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BULLETIN No. 94

PALEOCENE OSTRACODA FROM NÛGSSUAQ, WEST GREENLAND

BY

JANINA SZCZECHURA

WITH 8 PLATES

KØBENHAVN
BIANCO LUNOS BOGTRYKKERI A/S
1971

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Abstract

This paper is the first description of post-Palaeozoic ostracods from Greenland. The material was collected from the Paleocene (Danian) Agatdal Formation on Nûgssuaq, West Greenland, a formation which has yielded a huge fauna – over 600 species, mostly gastropods and pelecypods.

The ostracod assemblage described comprises 96 specimens belonging to 39 species of 24 genera belonging to the suborders Cladocopina, Platycopina and Podocopina.

The genera represented have very varied age ranges; some are known from Paleocene to Recent, others range from Jurassic or Cretaceous up to Recent time. One genus, *Sclerochilus*, has not previously been found in deposits earlier than Miocene, while another, *Orthonotacythere*, ranges from Jurassic to Paleocene.

None of the species could be assigned with certainty to any hitherto described species and therefore the assemblage is considered to be endemic and consequently does not throw new light on the age of the Agatdal Formation.

In the case of four species the material is sufficiently well preserved and plentiful to allow the description of the new species *Bairdia agatdalensis*, *Cushmanidea rosenkrantzi*, *Hazelina nova* and *Loxoconcha groenlandica*.

CONTENTS

INTRODUCTION

This paper constitutes the first study of the post-Palaeozoic ostracods of Greenland (Palaeozoic ostracods have been described by TEICHERT (1937) and POULSEN (1937)) and deals with the Paleocene Ostracoda of Nûgssuaq of West Greenland. The deposits from which the present assemblage of ostracods is described belong to the so-called Agatdal Formation, as defined by ROSENKRANTZ (in KOCH, 1959, p. 75), which crops out in the Agatdal area in the gorges known as Agatkløft and Turritellakløft, the latter being the type locality of the Agatdal Formation. The present paper gives only general information concerning the Agatdal Formation since detailed descriptions of the location, lithology and stratigraphy of these sections are given in papers by KOCH (1959, 1963), ROSENKRANTZ & PULVERTAFT (1969) and HANSEN (1970).

The ostracod assemblage placed at the author's disposal originates from the Turritellakløft Member and the Sonja Member (Sonja Lens), both of which belong to the Agatdal Formation and at present are regarded as time-equivalent deposits which differ, however, in their lithological characters.

The Turritellakløft Member, as exposed at Turritellakløft, consists of marine deposits, mainly black bituminous shales, and overlies black shales belonging to the Kangilia Formation: upwards it passes into delta-like deposits representing the Abraham Member of the Agatdal Formation where sandy sediments predominate.

The Sonja Member, which is exposed in the Agatdal gorge, represents deltaic deposits ranging from shales to conglomerates, with marked alternation of sediments; it overlies the Kangilia Formation and underlies the Andreas Member.

The Agatdal Formation deposits yield a rich fossil marine fauna and terrestrial flora. In particular there is a rather well preserved gastropod and pelecypod fauna of over 400 species, which is being studied by Professor A. ROSENKRANTZ. In addition, there are corals, brachiopods, bryozoans, crustaceans, echinoderms and fish which are also being studied in Denmark. The fossil flora of the Agatdal Formation has been described by KOCH (1959, 1963, 1964).

The microfauna of the Agatdal Formation, i.e. Foraminifera (which have been examined by H. J. HANSEN) and Ostracoda, has been picked out chiefly from the fine-grained sediment filling the interiors of the gastropod shells. These shells were specially collected for the purpose by Professor A. ROSENKRANTZ, mainly in the year 1958. Since then H. J. HANSEN has extracted a large number of microfossils from the shell infillings of gastropods from the Sonja Member by means of ultrasonic methods. In general the coarse Sonja Lens sandstone outside the gastropod shells contains only large foraminifera and no ostracods.

The present contribution has been prepared at the Palaeo-zoological Institute of the Polish Academy of Sciences in Warsaw. The material described is housed at the Mineralogical and Geological Museum, Copenhagen, with the catalogue numbers given in this paper, abbreviated as M. M. H. (Museum Mineralogicum Hafniense).

MATERIAL AND STRATIGRAPHY

The ostracod assemblage from the Turritellakløft Member and the Sonja Lens of the Sonja Member contains 96 specimens, both single valves and complete carapaces. The state of preservation of the material under study is in general fairly good, although some of the specimens are damaged and some have their internal morphology obscured. In addition, some species are represented only by juvenile specimens.

Because of the small number of specimens of each species, not all of which were well preserved, and the often unsatisfactory state of individual development of the representatives of the species described in this paper, it was difficult to identify them even at the generic level. Nevertheless, this paper does provide an opportunity of recording the types of ostracods that occur in the Lower Paleocene deposits of West Greenland.

Among the ostracods studied, 39 species of 24 genera were distinguished, representing the three suborders, Cladocopina, Platycopina and Podocopina. The following genera were determined: *Polycope*, *Cytherella*, *Cytherelloidea*, *Bairdia*, *Pontocypris*, *Argilloecia*, *Paracypris*, *Brachycythere*, *Kikliocythere*, *Cytheretta*, *Cyamocytheridea*, *Cushmanidea*, *Hemicytherura*, *Orthonotacythere*, *Paracytheridea*, *Leguminocythereis*, *Loxoconcha*, *Sclerochilus*, *Munseyella*, *Bradleya*, *Hazelina*, *Xestoleberis* and *Uroleberis*.

The time ranges of these genera differ markedly. Some of them are known from the Paleocene to Recent, others are described from beds of different ages ranging from Jurassic or Cretaceous up to Recent times. Representatives of *Bradleya*, *Cushmanidea*, *Cyamocytheridea*, *Cythere*, *Leguminocythereis*, *Munseyella*, and *Uroleberis* are apparently found no earlier than the Paleocene or even the Eocene or Oligocene, while *Sclerochilus* has so far not been found in deposits earlier than the Miocene. These seven genera together with *Orthonotacythere*, a genus recorded as ranging from the Jurassic to the Paleocene, suggest an age at least as early as the Paleocene for this ostracod assemblage from the Agatdal Formation. The whole ostracod assemblage appears to be endemic and thus not comparable with other more precisely dated assemblages, and so it is not possible to be more precise about the age of the Agatdal

Formation on the basis of this fauna. None of the specimens could be assigned with certainty to any hitherto described species and for this reason the assemblage is considered to be endemic. In the case of four species, material was sufficiently well preserved and plentiful to describe the new species *Bairdia agatdalensis*, *Cushmanidea rosenkrantzi*, *Hazelina nova* and *Loxoconcha groenlandica*. Some species appear to be related to ones described from the Upper Cretaceous or Tertiary of Europe or North America. The similarity in some cases, however, involves juvenile forms and comparisons must therefore be considered tentative.

The present author's conclusions concerning the age of the Agatdal Formation agree generally with those of ROSENKRANTZ (1951, 1963, 1970), ROSENKRANTZ et al. (1940), ROSENKRANTZ in KOCH (1959), KOCH (1959, 1963, 1964), ROSENKRANTZ & PULVERTAFT (1969) and HANSEN (personal communication). Whilst the opinions of these authors on the age of the Agatdal Formation are more definite than those of the present author, they are not discussed here since the evidence of the endemic ostracods threw no further light on this matter.

Within the ostracod assemblage under review, the large number of species apparently representing very different environmental conditions ranging from littoral to bathyal strongly suggests that they did not originally live together and it is most likely that the whole, or at least part, of the assemblage is derived.

In the descriptions below the abbreviations a – adult, j – juvenile, C – carapace, R – right, L – left and V – valve are used throughout.

SYSTEMATIC DESCRIPTIONS

Order **Myodocopida** SARS, 1866

Suborder **Cladocopina** SARS, 1866

Family **Polycopidae** SARS, 1866

Genus ***Polycope*** SARS, 1866

Polycope sp.
Pl. 8, fig. 8

Material: One right and one left, probably adult valves from Turritellaklø ft.

Dimensions of specimens (in mm):

	Length	Height
aRV (not figured)	0.34	0.34
aLV (M.M.H. 10720)	0.39	0.34

Description: Valve subcircular in lateral view, compressed, delicate. Both valves very similar in size, shape and ornamentation. Hinge margin straight, terminated by cardinal angles which are not prominent, especially in the case of the anterior one. Valve margin heavily rimmed and partly frilled. Well-developed ornamentation of subconcentric ribs concentrated in the central part and reaching the dorsal margin where they are nearly perpendicular to the hinge margin causing the latter to appear serrate. Indistinctly developed reticulation occurs between the principal ribs. In the right valve ornamentation is less pronounced and covers the whole valve surface although maintaining the same pattern. Internal morphological features poorly developed; duplicature extremely narrow, hinge of the right valve apparently a furrow which is somewhat enlarged terminally.

Remarks: The present species most closely resembles *Polycope luxuriosa* described by HERRIG (1964) from the Maastrichtian of Germany. In contrast to *P. luxuriosa* the Greenland species has no trace of a rostrum and is not spiny. There is also a difference in the pattern and degree of development of the ornamentation.

Order **Podocopida** MÜLLER, 1894

Suborder **Platycopina** SARS, 1866

Family **Cytherellidae** SARS, 1866

Genus ***Cytherella*** JONES, 1849

Cytherella sp. 1

Pl. 2, fig. 15

Material: One juvenile right valve from the Sonja Lens, Agatkløft.

Dimensions of specimen (in mm):

	Length	Height
jRV (M.M.H. 10721)	0.44	0.29

Description: Valve subovate in side view, highest anteriorly, widest posteriorly just above the ventral margin; in the muscle scar region it is somewhat concave. Anterior end broadly rounded, posterior end gently rounded and somewhat angulate. Dorsal and ventral margins almost straight, converging posteriorly. Valve surface smooth. Muscle scar field marked externally by a shallow, elongated pit.

Remarks: The Greenland specimen is somewhat similar to those described by MORROW (1934) as *Cytherella? unilacuna* from the Upper Cretaceous of the U.S.A. Compared with the American form, the present specimen is more inflated postero-ventrally and differs in outline, differences which may be the result of comparing forms from different ontogenetic stages.

Cytherella sp. 2

Pl. 2, figs 6 a–c

Material: One complete carapace, probably juvenile, from the Sonja Lens, Agatkløft.

Dimensions of specimen (in mm):

	Length	Height	Width
aC (M.M.H. 10722)	0.59	0.44	0.245

Description: Carapace ovate in side view, highest anteriorly, widest posteriorly just below the middle. Marginal region of the dorsal, anterior and antero-ventral parts conspicuously compressed. Anterior end broadly rounded, posterior end narrowly rounded. Dorsal and ventral margins gently arched. Right valve overlaps left valve except along the posterior margin. There is a distinct rim which runs parallel and close to the anterior margin of the left valve. Surface of carapace smooth.

Remarks: The present specimen is nearest to *Cytherella parallela* REUSS, 1845, from the Upper Cretaceous of Germany (see HERRIG, 1966, p. 728, pl. 3, figs 1, 2, 4), but is much more round in side view. A similar difference exists between the specimen from Greenland and specimens referred by ALEXANDER (1934) to *Cytherella excavata*, a species described from the Paleocene of the U.S.A.; the Greenland specimen, however, is slimmer than that from the American Paleocene.

Genus ***Cytherelloidea*** ALEXANDER, 1929

Cytherelloidea sp.
Pl. 2, fig. 17

Material: One juvenile left valve from Turritellakløft.

Dimensions of specimen (in mm):

	Length	Height
jLV (M.M.H. 10723)	0.34	0.2

Description: Valve rounded-subquadrate in lateral outline, compressed. Greatest height anteriorly, greatest width postero-ventrally. Dorsal and ventral margins nearly straight, somewhat converging posteriorly. Anterior and ventral ends rounded, the latter somewhat angular. Muscle scar area depressed. A short, oblique rib occurs at the postero-dorsal cardinal angle; another rib, bordering the greatest valve inflation, lies below the latter at the postero-ventral margin. Valve surface very finely pitted.

Remarks: The lack of adult specimens prevents one making comparisons with hitherto described specimens of the genus *Cytherelloidea.*

Suborder **Podocopina** SARS, 1866

Superfamily **Bairdiacea** SARS, 1866

Family **Bairdiidae** SARS, 1888

Genus ***Bairdia*** McCOY, 1844

Bairdia agatdalensis n. sp.
Pl. 2, figs 1–5; Pl. 7, fig. 9

Holotypus: Pl. 7, fig. 9. (M.M.H. 10724).

Stratum typicum: Agatdal Formation (Paleocene).

Locus typicus: Nûgssuaq (Western Greenland), Agatdal region.

Derivatio nominis: agatdalensis—named after Agatdal, the type locality.

Diagnosis: Carapace almost triangular in lateral view, moderately inflated. Dorsal margin angulate and strongly arched, ventral margin almost straight. Anterior end terminating in a bluntly round point below mid-height; posterior end terminating in a more sharply rounded, weakly upturned point about one-third of the height above the ventral margin.

Material: Eight complete adult and juvenile carapaces, and seven juvenile valves, some damaged, from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

		Length	Height	Width
aC	(M.M.H. 10724)	1.47	0.93	0.735
aC	(M.M.H. 10725)	1.225	0.78	0.59
jC	(M.M.H. 10726)	0.98	0.54	0.44
jLV	(M.M.H. 10727)	0.44	0.27	—
jRV	(M.M.H. 10728)	0.5	0.245	—

Description: Carapace elongate, triangular in lateral view, highest in middle, widest in central part, moderately inflated. Dorsal margin angulate, strongly arched, more steeply sloping posteriorly. Ventral margin almost straight. Anterior end angulately rounded just below mid-height, posterior end produced, pointed, especially in the right valve, somewhat upturned. The larger left valve overlaps the right along the dorsal and ventral margins. Internal morphological features of the adult forms not known. Surface of the carapace finely, closely punctate. Juvenile valves are more angular and triangular than the adults in lateral view; they also have a markedly concave ventral margin in the right valve. Juvenile specimens show the muscle scars typical of the genus.

Remarks: The Greenland form seems very similar to one described by HAZEL (1968) as *Bairdoppilata* sp., from the Paleocene of the U.S.A. However, comparison of the closed carapace of *Bairdia agatdalensis* n. sp. with a single valve of *Bairdoppilata* sp. does not give sufficient grounds for establishing their definite identity. Specimens of *Bairdia magna* ALEXANDER, 1927 which HAZEL (1968) compared with *Bairdoppilata* sp. are more ovate in lateral outline and more pointed posteriorly than the specimens referred to *Bairdia agatdalensis* n. sp. by the present author.

Superfamily **Cypridacea** BAIRD, 1845

Family **Pontocyprididae** G. W. MÜLLER, 1894

Genus ***Pontocypris*** SARS, 1866

Pontocypris sp.
Pl. 3, figs 11–14

Material: Five right and two left juvenile valves, mostly damaged, and two complete juvenile carapaces, both from Turritellakløft and the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

	Length	Height
jRV (M.M.H. 10730)	0.245	0.12
jRV (M.M.H. 10731)	0.34	0.19
jRV (M.M.H. 10732)	0.44	0.19
jLV (M.M.H. 10733)	0.44	0.245

Description: Valves thin, moderately and evenly inflated, subtriangular, somewhat lanceolate in side view; maximum height in front of centre. Valves differ in size and shape, the left one being the higher. Dorsal margin arched, angulate in front of the mid-length in the right valve, but at the midlength in the left one, gently sloping posteriorly, more rapidly so anteriorly; posterior cardinal angle weakly marked. Ventral margin only slightly sinuous, almost straight. Anterior end obliquely and narrowly rounded; posterior end truncated, more narrowly rounded. Valve surface smooth. Internal morphological features typical for immature specimens, weakly developed. In ontogenetic development the valve outline is more angular in the older specimens than the younger ones.

Remarks: Generic assignment is based solely on the general morphology of the forms described above, and the absence of adult specimens prevents any suggestion being made concerning their specific identity.

Genus ***Argilloecia*** SARS, 1866

Argilloecia sp.
Pl. 3, figs 5, 6

Material: One complete somewhat damaged probably adult carapace, and one left, juvenile valve, from Turritellakløft.

Dimensions of specimens (in mm):

	Length	Height	Width
aC (M.M.H. 10734)	0.44	0.2	0.19
jLV (M.M.H. 10735)	0.34	0.15	—

Description: Carapace elongate, sub-elliptical, typical of the genus in general shape, highest just behind the middle, widest in the mid-portion. It is evenly and markedly inflated, except the marginal region of the anterior end where it is somewhat compressed. Anterior end obliquely rounded, posterior end truncated, angulately rounded postero-ventrally. Dorsal margin slightly arched, ventral margin indistinctly sinuate. Right valve overlaps the left, especially along the dorsal and ventral margins. Surface of the carapace smooth. Internal morphological features unknown.

Remarks: This form is similar to *Argilloecia claibornensis* STEPHENSON, 1946 from the Eocene of the U.S.A. To the present author, however, the Greenland specimen appears higher and less pointed posteriorly (this view is based on a comparison of the only material available with STEPHENSON's figure of a single valve). Compared with *Argilloecia faba* ALEXANDER, 1934 the present specimen is longer and less pointed antero-ventrally.

Family **Paracyprididae** SARS, 1923

Genus ***Paracypris*** SARS, 1866

Paracypris sp.
Pl. 3, figs 7, 8

Material: One adult right valve and one juvenile right valve, from Turritellaklø ft.

Dimensions of specimens (in mm):

	Length	Height
aRV (M.M.H. 10736)	0.93	0.34
jRV (M.M.H. 10737)	0.39	0.19

Description: Valve elongated, evenly and moderately inflated, wedge-shaped; greatest height in front of the mid-length. Dorsal margin gently arched, slightly concave antero-dorsally, nearly parallel to the ventral margin and converging with it posteriorly. Anterior end broadly rounded, posterior end tapering, pointed postero-ventrally. Valve surface smooth. Muscle scars as shown on Pl. 3, fig. 7c. Faintly visible radial pore-canals not numerous, widely spaced, bifurcating at the antero-ventral margin. Duplicature wide, especially at the anterior and posterior ends, where large vestibules occur. Hinge adont; in the right valve the list only is present.

Remarks: The described species most closely resembles *Paracypris parapiculata*, described by ALEXANDER (1934) from the Paleocene of the U.S.A. The difference between these two species lies in the length/height ratio; the specimen from Greenland is more elongated.

Cyprydidid sp.
Pl. 1, fig. 8

Material: One complete adult carapace, from the Sonja Lens, Agatkløft.

Dimensions of specimen (in mm):

	Length	Height	Width
aC (M.M.H. 10738)	0.735	0.34	0.29

Description: Carapace reniform in side view, moderately and evenly inflated; highest in middle, widest in the posterior half. Marginally the larger left valve overlaps the right throughout. Dorsal margin broadly arched, ventral margin somewhat concave medially. Both ends similar, narrowly rounded. Valve surface smooth. Internal morphological features not known except the radial pore-canals seen from the outside; as figured on Pl. 1, fig. 8b, these are rather numerous and branching, and particularly long at the ventral margin near the anterior end. Duplicature wide along the ventral margin, particularly in its anterior part.

Remarks: Whilst the features described above suggest that this is a member of the Cyprididae, the various features of taxonomic importance are insufficiently known for the genus to be determined. In general shape it is close to *Aglaiella* with which it agrees in its branched radial pore canals.

Family uncertain
Sp. sp. 1
Pl. 3, fig. 4

Material: One adult right valve, from Turritellakløft.

Dimensions of specimen (in mm):

	Length	Height
aRV (M.M.H. 10739)	0.59	0.245

Description: Valve elongate, subreniform in lateral outline, weakly and evenly swollen, highest in middle, widest in central part. Dorsal margin broadly arched, indistinctly truncate posteriorly; ventral margin almost straight. Anterior end rounded, posterior end more narrowly rounded, somewhat extended postero-ventrally. Valve surface smooth. Duplicature wide along the anterior margin, less wide along the posterior margin, becoming very narrow along the middle of the ventral margin; there are large vestibules at both ends. Radial pore-canals extremely short, straight and sparse. Normal pore-canals not observed. Hinge adont, only the list being present in the valve studied. Muscle scars were seen only indistinctly in transmitted light, but seem to be typical of the Cypridacea.

Remarks: The general appearance and the observed taxonomic features of the described species suggest some similarity between the Greenland form and the genus *Aglaiocypris* SYLVESTER-BRADLEY, 1946.

Sp. sp. 2
Pl. 2, fig. 14

Material: One left, probably juvenile, valve from Turritellakløft.

Dimensions of specimen (in mm):

	Length	Height
jLV (M.M.H. 10740)	0.44	0.22

Description: Valve elongate, subovate in lateral outline, highest in front of middle, evenly and moderately swollen, widest centrally, somewhat flattened ventrally. Dorsal margin gently arcuate, more sloping posteriorly; ventral margin straight. Anterior end narrowly rounded with greatest extension antero-ventrally; posterior end less narrowly rounded, terminating just below mid-height. Valve surface smooth.

Remarks: This form is not known in sufficient detail to permit any suggestion concerning its specific or even generic assignment to be made.

Sp. sp. 3
Pl. 2, fig. 8

Material: A juvenile valve (probably a right valve) from Turritellakløft.

Dimensions of specimen (in mm):

	Length	Height
jRV (M.M.H. 10741)	0.27	0.15

Description: Valve somewhat semi-lunate in side view, almost equally, moderately inflated, widest in posterior half near the ventral margin; ventral side slightly flattened. Dorsal margin arched, ventral margin indistinctly concave medially. Both ends very similar, acutely rounded at the ventral margin. Valve surface smooth. Internal features obscured, although a distinct, narrow duplicature may be observed along the anterior and posterior margins. Hinge very simple, adont.

Remarks: The present author has no suggestion concerning the systematic position of the form described above.

Sp. sp. 4
Pl. 3, fig. 3; Pl. 5, fig. 3

Material: Two adult left valves, one damaged, from the Sonja Lens, Agatkløft.

Dimensions of specimen (in mm):

	Length	Height
aLV (M.M.H. 10742)	0.54	0.245

Description: Valves elongate, triangulary-ovate in lateral outline, evenly and weakly inflated. Maximum height and maximum width anteriorly. Dorsal margin weakly arched, gradually sloping posteriorly where it converges with the indistinctly sinuate ventral margin. Anterior end slightly obliquely rounded, posterior end truncated, narrowly rounded postero-ventrally. Valve surface smooth. Hinge simple, adont. Duplicature wide, especially at the anterior and posterior ends where it forms large vestibules; at both ends inner margin is parallel to the valve margin whereas they approach each other at the middle of the ventral margin. Radial pore-canals short and straight; normal pore-canals minute and sparse. Muscle scars invisible.

Remarks: The general appearance and the observed internal features of the described species suggest some similarity between the Greenland form and the genus *Pontocypris*. The shape of the representatives of the latter, however, is usually more triangular.

Superfamily **Cytheracea** BAIRD, 1850

Family **Brachycytheridae** PURI, 1954

Genus ***Brachycythere*** ALEXANDER, 1933

Brachycythere? sp. 1

Pl. 8, figs 1, 2

Material: Two juvenile right valves, one of them damaged, from the Sonja Lens, Agatkløft.

Dimensions of specimen (in mm):

	Length	Height
jRV (M.M.H. 10743)	0.49	0.29

Description: Valve rounded-triangular in lateral view, conspicuously swollen, especially postero-ventrally, flattened ventrally; the most distal, posterior and anterior parts compressed. Dorsal margin almost straight, converging posteriorly with the sinuate ventral margin. Anterior margin broadly and obliquely rounded, posterior end narrowly rounded; both ends slightly serrate. Eye tubercle very weakly developed, muscle scar node pronounced. Maximum valve inflation anteriorly is bounded by a small depression parallel to the anterior margin, whereas ventrally it forms a sharp latero-ventral ridge; in the damaged, larger valve, this is terminated posteriorly by a short, sharp, backwardly-directed spine.

Flattened ventral side weakly ribbed. Lateral valve surface smooth. Hinge simple, adont. Muscle scars and pore canals not observed. Duplicature very narrow.

Remarks: Tentative assignment of these forms to *Brachycythere* is based entirely on their general appearance. Insufficient knowledge of various features of taxonomic importance does not permit comparison with other known species.

Brachycythere? sp. 2
Pl. 2, fig. 19

Material: One juvenile left valve from the Sonja Lens, Agatkløft.

Dimensions of specimen (in mm):

	Length	Height
jLV (M.M.H. 10745)	0.54	0.3

Description: Valve rounded-triangular in lateral outline, highest at the eye region. Markedly, almost evenly inflated, especially postero-ventrally; ventrally flattened and distally compressed. Latero-ventrally a tubercle-like protuberance is developed at the maximum valve inflation posteriorly. Dorsal and ventral margins straight, converging posteriorly. Anterior margin slightly obliquely, broadly rounded; posterior end narrowly rounded. Muscle scar node well-developed. At the anterior end, some distance from the margin, is a shallow, furrow-like concavity. No trace of an eye tubercle was seen. Valve surface smooth, except for the indistinctly ribbed ventral side. Internal morphological features partly obscured, typical for immature specimens.

Remarks: As in the previous case, tentative assignment of this form to *Brachycythere* is based mainly on shape. More detailed data are needed before any comparison with other species can be made.

Genus ***Kikliocythere*** HOWE & LAURENCICH, 1958

Kikliocythere sp.
Pl. 4, fig. 8; Pl. 6, figs 5, 6

Material: One complete adult carapace, opened by the present author, from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

	Length	Height
aRV (M.M.H. 10746).....	1.28	0.59
aLV (M.M.H. 10747).....	1.28	0.61

Description: Valve thick, solid, subovate in lateral outline, markedly inflated, especially postero-ventrally, the most distal posterior part being compressed. Both valves of the carapace differ distinctly in size and shape; the smaller right valve is more truncated antero- and postero-dorsally, where it is particularly strongly overlapped by the larger left valve. Dorsal margin nearly straight, ventral margin slightly concave medially. Anterior end broadly and obliquely rounded, posterior end narrowly rounded, more so in the right valve. Eye tubercle well-developed. Valve surface rather smooth laterally, indistinctly ribbed ventrally, irregularly papillose antero-ventrally. Numerous normal pore-canals lie in the large funnel-like openings giving the valve surface a coarsely pitted appearance.

Muscle scars seen externally consist of five scars arranged in a somewhat fan-like fashion with a horse-shoe-like scar in front of them. Radial pore-canals numerous, straight, rather long. Duplicature not very wide; the line of concrescence coincides with the line of the inner margin and is almost parallel to the valve margin. Hinge amphidont; terminal elements of the right valve are distinctly crenulate.

Remarks: The form described above and assigned to *Kikliocythere* sp. is most similar to *Brachycythere pseudoinfundibuliformis* (*recte Kikliocythere pseudoinfundibuliformis*), a species described by VAN VEEN (1935), from the Maastrichtian of Holland. Specimens from Greenland, however, are less pointed posteriorly, more obliquely rounded anteriorly and, above all, they are more inflated just above the ventral margin. Compared with *Kikliocythere? nitida* described by the present author (1965) from the uppermost Cretaceous of Poland, the present specimens are more oblong, with a differently shaped anterior margin; and whereas the valve surface in Polish specimens is smooth that of the Greenland ones is coarsely pitted.

Family **Bythocytheridae** SARS, 1926

Bythocytheridid sp.
Pl. 2, fig. 18

Material: One left and one right adult(?) valve from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

	Length	Height
aRV (M.M.H. 10748)	0.54	0.245
aLV (not figured)	0.54	0.245

Description: Valve ovately-rhomboidal in side view, conspicuously inflated, particularly postero-ventrally; centrally there is a sub-vertical,

shallow sulcus. Both valves are very similar in size and shape. Dorsal margin almost straight, somewhat convergent posteriorly with the straight ventral margin. Anterior end broadly and obliquely rounded, posterior end narrowly rounded, slightly caudate and terminating above the mid-height. Valve surface smooth except for the ventral side where indistinct ribs occur. Duplicature very narrow, seen only along the anterior margin; line of concrescence parallel to the valve edge. Hinge lophodont, terminal elements very weakly developed. Neither muscle scars nor marginal pore-canals observed.

Remarks: Assignment of this species to the Bythocytheridae is based mainly on its general appearance. It is not impossible that the described specimens represent immature forms, without fully developed taxonomic features, which is why the nomenclature is left open.

Family **Cytherettidae** TRIEBEL, 1952

Genus ***Cytheretta*** G. W. MÜLLER, 1894

Cytheretta cf. *C. sahnii* PURI, 1952

Pl. 4, fig. 6; Pl. 6, figs 1, 2

Material: One right and one left adult valve from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

	Length	Height
aRV (M.M.H. 10749).....	0.93	0.44
aLV (M.M.H. 10750).....	0.93	0.49

Description: Valve thick, solid, subovate in side view; greatest height anteriorly, greatest width postero-ventrally. Both valves differ markedly in size and shape, the right being smaller and more truncated antero- and postero-dorsally as well as more pointed posteriorly. Dorsal margin almost straight, ventral margin slightly sinuate, more so in the right valve than the left. Anterior end obliquely rounded; posterior end compressed and elongate, narrowly rounded, indistinctly upturned. Valve surface bears a distinct median rib, running obliquely from the middle of the posterior part of the valve to the antero-ventral valve region where it gradually disappears; in the muscle scar area it is somewhat enlarged. The second rib (i.e. the latero-ventral one) bounds the greatest valve inflation ventrally; its length is almost the same as that of the middle rib. The dorsal rib in its posterior part is almost parallel to the dorsal margin, whereas anteriorly it turns down and disappears at the eye tubercle. Besides these main ribs, there are other more or less distinct

ribs following the main ornamental elements; between them the valve surface is smooth; distinct striation occurs on the ventral side.

Radial pore-canals long, not numerous, and distributed in fan-like fashion. Duplicature wide, especially anteriorly where the line of the inner margin is distinctly sinuous. Hinge amphidont; the anterior tooth, in the right valve, is prominent and highest anteriorly. All elements of the hinge are smooth.

Remarks: These specimens are most similar to *Cytheretta sahnii* PURI, 1952 described from the Miocene of the U.S.A. Compared with the latter, the Greenland specimens have a sharper or more pronounced latero-ventral rib. Compared with *C. nerva montensis* MARLIÈRE, 1958 (see DEROO, 1966, p. 108, pl. 14, figs 320–323), from the Paleocene of Western Europe, the present specimens are more elongated and have more prominent lateral ribs, especially in the case of that bordering the ventral valve inflation. The European species is also, more or less, reticulate whereas the Greenland form is only costate.

Cytheretta sp.
Pl. 8, figs 3, 4

Material: One right and one left juvenile valve, one of them damaged, from Turritellakløft.

Dimensions of specimens (in mm):

	Length	Height
jRV (M.M.H. 10751)	0.64	0.34
jLV (M.M.H. 10752)	0.49	0.245

Description: Valve sub-triangular in lateral outline, oblong, highest anteriorly, widest postero-ventrally; the most distal anterior and posterior parts compressed. Dorsal margin almost straight, converging posteriorly with truncate and anteriorly sinuate ventral margin. Weakly rimmed anterior end truncated in the right valve, rounded in the left valve, posterior end slightly serrate, obtusely pointed. Valve surface with two dorsal ribs, one parallel and close to the dorsal margin turning down and disappearing anteriorly, the second short and starting at the antero-dorsal cardinal angle from which it runs sub-parallel to the upper part of the anterior margin. A median rib crosses the central tubercle, joining posteriorly the latero-ventral rib which forms the latero-ventral ridge; the latter runs almost the whole length of the valve. Muscle node weakly marked. Valve surface covered by irregularly spaced tubercles and riblets; distinct ribs cover the ventral side. Internal morphological features typical for immature forms, very weakly developed. Radial pore-canals and muscle scars not observed.

Remarks: There is some similarity between the above form and *Cytheretta gutzwilleri* OERTLI, 1956 from the Upper Oligocene of Switzerland. The principal difference concerns the general appearance of the valves and the arrangement of the ornamentation which, however, may be merely a reflection of different ontogenetic stages. In comparison with *Cytheretta* (*Flexus*) *plicata* (MÜNSTER, 1830) from the Upper Oligocene of Germany, the Greenland species is more swollen latero-ventrally whilst in addition the ribs are differently arranged on the valve surface. These suggested similarities show the need for further studies on adult forms of *Cytheretta* sp. from Greenland.

Family **Cytherideidae** SARS, 1925

Subfamily **Cytherideinae** SARS, 1925

Genus ***Cyamocytheridea*** OERTLI, 1956

Cyamocytheridea cf. *Cytheridea falcoburgensis* VEEN, 1936
Pl. 1, figs 4–7

Material: One right and one left adult valve, one right and two left juvenile valves, from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

	Length	Height
aRV (M.M.H. 10753)	0.54	0.30
aLV (M.M.H. 10754)	0.56	0.34
jRV (M.M.H. 10755)	0.39	0.245
jLV (M.M.H. 10756)	0.46	0.27

Description: Valve subovate in lateral outline, moderately, almost evenly, inflated; greatest height anteriorly, greatest width posteriorly at mid-height. The most distal, posterior part, especially in the right valve, slightly compressed. Carapace valves differ from each other in outline and size; left valve less truncated antero- and postero-dorsally and, consequently, appears more ovate in side view than the right valve. Dorsal margin slightly arched, converging posteriorly with the nearly straight ventral margin. Anterior and posterior ends rounded, the latter more narrowly than the former. Valve surface smooth, irregularly and very weakly pitted by the funnel-like apertures of the normal pore-canals. Muscle scars, seen on the external valve surface (see Pl. 1, fig. 4c), consist of five scars arranged in a nearly vertical row, two horizontally elongated scars in front, and one scar below these. Radial pore-canals, faintly visible, not numerous, straight. Duplicature rather wide, especially anteriorly where a distinct vestibule occurs. Hinge in the right valve

consists of a crenulated bar passing anteriorly and posteriorly into distinctly denticulate tooth plates which are better developed at the anterior end of the hinge margin.

Juvenile specimens, in comparison with the adults, are more triangular in side view, less elongate and with less well-developed internal morphological features.

Remarks: The above form is comparable with *Cytheridea falcoburgensis*, especially the males, described by VAN VEEN (1936) from the Upper Maastrichtian of Holland. The small differences between these forms concern mainly the shape of the valve, particularly in the posterior region; whereas the Greenland species is compressed, the specimens figured by VAN VEEN seem to be evenly inflated. Specimens figured by DEROO (1966) as *Asciocythere falcoburgensis* (VEEN), from the Maastrichtian of Holland and Belgium, are shorter, higher and more triangular in lateral outline compared with those from Greenland. According to DEROO's figures (1966), the hinge of the right valve in *A. falcoburgensis* consists of a furrow and terminal teeth, corresponding to the complementary elements in the left valve, whereas in the specimens from Greenland there is a bar terminated by teeth in the right valve.

Cytherideinid? sp.
Pl. 2, fig. 16

Material: One juvenile left valve from Turritellakløft.

Dimensions of specimen (in mm):

	Length	Height
jLV (M.M.H. 10757)	0.40	0.20

Description: Valve reniform in lateral view, evenly and moderately inflated; highest in front of the mid-length, widest posteriorly. Dorsal margin gently arched, ventral margin slightly concave in middle. Anterior end somewhat obliquely, broadly rounded, posterior end less broadly rounded. A weakly developed subvertical sulcus occurs behind the muscle scar area. Valve surface smooth. Internal morphological features obscured but appear characteristic for immature specimens.

Remarks: In the absence of any adult representatives, this specimen can only tentatively be assigned to the Cytherideinae on the general features of the immature valve.

Subfamily **Neocytherideidinae** PURI, 1957

Genus ***Cushmanidea*** BLAKE, 1933

Cushmanidea rosenkrantzi n. sp.
Pl. 1, figs 9–12

Holotypus: Pl. 1, fig. 9 (M.M.H. 10759).

Stratum typicum: Agatdal Formation (Paleocene).

Locus typicus: Nûgssuaq (Western Greenland), Agatdal region.

Derivatio nominis: rosenkrantzi—named in honour of the Danish palaeontologist Professor, Dr. ALFRED ROSENKRANTZ.

Diagnosis: Valve asymmetrically elongate-oval, transversely oblong in lateral outline, highest just in front of the middle, widest posteriorly. Height less than half the length. Valve surface slightly striate near the anterior margin.

Material: One complete adult carapace, three adult right valves and three damaged juvenile right valves from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

	Length	Height	Width
cC (M.M.H. 10758)	0.64	0.27	0.245
aRV (M.M.H. 10759)	0.67	0.29	—
jRV (M.M.H. 10760)	0.39	0.15	—
jRV (M.M.H. 10761)	0.27	0.10	—

Description: Valve asymmetrically elongate-oval in side view (height almost $2^1/_2$ times the length), evenly inflated but more so posteriorly, highest in front of middle. Both valves are of similar size and shape although the left valve overlaps the right, mainly along the anterior margins. Dorsal margin moderately arched, ventral somewhat concave in front of the middle. Anterior end narrowly and obliquely rounded, posterior end more broadly and truncately rounded. Valve surface rather smooth, distinctly pitted in its lower part, the pits corresponding to the normal pore-canal apertures. Faint striation parallel to the valve margin occurs at the anterior end and in the ventral region. Duplicature narrow posteriorly, wider anteriorly where a distinct vestibule is developed. Radial pore-canals (see Pl. 1, fig. 9b) short, straight and not numerous. Hinge in the right valve (see Pl. 1, fig. 9c) consists of smooth elongated terminal tooth plates and a median furrow with a faint list above. Muscle scars not observed.

Remarks: In general appearance *Cushmanidea rosenkrantzi* is similar to *Bythocypris? mcguirti* described by HOWE & GARRETT (1934), and

redescribed by CHEETHAM (1952) as *Cytherideis mcguirti*, from the Eocene of the U.S.A. The main difference lies in the shape of the valve, *Cushmanidea rosenkrantzi* being highest in front of the middle instead of behind the middle as in the American species; moreover the hinge margin in the American species is situated much more posteriorly compared with that in the Greenland species.

There is also some similarity between *Cushmanidea rosenkrantzi* and *Neocytherideis elongatus*, a Recent species described by PURI (1952b) from shore sand from the south of England. These forms differ in the shape of the valve, especially in the outline of the dorsal margin which slopes more posteriorly in *C. rosenkrantzi* than in PURI's species.

Cushmanidea? sp.
Pl. 1, figs. 13, 14

Material: One complete adult carapace and one complete juvenile carapace from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

	Length	Height	Width
aC (M.M.H. 10762)	1.225	0.59	0.54
jC (M.M.H. 10763)	0.735	0.39	0.39

Description: Carapace large, solid, oblong, reniform in lateral outline, evenly and markedly swollen, especially in central part; greatest height in front of the middle. Both valves are very similar in size and shape, the larger left valve being less truncated antero- and posterodorsally. Dorsal margin broadly arched, nearly straight, subparallel to the slightly sinuate ventral margin. Anterior end obliquely rounded and somewhat downturned, posterior end evenly and broadly rounded. Carapace surface smooth, except for the marginal regions, the ventral side and the anterior margin, where it is weakly papillose, the papillae being arranged in a complex linear pattern, generally parallel to the valve edges. Sparse and rather irregularly distributed coarse pits correspond to the apertures of the normal pore-canals. Internal morphological features not known. In the juvenile form, which probably belongs to the same species, the external valve surface shows the muscle scars which consist of four, round scars arranged sub-vertically with two scars in front.

Remarks: This species is only tentatively assigned to the genus *Cushmanidea* because its internal taxonomic features are unknown. In its general appearance *Cushmanidea?* sp. is similar to *Cytherideis echolsae* MALKIN, 1953 from the Miocene of the U.S.A. It differs, however, in ornamentation as well as in the valve proportions; *Cushmanidea?* sp. is

papillose at the antero-ventral margin whereas a smooth valve surface seems to characterise the American species. There is also a distinct external similarity between *Cushmanidea?* sp. and *Clithrocytheridea pusilla* APOSTOLESCU, 1956 from the Lower Eocene of France. Compared with the latter, the Greenland species is more elongated, wider and more downturned anteriorly in side view.

Family **Cytheruridae** G. W. MÜLLER, 1894

Genus ***Hemicytherura*** ELOFSON, 1941

Hemicytherura sp.

Pl. 4, fig. 5; Pl. 8, fig. 5

Material: One adult right valve from the Sonja Lens, Agatkløft.

Dimensions of specimen (in mm):

	Length	Height
aRV (M.M.H. 10764).....	0.49	0.245

Description: Valve somewhat reniform but with distinct caudal process, highest posteriorly, widest postero-ventrally; in the central part there is a vertical sulcus-like depression. Dorsal margin broadly arched, ventral margin concave in middle. Anterior end rather narrowly, obliquely rounded, posterior end acuminately caudate below the mid-height. Valve surface covered with riblets which run more or less horizontally and converge somewhat anteriorly; posteriorly they are less distinct. Between the main ornamentation very fine reticulation and minute punctuation occur. Duplicature wide, particularly anteriorly, without vestibules. In the anterior region, especially, the line of the inner margin differs markedly from the ventral margin in being distinctly sinuous. Radial pore-canals sparse, long, branching and showing a fan-like distribution. Hinge in the right valve consists of a median groove with a list above, and terminal, enlarged ridge-like extensions of the selvage of which the anterior one is better developed.

Remarks: In general appearance this species resembles *Cytherura bananaformis* CORYELL & FIELDS, 1937, (see VAN DEN BOLD, 1967, p. 312, Pl. 1, fig. 18), from the Neogene of the Caribbean region. The differences are seen mainly in the valve inflation and the ornamentation; *Hemicytherura* sp. seems less inflated posteriorly, more arched dorsally and, in addition, has different ornamentation.

Genus ***Orthonotacythere*** ALEXANDER, 1933

Orthonotacythere sp.
Pl. 2, fig. 9

Material: One damaged juvenile right valve, from the Sonja Lens, Agatkløft.

Dimensions of specimen (in mm):

	Length	Height
jRV (M.M.H. 10765)	0.37	0.245

Description: Valve sub-quadrangular in lateral view, greatest width postero-ventrally. Dorsal margin straight, ventral margin rounded, truncated posteriorly. Anterior end broadly, somewhat obliquely rounded; posterior end caudate near the posterior cardinal angle. A faint sulcus-like depression occurs in the central part of the valve. Valve surface slightly bulbous; the most prominent tubercle-like swelling, behind the sulcus, bears a sharp protuberance. Internal morphological features weakly developed, typical for immature specimens of the genus.

Remarks: Adults are unknown and the present specimen cannot be placed in any species so far described. In general appearance it is similar to species of *Orthonotacythere* such as *O. hannai* (ISRAELSKY, 1929), *O. cristata* ALEXANDER, 1934 and *O. scrobiculata* ALEXANDER, 1934 from the Upper Cretaceous of the U.S.A., but detailed study of adult material is needed to clarify the relationships.

Genus ***Paracytheridea*** G. W. MÜLLER, 1894

Paracytheridea sp.
Pl. 8, fig. 7

Material: One juvenile left valve from Turritellakløft.

Dimensions of specimen (in mm):

	Length	Height
jLV (M.M.H. 10766)	0.32	0.19

Description: Valve sub-quadrangular, caudate in lateral view, alate and ventrally flattened; greatest inflation postero-ventrally. Dorsal margin straight, sub-parallel to the latero-ventral ridge; ventral margin slightly sinuate, truncate and completely hidden by the latero-ventral ridge. Anterior end rounded, posterior end drawn out into a distinct, down-turned caudal process. Another downward pointing process occurs between the caudal process and the end of the alar inflation. Valve surface with weakly developed ribs, the most distinct being the anterior

rib parallel to the anterior margin and the one bordering the alar inflation posteriorly. Another rib joins the postero-dorsal valve region with the muscle node; its prolongation runs in front of the muscle node where it enlarges markedly. Indistinct reticulation, better developed in the postero-dorsal region, may be seen between the main ornamentation.

Remarks: Whilst its shape is characteristic of the genus *Paracytheridea* it is not possible to determine the species on the material at present available.

Family **Leguminocythereididae** HOWE, 1961

Genus ***Leguminocythereis*** HOWE, 1936

Leguminocythereis? sp.
Pl. 4, fig. 4; Pl. 6, figs 7, 8

Material: One complete adult carapace (opened by the present author) from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

	Length	Height
aRV (M.M.H. 10767).....	1.2	0.54
aLV (M.M.H. 10768).....	1.3	0.54

Description: Valve large, ovate in lateral outline, almost evenly, conspicuously inflated laterally, somewhat flattened ventrally; greatest width postero-ventrally. The smaller right valve is more truncated postero- and antero-ventrally than the left. Dorsal margin indistinctly sinuate, sub-parallel to the ventral margin which is slightly concave in the middle. Anterior end bluntly, rather abruptly rounded; posterior end elongated, serrate, narrowly rounded. Valve surface very finely pitted and covered with a low reticulate network whose riblets tend to be parallel to the valve margin at the anterior end and on the ventral side. A shallow, transverse furrow occurs near the anterior margin behind the well-developed eye tubercle. Muscle node not prominent. Greatest valve inflation bordered by a lateral ridge which ends rather sharply posteriorly. Duplicature of medium width with the inner margin parallel to the valve margin. Vestibules absent. Muscle scars, poorly visible on the external valve surface, consist of four scars arranged in a vertical row and a V-shaped scar in front of them. Hinge amphidont; terminal elements of the right valve, especially the posterior one, elongate and distinctly crenulate. Radial pore-canals short, straight, numbering about 40 anteriorly.

Remarks: There is some resemblance particularly as regards ornamentation, between *Leguminocythereis?* sp. and the Recent *Australicythere polylyca* (MÜLLER, 1908) from Antarctica, redescribed by BENSON

(1964). The two forms differ considerably, however, in other features. The characteristic ornamentation of *Leguminocythereis?* sp. is also comparable with that of juvenile forms of a Recent species from Australia described as *Campylocytherinid* sp. by McKenzie (1967). Details of the internal morphology as well as some difference in external appearance, however, prove that they are separate species and genera.

Tentative assignment of the present species to *Leguminocythereis* is based mainly on the general shape of the valve; the hinge and muscle scar pattern differ markedly from those of the genotype.

Family **Loxoconchidae** Sars, 1925

Genus ***Loxochoncha*** Sars, 1866

Loxoconcha groenlandica n. sp.

Pl. 3, fig. 10; Pl. 4, fig. 7; Pl. 7, figs 5, 6

Holotypus: Pl. 3, fig. 10; Pl. 7, fig. 5. (M.M.H. 10769).

Paratypus: Pl. 4, fig. 7; Pl. 7, fig. 6. (M.M.H. 10770).

Stratum typicum: Agatdal Formation (Paleocene).

Locus typicus: Nûgssuaq (Western Greenland), Agatdal region.

Derivatio nominis: groenlandica—named after the island from which it is described.

Diagnosis: Valve oblong, laterally compressed with alar extensions above the ventral margin. Valve surface strongly reticulate with tubercle-like protuberances at the dorsal margin.

Material: One complete adult carapace, one left and one right adult valve, and one juvenile left valve from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

	Length	Height	Width
aC (M.M.H. 10769)	0.44	0.245	0.245
aRV (M.M.H. 10770)	0.39	0.22	—
aLV (not figured)	0.39	0.20	—
jLV (not figured)	0.29	0.17	—

Description: Valve small, rhomboidally-ovate in side view, somewhat arrow-shaped when seen dorsally, laterally compressed with alar extension above the ventral margin which is sharply terminated posteroventrally. Both valves differ little in size and shape, the larger right valve being higher posteriorly and less truncated anteriorly. Dorsal margin straight, sub-parallel to the slightly sinuous ventral margin. Anterior end broadly and rather obliquely rounded; posterior end com-

pressed, narrowly-rounded and upturned, the termination lying above the midheight. Eye tubercle well-developed. Valve surface very strongly reticulate, ridged and tuberculate. It carries a sharp lateral alar extension which ends sharply posteriorly and runs above the ventral oblique rib, and a marginal dorsal rib which turns down behind the posterior cardinal angle and almost reaches the postero-ventral margin. The most pronounced tubercle occurs in front of the weakly marked sulcus, below the dorsal rib and just below the eye tubercle, and is prolonged as a short rib to the anterior margin. Another protuberance occurs behind the sulcus and joins the dorsal rib. Muscle scars and pore-canals not observed. Duplicature moderately wide, without vestibules. Hingement appears typical of the genus, the right valve having a median furrow terminated posteriorly by teeth; the anterior tooth occurs some distance from the end of the furrow.

Remarks: In general appearance this form is similar to *Orthonotacythere sulcata* BROWN, 1957 from the Upper Cretaceous of the U.S.A., but may be easily distinguished by its ornamentation, particularly the arrangement of knob-like tubercles which are more prominent in *Loxoconcha groenlandica*.

Loxoconcha sp.
Pl. 5, fig. 2

Material: One juvenile left valve from Turritellakløft.

Dimensions of specimen (in mm):

	Length	Height
jLV (M.M.H. 10771)	0.245	0.16

Description: Valve thin, moderately and evenly inflated with the greatest inflation at mid-length, subovate in side view; highest posteriorly. Dorsal margin straight, ventral margin rounded, slightly sinuous in middle. Anterior end slightly oblique, broadly rounded; posterior end rounded, slightly upturned. Valve surface sub-concentrically pitted. Internal morphological features typical for immature specimen. On the external valve surface four round scars arranged in a vertical row may be seen.

Remarks: This form is similar in shape and ornamentation to many species described from Upper Cretaceous to Recent horizons. It is necessary to collect and analyse adult forms in order to make valid comparisons with the known species of *Loxoconcha*.

Family **Paradoxostomatidae** BRADY & NORMAN, 1889

Subfamily **Paradoxostomatinae** BRADY & NORMAN, 1889

Genus ***Sclerochilus*** SARS, 1886

Sclerochilus cf. *S. contortus* (NORMAN, 1862)
Pl. 3, fig. 9; Pl. 5, fig. 1

Material: One adult right valve from the Sonja Lens, Agatkløft.

Dimensions of specimen (in mm):

	Length	Height
aRV (M.M.H. 10772).....	0.49	0.245

Description: Valve thin, oblong, very weakly and evenly inflated, highest just behind the middle. Dorsal margin moderately arched, more sloping anteriorly; ventral margin distinctly concave in anterior third. Anterior end obliquely rounded, posterior end less broadly rounded. Valve surface smooth. Duplicature wide, especially anteriorly; line of concrescence and inner margin do not coincide, except in the oral region, so that vestibules occur of which the anterior one is the better developed. Radial and normal pore-canals not observed. Hinge simple, apparently only a groove is present in the right valve. Muscle scars (see Pl. 5, fig. 1b) consist of five elongated scars arranged in a subvertical row.

Remarks: The described specimen seems indistinguishable from the Recent *Sclerochilus contortus* (NORMAN, 1862). The only difference appears to be in the valve proportion, the specimen from Greenland being somewhat more elongated.

Family **Pectocytheridae** HANAI, 1957

Genus ***Munseyella*** VAN DEN BOLD, 1957

Munseyella sp.
Pl. 1, figs 1, 2; Pl. 2, fig. 10; Pl. 7, figs 7, 8

Material: One complete adult carapace (opened by the present author) from the Sonja Lens, Agatkløft and one juvenile right valve tentatively attributed to this species, from Turritellakløft.

Dimensions of specimens (in mm):

	Length	Height
aRV (M.M.H. 10773).....	0.39	0.196
aLV (M.M.H. 10774).....	0.39	0.196
jRV (M.M.H. 10775).....	0.29	0.15

Description: Valve small, thin, laterally compressed, subquadrangular in side view. Maximum height anteriorly, greatest width behind

the middle. Both valves very similar in size and shape. Dorsal margin straight; ventral margin truncated, slightly sinuous in front of the middle. Anterior end rounded and strongly oblique; posterior end compressed, angulate-rounded. Valves heavily ornamented with ribs and tubercles, the most characteristic being the postero-dorsal rib which curves down and almost joins the middle rib which consists of two sections separated by the muscle scar area. The anterior section of the middle rib bifurcates posteriorly as it approaches the muscle scar area. Above the latter, near the dorsal margin, are two knob-like tubercles. Parallel to the middle rib is a ventro-lateral rib which makes an acute angle with the ventral margin, and which expands posteriorly to form a sub-alate extension. The anterior margin is smooth and heavily rimmed whereas the posterior margin carries a few denticles.

Duplicature (see Pl. 1, fig. 2) wide anteriorly, narrow posteriorly. Anteriorly, radial pore-canals typical of the genus, sparse, rather short, extending from the distinct vestibule. Normal pore-canals and muscle scars not seen. Hinge (see Pl. 1, fig. 1) in the left valve consists of a median list terminated by teeth, and terminal sockets. The juvenile form, which is only tentatively placed here on the basis of general appearance, differs very much in ornamentation and to a lesser extent in outline.

Remarks: *Munseyella* sp. differs distinctly from all hitherto described species of the genus, particularly as regards ornamentation. It appears to be a new species which will be named when more material becomes available.

Family **Trachyleberididae** SYLVESTER-BRADLEY, 1948

Genus ***Bradleya*** HORNIBROOK, 1952

Bradleya? cf. *Cythereis? weaveri* HOWE & LAW, 1936
Pl. 4, fig. 1; Pl. 6, figs 3, 4

Material: Two adult, complete carapaces (one of them opened by the present author) from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

		Length	Height	Width
aC	(M.M.H. 10776).....	1.08	0.59	0.49
aRV	(M.M.H. 10777).....	1.05	0.49	—
aLV	(M.M.H. 10778).....	1.03	0.59	—

Description: Carapace large, solid, quadrangular in lateral outline with moderate lateral inflation and ventral flattening. Both valves differ in size and shape, the larger left valve being less truncated antero- and

postero-dorsally. Dorsal margin straight, nearly parallel to the ventral margin which is slightly concave in the oral region. Anterior end broadly rounded, posterior end compressed, truncated. Eye tubercle well-developed. Valve surface heavily ornamented and ribbed at the dorsal and ventral margin. The sharp, high dorsal rib starts behind the eye tubercle and runs in a slight arc towards the posterior cardinal angle, hiding the posterior part of dorsal margin; posteriorly it turns down sharply and rapidly disappears. The prominent latero-ventral rib originates at the anterior margin adjoining the strong reticulate and dentate rim and almost reaches the posterior margin where it is strongly protrusive. The posterior margin has a rim and is weakly spinose postero-ventrally. Muscle field well-developed. Valve surface, except the most distal posterior part and the marginal anterior region, coarsely reticulate; behind and in front of the muscle scar area and ventrally the dominant elements of the reticulation are longitudinal ribs. Muscle scars consist of four elongate scars, arranged in a sub-vertical row, with two, faintly visible separate scars in front. Radial pore-canals straight, regularly distributed, about forty anteriorly. Normal pore-canals sparse. Duplicature moderately wide anteriorly, narrow posteriorly, without vestibules. Hinge amphidont; anterior tooth in the right valve is distinctly crenulate.

Remarks: This species is comparable with *Cythereis? weaveri* Howe & Law, 1936 from the Middle Oligocene of the U.S.A. The main difference lies in the arrangement and length of the dorsal and latero-ventral ribs which extend further posteriorly in the Greenland species. Moreover there is a slight difference in the surface ornamentation of both species. The assignment of this species to *Bradleya* is tentative since the hinge varies somewhat from that typical of the genus.

Genus ***Hazelina*** Moos, 1966

Hazelina nova n. sp.

Pl. 3, fig. 2; Pl. 4, fig. 3; Pl. 7, figs 3, 4

Holotypus: Pl. 3, fig. 2; Pl. 7, fig. 4 (M.M.H. 10779).

Stratum typicum: Agatdal Formation (Paleocene).

Locus typicus: Nûgssuaq (Western Greenland), Agatdal region.

Derivatio nominis: Lat. nova = new; a new species of the genus *Hazelina*.

Diagnosis: Above and behind the muscle node the lateral valve surface bears a few more or less distinct ribs which are perpendicular to the dorsal rib. Two oblique ribs run from the latter with the posterior

end of the mid-rib. Behind the muscle node, below the median rib, a distinct tubercle occurs.

Material: Three complete carapaces (one of them opened by the present author) which differ markedly in size but which are most probably all adult, from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

	Length	Height	Width
aC (M.M.H. 10779).....	0.98	0.49	0.36
aRV (not figured)	0.71	0.39	—
aLV (M.M.H. 10780).....	0.735	0.39	—

Description: Carapace of large size, sub-quadrate in side view, compressed laterally and ventrally flattened. Both valves differ only slightly in size and shape; the larger left valve is less obliquely truncated antero-dorsally and posteriorly. Dorsal margin straight, almost parallel to the ventral margin which is slightly sinuous in its mid-part. Anterior end heavily rimmed and dentate, broadly round, posterior end compressed, angulate, truncated in its upper part and also rimmed and spinose; the 3–5 spines, which only occur postero-ventrally, are longest at the ventral margin. Muscle node distinct. Eye tubercle well-developed. Close to the dorsal margin there is a sharp rib which reaches the eye tubercle anteriorly and curves down at the cardinal angle posteriorly to join the middle rib. Middle rib somewhat oblique exceeding and disappearing in front of the muscle node; posteriorly two short ribs originate at the end of the mid-rib and run towards the end of the latero-ventral ridge. More or less distinct ribs originate from the mid-rib at the muscle field, of which the most characteristic seems to be a rib sub-perpendicular to the dorsal margin. Below the middle rib, at the muscle node, is a knob-like tubercle. The latero-ventral rib bordering the valve inflation is somewhat alate, sharply terminated and enlarges posteriorly. A few rather oblique ribs cover the ventral surface of the carapace. Valve surface sparsely but irregularly and coarsely pitted. Muscle scars not known. Duplicature narrow, without vestibules, line of concrescence parallel to the valve margin. Radial pore-canals straight, numerous. Hinge amphidont; terminal elements of the right valve appear slightly lobate.

Variation: Distinct variation in both size and valve ornamentation. The smaller carapaces are less distinctly ornamented and rimmed although the pattern of ornamentation is similar to that of the larger specimen so that for this reason they are all regarded as conspecific. The degree of calcification and the hinge development of the smaller carapaces suggest that they represent adult forms.

Remarks: This species somewhat resembles *Cythereis infragilis* described by the present author (1965) from the Paleocene of Poland.

The Greenland species, however, is differently ornamented; its middle rib is longer, especially anteriorly, than that in *C. infragilis*, and it has sub-vertical ribs which are never seen in Polish species.

Family **Xestoleberididae** SARS, 1928

Genus ***Xestoleberis*** SARS, 1866

Xestoleberis sp.
Pl. 1, fig. 3

Material: One juvenile left valve from Turritellakløft.

Dimensions of specimen (in mm):

	Length	Height
jLV (M.M.H. 10782)	0.41	0.29

Description: Valve ovate in lateral outline, highest and widest in the middle. Dorsal margin strongly arched, ventral margin only slightly convex, covering the contact margin which is sinuated in the middle. Anterior and posterior ends rounded, the anterior one somewhat more obliquely. Surface of the valve very finely pitted. Muscle scars and marginal area inside the valve obscured by rock material. Hinge, typical of the genus, consists of terminal, elongated sockets and a median bar (see Pl. 1, figs. 3 b, c).

Remarks: The described specimen most resembles the immature specimens assigned by the present author (SZCZECHURA, 1965) to *Xestoleberis pergensi* VEEN, a species occurring in the Upper Cretaceous of Holland, Belgium, Germany and the U.S.S.R., as well as in the Upper Cretaceous and Lower Tertiary (Paleocene) of Poland. The principal difference lies in the shape of the valve, the Greenland specimen being more elongate.

Genus ***Uroleberis*** TRIEBEL, 1958

Uroleberis? sp.
Pl. 2, fig. 7

Material: Two complete, probably immature, carapaces from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

	Length	Height	Width
jC (not figured)	0.245	0.15	0.15
jC (M.M.H. 10783)	0.29	0.15	0.15

Description: Carapace small, delicate, ovate in dorsal view, semi-ovate in side view, markedly inflated laterally, flattened ventrally. Dorsal margin gently arched, ventral margin straight. Both ends rounded, the anterior one more narrowly. Valves apparently similar although the larger left valve overlaps the right one all around. Valve surface smooth except for the finely ribbed ventral surface. Internal morphology unknown.

Remarks: Assignment of the described form to *Uroleberis* is based exclusively on its general external appearance. Its assignment to *Uroleberis* is, however, tentative since the posterior end does not appear to have a sufficiently developed caudal process; moreover, its internal morphology is unknown.

This is somewhat similar to that of *Cytherina impressa* described by REUSS (1851) from the Upper Cretaceous of the U.S.S.R. The Greenland form is less elongate and less inflated, having at the same time less sharp angular ends of the carapace. It is, however, a juvenile specimen the features of which generally differ from those of adult representatives of the species.

Family uncertain
Sp. sp. 5
Pl. 8, fig. 6

Material: One left and one right, probably juvenile, valve from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

	Length	Height
jRV (M.M.H. 10784)	0.44	0.29
jLV (not figured).....	0.465	0.29

Description: Valve small, delicate, triangular-ovate in lateral outline, moderately and evenly inflated, greatest height in front of the middle, greatest width in the central part. Both valves almost equal in size and shape, the left having an only slightly more rounded dorsal margin, with its maximum height near the mid-length. Dorsal margin weakly rounded, converging posteriorly with the nearly straight ventral one. Anterior end obliquely rounded, posterior end narrowly rounded. Valve surface completely tuberculate; postero-ventrally and on the weakly marked muscle node tubercle-like nodes are more prominent. Along the ventral and anterior margins, tubercles tend to be arranged almost parallel to the valve margin. Behind the muscle field, in the ventral region, there appears to be a shallow sulcus. Internal morphological features partly obscured. The hinge margin very simple, only a feeble furrow being developed in the left valve. Duplicature very narrow.

Remarks: These specimens are most similar to *Echinocythereis echinata* (SARS, 1865) (see HAZEL, 1967, p. 37, Pl. 6, figs 10, 11), Recent species occurring in the North Sea, Norwegian Sea and North as well as South Atlantic. This suggested similarity shows the need for further studies on adult representatives of Sp. sp. 8 from Greenland.

Sp. sp. 6
Pl. 2, figs 12, 13

Material: Two juvenile right valves, only tentatively attributed to the same species, from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

	Length	Height
jRV (M.M.H. 10785)	0.39	0.22
jRV (M.M.H. 10786)	0.47	0.27

Description: Valve small, thin, triangularly ovate in lateral outline, widest postero-ventrally, highest at the antero-dorsal cardinal angle. Almost straight dorsal margin converges posteriorly with the indistinctly sinuous ventral margin. Anterior end obliquely and broadly rounded, posterior end compressed and truncately rounded, the greatest length lying below midheight. Greatest inflation posteriorly, the valve surface sloping towards the pronounced muscle node, and bounded ventrally by a distinct latero-ventral ridge, and dorsally by a less prominent, shorter rib, which turns down posteriorly. Compressed anterior marginal region forms a distinct depression in front of the valve inflation. Eye tubercle weakly developed. Valve surface smooth. A thin rim occurs along all the valve margins. Internal morphology typical of immature specimen.

The size and shape of the valves vary as does the arrangement of the morphological details of the valve surface; the dorsal and ventral ribs are somewhat differently developed.

Remarks: The author has no suggestions concerning the specific attribution of the form described above. In general shape the valve is somewhat reminiscent of the genus *Phacorhabdotus*; the latter, however, has a median rib which is not seen in the Greenland form.

Sp. sp. 7
Pl. 2, fig. 11

Material: One juvenile right valve from the Sonja Lens, Agatkløft.

Dimensions of specimen (in mm):

	Length	Height
jRV (M.M.H. 10787)	0.39	0.245

Description: Valve small, thin, triangular-ovate in side view, widest postero-ventrally, highest anteriorly. Straight dorsal margin converges posteriorly with almost straight ventral margin. Anterior end very broadly rounded, truncate; posterior end narrowly rounded, also truncate. Ventral valve inflation is bordered by a sharp, arcuate latero-ventral rib which runs almost the whole length of the valve. Another sharp, knee-like rib occurs postero-dorsally. A weakly developed rim runs somewhat obliquely at the antero-dorsal cardinal angle. Muscle scar node poorly marked, with a sulcus-like deepening posteriorly. Valve surface smooth. Internal morphological features partly obscured. Hinge adont, simple.

Remarks: No affinities to known ostracod species or even genera, can be suggested.

Sp. sp. 8

Pl. 3, fig. 1; Pl. 4, fig. 2; Pl. 7, figs 1, 2

Material: Two complete adult carapaces (one of them opened by the present author) from the Sonja Lens, Agatkløft.

Dimensions of specimens (in mm):

		Length	Height	Width
cC	(M.M.H. 10788).....	0.59	0.32	0.34
aRV	(M.M.H. 10789).....	0.515	0.245	—
aLV	(M.M.H. 10790).....	0.515	0.29	—

Description: Valve thick, solid, subovate in lateral view, conspicuously inflated laterally, with ventral flattening; greatest height anteriorly, greatest width postero-ventrally. Both valves differ in size and shape, the smaller, right valve being more truncated antero- and postero-dorsally. Dorsal margin straight, slightly sloping towards the posterior end; ventral margin distinctly concave in front of the middle, posteriorly hidden by overhanging valve inflation. Anterior end broadly and obliquely rounded, posterior end compressed, narrowly rounded, sharply angulate in its upper part. Eye tubercle not observed. Valve surface strongly ornamented with thick ribs and reticulation; the anterior ribs are sub-concentric and parallel to the valve margin; these pass into straight, parallel ribs which cover the ventral side of the valve. Behind the muscle field the posterior lateral surface of the valves is covered with pronounced, parallel, longitudinal ribs separated by distinct furrows. The postero-ventral, most inflated part of the valve is bordered by a rather sharp ridge which extends up to the dorsal margin. The whole valve surface is somewhat reticulate and coarsely pitted. Duplicature wide, narrowest in the oral region; vestibules absent. Radial

pore-canals numerous, long, with a fan-like distribution. Normal pore-canals very fine and numerous. Muscle scars obscured. Hinge amphidont; terminal and median elements distinctly crenulate.

Remarks: The general appearance of the described species suggests some similarity between the Greenland form and the genus *Absonocytheropteron* PURI, 1957, described from the Upper Eocene of North America. Details of the internal morphology as well as some difference in external appearance, however, prove that they are separate genera. There is also a near similarity between the Sp. sp. 8 and the species from the Paleocene of Poland described by the present author (1965) as *Schizocythere solida*; the two species differ mainly in valve ornamentation, especially dorsally, whilst at the same time having a similar general outline and hinge margin.

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(Scales correspond to 0.1 mm)

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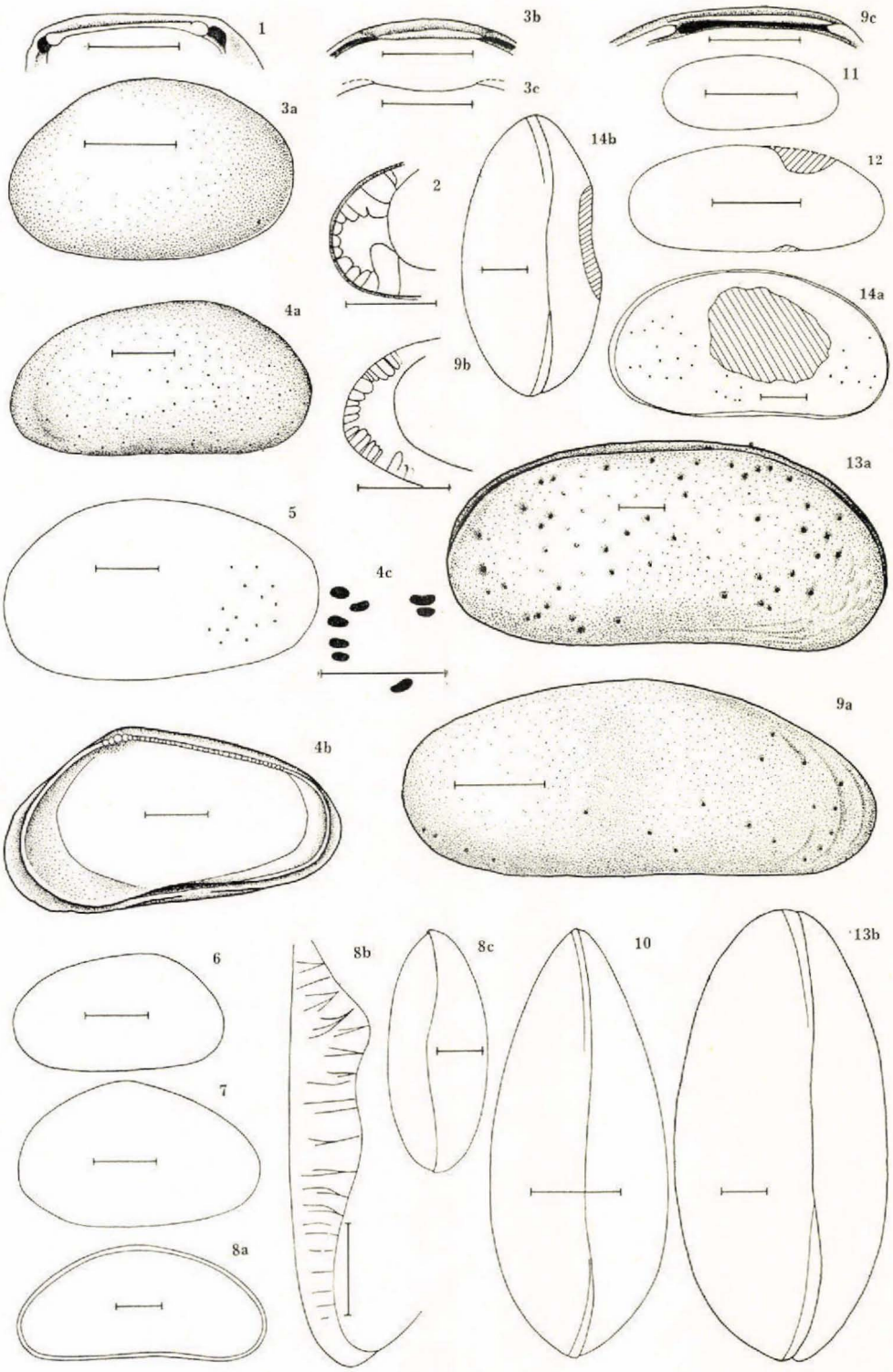
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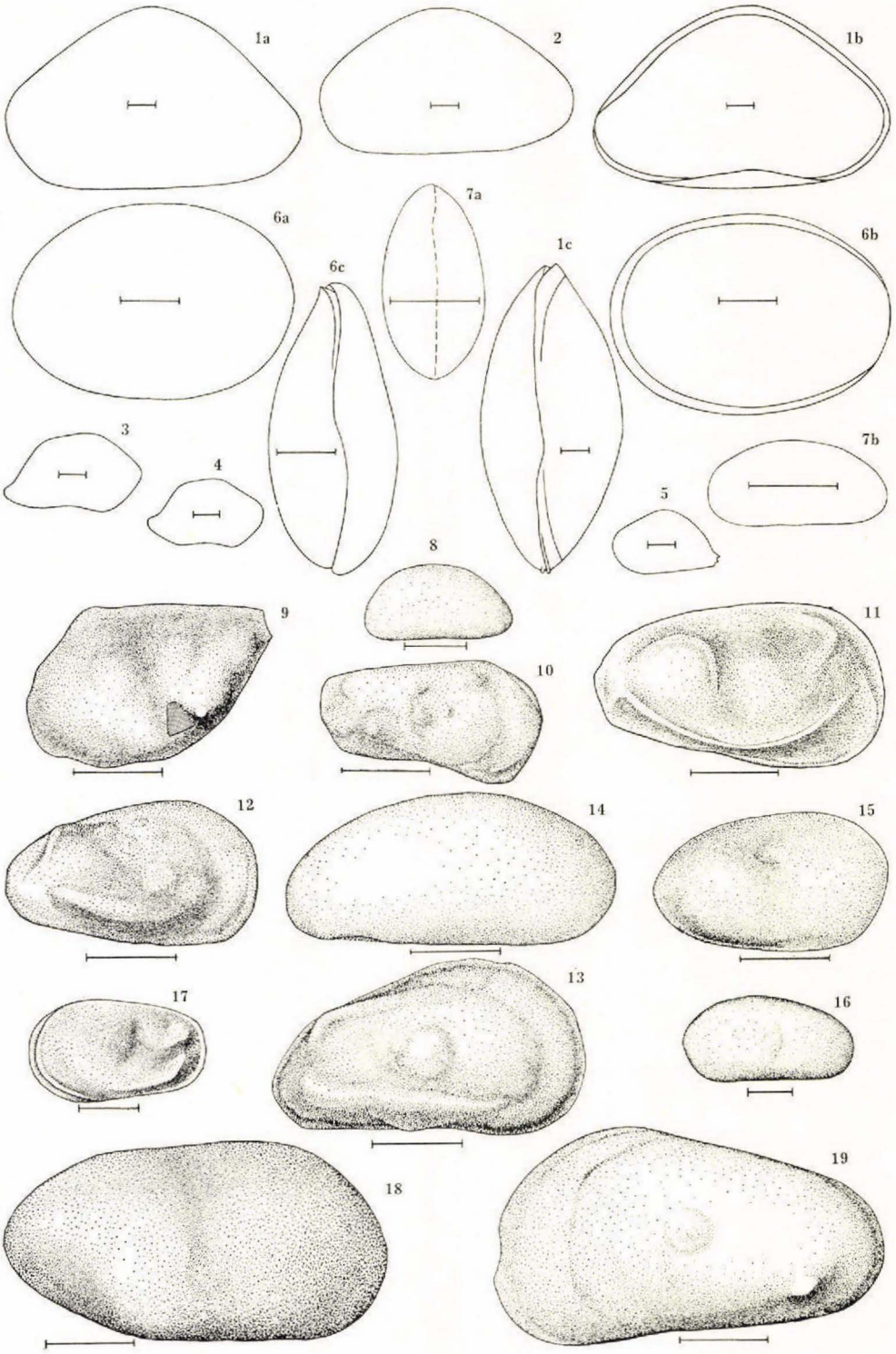
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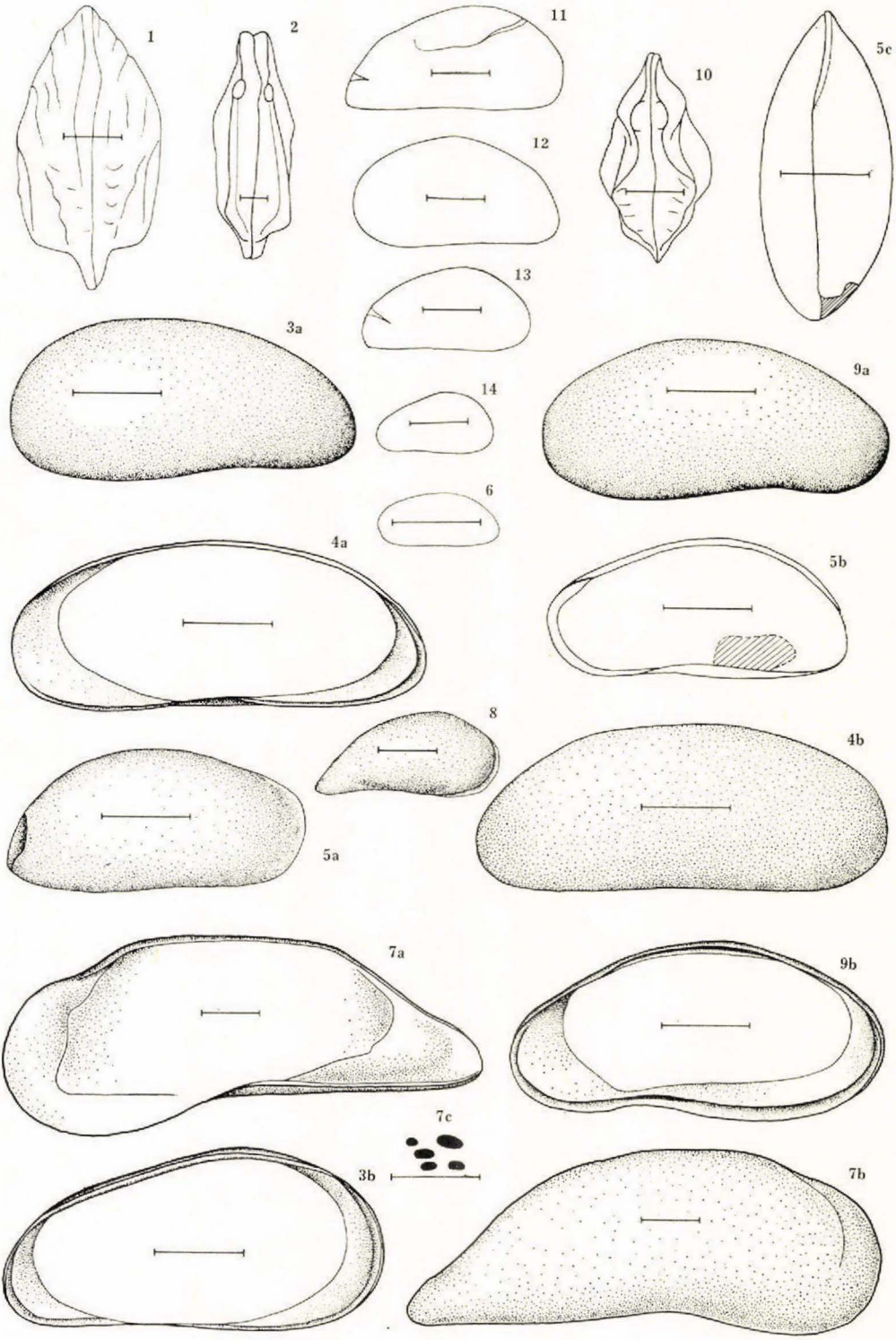
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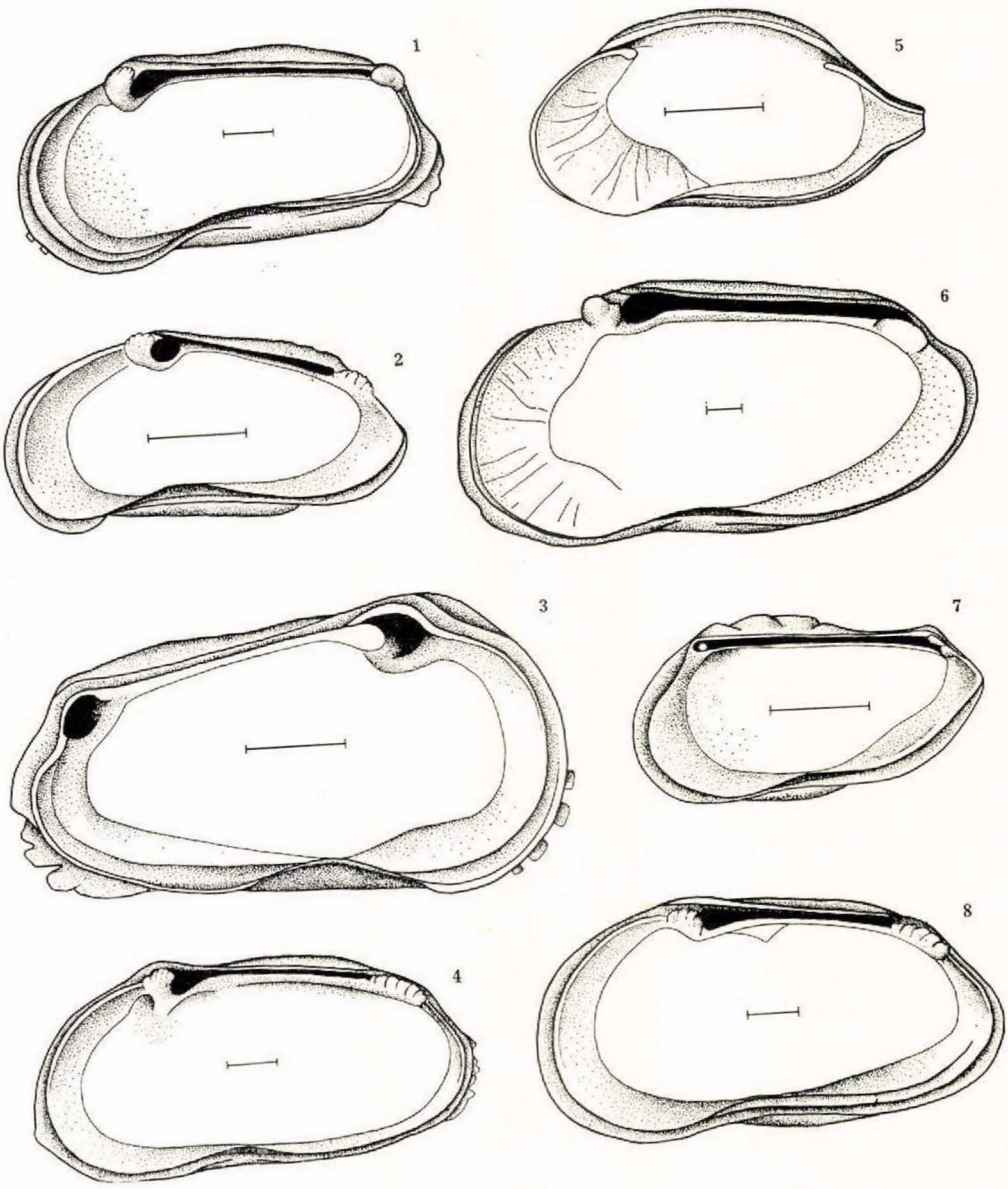
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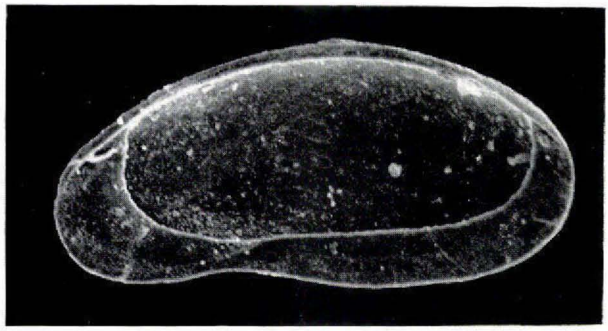

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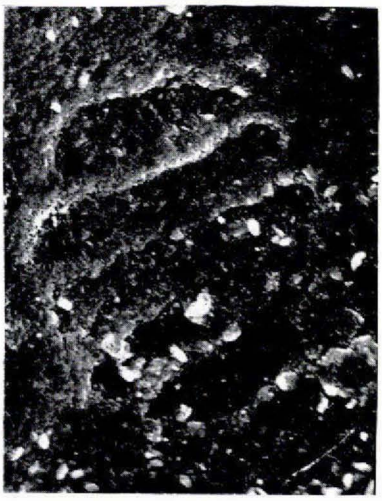

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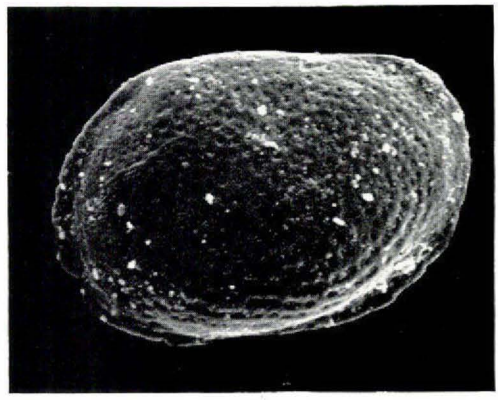

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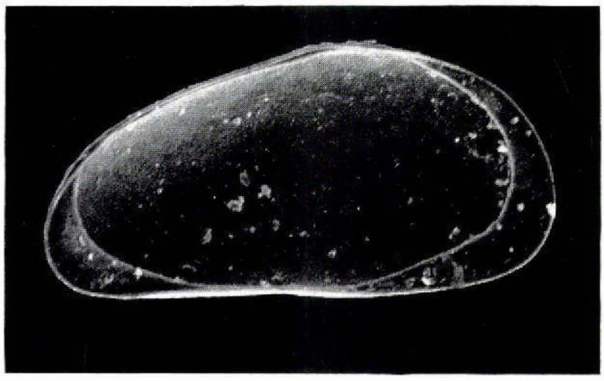

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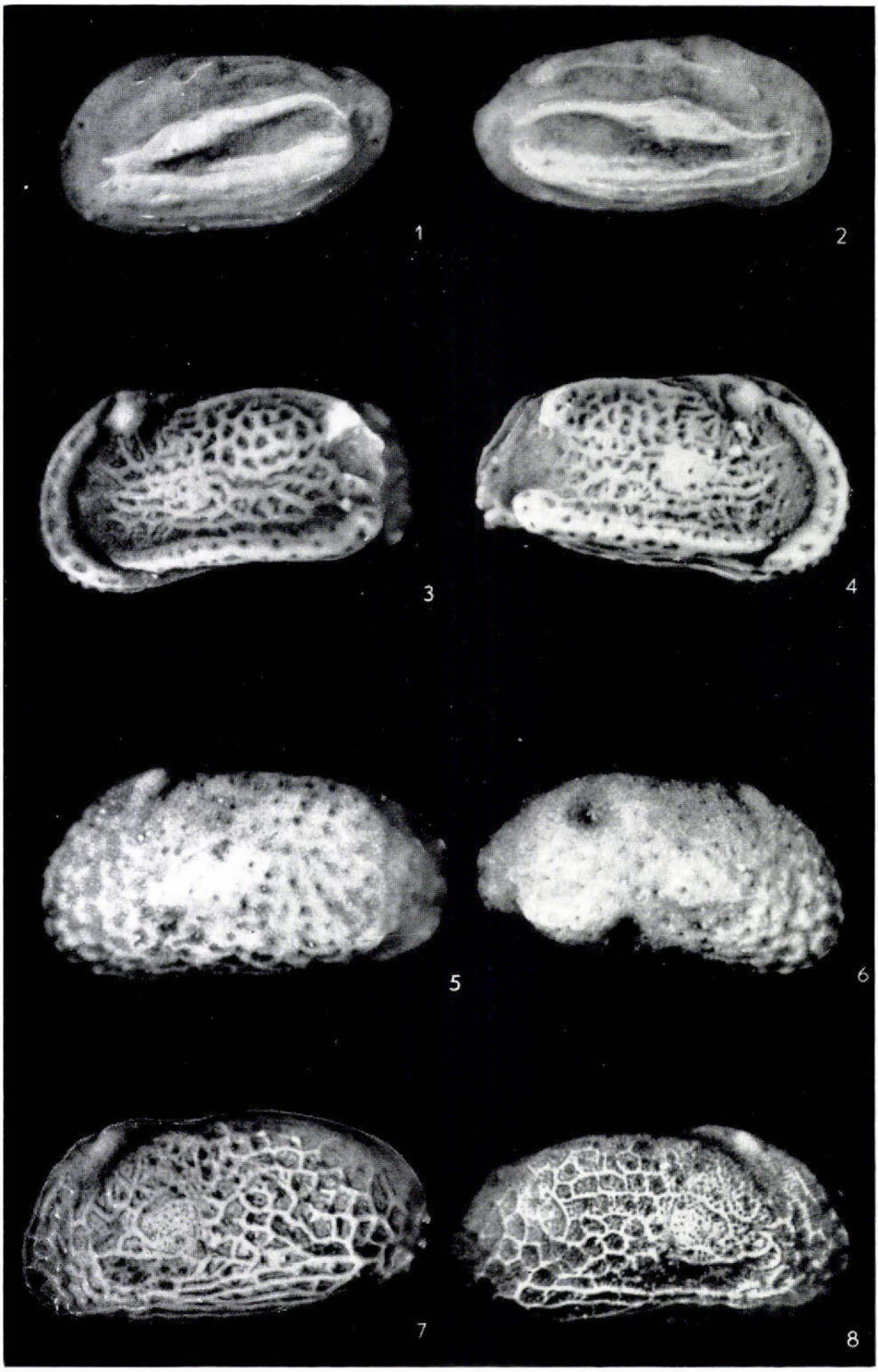
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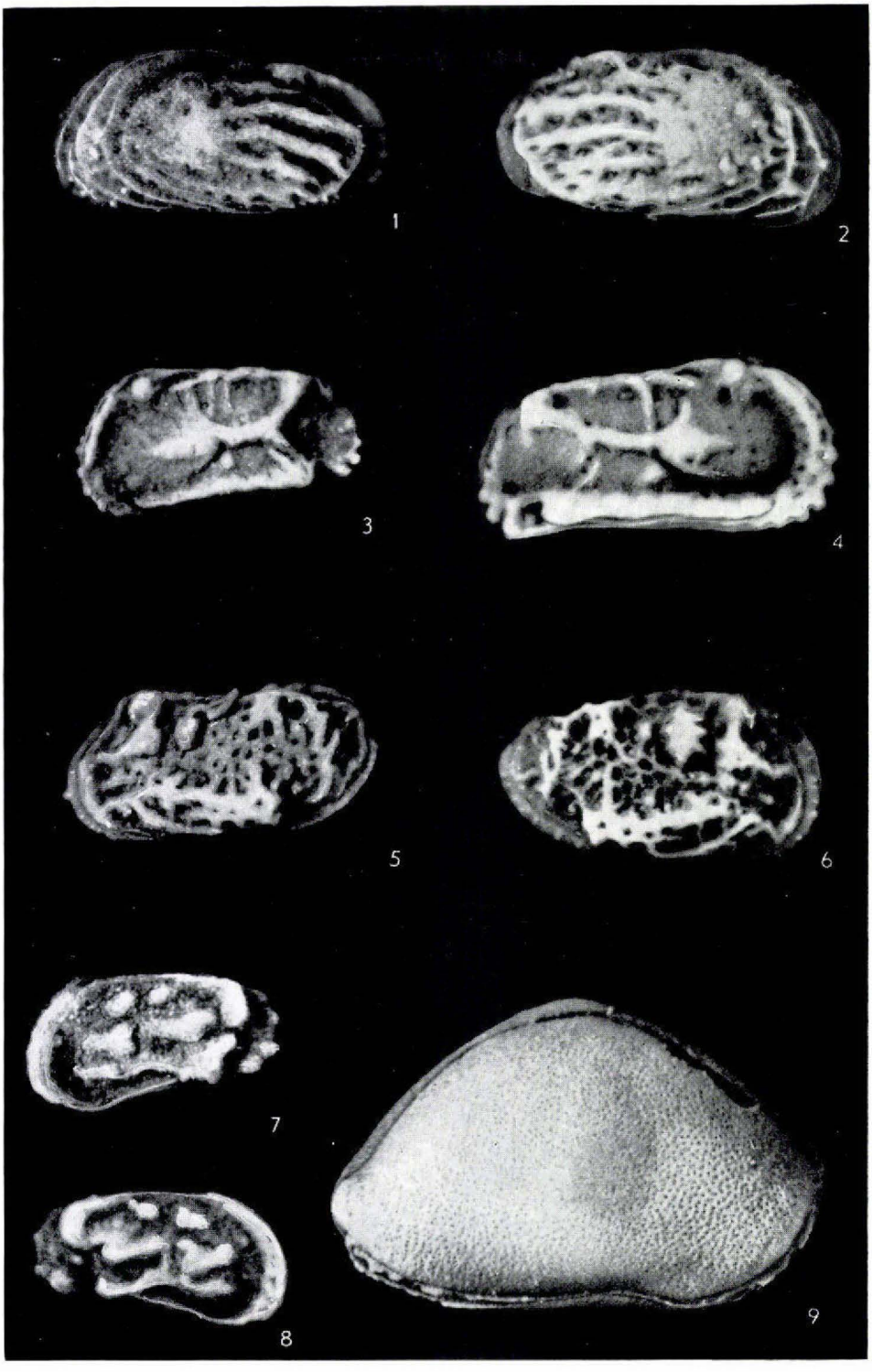
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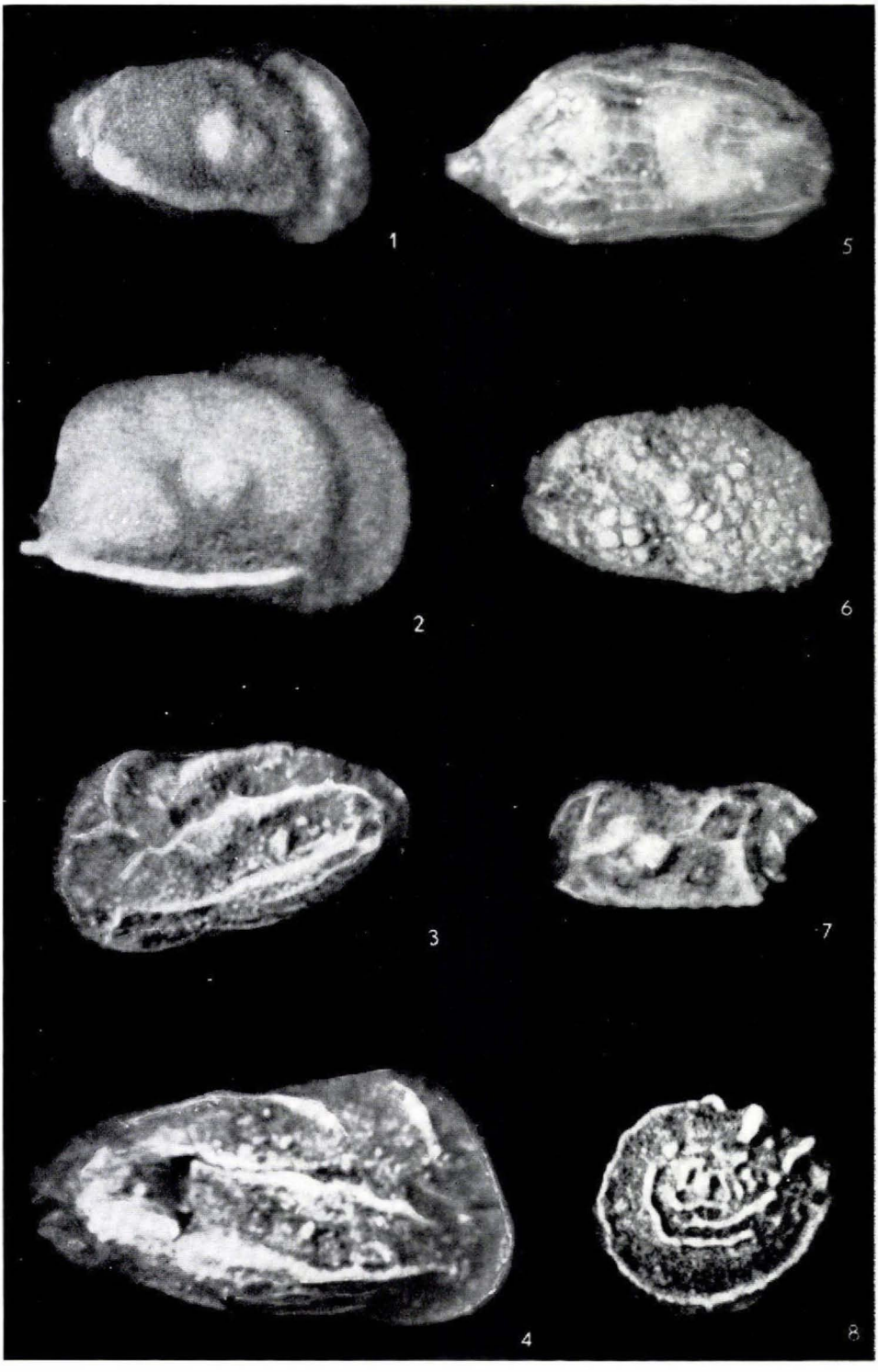
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