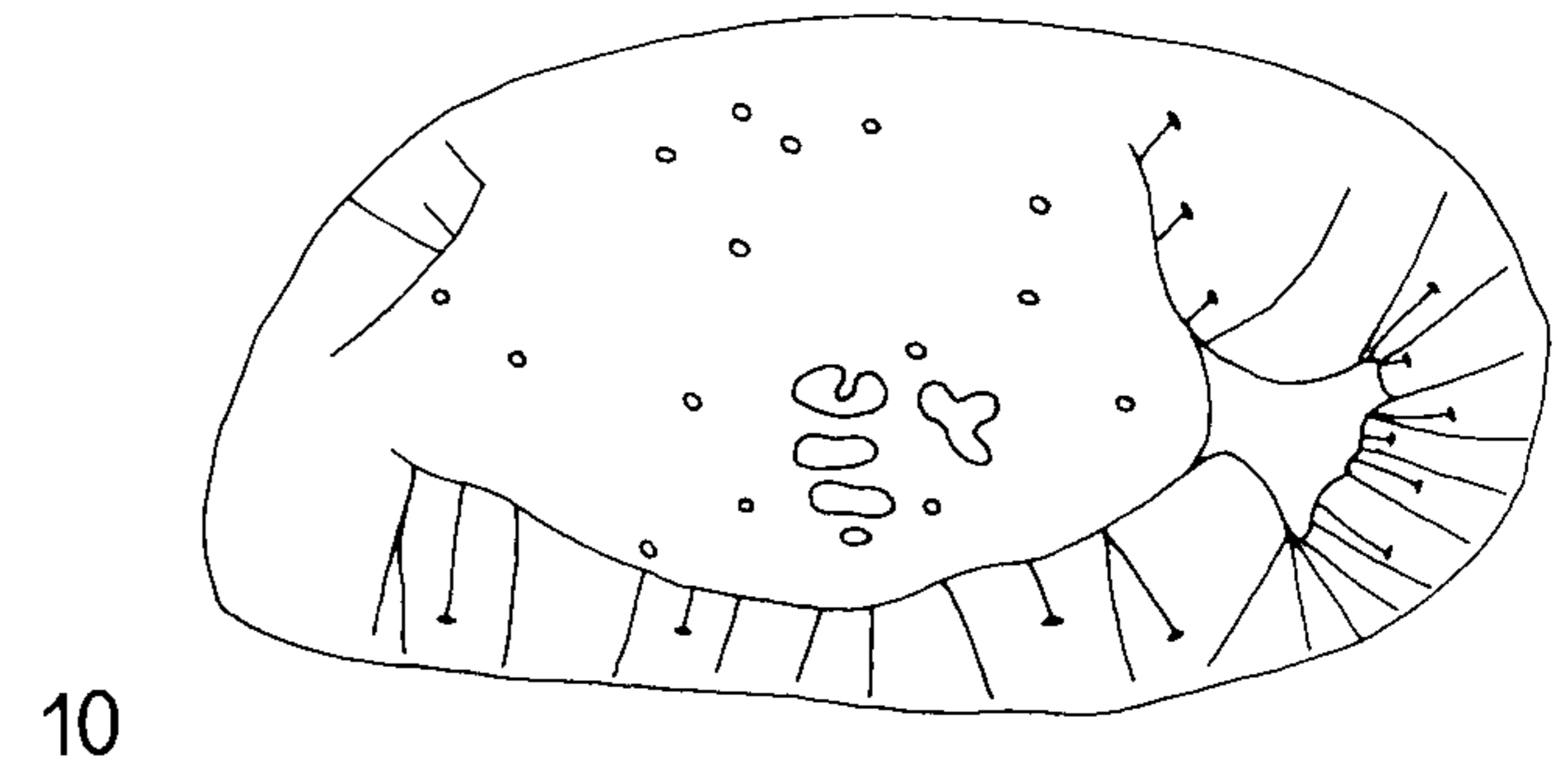
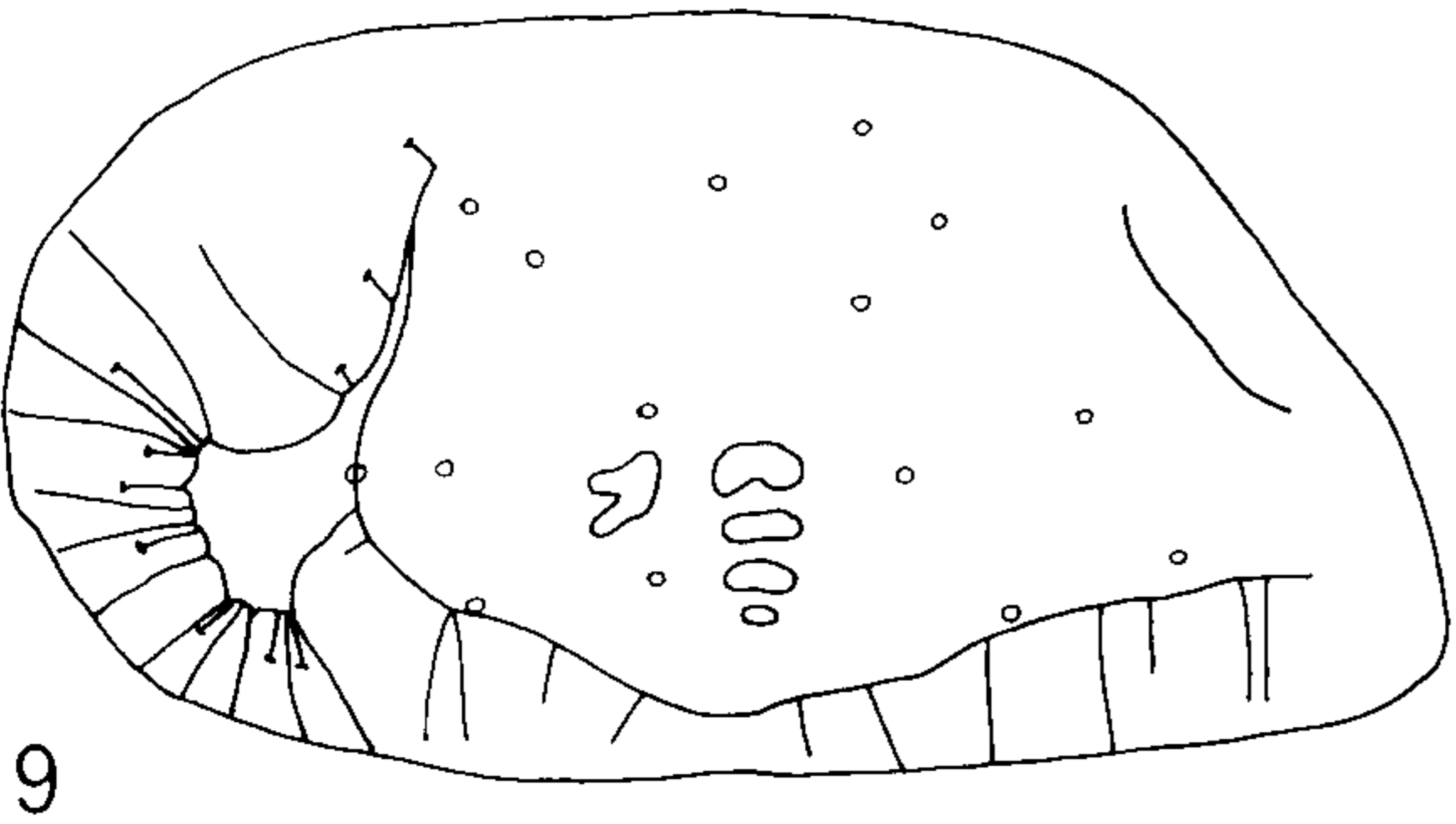
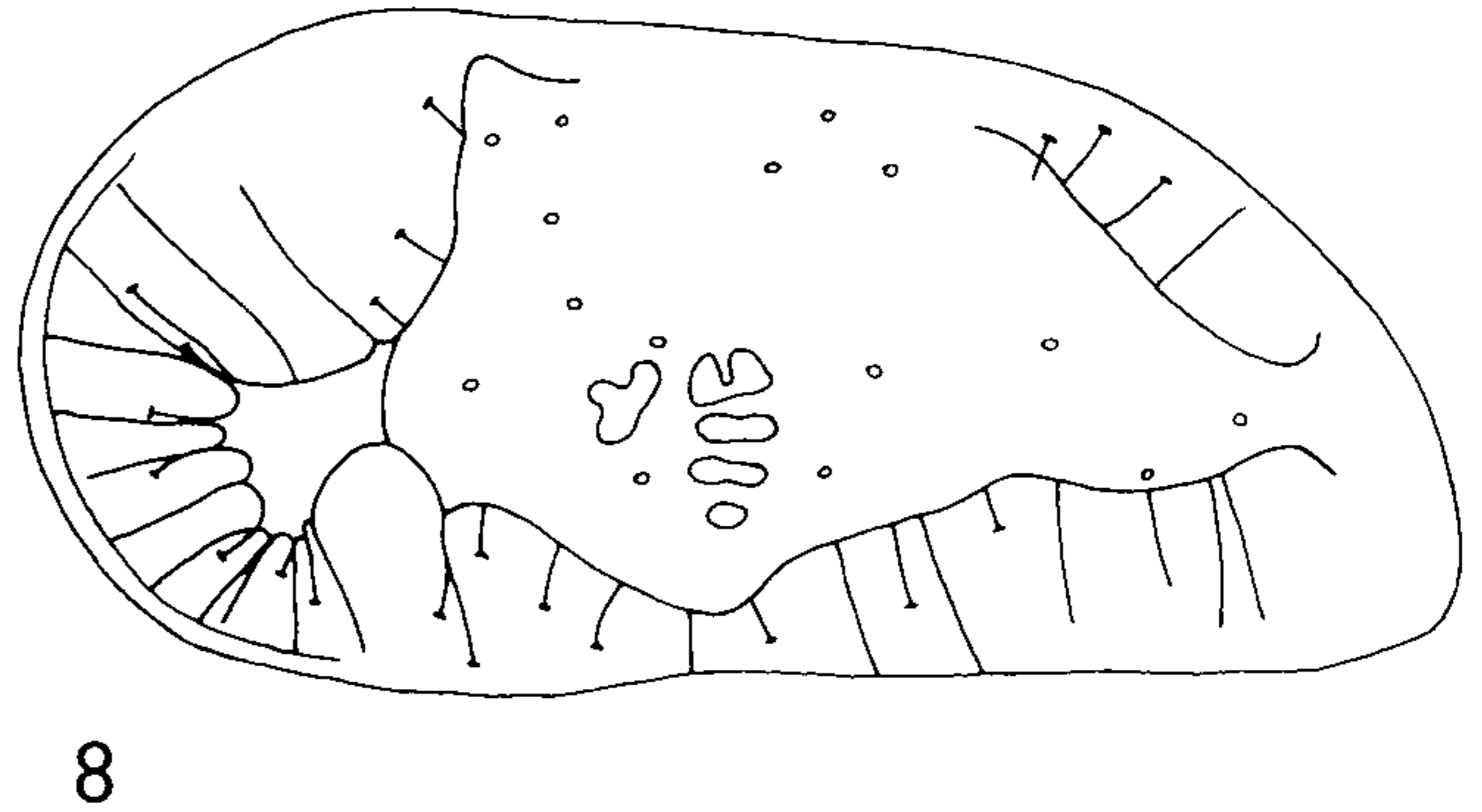
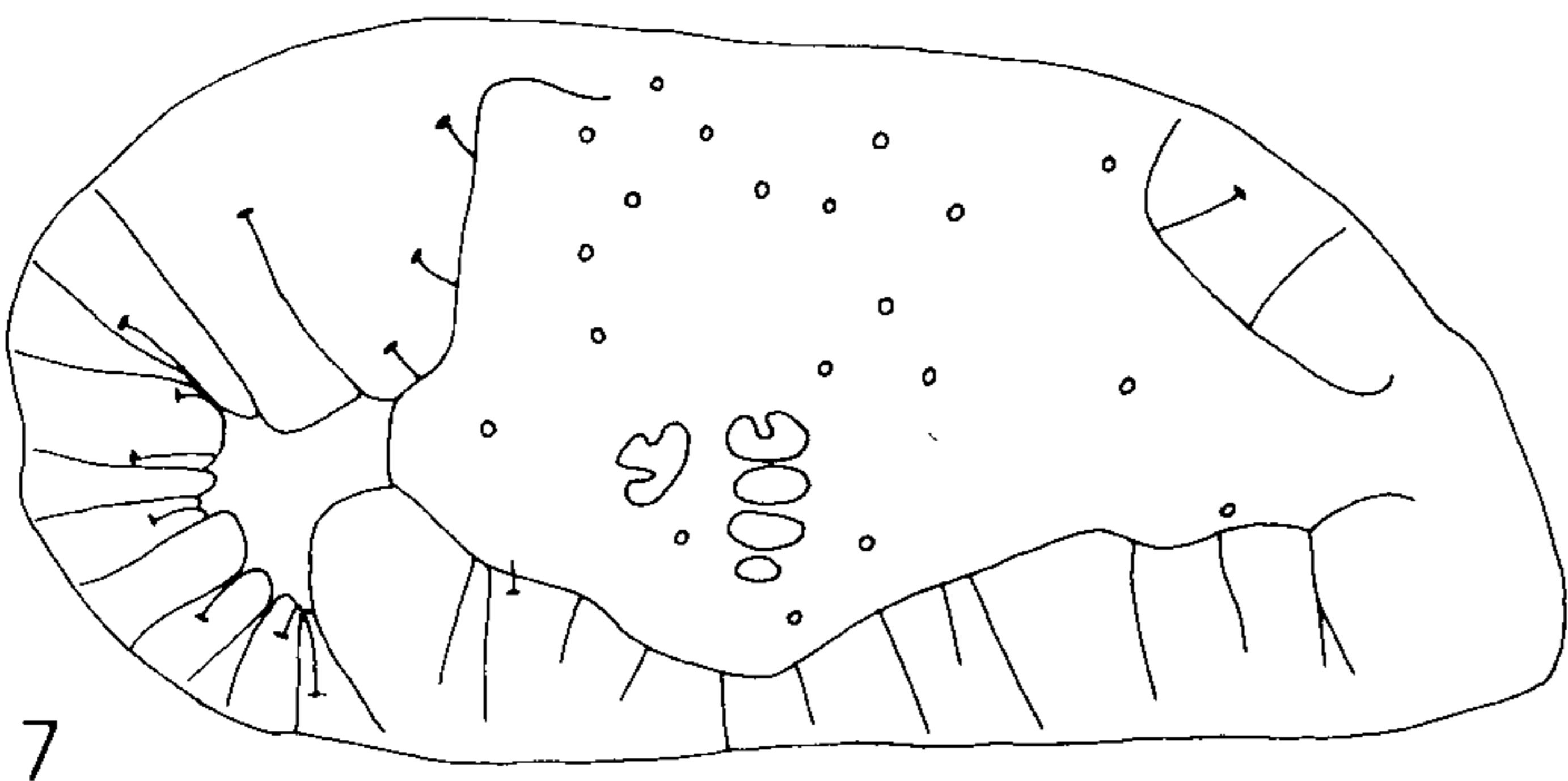
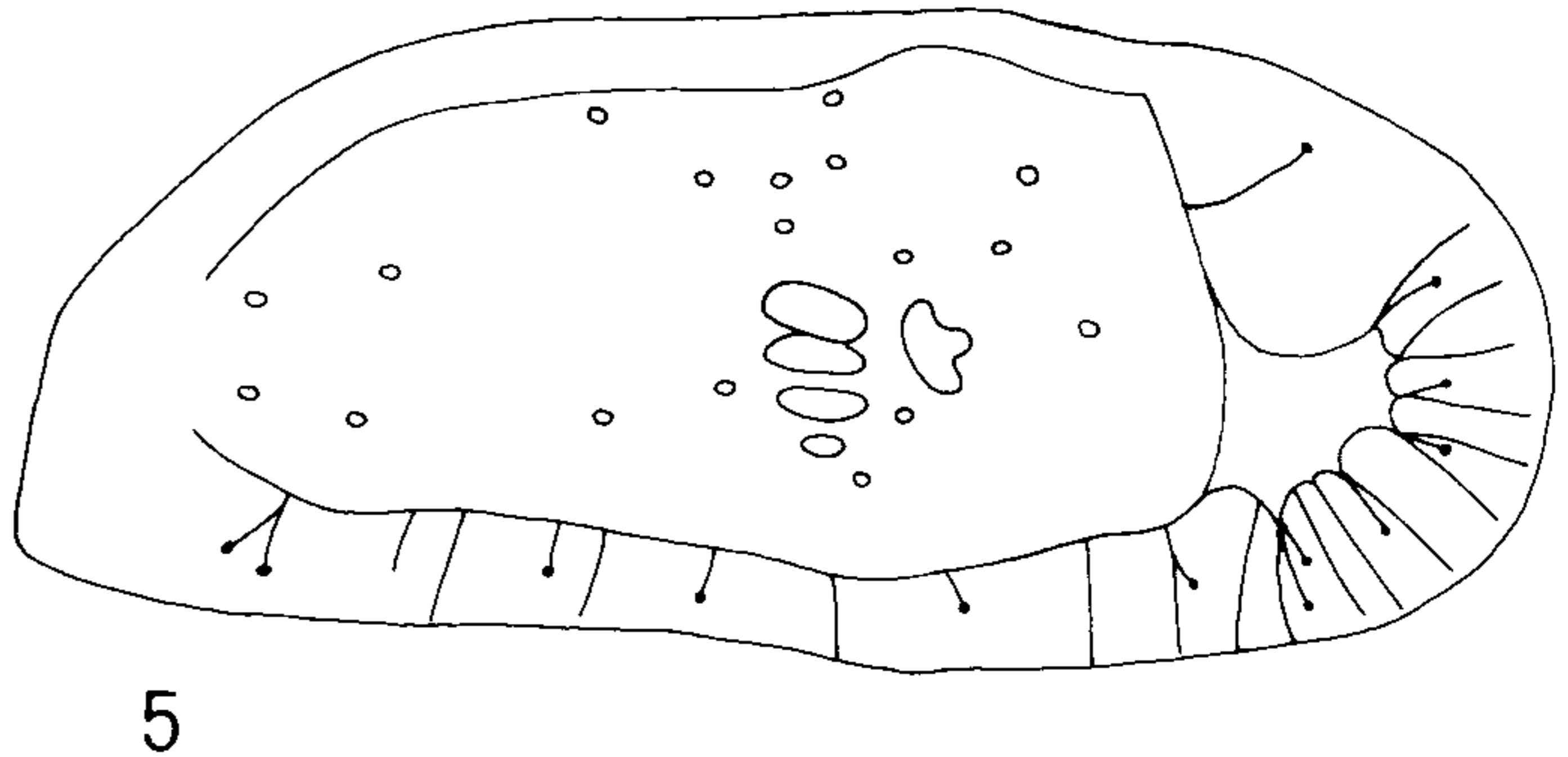
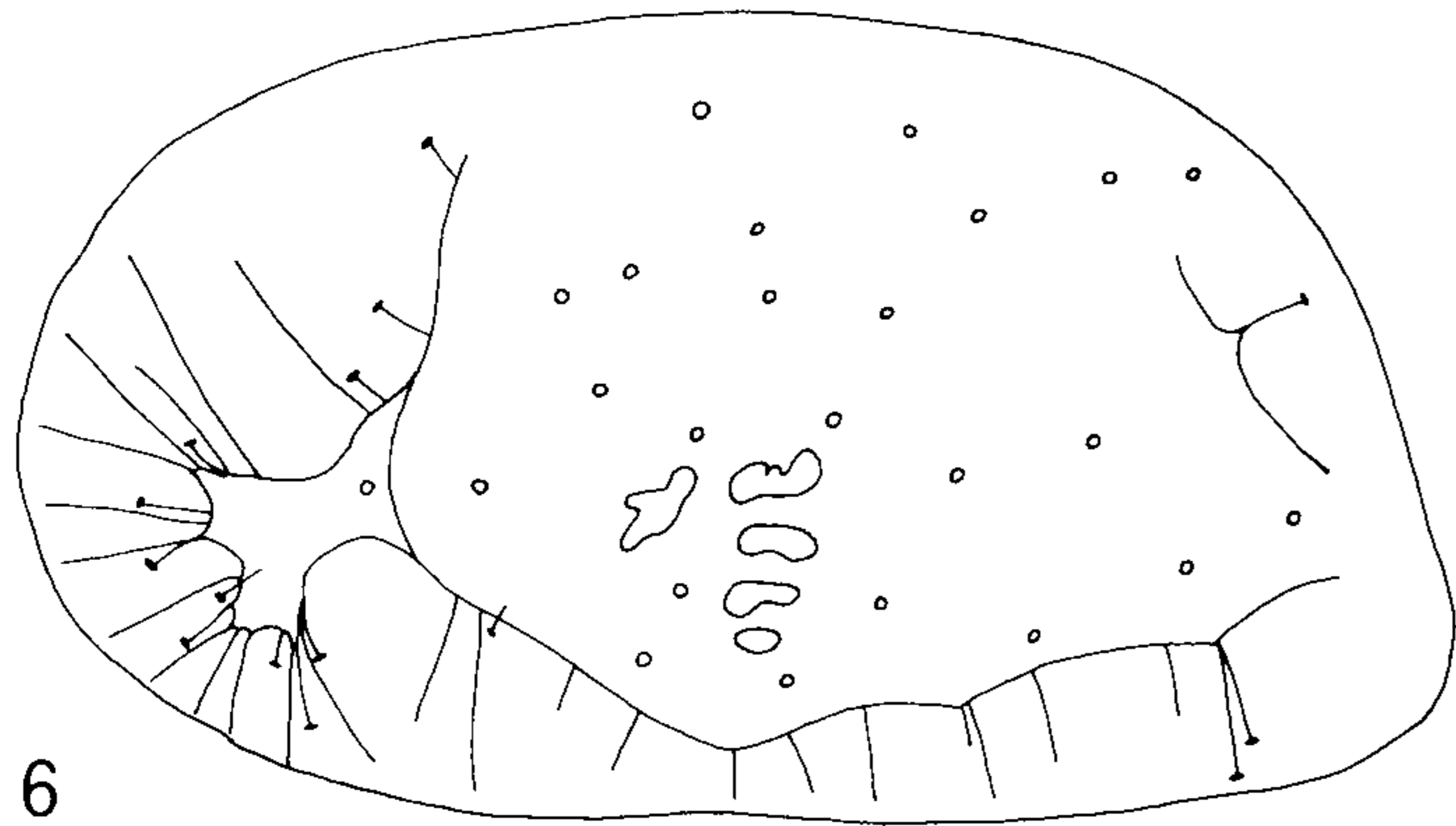
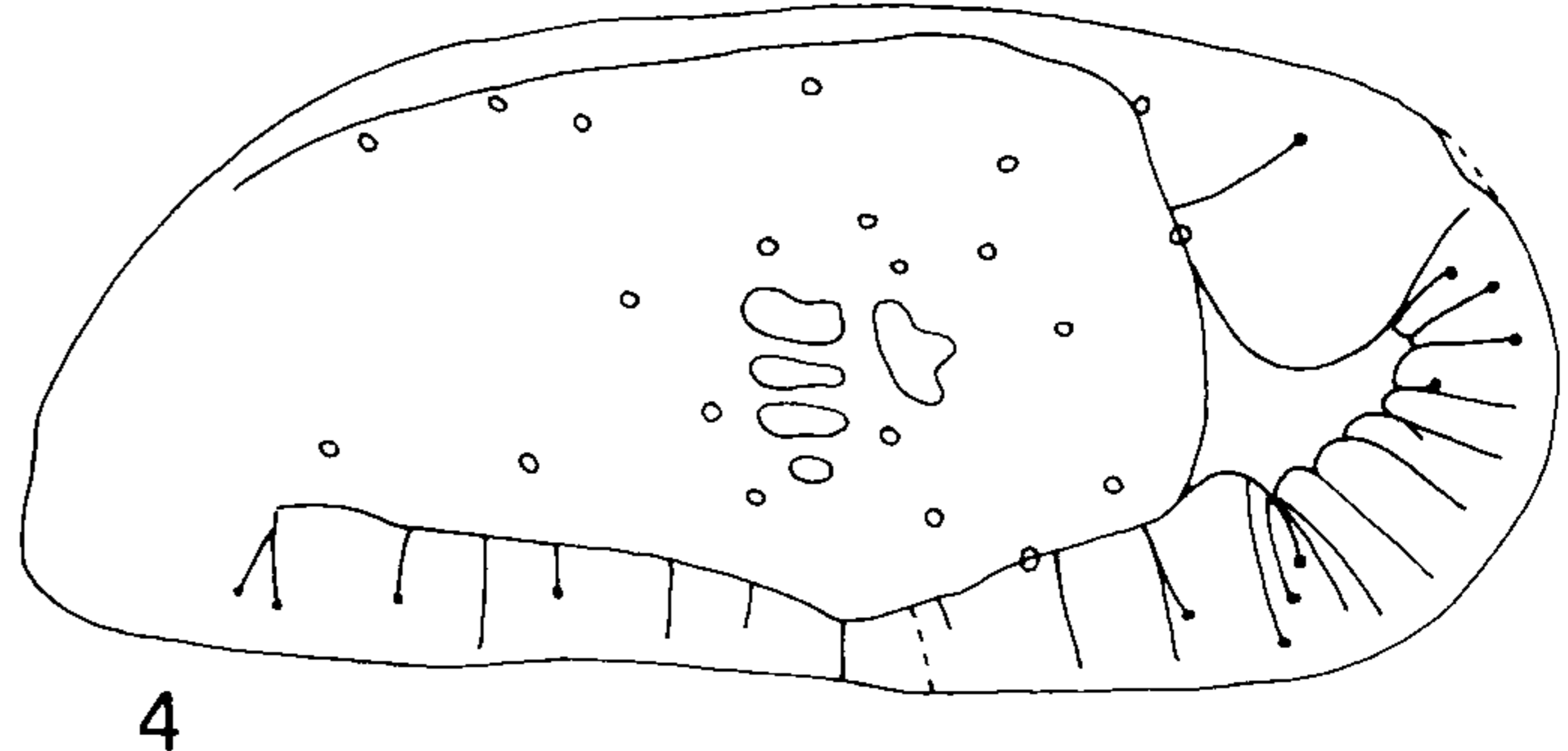
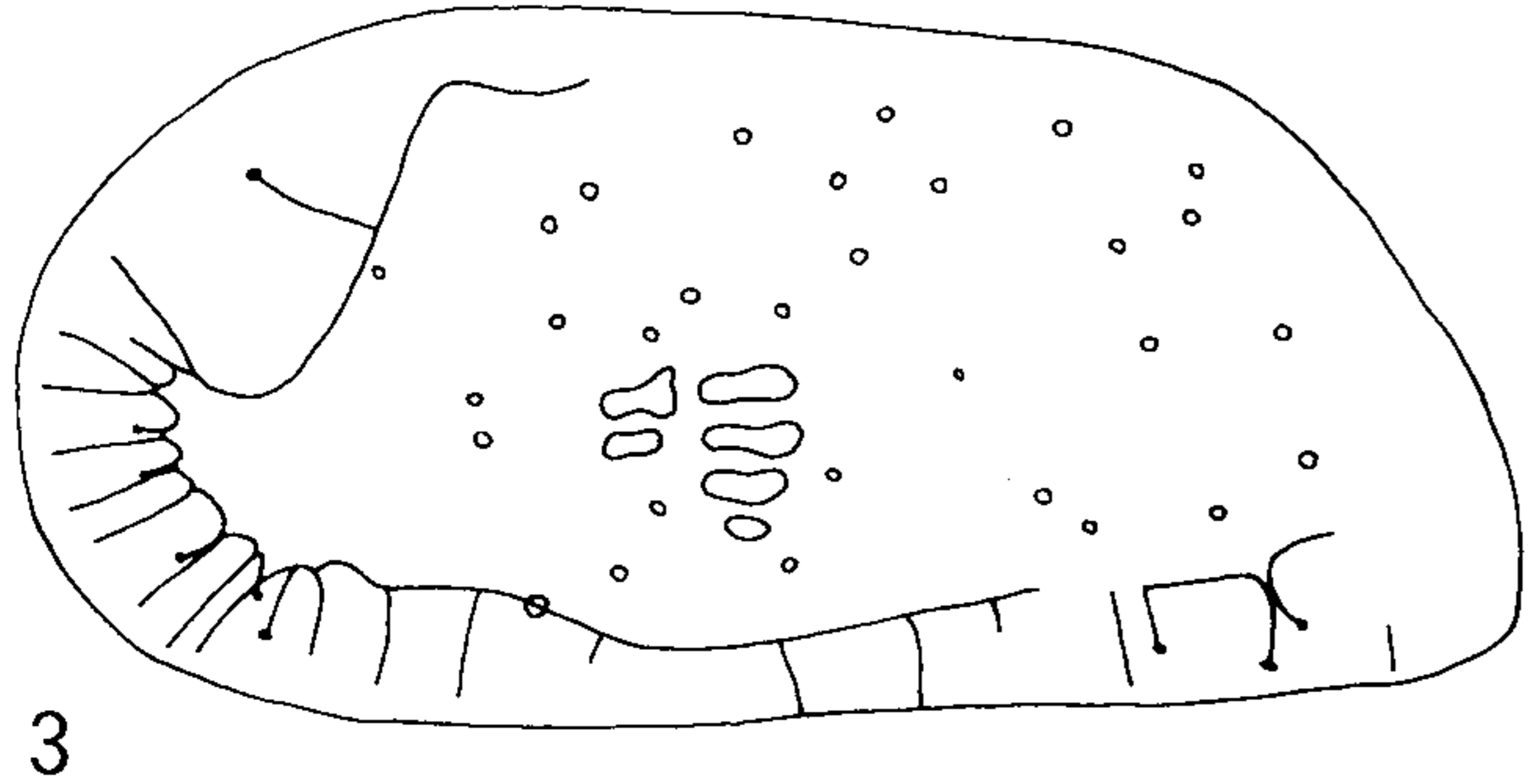
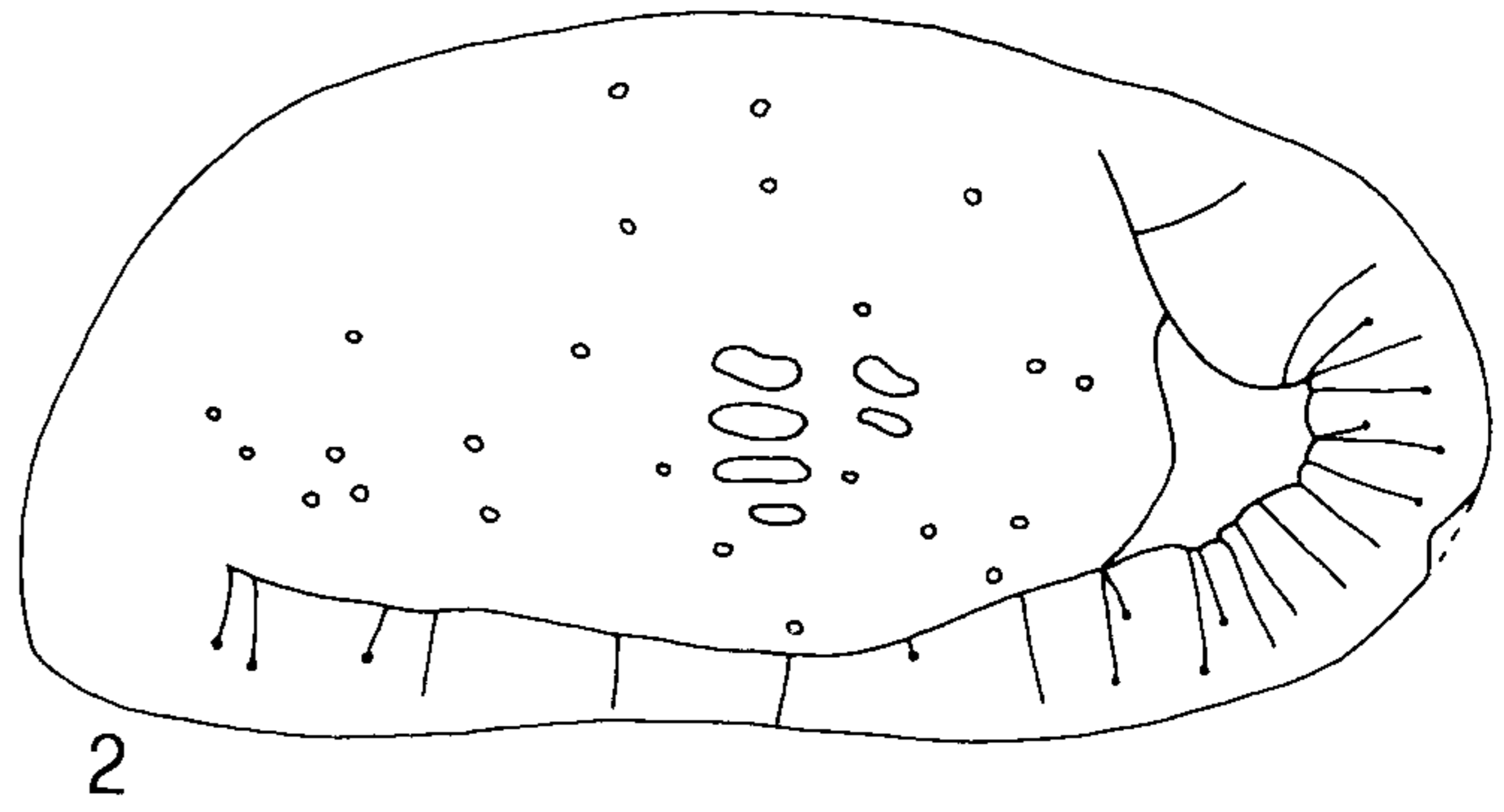
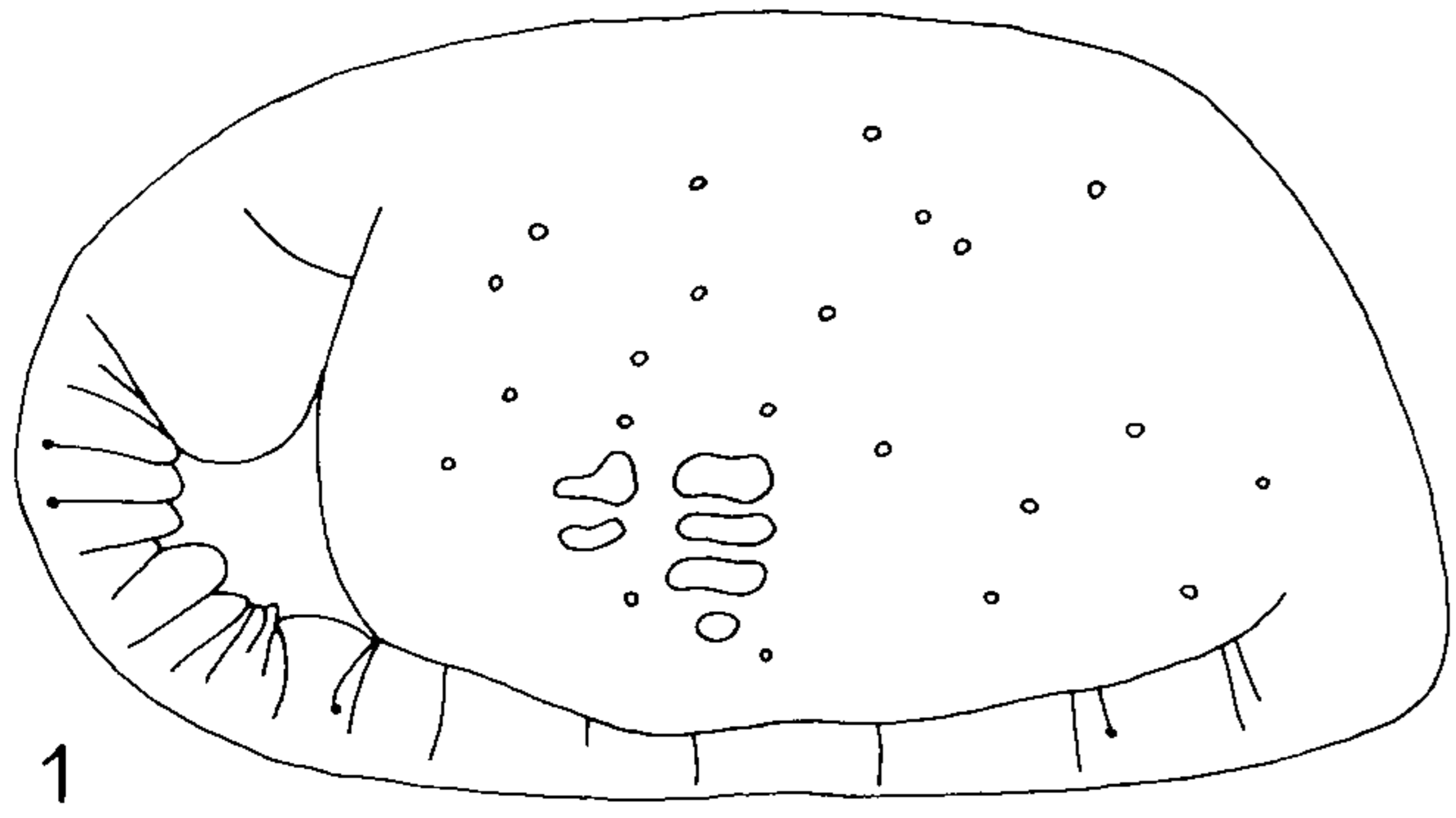
- Figs. 1-2 - *Krithe compressa* (Seguenza). 1) LV ♀, Stn. 78, B.O.C. 2017; 2) LV ♂, Stn. 33, B.O.C. 2018.
Figs. 3-5 - *Krithe compressa* (Seguenza), small form. 3) LV ♀, Stn. 52, B.O.C. 2019; 4) RV ♀, Stn. 46, B.O.C. 2020; 5) RV ♂, Stn. 46, B.O.C. 2020.
Figs. 6-9 - *Krithe perpulchra* n. sp. 6) Holotype, LV, Stn. 77, B.O.C. 2021; 7) Paratype, LV, B.O.C. 2022; 8) Paratype, RV, B.O.C. 2022; 9) Hypotype, RV, Stn. 46, B.O.C. 2023.
Fig. 10 - *Krithe praetexta* (Sars), large form with longer anterior distal marginal pore-canals, LV, Stn. 76, B.O.C. 2024.
Figs. 11-13 - *Krithe pernoides* (Bornemann) with reduced number of false marginal pore-canals in the lowest part of the anterior vestibule, 11) LV ♀, large form, Stn. 73, B.O.C. 2011; 12) RV ♂, large form, Stn. 73, B.O.C. 2013; 13) RV ♂, small form, Stn. 39, B.O.C. 2037.

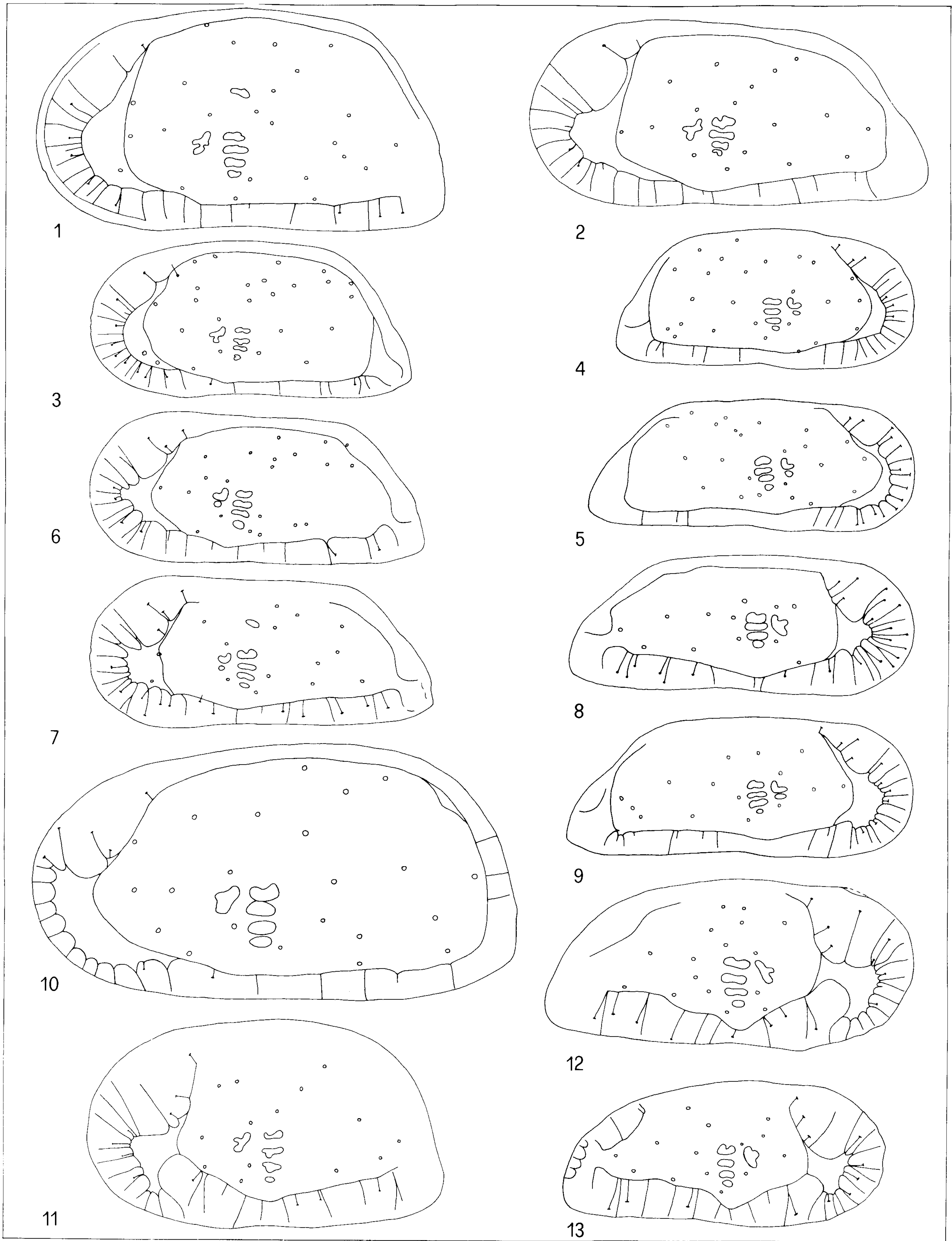
All magnifications x 100. The transparence drawings done by Visopan Reichert. RV = right valve; LV = left valve; CC = complete carapace.

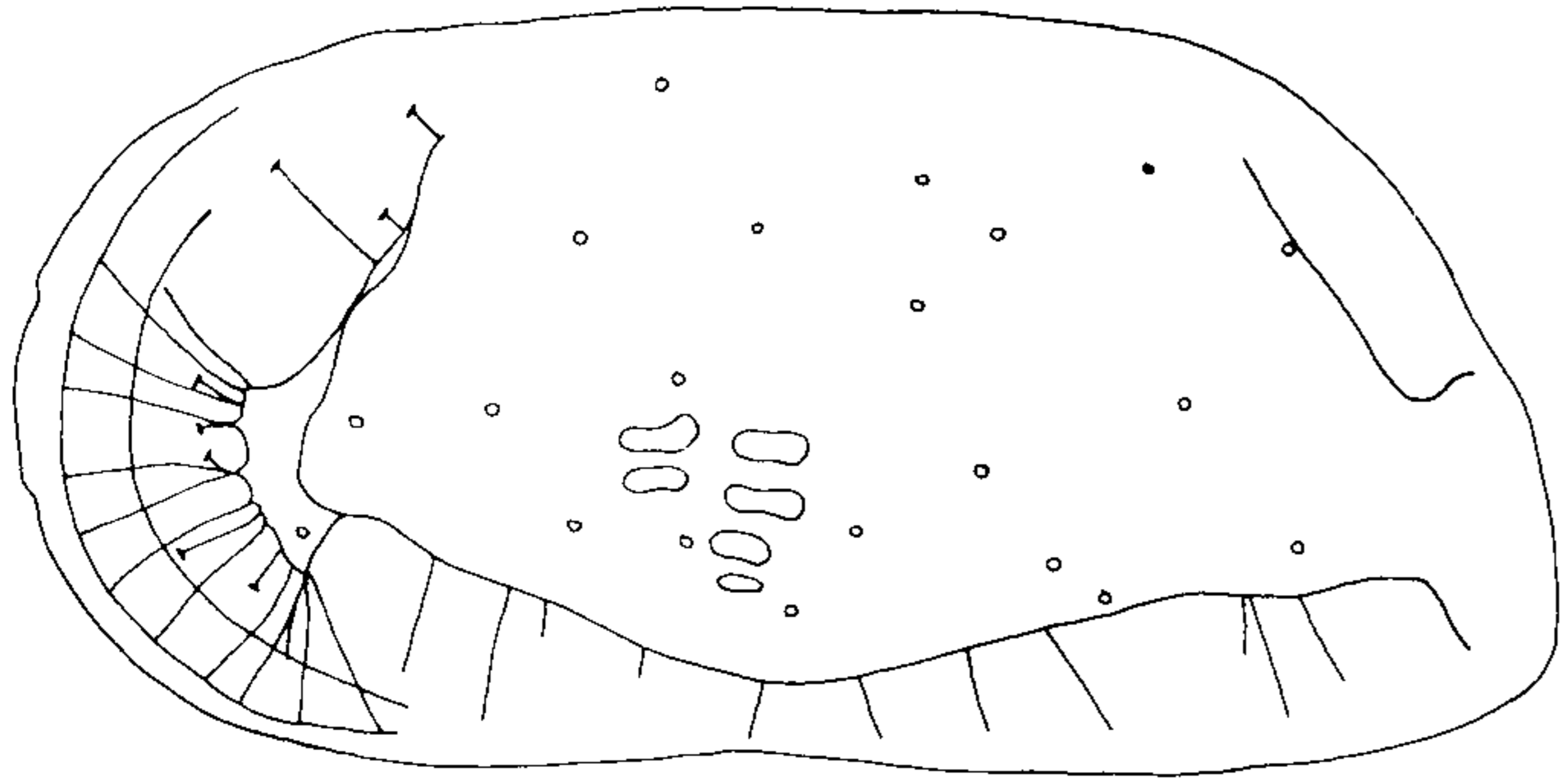
EXPLANATION OF PLATE 4

- Figs. 1-4 - *Krithe frutex* n. sp. 1) Holotype, LV ♀, Stn. 69, B.O.C. 2015; 2) Paratype RV ♀, B.O.C. 2016; 3) Paratype LV ♂, B.O.C. 2016; 4) Paratype RV ♂, B.O.C. 2016.
Figs. 5-6 - *Krithe parvipora* n. sp. 5) Holotype, RV ♀, Stn. 18, B.O.C. 2038; 6) Paratype RV ♂, B.O.C. 2039.
Figs. 7-11 - *Krithe iniqua* n. sp. 7) Holotype, LV ♀, Stn. 57, B.O.C. 2029; 8) Paratype, RV ♀, B.O.C. 2030; 9) Paratype, LV ♂, B.O.C. 2030. 10) LV ♀, Stn. 41, B.O.C. 2040; 11) form with long anterior marginal pore-canals, LV ♂, Stn. 41, B.O.C. 2041.
Fig. 12 - *Krithe anomala* n. sp., Holotype, RV, Stn. 57, B.O.C. 2025.

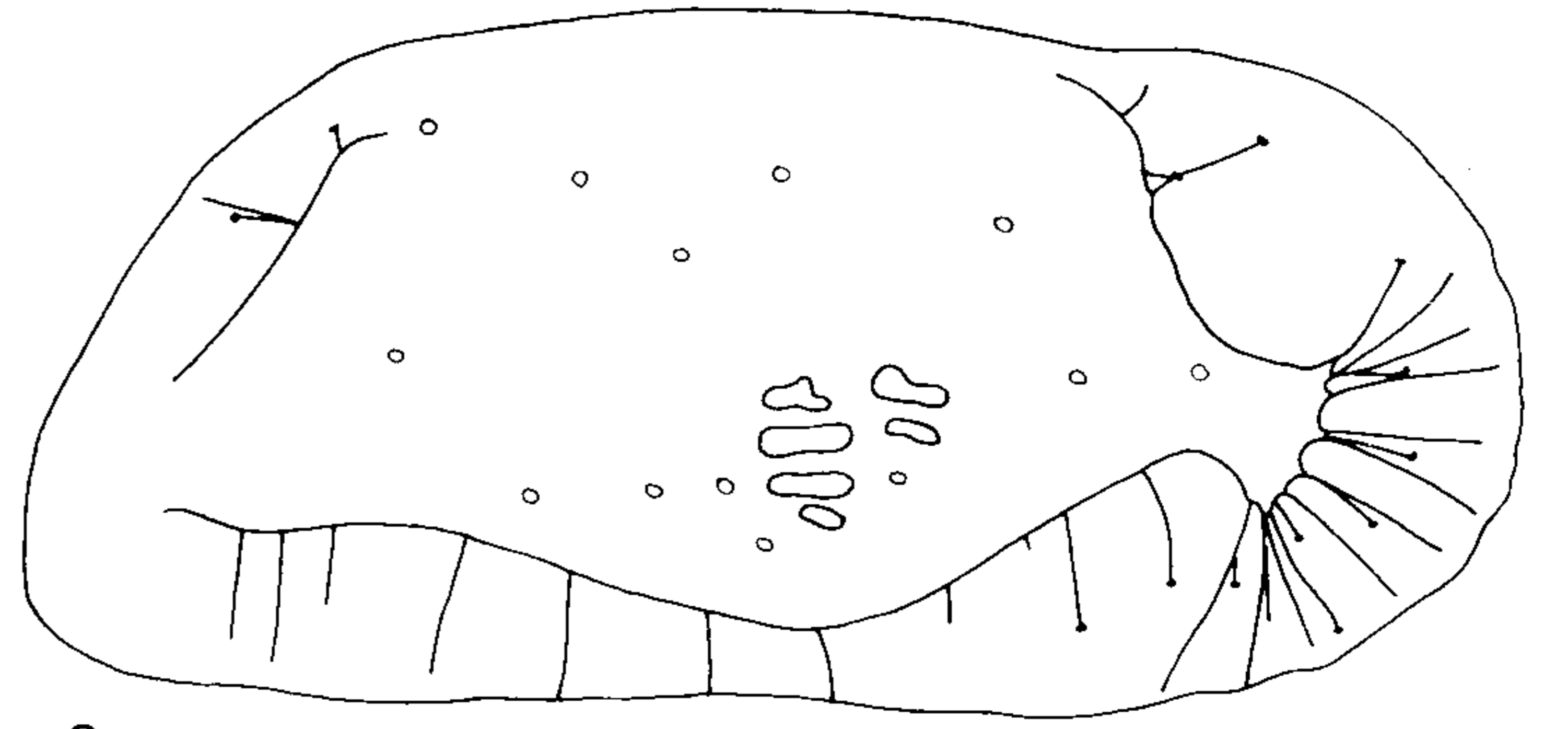
All magnifications x 100. The transparence drawings done by Visopan Reichert. RV = right valve; LV = left valve; CC = complete carapace.



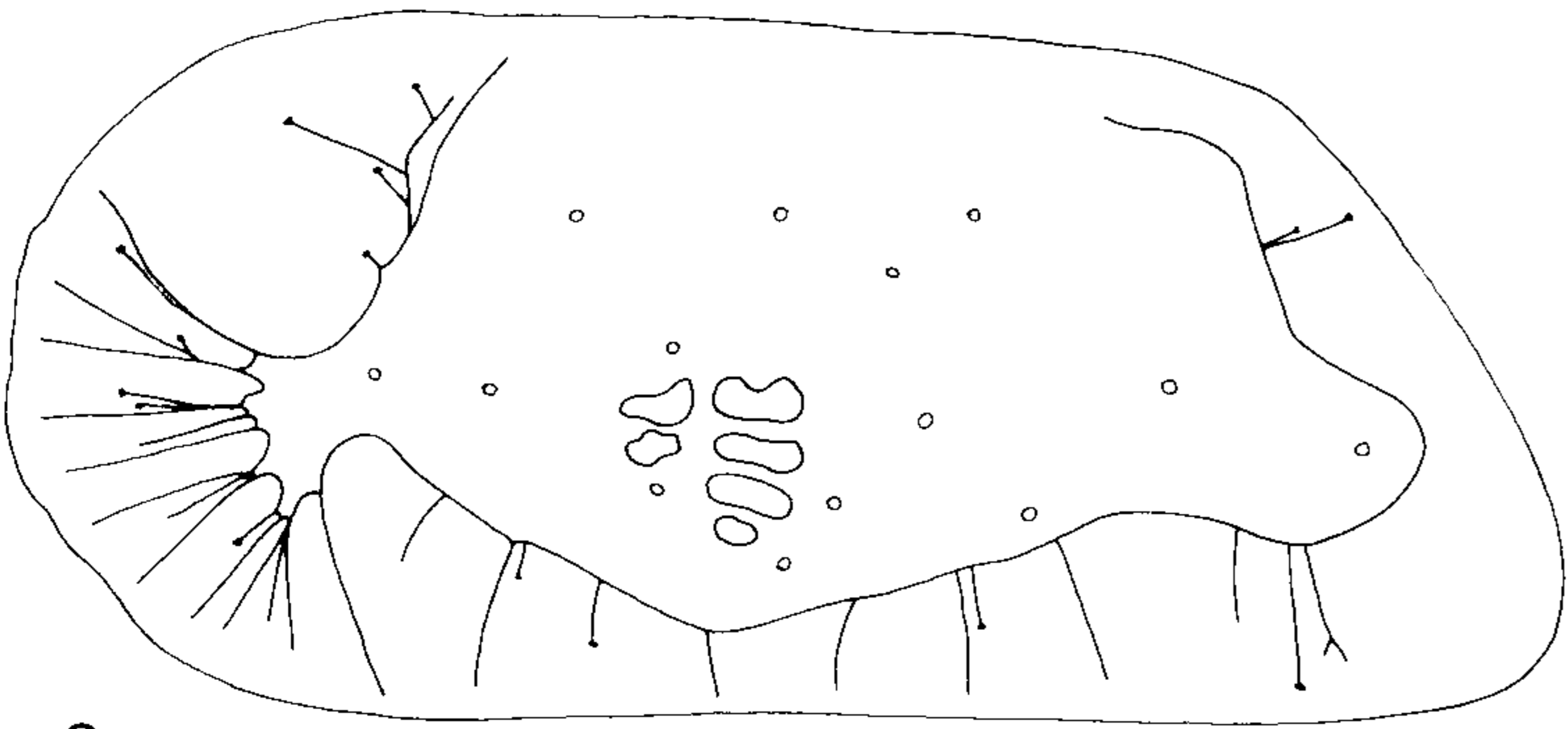




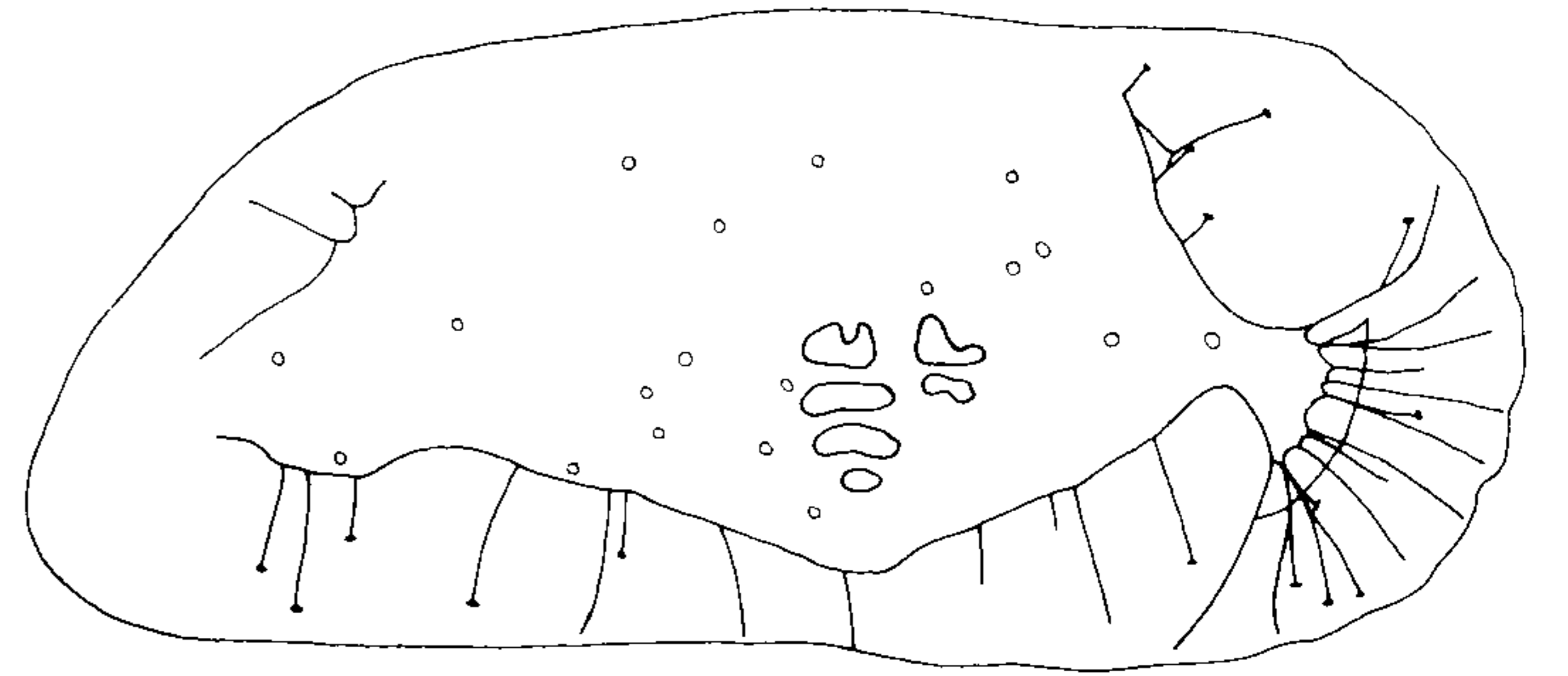
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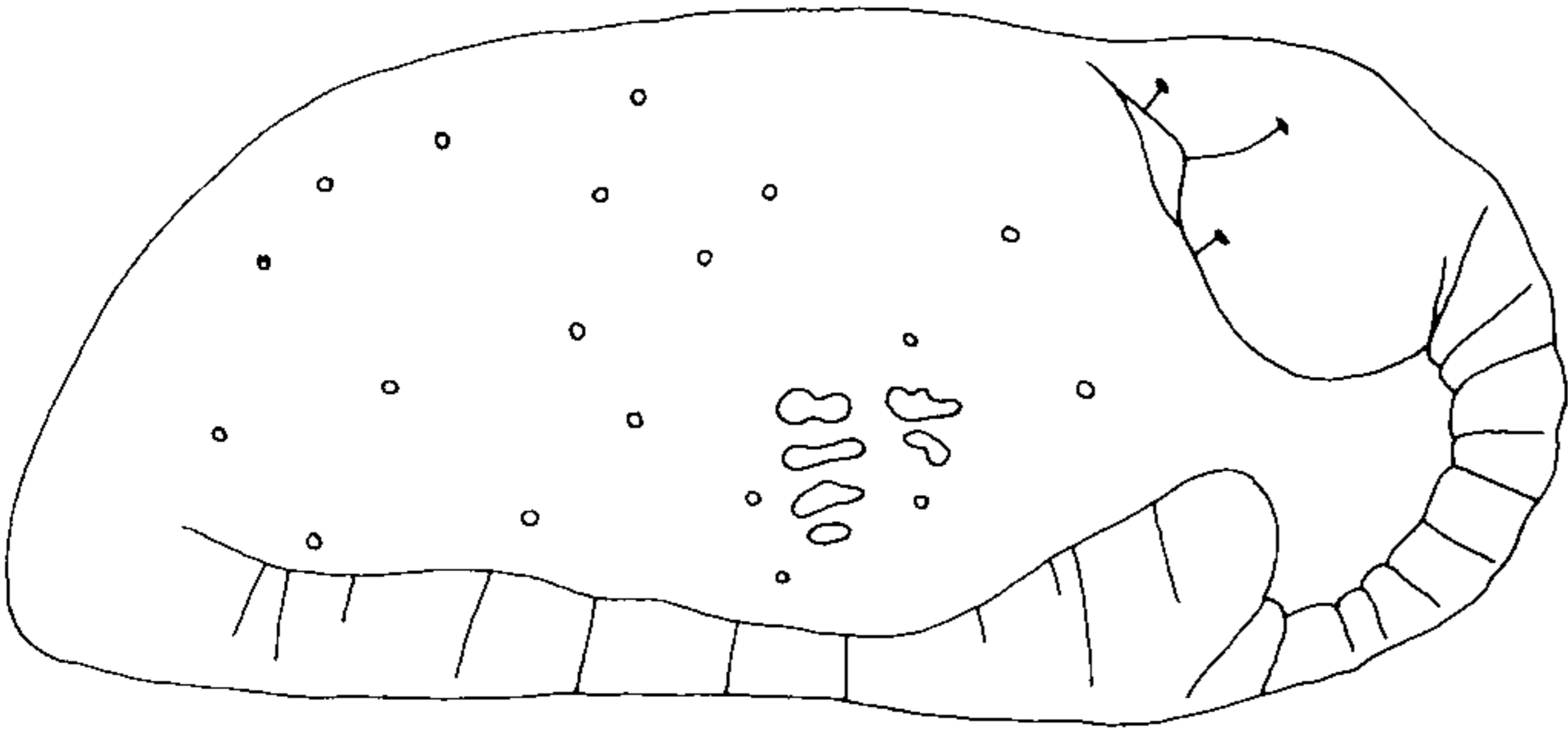
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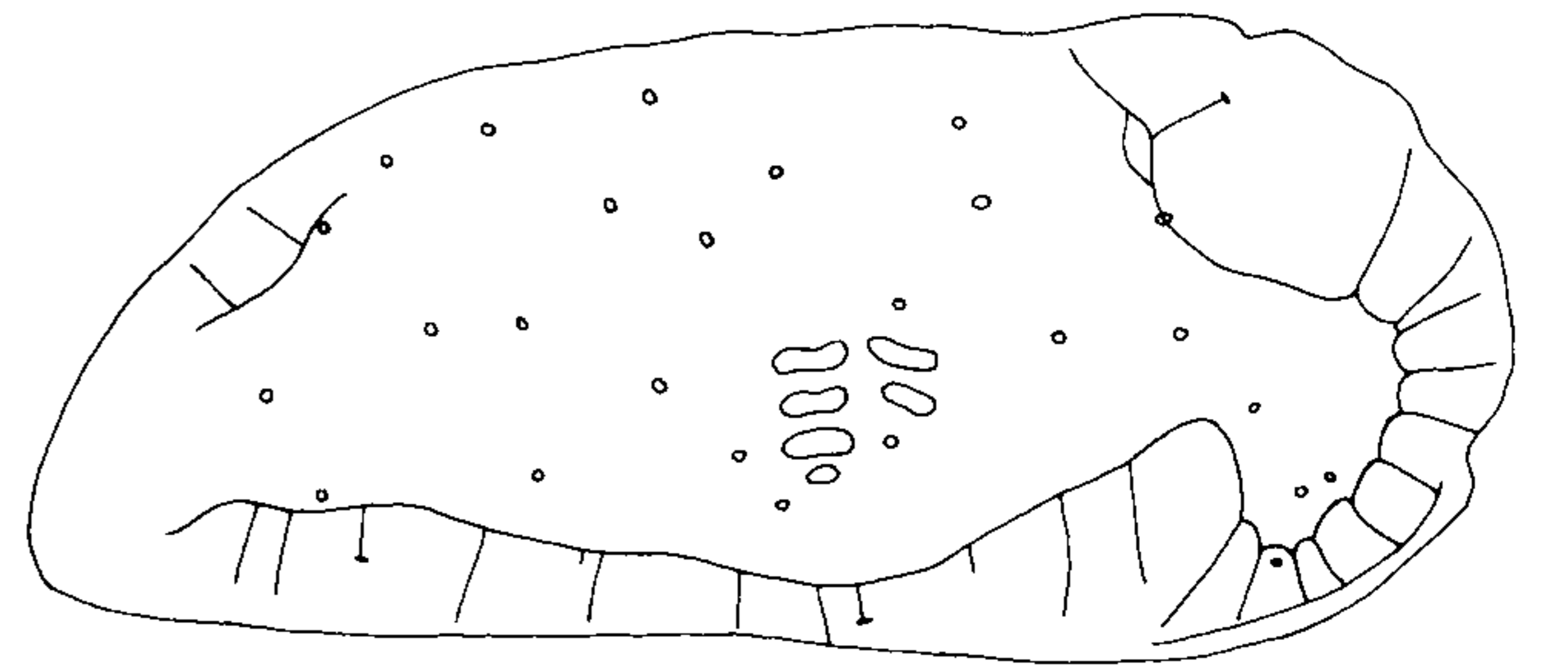
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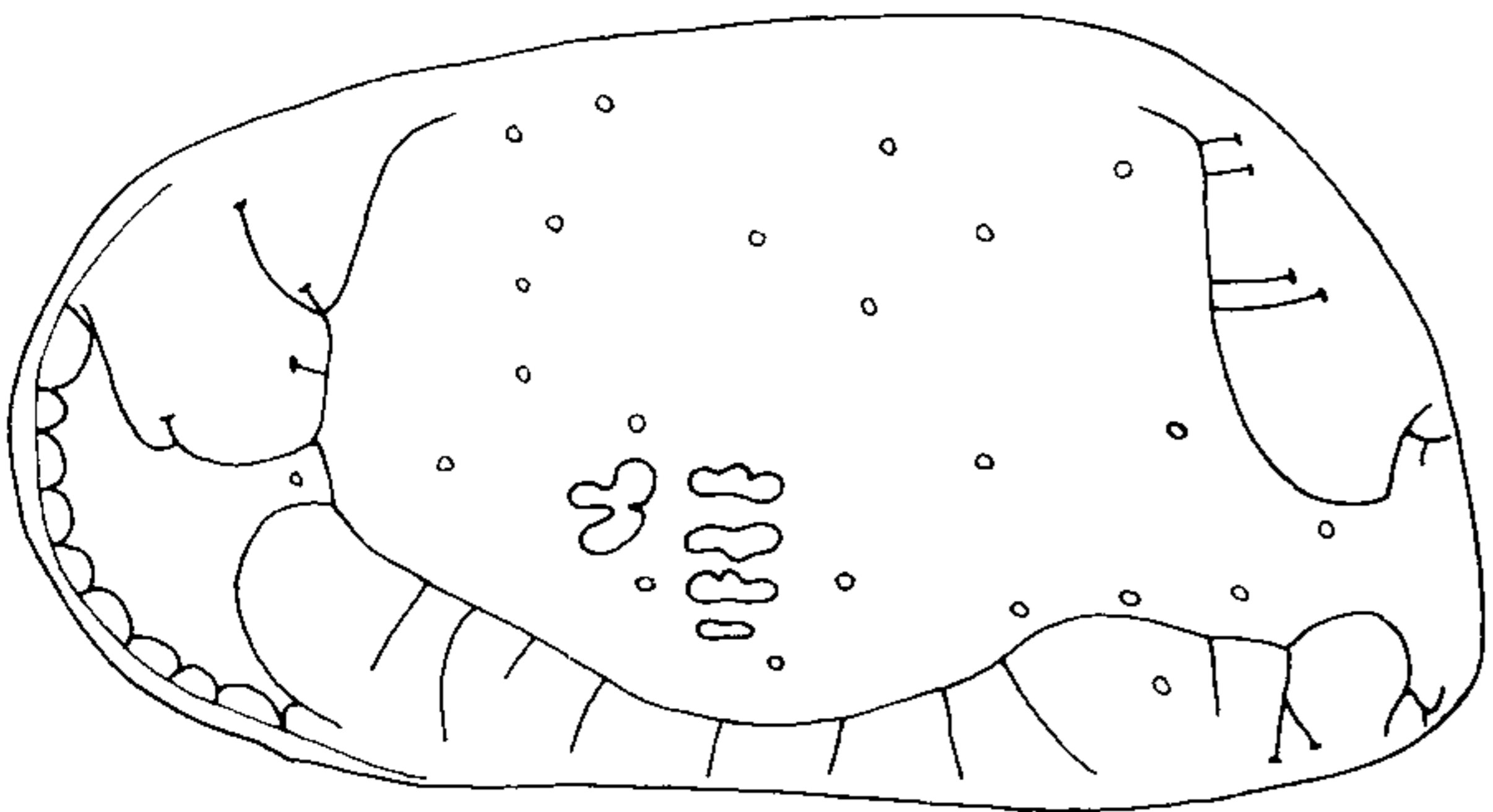
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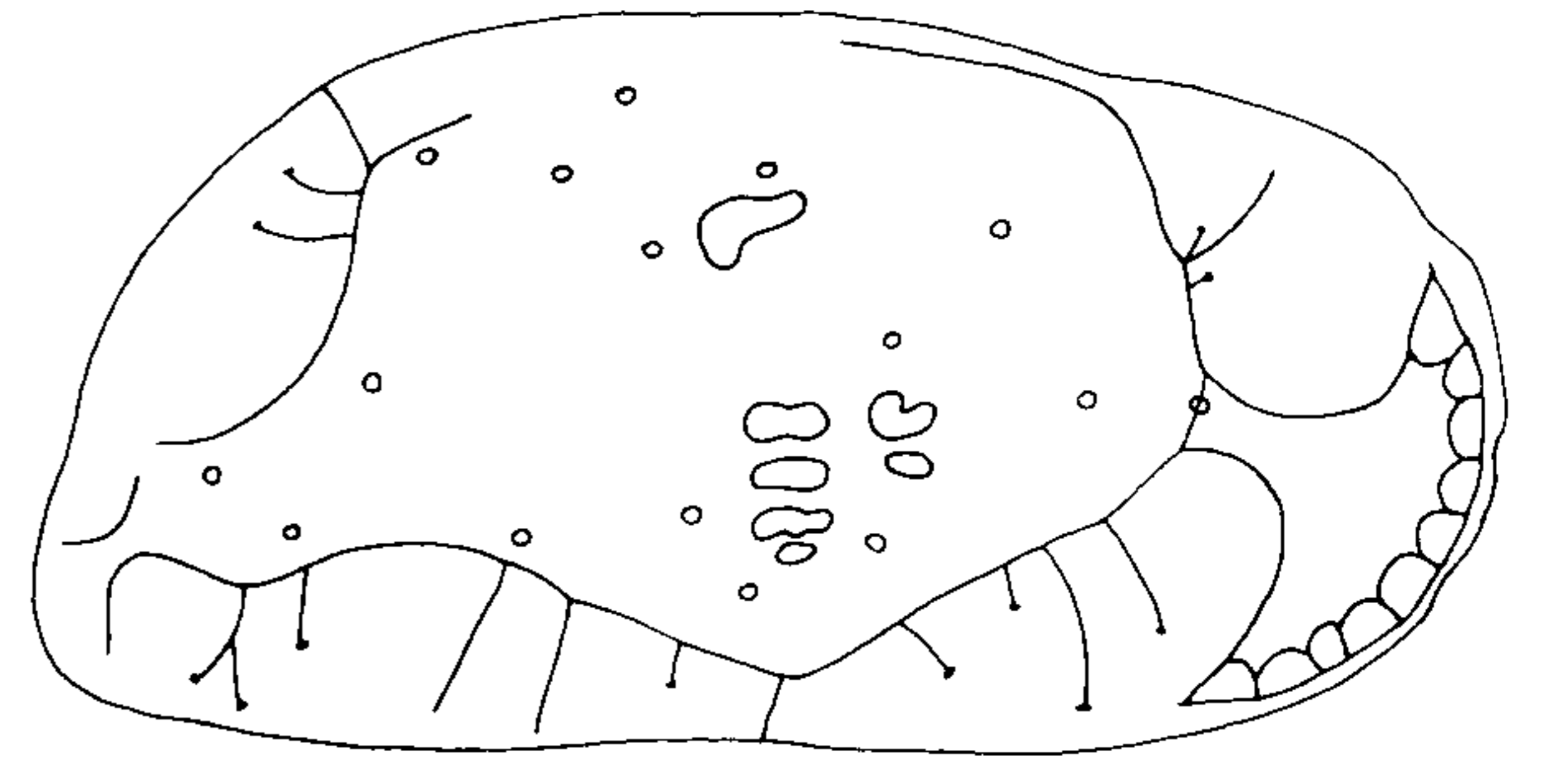
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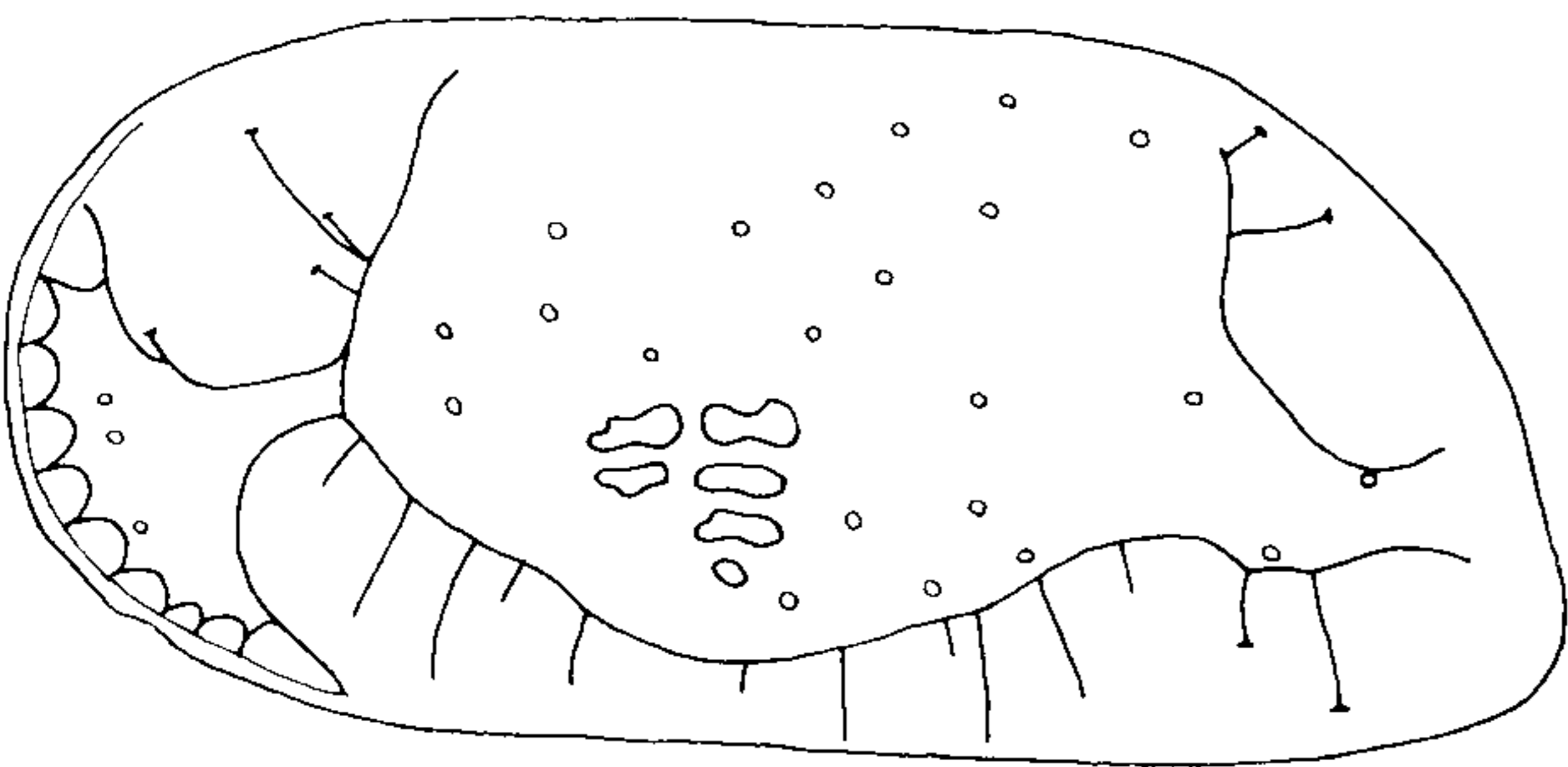
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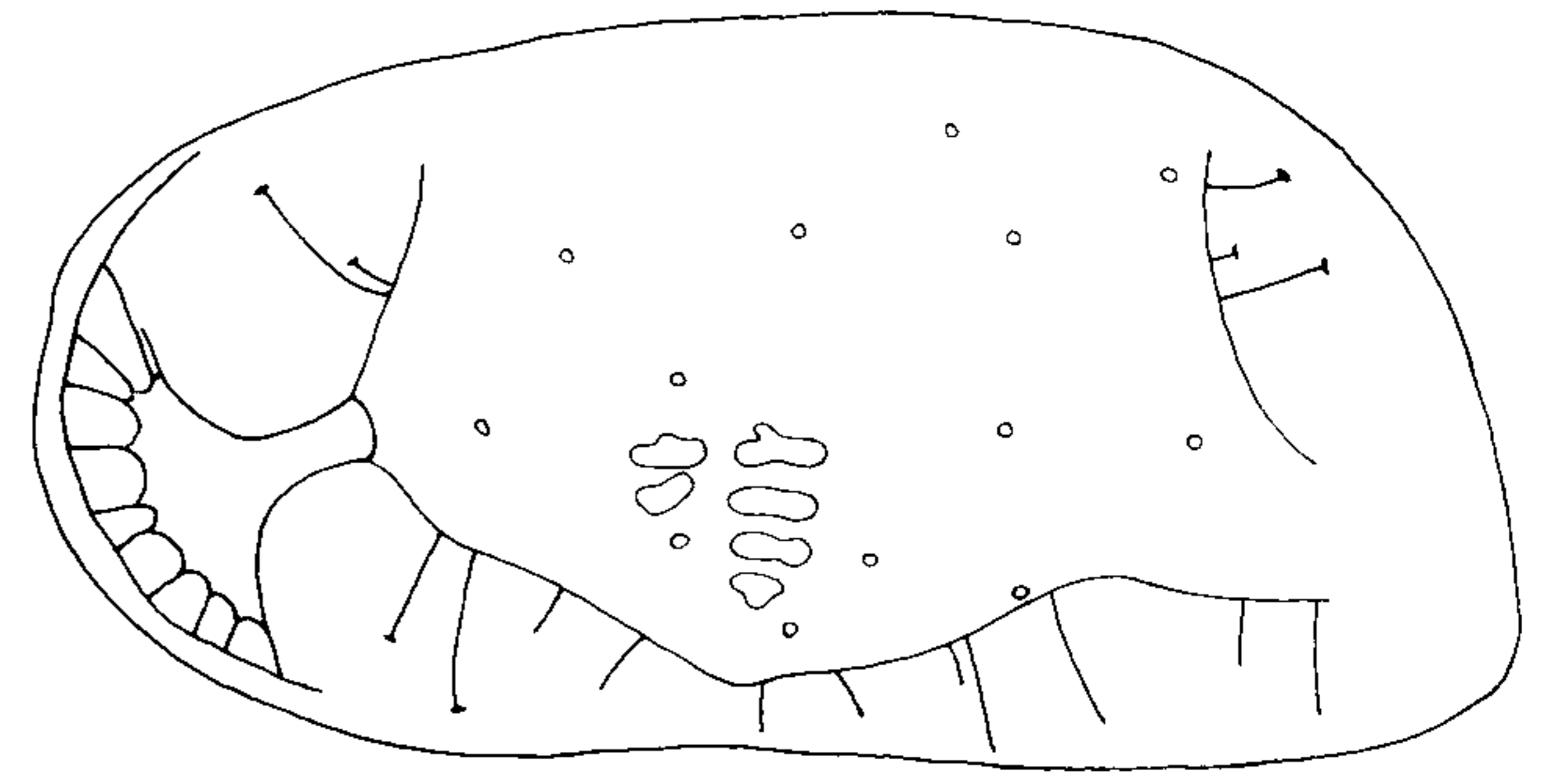
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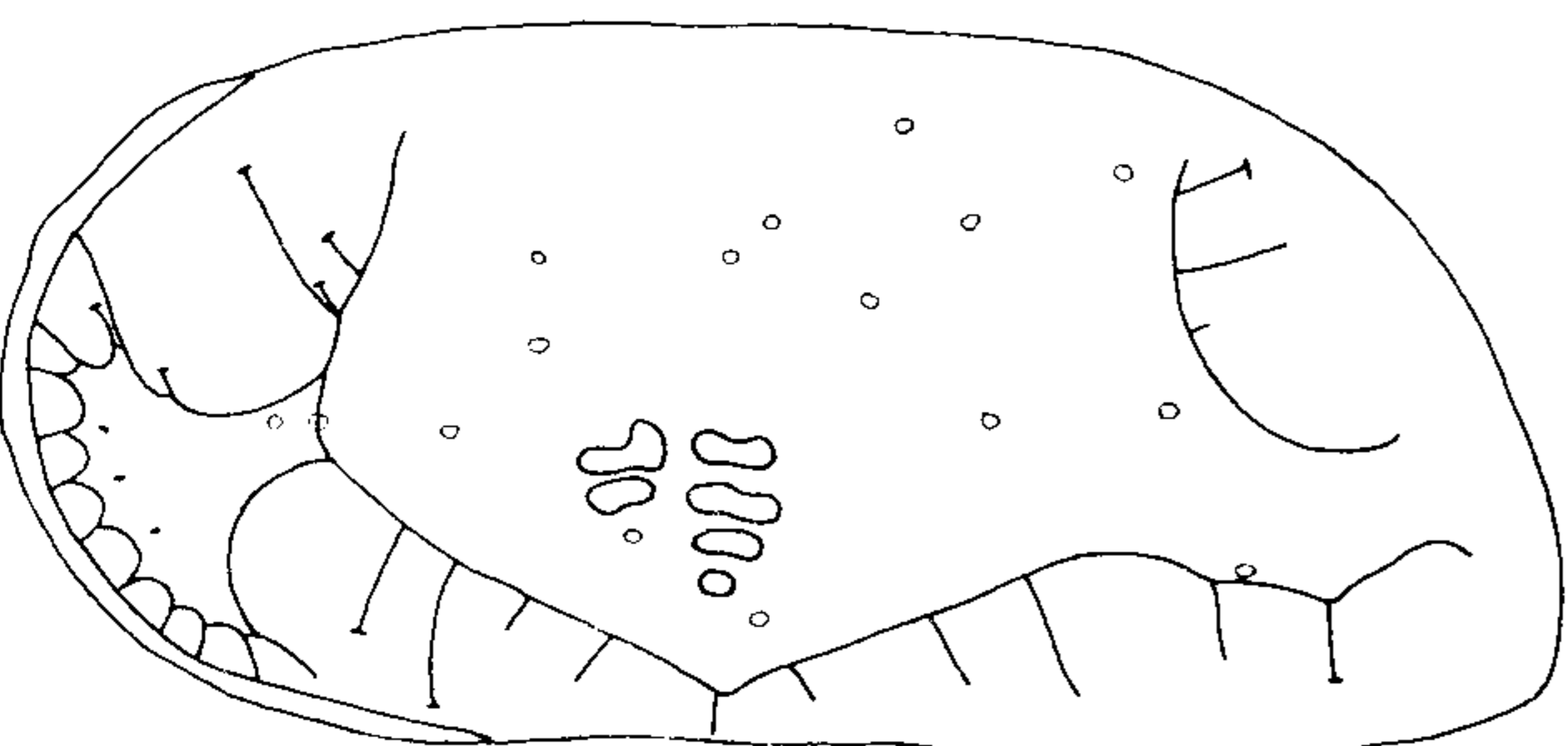
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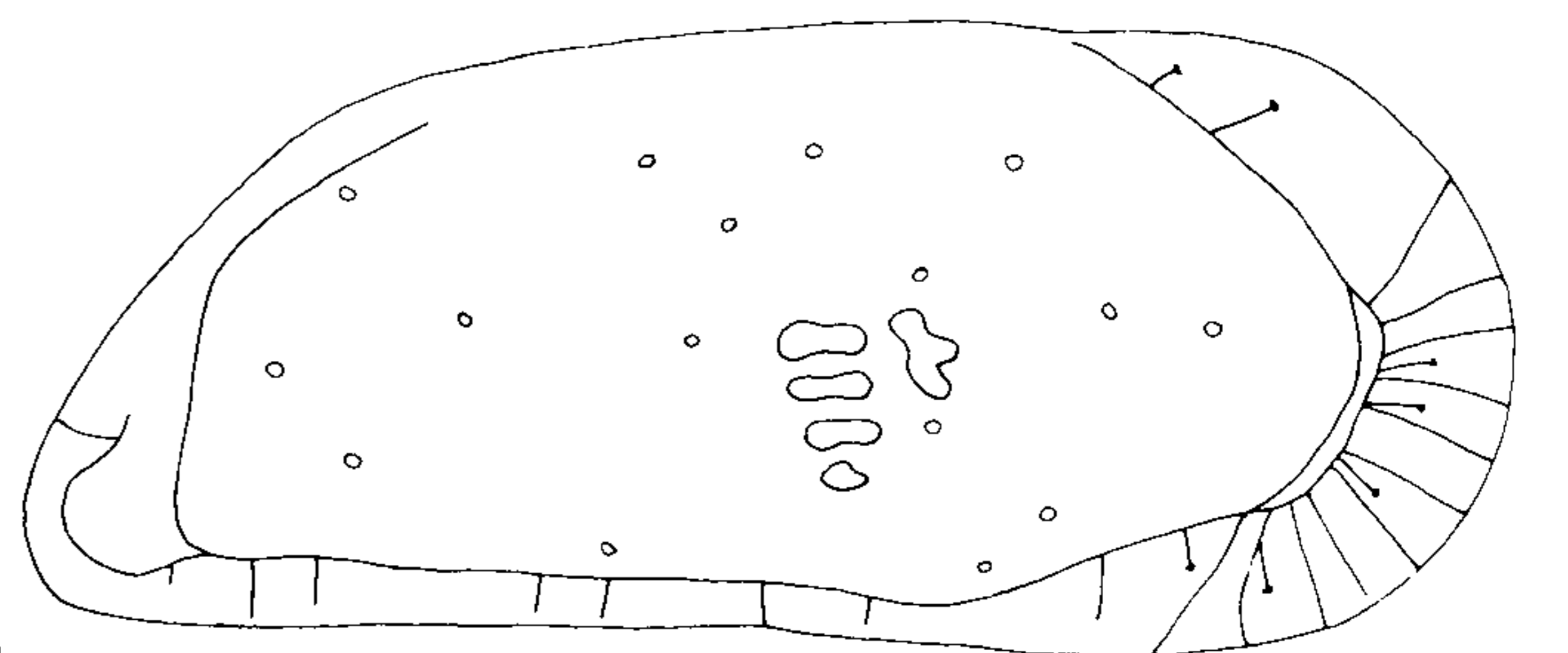
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12

Level of the figured specimens – M Pl 5, Stn. 33, Stn. 46; M Pl 6, Stn. 52; Early Pleistocene, Stn. 78.

Size (in mm) – LV ♀: L = 0.72; H = 0.40 (Pl. 3, fig. 1).
LV ♂: L = 0.72; H = 0.35 (Pl. 3, fig. 2).

Variability – The shape and the characters of the anterior vestibule appear almost constant. We noticed a form of very reduced size (Pl. 3, figs. 3-5; Pl. 6, fig. 8) which shows exactly the same characters of the typical one whose sizes in mm are the following: LV ♀: L = 0.56; H = 0.27; RV ♂: L = 0.57; H = 0.23.

Distribution – The typical large form occurs quite commonly all along the section. The reduced size form occurs from the end of M Pl 4 and seems to disappear at the first beginning of the Pleistocene.

KRITHE EXIGUA n. sp.
Pl. 1, figs. 8-10; Pl. 6, fig. 4

Etymology – From latin *exiguus* = exiguous.

Holotype – LV ♀ (Pl. 1, fig. 8). Stn. 39. B.O.C. 2007.

Paratypes – 4 valves (1 of which figured: Pl. 1, fig. 9). B.O.C. 2073.

Hypotypes – 1 RV ♀ (Pl. 1, fig. 10). Stn. 35. B.O.C. 2008; 1 LV ♀ (Pl. 6, fig. 4). Stn. 37. B.O.C. 2077.

Type-level – M Pl 5.

Diagnosis – A very small species characterized by the subacuminate posterior extremity and the reduced development of the upper and lower anterior inner lamella.

Description – In lateral view the valves show a gently and regularly arched dorsal margin which

regularly slopes down posteriorly to form a subacuminate angle with the ventral margin. In dorsal view, carapace regularly swollen with maximum width at mid-length. The anterior vestibule is particularly developed. The related anterior distal marginal pore-canals are very short; the false ones are always absent. The upper and lower marginal zones are poorly developed.

Size (in mm) – LV ♀: L = 0.63; H = 0.31 (Pl. 1, fig. 8).
LV ♂: L = 0.59; H = 0.26 (Pl. 1, fig. 9).

Variability – Reduced differences have been observed in the running of the anterior lower inner lamella.

Affinities – The proposed new species is very similar to *K. praetexta* (Sars) in the general shape in both lateral and dorsal view. It differs in the much smaller size, in the more acuminate posterior extremity and in the reduced development of the upper and lower anterior marginal zones.

Distribution – This species occurs from the second half of M Pl 4 to the half of M Pl 5.

KRITHE FRUTEX n. sp.
Pl. 4, figs. 1-4; Pl. 6, fig. 15

1962 *Krithe pernoides* (Bornemann) - RUGGIERI, p. 17, pl. 1, figs. 12, 13.

Etymology – For latin *frutex* = bush.

Holotype – LV ♀ (Pl. 4, fig. 1). Stn. 69. B.O.C. 2015.

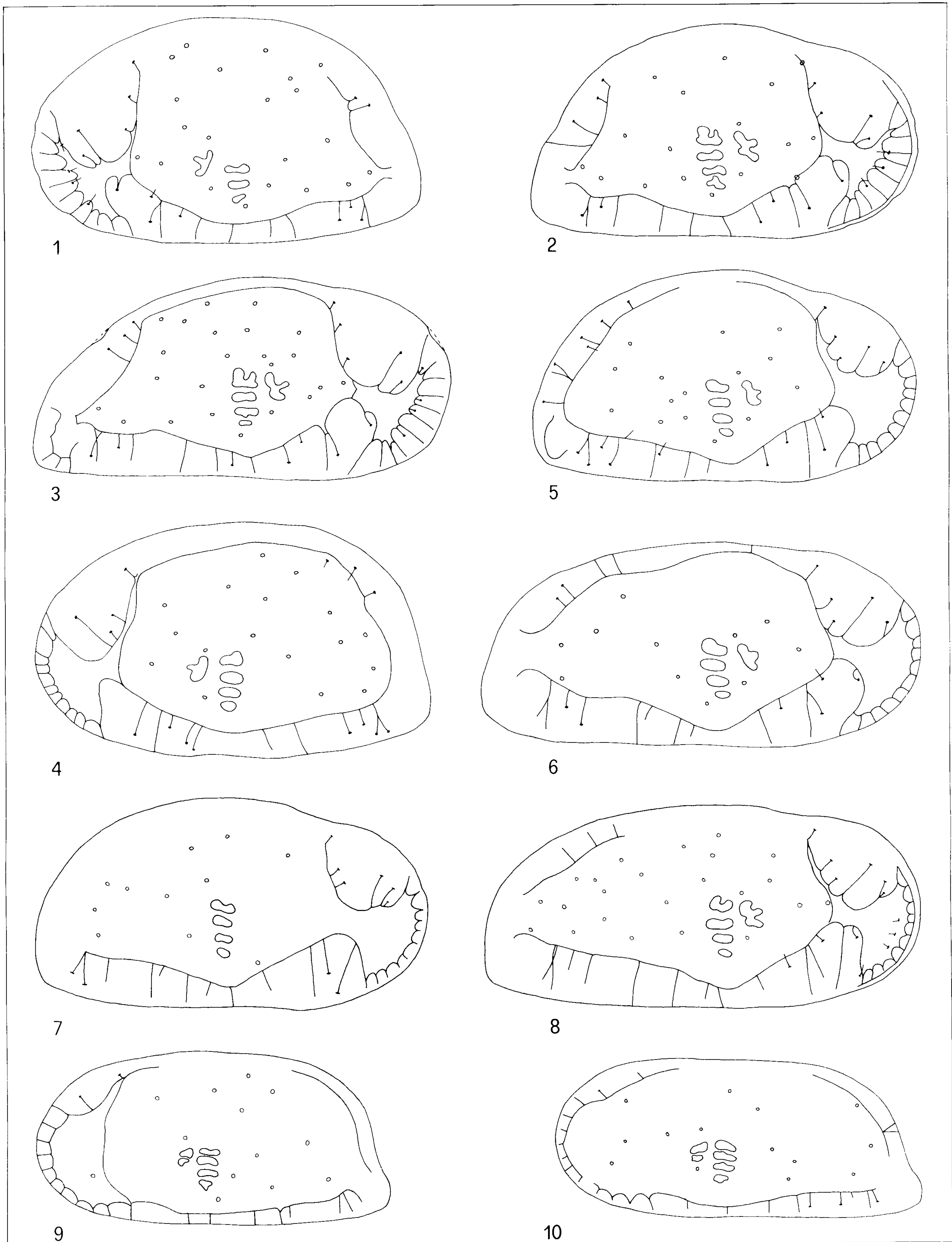
Paratypes – 5 valves (3 of which figured: Pl. 4, figs. 2-4). B.O.C. 2016; 1 complete carapace (Pl. 6, fig. 15). B.O.C. 2086.

Type-level – M Pl 6.

EXPLANATION OF PLATE 5

- Figs. 1-3 - *Krithe undecimradiata* Ruggieri. 1) LV ♀, Stn. 35, B.O.C. 2026; 2) RV ♀, Stn. 35, B.O.C. 2026; 3) RV ♂, Stn. 35, B.O.C. 2026.
Figs. 4-8 - *Krithe monosteracensis* (Seguenza). 4) LV ♀, Stn. B.O.C. 2027; 5) RV ♀, Stn. 77, B.O.C. 2028; 6) RV ♂, Stn. 77, B.O.C. 2028; 7) RV ♀, form with moved vestibular ventral pore-canal, Stn. 69, B.O.C. 2042; 8) RV ♂, form with moved vestibular ventral porecanal, Stn. 69, B.O.C. 2043.
Figs. 9-10 - *Krithe keyi* Breman. 9) LV ♀, Stn. 53, B.O.C. 2031; 10) LV ♂, Stn. 53, B.O.C. 2031.

All magnifications x 100. The transparence drawings done by Visopan Reichert. RV = right valve; LV = left valve; CC = complete carapace.



Diagnosis – A species characterized by the very narrow trapezoidal anterior vestibule and the particularly long anterior distal pore-canals, peculiarly numerous and grouped in the lowest distal part of the vestibule.

Description – The valves in lateral view appear almost rectangular. The anterior inner lamella is particularly wide with a small and narrow trapezoidal vestibule from which numerous distal pore-canals and intercalated false ones depart. The upper anterior inner lamella shows a strange structure similar to a small additional vestibule from which 2 short and 1 longer false marginal pore-canal depart. The lower inner lamella shows just before the beginning of the vestibule 2 well spaced pore-canals. In dorsal view it is very compressed.

Size (in mm) – LV ♀: L = 0.68; H = 0.31 (Pl. 4, fig. 1).
LV ♂: L = 0.69; H = 0.31 (Pl. 4, fig. 3).

Variability – The vestibule varies from hammer – to funnel shaped.

Affinities – *K. pernoides* (Bornemann) and *K. parvipora* n. sp. are very similar to the proposed new species. It differs from *K. pernoides* in the more compressed shape in dorsal view and chiefly in the absence of 2 upturning long marginal porecanals in the lowest part of the upper inner lamella; and in the presence of a strange structure similar to a small vestibule located at the top part of the upper inner lamella, structure from which a long false marginal pore-canal depart. Two shorter ones are located one above and a second below the structure. In the same area the typical 3 regularly spaced false marginal pore-canals of *K. pernoides* are absent. The lower inner lamella shows just before the beginning of the vestibule, two pore-canals well spaced from each other instead of almost bifurcating from the same stem. The proposed species differs from *K. pernoides* also in the presence of numerous grouped marginal pore-canals in the lowest distal part of the vestibule. For the differences with *K. parvipora* n. sp. see under that species.

Distribution – This species occurs rather constantly and is well represented from the first half of M Pl 5 up to the end of the section (Early Pleistocene).

KRITHE INIQUA n. sp.
Pl. 4, figs. 7-11; Pl. 6, figs. 12, 14

1980 *Krithe* sp. 1 CIAMPO, p. 14, pl. 4, figs. 1-3.

1986 *Krithe pernoides* (Bornemann) - CIAMPO, p. 14, pl. 4, figs. 1-3.

Etymology – From latin *iniquus* = iniquitous.

Holotype – LV ♀ (Pl. 4, fig. 7). Stn. 57. B.O.C. 2029.

Paratypes – 15 valves (1 of which figured: Pl. 4, fig. 8). B.O.C. 2030.

Type-level – M Pl 6.

Diagnosis – A species of *Krithe* characterized by the rectangular shape in lateral view, the anterior vestibule widely funnel-shaped, particularly narrow near the proximal part and more expanded towards the antero-ventral.

Description – Ventral and dorsal margins of the LV almost parallel, posterior extremity truncated. Anterior inner lamella very developed with vestibule very narrow proximally and very expanded distally towards the ventral and the dorsal. Distal anterior marginal pore-canals 11 in number, generally short, of the same length, and regularly spaced. The distal margin of the vestibule runs parallel to the valve margin. Inner lamella ventrally reduced at about mid-length and evidently upturning posteriorly. The upper anterior lamella shows a long upturning pore-canal below which a short false one occurs. Postero-dorsal inner lamella well developed, arched, and with two parallel subhorizontal pore-canals.

Size (in mm) – LV ♀: L = 0.55; H = 0.30 (Pl. 4, fig. 7).
LV ♂: L = 0.57; H = 0.26 (Pl. 4, fig. 9).

Variability – Our species shows a certain variability in the length of the anterior marginal pore-canals and the consequent increase or reduction of the vestibular area (Pl. 4, figs. 7-11). This fact can be related (Peypouquet, 1975) to the dissolved oxygen content. The position of all the marginal pores appears constant.

Affinities – This species differs from *K. frutex* n. sp. due to the different L/H ratio and especially to the vestibule shape and size which in the latter appears reduced and subrectangular in shape whereas in *K. iniqua* its anterior boundary runs parallel to the anterior margin with shorter marginal pore-canals. *K. iniqua* n. sp. is reported by Ciampo (1980; 1986) from the Tortonian and the Early Messinian of Sicily and Piedmont and occurs rather commonly in our section.

Distribution – This common species occurs from the base of the section up to the Pliocene – Pleistocene boundary.

KRITHE KEYI Breman, 1978
Pl. 5, figs. 9-10; Pl. 6, fig. 11

1975 *Krithe* sp. BREMAN, pp. 212-213, pl. 1, figs. 2 a-b.

1976 *Krithe caudata* BREMAN, pp. 12-14, pl. 1, figs. 3 a-d.

1978 *Krithe keyi* BREMAN *nomen novum*, p. 580 (misspelling for *Krithe keiji*).

Remarks – This species was originally described as *K. caudata* (name preoccupied by *K. caudata* van den Bold (1946) from the Tertiary of the Caribbean region) from Holocene sediments collected in the Adriatic Sea at depth ranging from 300 to 1200 m. It occurs also (unpublished data) in the Pliocene of the Bou Akrech sections (Rabat, Morocco). Van Harten & Droste (1988) reports it from the Holocene of the Mediterranean (9000 years B.P.) just before the S-1 sapropel layer.

Level of figured specimens – M Pl 5, Stn. 53.

Size (in mm) – LV ♀: L = 0.63; H = 0.31 (Pl. 5, fig. 9).
LV ♂: L = 0.65; H = 0.29 (Pl. 5, fig. 10).

Variability – The position of one pore-canal located in the upper inner lamella and of one in the lower inner lamella in some specimens appears displaced towards the narrower part of the vestibule in both sexes.

Distribution – This species occurs scattered from the half of M Pl 4 up to the top of the section (Early Pleistocene).

KRITHE MARIALUISAE n. sp.
Pl. 2, figs. 1-5; Pl. 6, figs. 5

Etymology – For Prof. Maria Luisa Colalongo, ostracodologist, University of Bologna, Italy.

Holotype – LV ♀ (Pl. 2, fig. 1). Stn. 74. B.O.C. 2009.

Paratypes – 6 valves (5 of which figured: Pl. 2, figs. 2-5; Pl. 6, fig. 5). B.O.C. 2010; 2012; 2078.

Type-level – Early Pleistocene.

Diagnosis – A species characterized by the anterior vestibule upturned and ventrally almost parallel to the antero-ventral margin.

Description – Left valve with dorsal and ventral margins almost parallel in the female, feebly converging backwards. Posterior extremity abruptly truncated in the female, more acuminate in the male. The anterior vestibule in both sexes is rather large proximally, becoming narrower and upturned

distally and almost parallel to the valve margin anteroventrally. The upper anterior inner lamella shows a single long marginal pore-canal which does not seem to reach the margin. The upturned distal part of the vestibule shows 3-4 characteristic pore-canals concentrated in a small area or bifurcating from the same stem. The distal anterior marginal pore-canals are rather long, sometimes intercalated with some false ones. The pore-canals of this area are 15-16 in number. The surface of the vestibule is reduced. The central muscle-scars are in a line of 4, the upper 3 of which subrectangular and the lowest one suboval and small, preceded by two separated scars.

Size (in mm) – LV ♀: L = 0.58; H = 0.33 (Pl. 2, fig. 1).
LV ♂: L = 0.59; H = 0.29 (Pl. 2, fig. 3).

Variability – The inner lamella does not seem to show any variability in the shape of the vestibule and in the length of the marginal pore-canals.

Affinities – This species is vaguely similar to *K. compressa* (Seguenza) from which it differs especially in the much more reduced vestibule and in the clearly more numerous marginal pore-canals in the vestibular area. It is closer to *K. perpulchra* n. sp. from which chiefly differs in the shape of the anterior vestibule which in the last species appears from roughly cuneiform to obtusely rounded.

Distribution – This species occurs from the beginning of M Pl 6 up to the Early Pleistocene.

KRITHE MONOSTERACENSIS (Seguenza, 1880)
Pl. 5, figs. 4-8; Pl. 6, fig. 1

1880 *Ilyobates bartonensis* var. *monosteracensis* SEGUENZA, p. 325, pl. 17, figs. 29, 29a.

1974 *Krithe monosteracensis* (Seguenza) - Ruggieri in GRECO *et al.*, p. 175, figs. 6/1-2.

1986 *Krithe monosteracensis* (Seguenza) - CIAMPO, pl. 17, fig. 19; pl. 18, fig. 1.

1991 *Krithe monosteracensis* (Seguenza) - RUGGIERI, p. 62.

Remarks – This species has been redescribed and reillustrated by Ruggieri (1974) from topotypic material (Early Pleistocene) of Monasterace (Calabria). This A. designates the neotype. Ciampo (1986) reports it from different Italian sections at the Tortonian – Messinian boundary. Our specimens appear bigger in size than those of Ruggieri (RV ♀: L = 0.63 mm). The species, together with *K. undecimradiata*, is supposedly pertaining to the psychrospheric assemblages (Ruggieri, 1974).

Level of the figured specimens – M Pl 6, Stn. 69; Early Pleistocene, Stn. 72, Stn. 77.

Size (in mm) – RV ♀: L = 0.68; H = 0.37 (Pl. 5, fig. 5).
RV ♂: L = 0.79; H = 0.37 (Pl. 5, fig. 6).
LV ♀: L = 0.70; H = 0.41 (Pl. 5, fig. 4).

Variability – This species shows in the lower part of the inner lamella a certain variability in the position of one of the marginal pore-canals which in some specimens moves towards the neck of the vestibule (Pl. 5, figs. 7, 8). The same phenomenon may occur in the upper inner lamella.

Distribution – This species occurs with a few specimens at the boundary M Pl 4 - M Pl 5, in an isolated sample and reappears at the boundary M Pl 5 - M Pl 6 with increasing numbers up to the top of the section (Early Pleistocene).

KRITHE PARVIPORA n. sp.
Pl. 4, figs. 5-6

Etymology – For latin *parvus* = few and *porus* = pore.

Holotype – RV ♀ (Pl. 4, fig. 5). Stn. 18. B.O.C. 2038.

Paratypes – 2 valves (one of which is figured: Pl. 4, fig. 6). B.O.C. 2039.

Type-level – M Pl 5.

Diagnosis – A species characterized by the funnel-shaped anterior vestibule with short and regularly

spaced distal marginal pore-canals and by the absence of intercalating false ones.

Description – In lateral view the RV female is subrectangular meanwhile the male shows the dorsal and ventral margins clearly converging backwards. The anterior inner lamella is wide with expanded funnel-shaped vestibule from which 11 short straight and regularly spaced distal pore-canals depart. The upper anterior inner lamella shows a typical long false marginal pore-canal at its top part where it is linked to a strange (vestibular?) structure.

Size (in mm) – RV ♀: L = 0.63; H = 0.28 (Pl. 4, fig. 5).
RV ♂: L = 0.61; H = 0.26 (Pl. 4, fig. 6).

Affinities – The proposed new species differs from *K. pernoides* (Bornemann) in the absence of false anterior distal marginal pore-canals, in the shorter distal anterior marginal pore-canals and in the shape of the anterior vestibule which distally runs parallel to the anterior margin. It differs from *K. frutex* n. sp. in the shape of the vestibule, in the shorter anterior marginal pore-canals, in the absence of intercalating false pore-canals at its distal part and in the smaller size (*K. frutex* ♀: L = 0.68 mm).

Distribution – The proposed new species is restricted to M Pl 4 and the first beginning of M Pl 5.

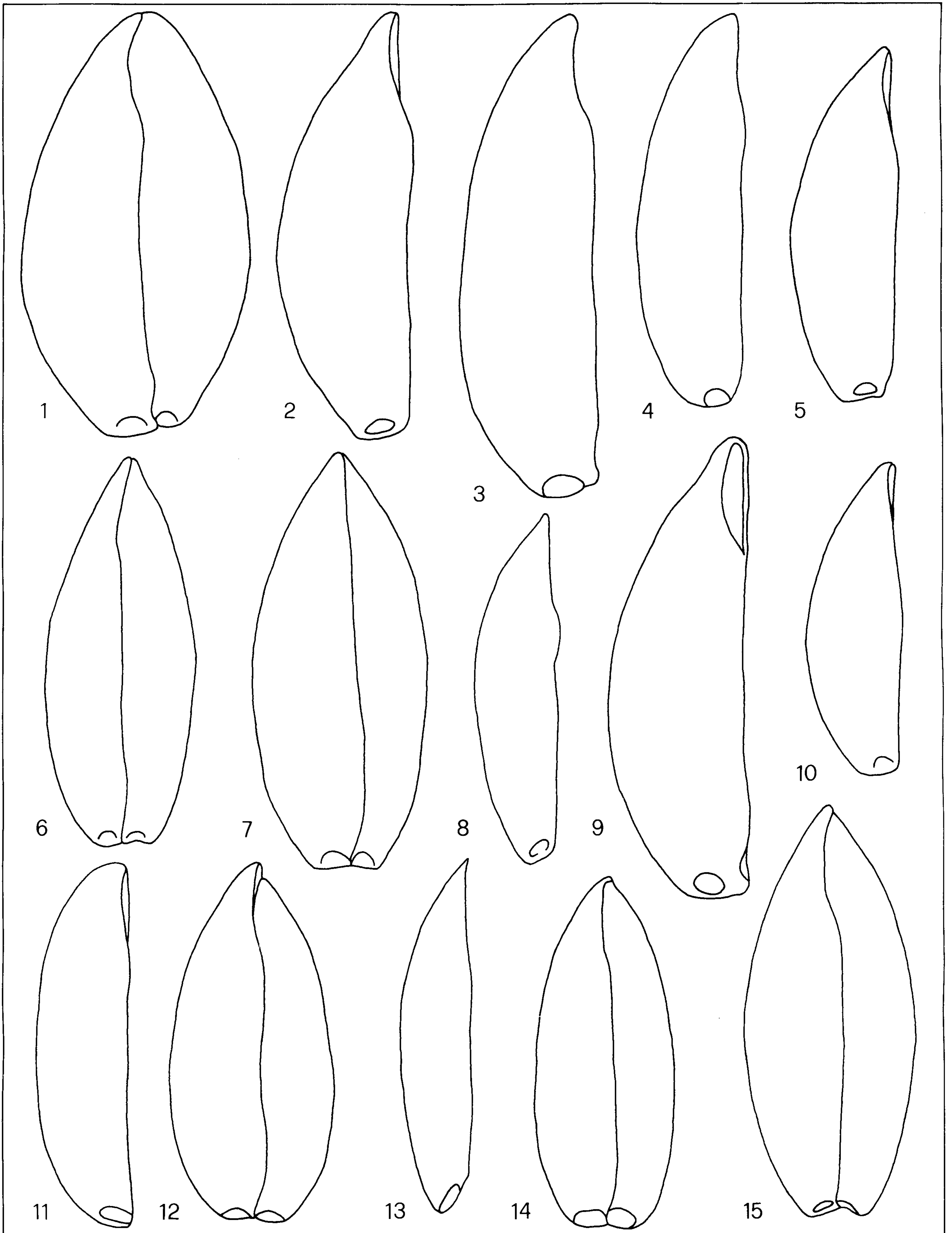
KRITHE PERNOIDES (Bornemann, 1855)
Pl. 2, figs. 6-12; Pl. 3, figs. 11-13; Pl. 6, figs. 9-10.

1855 *Bairdia pernoides* BORNEMANN, p. 358, pl. 20, figs. 7.
1957 *Krithe pernoides* (Bornemann) - KEIJ, p. 86, figs. 11 a-b.

EXPLANATION OF PLATE 6

- Fig. 1 - *Krithe monosteracensis* (Seguenza), CC ♀. Stn. 69. B.O.C. 2074 (× 106).
Fig. 2 - *Krithe undecimradiata* Ruggieri, LV ♀. Stn. 35. B.O.C. 2075 (× 104).
Fig. 3 - *Krithe praetexta* (Sars), LV ♀. Stn. 77. B.O.C. 2076 (× 104).
Fig. 4 - *Krithe exigua* n. sp., LV ♀. Stn. 37. B.O.C. 2077 (× 119).
Fig. 5 - *Krithe marialuisae* n. sp., LV ♀. Stn. 74. B.O.C. 2078 (× 108.5).
Figs. 6-7 - *Krithe compressa* (Seguenza). 6) CC ♂. Stn. 11. B.O.C. 2079 (× 109.5); 7) CC ♀. Stn. 11. B.O.C. 2079 (× 106).
Fig. 8 - *Krithe compressa* (Seguenza) small form, LV ♀. Stn. 37. B.O.C. 2080 (× 109).
Fig. 9 - *Krithe pernoides* (Bornemann), LV ♀. Stn. 77. B.O.C. 2081 (× 135).
Fig. 10 - *Krithe pernoides* (Bornemann), small form, LV ♀. Stn. 39. B.O.C. 2082 (× 108).
Fig. 11 - *Krithe keyi* Breman, LV ♀. Stn. 26. B.O.C. 2083 (× 113).
Fig. 12 - *Krithe iniqua* n. sp., CC ♀. Stn. 21. B.O.C. 2084 (× 104).
Fig. 13 - *Krithe perpulchra* n. sp., LV . Stn. 48. B.O.C. 2085 (× 109).
Fig. 14 - *Krithe iniqua* n. sp., CC ♂. Stn. 21. B.O.C. 2084 (× 106).
Fig. 15 - *Krithe frutex* n. sp., CC ♀. Stn. 69. B.O.C. 2086 (× 107).

The transparence drawings done by visopan Reichert. RV = right valve; LV = left valve; CC = complete carapace.



1968 *Krithe* aff. *morkhoveni* Van den Bold - RUSSO, pp. 39, 40 (*pars*), pl. 9, fig. 1b.

1986 *Krithe sinuosa* CIAMPO, pp. 87-88, pl. 17, figs. 3-5.

nec 1986 *Krithe pernoides* (Bornemann) - CIAMPO, p. 14, pl. 4, figs. 1-3.

Remarks - This species, originally described from the Oligocene of Hermsdorf near Berlin (Germany), has been carefully redescribed and reillustrated by Keij (1957) from material of the same age. The identification is accepted *vide* Keij because the original drawings are absolutely insufficient. The differences with *K. sinuosa* Ciampo (whose type-material generously offered has been examined) lie only in the presence of a few false marginal pore-canal in the lowest part of the anterior funnel - or hammer - shaped vestibule. The cited differences are considered in the range of variability of the species (Pl. 3, figs. 11-13).

Level of the figured specimens - M Pl 5, Stn. 35, Stn. 37, Stn. 39; M Pl 6, Stn. 58, Stn. 60; Early Pleistocene, Stn. 73, Stn. 77.

Size (in mm) - LV ♀: L = 0.62; H = 0.35 (Pl. 2, fig. 6).

LV ♂: L = 0.67; H = 0.34 (Pl. 2, fig. 7).

Variability - This species shows a clear variability in the position of 1 marginal pore-canal in the upper inner lamella and of a 2nd one in the lower inner lamella which both can move towards their upper and lower parts before the funnel of the vestibule (Pl. 2, figs. 11-12). The species is represented in the section by the typical large form (Pl. 2, figs. 6-7, 12) and a smaller one (Pl. 2, figs. 8-11). The size of the smaller form in mm is the following: LV: L = 0.53; H = 0.29. The vestibule varies from hammer to funnel-shaped.

Distribution - The large form occurs scattered from the half of M Pl 5 up to the end of the section (Early Pleistocene). The smaller form occurs in a single sample at the end of M Pl 4 and in 4 samples of the M Pl 5, associated with the large form.

KRITHE PERPULCHRA n. sp.

Pl. 3, figs. 6-9; Pl. 6, fig. 13

Etymology - For latin *perpulchrus* = very beautiful.

Holotype - LV (Pl. 3, fig. 6). Stn. 77. B.O.C. 2021.

Paratypes - 3 valves (two of which figured: Pl. 3, figs. 7-8). B.O.C. 2022.

Type-level - Early Pleistocene.

Diagnosis - A species characterized by the very

elongated shape in lateral view and by the irregularly cuneiform anterior vestibule with the apex towards the anterior margin.

Description - In lateral view the valves, very elongated, show the dorsal and ventral margins almost perfectly parallel, anterior acutely rounded and posterior very acuminate. Anterior inner lamella very wide with vestibule irregularly cuneiform, relatively large near the inner margin and becoming gradually narrower towards the anterior margin. Surface of the vestibule reduced, with maximum depth at about half the way of the width of the inner lamella. Three or 4 bifurcating distal anterior marginal pore-canal (one above and 2 - 3 below the mid - height) characterize the vestibule. Five or 6 false marginal pore-canal also occur in the same area.

Size (in mm) - RV: L = 0.62; H = 0.25.

LV: L = 0.60; H = 0.26 (Pl. 3, fig. 6).

Variability - The variability lies in the anterior vestibule which shows a shape from cuneiform to obtusely rounded.

Affinities - The proposed new species seems close to *K. interrupta* Dieci & Russo, 1964 of which it possibly can result in a junior synonym. It is also close to *K. compressa dertonensis* Ruggieri, 1962 as far as the shape of the anterior vestibule is concerned. It differs in the less arched dorsal margin, in the more truncated posterior extremity, in the much smaller size (*K. compressa dertonensis*: L = 0.83 mm) and in the more numerous anterior marginal pore-canal. Because of the incomplete description and figures which allow only for a hypothetical identification and the lack of original material, we prefer to erect a new species. It can also be vaguely compared with *K. marialuisae* n. sp. It differs in the evidently more slender shape in lateral view, the more sharply truncated posterodorsal margin and the cuneiform or obtusely rounded vestibule which in *K. marialuisae* appears evidently upturned at the anterior extremity. Moreover the upper inner lamella is characterized by a long pore-canal between two false ones whereas *K. marialuisae* shows a single long pore-canal.

Distribution - This species occurs from the end of M Pl 4 up to the end of the section (Early Pleistocene) with iterative presence and absence in groups of following samples.

KRITHE UNDECIMRADIATA Ruggieri, 1974

Pl. 5, figs. 1-3; Pl. 6, fig. 2

1974 *Krithe undecimradiata* Ruggieri in GRECO et al., pp. 175-177, figs. 6, 3a, 3b, 4a, 4b.

1986 *Krithe undecimradiata* Ruggieri - CIAMPO, pl. 18, figs. 2, 3.

Remarks – This species, described from the Early Pleistocene of Monasterace (Calabria), is reported by Ciampo (1986) from the Late Tortonian of Rio Mazzapiedi (Piedmont). Ruggieri (*op. cit.*) suggests the possibility of a psychrospheric species, due to the assemblages (with *Agrenocythere pliocenica*, *Bythoceratina scaberrima*, *Quasibuntonia radiatopora*, *Zabythocypris antemacella*, and *Bathycythere vanstraateni*) and a depth of more than 800 m. The presence of this species has not been previously reported from the Pliocene.

Level of the figured specimens – M Pl 5, Stn. 35.

Size (in mm) – LV ♀: L = 0.68; H = 0.41 (Pl. 5, fig. 1).

RV ♂: L = 0.75; H = 0.37 (Pl. 5, fig. 3).

Distribution – This species occurs only in one sample with rather numerous specimens, at the half of M Pl 5.

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