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Upper Jurassic and Neocomian ostracodes from Central Poland

ABSTRACT: The ostracodes contained within the Upper Kimmeridgian and Lower to Middle Volgian deposits pierced by eleven boreholes in the Barcin-Piechcin area (Kujawy region) and exposed at Brzostówka in Tomaszów Mazowiecki (NW margins of the Holy Cross Mts), as well as those collected from the Neocomian deposits exposed at Wąwał near Tomaszów Mazowiecki and pierced by boreholes at the nearby localities allow to distinguish four ostracode zones in the Upper Kimmeridgian-Volgian sequence: *G. monstrata*, *G. oertlii*, *G. barcinensis* and *G. punctilataeformis* Zones, and two others, *P. aubersonensis* and *M. frankei* Zones, within the Neocomian deposits. The newly recognized ostracode zones are correlated with the ammonite subdivisions of the Upper Kimmeridgian, Lower and Middle Volgian, and the Neocomian.

In the paleontological part of the paper, described are 37 species (4 new) of the Upper Jurassic ostracodes, and 51 species (18 new) of the Neocomian ostracodes. Some of the recognized species display a pronounced ornamental variability which, among the Neocomian ostracodes, is ascribed to the ecophenotypic differentiation caused by the environmental stimuli.

INTRODUCTION

In Poland, outside the Tethys geosyncline of the Carpathians, the depositional continuity between the Jurassic and the Neocomian had existed only within the Purbeck basin. This relict basin of the Upper Jurassic had been restricted to West Pomerania and the Kujawy region in northern and Central Poland. The Upper Jurassic deposits of the Purbeck as well as those of the Wealdian facies pass into the Upper

Berriasian marine sequence. In the other epicontinental areas of Poland, the Upper Berriasian rests with a low unconformity upon the Upper Jurassic strata.

The ostracodes of the Purbeck and Wealdian facies of Poland are reasonably well known and provided a basis for biostratigraphic subdivisions (Bielecka & Sztejn 1966; Bielecka 1975, 1978). The ostracodes of the marine sequences (Upper Kimmeridgian through Middle Volgian, and Neocomian), although frequently cited in the faunal lists as associated with ammonites or foraminifers, have not been subjected to any detailed taxonomic and stratigraphic investigations.

The materal which permitted to carry out the present studies was supplied from boreholes located in the Barcin-Piechcin area of the Zalesie anticline in the Kujawy region as well as from boreholes and classical natural exposures (*cf.* Lewiński 1922—1923, 1932; Kutek 1962a, Kutek & Zeiss 1974) located just at the town of Tomaszów Mazowiecki in the northwestern margins of the Holy Cross Mts, Central Poland (Text-fig. 1).

The Zalesie anticline is a secondary structure of a large tectonic unit, the Mid-Polish Anticlinorium. Its Upper Jurassic and Cretaceous deposits have been penetrated by many boreholes in the Barcin-Piechcin area (*see* Wierzbowski & *al.* 1978, 1980, 1982; Matyja & Wierzbowski 1981). A normal fault of a large throw, running in the south-western part of the Zalesie anticline, is responsible here for the tectonic nature of the Jurassic/Cretaceous boundary. The Lower Cretaceous deposits rest directly on those of Lower Volgian or lowest Middle Volgian age; the deposits of the younger Volgian, Berriasian, Valanginian and Lower Hauterivian are lacking.

At present, only the Middle Volgian deposits are exposed in Tomaszów Mazowiecki, previously in the settlement at Brzostówka which has recently become a quarter of the town.

The Neocomian sequence (Upper Berriasian, Valanginian, and probably Lower Hauterivian) is now accessible in the clay-pit at Wąwał, 5 km SE of Tomaszów Mazowiecki (*see* Text-fig. 1). The Valanginian deposits have also been pierced in boreholes situated in two nearby localites, Dąbrówka and Wiaderno.

At Wąwał as well as in all other spots of the Tomaszów syncline, there exist a distinct stratigraphic gap between the Middle Volgian and the Upper Berriasian.

The ostracodes from Brzostówka have previously subjected to a contribution by the present author (Kubiatowicz 1977), whilst those from Wąwał have been discussed by various authors (Liszka 1948; Sztejn 1957, 1967a; Małecki 1960; Kubiatowicz 1976, 1980).

Acknowledgements. The author is greatly indebted to Professor J. Kutek (Institute of Geology, University of Warsaw), Professor J. W. Neale (Department of Geology, University of Hull), and to Dr. J. Szczechura (Institute of Paleobiology, Polish Academy of Sciences, Warsaw) for helpful comments on the manuscript; to Dr. P. S. Lyubimova (VNIGRI Institute in Leningrad), Dr. P. Donze (Laboratoire de Géologie, University of Lyon), and Dr. H. J. Oertli (SNPA — Centre de Recherches in Pau) for discussion on taxonomic problems; to Professor V. Pokorný (Charles University, Prague), Professor S. W. Alexandrowicz (University of Mining and Metalurgy, Cracow), Dr. K. A. Tröger (Bergakademie Freiberg), and Dr. J. Sztejn (Geological Survey of Poland, Warsaw) for informative talks and access to collections under their care. The most sincere thanks are also due to all colleagues and friends from the Institute of Geology, University of Warsaw, and from the Institute of Paleobiology, Polish Academy of Sciences, Warsaw, for interest shown and for helpful discussions; to the technical staff of the Institute of Paleobiology for technical assistance in various ways.

The *SEM* micrographs have been taken at the Geological and Mineralogical Institute of the University of Leiden; in the Laboratory of Electron Microscopy at the Nenciki Institute of Experimental Biology in Warsaw; and in SNPA — Centre de Recherches in Pau, through the courtesy of Dr. H. J. Oertli.

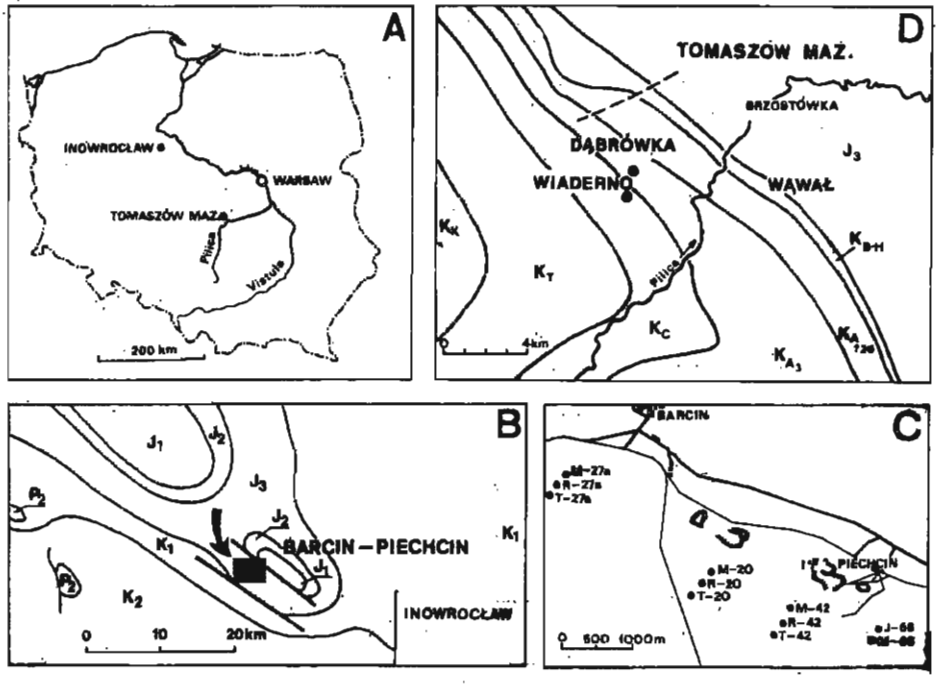

Fig. 1

A — General map of Poland; **B** — Geological map of the Zalesie anticline in the Kujawy region (Based on the Geological Map of Poland, by Osika & *al.* 1972; *taken from* Matyja & Wierzbowski 1981), shaded is the area presented in C; **C** — Location of the studied boreholes near Barcin-Piechcin; **D** — Geological map of the Tomaszów syncline, NW margins of the Holy Cross Mts (*after* Witkowski 1969; modified, *see* Marcinowski & Radwański 1983); location of studied boreholes is indicated with black circles; P_2 — Upper Permian (Zechstein salt deposits); J_1 — Lower Jurassic; J_2 — Middle Jurassic; J_3 — Upper Jurassic; K_1 — Lower Cretaceous, K_{B-H} — Berriasian to Hauterivian (Neocomian); K_2 — Upper Cretaceous, $K_{A?2+3}$ — ?Middle and Upper Albian, K_{A3} — Upper Albian, K_C — Cenomanian, K_T — Turonian, K_K — Coniacian.

DESCRIPTION OF EXPOSURES

BRZOSTÓWKA in TOMASZÓW MAZOWIECKI

The Volgian deposits exposed at Brzostówka, due to the contained ammonites and their biostratigraphic significance have long been the subject of great interest in both Polish and abroad literature (Michalski 1884, 1890; Lewiński 1922—1923; Kutek 1962a, b, c, 1967, 1975, 1980;

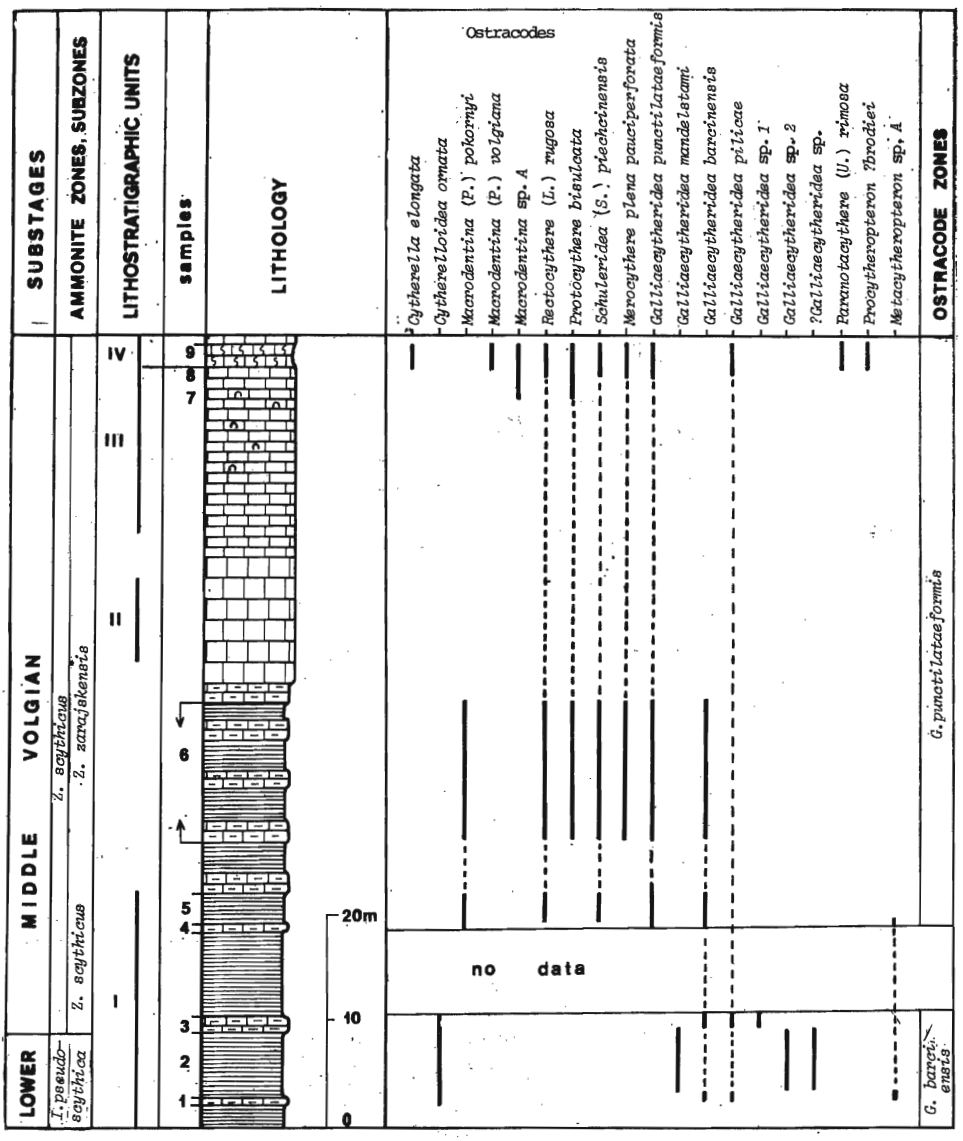

Fig. 2

Occurrence of the ostracodes in the Volgian deposits exposed at Brzostówka in Tomaszów Mazowiecki

Lithology and stratigraphy *after* Kutek & Zeiss (1974), Kutek (1980); for lithological explanations *see* Text-fig. 3

Distribution of the ostracodes in the borehole cores

BARCIN—PIECHCIN boreholes	M–20				J–66					M–42					M–66														R–42									R–20										T–42									T–20		
Ostracodes / borehole depth (in m)	65.0	60.5	52.5	44.5	98.0	68.0	58.0	48.0	38.0	92.0	76.0	50.0	45.0	34.0	177.0	162.0	140.0	130.0	123.0	117.0	111.0	107.0	104.0	74.0	68.0	59.0	49.0	43.0	145.0	128.0	112.5	102.5	97.5	70.0	62.0	47.0	43.0	179.0	153.8	126.5	108.5	91.5	79.3	76.5	66.0	62.0	58.4	187.0	183.5	179.2	174.8	170.5	166.3	159.5	149.5	141.5	176.5	164.0	156.0
Cytherella elongata																																																								●		●	●
Cytherella crassivalvis																									●										●										●			●		●									
Cytherelloidea ornata																																				●																							
Cytherelloidea sp.																																																										●	
Lophocythere cruciata kimmeridgiensis									●																																																		
Macrodentina (P.) *irregularis*																				●	●	●										●	●		●	●						●							●		●								
Macrodentina (P.) *pokornyi*																												●																							●	●	●	●		●	●	●	●
Cuvillierella jeani																																				●														●									
Rectocythere (L.) *scandia*																														●										●																			
Rectocythere (L.) *rugosa*																						●																					●	●						●									●
Kentrodictyocythere ?reticulocallosa																			●		●	●										●	●									●	●																
Protocythere bisulcata																						●			●		●																				●			●					●	●		●	●
Pleurocythere (K.) *kostytschevkaensis*																		●	●	●			●								●	●		●							●	●			●	●	●												
Pleurocythere (K.) *furcata*							●																																●																				
Exophthalmocythere fuhrbergensis					●				●	●	●																																																
Schuleridea (S.) *piechcinensis*																								●												●													●				●	●				●	●
Schuleridea ?consobrina																																			●													●											
Galliaecytheridea mandelstami																																			●										●	●	●												
Galliaecytheridea monstrata		●	●	●			●	●	●		●		●	●	●	●																						●																					
Galliaecytheridea volgaensis																				●																																							
Galliaecytheridea inaequalipunctata	●	●				●	●			●		●	●			●																																											
Galliaecytheridea raripunctata					●		●						●																																														
Galliaecytheridea barcinensis																							●	●		●		●						●		●										●	●		●		●	●	●	●			●		
Galliaecytheridea pilicae																											●	●																								●	●		●			●	●
Galliaecytheridea oertlii																	●	●	●										●	●	●									●	●																		
Galliaecytheridea sp. 1																											●																																
Galliaecytheridea sp. 2																								●		●										●													●	●									
?Galliaecytheridea sp.																						●												●		●	●							●	●	●													
Cytheropteron sp.																																										●																	
Metacytheropteron sp. A																										●																							●										
Eucytherura sp.																																●																											
Bythoceratina sp.													●		●																									●																			

Kutek & Zeiss 1974). Their four lithological horizons (*I—IV* in Text-fig. 2) have been introduced by Lewiński (1922—1923).

Horizon *I* — dark-coloured marly and shaly clays with marl and marly-limestone intercalations; to this horizon belong also clays, marls and limestones, unknown to Lewiński, and recognized by Kutek (1962a, Kutek & Zeiss 1974);

Horizon *II* — limestones with bivalves and fairly abundant ammonites;

Horizon *III* — white platy limestones with numerous corbulids (bivalves of the genus *Corbula*);

Horizon *IV* — cream-coloured limestones replete with serpulids, abounding in bivalves, and containing echinoderm remains and fish teeth; its highest part is represented by platy limestones 1.0—1.5 m thick.

The ammonites indicate that the lower part of horizon *I* represents the Lower Volgian (upper *pseudoscythica* Zone), whilst the upper part belongs to the Middle Volgian (*scythicus* Subzone). In strata lying just above horizon *I*, runs the boundary between the *scythicus* and *zarajskensis* Subzones of the *scythicus* Zone; the latter subzone comprises also the horizons *II*, *III*, and *IV*.

BARCIN-PIECHCIN AREA

In the area between Barcin and Piechcin, the Upper Kimmeridgian and/or Volgian deposits have been penetrated by a series of boreholes: *M—20*, *R—20*, *T—20*, *M—42*, *R—42*, *T—42*, *J—66*, *M—66*, *M—27a*, *R—27a* and *T—27a* (*see* Text-fig. 3). The deposits are represented by a shale-marly-siltstone sequence (the *Pałuki formation* of Dembowska 1979) divided into the following informal lithostratigraphic members (Wierzbowski & Matyja *in* Wierzbowski & *al.* 1980, 1982).

Member D_1 — clays and marly siltstones with subordinate marly intercalations; thickness about 95 m;

Occurrence: M-20 (depth 43—114 m), J-66 (36—110 m), M-42 (30—98 m), M-27a (80—108 m), M-66 (106—137 m), R-20 (89—179 m), R-42 (97—189 m), R-27a (162—182 m);

Member D_2 (the *Znin member* of Dembowska 1979) — marly, oolitic and organodetrital limestones with marly intercalations; thickness about 30 m;

Occurrence: M-66 (depth 75—106 m), R-20 (64—89 m), R-42 (79—97 m), R-27a (133—162 m);

Member D_3 — marly siltstones with subordinate marly clays, marly and marly-limestone intercalations; thickness about 60 m;

Occurrence: M-66 (depth 40—75 m), R-20 (52—64 m), R-42 (42—79 m), R-27a (66—133 m), T-20 (174—180 m), T-42 (160—188 m), T-27a (178—183 m);

Member D_4 — oolitic and organodetrital limestones with marly intercalations, occasionally limestones replete with serpulids; thickness about 30 m;

Occurrence: T-20 (depth 152—174 m), T-42 (140—160 m), T-27a (144—178 m).

The Upper Kimmeridgian age of the member D_1 and the Volgian age of the members D_2, D_3, and D_4 have been established on the basis of ammonite and ostracode fauna (Kubiatowicz & Kutek *in* Wierzbowski & *al.* 1978, 1980, 1982; Matyja & Wierzbowski 1981).

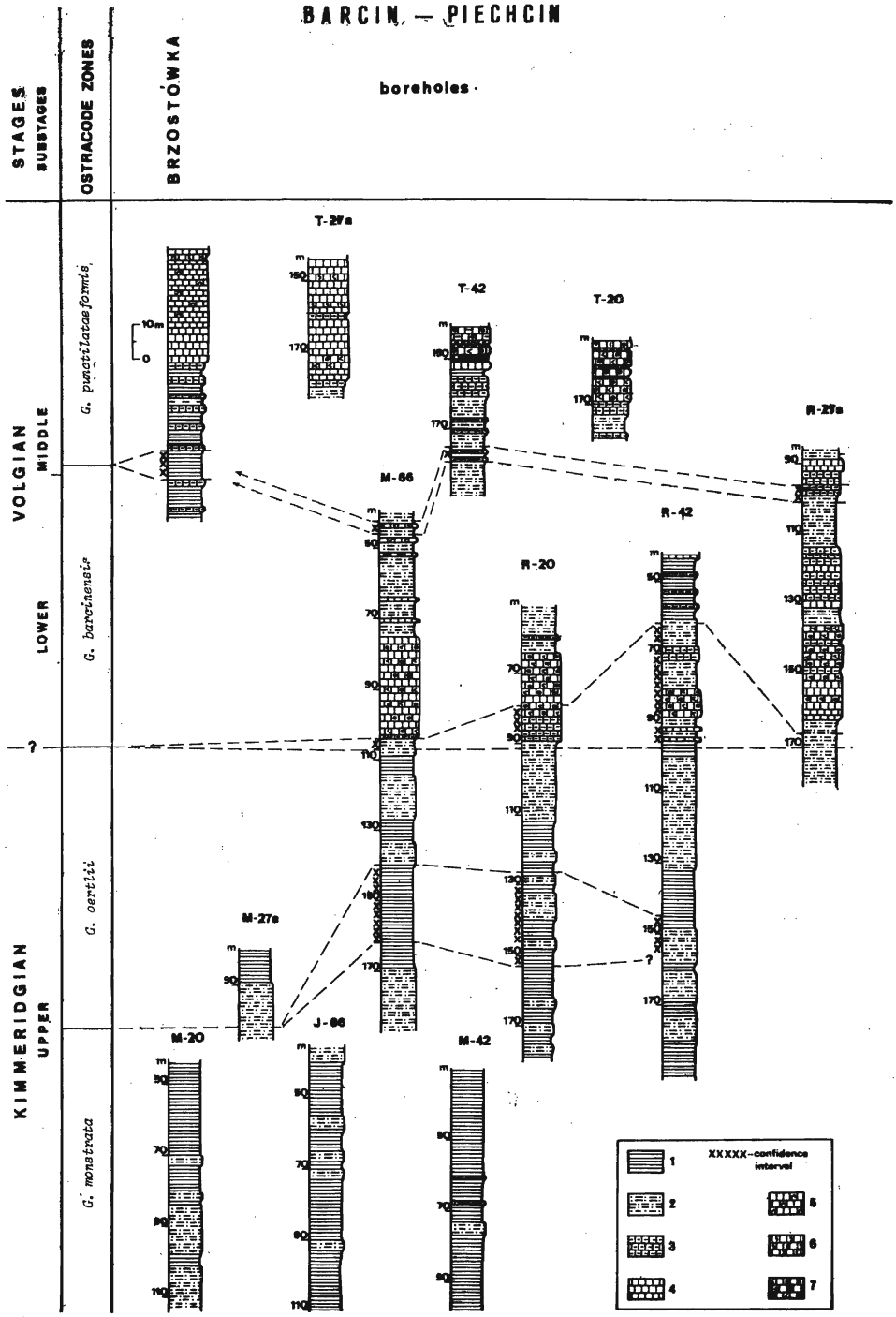

Fig. 3
Investigated Upper Jurassic profiles and their biostratigraphical correlation based on ostracodes

Table 2

Distribution of the ostracodes in the borehole cores

BARCIN–PIECHCIN boreholes	M–27a					R–27a											T–27a					
borehole depth (in m) / Ostracodes	108.0	106.0	105.0	95.0	83.0	181.0	179.0	175.0	171.0	167.0	165.0	131.0	125.0	107.0	101.0	97.0	87.5	182.0	178.0	167.5	161.0	159.0	154.0
Cytherella crassivalvis						o		o	o														
Macrodentina (P.) irregularis							o	o	o			o											
Macrodentina (P.) pokornyi																o	o	o	o				
Macrodentina sp. A																					o		
Rectocythere (L.) scandia				o																			
Rectocythere (L.) rugosa										o	o				o								
Xestoleberoythere reticulocostosa										o	o												
Protocythere bisulcata											o									o	o	o	
Pleurocythere (K.) kostyczokowskensis							o	o				o											
Mercythere plena pauciperforata																						o	
Schuleridea (S.) piscokinensis														o							o	o	
Cytheridea punctillatosaforensis																					o	o	o
Cytheridea monstrata	o	o																					
Cytheridea ovalis			o	o	o																		
Cytheridea barcinensis												o	o	o	o		o	o					
Cytheridea pilula																			o		o	o	
Cytheridea sp.													o										
Procytheropteron fbrodiei																						o	

WĄWAŁ near TOMASZÓW MAZOWIECKI

The Neocomian sequence recognized by Lewiński (1930) in the clay-pit of the Wąwał brick-yeard has subsequently been the subject of numerous investigations, devoted either to the stratigraphy or to the ammonites and associated bryozoans, oysters, lobsters, holothurian sclerites, ostracodes and foraminifers (Lewiński 1932; Kobyłecki 1948; Liszka 1948; Kokoszyńska 1956; Sztejn 1957, 1967a; Pruszkowski 1962; Collins 1969; Witkowski 1969; Pugaczewska 1975; Dzik 1975; Kubiatowicz 1976, 1980; Kubiatowicz & Matyja 1977).

The lithological sequence has been subdivided by the present author into the following eight beds (Text-fig. 4).

Bed *1* — conglomerate composed of limestone pebbles in a marly cement; thickness 0.2 m;

Bed *2* — fine-grained quartz sand with shell debris, in its lower part with scarce calcareous ooids; thickness 1.2 m;

Bed *3* — rusty to grey coloured clays and siltstones with ferruginous ooids; in the uppermost part with burrows of the *Rhizocorallium* type; thickness 2.0 m;

Bed *4* — grey siltstones with a high clay content, fine-grained quartz sand, and streaks of shell debris, scattered "sideritic" nodules; in the lower part scarce ferruginous ooids; thickness 2.0 m;

Bed *5* — the lower part of the bed is built of light grey clays, the upper one of dark grey clays and siltstones grading into siltstones with glauconite; frequent

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Lithology for Barcin-Piechcin boreholes taken from Wierzbowski & Matyja (*in:* Wierzbowski & *al.* 1978, 1980, 1982); for Brzostówka section *see* Text-fig. 2

1 clays, marly clays, *2* marly siltstones, *3* marls, marly limestones, *4* limestones, *5* limestones with corbulids, *6* limestones with serpulids, *7* oolitic, organodetrital limestones

are thin streaks of shell debris, and "sideritic" nodules which form two distinct layers 2.7 m apart; in the higher layer, large (10—20 cm) nodules prevail, while the lower one contains largely small (5—12 cm) ones; 3 m above the upper "sideritic" nodules the calcareous nodules appear, up to 60 cm in diameter; thickness 9.0 m;

Bed *6* — beige marly siltstone with scarce glauconite grains; thickness 0.2 m;

Bed *7* — black siltstones abounding in shell debris and glauconite; thickness 0.6 m;

Bed *8* — black, brown-yellow siltstones and clays with a variable amount of glauconite; in the upper part there appear limonitic crusts; thickness 3.0 m.

The conglomerate of Bed *1* commencing the Wąwał sequence, and built of yellowish calcareous pebbles, rests upon yellowish Volgian limestones which implies that the pebbles have been directly derived from that substrate (Kobyłecki 1948). In one of the pebbles, an ammonite of the family Beriasellidae has been found (Professor J. Kutek; *personal information*). This ammonite, described by Pruszkowski (1962) and Witkowski (1969) as *Neocomites* sp. is indicative of the Berriasian age of the limestones which, after having been eroded, supplied pebbles to Bed *1;*

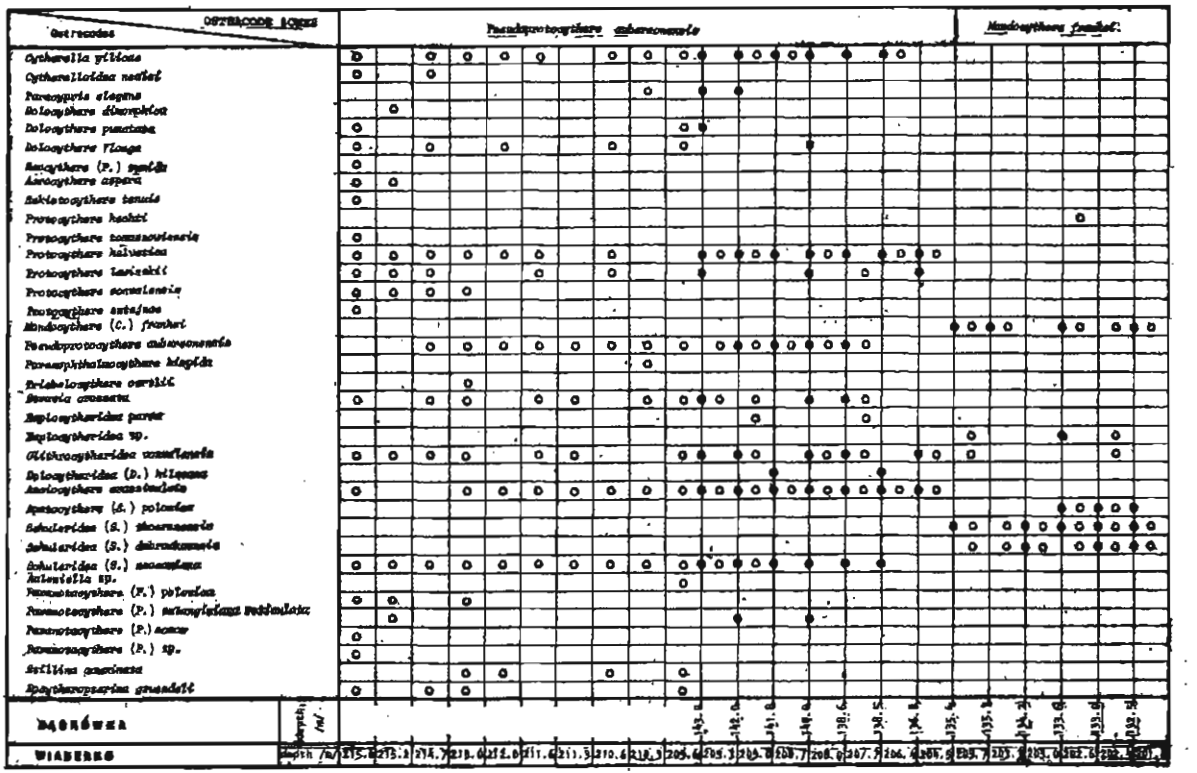
The Bed 2 has not provided any ammonites. Its "Infravalanginian" (Berriasian) age suggested by Lewiński (1930), seems to be acceptable considering indirect stratigraphic data (Witkowski 1969, Marek & Raczyńska 1973a).

The ammonites of the genera *Platylenticeras* and *Polyptychites* point to the Lower Valanginian age of the upper part of Bed *3* and of the entire Bed *4* (Marek & Raczyńska 1979).

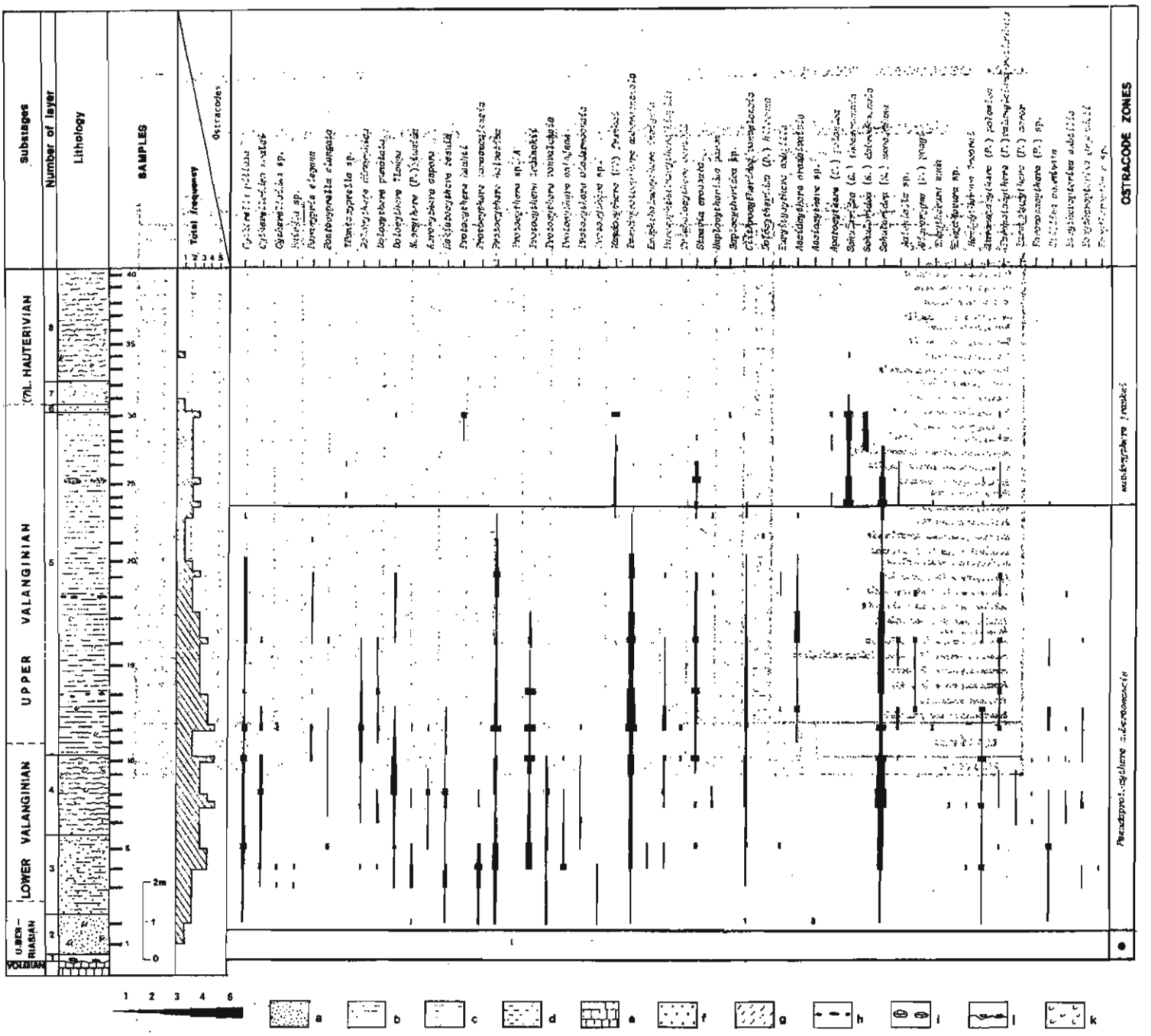
The lowermost part of Bed *5* is known to contain numerous ammonites, including *Saynoceras verrucosum* d'Orbigny which is diagnostical for the Upper Valanginian. The upper part of Bed *5*, however, contains numerous ammonites of the genus *Dichotomites*. The specimens identified by Witkowski (1969) as *Dichotomites bidichotomus* Leymerie impelled him to accept a Lower Hauterivian age for the interval discussed. Kemper (1978), however, referred these specimens to *D. evolutus* Kemper. The latter species occurs in the *crassus* Zone, the third one of the five zones distinguished within the *Dichotomites* Beds of Upper Valanginian age (Kemper *in* Kemper & *al.* 1978). In the Tethyan province area, where the Upper Valanginian is divided into three ammonite zones only (*verrucosum, trinodosum* and *callidiscus*), the genus *Dichotomites* occurs in the two latter, below the upper boundary of the Valanginian (Thieulay 1973). The above data are indicative of the Upper Valanginian age for the upper part of Bed *5* suggesting that it does not extend into the upper ranges of the Upper Valanginian.

The Beds 7 an *8* have not provided any ammonites; indirect stratigraphic data suggest that the uppermost part of the Wąwał sequence may belong to the Lower Hauterivian (Marek & Raczyński 1973a, 1979).

Occurrence of the ostracodes in the Valanginian deposits pierced at Dąbrówka and Wiaderno near Tomaszów Mazowiecki



Occurrence of the ostracodes in the Neocomian deposits exposed at Wąwał near Tomaszów Mazowiecki



Lithology: *a* fine sand, *b* clays, *c* siltstones, *d* marly silstone, *e* limestone, *f* ferruginous ooids, *g* glauconite, *h* "sideritic" nodules, *i* calcareous nodules, *j* erosion surface & calcareous pebbles, *k* shell debris

Total frequency of ostracodes: **1** — 1—25 specimens, **2** — 26—100 specimens, **3** — 101—200 specimens, **4** — 201—300 specimens, **5** — more than 300 specimens in a sample

Number of specimens of a definite taxon in a sample: **1** — 1—5 specimens, **2** — 6—20 specimens, **3** — 21—40 specimens, **4** — 41—60 specimens, **5** — more than 60 specimens in a sample

Marked by an asterisk is the ostracode assemblage with *"Protocythere propria emslandensis"*

WIADERNO and DĄBRÓWKA near TOMASZÓW MAZOWIECKI

The data on the Valanginian strata penetrated by boreholes at Wiaderno and Dąbrówka will be published separately (Professor S. W. Alexandrowicz; *personal information).*

SYSTEMATIC DESCRIPTION

The presented paleontological descriptions of the ostracode species are virtually confined to brief remarks only, with the exception of new species.

The classification applied is based mostly on that published by Hartman & Puri (1974). The descriptive terminology of features visible under high magnification is adopted from Sylvester-Bradley & Benson (1971).

The abbreviations used are: **a** — adult, **j** — juvenile, **C** — complete carapace, **LV** — left valve, **RV** — right valve, **L** — length, **H** — height, **W** — width; for localities: **B** — Brzostówka, **W** — Wąwał, **Wd** — Wiaderno, **D** — Dąbrówka.

Ostracodes described are housed at the Institute of Paleobiology of the Polish Academy of Sciences in Warsaw; abbreviations are: *ZPAL O.XXII* for the Upper Jurassic ostracodes and *ZPAL O.XXI* for the Lower Cretaceous ostracodes.

THE UPPER JURASSIC OSTRACODES (Plates 1—7)

Order **Podocopida** Müller, 1894
Suborder **Platycopa** Sars, 1866
Family **Cytherellidae** Sars, 1866
Genus *CYTHERELLA* Jones, 1894
Type species: *Cytherina ovata* Roemer, 1941

Cytherella elongata Donze, 1964
(Pl. 1, Fig. 7)

1964. *Cytherella elongata* n. sp.; Donze, pp. 105—106, Pl. 1, Figs 2—9.
1973. *Cytherella elongata* Donze; Pokorný, pp. 26—28, Text-fig. 8a-b, Pl. 15, Figs 3—4.
1977. *Cytherella elongata* Donze; Kubiatowicz, p. 67, Pl. 1, Fig. 2.
Material: Eleven, variously preserved, adult and juvenile specimens.
Dimensions (in *mm*):

RV♀ ZPAL O.XXII/1 L=1.00 H=0.57

Remarks. — Comparison with the similar species, *C. suprajurassica* Oertli (1959), is made by Pokorný (1973).

Occurrence. — Czechoslovakia: (?)Tithonian, Moravia (Pokorný 1973).

Central Poland (Brzostówka; Barcin-Piechcin *T-42, T-20*): Middle Volgian.

Cytherella crassivalvis Pokorný, 1973
(Pl. 1, Figs 3—6)

1973. *Cytherella crassivalvis* sp. n.; Pokorný, pp. 23—24, Text-figs 4—5, Pl. 14, Figs 1—3.

Material: Thirty-two, variously preserved, adult and juvenile specimens.
Dimensions (in *mm*):

LV♀ ZPAL 0.XXII/3	L=0.96	H=0.52
LV♂ ZPAL 0.XXII/5	0.96	0.48

Remarks. — In the material under study the male representatives of *C. crassivalvis* have been found. Compared with the females, the males are lower posterioly in lateral view, and narrower in posterior half of the valves in dorsal view (*cf.* Pl. 1, Figs 5 and 6).

Occurrence. — Czechoslovakia: (?)Tithonian, Moravia (Pokorný 1973).

Central Poland (Barcin-Piechcin *M-66, R-42, R-20, R-27a, T-42*): Upper Kimmeridgian to Lower Volgian.

Genus *CYTHERELLOIDEA* Alexander, 1929
Type species: *Cythere (Cytherella) williamsoniana* Jones, 1894

Cytherelloidea ornata (Lyubimova, 1955)
(Pl. 1, Figs 1—2)

1955. *Cytherella ornata* sp. n.; Lyubimova, p. 111, Pl. 13, Fig. 4a, b, w, g.
(?) 1973. *Cytherelloidea* aff. *mandelstami* Neale; Pokorný, pp. 28—31, Pl. 2, Fig. 2.
1978. *Cytherelloidea ornata* (Lubimova); Permyakova, p. 123, Pl. 45, Fig. 4.
1980. *Cytherella ornata* Lubimova; Bielecka & Styk, p. 508, Pl. 164, Fig. 1a-b.

Material: Eight, mostly well preserved, adult specimens.
Dimensions (in *mm*):

LV♀ ZPAL 0.XXII/6	L=0.76	H=0.40
RV♀ ZPAL 0.XXII/7	0.74	0.44

Remarks. — It is very likely that specimen referred by Pokorný to *C.* aff. *mandelstami*, displaying *paraweberi* type of sculpture, belong to *C. ornata*; it differs from the female right valve of *C. ornata* only in its straight ventral margin, while the ventral margin of *C. ornata* is centrally concave.

Occurrence. — USSR: Volgian, Volga area (near Ulyanovsk) and the Ukraine (Lyubimova 1955; Permyakova *in* Pyatkova & Permyakova 1978).

Central Poland (Brzostówka; Barcin-Piechcin *R-42*): Lower and Middle Volgian. It is regarded as typically Middle Portlandian (=Middle Volgian) species in Poland (Bielecka & Styk 1980).

Cytherelloidea sp.
(Pl. 1, Figs 9 and 12)

Material: Two, well preserved, adult specimens.
Dimensions (in *mm*):

C♀ ZPAL 0.XXII/8	L=0.82	H=0.44	W=0.28

Remarks. — The distinctive shape, consisting of a centrally situated broad depression with two angle-shaped ridges inside it, makes this species unlike any other known species of the genus *Cytherelloidea*. Insufficient material does not allow the establishment of a new species.

Occurrence. — Central Poland (Barcin-Piechcin *T-20*): Middle Volgian.

Suborder **Podocopa** Sars, 1866
Family **Progonocytheridae** Sylvester-Bradley, 1948
Genus *LOPHOCYTHERE* Sylvester-Bradley, 1948
Type species: *Cytheridea ostreata* Jones & Sherborn, 1888

Lophocythere cruciata kimmeridgiensis Guyader, 1966
(Pl. 5 Fig. 18)

1966. *Lophocythere cruciata kimmeridgiensis* n. sp.; Guyader, p. 47, Pl. 1, Figs 16—20.
1966. *Lophocythere* cf. *cruciata oxfordiana* Lutze; Bielecka & Styk, p. 354, Text-fig. 3.
1976. *Lophocythere cruciata kimmeridgiensis* Guyader; Bielecka & *al.*, pp. 227—228, Text-fig. 8, Pl. 16, Figs 11a-b, 12a-b, 13a-d.
1980. *Lophocythere cruciata kimmeridgiensis* Guyader; Bielecka & Styk, p. 509, Pl. 164, Fig. 5a-b.

Material: Five, variously preserved, adult specimens.
Dimensions (in *mm*):

RV♂ ZPAL O.XXII/11 L=0.64 H=0.32

Occurrence. — France: Lower Kimmeridgian, Paris Basin (Guyader 1966).

Central Poland (Barcin-Piechcin *J-66*): Upper Kimmeridgian; recorded in the Lower and Upper Kimmeridgian of the Polish Lowland and in the Lower Kimmeridgian of the NW margins of the Holy Cross Mts (Bielecka & Styk 1966, Bielecka & *al.* 1976). It is regarded as typically Lower Kimmeridgian species in Poland (Bielecka & Styk 1980).

Genus *MACRODENTINA* Martin, 1940
Subgenus *POLYDENTINA* Malz, 1958
Type species: *Clithrocytheridea? steghausi* Klinger, 1955

Macrodentina (Polydentina) irregularis Pokorný, 1973
(Pl. 2, Figs 3 and 6)

1973. *Macrodentina (Polydentina) irregularis* sp. n.; Pokorný, pp. 38—40, Text-fig. 14, Pl. 4, Fig. 4; Pl. 16, Fig. 5; Pl. 19, Figs 1—3, 5.

Material: Thirty-five, variously preserved, adult and juvenile specimens.
Dimensions (in *mm*):

LV♀ ZPAL O.XXII/12 L=0.80 H=0.48

Remarks. — The investigated specimens do not differ in general shape and ornamentation from those figured and described by Pokorný. Hinge of the right valve (Pl. 2, Fig. 3), like in the specimen figured by Pokorný (1973; Pl. 19, Fig. 1), has a distinct anteromedian element represented by a deep and wide socket, bordered ventrally by a thick vallum.

Occurrence. — Czechoslovakia: (?)Tithonian, Moravia (Pokorný 1973).

Central Poland (Barcin-Piechcin *M-66, R-42, R-20, R-27a, T-42*): Upper Kimmeridgian to Lower Volgian.

Macrodentina (Polydentina) volgiana Kubiatowicz, 1977
(Pl. 2, Fig. 2)

1977. *Macrodentina (Polydentina) volgiana* sp. n.; Kubiatowicz, p. 68, Pl. 2, Figs 4—5, 6a-d, 7—8.

Material: Ten, variously preserved, adult and juvenile specimens.
Dimensions (in *mm*):

C♂ ZPAL 0.XXII/15 L=0.80 H=0.44 W=0.44

Remarks. — See Kubiatowicz (1977).

Occurrence. — Central Poland (Brzostówka): Middle Volgian.

Macrodentina (Polydentina) pokornyi sp. n.
(Pl. 2, Figs 4—5 and 7—12)

Holotype: The specimen C♂ ZPAL O. XXII/22; presented in Pl. 2, Fig. 9.
Type horizon: Middle Volgian (*scythicus* ammonite Zone; *punctilataeformis* ostracode Zone).
Type locality: Brzostówka in Tomaszów Mazowiecki, Central Poland.
Derivation of the name: In honour of Professor V. Pokorný, Charles University in Prague, an outstanding researcher of the Mesozoic ostracodes.

Diagnosis: Species with variable ornamentation; valve surface reticulate or pitted, fossae or pits arranged concentrically along the anterior, ventral and posterior margins. Sexual dimorphism distinct.

Material: Over a hundred, mostly well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

C♂ ZPAL 0.XXII/22 L=1.00 H=0.58 W=0.48

Description. — Male carapace elongate, sub-rectangular in lateral outline, with greatest height at the anterior cardinal angle; valves compressed dorso-centrally and peripherally along the anterior and posterior margins. In dorsal view moderately and flatly swollen, widest posteriorly. The larger left valve overlaps the right valve all round; both valves similar in shape. Anterior margin symmetrically rounded; posterior margin truncated postero-dorsally, and with posterior end situated below the valve mid-height; dorsal margin concave medially with well marked posterior cardinal-angle; ventral margin slightly curved. Dorsal and ventral margins sloping slightly posteriorly. Ornamentation variable; valve surface reticulate or pitted, fossae or pits are arranged concentrically along the anterior, ventral and posterior margins. The antero-dorsal corner and peripheral zones of the valve are smooth. Internal features as for the subgenus (Pl. 2, Fig. 7).

Sexual dimorphism prominent. Compared with the males, the females are smaller, higher in proportion to length, narrower in posterior half of the valves in dorsal view, and have triangular lateral outline.

The juveniles resemble the males more than the females in general shape.

Variation. — Two forms may be recognized: a reticulate form (Pl. 2, Figs 5 and 8—9, 12) and a pitted one (Pl. 2, Figs 4 and 10—11). They are defined by adult and juvenile specimens with reticulate and pitted valve surfaces, respectively. This type of smoothing out of the ornamentation is described under the terms of "microreticulization" by Liebau (1977).

There is also some variability displayed in general shape of the male and female valves, mainly as regards their length to height ratio (*cf.* in Pl. 2, Figs 10 and 11).

Remarks. — The male specimens of the reticulate form of *M. (P.) pokornyi* sp. n. appear to be very similar, in general shape, to the male specimens of *M. (P.) regularis* Pokorný, 1973, however, the females of the two species differ markedly.

Occurrence. — Central Poland (Brzostówka; Barcin-Piechcin *M-66, R-27a, T-20, T-24, T-27a*): Middle Volgian; the reticulate form of this species occurs only in the Middle Volgian deposits at Brzostówka (samples *4—6*; *see* Text-fig. 2) while the pitted form occurs in the Middle Volgian deposits of the Barcin-Piechcin area (*see* Tables 1—2 and Text-fig. 3) and at Brzostówka (sample *6*).

Macrodentina sp. *A* of Kubiatowicz (1977)
(Pl. 2, Fig. 1)

1977. *Macrodentina* sp. *A*; Kubiatowicz, pp. 68—69, Pl. 2, Figs 13—15.
Material: Twenty, poorly preserved, adult and juvenile specimens.
Dimensions (in *mm*):

RV♀ ZPAL O.XXII/23 L=0.80 H=0.44

Remarks. — See Kubiatowicz (1977).
Occurrence. — Central Poland (Brzostówka, Barcin-Piechcin *T-27a*): Middle Volgian.

Genus *CUVILLIERELLA* Pokorný, 1971
Type species: *Cuvillierella jeani* Pokorný, 1971

Cuvillierella jeani Pokorný, 1971
(Pl. 7, Fig. 8)

1971. *Cuvillierella jeani* sp. nov.; Pokorný, pp. 78—82, Text-fig. 1, Pl. 1, Figs 1—6.
1973. *Cuvillierella jeani* Pokorný; Pokorný, pp. 45—46, Text-fig. 17, Pl. 5, Fig. 4; Pl. 6, Figs 1—3.
Material: Three, fairly well preserved, adult specimens.
Dimensions (in *mm*):

RVa ZPAL O.XXII/24 L=0.66 .... H=0.40 ...

Occurrence. — Czechoslovakia: (?)Tithonian, Moravia (Pokorný 1973).
Central Poland (Barcin-Piechcin *R-42*, *T-42*): Lower Volgian.

Genus *RECTOCYTHERE* Malz, 1958
Subgenus *LYDICYTHERE* Christensen & Kilenyi, 1970
Type species: *Rectocythere (Lydicythere) scandia* Christensen & Kilenyi, 1970

Rectocythere (Lydicythere) scandia Christensen & Kilenyi, 1970
(Pl. 7, Figs 1—2)

1970. *Rectocythere (Lydicythere) scandia* nov. sp.; Christensen & Kilenyi, pp. 58—59, Pl. 4, Figs 4a-f.
Material: Four, well preserved, adult specimens.
Dimensions (in *mm*):

C♀ ZPAL O.XXII/25	L=0.46	H=0.28	W=0.24
C♂ ZPAL O.XXII/26	0.52	0.28	0.24

Occurrence. — Southern Sweden and Denmark: Upper Kimmeridgian (Christensen & Kilenyi 1970).
Central Poland (Barcin-Piechcin *R-42*, *R-20*, *M-27a*): Upper Kimmeridgian.

Rectocythere (*Lydicythere*) *rugosa* Malz, 1966
(Pl. 6, Figs 1, 2a—c and 3a—b, 4 and 5a—b)

1966. *Rectocythere rugosa* n. sp.; Malz, pp. 405—409, Figs 6—9.
1973. *Rectocythere rugosa* Malz; Pokorný, p. 59, Pl. 7, Fig. 4; Pl. 18, Figs 2—3; Pl. 20, Fig. 5.
1977. *Rectocythere rugosa* Malz; Kubiatowicz, p. 69, Pl. 2, Figs 2—3.
Material: Twenty-three, mostly well preserved, adult specimens.
Dimensions (in *mm*):

C♀ ZPAL 0.XXII/28	L=0.52	H=0.32	W=0.28
C♂ ZPAL 0.XXII/29	0.60	0.36	0.30

Variation. — Two distinct forms may be recognized: a pitted form (Pl. 6, Figs 2a-c and 5a-b) and a smooth one (Pl. 6, Figs 1, 3a-b and 4). They are defined by specimens with pitted and smooth valve surfaces, respectively. Specimens referred to the pitted form of the species have papillate pits. While the papillae of sola are sparsly spaced, the papillae of muri are closely packed together; it seems that interspaces left by the packed together papillae create the foveolae (Pl. 6, Fig. 2c). In the specimens referred to the smooth form, the papillate pits are still present, but they are much smaller in size in comparison with those of the pitted form (*cf.* in Pl. 6: Figs 2b and 3b).

Remarks. — The specimens of the pitted form of *R. (L.) rugosa* correspond exactly with those figured by Pokorný (1973), while specimens of the smooth form compare well with those originally described by Malz (1966).

Occurence. — Czechoslovakia — (?)Tithonian, Moravia (Pokorný 1973); France — Lower Portlandian, Ile d'Oleron (Malz 1966).

Central Poland (Brzostówka; Barcin-Piechcin *M-66, R-20, R-27a, T-20*): Lower and Middle Volgian; the pitted form of this species occurs in the Lower Volgian while the smooth form in the Middle Volgian deposits of the Barcin-Piechcin area (*see* Tables 1—2 and Text-fig. 3), the smooth form is also known from the Middle Volgian deposits at Brzostówka (samples *5—6* and *8—9*; *see* Text-fig. 2).

Genus *KENTRODICTYOCYTHERE* Donze, 1968
Type species: *Kentrodictyocythere typica* Donze, 1968

Kentrodictyocythere ?reticulocallosa Pokorný, 1973
(Pl. 7, Figs 3—6)

(?) 1973. *Kentrodictyocythere reticulocallosa* sp. n.; Pokorný, p. 53, Pl. 7, Figs 6—7; Pl. 20, Fig. 4.

Material: Ten, fairly well preserved, adult and juvenile specimens.

Dimensions (in *mm*):

LVa ZPAL 0.XXII/35	L=0.31	H=0.20
RVj ZPAL 0.XXII/36	0.27	0.16

Remarks. — The investigated specimens compare well in general shape and size with those of *K. reticulocallosa* Pokorný. They differ in ornamentation, mainly in development of the "smooth areas". Therefore they can only tentatively be referred to the Pokorný's species.

Occurrence. — Central Poland (Barcin-Piechcin *M-66, R-42, R-20, R-27a*): Upper Kimmeridgian to Lower Volgian.

The species *K. reticulocallosa* Pokorný is known from the (?)Tithonian of Moravia, Czechoslovakia.

Family **Trachyleberididae** Sylvester-Bradley, *sensu* Liebau, 1975
Subfamily **Protocytherinae** Lyubimova, 1955
Genus *PROTOCYTHERE* Triebel, 1938
Type species: *Cytherina triplicata* Roemer, 1840

Protocythere bisulcata (Sharapova, 1939)
(Pl. 5, Figs 13 and 17)

1939. *Orthonotacythere bisulcata* nov. sp.; Sharapova, p. 27, Pl. 3, Fig. 31.
1977. *Protocythere* aff. *fistulosa* Ljubimova; Kubiatowicz, p. 70, Pl. 2, Figs 9a-d, 10—12.

1978. *Protocythere bisulcata* (Sharapova); Permyakova, p. 156, Pl. 71, Fig. 1.
1980. *Protocythere bisulcata* (Sharapova); Bielecka & Styk, p. 511, Pl. 165, Fig. 3a-b.

Material: Fourty-three, mostly poorly preserved, adult and juvenile specimens.
Dimensions (in *mm*):

C♀ ZPAL O.XXII/39	L=0.65	H=0.39	W=0.32
C♂ ZPAL O.XXII/40	0.96	0.53	0.46

Remarks. — Specimens from Poland, attributed to *P. bisulcata* (Sharapova), have been kindly compared by Dr. P. Lyubimova, VNIGRI Institute of Leningrad, with the original type-material of the species. Dr. P. Lyubimova has confirmed the above assignment.

Occurrence. — USSR: Middle Volgian, Volga area (near Ulyanovsk and Kuibyshev), Obchai Syrt, the Ural region, the Ukraine (Lyubimova 1955; Permyakova *in* Pyatkova & Permyakova 1978).

Central Poland (Brzostówka; Barcin-Piechcin *M-66, R-20, R-27a, T-42, T-20, T-27a*): Lower and Middle Volgian; recorded in the Bononian (=Volgian) of the Polish Lowland (Bielecka 1961; Bielecka & Styk 1963, 1964). It is regarded as typically Lower and Middle Portlandian (=Lower and Middle Volgian) species in Poland (Bielecka & Styk 1980).

Genus *PLEUROCYTHERE* Triebel, 1951
Subgenus *KLENTNICELLA* Pokorný, 1973
Type species: *Pleurocythere (K.) klentnicensis* Pokorný, 1973

Pleurocythere (Klentnicella) furcata (Bielecka & Styk, 1966)
(Pl. 5, Figs 14 and 16)

1966. *Protocythere furcata* n. sp.; Bielecka & Styk, pp. 361—362, Pl. 1, Fig. 1a-f.
1976. *Protocythere furcata* Bielecka et Styk; Bielecka & *al.*, pp. 229—229, Text-fig. 9, Pl. 17, Figs 1a-d, 2a-b.
1980. *Protocythere furcata* Bielecka et Styk; Bielecka & Styk, p. 512, Pl. 165, Fig. 3a-c.

Material: Six, mostly poorly preserved, adult specimens.
Dimensions (in *mm*):

LV♀ ZPAL O.XXII/46	L=0.51	H=0.31

Remarks. — The generic interpretation of this species, referred by Bielecka & Styk (1966) to the genus *Protocythere*, seems to be doubtful. General shape, lack of dorsal ridge and anterodorsal ear in the left valve, place this species in the genus *Pleurocythere* rather than in *Protocythere*.

Occurrence. — Central Poland (Barcin-Piechcin *J-66, R-20*): Upper Kimmeridgian; recorded in the Lower and Upper Kimmeridgian of the Polish Lowland and in the Lower Kimmeridgian of the NW margins of the Holy Cross Mts (Bielecka & Styk 1966, 1968; Bielecka & *al.* 1976). It is regarded as typically Lower Kimmeridgian and the lowest Upper Kimmeridgian species in Poland (Bielecka & Styk 1980).

Pleuroctyhere (Klentnicella) kostytschevkaensis (Lyubimova, 1955)
(Pl. 5, Figs 9—12 and 15)

1955. *Orthonotacythere kostytschevkaensis* sp. n.; Lyubimova, pp. 91—92, Pl. 10, Fig. 6a-b.
1973. *Pleurocythere (Klentnicella) fossulata* sp. n.; Pokorný, pp. 72—73, Pl. 12, Fig. 1.
1978. *Infacythere kostytschevkaensis* (Lubimova); Permyakova, p. 148, Pl. 64, Fig. 1; Pl. 65, Fig. 2.
1979b. *Oligocytherels kostytschevkaensis* (Lyubimova); Fuller & Lord, Pl. 6 (56), Figs 1a-b, 2a-b, 3a-b; Pl. 6 (58), Figs 1a-b, 2a-b, 3a-b; Pl. 6 (60), Figs 1a-b, 2—4, 5a-b; Pl. 6 (62), Figs 1a-b, 2a-b, 3a-b.

Material: Thirty-nine, variously preserved, adult specimens.
Dimensions (in *mm*):

C♀ ZPAL 0.XXII/41	L=0.64	H=0.40	W=0.28
C♂ ZPAL 0.XXII/42	0.68	0.36	0.28

Remarks. — An emended diagnosis of the species *Orthonotacythere kostytschevkaensis* Lyubimova has been published recently by Fuller & Lord (1979b) under the generic name of *Oligocythereis*. It was accompanied by excellent SEM-pictures of the holotype of the species and other specimens from the Volga area, whence this species was first described by Lyubimova. Specimens from Poland, attributed herein to *Pleurocythere (K.) kostytschevkaensis*, and those described by Pokorný as *P. (K.) fossulata* (refigured in Pl. 5, Fig. 12), agree with specimens figured by Fuller & Lord in all respects. They are, however, not referred to the genus *Oligocythereis* due to the following features: (*1*) number of anterior marginal pore-canals, 19 in the type-species of the genus *Oligocythereis* (Fig. 290 *in* Morkhoven 1963), but only 10—12 in the present species (after the data *in* Fuller & Lord 1979b, Pokorný 1973, and author's observations); (*2*) shape of the ventral ridge.

Occurrence. — USSR — Oxfordian to Middle Volgian, Volga area (near Ulyanovsk and Syzran), Obchai Syrt, Tatar ASSR and the Ukraine (Lyubimova 1955; Permyakova *in* Pyatkova & Permyakova 1978); more recently found in the Upper Kimmeridgian and Lower Volgian at Gorodische near Ulyanovsk (Fuller & Lord 1979b); Czechoslovakia — (?)Tithonian, Moravia (Pokorný 1973).

Central Poland (Barcin-Piechcin *M-66, R-42, R-20, R-27a*): Upper Kimmeridgian to Lower Volgian; recorded in the Lower and Upper Kimmeridgian of the Polish Lowland (Bielecka & Styk 1968).

Subfamily **Exophthalmocytherinae** Gründel, 1966
Genus *EXOPHTHALMOCYTHERE* Triebel, 1951
Type species: *Exophthalmocythere mamillata* Triebel, 1951
Exophthalmocythere fuhrbergensis Steghaus, 1951
(Pl. 7, Fig. 19)

1951. *Exophthalmocythere fuhrbergensis* n. sp.; Steghaus, p. 220, Pl. 15, Figs 46—48.
1969. *Exophthalmocythere fuhrbergensis* Steghaus; Kilenyi, p. 152, Pl. 28, Figs 12—13 (*here synonymy*).
1978. *Exophthalmocythere fuhrbergensis* Steghaus; Permyakova, p. 157, Pl. 71, Fig. 5.

Material: Four, fairly poorly preserved, (?)juvenile specimens.
Dimensions (in *mm*):

RV (? j) ZPAL 0.XXII/47	L=0.68	H=0.36

Remarks. — Comparatively small size, and lack of the fifth tubercle on the lateral surface, suggest that figured herein specimen of *E. fuhrbergensis* is a juvenile one. Internal features not seen because of encrusting sediment.

Occurrence. — Great Britain — Upper Kimmeridgian, Dorset (Kilenyi 1969); German Federal Republic — Upper Kimmeridgian, Lower Saxony (Steghaus 1951, Schmidt 1955); USSR — Upper Oxfordian to Lower Volgian, Volga area (near Ulyanovsk) and the Ukraine (Lyubimova 1955; Permyakova *in* Pyatkova & Permyakova 1978); France — Lower Kimmeridgian, Paris Basin (Oertli 1957).

Central Poland (Barcin-Piechcin *J-66, M-42*): Upper Kimmeridgian; recorded in the Lower and Upper Kimmeridgian of the Polish Lowland and in the Lower Kimmeridgian of the NW margins of the Holy Cross Mts (Bielecka & Styk 1968, Bielecka & *al.* 1976).

Family Cytherideidae Sars, 1925
Subfamily Schulerideinae Mandelstam, *sensu* Neale, 1982
Genus *SCHULERIDEA* Swartz & Swain, 1946
Subgenus *SCHULERIDEA* Swartz & Swain, 1946
Type species: *Schuleridea acuminata* Swartz & Swain, 1946

Schuleridea (Schuleridea) piechcinensis sp. n.
(Pl. 1, Figs 8, 10 and 13, 15a—b and 16)

1977. *Schuleridea* sp. *A*; Kubiatowicz, pp. 70—71, Pl. 1, Figs 10a-c, 11a-c.

Holotype: The specimen C♂ ZPAL O. XXII/51; presented in Pl. 1, Fig. 15a-b.
Type horizon: Middle Volgian (*scythicus* ammonite Zone; *punctilataeformis* ostracode Zone).
Type locality: Brzostówka in Tomaszów Mazowiecki, Central Poland.
Derivation of the name: After the locality of Piechcin.

Diagnosis: Species with prominent eye-tubercle, deep ocular-sulcus, and sub-central bulge. Sexual dimorphism pronounced.

Material: Fifty-three, variously preserved, adult specimens.
Dimensions (in *mm*):

C♀ ZPAL O.XXII/49	L = 0.74	H=0.54	W=0.46
C♂ ZPAL O.XXII/51	0.90	0.56	0.48

Description. — Male carapace elongate, sub-rectangular in lateral outline, with greatest height anterior to the mid-length. In dorsal view spindle-shaped with well marked bulge medially. The larger left valve overreaches the right valve along the entire periphery. Anterior margin broadly rounded; posterior margin narrowly rounded, and with posterior end situated at the valve mid-height; dorsal margin in the left valve vaulted with very slight indication of the posterior cardinal-angle, while in the right valve it is straight with better marked posterior cardinal-angle; ventral margin almost straight. There is a prominent eye-tubercle and a deep ocular-sulcus in each valve. Valve surface very finely pited. Internal features as for the subgenus *Schuleridea*.

Sexual dimorphism distinct. Compared with the males, the females are higher in proportion to length, and smaller in size.

Variability. — It is displayed in size (the length of LV♂: 0.76—0.90 mm; LV♀: 0.58—0.74 mm), and general shape of the valves, mainly as regards their length to height ratio (LV♂: 1.46—1.60; LV♀: 1.31—1.41).

Remarks. — The new species, *Schuleridea (S.) piechcinensis* sp. n., differs from *S. consobrina* Pokorný (1973) in having a deep ocular-sulcus, and a prominent eye-tubercle in both the right and left valves (only in the right valve of *S. consobrina*), and in being larger in size.

Occurrence. — Central Poland (Brzostówka; Barcin-Piechcin *M-66, R-42, R-27a, T-42, T-20, T-27a*): Lower and Middle Volgian.

Schuleridea ?consobrina Pokorný, 1973
(Pl. 1, Figs 11 and 14)

(?) 1973. *Schuleridea consobrina* sp. n.; Pokorný, pp. 73—75, Text-fig. 32, Pl. 17, Figs 5—6.

Material: Three, detached, adult specimens.
Dimensions (in *mm*):

RV♀ ZPAL O.XXII/53	L=0.60	H=0.40

Remarks. — The investigated specimens correspond fairly well with the original ones of *S. consobrina* Pokorný, but richer and better preserved material is necessary for a more exact determination.

Occurrence. — Central Poland (Barcin-Piechcin *R-42, T-42*): Lower Volgian.

The species *S. consobrina* Pokorný is known from the (?)Tithonian of Moravia, Czechoslovakia.

Subfamily **Galliaecytherideinae** Andreev & Mandelstam, 1964
Genus *GALLIAECYTHERIDEA* Oertli, 1957
Type species: *Galliaecytheridea dissimilis* Oertli, 1957
Galliaecytheridea punctilataeformis (Lyubimova, 1955)
(Pl. 4, Figs 11 and 13—15)

1955. *Palaeocytheridea punctilataeformis* sp. n.; Lyubimova, pp. 54—55, Pl. 4, Fig. 3a-b.
1980. *Galliaecytheridea punctilataeformis* (Lubimova); Bielecka & Styk, p. 517, Pl. 168, Fig. 1a-b.

Material: Thirty-nine, fairly well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

C♀ ZPAL 0.XXII/55	L=1.13	H=0.88	W=0.68
C♂ ZPAL 0.XXII/57	1.31	0.85	0.72

Remarks. — Dr. P. Lyubimova, VNIGRI Institute of Leningrad, kindly compared the specimens from Poland with the type-material of *G. punctilataeformis* and confirmed the above assignment.

Occurrence. — USSR: Middle Volgian, Volga area (near Ulyanowsk), Obchai Syrt and the Ural region (Lyubimova 1955).

Central Poland (Brzostówka; Barcin-Piechcin *T-27a*): Middle Volgian; recorded in the Middle Portlandian (=Middle Volgian) of the Polish Lowland (Bielecka & Styk 1964, Bielecka 1971, Bielecka *in* Dembowska 1973). It is regarded as typically Middle Portlandian (=Middle Volgian) species in Poland (Bielecka & Styk 1980).

Galliaecytheridea mandelstami (Lyubimova, 1955)
(Pl. 5, Figs 4—5)

1955. *Palaeocytheridea mandelstami* sp. n.; Lyubimova, pp. 42—43, Pl. 4, Fig. 4a-b.
1978. *Galliaecytheridea mandelstami* (Lubimova); Permyakova, p. 132, Pl. 50, Fig. 4.
Material: Thirty, fairly well preserved, adult specimens.
Dimensions (in *mm*):

Ca ZPAL 0.XXII/59	L=0.80	H=0.53	W=0.38

Remarks. — Determination of this species has been kindly accepted by its original author, Dr. P. Lyubimova of the VNIGRI Institute in Leningrad.

Occurrence. — USSR: Oxfordian to Lower Volgian, Volga area (near Kuibyshev), Obchai Syrt and the Ukraine (Lyubimova 1955; Permyakova *in* Pyatkowa & Permyakova 1978).

Central Poland (Brzostówka; Barcin-Piechcin *R-42, R-20*): Lower Volgian; recorded in the Lower and Upper Kimmeridgian of the Polish Lowland (Bielecka & Styk 1968).

Galliaecytheridea monstrata (Lyubimova, 1955)
(Pl. 4, Figs 1—2)

1955. *Palaeocytheridea monstrata* sp. n.; Lyubimova, pp. 44—45, Pl. 5, Fig. 1a-b, w.

Material: Over two hundred, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

C♂ ZPAL 0.XXII/61	L=0.80	H=0.45	W=0.36

Remarks. — These specimens, referred to *G. monstrata*, agree with those figured by Lyubimova in all respects, except for their smaller size.

Occurrence. — USSR: Oxfordian to Upper Kimmeridgian, Volga area (near Ulyanovsk) and Tatar ASSR (Lyubimova 1955).

Central Poland (Barcin-Piechcin *M-20, J-66, M-42, M-27a, M-66, R-20*): Upper Kimmeridgian; recorded in the Upper Kimmeridgian of the Polish Lowland (Bielecka & Styk 1963, 1964; Dąbrowska 1970), reported also from the Lower Kimmeridgian (Bielecka & Styk 1968).

Galliaecytheridea volgaensis (Lyubimova, 1955)
(Pl. 3, Figs 8 and 10)

1955. *Palaeocytheridea volgaensis* Mandelstam sp. n.; Lyubimova, pp. 41—42, Pl. 3, Fig. 4a-b.
1978. *Pararisous volgaensis* (Mandelstam in Lyubimova); Permyakova: p. 136, Pl. 54, Figs 2—3.
1979a. *Galliaecytheridea volgaensis* (Lyubimova); Fuller & Lord, Pl. 6 (48), Figs 1a-b, 2a-b, 3a-b; Pl. 6 (50), Figs 1a-b, 2a-b, 3a-b.

Material: Two, well preserved, adult specimens.
Dimensions (in *mm*):

LV♀ ZPAL O.XXII/63	L=0.64	H=0.39
LV♂ ZPAL O.XXII/64	0.76	0.40

Remarks. — Fuller & Lord (1979a) published excellent SEM-pictures of *G. volgaensis*, based on specimens from the Volga region whence the species was originally described. The investigated specimens agree with those figured by Fuller &Lord even in respects of small details of ornamentation.

Occurrence. — USSR: Oxfordian to Lower Volgian, Volga area (near Ulyanovsk and Sryzan), Tatar ASSR and the Ukraine (Lyubimova 1955; Permyakova *in* Pyatkova & Permyakova 1978); more recently found in the Upper Kimmeridgian at Gorodische near Ulyanovsk (Fuller & Lord 1979a).

Central Poland (Barcin-Piechcin *M-66*): Upper Kimmeridgian.

Galliaecytheridea oertlii Christensen & Kilenyi, 1970
(Pl. 3, Figs 1—6)

1970. *Galliaecytheridea oertlii* nov. sp.; Christensen & Kilenyi, p. 48, Pl. 3, Fig. 1a-i.

Material: Over a hundred, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

C♀ ZPAL O.XXII/85	L=0.60	H=0.44	W=0.32
C♂ ZPAL O.XXII/89	0.68	0.42	0.32

Remarks. — The investigated specimens correspond very well with those of *G. oertlii* Christensen & Kilenyi from Scania, except their smaller size and more coarsely pitted ornamentation.

Occurrence. — Southern Sweden: Upper Kimmeridgian (Christensen & Kilenyi 1970).

Central Poland (Barcin-Piechcin *M-66, M-27a, R-42, R-20*): Upper Kimmeridgian.

Galliaecytheridea inaequalipunctata Bielecka & *al.*, 1976
(Pl. 3, Figs 12—13)

1976. *Galliaecytheridea inaequalipunctata* sp. n.; Bielecka, Blaszyk & Styk, p. 220, Pl. 11, Figs 1a-d, 2a-b, 3a-d, 4a-d; Pl. 12, Figs 1a-b, 2a-b, 3a-d, 4a-b.
1980. *Galliaecytheridea inaequalipunctata* Bielecka, Blaszyk et Styk; Bielecka & Styk, p. 516, Pl, 167, Fig. 3a-c.

Material: Twenty-six, well preserved, adult specimens.
Dimensions (in *mm*):

C♀ ZPAL XXII/65	L=0.73	H=0.47	W=0.40
C♂ ZPAL 0.XXI/66	0.92	0.48	0.44

Occurrence. — Central Poland (Barcin-Piechcin *M-20, J-66, M-42, M-66*): Upper Kimmeridgian; reported from the Upper Oxfordian and Lower Kimmeridgian of the NW margins of the Holy Cross Mts (Bielecka & *al.* 1976). It is regarded as typically Upper Oxfordian and Lower Kimmeridgian species in Poland (Bielecka & Styk 1980).

Galliaecytheridea raripunctata Bielecka & *al.*, 1976
(Pl. 3, Figs 7 and 9)

1976. *Galliaecytheridea raripunctata* sp. n.; Bielecka, Błaszyk & Styk, p. 221, Pl. 13, Figs 1a-d, 2a-d, 3, 4a-d, 5, 6a-d.

1980. *Galliaecytheridea raripunctata* Bielecka, Błaszyk et Styk; Bielecka & Styk, p. 517, Pl. 168, Fig. 2a-d.

Material: Fourty-two, well preserved, adult specimens.
Dimensions (in *mm*):

LV♂ ZPAL 0.XXII/67	L=0.76	H=0.42

Occurrence. — Central Poland (Barcin-Piechcin *J-66, M-42*): Upper Kimmeridgian; reported from the Upper Oxfordian and Lower Kimmeridgian of NW margins of the Holy Cross Mts (Bielecka & *al.* 1976). It is regarded as typically Upper Oxfordian and Lower Kimmeridgian species in Poland (Bielecka & Styk 1980).

Galliaecytheridea barcinensis sp. n.
(Pl. 3, Figs 11a—b and 14—19)

Holotype: The specimen C♀ ZPAL 0.XXII/69; presented in Pl. 3, Fig. 11a-b.
Type horizon: Lower Volgian (*barcinensis* ostracode Zone).
Type locality: Barcin-Piechcin area (borehole *M-66*, depth 49.0 m), Central Poland.
Derivation of the name: After the locality of Barcin.

Diagnosis: Species with faint depression around ocular region. Strongly dimorphic: females with obtusely pointed posterior end, situated at valve mid-height; males with rounded posterior end, situated above valve mid-height.

Material: About a hundred, variously preserved, adult specimens.
Dimensions (in *mm*):

C♀ ZPAL 0.XXII/69	L=0.62	H=0.40	W=0.32
C♂ ZPAL 0.XXII/74	0.76	0.44	0.34

Description. — Female carapace angularly-ovate in lateral view, with greatest height at the anterior cardinal-angle, compressed peripherally along the anterior margins of the valves; in dorsal view lenticular. The larger left valve overlaps the right valve all round. Anterior margin symmetrically rounded; posterior margin truncated dorsally, and with obtusely pointed posterior end situated at the valve mid-height; dorsal margin straight with well marked cardinal angles; ventral margin slightly curved. Dorsal and ventral margins tapering posteriorly. There is a faint depression around the ocular region which is present in both valves.

Male carapace elongate-oval, with greatest height at the anterior cardinal-angle; in dorsal view moderately and flatly swollen, widest posteriorly. Both valves similar in size and shape, with a faint depression around the ocular region. Anterior margin broadly rounded; posterior margin narrowly rounded, and with posterior end situated above the valve mid-height; dorsal margin straight with cardinal

angle not well pronounced; ventral margin slightly curved. Dorsal and ventral margins slightly tapering posteriorly. Valve surface finely pitted, most of the pits concentrated centrally.

Hinge of the right valve has 6—7 denticles both anteriorly and posteriorly; the left valve with complementary hinge elements and an accomodation groove above a hinge bar (Pl. 3, Fig. 15).

Variability. — It is seen in lateral outline of the females. Valves with a pointed posterior end and those with a less acuminate posterior margin can be distinguished (*cf.* in Pl. 3, Figs 11a and 18, 14 and 16).

Remarks. — The new species, *G. barcinensis* sp. n., is closest to *G. wolburgi minuta* (Schmidt, 1955). The two can be separated on subtle but distinct differences in shape, *i.e.* the more evenly rounded posterior margin of the males and more strongly converging dorsal and ventral margins of the females in *G. barcinensis*.

Occurrence. — Central Poland (Brzostówka; Barcin-Piechcin *M-66, R-42, R-20, R-27a, T-42, T-20, T-27a*): Lower and Middle Volgian.

Galliaecytheridea pilicae sp. n.
(Pl. 4, Figs 3—10 and 12)

1973. *Galliaecytheridea* div. sp.; Pokorny, p. 76, Pl. 17, Fig. 9.
1977. *?Vernoniella* sp.; Kubiatowicz, p. 71, Pl. 1, Figs 12—13.
Holotype: The specimen ♀ ZPAL O. XXII/76, presented in Pl. 4, Fig. 8.
Type horizon: Middle Volgian (*scythicus* ammonite Zone; *barcinensis* ostracode Zone).
Type locality: Brzostówka in Tomaszów Mazowiecki, Central Poland.
Derivation of the name: After the Pilica river.

Diagnosis: Species with dorsal and ventral margins slightly tapering posteriorly, greatest height at anterior cardinal-angle at about valve mid-length, rounded posterior end being situated below valve mid-height. Sexual dimorphism pronounced.

Material: Over fifty, variously preserved, adult and juvenile specimens.
Dimensions (in *mm*):

C♀ ZPAL O.XXI/76	L=0.81	H=0.50	W=0.44
RV♂ ZPAL O.XXI/83	0.98	0.51	—

Description. — Female carapace elongate, angularly-ovate in lateral outline, with greatest height at the anterior cardinal-angle at about valve mid-length; compressed peripherally along the anterior margins of the valves. In dorsal view moderately and flattly swollen, widest medially. The left valve slightly larger than the right. Anterior margin asymmetrically rounded; posterior margin slightly truncated dorsally, and with rounded posterior end situated below the valve mid-height. When well preserved, there is a minute anterior and similar postero-ventral spine in adult specimens (Pl. 4, Fig. 6). These spines are much more prominent in the juvenile specimens (Pl. 4, Fig. 4). Dorsal margin straight with well marked anterior cardinal-angle. Ventral margin almost straight. Dorsal and ventral margins tapering posteriorly. Valve surface very finely-pitted or smooth. Hinge of the hemimerodont type, in the left valve with a very narrow accomodation groove above a hinge-bar (Pl. 4, Fig. 3). Muscle-scar form the usual pattern seen in the genus.

Sexual dimorphism prominent. Compared with the females, the males being more elongate and larger.

The juveniles (Pl. 4, Fig. 4) resemble the males more than the females in general shape.

Variability. — It is displayed in size, and shape of the valves, mainly as regards their length to height ratio (*cf.* in Pl. 4, Figs 6 and 8).

Remarks. — The new species, *Galliaecytheridea pilicae* sp. n., bears some external similarity to *G. compressa* described by Christensen & Kilenyi (1970) from the Portland Beds of Dorset, but differs significantly from the latter in dorsal view. The specimen figured by Pokorný as *Galliaecytheridea* sp. seems to represent the female right valve of this species.

Occurrence. — Central Poland (Brzostówka; Barcin-Piechcin *M-66, T-42, T-20, T-27a*): Lower and Middle Volgian.

Galliaecytheridea sp. *1*
(Pl. 5, Figs 1—3)

Material: Five, variously preserved, adult specimens.
Dimensions (in *mm*):

Ca	ZPAL 0.XXII/91	L=0.81	H=0.48	W=0.42
LVa	ZPAL 0.XXII/92	0.79	0.48	—

Remarks. — The mid-central concavity, coarsely pitted ornamentation, and asymmetrically acuminate posterior margin of the valves, make this species unlike any hitherto described species of the genus *Galliaecytheridea*. The scarcity of the material under study does not allow the establishement of a new species.

Occurrence. — Central Poland (Brzostówka; Barcin-Piechcin *M-66*): Lower Volgian to the lowest Middle Volgian.

Galliaecytheridea sp. *2*
(Pl. 5, Figs 6—8)

Material: Twelve, variously preserved, adult and juvenile specimens.
Dimensions (in *mm*):

LVa	ZPAL 0.XXII/94	L=0.88	H=0.60
RVa	ZPAL 0.XXII/95	0.85	0.56

Remarks. — The adult specimens can be distinguished from the female specimens of *G. pilicae* sp. n. by their more angular lateral outline and more coarsely pitted ornamentation.

Occurrence. — Central Poland (Brzostówka; Barcin-Piechcin *M-66*): Lower Volgian.

? *Galliaecytheridea* sp.
(Pl. 7, Figs 15 and 18)

Material: Twenty, poorly preserved, specimens.
Dimensions (in *mm*):

C(?a)	ZPAL 0.XXII/97	L=0.76	H=0.44	W=0.36

Remarks. — The investigated specimens in their external appearance resemble representatives of the genus *Galliaecytheridea*. Their internal features are poorly seen due to the state of preservation. Therefore, they are only tentatively referred to the genus *Galliaecytheridea*.

Occurrence. — Central Poland (Brzostówka; Barcin-Piechcin *M-66, R-42, R-20*): Lower Volgian.

Genus *MEROCYTHERE* Oertli, 1957
Type species: *Clithrocytheridea plena* Schmidt, 1954

Merocythere plena pauciperforata Donze, 1960
(Pl. 1, Fig. 17)

1960. *Amphicythere*? (*Merocythere*) *plena pauciperforata* n. subsp.; Donze, pp. 24—25, Pl. 6, Figs 70—73.

1977. *Amphicythere*? (*Merocythere*) *plena pauciperforata* Donze; Kubiatowicz, p. 69, Pl. 1, Figs 7, 8a-c, 9.

Material: Thirty-six, mostly poorly preserved, adult and juvenile specimens.
Dimensions (in *mm*):

RV♀ ZPAL O.XXII/48 L=0.65 H=0.39

Remarks. — See Kubiatowicz (1977).

Occurrence. — France: Lower Portlandian, Ile d'Oleron (Donze 1960).
Central Poland (Brzostówka; Barcin-Piechcin *T-27a*): Middle Volgian.

Family **Cytheruridae** Müller, 1894
Genus *EUCYTHERURA* Müller, 1894
Type species: *Cythere complexa* Brady, 1867

Eucytherura sp.
(Pl. 7, Fig. 16a—b)

Material: A single valve.
Dimensions (in *mm*):

RVa ZPAL O.XXII/104 L=0.36 H=0.18

Remarks. — The specimen figured here which is referred to *Eucytherura*, is closely comparable with the right valve of *E. soror* Pokorný (1973; Pl. 8, Fig. 7) from the (?)Tithonian of Moravia, but has a dorsal ridge with only one anteroventrally directed branch (in *E. soror*, two such branches are present). SEM-examination shows that its valve surface is covered with polygonal fossae having papillate sola.

Occurrence. — Central Poland (Barcin-Piechcin *R-42*): Upper Kimmeridgian.

Genus *PARANOTACYTHERE* Bassiouni, 1974
Subgenus *UNICOSTA* Bassiouni, 1974
Type species: *Paranotacythere nealei* Bassiouni, 1974

Paranotacythere (Unicosta) rimosa (Martin, 1940)
(Pl. 7, Fig. 11)

1940. *Orthonotacythere rimosa* n. sp.; Martin, p. 335, Pl. 6, Figs 84—86.
1974. *Paranotacythere (Unicosta) rimosa* (Martin); Bassiouni, pp. 68—69, Pl. 13, Figs 4—5 (*here synonymy*).
1975. *Orthonotacythere rimosa* Martin; Bielecka, p. 372, Pl. 14, Fig. 7.
1977. *Paranotacythere (Unicosta) rimosa* (Martin); Kubiatowicz, p. 71, Pl. 2, Fig. 1.
1980. *Paranotacythere (Unicosta) rimosa* (Martin); Bielecka & Styk, p. 514, Pl. 170, Fig. 6.

Material: Six, poorly preserved, adult specimens.
Dimensions (in *mm*):

LVa ZPAL 0.XXII/103 L=0.51 H=0.27

Occurrence. — This species is known from the "Purbeckian" deposits of Sweden, Southern England, German Federal Republic, German Democratic Republic and France (Bassiouni 1974).

Central Poland (Brzostówka): Middle Volgian; recorded in the uppermost Middle Portlandian and the lowest Upper Portlandian of the Polish Lowland (Bielecka 1975, 1978; Bielecka & Styk 1980).

Genus *CYTHEROPTERON* Sars, 1866
Type species: *Cythere latissima* Norman, 1865

Cytheropteron sp.
(Pl. 7, Figs 9 and 12)

Material: Two, fairly well preserved, adult specimens.
Dimensions (in *mm*):

LVa ZPAL 0.XXII/99 =0.48 H=0.28

Remarks. — The investigated specimens bear external similarity to *C. bispinosum crassum* (Schmidt 1954) from the Lower Kimmeridgian of G.F.R., but have only one laterally directed spine.

Occurrence. — Central Poland (Barcin-Piechcin *R-20*): Upper Kimmeridgian.

Genus *PROCYTHEROPTERON* Lyubimova, 1955
Type species: *Procytheropteron obesum* Lyubimova, 1955

Procytheropteron ?brodiei (Jones, 1894)
(Pl. 7, Fig. 7)

(?) 1894. *Cytheropteron brodiei* sp. nov.; Jones, p. 167, Pl. 9, Fig. 13.
1977. *Procytheropteron* ex gr. *brodiei* (Jones); Kubiatowicz, p. 72, Pl. 1, Figs 3a-b, 4—6.
Material: Fourteen, poorly preserved, adult and juvenile specimens.
Dimensions (in *mm*):

LV♀ ZPAL 0.XXII/100 L=0.56 H=0.36

Remarks. — See Kubiatowicz (1977).

Occurrence. — Central Poland (Brzostówka; Barcin-Piechcin *T-27a*): Middle Volgian.

The species *P. brodiei* (Jones) is known from the Cinder and Purbeck Beds of Southern England.

Genus *METACYTHEROPTERON* Oertli, 1957
Type species: *Metacytheropteron elegans* Oertli, 1957

Metacytheropteron sp. *A* of Pokorný (1973)
(Pl. 7, Figs 10 and 13)

1973. *Metacytheropteron* sp. n.; *A*; Pokorný, pp. 91—92, Text-figs 41, 42, 42a; Pl. 13, Fig. 3.
Material: Twelve, variously preserved, adult specimens.
Dimensions (in *mm*):

C♀	ZPAL 0.XXII/101	L=0.46	H=0.25	W=0.21
LV♂	ZPAL 0.XXII/102	0.53	0.26	—

Occurrence. — Czechoslovakia: (?)Tithonian, Moravia (Pokorný 1973).

Central Poland (Brzostówka; Barcin-Piechcin *M-66, T-42*): Lower and Middle Volgian.

Family **Bythocytheridae** Sars, 1866
Genus *BYTHOCERATINA* Hornibrook, 1952
Type species: *Bythoceratina mestayerae* Hornibrook, 1962

Bythoceratina sp.
(Pl. 7, Figs 14 and 17)

Material: Eight, variously preserved, specimens.
Dimensions (in *mm*):

RVa ZPAL 0.XXII/105 L=0.66 H=0.34

Remarks. — The investigated specimens differ from that illustrated by Pokorný (1973; Pl. 12, Fig. 4) as *Bythoceratina* sp. *A* in their larger size and, shape of the ventral part of the valves.

Occurrence. — Central Poland (Barcin-Piechcin *M-42, M-66, R-20*): Upper Kimmeridgian.

THE NEOCOMIAN OSTRACODES (Plates 8—20)

Order **Podocopida** Müller, 1894
Suborder **Platycopa** Sars, 1866
Family **Cytherellidae** Sars, 1866
Genus *CYTHERELLA* Jones, 1894,
Type species: *Cytherina ovata* (Roemer, 1841)
Cytherella pilicae sp. n.
(Pl. 8, Figs 1—2, 3a—b and 4, 6—7)

1957. *Cytherella staringi* Veen; Sztejn, p. 254, Pl. 12, Fig. 104a-c.
1960. *Cytherella ovata* (Roemer); Małecki, pp. 101—102.

Holotype: The specimen C♀ ZPAL 0.XXII/1; presented in Pl. 8, Fig. 3a-b.
Type horizon: Lower Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: After the Pilica river.

Diagnosis: Right valve with unevenly rounded posterior margin being cut away in its postero-ventral part. Both right and left valves with shallow, longitudinal depression below dorsal margin. Sexual dimorphism pronounced.

Material: Over three hundred, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

C♀	ZPAL 0.XXI/1	L=0.87	H=0.54	W=0.42
RV♂	ZPAL 0.XXI/4	0.92	0.52	—
(?♂) RVj	ZPAL 0.XXI/5	0.88	0.48	—
RVj	ZPAL 0.XXI/6	0.72	0.48	—

Description. — Female carapace regularly ovate in lateral view; moderately and flatly swollen in dorsal view, widest posteriorly. It has the greatest height at about mid-length where the dorsal margin of the right valve forms "peak". In the left valve the greatest height lies at approximately two-thirds of the length from anterior end. The right valve overlaps the left one along the entire free margin. Anterior margin broadly rounded, weakly rimmed in the left valve. Posterior margin unevenly rounded in the right valve being cut away in its postero-ventral part, evenly rounded in the left valve. Ventral margin almost straight. There is a very shallow, longitudinal, depression below the dorsal margin, present in both valves. Valve surface smooth. Internal features as for the genus.

Cytherelloidea sp.
(Pl. 9, Figs 1—2)

1960. *Cytherelloidea subgoodlandensis* Vanderpool subsp.; Małecki, p. 103, Pl. 16, Fig. 5.
Material: Four, well preserved, juvenile specimens.
Dimensions (in *mm*):

LVj ZPAL 0.XXI/13	L=0.56	H=0.32
RVj ZPAL XXI/14	0.44	0.28

Remarks. — The investigated specimens differ from those of *Cytherelloidea subgoodlandensis* Vanderpool (1933) as well as *C. nealei* sp. n. in shape of the dorsal rib, and the coarsely bireticulate ornamentation. They appear to be very similar in rib-pattern and ornamentation to specimens of *C. rehbergensis* Bartenstein & Brand (1959). To make more exact determination further research based on more complete material is necessary. In the samples under study only juvenile specimens have been found. The specimen figured by Małecki (1960) is also a juvenile.

Occurrence. — Central Poland (Wąwał): Lower Valanginian.

Suborder **Podocopa** Sars, 1866
Superfamily **Bairdiacea** Sars, 1888
Family **Bairdiidae** Sars, 1888
Genus *BAIRDIA* M'Coy, 1844
Type species: *Bairdia curtus* M'Coy, 1844

Bairdia sp.
(Pl. 8, Fig. 9)

(?) 1960. *Bairdia subdeltoidea* (Münster); Małecki, pp. 103—104, Pl. 17, Fig. 2a-b.
Material: Three, well preserved, juvenile specimens.
Dimensions (in *mm*):

LVj ZPAL 0.XXI/15	L=0.67	H=0.40

Remarks. — The investigated specimens are most probably juveniles of the species, which adults were referred to the Tertiary species *Bairdia subdeltoidea* (Münster) by Małecki (1960). In view of their immaturity and the limited material any detailed comparisons are of a little value, but assignment to *B. subdeltoidea* is difficult to be accepted.

Occurrence. — Central Poland (Wąwał): Lower Valanginian.

Superfamily **Cypridacea** Baird, 1845
Family **Candonidae** Kaufmann, 1900
Genus *PARACYPRIS* Sars, 1866
Type species: *Paracypris polita* Sars, 1866

Paracypris elegans sp. n.
(Pl. 8, Figs 8a—b and 10)

1960. *Paracypris siliqua* (Jones); Małecki, p. 104, Pl. 16, Fig. 2a-b.
Holotype: The specimen Ca ZPAL 0. XXI/16; presented in Pl. 8, Fig. 8a-b.
Type horizon: Upper Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: Latin *elegans* — elegant; referring to the general appearance.

lack the postero-ventral node and hence the connection between the supra-ventral and posterior ribs is very weak.

The juveniles resemble adult males more than females in the basic pattern of sculpture (Pl. 8, Fig. 15).

Variability. — It is displayed in size, and general shape of the female valves, mainly as regards their length to height ratio (*cf.* in Pl. 9, Figs 4a and 5).

Remarks. — The new species, *Cytherelloidea nealei* sp. n., was previously assigned to *C. subgoodlandensis* by Sztejn (1957), who gave the length of specimens as 0.61—0.83 mm. Comparatively small specimens (length of females and males respectively: 0.55—0.61 and 0.63—0.68 mm) Małecki (1960) redescribed as *C. subgoodlandensis* while large ones (only length of females was given: 0.73—0.83 mm)

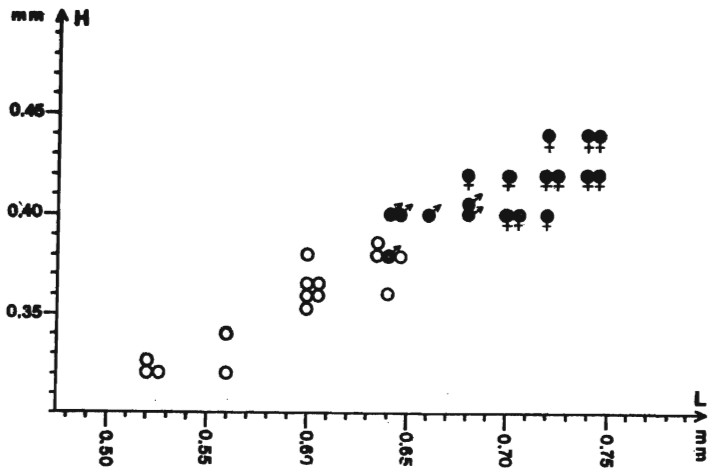


Fig. 5

Size dispersion diagram of the right valves for juvenile and adult specimens of *Cytherelloidea nealei* sp. n. (ZPAL O.XXI/183—215)

identified as *C. williamsoniana*. These two species are attributed herein to *C. nealei*. The specimens referred by Małecki to *C. williamsoniana* are considered to be the females, while those referred to *C. subgoodlandensis* to be the males and juveniles of the penultimate-instar of the new species (*see* Text-fig. 5). The new erected species may be distinguished from *C. subgoodlandensis* Vanderpool (1933) as well as from *C. williamsoniana* (Jones, 1849) by the presence of the sub-dorsal rib, and reticulate ornamentation. The species *C. nealei* seems to be closely related to *C. ovata* Weber. In a detailed study by Bettenstaedt (1958) and later by Neale (1973), it was shown how *C. ovata* evolved throughout the Hauterivian by way of various subspecies to the Upper Hauterivian and Lower Barremian species of *C. pulchra* Neale. The species *C. nealei* is closest to *C. ovata ovata* and to *C. ovata* subsp. *A* (*cf.* Neale 1978, Pl. 1, Fig. 9; Bartenstein & Oertli 1975, Pl. 2, Fig. 1). It may be distinguished from both subspecies by the course of the sub-dorsal rib which is subparallel to the dorsal margin in *C. nealei* but directed antero-ventrally in *C. ovata ovata* and *C. ovata* subsp. *A*. The reticulate ornamentation suggests a Tethyan affinity (*see* Neale 1973, p. 177) for *C. nealei*.

Occurrence. — Central Poland (Wąwał, Wiaderno): Lower and Upper Valanginian.

Cytherelloidea sp.
(Pl. 9, Figs 1—2)

1960. *Cytherelloidea subgoodlandensis* Vanderpool subsp.; Małecki, p. 103, Pl. 16, Fig. 5.
Material: Four, well preserved, juvenile specimens.
Dimensions (in *mm*):

LVj ZPAL 0.XXI/13	L=0.56	H=0.32
RVj ZPAL XXI/14	0.44	0.28

Remarks. — The investigated specimens differ from those of *Cytherelloidea subgoodlandensis* Vanderpool (1933) as well as *C. nealei* sp. n. in shape of the dorsal rib, and the coarsely bireticulate ornamentation. They appear to be very similar in rib-pattern and ornamentation to specimens of *C. rehbergensis* Bartenstein & Brand (1959). To make more exact determination further research based on more complete material is necessary. In the samples under study only juvenile specimens have been found. The specimen figured by Małecki (1960) is also a juvenile.

Occurrence. — Central Poland (Wąwał): Lower Valanginian.

Suborder **Podocopa** Sars, 1866
Superfamily **Bairdiacea** Sars, 1888
Family **Bairdiidae** Sars, 1888
Genus *BAIRDIA* M'Coy, 1844
Type species: *Bairdia curtus* M'Coy, 1844

Bairdia sp.
(Pl. 8, Fig. 9)

(?) 1960. *Bairdia subdeltoidea* (Münster); Małecki, pp. 103—104. Pl. 17, Fig. 2a-b.
Material: Three, well preserved, juvenile specimens.
Dimensions (in *mm*):

LVj ZPAL 0.XXI/15	L=0.67	H=0.40

Remarks. — The investigated specimens are most probably juveniles of the species, which adults were referred to the Tertiary species *Bairdia subdeltoidea* (Münster) by Małecki (1960). In view of their immaturity and the limited material any detailed comparisons are of a little value, but assignment to *B. subdeltoidea* is difficult to be accepted.

Occurrence. — Central Poland (Wąwał): Lower Valanginian.

Superfamily **Cypridacea** Baird, 1845
Family **Candonidae** Kaufmann, 1900
Genus *PARACYPRIS* Sars, 1866
Type species: *Paracypris polita* Sars, 1866

Paracypris elegans sp. n.
(Pl. 8, Figs 8a—b and 10)

1960. *Paracypris siliqua* (Jones); Małecki, p. 104, Pl. 16, Fig. 2a-b.
Holotype: The specimen Ca ZPAL 0. XXI/16; presented in Pl. 8, Fig. 8a-b.
Type horizon: Upper Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: Latin *elegans* — elegant; referring to the general appearance.

Diagnosis: Species strongly drawn out posteriorly, forming an acute posterior end, and having the greatest width at one-quarter length from anterior end.

Material: Twenty-nine, mostly well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

Ca ZPAL 0.XXI/16	L=0.72	H=0.30	W=0.22

Description. — Carapace strongly elongate, sub-triangular in lateral outline. Greatest height and width at one-quarter the length from the anterior end. The left valve somewhat larger than the right, overlapping the latter along its antero-dorsal part. Anterior margin broadly rounded, forming a marked cardinal angle with the strongly sloping dorsal margin. Posterior margin drawn out, forming an acute posterior end; postero-dorsal cardinal angle well marked. Dorsal margin straight, ventral margin sinuate. Valve surface smooth. Marginal zone crossed anteriorly by 11—12 thick, marginal pore-canals which branch distally. Hinge-structure and muscle-scar pattern as for the genus.

Sexual dimorphism not ascertained.

The juveniles are essentially similar to the adults in lateral outline.

Remarks. — The new species, *Paracypris elegans* sp. n., compares well with *P. anterorotunda* Gründel (1966), known from the Albian of G.D.R., but is more strongly drawn out and slimmer posteriorly. It can be easily distinguished from *P. siliqua* Jones & Hinde by its concave ventral margin and broadly rounded anterior margin.

Occurrence. — Central Poland (Wąwał, Wiaderno, Dąbrówka): Lower and Upper Valanginian.

Genus *PONTOCYPRELLA* Lyubimova, 1955
Type species: *Cythere (Bairdia) harrisiana* Jones, 1849
Pontocyprella elongata sp. n.
(Pl. 8, Figs 11 and 13)

1960. *Stenocypris harrisiana* (Jones); Małecki, pp. 104—105, Pl. 18, Fig. 3a-b.
Holotype: The specimen LVa ZPAL O. XXI/18; presented in Pl. 8, Fig. 13.
Type horizon: Lower Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: Latin *elongatus* — prolonged; referring to the great length in proportion to height.

Diagnosis: An elongate species with posterior end situated at one-third of height.

Material: Thirteen, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

LVa ZPAL 0.XXI/18	L=0.84	H=0.36
RVa ZPAL 0.XXI/19	0.76	0.30

Description. — Valves elongate, almost equally inflated laterally. The left valve slightly larger than right, both similar in shape. Greatest height anterior of the mid-length; height less than half the length. Anterior margin unevenly rounded, being more elongated in its upper half; posterior margin pointed ventrally, posterior end situated at one-third of the height. Dorsal margin weakly arched, sloping down more steeply posteriorly than anteriorly; ventral margin slightly sinuate. Valve surface smooth. Hinge adont, muscle-scar pattern not seen. Marginal zone broad anteriorly, less so posteriorly. Marginal pore-canals straight, fairly numerous.

Sexual dimorphism not ascertained.

The juveniles are similar to the adults in lateral outline.

Remarks. — The new species, *Pontocyprella elongata* sp. n., is closely allied to *P. harrisiana* (Jones, 1894); known from the Middle and Upper Albian of England, G.D.R. and G.F.R.; but differs in being more elongate and less acutely pointed postero-ventrally.

Occurrence. — Central Poland (Wąwał): Lower and Upper Valanginian.

?*Pontocyprella* sp.
(Pl. 8, Fig. 5)

Material: Two, fairly poorly preserved, specimens.
Dimensions (in *mm*):

C(?a) ZPAL 0.XXI/20	L=0.76	H=0.36	W=0.22

Remarks. — The investigated specimens in their general external appearance are most similar to members of the genus *Pontocyprella*. Internal features not seen.

Occurrence. — Central Poland (Wąwał): Upper Valanginian.

Superfamily **Cytheracea** Baird, 1850
Family **Cytheridae** Baird, 1850
Genus *DOLOCYTHERE* Mertens, 1956
Type species: *Dolocythere rara* Mertens, 1956
Dolocythere dimorphica sp. n.
(Pl. 10, Figs 4—5, 8a—b and 9, 13a—b)

Holotype: The specimen C♂ ZPAL 0.XXI/25; presented in Pl. 10, Fig. 8a-b.
Type horizin: Upper Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: A reference to strongly dimorphic nature of the species.

Diagnosis: A reticulate, strongly sexually dimorphic species. Females sub-quadrate, while males sub-triangular in lateral outline.

Material: Over a hundred, well preserved, adult specimens.
Dimensions (in *mm*):

C♂ ZPAL 0.XXI/25	L=0.36	H=0.19	W=0.19
LV♀ ZPAL 0.XXI/21	0.32	0.16	—

Description. — Female carapace sub-quadrate in lateral outline, flatly swollen in dorsal view. Valves peripherally compressed along the anterior and postero-ventral margins; similar in shape and size. Anterior margin broadly rounded; posterior margin narrowly rounded in the left valve, but obtusely pointed dorsally in the right valve; dorsal and ventral margins straight and subparallel.

Male carapace elongate, sub-triangular in lateral outline; flatly swollen in dorsal view. Greatest height at one-quarter the length from the anterior end. Valves peripherally compressed along the anterior and postero-ventral margins; similar in shape and size. Anterior margin broadly rounded, posterior margin more narrowly so; dorsal and ventral margins straight, converging towards the posterior end.

Valve surface delicately reticulate, sola of the fossae are very finely pitted (Pl. 10, Fig. 13b). Marginal zone relatively broad, being crossed anteriorly by 8—9, and posteriorly by 5, straight marginal pore-canals. Hinge-structure and muscle-scar pattern as for the genus.

Remarks. — The new species, *Dolocythere dimorphica* sp. n., is unlikely to be confused with any hitherto described species of the genus.

Occurrence. — Central Poland (Wąwał, Wiaderno): Lower and Upper Valanginian.

Dolocythere punctata sp. n.
(Pl. 10, Figs 1—3 and 6a—b)

Holotype: The specimen Ca ZPAL 0. XXI/31; presented in Pl. 10, Fig. 6a-b.
Type horizon: Upper Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: Latin *punctum* — a small pit; referring to the type of ornamentation.

Diagnosis: Species with distinct fringe at anterior margin, punctate valve-surface, and sub-quadrate lateral outline.
Material: Over sixty, well preserved, adult specimens.
Dimensions (in *mm*):

Ca ZPAL 0.XXI/31	L=0.32	H=0.16	W=0.15

Description. — Carapace sub-quadrate in lateral outline; fusi-form in dorsal view, widest posteriorly. The left valve somewhat larger than the right, overlapping the latter along its postero-dorsal and antero-ventral parts. The right and left valves similar in shape, peripherally compressed along their anterior margins and less distictly so along their posterior margins. Anterior margin broadly rounded; rimmed with a riblet, and with a distinct fringe, i.e. a plate-like prolongation of the anterior margin; posterior margin narrowly rounded. Dorsal margin straight, ventral margin sinuous; both margins tapering slightly posteriorly. Valve surface punctate, and with riblets developed between the punctae (Pl. 10, Fig. 6a). Marginal zone relatively broad, being crossed anteriorly by 10, and posteriorly by 6, straight marginal pore-canals. Hinge-structure and muscle-scar pattern as for the genus.

Sexual dimorphism not ascertained.

Remarks. — The new species, *Dolocythere punctata* sp. n., is most similar to *D. rara* Mertens (1956), but differs in considerably smaller size and punctated ornamentation (the latter species is reticulate), and in dorsal view.

Occurrence. — Central Poland (Wąwał, Wiaderno, Dąbrówka): Lower and Upper Valanginian.

Dolocythere ?longa Gründel, 1966
(Pl. 10, Figs 7, 10—11 and 12a—b)

(?) 1966. *Dolocythere longa* n. sp.; Gründel, p. 24, Pl. 3, Figs 30—31.
Material: Over a hundred, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

C♀	ZPAL 0.XXI/27	L=0.40	H=0.24	W=0.24
RV♂	ZPAL 0.XXI/30	0.42	0.24	—

Remarks. — The male specimen figured in Pl. 10, Fig. 11 appears to be very similar, in general shape, to the holotype of *Dolocythere longa* Gründel. It differs mainly in its smaller size and pitted ornament (specimens of *D. longa* are reticulate). More complete comparisons of Polish and the type-specimens are difficult to make since only male specimens of *D. longa* are figured in Gründel's original paper.

Occurrence. — Central Poland (Wąwał, Wiaderno, Dąbrówka): Lower and Upper Valanginian.

The species *D. longa* Gründel is known from the Lower Hauterivian of German Democratic Republic.

Family **Progonocytheridae** Sylvester-Bradley, 1948
Genus *NEOCYTHERE* Mertens, 1956
Subgenus *PHYSOCYTHERE* Kaye, 1963
Type species: *Cythere lingenensis* Mertens, 1956
Neocythere (Physocythere) tumida sp. n.
(Pl. 9, Figs 7, 8a—c and 10, 12a—b)

Holotype: The specimen C♀ ZPAL O. XXI/37; presented in Pl. 9, Fig. 8a-c.
Type horizon: Lower Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: Latin *tumidus* — swollen; referring to the centro-lateral tumidity.

Diagnosis: An elongate species, markedly tumid centro-laterally. Valve surface covered with 9—11 concentric riblets, smoothed out in dorsal part of valves. Sexual dimorphism pronounced.

Material: Thirty-two, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

C♀	ZPAL O.XXI/37	L=0.66	H=0.39	W=0.45
LV♂	ZPAL O.XXI/40	0.69	0.39	—

Description. — Female carapace elongate, triangular in lateral outline, markedly tumid centro-laterally and flattened ventrally. Greatest height at one-third the length from the anterior end; greatest width about mid-length. The left valve slightly larger than right, overlapping the right valve along the entire free margin. Anterior margin gently rounded; posterior margin fairly narowly rounded. Dorsal and ventral margins straight, strongly converging towards the posterior end. Valve surface covered with 9—11 concentric riblets which are smoothed out in the dorsal part of the valves. Marginal zone relatively broad, being crossed anteriorly by 8, and posteriorly by 3, short and straight marginal pore-canals. Hinge-structure as for the subgenus (Pl. 9, Fig. 10). Muscle-scar pattern consists of a vertical row of four oval scars and an oval scar in front of them.

Sexual dimorphism pronounced. The males are slimmer than the females in dorsal view and lower in lateral view.

The juveniles closely resemble the males in shape.

Remarks. — The centro-laterally swollen valves make *Neocythere (Physocythere) tumida sp. n.* dissimilar to known species of the subgenus. The only comparable species is *N. (P.) elongata* of Colin (1974), recorded in the Upper Cenomanian of Portugal and France. The present species is similar to *N. (P.) elongata* in dorsal view, but in lateral view tends to be lower, and lacks marginal spines at the postero-ventral margin.

Occurrence. — Central Poland (Wąwał, Wiaderno): Upper Berriasian to the lowest Upper Valanginian.

Genus *ACROCYTHERE* Neale, 1960
Type species: *Orthonotacythere hauteriviana* Bartenstein, 1956
Acrocythere aspera Donze, 1965
(Pl. 10, Figs 14—15)

1965. *Acrocythere aspera* n. sp.; Donze, pp. 94—95, Pl. 2, Figs 42—45.
Material: Twenty, fairly well preserved, adult and juvenile specimens
Dimensions (in *mm*):

LVa ZPAL 0.XXI/41	L=0.38	H=0.22
RVa ZPAL 0.XXI/42	0.36	0.20

Remarks. — The investigated specimens agree with specimens originally figured by Donze (1965) in all respects, except for their slightly smaller size.

Occurrence. — France: lowest Valanginian, Ardèche (Donze 1965).

Central Poland (Wąwał, Wiaderno): Lower Valanginian to the lowest Upper Valanginian.

Genus *HEKISTOCYTHERE* Bate, 1969
Type species: *Hekistocythere venosa* Bate, 1969
Hekistocythere tenuis (Donze, 1965)
(Pl. 9, Figs 6a—b, 9 and 11)

1965. *Pseudobythocythere? tenuis* n. sp.; Donze, pp. 95—96, Pl. 2, Figs 46—49.
Material: Over seventy, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

RV♀ ZPAL 0.XXI/43	L=0.36	H=0.24
LV♂ ZPAL 0.XXI/45	0.45	0.27

Remarks. — In the material under study, hinge-structure in the right valve is made up of divided terminal elements, which are part of the selvage, and a median element which is crenulate at both ends (Pl. 9, Fig. 11). In the type-species of the genus *Hekistocythere* (as defined by Bate 1969, p. 430, Fig. 17) all the above mentioned elements are smooth. It should be pointed out, however, that the crenulation in the investigated specimens is only discernable on perfectly preserved material.

Occurrence. — France: lowest Valanginian, Ardèche (Donze 1965).

Central Poland (Wąwał, Wiaderno): Upper Berriasian to the lowest Upper Valanginian.

Family **Trachyleberididae** Sylvester-Bradley, *sensu* Liebau, 1975
Subfamily **Protocytherinae** Lyubimova, 1955
Genus *PROTOCYTHERE* Triebel, 1938
Type species: *Cytherina triplicata* Roemer, 1840

Protocythere hechti Triebel, 1938
(Pl. 12, Figs 7—8)

1938a. *Protocythere hechti* n. sp.; Triebel, p. 189, Pl. 1, Figs 11—16.
1966. *Protocythere hechti* Triebel; Gründel, p. 26, Pl. 4, Fig. 7 (*here synonymy*).
1966. *Protocythere hechti* Triebel; Oertli, pp. 111—112, Pl. 5, Figs 52—53.
1975. *Hechticythere hechti* (Triebel); Bartenstein & Oertli, p. 13, Pl. 3, Fig. 13.
1978. *Protocythere hechti* Triebel; Neale, p. 338, Pl. 3, Fig. 8.

Material: Sixty-nine, well preserved, adult specimens.
Dimensions (in *mm*):

LV♀ ZPAL 0.XXI/46	L=0.66	H=0.43
LV♂ ZPAL 0.XXI/47	0.76	0.43

Remarks. — For comment on the genus *Hechticythere*, *see* Liebau (1975, p. 379).

Occurrence. — Great Britain — Hauterivian, Yorkshire (Neale 1978); German Democratic Republic — Hauterivian, West Mecklenburg (Gründel 1966); German Federal Republic — Upper Valanginian to Barremian, Lower Saxony, Heligoland

(Triebel 1938a, Kemper 1971, Bartenstein & Oertli 1975); France — Lower Hauterivian, Paris Basin (Grosdidier 1964); Switzerland — Hauterivian, the Jura Mts (Oertli 1966).

Central Poland (Wąwał, Wiaderno): Upper Valanginian; recorded in the Upper Valanginian and Lower Hauterivian of the Polish Lowland (Sztejn 1968, 1969).

Protocythere tomaszowiensis Sztejn, 1957
(Pl. 11, Figs 7, 9 and 13)

1957. *Protocythere tomaszowiensis* n. sp.; Sztejn, pp. 259—260, Pl. 15, Fig. 115a-c.
Material: Over fifty, variously preserved, adult and juvenile specimens.
Dimensions (in *mm*):

C♀	ZPAL 0.XXI/48	L=0.76	H=0.47	W=0.43
RV♂	ZPAL 0.XXI/49	0.82	0.44	—
LVj	ZPAL 0.XXI/50	0.57	0.38	—

Remarks. — The species *Protocythere tomaszowiensis*, with its anteriorly inflated valves and highly reduced coarse-sculpture, is similar to *P. obsoleta* Pokorný (1973) from the (?)Upper Tithonian of Moravia; however, it differs distinctly in its lateral outline.

Occurrence. — Central Poland (Wąwał, Wiaderno): Upper Berriasian to Lower Valanginian.

Protocythere helvetica Oertli, 1966
(Text-fig. 9 and Pl. 13, Figs 1 and 2a—b, 3a—b and 4a—b, 5a—b and 6—7)

1966. *Protocythere helvetica* n. sp.; Oertli, p. 107, Pl. 3, Figs 22—26, 27a-c, 28a-c, 29.
1976. *Protocythere helvetica* Oertli; Kubiatowicz, pp. 122—123, Text-fig. 2H, Pl. 1, Figs 10, 11a-b, 12—14; Pl. 5, Fig. 1a-b.
Material: Over four hundred, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

LV♂	ZPAL 0.XXI/54	L=0.96	H=0.54
LV♂	ZPAL 0.XXI/53	0.91	0.52

Variation. — Three forms may be recognized: a reticulate form, a bireticulate form and a smooth one. They refer to the adult specimens of *P. helvetica*; the juvenile specimens are very rare in the material studied, and have been found only in samples yielding adult specimens of the reticulate and bireticulate forms of the species.

— The reticulate form (Pl. 13, Figs 1—2) is defined by those specimens in which the valve surface is ornamented with polygonal fossae having smooth sola or occupied by amoeba-like shaped protuberances (Pl. 13, Fig. 2b).

— The bireticulate form (Pl. 13, Figs 3—4) is defined by those specimens in which the valve surface is ornamented with poligonal fossae which all sola are occupied by amoeba-like shaped protuberances (Pl. 13, Figs 3b and 4b). The protuberance is situated in the centre of each solum, while its extensions are thick enough they divide the fossae into 4 to 8 pits. Detailed examination of fossae under the SEM revealed that some fossae are also papillate (Pl. 13, Fig. 3b).

— The smooth form (Pl.. 13, Figs 5—7) is defined by specimens with almost entirely smooth valve surface, except for the postero-dorsal and ventral parts which are pitted, and by specimens with a very finely pitted valve surface (Pl. 13, Fig. 5b).

This ornamental variability seems to be ecologically controlled.

Remarks. — Specimens from Poland, referred to the reticulate form of *P. helvetica*, correspond well with those originally figured by Oertli from the Jura Mts.

Occurrence. — German Federal Republic — Upper Valanginian (=Ober Valendis *1—2*), Lower Saxony (Bartenstein & Brand 1951, Oertli 1966); France — Upper Berriasian to Lower Valanginian, Alpes de Haute-Provence (Donze 1976); Switzerland — Lower Valanginian, the Jura Mts (Oertli 1966, Donze *in* Donze & Thieuloy 1975); Southern Spain — Upper Berriasian (Donze 1977).

Central Poland (Wąwał, Wiaderno, Dąbrówka): Upper Berriasian to Upper Valanginian; the reticulate form of this species occurs in the Upper Berriasian and Lower Valanginian deposits at Wąwał (samples *2—11*; *see* Text-figs 4 and 9) and in the Lower Valanginian deposits in the Wiaderno borehole (depth 215.6—210.6 m; *see* Table 3), the bireticulate form occurs in the lowest Upper Valanginian deposits at Wąwał (sample *12*), while the smooth form appears in the Upper Valanginian deposits at Wąwał (samples *13—22*) as well as in the Wiaderno (depth 209.3—204.5 m) and Dąbrówka (depth 143.9—136.8 m; *see* Table 3) boreholes.

Protocythere sp. *A* of Donze, 1975
(Pl. 11, Figs 14 and 15a—b)

1967b. *Protocythere propria emslandensis* Bart. et Burri; Sztejn, pp. 256—257, Pl. 2, Figs 9a-b, 10a-b.

1975a. *Protocythere* sp. *A*; Donze, p. 104, Pl. 1, Figs 21—23.

Material: A single adult and three juvenile specimens, all well preserved.

Dimensions (in *mm*):

C♂ ZPAL 0.XXI/59	L=1.06	H=0.62	W=0.56
LVj ZPAL 0.XXI/60	0.84	0.60	—

Remarks. — The investigated specimens are identical with these referred by Sztejn to *Protocythere propria emslandensis*, as well as those described by Donze as *Protocythere* sp. *A*. They differ from the original specimens of *P. propria emslandensis* Bartenstein & Burri (1954), known from the Upper Berriasian of Switzerland and Germany, in shape of the ventral rib, which overreaches ventral margin in *P. propria emslandensis* while it follows ventral margin in *Protocythere* sp. *A*.

Occurrence. — France: Lower and Upper Berriasian, Haute-Provence (Donze 1975a).

Central Poland (Wąwał): Upper Berriasian; recorded in the Upper Berriasian of the Polish Lowland (Sztejn, 1967b, 1968, 1969; Dmoch 1978). It is regarded as typically Upper Berriasian species of the Polish Lowland (Sztejn *in* Marek & Raczyńska 1973a).

Protocythere lewinskii Kubiatowicz, 1976
(Text-fig. 9 and Pl. 12, Figs 9—10 and 13)

1976. *Protocythere lewinskii* sp. n; Kubiatowicz, pp. 124—127, Text-fig. 1, Text-fig. 2A-F; Pl. 2, Figs 1a-c, 2a-d, 3—4; Pl. 3, Figs 1—3, 4a-b, 5, 6a-b; Pl. 4, Figs 1, 2a-c, 3a-b, 4—5; Pl. 6, Figs 1—6.

Material: Over four hundred, well preserved, adult and juvenile specimens.

Dimensions (in *mm*):

RV♂ ZPAL 0.XXI/61	L=1.02	H=0.52
RV♂ ZPAL 0.XXI/62	0.98	0.49

Variation. — Two forms may be recognized: forma lewinskii (Pl. 12, Fig. 9) and forma bireticulata (Pl. 12, Figs 10 and 13); they both were described previously (Kubiatowicz 1976). This variability seems to be ecologically controlled.

Occurrence. — Central Poland (Wąwał, Wiaderno, Dąbrówka): Lower and Upper Valanginian; forma lewinskii of this species occurs in the Lower Valanginian deposits at Wąwał (samples *4—12*; *see* Text-figs 4 and 9) and in the Lower Valanginian deposits in the Wiaderno borehole (depth 215.6—210.6 m; *see* Table 3), while forma bireticulata is recorded in the Upper Valanginian deposits at Wąwał (samples *12—17*) as well as in the Wiaderno (depth 207.7 m) and Dąbrówka (depth 143.0—136.8 m; *see* Table 3) boreholes.

Protocythere vonvalensis Kubiatowicz, 1976
(Text-fig. 9 and Pl. 12 Figs 15—17)

1976. *Protocythere vonvalensis* sp. n.; Kubiatowicz, pp. 123—124, Text-fig. 2G, Pl. 1, Figs 1a-c, 2, 3a-b, 4a-b, 5—9.

Material: Over eighty, variously preserved, adult and juvenile specimens.
Dimensions (in *mm*):

RV♂ ZPAL 0.XXI/65	L=0.80	H=0.44
RV♂ ZPAL 0.XXI/64	0.84	0.44

Variation. — Two forms may be recognized: a coarsely pitted form, defined by adult specimens with coarsely pitted valve surface and a short median rib (Pl. 12, Figs 15—16), and a finely pitted one, defined by adult specimens with finely pitted valve surface and longer median rib (Pl. 12, Fig. 17). The juvenile specimens, lacking ribs, exhibit very slight variation in the coarseness of pitting. This variability seems to be ecologically controlled.

Remarks. — See Kubiatowicz (1976).

Occurrence. — Central Poland (Wąwał, Wiaderno): Upper Berriasian to Lower Valanginian; the coarsely pitted form of this species occurs in the Upper Berriasian to Lower Valanginian deposits at Wąwał (samples *2—8*; *see* Text-figs 4 and 9) and in the Lower Valanginian deposits in the Wiaderno borehole (depth 215.6—214.7 m; *see* Table 3), while the finely pitted form is recorded in the Lower Valanginian deposits at Wąwał (samples *4—10*) and in the Wiaderno borehole (depth 214.7—213.0 m).

Protocythere sztejnae sp. n.
(Pl. 11, Figs 1—2, 3a—b and 4, 10—11)

Holotype: The specimen C♀ ZPAL 0.XXI/66; presented in Pl. 11, Fig. 3a-b.
Type horizon: Lower Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: In honour of Dr. Janina Sztejn, Geological Survey of Poland, Warsaw, who described the first ostracodes from Wąwał.

Diagnosis: Species with rectangular lateral outline, smooth valve surface, and muscle scar-node elongated postero-dorsally. Sexual dimorphism pronounced.

Material: Over thirty, well preserved, adult specimens.
Dimensions (in *mm*):

C♀ ZPAL 0.XXI/66	L=0.69	H=0.43	W=0.38
RV♀ ZPAL 0.XXI/69	0.66	0.38	—
RV♂ ZPAL 0.XXI/71	0.69	0.40	—

Description. — Female carapace rectangular in lateral outline, peripherally compressed along the anterior and posterior margins, swollen ventro-laterally; spindle-shaped in dorsal view. The left and right valves differ slightly in shape. The left valve, having a very distinct anterior hinge-ear, overlaps the right valve all round. Anterior margin of both valves broadly rounded; posterior margin obtusely pointed dorsally in the left valve, but more centrally so in the right

valve. Dorsal and ventral margins straight and subparallel. Valve sculpture confined to dorsal rib, following the dorsal margin, and muscle-scar node elongated postero-dorsally. Valve surface smooth. Hinge in the right valve with 6 bifid denticles both anteriorly and posteriorly, and with crenulate median groove (Pl. 11, Fig. 11); the left valve with complementary hinge elements (Pl. 11, Fig. 10). Muscle--scar pattern typical for the genus.

Sexual dimorphism pronounced, the males being more elongate than the females.

Remarks. — The rectangular lateral outline, reduced and subdued ribbing, make *Protocythere sztejnae* sp. n. dissimilar to the known species of the genus.

Occurrence. — Central Poland (Wąwał, Wiaderno): Lower Valanginian.

Protocythere wiadernoensis sp. n.
(Pl. 11, Figs 5—6, 8a—b and 12)

Holotype: The specimen C♀ ZPAL O. XXI/72; presented in Pl. 11, Fig. 8a-b.
Type horizon: Lower Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: After the locality of Wiaderno.

Diagnosis: Species with sub-triangular lateral outline, convex dorsal rib, and subdued median rib. Sexual dimorphism pronounced.

Material: Twenty, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

C♀	ZPAL O.XXI/72	L=0.76	H=0.47	W=0.44
RV♂	ZPAL O.XXI/74	0.80	0.41	—

Description. — Female carapace sub-triangular in lateral outline, peripherally compressed along the anterior and posterior margins, evenly inflated laterally; spindle-shaped in dorsal view. Greatest height at one-third the length from the anterior end. The larger left valve with anterior hinge-ear, it overlaps the right valve all round. Anterior margin of both valves broadly rounded; posterior margin rounded in the left valve, while in the right valve it is sharply truncated postero--dorsally, and with posterior end situated below the valve mid-height. Dorsal and ventral margins straight, both converging towards the posterior end. Valve sculpture confined to weakly convex dorsal-rib, and very short median-rib which merges anteriorly with the muscle-scar node. Valve surface smooth. Hinge-structure and muscle-scar pattern as for the genus (Pl. 11, Fig. 12).

Sexual dimorphism pronounced, the males being more elongate than the females.

The juveniles resemble the males more than females in later outline.

Remarks. — The new species, *Protocythere wiadernoensis* sp. n., in its general shape compares well with *P.* ? *gondronensis* of Donze (1964) from the type Berriasian strata, but differs significantly in lateral and dorsal views.

Occurrence. — Central Poland (Wąwał): Lower Valanginian.

Protocythere sp.
(Pl. 12, Fig. 14)

Material: Ten, variously preserved, adult specimens.
Dimensions (in *mm*):

RVa	ZPAL O.XXI/36	L=0.90	H=0.46

Remarks. — The investigated specimens differ from those of *Protocythere hechti* Triebel in being more inflated in the muscle-scar node region, and in having straight dorsal and median ribs.

Occurrence. — Central Poland (Wąwał): Upper Berriasian to Lower Valanginian.

Genus *MANDOCYTHERE* Gründel, 1964
Subgenus *COSTACYTHERE* Gründel, 1966
Type species: *Protocythere granifera* Grosdidier, 1964
Mandocythere (Costacythere) frankei (Triebel, 1938)
(Pl. 14, Figs 10a—c and 11)

1938a. *Protocythere frankei* n. sp.; Triebel, p. 192, Pl. 2, Figs 23—26.
1960. *Protocythere frankei* Triebel; Neale, p. 211, Pl. 2, Fig. 18a-b.
1966. *Mandocythere (Costacythere) frankei frankei* (Triebel); Oertli, p. 117, Pl. 5, Fig. 47 (*here synonymy*).
1966. *Mandocythere (Costacythere) frankei fordonensis* (Neale); Gründel, p. 29, Pl. 14, Fig. 12.
1969. *Mandocythere (Costacythere) frankei frankei* (Triebel); Sztejn, p. 253, Pl. 3, Figs 4—5.
1972. *Mandocythere (Costacythere) frankei* (Triebel); Geroch & *al.*, Pl. 52, Fig. 1.
1975. *Mandocythere (Costacythere) frankei frankei* (Triebel); Bartenstein & Oertli, p. 12, Pl. 3, Fig. 11.
1978. *Mandocythere frankei frankei* Triebel; Neale, p. 338, Pl. 3, Fig. 9.

Material: Over two hundred, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

LV♀ ZPAL 0.XXI/77	L=0.72	H=0.44
LV♂ ZPAL 0.XXI/78	0.88	0.52

Remarks. — The investigated specimens are identical with those referred by Neale (1960) as well as Gründel (1966) to *Mandocythere (Costacythere) frankei fordonensis* (Neale). The most obvious difference between *M. (C.) frankei fordonensis* and the nominate subspecies *M. (C.) frankei frankei* lies in the pitting (Neale 1962, p. 443), which is finer and denser in the former subspecies.

In the material under study, these specimens are accompanied by smoothed out specimens of *Protocythere helvetica* as well as by finely pitted specimens of *Pseudoprotocythere aubersonensis* (*see* Text-figs 4 and 9). It is suggest therefore, that *M. (C.) frankei fordonensis* is only an ecovariant of *M. (C.) frankei frankei*.

Occurrence. — Great Britain — Lower Hauterivian, Yorkshire (Neale 1978); German Democratic Republic — Lower Hauterivian, West Mecklenburg (Gründel 1966); German Federal Republic — Upper Valanginian to Lower Hauterivian, Lower Saxony (Bartenstein & Brand 1951, Kemper 1971), and Lower Hauterivian or lowermost Upper Hauterivian, Heligoland (Bartenstein & Oertli 1975); France — Upper Valanginian to Lower Hauterivian, Alpes de Haute-Provence, Paris Basin (Grosdidier 1964, Donze 1976); Switzerland — Upper Valanginian to Lower Hauterivian, the Jura Mts (Oertli 1966).

Central Poland (Wąwał, Wiaderno, Dąbrówka): Upper Valanginian; recorded in the Upper Valanginian and Lower Hauterivian of the Polish Lowland, as well as in the Upper Valanginian of the southern part of the Carpathian Foredeep (Sztejn 1976b, 1968, 1969; Geroch & *al.* 1972).

Genus *PSEUDOPROTOCYTHERE* Oertli, 1966
Type species: *Pseudoprotocythere aubersonensis* Oertli, 1966
Pseudoprotocythere aubersonensis Oertli, 1966
(Text-fig. 9 and Pl. 12, Figs 1—6, 11—12 and 18)

1966. *Pseudoprotocythere aubersonensis* n. sp.; Oertli, pp. 122—124, Pl. 7, Figs 74—86.

Material: Over four hundred, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

RV♂ ZPAL 0.XXI/82	L=0.85	H=0.42
RV♂ ZPAL 0.XXI/83	0.77	0.38

Variation. — Two forms may be recognized: a coarsely pitted form (Pl. 12, Figs 3—4 and 11), with a coarsely pitted valve surface and a short median rib;

finely pitted one (Pl. 12, Figs 5—6, 12 and 18), with a finely pitted valve surface, longer median rib, and relatively smaller in size. They refer to the adult specimens of *P. aubersonensis;* the juvenile specimens display only slight variation in coarseness of pitting (Pl. 12, Figs 1—2). This variability seems to be ecologically controlled.

Remarks. — Specimens from Poland, referred to the coarsely pitted form of *P. aubersonensis*, are identical with those originally figured as *"gedrungene Varietät"* of the species by Oertli (1966, Pl. 7, Figs 84—86).

Occurrence. — Switzerland — Lower and Upper Valanginian, the Jura Mts (Oertli 1966); Southern Spain — Upper Berriasian (Donze 1977).

Central Poland (Wąwał, Wiaderno, Dąbrówka): Upper Berriasian to Upper Valanginian; the coarsely pitted form of this species occurs in the Upper Berriasian to the lowest Upper Valanginian deposits at Wąwał (samples *2—12*; *see* Text-figs 4 and 9) and in the Lower Valanginian deposits in the Wiaderno borehole (depth 214.7—209.3 m; *see* Table 3), while the finely pitted form is recorded in the Upper Valanginian deposits at Wąwał (samples *12—22*) and in the Wiaderno (depth 209.0—207.7 m) and Dąbrówka (depth 142.0—138.6 m; *see* Table 3) boreholes.

Subfamily **Exophthalmocytherinae** Gründel, 1966

Genus *EXOPHTHALMOCYTHERE* Triebel, 1938

Type species: *Exophthalmocythere mamillata* Triebel, 1938

Exophthalmocythere insignis Donze, 1965

(Pl. 14, Fig. 1a—b)

1965. *Exophthalmocythere insignis* n. sp.; Donze, p. 99, Pl. 2, Figs 27—32.

Material: Four, fairly well preserved, adult specimens.
Dimensions (in *mm*):

LVa ZPAL 0.XXI/86 L=0.58 H=0.33

Occurrence. — France — lowest Valanginian, Ardèche (Donze 1965); Southern Spain — Upper Berriasian (Donze 1977).

Central Poland (Wąwał): Lower Valanginian.

Genus *PAREXOPHTHALMOCYTHERE* Oertli, 1959

Type species: *Parexophthalmocythere rodewaldensis* Bartenstein & Brand, 1959

Parexophthalmocythere hispida (Małecki, 1960)

(Taxt-fig. 9 and Pl. 14, Figs 5, 7—9)

1960. *Exophthalmocythere hispida* n. sp.; Małecki, pp. 117—118, Pl. 18, Fig. 1a-c.

Material: Fifty, well preserved, adult and juvenile specimens; many of them partly damaged.
Dimensions (in *mm*):

RVa ZPAL 0.XXI/89 L=0.72 H=0.40

Variation. — Two forms may be recognized: a pitted form (Pl. 14, Fig. 9), with a pitted valve surface; a smooth one (Pl. 14, Figs 5 and 8), with a smooth valve surface. This variability seems to be ecologically controlled.

Remarks. — The hinge-structure (Pl. 14, Fig. 7) and shape place this species in the genus *Parexophthalmocythere.*

Occurrence. — Central Poland (Wąwał, Wiaderno): Lower and Upper Valanginian; the pitted form of this species occurs in the Lower Valanginian to the

lowest Upper Valanginian deposits at Wąwał (samples *4—13*; *see* Text-figs 4 and 9) and in the Lower Valanginian depostits in the Wiaderno borehole (depth 210.3 m, *see* Table 3), while the smooth form is confined to the Upper Valanginian deposits at Wąwał (samples *14—16* and *19*).

Genus *TRIEBELOCYTHERE* Gründel, 1967
Type species: *Triebelocythere triebeli* Gründel, 1967
Triebelocythere oertlii sp. n.
(Pl. 14, Figs 2a—b, 3—4 and 6)

Holotype: The specimen LV♂ ZPAL 0. XXI/93; presented in Pl. 14, Fig. 3.
Type horizon: Lower Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: In honour of an outstanding ostracodologist, Dr. Henri J. Oertli, SNPA-Centre de Recherches in Pau.

Diagnosis: Fragile species, with triangular lateral outline, marginal spines antero-ventrally, and pitted surface. Sexual dimorphism pronounced.
Material: Twenty, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

RV♀ ZPAL 0.XXI/91	L=0.53	H=0.32
LV♂ ZPAL 0.XXI/93	0.57	0.30

Description. — Valves fragile, triangular in later outline, with greatest height at one-third the length from the anterior end; greatest width posterior of the mid-length. The left and right valves similar in shape and size, compressed anteriorly in the peripheral zones. Anterior margin broadly rounded with three marginal spines antero-ventrally, the middle spine is the longest; posterior margin truncated dorsally. Dorsal and ventral margins straight and converging strongly toward the posterior end. Eye-protuberance distinct and high. Valve surface covered with pits, and minute tubercles which bear sieve-pores (Pl. 14, Fig. 2b). Internal features as for the genus (Pl. 14, Fig. 6).

Sexual dimorphism pronounced. The males are more elongate than the females.

The juveniles resemble the males more than the females in lateral outline.

Remarks. — The genus *Triebelocythere* was erected by Gründel for a single species *T. triebeli* (Gründel, 1967), occurring in the Middle Albian of G.D.R. The new species, *Triebelocythere oertlii* sp. n., differs from the type species of the genus in general outline, presence of marginal spines at the antero-ventral margin, and in the position of the eye-protuberance which is set more anteriorly.

Occurrence. — Central Poland (Wąwał, Wiaderno): Lower Valanginian to the lowest Upper Valanginian.

Family **Eucytheridae** Puri, 1954
Genus *STRAVIA* Neale, 1962
Type species: *Stravia crossata* Neale, 1962
Stravia crossata Neale, 1962
(Pl. 15, Figs 14 and 17)

1957. *Cytheridea (Haplocytheridea) nana* Trieb.; Sztejn, p. 255, Pl. 13, Fig. 107a-c.
1962. *Stravia crossata* Neale, new species; Neale, pp. 435—436, Pl. 2, Figs 17—18; Pl. 3, Figs 1—6.
1978. *Stravia crossata* Neale; Neale, p. 336, Pl. 2, Figs 1—3.

Material: Over four hundred, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

LV♀ ZPAL 0.XII/95	L=0.60	H=0.34
RV♀ ZPAL 0.XXI/96	0.56	0.32

Occurrence. — Great Britain: Valanginian, Yorkshire (Neale 1962, 1978). Central Poland (Wąwał, Wiaderno, Dąbrówka): Lower and Upper Valanginian.

Genus *AALENIELLA* Plumhoff, 1963
Type species: *Aaleniella compressa* Plumhoff, 1963
Aaleniella sp.
(Pl. 18, Figs 3, 6 and 9)

1960. *Cyprione* cf. *C. oblonga* (Roemer); Neale, p. 214, Pl. 1, Figs 6, 8; Pl. 3, Figs 9, 11; Pl. 4, Figs 1—4.

Material: Fourty, well preserved, adult specimens.
Dimensions (in *mm*):

LVa ZPAL 0.XXI/145	L=0.32	H=0.18
RVa ZPAL 0.XXI/147	0.32	0.16

Remarks. — The specimens, referred by Neale (1960) to *Cyprione* cf. *oblonga*, should certainly be included into a new species of the genus *Aaleniella* by Christensen (*after* Neale 1973, p. 171).

Occurrence. — Great Britain: Hauterivian, East Yorkshire (Neale 1960). Central Poland (Wąwał, Wiaderno): Lower and Upper Valanginian.

Family **Cytherideidae** Sars, 1925
Subfamily **Cytherideinae** Sars, 1925
Genus *HAPLOCYTHERIDEA* Stephenson, 1936
Type species: *Cytheridea montgomeryensis* Howe & Chambers, 1935
Haplocytheridea parva sp. n.
(Pl. 15, Figs 1, 2a—b and 3a—b, 4 and 9)

Holotype: The specimen C♂ ZPAL 0. XIX/100; presented in Pl. 15, Fig. 2a-b.
Type horizon: Lower Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: Latin *parvus* — small; referring to the small size.

Diagnosis: A strongly inequivalve and sexually dimorphic species: female left valve is oval, high in proportion to length, while female right valve is rounded, sub-hexagonal in lateral outline; male valves are elongate-oval.
Material: Twenty, well preserved, adult specimens.
Dimensions (in *mm*):

C♂ ZPAL 0.XXI/100	L=0.80	H=0.54	W=0.36
RV♀ ZPAL 0.XXI/99	0.69	0.46	—

Description. — Male carapace elongate-oval with greatest height at one-quarter of the length from the anterior end; in dorsal view moderately and flatly swollen, widest posteriorly. The left valve slightly larger than right, overlapping the right valve along the entire free margin. Both valves similar in shape. Anterior margin broadly rounded, posterior margin narrowly rounded, dorsal and ventral margins straight and slightly converging towards the posterior end.

Female left and right valves differ in size and shape. The larger left valve is oval, high in proportion to length. Its anterior margin is broadly rounded, posterior margin very slightly truncated dorsally, dorsal margin evenly arched, ventral margin broadly convex. The right valve is rounded, sub-hexagonal in lateral outline with prominant cardinal angles, and obtusely pointed posterior end situated below the valve mid-height.

Valve surface smooth, covered with open and sieve pores (Pl. 15, Fig. 3b). Hinge of the holomerodont type (Pl. 15, Fig. 9), the left valve without an accomodation groove. Muscle-scar pattern with a vertical row of four scars and a heart-shaped scar in front of them.

Remarks. — The new species, *Haplocytheridea parva* sp. n., is its general appearance, is similar to the presented herein *Haplocytheridea* sp. It differs from the latter in smaller size, and more symmetrical outline of the anterior margin.

Occurrence. — Central Poland (Wąwał, Wiaderno): Lower and Upper Valanginian.

Haplocytheridea sp.
(Pl. 15, Figs 5—6, 8 and 10)

Material: Eight, well preserved, adult specimens.
Dimensions (in *mm*):

LV♀ ZPAL 0.XXI/102	L=0.80	H=0.60
RV♂ ZPAL 0.XXI/104	0.88	0.54

Remarks. — The investigated specimens are very similar in general shape and hinge-structure to those of *Haplocytheridea kummi* (Triebel, 1938b).

Occurrence. — Central Poland (Wąwał, Wiaderno, Dąbrówka): Upper Valanginian.

Genus *CLITHROCYTHERIDEA* Stephenson, 1936
Type species: *Cytheridea? garretti* Howe & Chambers, 1935

Clithrocytheridea vonvalensis (Sztejn, 1957)
(Pl. 15, Figs 13, 16 and 19)

1957. *Cytheridea (Haplocytheridea) vonvalensis* n. sp.; Sztejn, p. 257, Pl. 14, Fig. 110a-c.
1960. *Cytheridea vonvalensis* Sztejn; Małecki, pp. 107—108, Text-fig. 1a-d, Pl. 16, Fig. 6a-b.

Material: Over two hundred, well preserved adult and juvenile specimens.
Dimensions (in *mm*):

RV♀ ZPAL 0.XXI/106	L=0.69	H=0.48
LV♂ ZPAL 0.XXI/107	0.73	0.46

Remarks. — The species *Clithrocytheridea vonvalensis* bears external similarity to *C. heslertonensis Kaye* (1963), recorded in the Middle Albian of Great Britain. It differs in details of the hinge-structure, *i.e.* it has finely denticulated bar in the left valve (Pl. 15, Fig. 13), and in being more sharply truncated posteriorly.

Occurrence. — Central Poland (Wąwał, Wiaderno, Dąbrówka): Upper Berriasian to Upper Valanginian.

Genus *DOLOCYTHERIDEA* Triebel, 1938
Subgenus *DOLOCYTHERIDEA* Triebel, 1938
Type species: *Cytherina hilseana* Roemer, 1841

Dolocytheridea (Dolocytheridea) hilseana (Roemer, 1841)
(Pl. 15, Figs 7 and 11—12)

1841. *Cytherina hilseana* sp. nov.: Roemer, p. 104, Pl. 16, Fig. 17.
1971. *Dolocytheridea (Dolocytheridea) hilseana* (Roemer); Gründel, pp. 21—22, Text-fig. 1, Pl. 4, Figs 14—19 (*here synonymy*).

Material: Seven, well preserved, adult specimens.
Dimensions (in *mm*):

RV♀ ZPAL 0.XXI/109	L=0.96	H=0.58
RV♂ ZPAL 0.XXI/110	1.12	0.60

Occurrence. — Great Britain — Lower Hauterivian, East Yorkshire (Neale 1960); German Democratic Republic — Lower Hauterivian, West Mecklenburg (Gründel 1966); German Federal Republic — Upper Valanginian to Lower Hauterivian, Lower Saxony (Kemper *in* Kemper & *al.* 1978).

Central Poland (Wąwał, Dąbrówka): Upper Valanginian.

Genus *EURYITYCYTHERE* Oertli, 1958
Type species: *Euryitycythere subtilis* Bartenstein & Brand, 1959
Euryitycythere subtilis Bartenstein & Brand, 1959
(Pl. 15, Figs 15 and 18)

1959. *Euryitycythere subtilis* Bartenstein & Brand, n. sp.; Bartenstein, p. 228, Pl. 27, Fig. 4; Pl. 28, Figs 9—13; Pl. 31, Figs 5—6, 8.
1959a. *Euryitycythere subtilis* Bartenstein & Brand; Oertli, pp. 242—243, Text-fig. 1.

Material: Nine, well preserved, adult specimens.
Dimensions (in *mm*):

LVa ZPAL 0.XXI/111	L=0.48	H=0.31

Occurrence. — German Federal Republic — Lower and Upper Valanginian (Mittel-Valendis to Ober-Valendis), Lower Saxony (Bartenstein 1959, Oertli 1959a); Southern Spain — Upper Berriasian (Donze 1977).

Central Poland (Wąwał): Lower and Upper Valanginian.

Genus *ASCIOCYTHERE* Swain, 1952
Type species: *Bythocypris rotundus* Vanderpool, 1928
Asciocythere crassivalvis sp. n.
(Pl. 16, Figs 4—5 and 6a—b, 7—11 and 13)

1957. *Cytheridea (Haplocytheridea) kummi* Triebel; Sztejn, p. 255, Pl. 12, Fig. 106a-c.
Holotype: The specimen C♂ ZPAL 0. XXI/117; presented in Pl. 16, Fig. 10.
Type horizon: Upper Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: Latin *crassus* — thick, *valva* — valve; according to the strongly calcified valves.

Diagnosis: A strongly inaequivalve species; left valve is rounded, triangular while right valve is sub-hexagonal in lateral outline; both valves compressed dorso-centrally. Sexual dimorphism pronounced.

Material: Over three hundred, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

C♂ ZPAL 0.XXI/117	L=1.08	H=0.80	W=0.56
LV♀ ZPAL 0.XXI/113	0.96	0.76	—
LVj ZPAL 0.XXI/119	0.84	0.60	—

Description. — Male carapace elongate, compressed dorso-centrally, and peripherally along the anterior margins of the valves; in dorsal view moderately and flatly swollen. The larger left valve overlaps the right valve all round. Both valves differ in shape. The left valve is rounded, triangular in lateral outline with greatest height at the mid-length. Its anterior margin is asymmetrically rounded; posterior margin narrowly rounded; dorsal margin arched, curving down anteriorly

and posteriorly and continues almost without change in slope at cardinal angles; ventral margin broadly convex. The right valve is sub-hexagonal in lateral outline with prominent cardinal angles, and obtusely pointed posterior end situated below the valve mid-height. Valve surface smooth, with scattered large sieve-pores (Pl. 16, Fig. 6b). Marginal zone being crossed anteriorly by approximately 20, and posteriorly by 9—10, straight marginal pore-canals. Hinge of the antimerodont type: the right valve with 9—10 denticles anteriorly and posteriorly, and a very short median groove; the left valve with a broad accomodation groove. Muscle-scar pattern made of a vertical row of 4 scars and a heart-shaped scar in front of them.

Sexual dimorphism marked. Compared with the males, the females are smaller in size, and higher in proportion to length.

The juveniles differ markedly from the adults in general shape (Pl. 16, Fig. 5), and hinge-structure which in the left valve has much longer median bar (Pl. 16, Fig. 7).

Remarks. — The new species, *Asciocythere crassivalvis* sp. n., bears an external similarity to *Haplocytheridea kummi* (Triebel, 1938b), but can be easily distinguished by its arched dorsal margin, and the presence of a broad accomodation groove in the left valve.

Occurrence. — Central Poland (Wąwał, Wiaderno, Dąbrówka): Upper Valanginian.

Asciocythere sp.
(Pl. 16, Figs 1—3)

Material: Eleven, variously preserved, adult specimens.
Dimensions (in *mm*):

LVa ZPAL 0.XXI/120	L=0.72	H=0.48
RVa ZPAL 0.XXI/121	0.70	0.42

Remarks. — The investigated specimens compare well in general shape with those assigned to *Lycopterocypris? sabaudiae* by Donze (1964). The internal features of the latter species are unknown.

Occurrence. — Central Poland (Wąwał): Upper Berriasian.

Subfamily **Schulerideinae** Mandelstam, *sensu* Neale, 1982
Genus *APATOCYTHERE* Triebel, 1940
Subgenus *SCHULAPATOCYTHERE* Malz, 1970
Type species: *Schulapatocythere neagui* Malz, 1970
Apatocythere (Schulapatocythere) polonica sp. n.
(Pl. 16, Figs 12, 14a—b and 15; Pl. 17, Figs 1—4)

Holotype: The specimen C♀ ZPAL 0. XXI/122; presented in Pl. 16, Fig. 14a-b.
Type horizon: Upper Valanginian (*frankei* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: After its type occurrence in Poland.

Diagnosis: A blind species with elliptical lateral outline. Sexual dimorphism pronounced.
Material: Over forty, well preserved, adult specimens.
Dimensions (in *mm*):

C♀ ZPAL 0.XXI/122	L=0.62	H=0.40	W=0.32
RV♀ ZPAL 0.XXI/126	0.60	0.32	—
LV♂ ZPAL 0.XXI/128	0.76	0.44	—

Description. — Female carapace elliptical in lateral outline, truncated postero-dorsally; lenticlar in dorsal view; the left valve very slightly compressed postero-

-dorsally and postero-ventrally. The larger left valve overlaps the right valve all round. Anterior margin of both valves broadly rounded, posterior margin narrowly rounded. Dorsal margin of the left valve almost regularly arched, while of the right valve slopes down less steeply anterior of its highest point than posterior of it, being more truncated postero-dorsally. Ventral margin broadly convex, particularly so in the left valve. Valve surface smooth. Hinge in the right valve composed of a knob-like anterior tooth, and a smooth, straight median bar which passes posteriorly into an elongate and low terminal tooth (Pl. 16, Fig. 12). The latter tooth is very finely denticulate (*see* in Pl. 16, Fig. 15; complementary element in the left valve). The left valve with an accomodation groove.

Sexual dimorphism pronounced. Compared with the females, the males are slimmer and larger in size.

Remarks. — The new species, *Apatocythere (S.) polonica* sp. n., bears an external similarity to (stratigraphically higher) *Apatocythere ellipsoidea* Triebel (1940), but differs markedly in details of the hinge-structure, and in being truncated posteriorly.

Occurrence. — Central Poland (Wąwał, Wiaderno, Dąbrówka): Upper Valanginian.

Genus *SCHULERIDEA* Swartz & Swain, 1946
Subgenus *SCHULERIDEA* Swartz & Swain, 1946
Type species: *Schuleridea accuminata* Swartz & Swain, 1946
Schuleridea (Schuleridea) thoerenensis (Triebel, 1938)
(Pl. 17, Figs 5—8)

1938b. *Cytheridea (Haplocytheridea) thörenensis* n. sp.; Triebel, p. 482, Pl. 2, Figs 26—29.
1951. *Cytheridea (Haplocytheridea) thörenensis* Triebel; Bartenstein & Brand, p. 331, Pl. 16, Figs 61—62.
1957. *Cytheridea (Haplocytheridea) thörenesis* Triebel; Sztejn, pp. 256—257, Pl. 13, Fig. 109a-c.
1962. *Schuleridea thoerenensis* (Triebel); Neale, p. 441, Pl. 13, Figs 9—12.

Material: Over three hundred, well preserved, adult specimens.
Dimensions (in *mm*):

RV♀	ZPAL 0.XXI/130	L=0.60	H=0.39
LV♂	ZPAL 0.XXI/131	0.69	0.46

Occurrence. — German Federal Republic: Lower and Upper Valanginian (Mittel-Valendis to Ober-Valendis *2*), Lower Saxony (Triebel 1938b, Bartenstein & Brand 1951).

Central Poland (Wąwał, Wiaderno, Dąbrówka): Upper Valanginian to (?)Lower Hauterivian.

Schuleridea (Schuleridea) dabrowkaensis sp. n.
(Text-fig. 6 and Pl. 17, Figs 9—11 and 13a—b)

Holotype: The specimen C (?♀) ZPAL 0.XXI/133; presented in Pl. 17, Fig. 13a-b.
Type horizon: Upper Valanginian (*frankei* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: After the locality of Dąbrówka.

Diagnosis: Species with weakly pronounced eye-tubercle; valves elongate, triangular in lateral outline, in dorsal view, they are moderately and flatly swollen being widest medially. Sexual dimorphism indistinct.

Material: Over a hundred, well preserved, adult specimens.
Dimensions (in *mm*):

C(?♀) ZPAL 0.XXI/133 L=0.60 H=0.44 W=0.34

Description. — Carapace elongate, triangular in lateral outline, with greatest height anterior of the mid-length; in dorsal view it is moderately and flately swollen being widest medially. The larger left valve overlaps the right valve all round. Anterior margin of both valves broadly rounded; posterior margin slightly truncated dorsally, and with posterior end situated below the valve mid-height. Dorsal margin vaulted in the left valve, straight in the right valve; ventral margin somewhat convex in the left valve, while in the right valve with convex bulging of the median part. Eye-tubercle weakly pronounced. Valve surface very finely pitted. Hinge-structure and muscle-scar pattern as for the genus.

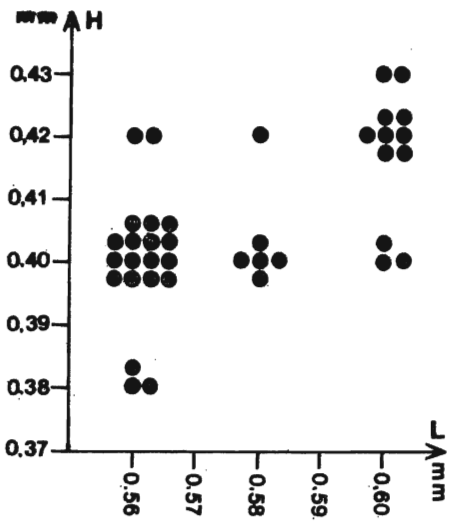


Fig. 6

Size dispersion diagram of the left valves for adult specimens of *Schuleridea (Schuleridea) dabrowkaensis* sp.n. (ZPAL 0.XXI/216—253)

Sexual dimorphism indistinct (*see* Text-fig. 6). The slightly higher specimens are regarded as the females while the lower ones as the males.

Remarks. — In lateral view, the specimens of *Schuleridea (S.) dabrowkaensis* sp. n. resemble small, female specimens of *Schuleridea (S.) neocamiana* sp. n., however, they differ from the latter in dorsal view, and in prominence of the eye-tubercle.

Occurrence. — Central Poland (Wąwał, Wiaderno, Dąbrówka): Upper Valanginian.

Schuleridea (Schuleridea) neocomiana sp. n.
(Text-fig. 7 and Pl. 17, Figs 12 and 14a—b, 15—20)

1951. *Cytheridea (Haplocytheridea)* cf. *thörenensis* Triebel; Bartenstein & Brand, p. 331, Pl. 14A, ?Fig. 36; Pl. 15D, Fig. 43; Pl. 16, Figs 63—65; Pl. 17A, Figs 22—23; Pl. 18, Figs 103—105, 108.

1957. *Cytheridea (Haplocytheridea) rara* Tried.; Sztejn, p. 256, Pl. 13, Fig. 108a-c.

Holotype: The specimen C♀ ZPAL 0. XXI/138; presented in Pl. 17, Fig. 14a-b.

Type horizon: Upper Valanginian (*aubersonensis* ostracode Zone).

Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.

Derivation of the name: After the Neocomian deposits.

Diagnosis: Species with distinct eye-tubercle, spindle-shaped in dorsal view. Sexual dimorphism pronounced.

Material: Over four hundred, well preserved, adult specimens.

Dimensions (in *mm*):

C♀ ZPAL 0.XXI/138 L=0.60 H=0.48 W=0.36

Description. — Female carapace oval, triangular in lateral outline, with greatest height posterior of the mid-length; spindle-shaped in dorsal view, greatest width just behind middle. The left and right valves differ in shape and size. The larger left valve overlaps the right valve all round. Anterior margin asymmetrically rounded in the left valve, while more symmetrically so in the right valve; posterior margin of the left valve narrowly rounded while posterior margin of the right valve truncated postero-dorsally, and with posterior end situated below the valve mid-height. Dorsal margin highly vaulted in the left valve, straight in the right valve; ventral margin sligtly convex. There is a prominent eye-tubercle, and a shallow postocular depression which is directed somewhat antero-ventrally, present in both valves. Valve surface finely pitted. Internal features as for the subgenus.

Sexual dimorphism distinct. Compared with the females, the males are lower in proportion to length, and larger in size.

Variability. — It is displayed in general shape of the valves, mainly as regards their length to height ratio (*cf.* Pl. 17, Figs 19 and 20), and in size (*see* Text-fig. 7).

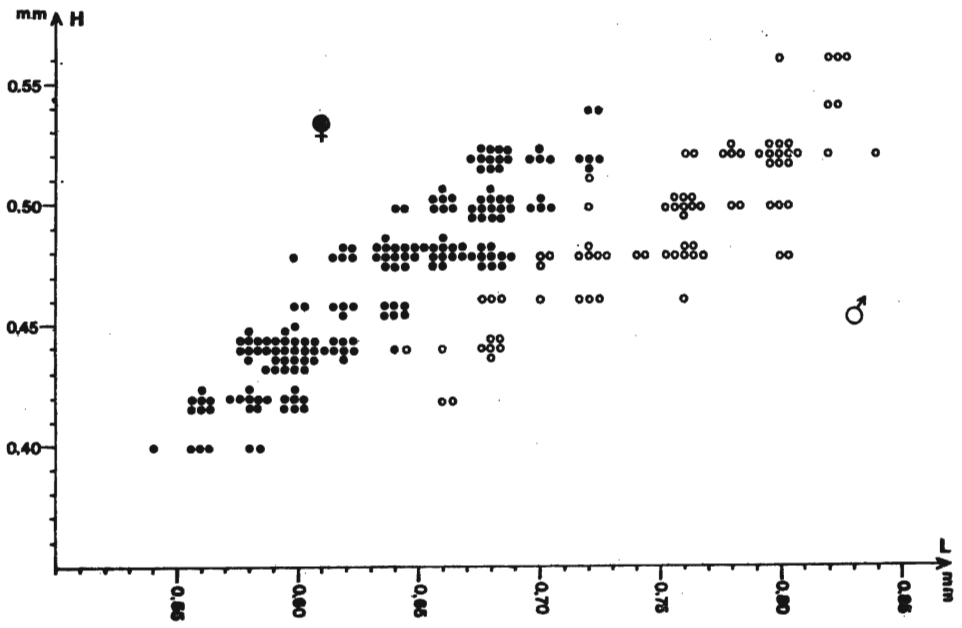


Fig. 7

Size dispersion diagram of the left valves for adult specimens of *Schuleridea (Schuleridea) neocomiana* sp.n. (ZPAL 0.XXI/260—566)

Remarks. — It seems that most of the specimens referred by Bartenstein & Brand (1951) to *Schuleridea* cf. *thoerenensis* are conspecific with those of *Schuleridea (S.) neocomiana* sp. n. However, the specimens of *S.* cf. *thoerenensis* originally figured are magnified only ×20, and therefore in some cases not particularly informative. The species *S. (S.) neocomiana* can be differentiated from *S. (S.) thoerenensis* (Triebel) by its less acuminate posterior margin.

Occurrence. — German Federal Republic: Lower and Upper Valanginian (Mittel-Valendis *2* to Ober-Valendis *3*), Lower Saxony (Bartenstein & Brand 1951).

Central Poland (Wąwał, Wiaderno, Dąbrówka): Upper Berriasian to Upper Valanginian.

Subfamily **Cuneocytherinae** Mandelstam, 1959
Genus *DICRORYGMA* Poag, 1962
Subgenus *DICRORYGMA* Poag, 1962
Type species: *Dicrorygma mullinsi* Poag, 1962

Dicrorygma (Dicrorygma) poagi sp. n.
(Pl. 18, Figs 1—2, 4—5)

Holotype: The specimen C♂ ZPAL O. XXI/151; presented in Pl. 18, Fig. 1.
Type horizon: Upper Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: In honour of the genus-creator W. C. Poag.

Diagnosis: Species with valves being compressed peripherally along anterior, ventral and posterior margins, and truncated postero-dorsally. Sexual dimorphism pronounced.

Material: Eighteen, well preserved, adult specimens.
Dimensions (in *mm*):

C♂ ZPAL O.XXI/151	L=0.45	H=0.28	W=0.18
RV♀ ZPAL O.XXI/150	0.38	0.25	—

Description. — Male carapace elongate-oval, compressed peripherally along the anterior, ventral and posterior margins; in dorsal view slim, spindle-shaped, widest posteriorly. The larger left valve overlaps the right valve all round; both valves similar in shape. Anterior margin broadly rounded; posterior margin bluntly rounded, and with posterior end situated below the valve mid-height; dorsal margin arched; ventral margin broadly convex. Valve surface smooth. Hinge-structure and muscle-scar pattern as for the subgenus (Pl. 18, Fig. 2).

Sexual dimorphism pronounced. Compared with the males, the females are higher in proportion to length, smaller in size, and more pointed posteriorly.

Remarks. — The new species, *Dicrorygma (D.) poagi* sp. n., differs from the related *D. (D.) minuta* (Kaye, 1963) in being laterally inflated in the dorsal half of the valves.

Occurrence. — Central Poland (Wąwał): Upper Valanginian.

Family **Cytheruridae** Müller, 1894
Genus *EUCYTHERURA* Müller, 1894
Type species: *Cythere complexa* Brady, 1867

Eucytherura nuda Kaye, 1964
(Pl. 20, Figs 1a—b and 2)

1964. *Eucytherura nuda* n. sp.; Kaye, p. 99, Pl. 4, Figs 13—15.
1978. *Eucytherura nuda* Kaye; Neale, p. 338, Pl. 3, Fig. 4.

Material: Six, well preserved, adult specimens.
Dimensions (in *mm*):

LVa ZPAL O.XXI/153	L=0.40	H=0.19
RVa ZPAL O.XXI/154	0.38	0.20

Occurrence. — Great Britain: late Hauterivian to Barremian, Yorkshire (Kaye 1964, Neale 1978).

Central Poland (Wąwał): Lower and Upper Valanginian.

Eucytherura sp.
(Pl. 20, Figs 3a—d and 4a—e)

Material: Two, well preserved, adult specimens.
Dimensions (in *mm*):

LVa ZPAL 0.XXI/155	L=0.37	H=0.21
RVa ZPAL 0.XXI/156	0.36	0.20

Remarks. — These specimens display a very interesting valve-surface ornamentation, coused by celation.

The term *celation* has been introduced by Sylvester-Bradley & Benson (1971, p. 281) and referred to "development of an outer, presumbly secondary, layer of calcite (the tegmen) which overlaps and obscures underlying ornament".

In the investigated specimens the tegmen is not fully developed. It is represented only by the tegminal covers and spots (Pl. 20, Figs 3b and 4c). The first being confined to the positive features of the valve relief such as tubercles and ridges, the latter being scarcely spaced on the lateral valve surface (*cf.* in Pl. 20: Figs 3a and 3d, 4a and 4e). The tegminal covers are foveolate (Pl. 20, Fig. 3c) while the tegminal spots are pitted (Pl. 20, Fig. 4c). The underlaying ornament is made of the papillate fossae. The muri of the fossae are formed of closely packed together papillae, their sola are covered with papillae and very fine reticulation (Pl. 20, Fig. 4d). Seemingly, the tegminal covers and spots are created by getting together papillae.

Occurrence. — Central Poland (Wąwał): Lower Valanginian.

Genus *HEMICYTHERURA* Elofson, 1941
Type species: *Cythere cellulosa* Norman, 1865
Hemicytherura ?moorei Neale, 1967
(Pl. 19, Figs 3—4)

(?) 1967. *Hemicytherura moorei* Neale, n. sp.; Neale, pp. 561—563, Pl. 9, Fig. 3; Pl. 10, Figs 1a-b, 2a-b.

Material: Five specimens, three of which are partly damaged.
Dimensions (in *mm*):

RV(?♂) ZPAL 0.XXI/157	L=0.28	H=0.18

Remarks. — The investigated specimens correspond fairly well only with the male specimens of *Hemicytherura moorei* Neale.

Occurrence. — Central Poland (Wąwał): Lower Valanginian.

The species *H. moorei* Neale is known from the type-Berriasian strata, France.

Genus *PARANOTACYTHERE* Bassiouni, 1974
Subgenus *PARANOTACYTHERE* Bassiouni, 1974
Type species: *Orthonotacythere diglypta* Triebel, 1941

Paranotacythere (Paranotacythere) polonica (Sztejn, 1957)
(Pl. 18, Figs 12—13)

1957. *Orthonotacythere polonica* n. sp.; Sztejn, pp. 258—259, Pl. 15, Fig. 113a-c.
1974. *Paranotacythere (Paranotacythere) polonica* (Sztejn); Bassiouni, p. 22, Pl. 3, Figs 6—7.

Material: Over two hundred, well preserved, adult specimens.
Dimensions (in *mm*):

LV♀ ZPAL 0.XXI/159	L=0.36	H=0.23
LV♂ ZPAL 0.XXI/160	0.33	0.19

Remarks. — See Bassiouni (1974).

Occurrence. — Central Poland (Wąwał, Wiaderno): Upper Berriasian to Upper Valanginian.

Paranotacythere (Paranotacythere) valanginiana reticulata (Bassiouni, 1974)
(Pl. 18, Figs 7a—b and 15)

1960. *Orthonotacythere diglypta* Triebel; Małecki, p. 113, Text-fig. 3, Pl. 18, Fig. 3a-c.
1974. *Paranotacythere (Paranotacythere) valanginiana reticulata* n. ssp.; Bassiouni, pp. 35—36, Pl. 6, Figs 18—22.

Material: Sixty, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

LV♀ ZPAL 0.XXI/161	L=0.46	H=0.30

Remarks. — The investigated specimens, previously attributed by Małecki (1960) to *O. diglypta* Triebel, do not differ from those described by Bassiouni (1974) as *P. (P.) valanginiana reticulata.* Comparison of *P. (P.) valanginiana reticulata* with the closely allied *P. (P.) diglypta diglypta* (Triebel) is made by Bassiouni (1974, p. 36).

Occurrence. — German Federal Republic: Upper Valanginian, Lower Saxony (Bassiouni 1974).

Central Poland (Wąwał, Wiaderno, Dąbrówka): Lower and Upper Valanginian.

Paranotacythere (Paranotacythere) soror sp. n.
(Pl. 18, Figs 8 and 10, 11 and 18)

Holotype: The specimen LV♀ ZPAL 0. XXI/166; presented in Pl. 18, Fig. 11.
Type horizon: Lower Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: Latin *soror* — sister; in reference to its similarity to *P. (P.) polonica* (Sztejn).

Diagnosis: Species with the shape of *Paranotacythere (P.) polonica* (Sztejn) but having strongly pitted valve surface, and prominent eye-tubercle. Sexual dimorphism pronounced.

Material: Twenty, well preserved, adult specimens.
Dimensions (in *mm*):

LV♀ ZPAL 0.XXI/166	L=0.36	H=0.23
RV♂ ZPAL 0.XXI/169	0.37	0.22

Descriptions. — Female left valve sub-rectangular in later outline, with a deep median-sulcus and a prominent eye-tubercle. It is slightly larger than the right valve, both are similar in shape. Anterior margin gently rounded with short marginal-spines; posterior margin drown out, forming compressed sub-dorsal process; dorsal margin straight; ventral margin broadly convex. Valve surface strongly pitted, *i.e.* covered with deep fossae, and with three riblets developed between the fossae. The ventral riblet runs subparallel to the ventral margin, and reaches the anterior margin at about one-third of the valve height; the other two riblets depart from a weak postero-dorsal tubercle, they run vertically. Internal features typical for the subgenus.

Sexual dimorphism pronounced. Compared with the females, the males are slimmer, and more swollen posteriorly in dorsal view.

Remarks. — The new species, *Paranotacythere (P.) soror* sp. n., can be distinguished from *P. (P.) polonica* (Sztejn) by its strongly pitted ornamentation and prominent eye-tubercle. The later species has punctated valve surface, and lacks the eye-tubercle.

Occurrence. — Central Poland (Wąwał, Wiaderno): Lower Valanginian.

Paranotacythere (Paranotacythere) sp.
(Pl. 18, Figs 14 and 16—17)

Material: Nine, well preserved, specimens.
Dimensions (in *mm*):

LV♂ ZPAL 0.XXI/165	L=0.44	H=0.26

Remarks. — The investigated specimens in their ridge-pattern resemble those of *P. (P.) diglypta diglypta* (Triebel, 1941), however, they differ in the course and shape of the ventral ridge.

Occurrence. — Central Poland (Wąwał, Wiaderno): Lower Valanginian.

Genus *STILLINA* Laurencich, 1957
Type species: *Stillina asterata* Laurencich, 1957

Stillina acuminata Neale, 1962
(Pl. 19, Figs 1—2)

1962. *Stillina acuminata* Neale, new species; Neale, p. 458, Pl. 9, Fig. 8.
Material: Sixty-two, well preserved, adult and juvenile specimens.
Dimensions (in *mm*):

LV♀ ZPAL 0.XXI/181	L=0.40	H=0.22
RV♂ ZPAL 0.XXI/182	0.45	0.20

Remarks. — In the material under study, the hitherto unknown male specimens are presented (Pl. 19, Fig. 2). Compared with the female specimens, they are lower in lateral view, and more swollen posteriorly as seen in dorsal view.

Occurrence. — Great Britain: Valanginian, Yorkshire (Neale 1962).
Central Poland (Wąwał, Wiaderno): Upper Berriasian to Upper Valanginian.

Genus *EOCYTHEROPTERINA* Gründel, 1977
Type species: *Cytheropteron? diversum* Herring, 1966

Eocytheropterina subtilis (Gründel, 1966)
(Pl. 19, Figs 5—6 and 11)

1966. *Metacytheropteron? subtilis* n. sp.; Gründel, p. 47, Pl. 8, Figs 38—39.
Material: Nine, well preserved, adult specimens.
Dimensions (in *mm*):

RV♀ ZPAL 0.XXI/171	L=0.30	H=0.20
LV♂ ZPAL 0.XXI/170	0.32	0.18

Remarks. — The species *Eocytheropterina subtilis* (Gründel) is closest to *E. gruendeli* sp.n., from which it can be separated on subtle but distinct differences in shape.

Occurrence. — German Democratic Republic: Hauterivian, West Mecklenburg (Gründel 1966).
Central Poland (Wąwał): Lower and Upper Valanginian.

Eocytheropterina gruendeli sp. n.
(Pl. 19, Figs 7—10 and 12—13)

Holotype: The specimen C♂ ZPAL 0. XXI/175; presented in Pl. 19, Fig. 10.
Type horizon: Lower Valanginian (*aubersonensis* ostracode Zone).
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: In honour of the genus-creator J. Gründel.

Diagnosis: Species having wide and long caudal-process situated centrally; valve surface covered with longitudinal ribles interspaces of which are smooth or pitted. Sexual dimorphism pronounced.

Material: Fourty-eight, well preserved, adult specimens.
Dimensions (in *mm*):

RV♀ ZPAL 0.XXI/174	0.32	0.19	—
C♂ ZPAL 0.XXI/175	L=0.35	H=0.19	W=0.10

Description. — Male carapace elongate, sub-rectangular in lateral outline, valves with slight ventro-lateral swellings; very slim and fusiform in dorsal view. The right valve overlaps the left valve along the dorsal margin. Both valves are compressed peripherally along the anterior and ventral margins. Anterior margin obligue in its upper part, acutely rounded in its ventral half; posterior margin produced into wide and long caudal-process, and with posterior end situated centrally; dorsal margin arched, ventral margin almost straight. Valve surface covered with longitudinal riblets, the interspaces of which are smooth or pitted. The riblets converge towards anterior and posterior ends of the valve, some of them reache the anterior margin. Hinge of the lophodonte type, inner lamella vide (Pl. 19, Fig. 13). Muscle scar not seen.

Sexual dimorphism pronounced. Compared with the males, the females are higher in proportion to length.

Remarks. — The new species, *Eocytheropterina grundeli* sp. n., differs from *E. subtlis* (Gründel) in having wide and long caudal-process, in being more elongate, and in ornamentation (the valve-surface is smooth out in the former species, while covered with small, rounded fossae in the latter species).

Occurrence. — Central Poland (Wąwał, Wiaderno): Lower and Upper Valanginian.

Genus *EOCYTHEROPTERON* Alexander, 1933
Type species: *Cytheropteron bilobatum* Alexander, 1929

Eocytheropteron sp.
(Pl. 19, Figs 14a—b and 15)

Material: Two, fairly well preserved, adult specimens.
Dimensions (in *mm*):

LVa ZPAL 0.XXI/179	L=0.47	H=0.36	W=0.33

Remarks. — The only comparable specimen is that described as "*Cytheropterina* aff. *C. triebeli* Neale" from the type-Berriasian strata by Neale (1967, Pl. 10, Fig. 5a-b). The external comparison is fairy close, but they can differ in hinge-structure and other internal features.

Occurrence. — Central Poland (Wąwał): Upper Berriasian.

OSTRACODE BIOSTRATIGRAPHY

The ostracode biostratigraphic zones established hereafter, have been designated on the basis of both the personal investigations (Text-figs 2—4 and 8—9, Tables 1—3), and on the reference data *(taken from* Neale 1978, Raczyńska 1979, Bielecka & Styk 1980).

Within the Upper Kimmeridgian, Lower and low-Middle Volgian four ostracode zones (Table 4) have been distinguished: *G. monstrata, G. oertlii, G. barcinensis,* and *G. punctilataeformis.* The Neocomian

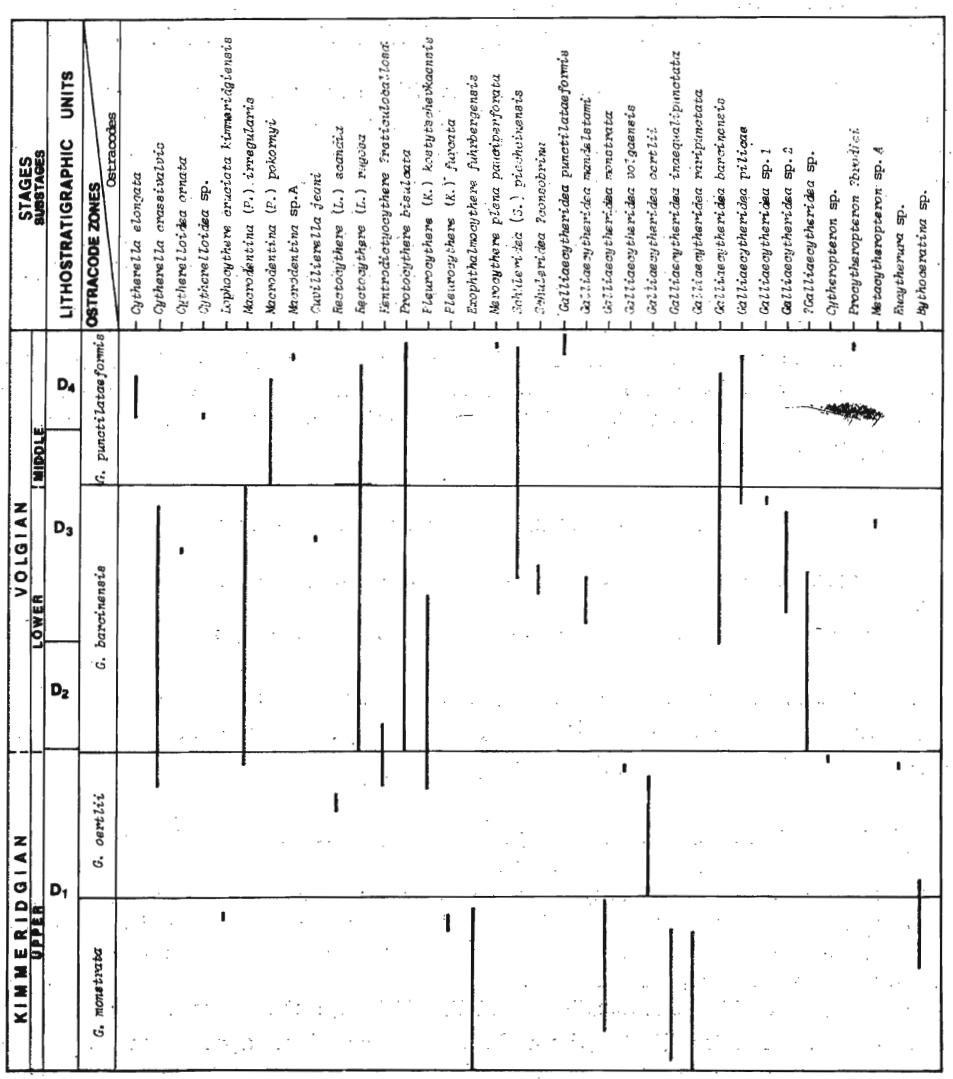


Fig. 8
Stratigraphic ranges of the ostracodes occurring in the Upper Kimmeridgian and Volgian deposits of the Barcin-Piechcin area
Stratigraphy *after* Wierzbowski & *al* (1978, 1980, 1982)

strata (uppermost Berriasian, Valanginian and Lower Hauterivian) are attributed to the other two ostracode zones, viz. *P. aubersonensis*, and *M. frankei*.

GALLIAECYTHERIDEA MONSTRATA ASSEMBLAGE-ZONE

LOCALITY: Barcin-Piechcin area, boreholes *M-20, M-27a, J-66, M-66, R-20, M-42, R-42* (Text-fig. 1A-C).

LITHOLOGY: Lower part of the member D_1 in the Barcin-Piechcin area.

DEFINITION: Strata with *Galliaecytheridea monstrata* (Lyubimova), *G. inaequalipunctata* Bielecka & *al.*, and *G. raripunctata* Bielecka & *al.*

CHARACTERISTICS: The ostracode assemblage is characterized by the common occurrence of the index-species *Galliaecytheridea monstrata* (Lyubimova), *G. inaequalipunctata* Bielecka & *al.*, and *G. raripunctata* Bielecka & al. Moreover, *Lophocythere cruciata kimmeridgiensis* Guyader, *Pleurocythere (Klentnicella) furcata* (Bielecka & Styk), and *Bythoceratina* sp. occur in small numbers.

AGE: The taxa typical of the *monstrata* Zone have been recorded from the uppermost Oxfordian, Lower and Upper Kimmeridgian deposits pierced by numerous boreholes in Poland. The index species has commonly been reported from the Upper Kimmeridgian strata.

The ammonites of the genera *Aulacostephanus, Sutneria, Aspidoceras, Glochioceras* and *Amoeboceras (Nannocardioceras)*, diagnostic for the Upper Kimmeridgian (Matyja & Wierzbowski 1981; Wierzbowski & *al.* 1978, 1980, 1982) define this very age of the *mostrata* Zone.

GALLIAECYTHERIDEA OERTLII INTERVAL-ZONE

LOCALITY: Barcin-Piechcin area, boreholes *M-27a, M-66, R-20, R-42, R-27a* (Text-fig. 1A-C).

LITHOLOGY: Upper part of the member D_1 in the Barcin-Piechcin area.

DEFINITION: Interval from the first occurrence of the zonal marker *Galliaecytheridea oertli* Christensen & Kilenyi to the first appearance of *Protocythere bisulcata* (Sharapova).

CHARACTERISTICS: The index-species *Galliaecytheridea oertlii* Christensen & Kilenyi is the only one which appears at the base of the zone. The species *Cytherella crassivalvis* Pokorný, *Macrodentina (Polydentina) irregularis* Pokorný, *Rectocythere (Lydicythere) scandia* Christensen & Kilenyi, *Kentrodictyocythere? reticulocallosa* Pokorný, and *Galliaecytheridea volgaensis* (Lyubimova) occur in the middle and upper parts of this zone. The transit species are: *C. crassivalvis, M. (P.) irregularis, K. ?reticulocallosa*, and *P. (K.) kostytschevkaensis*.

AGE: The species *Protocythere bisulcata*, the final appearance of which defines the upper boundary of the *oertlii* Zone, has been recorded in Poland just at the base of the Volgian (Bielecka & Styk 1980). Consequently, an Upper Kimmeridgian age of the *oertlii* Zone is postulated. The Upper boundary of this Zone may presumably coincide with the Kimmeridgian/Volgian boundary *(see* Matyja & Wierzbowski 1981).

GALLIAECYTHERIDEA BARCINENSIS INTERVAL-ZONE

LOCALITIES: Brzostówka; Barcin-Piechcin area, boreholes *M-66, R-20, R-42, R-27a, T-20, T-42* (Text-fig. 1*A-C*).

LITHOLOGY. Horizon *I* at Brzostówka; members D_2 and D_3 in the Barcin-Piechcin area.

DEFINITION: Interval from the first appearance of *Protocythere bisulcata* (Sharapova) to the first occurrence of *Macrodentina (Polydentina) pokornyi* sp. n.

CHARACTERISTICS: In addition to *Protocythere bisulcata (Sharapova)*, the species *Rectocythere (Lydicythere) rugosa* Malz and *?Galliaecytheridea* sp. appear at the base of the zone. Higher up there appear: *Schuleridea (Schuleridea) piechcinensis* sp. n., the index-species *Galliaecytheridea barcinensis* sp. n., *G. mandelstami* (Lyubimova), *G. pilicae* sp. n., *Galliaecytheridea* sp. *2* and *Metacytheropteron* sp. *A*; besides, *Cytherelloidea ornata* (Lyubimova), *Cuvillierella jeani* Pokorný, *Schuleridea (Schuleridea) ?consobrina* Pokorný, and *Galliaecytheridea* sp. *1* occur sporadically. The transit species are: *P. bisulcata, R. (L.) rugosa, S. (S.) piechcinensis, G. barcinensis, G. pilicae,* and *Metacytheropteron* sp. *A;* the species typical of the *oertlii* Zone, *C. crassivalvis, M. (P.) irregularis, P. (K.) kostytschevkaensis,* and *K. ?reticulocallosa* terminate within this zone.

AGE: The species *P. bisulcata* and *C. ornata* have been recorded from the Lower and Middle Volgian deposits pierced in numerous boreholes in Poland. The ammonites *(see* Kutek & Zeiss 1974, Matyja & Wierzbowski 1981) define the Lower to low-Middle Volgian age of the *barcinensis* Zone.

GALLIAECYTHERIDEA PUNCTILATAEFORMIS ASSEMBLAGE-ZONE

LOCALITIES: Brzostówka; Barcin-Piechcin area, boreholes *T-27a, T-42, T-20, R-27a, M-66* (Text-fig. 1*A-C*)

LITHOLOGY: Horizons *II, III,* and *IV* at Brzostówka; members D_3 and D_4 in the Barcin-Piechcin area.

DEFINITION: Strata with *Galliaecytheridea punctilataeformis* (Lyubimova), *G. pilicae* sp. n., *Macrodentina (Polydentina) pokornyi* sp. n., and *Cytherella elongata* Donze.

CHARACTERISTICS: The species *Macrodentina (Polydentina) pokornyi* sp. n. appears at the base of the zone; slightly higher *Cytherella elongata* Donze makes its appearance as well as the index-species *Galliaecytheridea punctilataeformis* (Lyubimova), and *Merocythere plena pauciperforata* Donze. The species *Macrodentina (Polydentina) volgiana* Kubiatowicz, *Macrodentina* sp. *A, Procytheropteron ?brodiei* (Jones) and *Paranotacythere (Unicosta) rimosa* (Martin) occur in the upper part of this zone. They are accompanied with *P. bisulcata, R. (L.) rugosa, S. (S.) piechcinensis,* and *G. pilicae* known from the *barcinensis Zone.*

AGE: The index-species has been reported from the Middle Volgian deposits pierced by numerous boreholes in the Polish Lowland (Bielecka & Styk 1964, Bielecka 1971, Dembowska 1973), and this very age is postulated for the *punctilataeformis* Zone.

ZONES STRADDLING THE JURASSIC/CRETACEOUS BOUNDARY

In Poland, outside the Carpathians, above the ammonite *scythicus* and/or *virgatus* Zone *(see* Kutek & *al* 1973), there appear the Purbeck and Wealdian facies. They both contain ostracodes which were used as stratigraphic key by Bielecka & Sztejn (1966) who distinguished the six ostracode zones (*F* at the bottom,

through *A* at the top; *see* Table 4). It is commonly believed (Marek & *al.* 1969, Dembowska & Marek 1976, Zeiss 1977, Marek & Raczyńska 1979) that the Jurassic/Cretaceous boundary, identical with that of the Volgian and Ryazanian

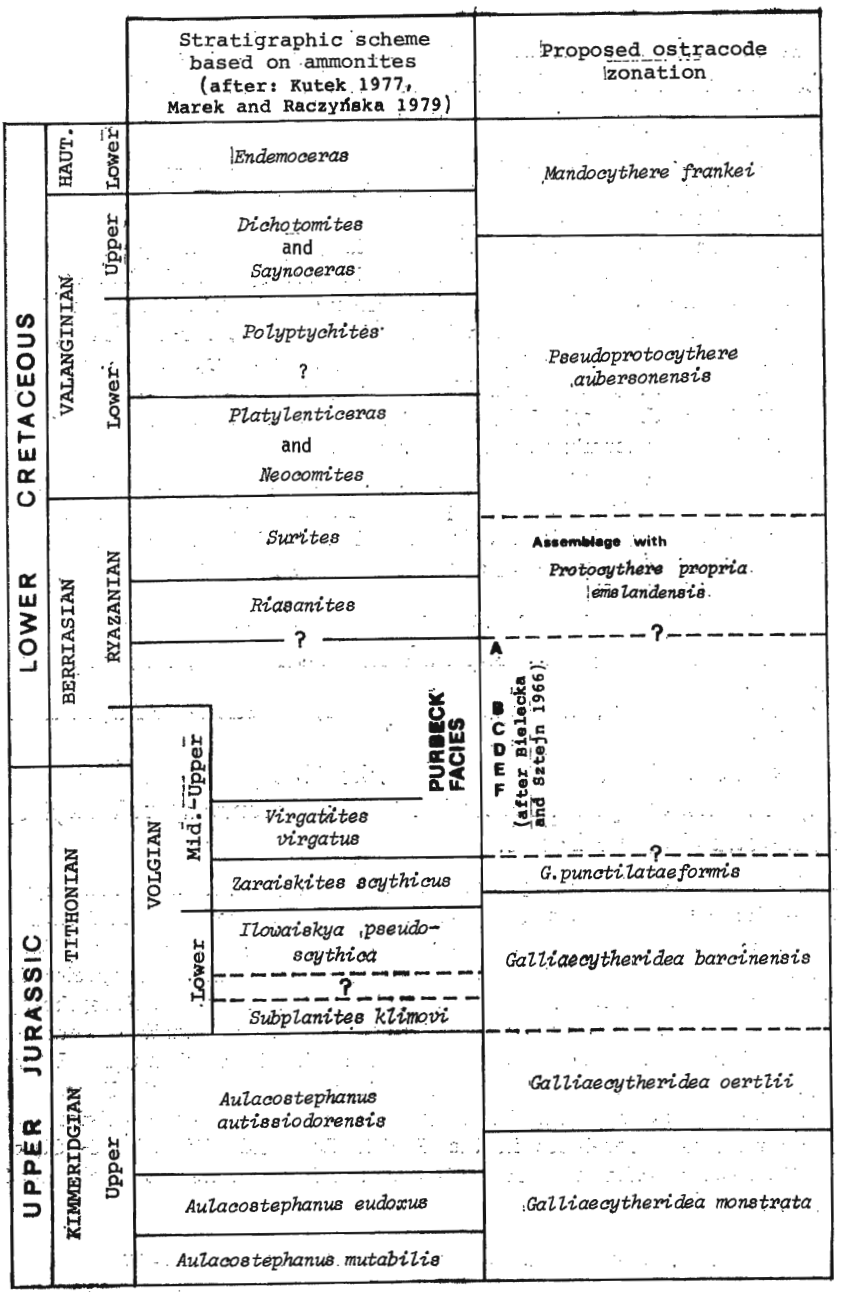


Table 4

Correlation of the proposed ostracode zones with the ammonite subdivisions of the Upper Kimmerdgian, Lower and Middle Volgian, and the Neocomian

stages, runs between the ostracode zones *A* and *B*, whilst the Tithonian/Berriasian boundary is disccussed to be placed at various lavels, all of which situated, however, beneath the zone *B*.

The deposits attributed to the zone *A* are overlain by marine deposits with ammonites (Marek & Raczyńska 1973b) and ostracodes (Sztejn 1967b, 1968, 1969) indicative of Upper Berriasian age. Of these ostracodes, a special attention would be paid to *Protocythere propria emslandensis* Bartenstein & Burri *(sensu* Sztejn 1967b) which is determined in the present paper as *"Protocythere* sp. *A* of Donze, 1975". This ostracode is regarded as a stratigraphic key within the Upper Berriasian deposits of the Polish Lowland (Sztejn *in* Marek & Raczyńska 1973a). The deposits containing *P. propria emslandensis* are to be distinguished by Dr. J. Sztejn *(personal information)* as a separate ostracode zone, which in the present paper *(see* Table 4) is tentatively called "the assemblage with *P. propria emslandensis*".

At Wąwał, the deposits featured by "the assemblage with *P. propria emslandensis*" are overlain by those of the hereafter distinguished new ostracode zone *(Pseudoprotocythere aubersonensis).*

PSEUDOPROTOCYTHERE AUBERSONENSIS INTERVAL-ZONE

LOCALITY: Wąwał, Wiaderno and Dabrówka (Text-fig. 1A-D).
LITHOLOGY: Beds 1—5 at Wąwał.

DEFINITION: Interval from the first appearance of the zonal marker *Pseudoprotocythere aubersonensis* Oertli to the first occurrence of *Mandocythere (Costacythere) frankei* (Triebel) accompanied with *Schuleridea (Schuleridea) thoerenensis* (Triebel) and *Apatocythere Schulapatocythere) polonica* sp. n.

CHARARCTERISTICS: In the investigated sections, the *aubersonensis* Zone is bipartite. Its lower part is featured by the occurrence of definite forms of the species: *Protocythere helvetica* Oertli, *P. lewinskii* Kubiatowicz, *Parexophthalmocythere hispida* (Małecki) and the index-species *Pseudoprotocythere aubersonensis* Oertli; associated are: *Neocythere (Physocythere) tumida* sp. n., *Acrocythere aspera* Donze, *Hekistocythere tenuis* (Donze), *Protocythere tomaszowiensis* Sztejn, *P. vonvalensis* Kubiatowicz, *P. sztejnae* sp. n., *P. wiadernoensis* sp. n., *Exophthalmocythere insignis* Donze, *Triebelocythere oertlii* sp. n., and *Paranotacythere (Paranotacythere) soror* sp. n.

The upper part of this zone yields: *Dolocythere (Dolocythere) hilseana* (Roemer), *Asciocythere crassivalvis* sp. n., and *Dicrorygma (Dicrorygma) poagi* sp. n., whilst the uppermost part displays the first appearance of *Mandocythere (Costacythere) frankei.* The index-species *P. aubersonensis,* as well as *P. helvetica, P. lewinskii,* and *P. hispida* are represented by their new forms.

Such species as *Cytherella pilicae* sp. n., *Paracypris elegans* sp. n., *Dolocythere dimorphica* sp.n., *D. punctata* sp. n., *D. ?longa* Gründel, *Stravia crossata* Neale, *Clithrocytheridea vonvalensis* (Sztejn), *Schuleridea (Schuleridea) neocomiana* sp. n., *Aaleniella* sp., *Paranotacythere (Paranotacythere) polonica* (Sztejn), and *P. (P). valanginiana reticulata* Bassiouni range through the whole *aubersonensis* Zone, and some of them enter the *frankei* Zone.

The species *(see* Text-fig. 9) such as P. *helvetica, P. vonvaleensis, P. lewinskii, P. aubrsonensis,* and *P. hispida* display an almost simultaneous change in ornamentation. They also display the same trend of changes, resulting in the passage of the reticulate or coarsely-pitted valve ornamentation into finely-pitted or

smooth one. The ribbed species apart from variation in coarseness of pitting exhibit also some variation in the pronounce of the ribs. Generally, the median rib of these species is short in their pitted forms, whilst it becomes longer and more distinctly pronounced in their finely pitted forms. These changes appear in the lower part of the Bed 5 which points to the deeping of the basin. Consequently, the discussed changes in ornamentation are postulated to be of an ecophenotypic character. This also suggests that the bipartity of the *aubersonensis* Zone was controlled by the environmental conditions; it bears a local correlation value (e.g. Wiaderno and Dąbrówka boreholes), but it should not be taken as a universal biostratigraphic event.

AGE: The ammonites indicate that the *aubersonensis* Zone, in its lower part, is attributable to the uppermost Berriasian and Lower Valanginian, whilst its upper part points to the Upper Valanginian (ammonite assemblage with *S. verrucosum).*

PALEOGEOGRAPHICAL REMARKS: In the Upper Berriasian and in Valanginian, the ostracode faunas of Europe were much differentiated being dependent upon the the biogeographical conditions of the Boreal and Tethyan Realms.

The Tethyan ostracodes are known from western Spain, south-eastern France and the Jura Mts (Oertli 1966; Neale 1967; Donze 1971, 1973b, 1975a, 1976, 1977). The Boreal ostracodes have been recognized within the North Sea Basin (Neale 1962, 1977; Christensen 1974). The ostracode faunas of southern Europe differ from those typical of northern Europe by an early occurrence (Upper Berriasian) of some genera which appear, *e.g.* in Great Britain, in the Hauterivian. The genera of such very type are represented for instance by *Cytherelloidea, Acrocythere, Exophthalmocythere, Parexophthalmocythere, Cythereis, and Cytherella.* At that time, the mid-European countries were the areas of diachronous migration of the Tethyan ostracodes to the north *(see* Neale 1967, 1973; Donze 1973a, 1975b). Of these ostracodes, the genus *Cytherelloidea* is of a special importance..

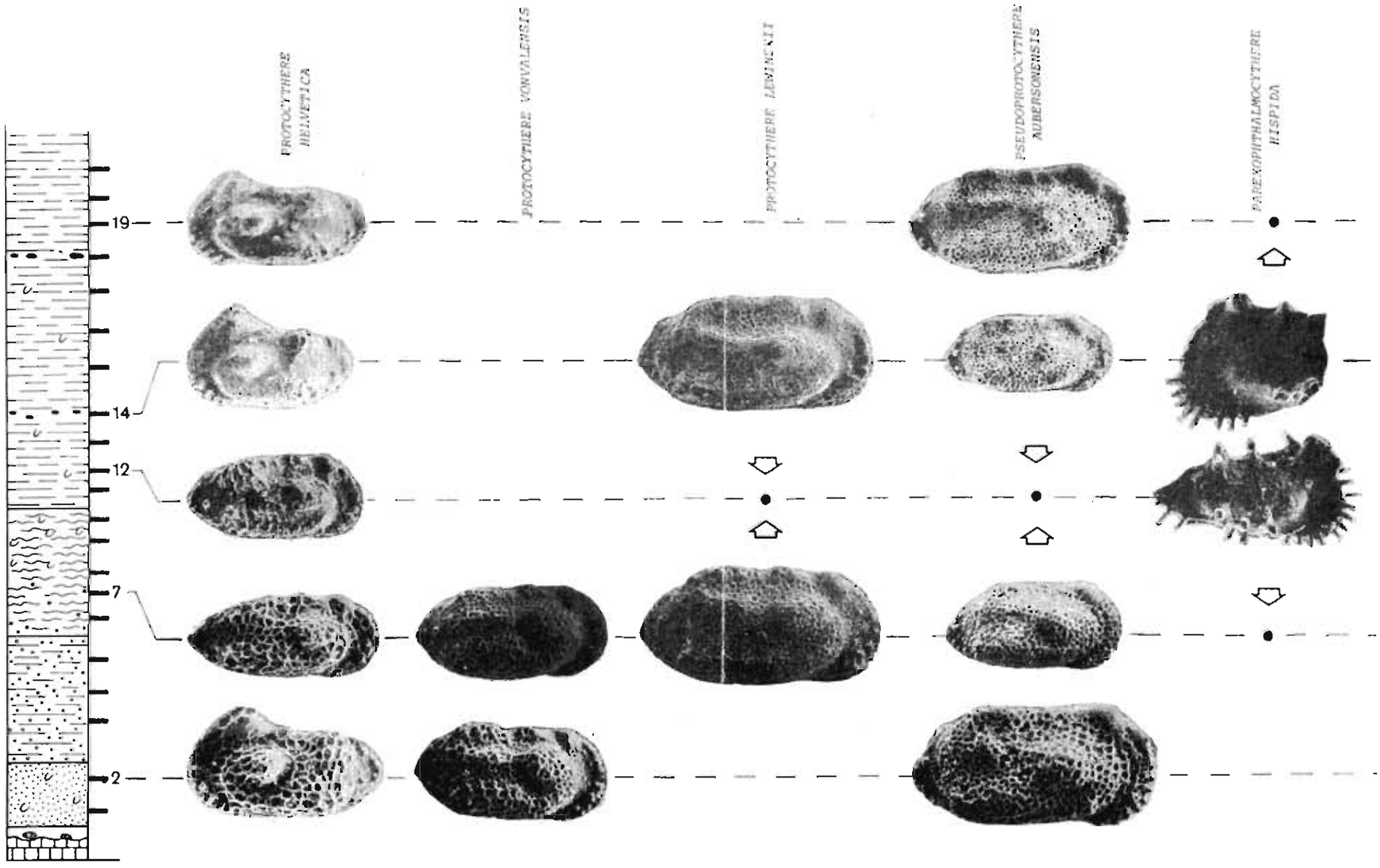
Shon (1962), when studing the Recent and fossil materials of *Cytherelloidea,* concluded an essentially thermophilic nature of the genus, and its good paleotemperature significance. According to Neale (1967, 1973), the representatives of this genus are well known in the Berriasian of the Tethys, whilst they are unknown in the Boreal Realm; they appear at the top of the Berriasian stage in Portugal and Spain, in lowest Valanginian of Poland, in the Valanginian of G.D.R. and G.F.R., but they make their first appearance in Great Britain in the Hauterivian. Neale (1967, 1973) suggested that the differences between the Tethyan and Boreal faunas may be explained in terms of paleotemperature (warming of the sea water) rather than of geographical isolation.

The ostracodes of the *aubersonensis* Zone make up a rich and taxonomically differentiated assemblage *(see* Text-fig. 4) which displays some connections with the ostracode fauna of the Tethyan Realm, as indicated by the presence of such species as: *Acrocythere aspera, Hekistocythere tenuis, Protocythere helvetica, Pseudoprotocythere aubersonensis,* and *Exophthalmocythere insignis,* as well as of the representatives of the genera *Cytherelloidea, Parexophthalmocythere.*

MANDOCYTHERE FRANKEI ZONE

The *frankei* Zone has been established within the Lower Hauterivian strata of Great Britain (Neale 1978). It bears the ostracode species *Mandocythere frankei (Triebel), Protocythere hechti* Triebel, *P. triplicata*

Occurrence of some ostracode species in the Neocomian sequence exposed at Wąwał near Tomaszów Mazowiecki (*cf.* Text-fig. 4)



SAMPLE 2: reticulate form of *P. helvetica* (*see* Pl. 13, Fig. 1), coarsely pitted form of *P. vonvalensis* (*see* Pl. 12, Fig. 16), coarsely pitted form of *P. aubersonensis* (*see* Pl. 12, Fig. 11); SAMPLE 7: reticulate form of *P. helvetica* (*see* Pl. 13, Fig. 2), finely pitted form of *P. vonvalensis* (*see* Pl. 12, Fig. 17) as well as its coarsely pitted form, forma lewinskii of *P. lewinskii* (*see* Pl. 12, Fig. 9), coarsely pitted form of *P. aubersonensis* (*see* Pl. 12, Fig. 4), pitted form of *P. hispida;* SAMPLE 12: bireticulate form of *P. helvetica* (*see* Pl. 13, Fig. 3), both forma lewinskii and forma bireticulata of *P. lewinskii,* both the coarsely-pitted and finely-pitted forms of *P. aubersonensis,* pitted form of *P. hispida* (*see* Pl. 14, Fig. 9); SAMPLE 14: smooth form of *P. helvetica* (*see* Pl. 13, Fig. 5), forma bireticulata of *P. lewinskii* (*see* Pl. 12, Fig. 10), finely pitted form of *P. aubersonensis* (*see* Pl. 12, Fig. 6), smooth form of *P. hispida* (*see* Pl. 14, Fig. 5); SAMPLE 19: smooth form of P. *helvetica* (*see* Pl. 13, Fig. 7), finely pitted form of *P. aubersonensis* (*see* Pl. 12, Fig. 12), smooth form of *P. hispida*

(Roemer), *Schuleridea lamplughi* Neale, *Haplocytheridea kummi* Triebel, *Rehacythereis sencenbergi* (Triebel), *Cytherella exquisita* Neale, *Euryitycythere parisiorum* Oertli, and *Parexophthalmocythere rodenwaldensis* Bartenstein & Brand.

In the sections under study (Text-fig. 4, Table 3), this zone is characterized by the occurrence of the index-species *Mandocythere (Costacythere) frankei* (Triebel), *Schuleridea (Schuleridea) thoerenensis* (Triebel), *S. (S.) dobrowkaensis* sp. n., *Apatocythere (Schulapatocythere) polonica* sp.n., and *Protocythere hechti* Triebel. The assocciated species *Haplocytheridea* sp., *?Pontocyprella* sp., *Dolocythere ?longa* Gründel, *Stravia crossata* Neale, *Clithrocytheridea vonvalensis* (Sztejn), *Schuleridea (Schuleridea) neocomiana* sp.n., *Aaleniella* sp., *Eucytherura nuda* Kaye, *Paranotacythere (Paranotacythere) polonica (Sztejn), P. (P.) valanginiana reticulata* Bassiouni, and *Stillina acuminata* occur sporadically

The ammonites of the genus *Dichotomites,* contained in these strata, indicate the Upper Valanginian age of the *frankei* Zone.

A similar assemblage of ostracodes is known from the Upper Valanginian and Lower Hauterivian deposits of the Polish Lowland *(see* Raczyńska 1979, Tables 3 and 5); the Upper Valanginian strata contain *Cytherella* sp., *Cytherella ovata* (Roemer), *Schuleridea thoerenensis* (Triebel), *Dolocytheridea* sp., *Cytherella* (Roemer), *Haplocytheridea kummi* Triebel, *Mandocythere frankei frankei* (Triebel), *Protocythere* aff. *hechti* Triebel, *P. triplicata* (Roemer), and *Schuleridea* aff. *lamplughi* Neale. The majority of these species, together with *Mandocythere (Costacythere) frankei* pass on to the Lower Hauterivian sequence, where also appear *Euryitycythere parisiorum* Oertli and *Paranotacythere anglica* (Neale).

Within the section exposed at Speeton in England, where the *frankei* Zone has been established (Neale 1978), there evidently occurs a stratigraphic gap. The Lower Hauterivian strata rest here directly on the Valanginian deposits which do not represent the topmost parts of this stage (Neale 1962, 1978); missing are the deposits corresponding to the *Dichotomites*-bearing beds, and thus being an equivalent to the lower part of the *frankei* Zone in Poland.

In south-eastern France (*see* Donze 1976), similarly as in Poland, the species *Mandocythere (C.) frankei* appears in the Upper Valanginian, slightly above the ammonite *verrucosum* Zone.

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PLATE 1

1—2 *Cytherelloidea ornata* (Lyubimova); 1 — LV♀ (ZPAL 0.XXII/6, R—42/47.0 m) in lateral view, x50, Barcin-Piechcin, Lower Volgian; 2 — RV♀ (ZPAL 0.XXII/7, B 3) in posterior view, x57, Brzostówka, Middle Volgian; **3, 4, 5** and **6** — *Cytherella crassivalvis* Pokorný; 3 — C♀ (ZPAL 0.XXII/55.0 m) in right lateral view, 4 — LV♂ (ZPAL 0.XXII/4, R-42/55.0 m) in lateral view, 5 — LV♀ (ZPAL 0.XXII/3, T-42/187.0 m) and 6 — LV♂ (ZPAL 0.XXII/5, R-42/55.0 m) in dorsal views, all x50, Barcin-Piechcin, Lower Volgian; **7** — *Cytherella elongata* Donze, RV♀ (ZPAL 0.XXII/1, T-42/141.5 m) in lateral view, x50, Barcin-Piechcin, Middle Volgian; **9** and **12** — *Cytherelloidea* sp.; 9 — C♀ (ZPAL 0.XXII/8, T-20/164.0 m) in left lateral view, 12 — RV♀ (ZPAL 0.XXII/9, T-20/164.0 m) in lateral view, all x50, Barcin-Piechcin, Middle Volgian; **8, 10, 13, 15** and **16** — *Schuleridea (Schuleridea) piechcinensis* sp.n.; 8 — RV♀ (ZPAL 0.XXII/50A, T-42/166.3 m) in lateral view, x50, Barcin-Piechcin, Middle Volgian; 10 — LV♀ (ZPAL 0.XXII/50, B 8) in lateral view, 13 — C♀ (ZPAL 0.XXII/49, B 6) in dorsal view, 15 — C♂(holotype, ZPAL 0.XXII/51, B 6): a — left lateral view, b— dorsal view, 16 — LV♂ (ZPAL 0.XXII/52, B 9) in lateral view, all x50, Brzostówka, Middle Volgian; **11** and **14** — *Schuleridea (Schuleridea) ?consobrina* Pokorný; 11 — RV♀ (ZPAL 0.XXII/53, R-42/55.0 m) and 14 — RV♂ (ZPAL 0.XXII/54, T-42/187.0 m, partly damaged) in lateral views, x60, Barcin-Piechcin, Lower Volgian, **17** — *Merocythere plena pauciperforata* Donze, RV♀ (ZPAL 0.XXII/48, B 9) in lateral view, x 50, Brzostówka, Middle Volgian

PLATE 2

1 — *Macrodentina* sp. *A* of Kubiatowicz (1977), RV♀ (ZPAL 0.XXII/23, T-27a/161,0 m) in lateral view, x40, Barcin-Piechcin, Middle Volgian; **2** — *Macrodentina (Polydentina) volgiana* Kubiatowicz, C♂ (ZPAL 0.XXII/15, B 9) in right lateral view, x40, Brzostówka, Middle Volgian; **3** and **6** — *Macrodentina (Polydentina) irregularis* Pokorný; 3 — RV♂ (ZPAL 0.XXII/13, R-42/97.5 m) internal view, showing anterior part of the hinge structure, x100, 6 — LV♀ (ZPAL 0.XXII/12, R-42/97,5 m) in lateral view, x50, Barcin-Piechcin, Upper Kimmeridgian; **4—5** and **7—12** — *Macrodentina (Polydentina) pokornyi* sp.n.; 4 — RV♀ of pitted form (ZPAL 0.XXII/20, T-20/167.0 m) in lateral view, x40, Barcin-Piechcin, Middle Volgian; 5 — C♂ of the reticulate form (ZPAL 0.XXII/21, B. 5) in dorsal view, x40, Brzostówka, Middle Volgian; 7 — LV♀ of the pitted form (ZPAL 0.XXII/16, T-42/166.3 m) in internal view, showing the hinge structure, x80, Barcin-Piechcin, Middle Volgian; 8 — C♂ of the reticulate form (ZPAL 0.XXII/14, B 5) in right lateral view, x45, 9 — C♂ of the reticulate form (holotype, ZPAL 0.XXII/22, B 5) in left lateral view, Brzostówka, Middle Volgian; 10 — LV♀ of the pitted form (ZPAL 0.XXII/17, T-20/167.0 m) and 11 — LV♀ the pitted form (ZPAL 0.XXII/19, T-20/167.0 m) in lateral views, x65, Barcin-Piechcin, Middle Volgian; 12 — LV♀ of the reticulate form (ZPAL 0.XXII/18, B 5) in lateral view, x65, Brzostówka, Middle Volgian

PLATE 3

1—6 *Galliaecytheridea oertlii* Christensen & Kilenyi; 1 — LV♀ (ZPAL 0.XXII/87, R-42/146.0 m) in lateral view, 2 — C♀ (ZPAL 0.XXII/85 R-42/145.0 m) in right lateral view, 3 — LV♀ (ZPAL 0.XXII/88, R-42/128.0 m) and 4 — LV♂ (ZPAL 0.XXII/90, R-42/128.0 m) in lateral views, 5 — C♀ (ZPAL 0.XXII/86, R-20/126.5 m) and 6 — C♂ (ZPAL 0.XXII/89, R42/128.0 m) in dorsal views, all x50, Barcin-Piechcin, Upper Kimmeridgian; **7** and **9** — *Galliaecytheridea raripunctata* Bielecka & *al.*; 7 — LV♂ (ZPAL 0.XXII/67, M-42/45.0 m) and 9 RV♂ (ZPAL 0.XXII/68, J-66/58.0 m) in lateral views, x50, Barcin-Piechcin, Upper Kimmeridgian; **8** and **10** — *Galliaecytheridea volgaensis* (Lyubimova); 8 — LV♀ (ZPAL 0.XXII/63, M-66/117.0 m) and 10 — LV♂ (ZPAL 0.XXII/64, M-66/117.0 m) in lateral views, x50, Barcin-Piechcin, Upper Kimmeridgian; **12—13** — *Galliaecytheridea inaequalipunctata* Bielecka & *al.*; 12 — C♂ (ZPAL 0.XXII66, M-42/45.0 m) in dorsal view, 13 — C♀ (ZPAL 0.XXII/65, M-42/45.0 m) in left lateral view, all x40, Barcin-Piechcin, Upper Kimmeridgian; **11** and **14—19** — *Galliaecytheridea barcinensis* sp.n.; 11 — C♀ (holotype, ZPAL 0.XXII/69, M-66/49.0 m): a — left lateral view, b — dorsal view, x50, Barcin-Piechcin, Lower Volgian; 14 — RV♀ (ZPAL 0.XXII/73, B 5) in lateral view, x50, Brzostówka, Middle Volgian; 15 — LV♀ (ZPAL 0.XXII/71, R-42/47.0 m) in internal view, showing the hinge structure, x80, 16 — RV♀ (ZPAL 0.XXII/72, M-66/49.0 m), 17 — RV♂ (ZPAL 0.XXII/75, R-42/47,0 m) and 18 — LV♀ (ZPAL 0.XXII/70, M-66/49.0 m) in lateral views, 19 — C♂ (ZPAL 0.XXII/74, M-66-49,0 m) in left lateral view, all x50, Barcin-Piechcin, Lower Volgian

PLATE 4

1—2 — *Galliaecytheridea monstrata* (Lyubimova); 1 — LV♂ (ZPAL 0.XXII/62, M-20/60.6 m) in lateral view, x40, 2 — C♂ (ZPAL 0.XXII/61, M-20/60,5 m) in right lateral view, x50, Barcin-Piechcin, Upper Kimmeridgian; **3—10** and **12** — *Galliaecytheridea pilicae* sp.n.; 3 — LV♂ (ZPAL O.XXII/82, B 9) in internal view, 4 — Cj (ZPAL 0.XXII/84, B 4) in left lateral view, 5 — RV♀ (ZPAL 0.XXII/79, B 9), 6 — LV♀ (ZPAL 0.XXII/78, B 4) and 7 — LV♂ (ZPAL 0.XXII/80 B 4) in lateral views, 8 — C♀ (holotype, ZPAL 0.XXII/76, B 3) in left lateral view, 9 — LV♂ (ZPAL 0.XXII/81, B 9) in lateral view, all x 40, 10 — C♀ (ZPAL 0.XXII/77, B 3) in dorsal view, x50, 12 — RV♂ (ZPAL 0.XXII/83, B 9) in lateral view, x40, Brzostówka, Middle Volgian; **11** and **13—15** — *Galliaecytheridea punctilataeformis* (Lyubimova); 11 — RV♀ (ZPAL 0.XXII/56, T-27a/161.0 m) in lateral view, x40, Barcin-Piechcin, Middle Volgian; 13 — RV♂ (ZPAL 0. XXII/58, B 6) in lateral view, x37, 14 — C♂ (ZPAL 0.XXII/57, B 6) in dorsal view, x40, 15 — C♀ (ZPAL 0.XXII/55, B 6) in left lateral view, x40, Brzostówka, Middle Volgian

PLATE 5

1—3 *Galliaecytheridea* sp. *1*; 1 — LVa (ZPAL 0.XXII/92, M-66/46.5 m) in lateral view, 2 Ca (ZPAL 0.XXII/91, M-66/46.5 m) in dorsal view, 3 — RVa (ZPAL 0.XXII/93, M-66/46,5 m) in lateral view, all x40, Barcin-Piechcin, Lower Volgian; **4—5** — *Galliaecytheridea mandelstami* (Lyubimova); 4 — LVa (ZPAL 0.XXII/60, B 2) in lateral view, x40, 5 — Ca (ZPAL 0.XXII/59, B 2) in dorsal view, x50, Brzostówka, Lower Volgian; **6—8** — *Galliaecytheridea* sp. *2*; 6 — LVa (ZPAL 0.XXII/94, B 2) and 7 — RVa (ZPAL 0.XXII/95, B 2) in lateral views, 8 — Cj (ZPAL 0.XXII/95A, B 2) in left lateral view, all x40, Brzostówka, Lower Volgian; **9—12** and **15** — *Pleurocythere (Klentnicella) kostytschevkaensis* (Lyubimova); 9 — C♂ (ZPAL 0.XXII/42, R-42/112.6 m) in right lateral view, x57, Barcin-Piechcin, Upper Kimmeridgian; 10 — LV♀ (ZPAL 0.XXII/44, R-20/66 m) in lateral view, x57, Barcin-Piechcin, Lower Volgian; 11 — C♀ (ZPAL 0.XXII/41, R-20/108.5 m) in right lateral view, x57, Barcin-Piechcin, Upper Kimmeridgian; 12 — specimen figured by Pokorný (1973, Pl. 12, Fig. 1) as *P. (K.) fossulata* sp.n., x57, Moravia (?)Tithonian; 15 — RV♂ (ZPAL 0.XXII/43, R-20/91.5 m) in lateral view, x57, Barcin-Piechcin, Upper Kimmeridgian; **14** and **16** — *Pleurocythere (Klentnicella) furcata* (Bielecka & Styk); 14 — LV♀ (ZPAL 0.XXII/45, R-20/153.8 m) in internal view, showing the hinge structure, x120, 16 — LV♀ (ZPAL 0.XXII/46, J-66/58.0 m) in lateral view, x57, Barcin-Piechcin, Upper Kimmeridgian; **13** and **17** — *Protocythere bisulcata* (Sharapova); 13 — C♀ (ZPAL 0.XXII/39, M-66/104.5 m) in right lateral view, x45, Barcin-Piechcin, Lower Volgian; 17 — C♂ (ZPAL 0.XXII/40, T-42/141.5 m) in left lateral view, x40, Barcin-Piechcin, Middle Volgian; **18** — *Lophocythere cruciata kimmeridgiensis* Guyader, RV♂ (ZPAL 0.XXII/11, J-66/38,0 m) in lateral view, x57, Barcin-Piechcin, Upper Kimmeridgian

PLATE 6

1—5 — *Rectocythere (Lydicythere) rugosa* Malz; 1 — LV♀ of the smooth form (ZPAL O.XXII/30, B 5) in lateral view, x65, Brzostówka, Middle Volgian; **2** — RV♀ of the pitted form (ZPAL O.XXII/31, M-66/104.6 m): a — lateral view, x65, b — papillate and foveolate pits, x1010, c — single pit with foveolate murus and papillate solum, x2020, Barcin-Piechcin, Lower Volgian; 3 — C♀ of the smooth form (ZPAL O.XXII/28, B 5): a — right lateral view, x65, b — papillate and foveolate pits, x1010, Brzostówka, Middle Volgian; 4 — C♂ of the smooth form (ZPAL O.XXII/29, B 6) in right lateral view, x65, Brzostówka, Middle Volgian; 5 — C♀ of the pitted form (ZPAL O.XXII/32, R-27a/167.0 m): a — right lateral view, x65, b — central part of the right valve, x100, Barcin-Piechcin, Lower Volgian

Scale bar 5 μ

PLATE 7

1—2 — *Rectocythere (Lydicythere) scandia* Christensen & Kilenyi; 1 — C♀ (ZPAL O.XXII/25, R-42/128.0 m) in right lateral view, 2 — C♂ (ZPAL O.XXII/26, R-42/128,0 m) in left lateral view, all x65, Barcin-Piechcin, Upper Kimmeridgian; **3—6** — *Kentrodictyocythere ?reticulocallosa* Pokorný; 3 — LVa (ZPAL O.XXII/35, R-42/102.5 m) and 4 — RVj (ZPAL O.XXII/36, R-42/102,5 m) in lateral views, x123, 5 — RVa (ZPAL O.XXII/38, M-66/107.0 m) in internal view, showing anterior part of the hinge structure, x245, 6 — RVa (ZPAL O.XXII/37, R-20/91.5 m) in lateral view, x123, Barcin-Piechcin, Upper Kimmeridgian; **7** — *Procytheropteron ?brodiei* (Jones), LV♀ (ZPAL O.XXII/100, B 9) in lateral view, x57, Brzostówka, Middle Volgian; **8** — *Cuvillierella jeani* Pokorný, RVa (ZPAL O.XXII/24, R-42/47.0 m) in lateral view, x50, Barcin-Piechcin, Lower Volgian; **9** and **12** *Cytheropteron* sp.; 9 — LVa (ZPAL O.XXII/99, R-20/91.5 m) in lateral view, 12 — LVa (ZPAL O.XXII/98, R-20/91,5 m) in internal view, all x80, Barcin-Piechcin, Lower Volgian; **10** and **13** — *Metacytheropteron* sp. *A* Pokorný; 10 — LV♂ (ZPAL O.XXII/102, B 1) in lateral view, 13 — C♀ (ZPAL O.XXII/101, B 1) in right lateral view, all x65, Brzostówka, Lower Volgian; **11** — *Paranotacythere (Unicosta) rimosa* (Martin), LVa (ZPAL O.XXII/103, B 9) in lateral view, x65, Brzostówka, Middle Volgian; **14** and **17** — *Bythoceratina* sp.; 14 — RVa (ZPAL O.XXII/106, M-66/177.0 m) and 17 — RVa (ZPAL O.XXII/105, M-42/45.0 m) in lateral views, x65, Barcin-Piechcin, Upper Kimmeridgian; **15** and **18** — *?Galliaecytheridea* sp.; 15 — C (?a) (ZPAL O.XXII/97, R-42/62.0 m) in right lateral view, x50, 18 — RV (?a) (ZPAL O.XXII/96, R-20/62.0 m) in lateral view, x57, Barcin-Piechcin, Lower Volgian; **16** — *Eucytherura* sp., RVa (ZPAL O.XXII/104, R-42/102.5 m): a — lateral view, x105, b — valve surface under higher magnification, showing papillate sola of fossae, x2050 (bar 5 μ), Barcin-Piechcin, Upper Kimmeridgian; **19** — *Exophthalmocythere fuhrbergensis* Steghaus, RV (?j) (ZPAL O.XXII/47, M-42/76.0 m) in lateral view, x57, Barcin-Piechcin, Upper Kimmeridgian

PLATE 8

1—4 and **6—7** — *Cytherella pilicae* sp.n.; 1 — LV♀ (ZPAL O.XXI/2, W 10) and 2 — RV♀ (ZPAL O.XXI/3, W 8) in lateral views, x40, 3 — C♀ (holotype, ZPAL O.XXI/1 W 8): a — left lateral view, x40, b — dorsal view, x57, 4 — RV♂ (ZPAL O.XXI/4 W 7), 6 — RVj (ZPAL O.XXI/6, W 7) and 7 — (?♂) RVj (ZPAL O.XXI/5, W 7) in lateral views, all x40, Lower Valanginian; **5** — *?Pontocyprella* sp., C (?a) (ZPAL O.XXI/21, W 24) in left lateral view, x50, Upper Valanginian; **8** and **10** — *Paracypris elegans* sp.n.; 8 — Ca (holotype, ZPAL O.XXI/16, W 19): a — right lateral view, x57, b — dorsal view, x90, 10 — RVa (ZPAL O.XXI/17, W 14) in lateral view, x57, Upper Valanginian; **9** — *Bairdia* sp., LVj (ZPAL O.XXI/15, W 4) in lateral view, x50, Lower Valanginian; **11** and **13** — *Pontocyprella elongata* sp.n.; 11 — RVa (ZPAL O.XXI/19, W 10) and 13 — LVa (holotype, ZPAL O.XXI/18, W 10) in lateral views, x60, Lower Valanginian; **12** and **14—15** — *Cytherelloidea nealei* sp.n.; 12 — C♀ (holotype, ZPAL O.XXI/7, W 7) in left lateral view, x60, 14 — RV♂ (ZPAL O.XXI/11, W 7) in internal view, x65, Lower Valanginian; 15 — RVj (ZPAL O.XXI/12, W 12) in lateral view, x85, Upper Valanginian

All specimens from Wąwał

PLATE 9

1—2 — *Cytherelloidea* sp.; 1 — LVj (ZPAL O.XXI/13, W 4) and 2 — RVj (ZPAL O.XXL/14, W 4) in lateral views, x65, Lower Valanginian; **3—5** — *Cytherelloidea nealei* sp.n.; 3 — C♂ (ZPAL O.XXI/10, W 10) in right lateral view, x57, 4 — RV♀ (ZPAL O.XXI/8, W 8): a — lateral view, x57, b — ornamentation, arrow points to the celate fossa, x820 (bar 10μ), 5 — RV♀ (ZPAL O.XXI/9, W 10) in lateral view, x57, Lower Valanginian; **6, 9** and **11** — *Hekistocythere tenuis* (Donze); 6 — RV♀ (ZPAL O.XXI/43, W 7): a — lateral view, x80, b — ornamentation, x1270 (bar 10 μ), 9 — LV♂ (ZPAL O.XXI/45, W 4) in lateral view, x80, 11 —RV♂ (ZPAL O.XXI/44, W 8) in internal view, showing posterior part of the hinge structure, x245, Lower Valanginian; **7—8, 10** and **12** — *Neocythere* (*Physocythere*) *tumida* sp.n.; 7 — LV♂ (ZPAL O.XXI/40, W 5) in lateral view, x57, 8 — C♀ (holotype, ZPAL O.XXI/37, W 4): a — left lateral view, x57, b — dorsal view, x75, c — anterior view, x75, Lower Valanginian; 10 — LV♀ (ZPAL O.XXI/38, W 12) in internal view, showing the hinge structure, x75; 12 — RV♀ (ZPAL O.XXI/39: W 12): a — lateral view, x57, b — dorsal view, x60, Upper Valanginian

All specimens from Wąwał

PLATE 10

1—3 and **6** — *Dolocythere punctata* sp.n.; 1 — RVa (ZPAL O.XXI/34, W 7) in internal view, 2 — RVa (ZPAL O.XXI/33, W 7) in lateral view, all x80, Lower Valanginian; 3 — Ca (ZPAL O.XXI/32, W 14) in right lateral view, x80, 6 — Ca (holotype, ZPAL O.XXI/31, W 14). a — left lateral view, x145, b — dorsal view, x80, Upper Valanginian; **4—5, 8—9** and **13** — *Dolocythere dimorphica* sp.n.; 4 — RV♀ (ZPAL O.XXI/23, W 8) in lateral view, x80, Lower Valanginian; 5 — RV♀ (ZPAL O.XXI/22, W 15) in lateral view, 8 — C♂ (holotype, ZPAL O.XXI/25, W 15) a — left lateral view, b — dorsal view, 9 — RV♂ (ZPAL O.XXI/26, W 13) in lateral view,all x80, 13 — LV♀ (ZPAL O.XXI/21, W 15): a — lateral view, x150, b — ornamentation, x660 (bar 10 μ), Upper Valanginian; **7** and **10—12** — *Dolocythere ?longa* Gründel; 7 — RV♀ (ZPAL O.XXI/29, W 8) in internal view, 10 — C♀ (ZPAL O.XXI/27, W 10) in dorsal view, 11 — RV♂ (ZPAL O.XXI/30, W 10) in lateral view, all x80, 12 — LV♀ (ZPAL O.XXI/28, W 10): a — lateral view, x80, b — ornamentation, x570 (bar 10 μ), Lower Valanginian; **14—15** — *Acrocythere aspera* Donze; 14 — LVa (ZPAL O.XXI/41, W 8) and 15 — RVa (ZPAL O.XXI/42, W 8) in lateral views, x80, Lower Valanginian

All specimens from Wąwał

PLATE 11

1—4 and **10—11** — *Protocythere sztejnae* sp.n.; 1 — LV♂ (ZPAL O.XXI/70, W 10) and 2 — RV♂ (ZPAL O.XXI/71, W 10) in lateral views, 3 — C♀ (holotype, ZPAL O.XXI/66, W 10): a — left lateral view, b — dorsal view, 4 — RV♀ (ZPAL O.XXI/69, W 7) in lateral view, all x57, 10 — LV♀ (ZPAL O.XXI/67, W 4) and 11 — RV♀ (ZPAL O.XXI/68, W 4) in internal views, showing the hinge structure, x80, Lower Valanginian; **5—6, 8** and **12** — *Protocythere wiadernoensis* sp.n.; 5 — RV♂ (ZPAL O.XXI/74, W 6) and 6 — RV♀ (ZPAL O.XXI/74A, W 4) in lateral views, x50, 8 — C♀ (holotype, ZPAL O.XXI/72, W 6): a — left lateral view, b — dorsal view, x60, 12 — LV♂ (ZPAL O.XXI/73, W 6) in internal view, x57, Lower Valanginian; **7, 9** and **13** — *Protocythere tomaszowiensis* Sztejn; 7 — LVj (ZPAL O.XXI/50, W 6) in lateral view, 9 — C♀ (ZPAL O.XXI/48, W 4) in dorsal view, 13 — RV♂ (ZPAL O.XXI/49, W 4) in lateral view, all x57, Lower Valanginian; **14—15** — *Protocythere* sp. *A* of Donze (1975); 14 — LVj (ZPAL O.XXI/60, W 1) in lateral view, 15 — C♂ (ZPAL O.XXI/59, W 1): a — right lateral view, b — dorsal view, all x50, Upper Berriasian

All specimens from Wąwał

PLATE 12

1—6, 11—12 and **18** — *Pseudoprotocythere aubersonensis* Oertlii; 1 — LVj (ZPAL O.XXI/75A, W 10) in lateral view, Lower Valanginian; 2 — RVj (ZPAL O.XXI/75, W 5) in lateral view, x57, Upper Valanginian; 3 — LV♀ of the coarsely pitted

form (ZPAL O.XXI/75, W 10) and 4 — RV♂ of the coarsely pitted form (ZPAL O.XXI/81, W 7) in lateral views, x40, Lower Valanginian; 5 — RV♂ of the finely pitted form (ZPAL O.XXI/84, W 14) and 6 — RV♂ of the finely pitted form (ZPAL O.XXI/85, W 14) in lateral views, x40, Upper Valanginian; 11 — RV♂ of the coarsely pitted form (ZPAL O.XXI/82, W 2) in lateral view, x60, Upper Berriasian; 12 — RV♂ of the finely pitted form (ZPAL O.XXI83, W 19) in lateral view, x60, 18 — LV♂ of the finely pitted form (ZPAL O.XXI/79, W 19) in lateral view, x50, Upper Valanginian; **7—8** — *Protocythere hechti* Triebel; 7 — LV♀ (ZPAL O.XXI/46, W 30) and 8 — LV♂ (ZPAL O.XXI/47, W 30) in lateral views, x60, Upper Valanginian; **9—10** and **13** — *Protocythere lewinskii* Kubiatowicz; 9 — RV♂ forma lewinskii (ZPAL O.XXI/61, W 7) in lateral view, x50, Lower Valanginian; 10 — RV♂ of forma bireticulata (ZPAL O.XXI/62 W 14) and 13 — LV♀ of forma bireticulata (ZPAL O.XXI/62A, W 14) in lateral views, x50, Upper Valanginian; **14** — *Protocythere* sp.; RVa (ZPAL O.XXI/36, W 3) in lateral view, x40, Lower Valanginian; **15—17** — *Protocythere vonvalensis* Kubiatowicz; 15 — RV♀ of the coarsely pitted form (ZPAL O.XXI/63, W 7) in lateral view, x57, Lower Valanginian; 16 — RV♂ of the coarsely pitted form (ZPAL O.XXI/64, W 2) in lateral view, x50, Upper Berriasian; 17 — RV♂ of the finely pitted form (ZPAL O.XXI/65, W 7) in lateral view, x50, Lower Valanginian

All specimens from Wąwał

PLATE 13

1—7 — *Protocythere helvetica* Oertli; 1 — LV♂ of the reticulate form (ZPAL O.XXI/54, W 2) in lateral view, ×43, Upper Berriasian; 2 — RV♂ of the reticulate form (ZPAL O.XXI/55, W 7): a — lateral view, ×43, b — ornamentation, ×250, Lower Valanginian; 3 — RV♂ of the bireticulate form (ZPAL O.XXI/56, W 12): a — lateral view, ×43, b — ornamentation, note a ring of papillae around each pit, ×1230, Upper Valanginian; 4 — LV♀ of the bireticulate form (ZPAL O.XXI/57, W 12): a — lateral view, ×43, b — ornamentation, ×800, Upper Valanginian; 5 — LV♀ of the smooth form (ZPAL O.XXI/51, W 14): a — lateral view, ×43, b — ornamentation, ×490, Upper Valanginian; 6 — LV♂ of the smooth form (ZPAL O.XXI/52, W 18) in lateral view, ×43, Upper Valanginian; 7 — LV♂ of the smooth form (ZPAL O.XXI/53, W 19) in lateral view, ×43, Upper Valanginian

All specimens from Wąwał

PLATE 14

1 — *Exophthalmocythere insignis* Donze, LVa (ZPAL O.XXI/86, W 5): a — oblique lateral view, b — anterior view, ×75, Lower Valanginian; **2—4** and **6** — *Triebelocythere oertlii* sp.n.; 2 — RV♂ (ZPAL O.XXI/94, W 10): a — lateral view, ×80, b — ornamentation and sieve-pore, ×820 (bar 10 μ), 3 — LV♂ (holotype ZPAL O.XXI/93, W 10) in lateral view, ×85, 4 — RV♀ (ZPAL O.XXI/91, W 10) in lateral view, ×80, 6 — RV♀ (ZPAL O.XXI/92, W 10) in internal view, showing anterior part of the valve, ×85, Lower Valanginian; **5** and **7—9** *Parexophthalmocythere hispida* (Małecki); 5 — LVa of the smooth form (ZPAL O.XXI/90, W 14, partly damaged) in oblique lateral view, ×75, Upper Valanginian; 7 — LVa of the pitted form (ZPAL O.XXI/87, W 10) in internal view, ×75, Lower Valanginian; 8 — RVa of the smooth form (ZPAL O.XXI/89, W 18) in lateral view, ×60, Upper Valanginian; 9 — RVa of the pitted form (ZPAL O.XXI/88, W 12) in lateral view, ×60, Upper Valanginian; **10—11** — *Mandocythere* (*Costacythere*) *frankei* (Triebel); 10 — LV♀ (ZPAL O.XXI/77, W 24): a — lateral view, ×60, b — ornamentation and rimmed pore, ×1230 (bar 10 μ), c — single papillate pit, ×2460, 11 — LV♂ (ZPAL O.XXI/78, W 30) in lateral view, ×60, Upper Valanginian

All specimens from Wąwał

PLATE 15

1—4 and **9** — *Haplocytheridea parva* sp.n.; 1 — LV♂ (ZPAL O.XXI/101, W 7) in lateral view, ×50, 2 — C♂ (holotype, ZPAL O.XXI/100, W 7): a — right lateral view, b — dorsal view, ×45, 3 — LV♀ (ZPAL O.XXI/97, W 7): a — lateral view, ×45, b — sieve and open pores, ×820, 4 — RV♀ (ZPAL O.XXI/99, W 7) in lateral view, ×45, Lower Valanginian; 9 — LV♀ (ZPAL O.XXI/98, W 19) in internal view,

showing the hinge structure, ×90, Upper Valanginian; **5—6, 8** and **10** — *Haplocytheridea* sp.; 5 — LV♀ (ZPAL 0.XXI/102, W 30) in lateral view, ×45, Upper Valanginian; 6 — RV♂ (ZPAL 0.XXI/104, Wd 202.5 m) in lateral view, ×40, Wiaderno, Upper Valanginian; 8 — RV♀ (ZPAL 0.XXI/103, W 30) in lateral view, ×45, 10 — LV♀ (ZPAL 0.XXI/102A, W 30) in internal view, showing the hinge structure, ×75, Upper Valanginian; **7** and **11—12** — *Dolocytheridea* (*Dolocytheridea*) *hilseana* (Roemer); 7 — RV♀ (ZPAL 0.XXI/109, W 21) and 11 — RV♂ (ZPAL 0.XXI/110, W 21) in lateral views, ×40, Upper Valanginian; 12 — LV♀ (ZPAL 0:XXI/108, D 138.5 m) in internal view, showing the hinge structure, ×57, Dąbrówka, Upper Valanginian; **13, 16** and **19** — *Clithrocytheridea vonvalensis* (Sztejn); 13 — LV♀ (ZPAL 0.XXI/105, W 9) in internal view, showing the hinge structure, ×85, 16 — LV♂ (ZPAL 0.XXI/107, W9) in lateral view, ×45, Lower Valanginian; 19 — RV♀ (ZPAL 0.XXI/106, W 13) in lateral view, ×45, Upper Valanginian; **14** and **17** — *Stravia crossata* Neale; 14 — RV♀ (ZPAL 0.XXI/96, W 24) in lateral view, ×60, Upper Valanginian; 17 — LV♀ (ZPAL 0.XXI/95, W 10) in lateral view, ×60, Lower Valanginian; **15** and **18** — *Euryitycythere subtilis* Bartenstein & Brand; 15 — LVa (ZPAL 0.XXI/111, W 13) and 18 — LVa (ZPAL 0.XXI/112, W 18) in lateral views, ×85, Upper Valanginian

All specimens from Wąwał (except for Figs 6 and 12)

PLATE 16

1—3 — *Asciocythere* sp.; 1 — LVa (ZPAL 0.XXI/120, W 2) in lateral view, 2 — RVa (ZPAL 0.XXI/121A, W 2) in internal view, 3 — RVa (ZPAL 0.XXI/121, W 2) in lateral view, all ×57, Upper Berriasian; **4—11** and **13** — *Asciocythere crassivalvis* sp.n.; 4 — LV♀ (ZPAL 0.XXI/113, W 16) and 5 — LVj (ZPAL 0.XXI/119A, W 14) in lateral views, ×45, 6 — LV♀ (ZPAL 0.XXI/114, W 13): a — lateral view, ×45, b — sieve pore, ×1230, 7 — LVj (ZPAL 0.XXI/119, W 14) and 8 — LV♀ (ZPAL 0.XXI/115, W 16) in internal views, showing the hinge structure, ×55, 9 — RV♀ (ZPAL 0.XXI/116, W 14) in lateral view, ×40, 11 — C♂ (holotype ZPAL 0.XXI/117, W 14) in left lateral view, ×40, 11 — C♂ (ZPAL 0.XXI/117A, W 17) in dorsal view, ×35, 13 — LV♂ (ZPAL 0.XXI/118, W 14) in lateral view, ×40, Upper Valanginian; **12** and **14—15** — *Apatocythere* (*Schulapatocythere*) *polonica* sp.n.; 12 — RV♀ (ZPAL 0.XXI/127, W 30) in dorsal view, ×80, 14 — C♀ (holotype, ZPAL 0.XXI/122, W 24): a — right lateral view, ×60, b — oblique dorsal view, ×65, 15 — LV♀ (ZPAL 0.XXI/125, W 25) in internal view, showing posterior part of the hinge structure, ×20, Upper Valanginian

All specimens from Wąwał

PLATE 17

1—4 — *Apatocythere* (*Schulapatocythere*) *polonica* sp.n.; 1 — LV♀ (ZPAL 0.XXI/123, W 24), 2 — LV♀ (ZPAL 0.XXI/124, W 30), 3 — LV♂ (ZPAL 0.XXI/128, W 25) and 4 — RV♀ (ZPAL 0.XXI/126, W 30) in lateral views, ×40, Upper Valanginian; **5—8** — *Schuleridea* (*Schuleridea*) *thoerenensis* (Triebel); 5 — LV♀ (ZPAL 0.XXI/129, W 30) and 6 — RV♀ (ZPAL 0.XXI/130, W 30) in lateral views, 7 — LV♂ (ZPAL 0.XXI/132, W 24) in internal view, 8 — LV♂ (ZPAL 0.XXI/131, W 30) in lateral view, all ×40, Upper Valanginian; **9—11** and **13** — *Schuleridea* (*Schuleridea*) *dabrowkaensis* sp.n.; 9 — LV (? ♂) (ZPAL 0.XI/134, W 29), 10 — LV (? ♀) (ZPAL 0.XXI/135, W 30) and 11 — RV (? ♀) (ZPAL 0.XXI/136, W 30) in lateral views, all ×50, 13 — C (? ♀) (holotype, ZPAL 0.XXI/133, W 30): a — right lateral view, b — oblique dorsal view, ×50, Upper Valanginian; **12** and **14—20** — *Schuleridea* (*Schuleridea*) *neocomiana* sp.n.; 12 — RV♀ (ZPAL 0.XXI/139A, W 14) in lateral view, ×40, 14 — C♀ (holotype, ZPAL 0.XXI/138, W 14): a — dorsal view, b — right lateral view, ×50, Upper Valanginian; 15 — LV♂ (ZPAL 0.XXI/143, W 10) in lateral view, ×40, Lower Valanginian; 16 — LV♂ (ZPAL 0.XXI/144, W 14) in lateral view, ×40, Upper Valanginian; 17 — C♀ (ZPAL 0.XXI/139, W 10) in right lateral view, 18 — LV♂ (ZPAL 0.XXI/142, W 10) and 19 — LV♀ (ZPAL 0.XXI/140, W 7) in lateral views, all 40, Lower Valanginian; 20 — LV♀ (ZPAL 0.XI/141, W 23) in lateral view, ×40, Upper Valanginian

All specimens from Wąwał

PLATE 18

1—2 and **4—5** — *Dicrorygma (Dicrorygma) poagi* sp.n.; 1 — C♂ (holotype, ZPAL O.XI/151, W 18) in left lateral view, 2 — LV♀ (ZPAL O.XXI/149, W 18) in internal view, 4 — LV♀ (ZPAL O.XXI/148, W 18) and 5 — RV♀ (ZPAL O.XXI/150, W 18) in lateral views, all ×80, Upper Valanginian; **3, 6** and **9** — *Aaleniella* sp.; 3 — LVa (ZPAL O.XXI/145, W 10), 6 — RVa (ZPAL O.XXI146, W 10) and 9 — RVa (ZPAL O.XXI/147, W 10) in lateral views, all ×123, Lower Valanginian; **7** and **15** — *Paranotacythere (Paranotacythere) valanginiana reticulata* Bassiouni; 7 — LV♀ (ZPAL O.XXI/161, W 19): a — lateral view, b — oblique anterior view, 15 — LV♀ (ZPAL O.XXI/162, W 14) in oblique anterior view, all ×100, Upper Valanginian; **8, 10—11** and **18** — *Paranotacythere (Paranotacythere) soror* sp.n.; 8 — RV♂ (ZPAL O.XXI/169, W 10), 10 — LV♂ (ZPAL O.XXI/168, W 8) and 11 — LV♀ (holotype, ZPAL O.XXI/166, W 7) in lateral views, all ×85, 18 — LV♀ (ZPAL O.XXI/167, W 8) in oblique anterior view, ×150, Lower Valanginian; **12—13** — *Paranotacythere (Paranotacythere) polonica* (Sztejn); 12 — LV♀ (ZPAL O.XXI/159, W 4) in oblique anterior view, ×150, 13 — LV♂ (ZPAL O.XXI/160, W 10) in lateral view, ×80, Lower Valanginian; **14** and **16—17** — *Paranotacythere (Paranotacythere)* sp.; 14 — RV♀ (ZPAL O.XXI/164, W 6), 16 — LV♂ (ZPAL O.XXI/165, W 6) and 17 — LV♀ (ZPAL O.XXI/163, W 8) in lateral views, all ×80, Lower Valanginian

All specimens from Wąwał

PLATE 19

1—2 — *Stillina acuminata* Neale; 1 — LV♀ (ZPAL O.XXI/181, W 7) in lateral view, ×80, Lower Valanginian; 2 — RV♂ (ZPAL O.XXI/182, W 14) in lateral view, ×80, Upper Valanginian; **3—4** — *Hemicytherura ?moorei* Neale; 3 — RV (?♂) (ZPAL O.XXI/157, W 7) and 4 — RV (?♂) (ZPAL O.XXI/158, W 7) in lateral views, ×115, Lower Valanginian; **5—6** and **11** — *Eocytheropterina subtilis* (Gründel); 5 — LV♂ (ZPAL O.XXI/170, W 18) in lateral view, ×100, Upper Valanginian; 6 — RV♀ (ZPAL O.XXI/171, W 7) in lateral view, ×95, 11 — RV♀ (ZPAL O.XXI/172, W 8) in lateral view, ×165, Lower Valanginian; **7—10** and **12—13** — *Eocytheropterina gruendeli* sp.n.; 7 — LV♂ (ZPAL O.XXI/177, W 8), 8 — LV♀ (ZPAL O.XXI/173, W 8) and 9 — LV♂ (ZPAL O.XXI/176, W 8) in lateral views, all ×100, 10 — C♂ (holotype, ZPAL O.XXI/175, W 10) in left lateral view, ×160, 12 — RV♀ (ZPAL O.XXI/174, W 8) in lateral view, 13 — RV♂ (ZPAL O.XXI/178, W 8) in internal view, ×160, Lower Valanginian; **14—15** — *Eocytheropteron* sp.; 14 — LVa (ZPAL O.XXI/179, W 4): a — left lateral view, b — dorsal view, 15 — LVa (ZPAL O.XXI/180, W 4) in internal view, all ×80, Lower Valanginian

All specimens from Wąwał

PLATE 20

1—2 — *Eucytherura nuda* Kaye; 1 — LVa (ZPAL O.XXI/153, W 23): a — lateral view, ×100, b — ornamentation, ×740, 2 — RVa (ZPAL O.XXI/154, W 12) in lateral view, ×100, Upper Valanginian; **3—4** — *Eucytherura* sp.; 3 — LVa (ZPAL O.XXI/155, W 7): a — lateral view, ×100, b — foveolate, tegminal cover of the dorsal tubercle, ×1025, c — the latter under greater magnification, ×2300, d — scheme of the ornamental pattern, 4 — RVa (ZPAL O.XXI/156, W 7): a — lateral view, ×100, b — central part of the valve, ×530, c — tegminal spot and papillate fossae, ×1600, d — papillate fossae, sola of the fossae with papillae and faint very fine reticulation, ×1600, e — scheme of the ornamental pattern, Lower Valanginian

Scale bar 5 μ

All specimens from Wąwał

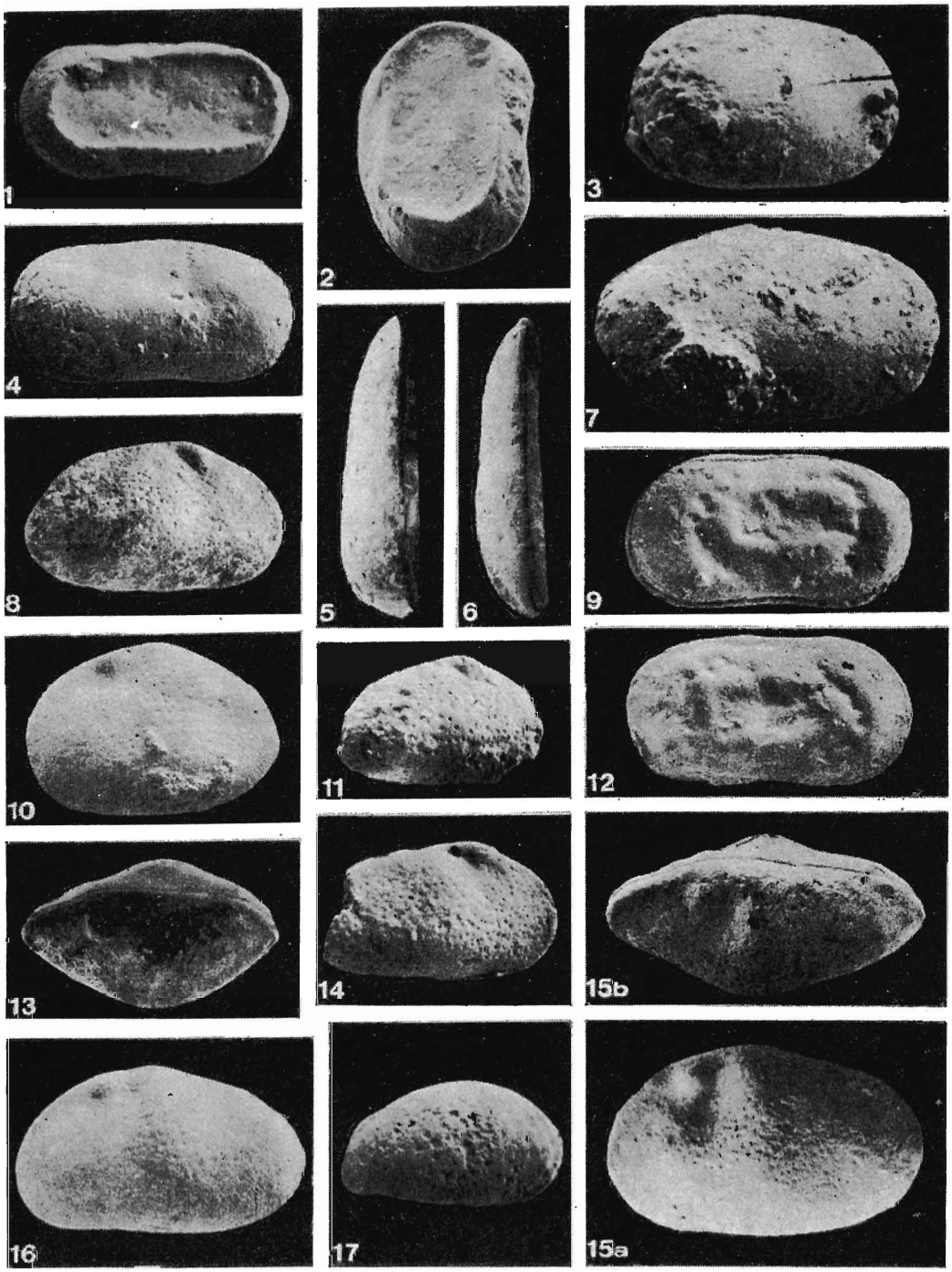
W. KUBIATOWICZ

MAŁŻORACZKI Z OSADÓW GÓRNEJ JURY I NEOKOMU POLSKI ŚRODKOWEJ

(Streszczenie)

Przedmiotem pracy jest analiza małżoraczków górnojurajskich (górny kimeryd, dolny i środkowy wołg) pochodzących z obszaru Barcina i Piechcina na Kujawach oraz z Brzostówki w Tomaszowie Mazowieckim, a także małżoraczków neokomskich pochodzących z okolic Tomaszowa Mazowieckiego, m. in. z Wąwału (fig. 1). Badany materiał (fig. 2—8 oraz tab. 1—3) pozwolił na wydzielenie w obrębie sekwencji osadów górnego kimerydu — wołgu czterech poziomów małżoraczkowych: *Galliaecytheridea monstrata, G. oertlii, G. barcinensis, G. punctilataeformis,* zaś w obrębie sekwencji neokomu dwóch poziomów: *Pseudoprotocythere aubersonensis* oraz *Mandocythere frankei.* Poziomy małżoraczkowe zostały skorelowane z ogólnie przyjętym podziałem stratygraficznym opartym na amonitach (tab. 4).

Część systematyczna pracy zawiera opisy 37 gatunków (w tym 4 nowe) małżoraczków górnojurajskich (pl. 1—7) oraz 51 gatunków (w tym 18 nowych) małżoraczków neokomskich (pl. 8—20). Kilka spośród badanych gatunków wykazuje interesującą zmienność ornamentacji, którą w przypadku małżoraczków neokomskich (fig. 9) można tłumaczyć czynnikami ekologicznymi.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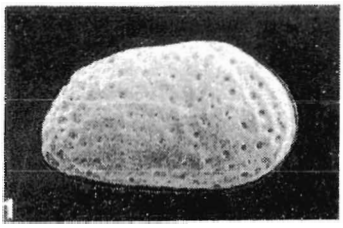
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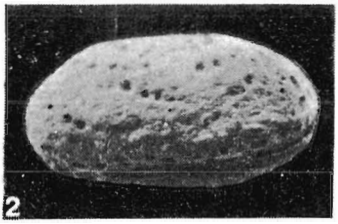
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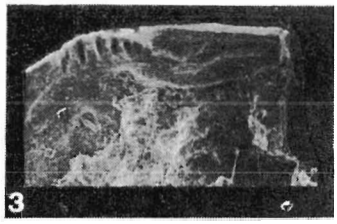
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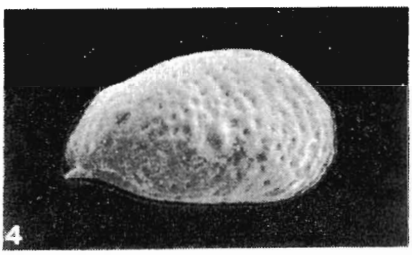
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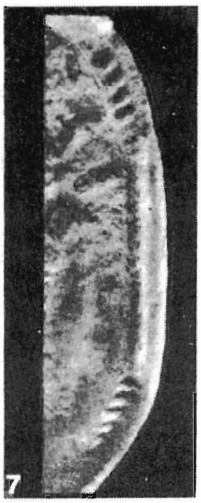
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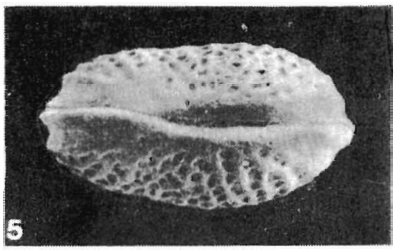
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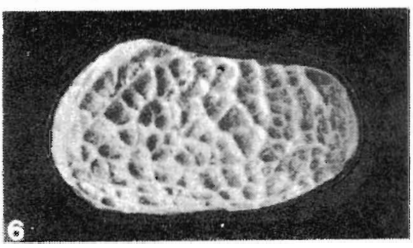
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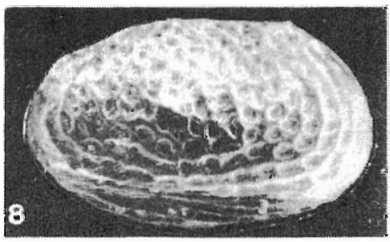
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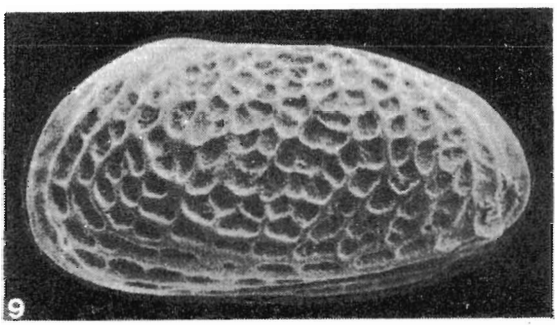
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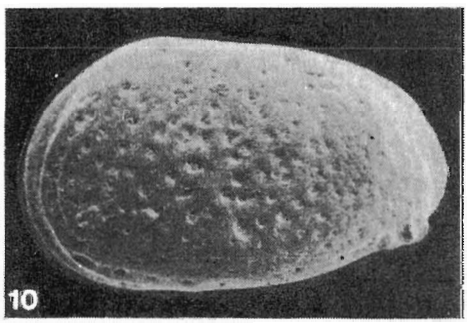
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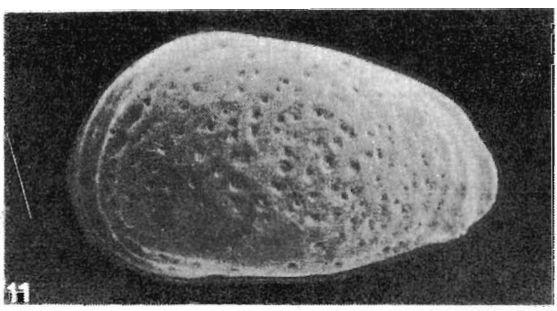
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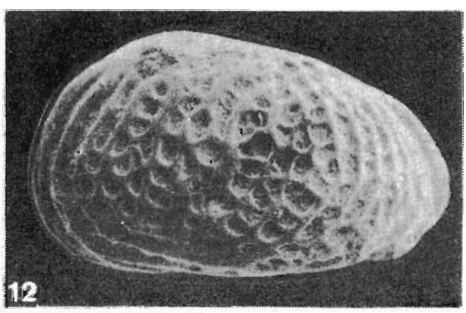
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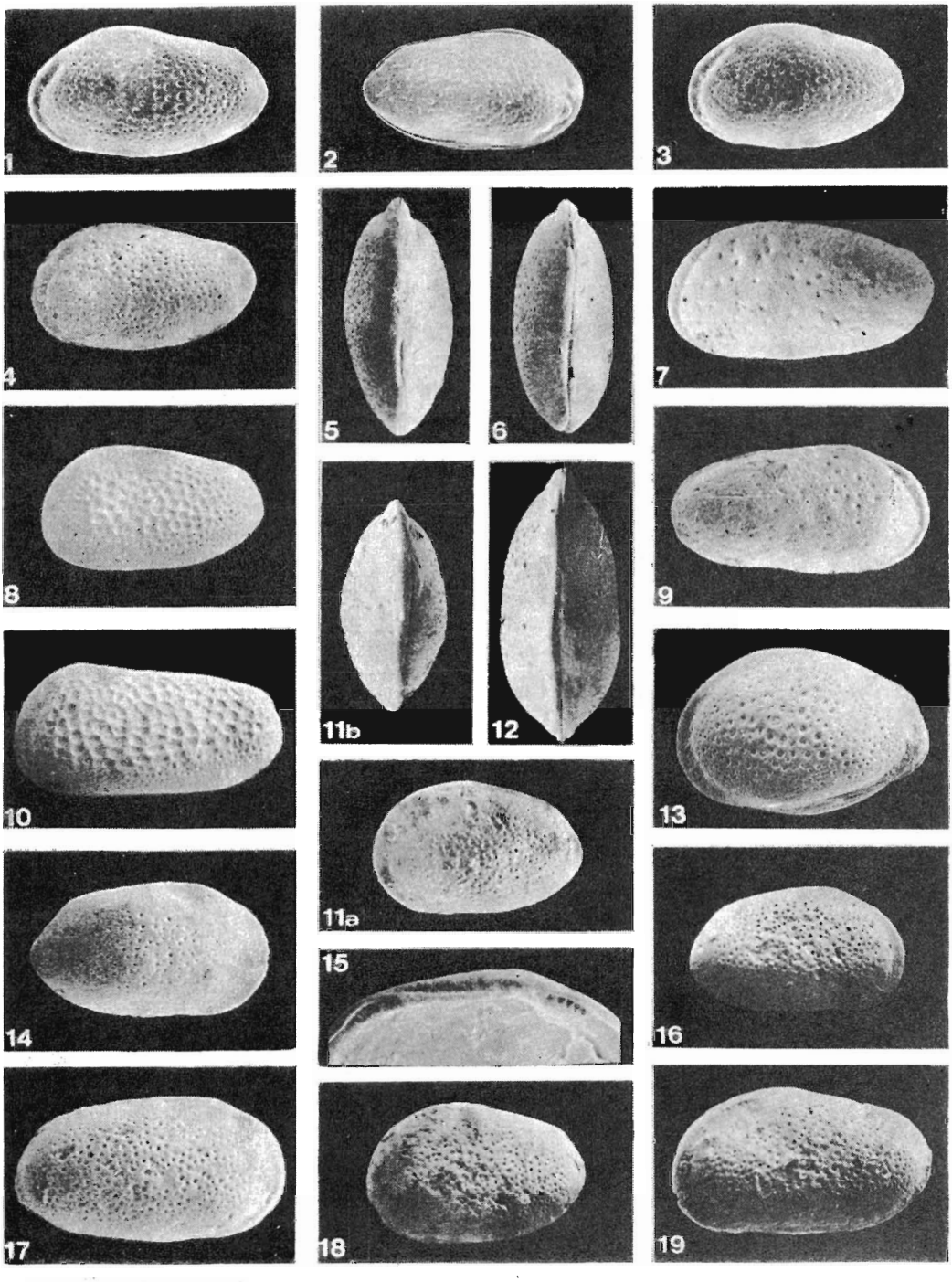
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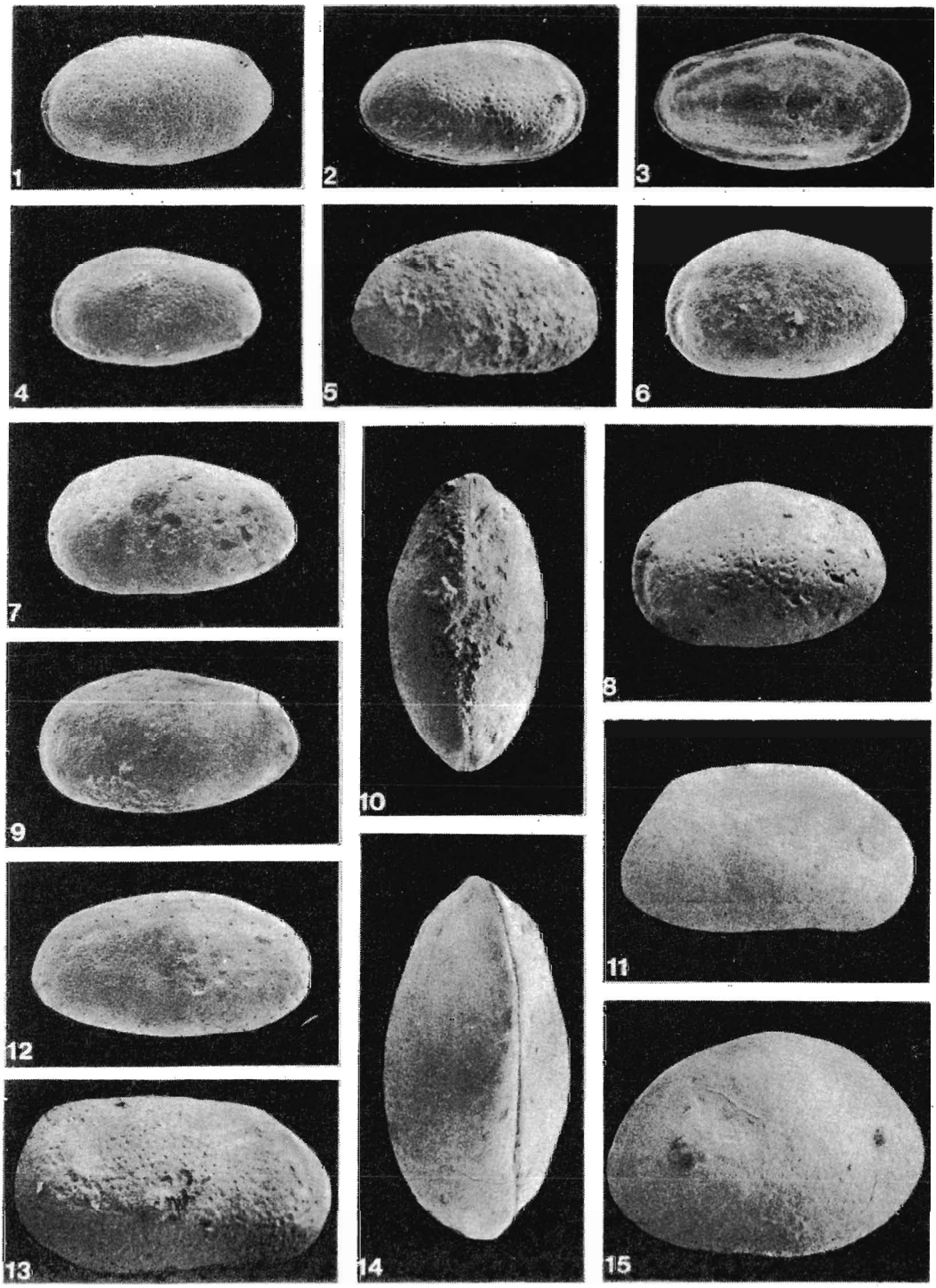
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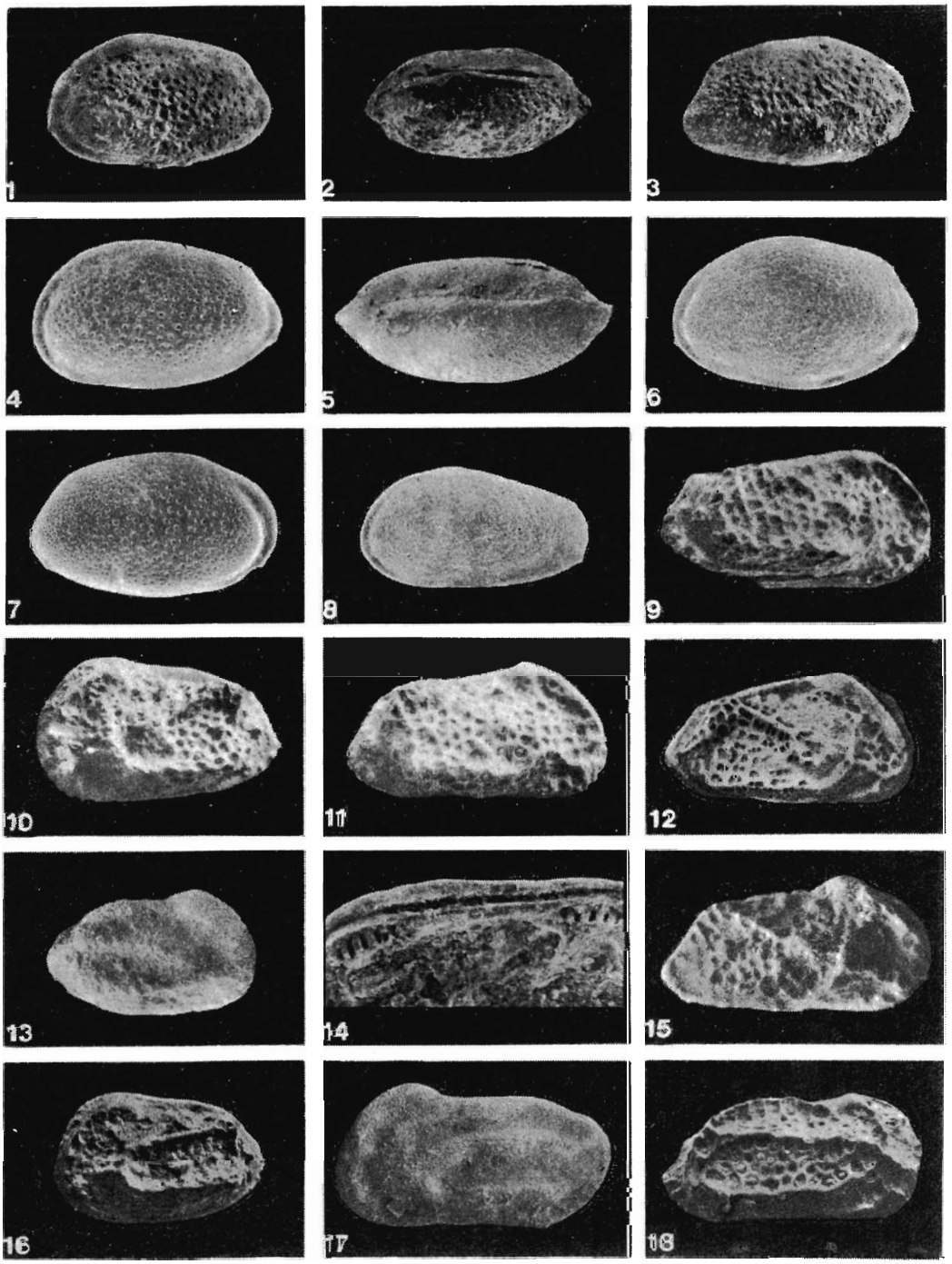
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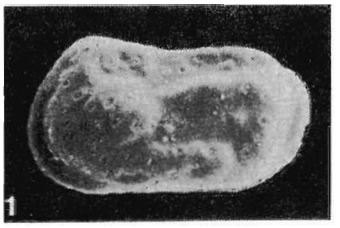
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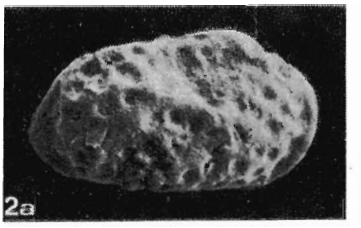
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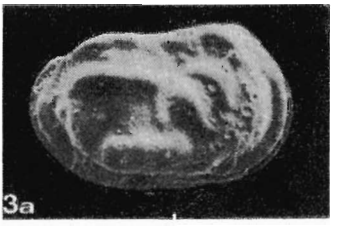
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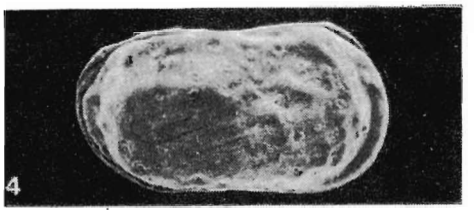
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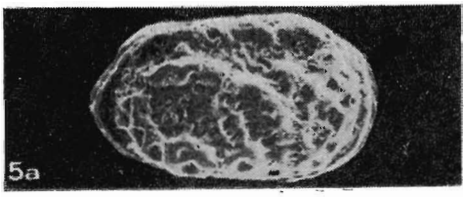
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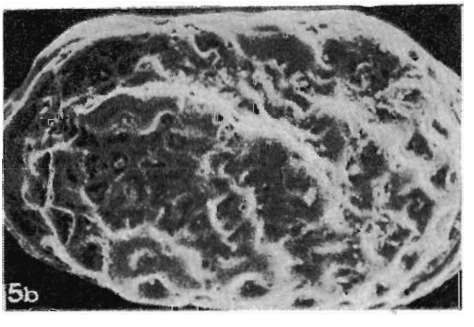
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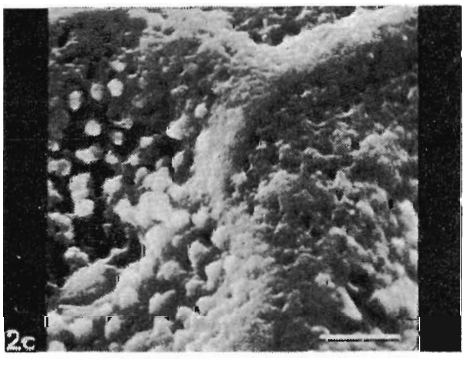
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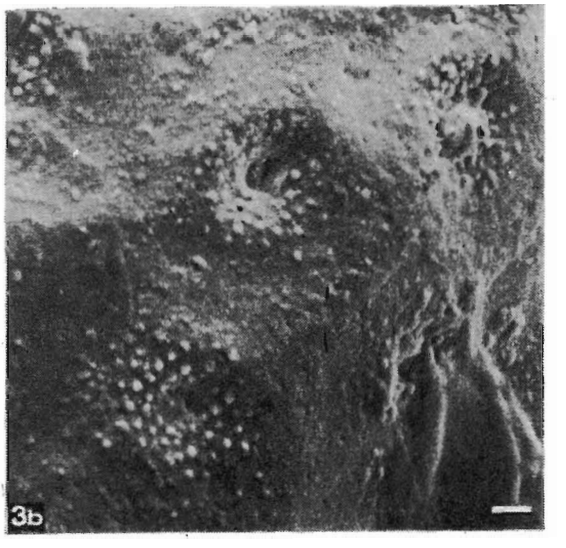
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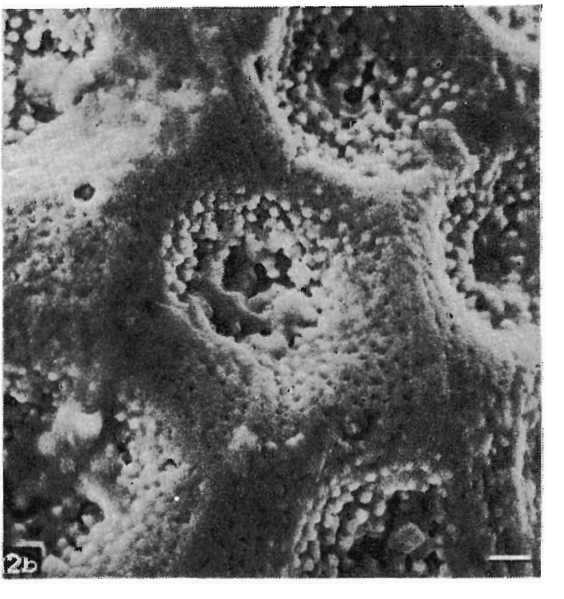
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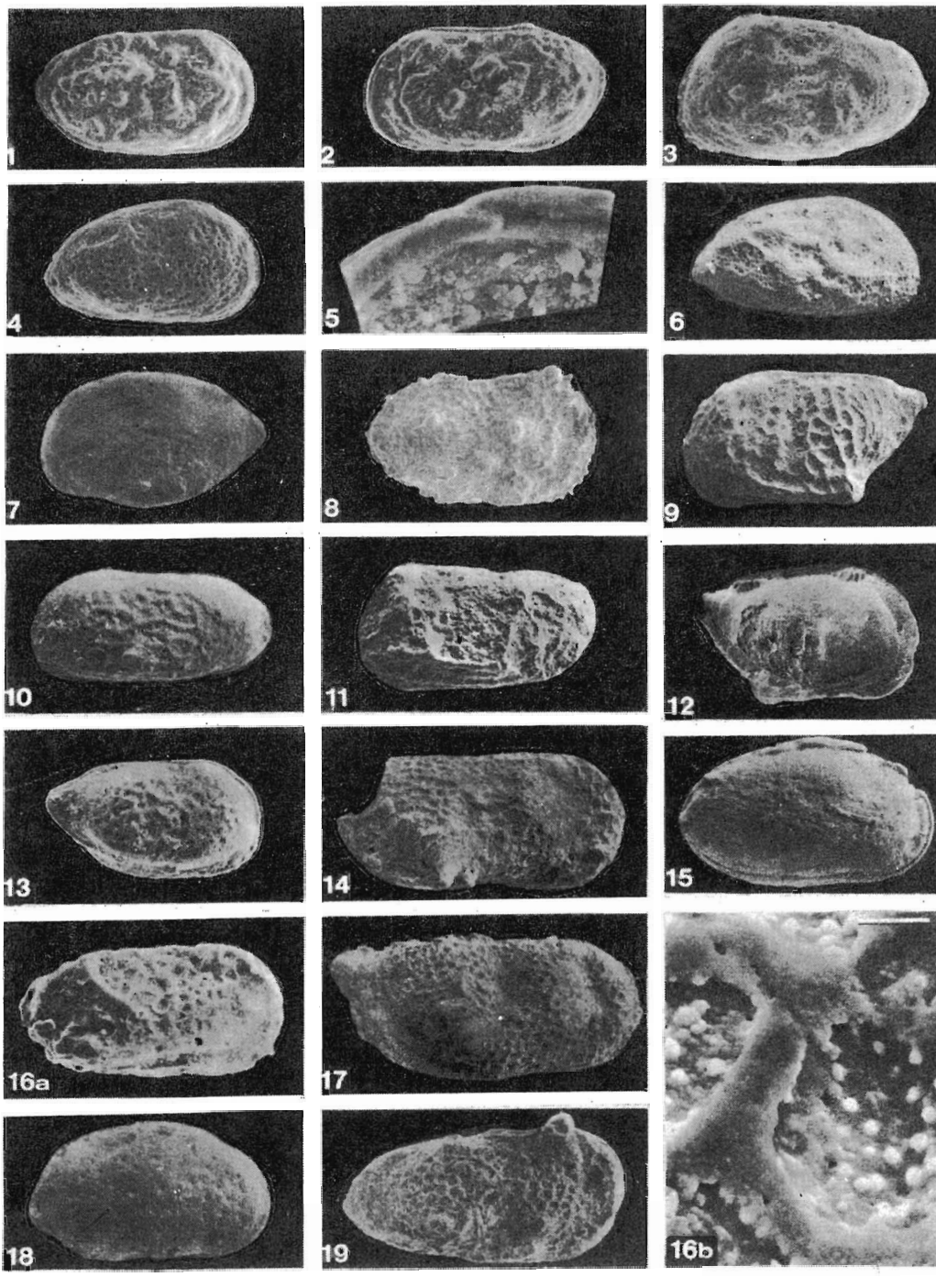
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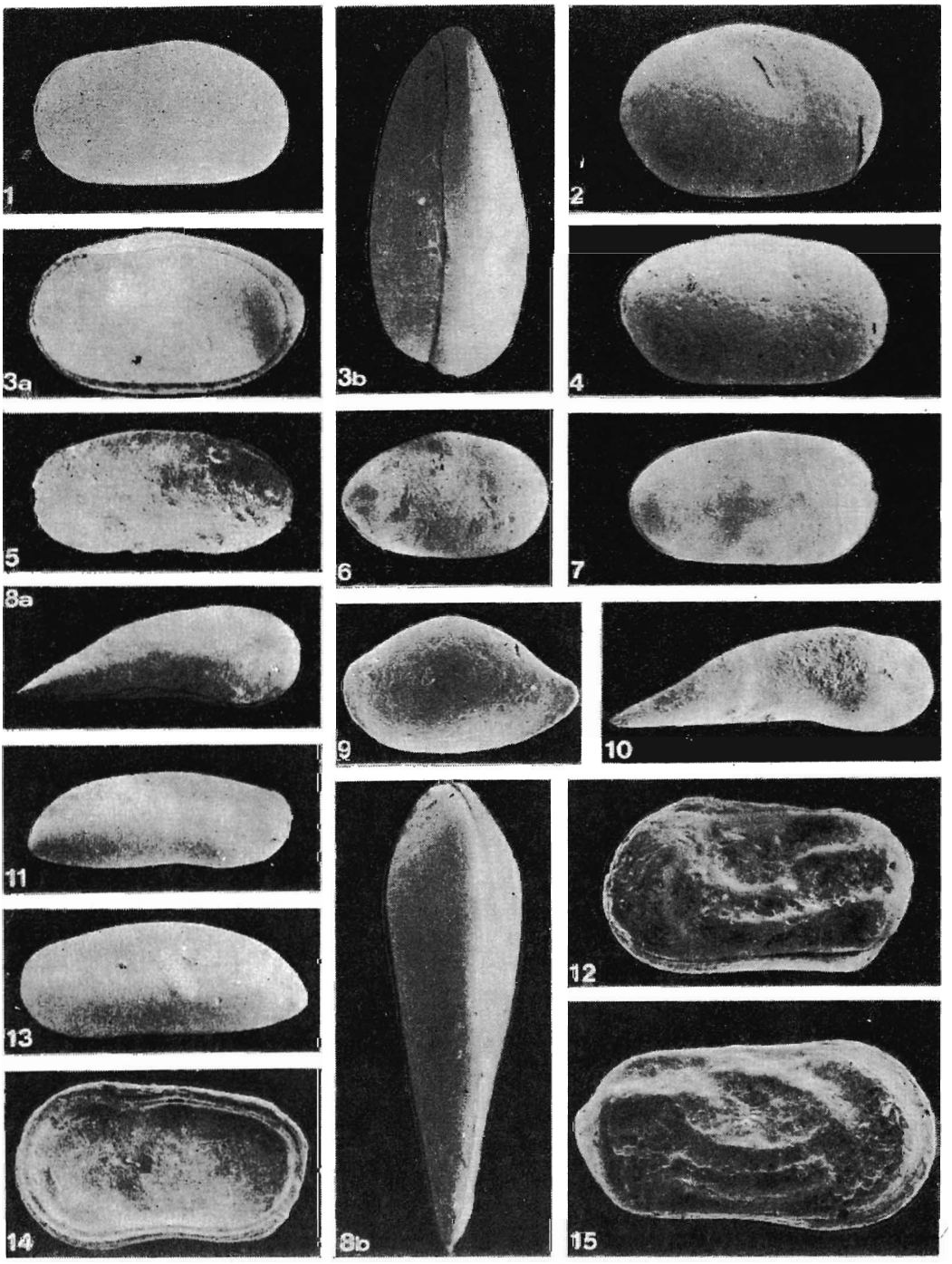
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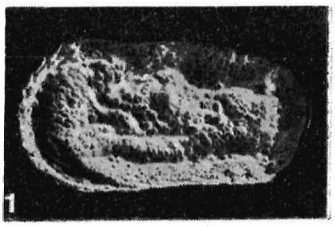
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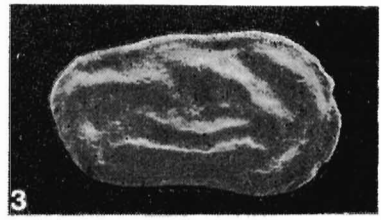
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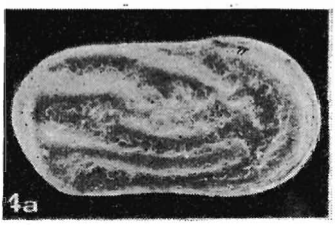
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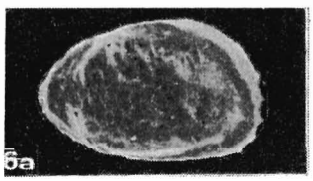
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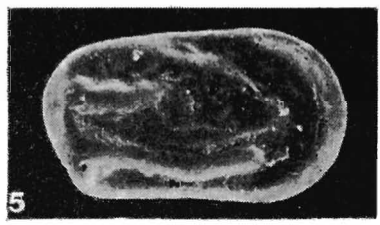
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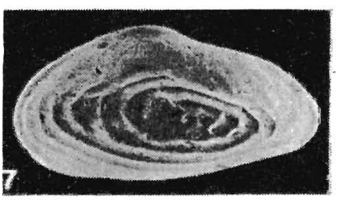
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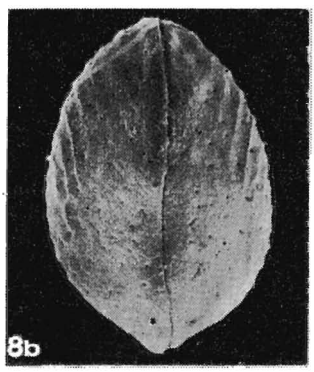
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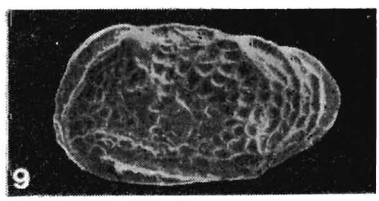
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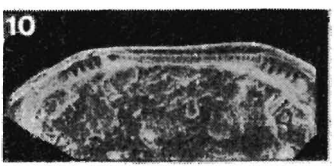
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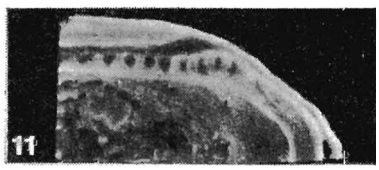
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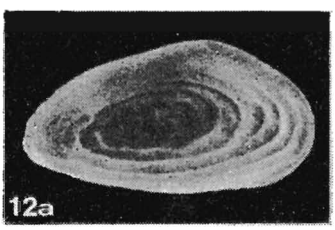
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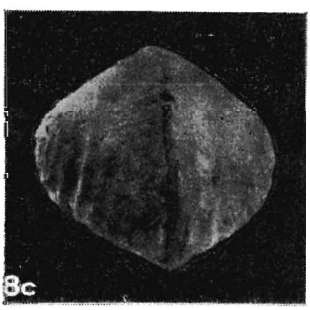
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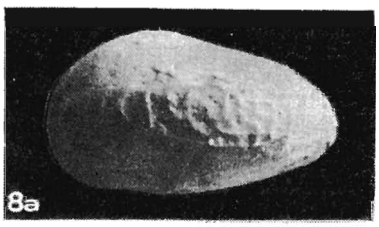
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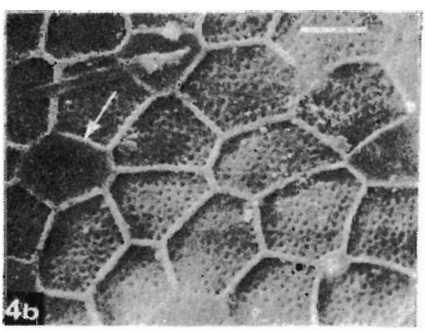
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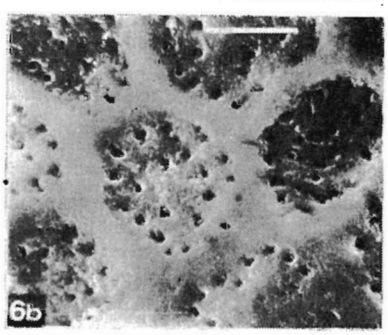
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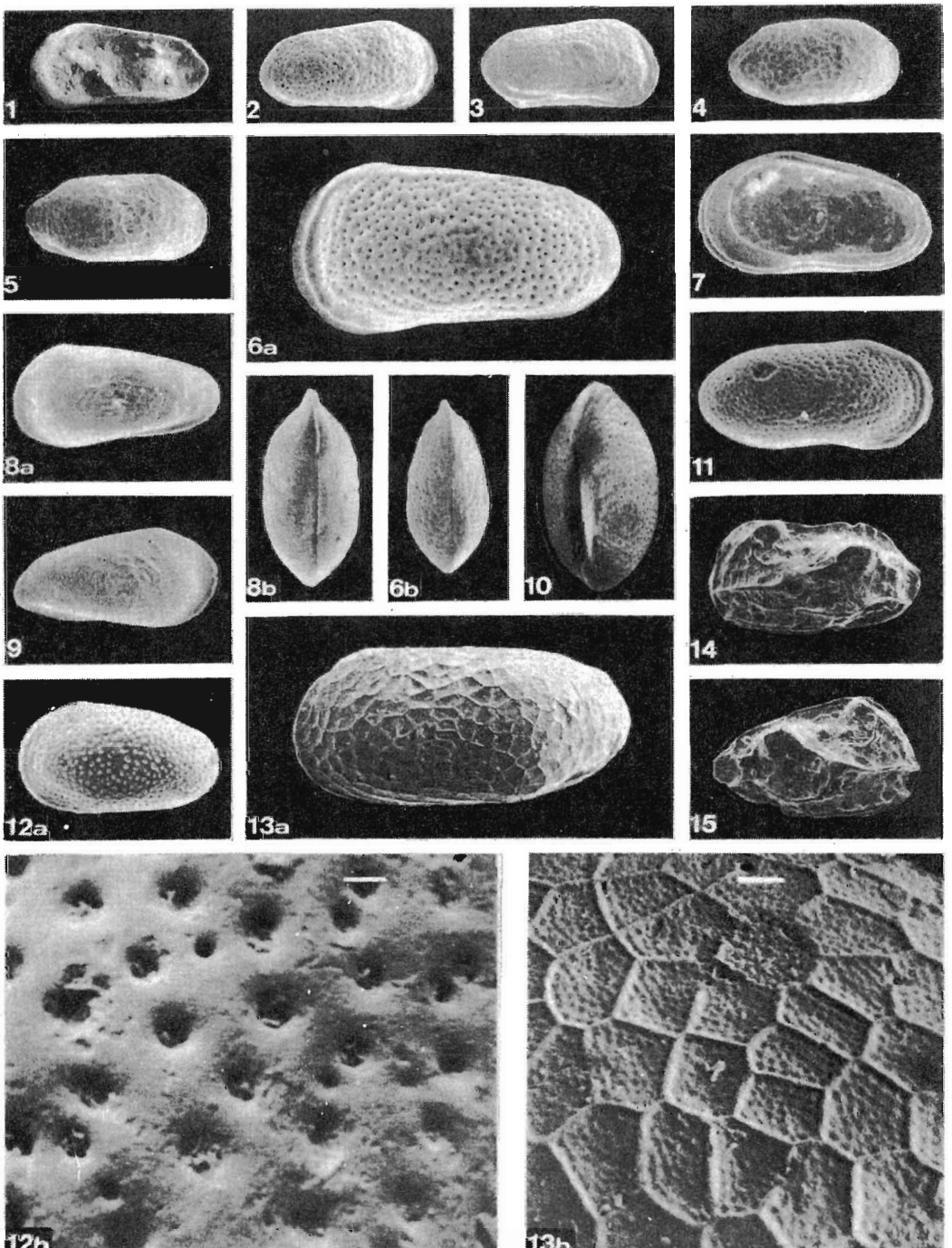
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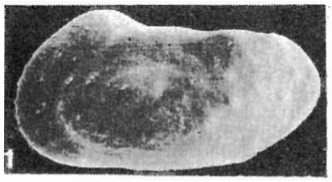
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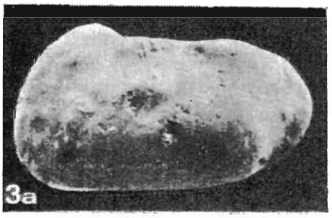
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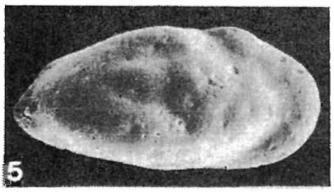
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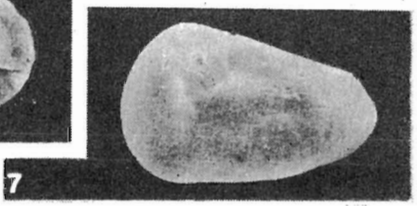
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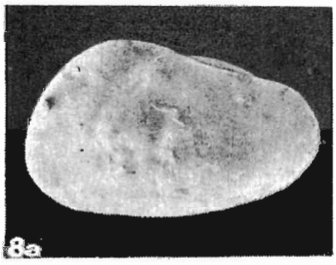
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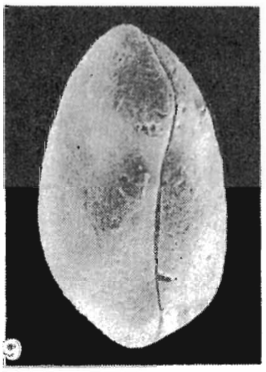
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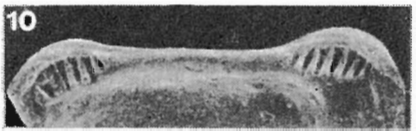
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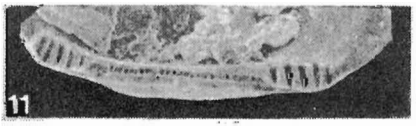
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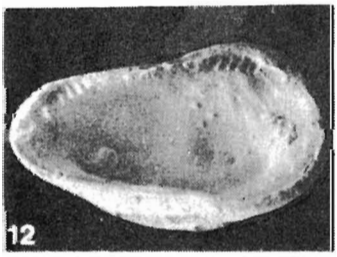
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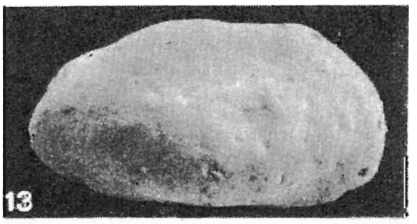
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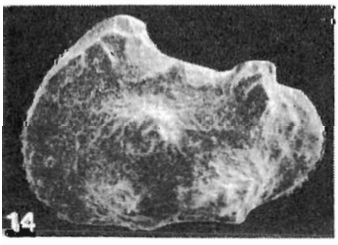
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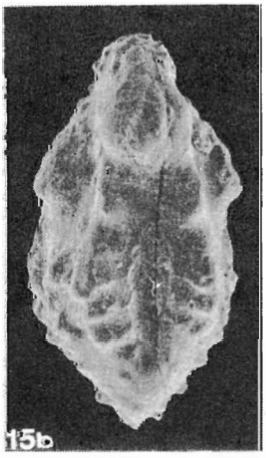
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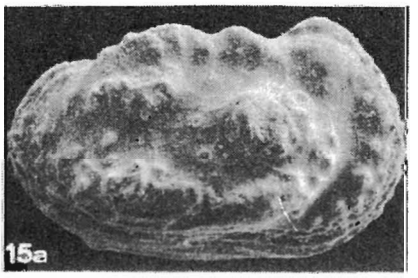
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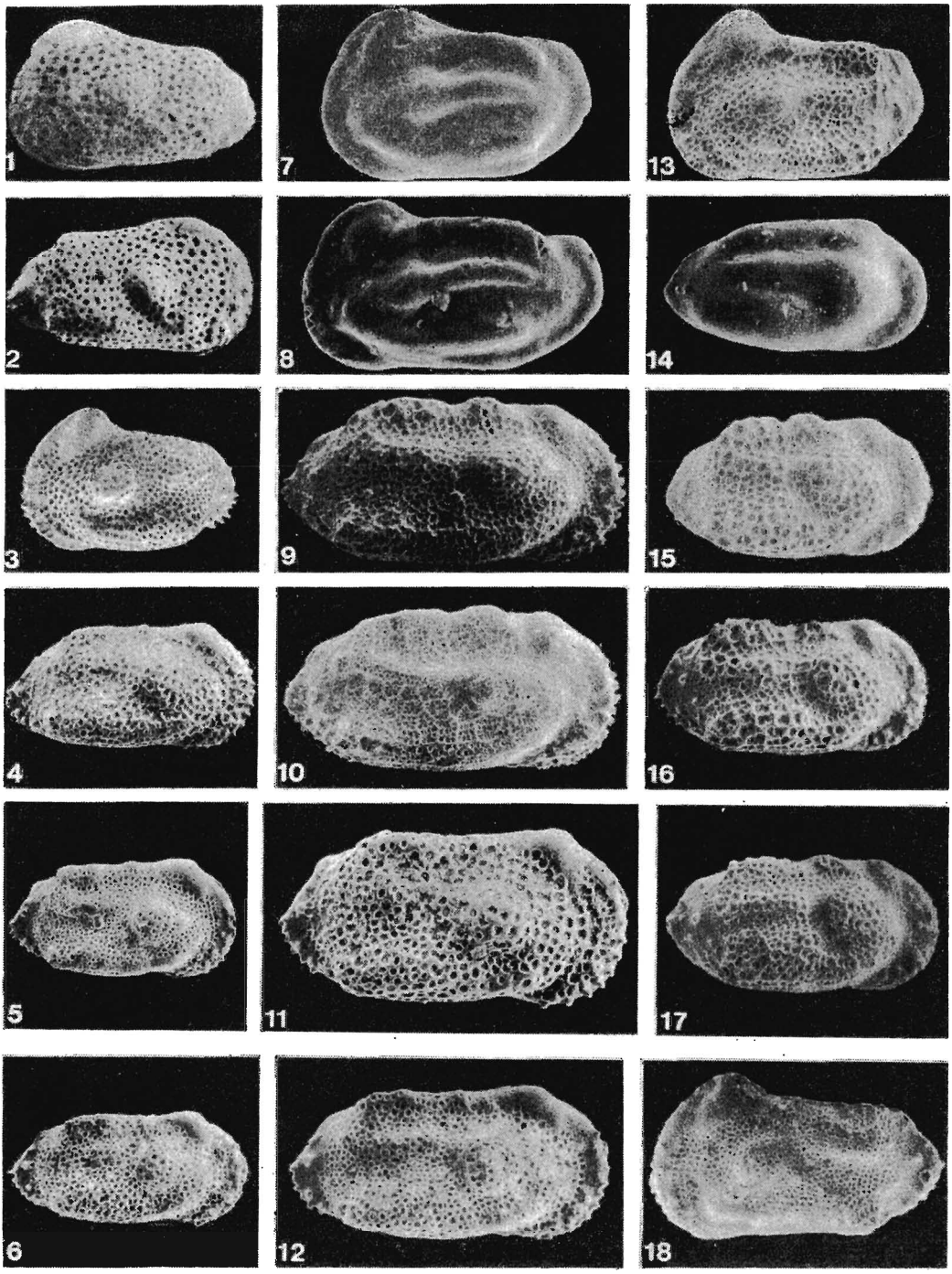
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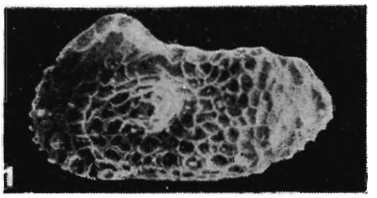
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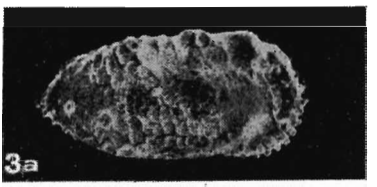
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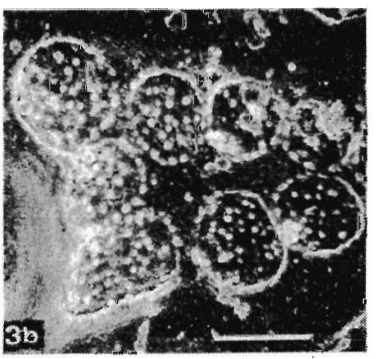
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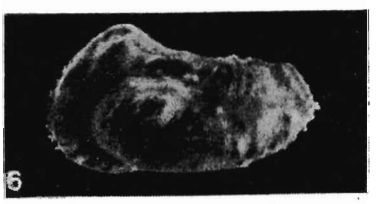
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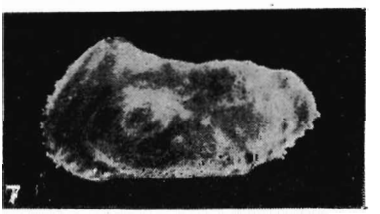
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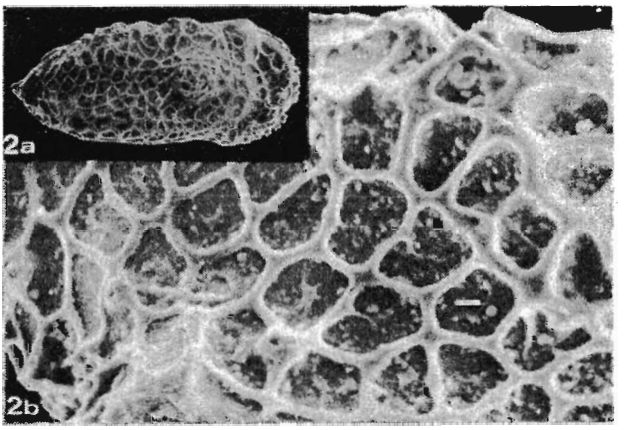
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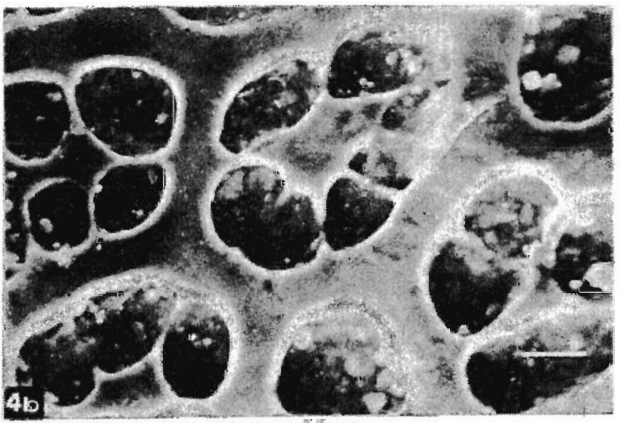
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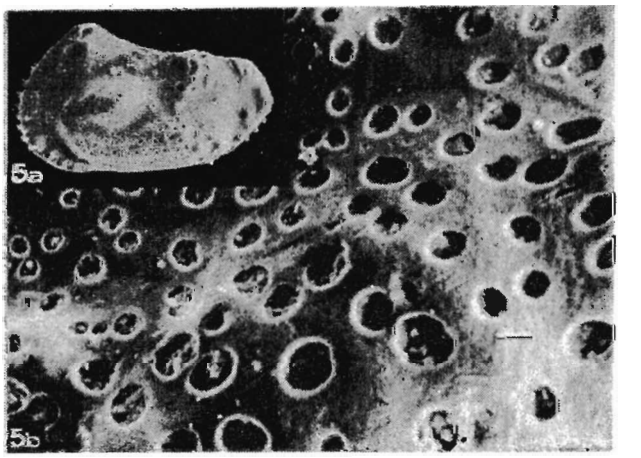
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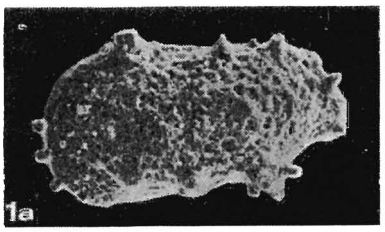
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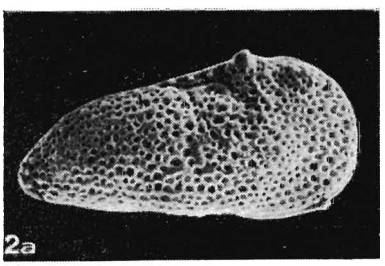
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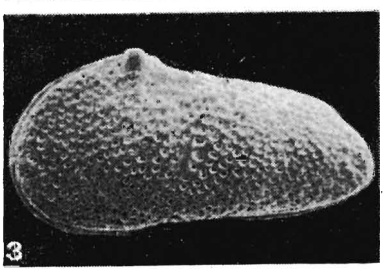
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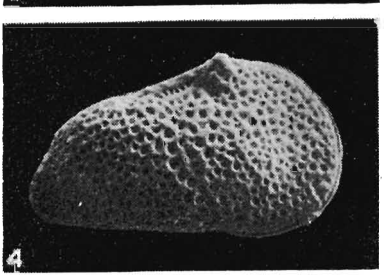
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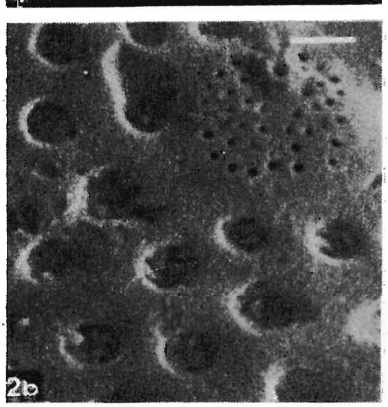
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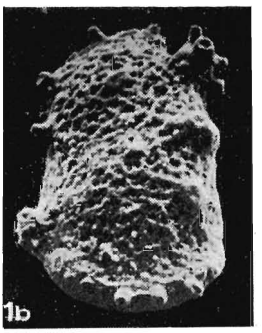
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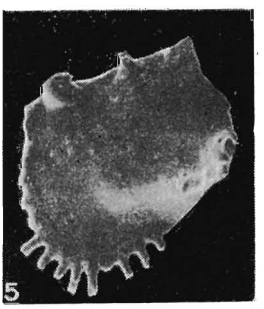
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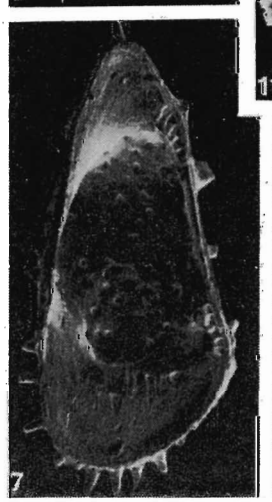
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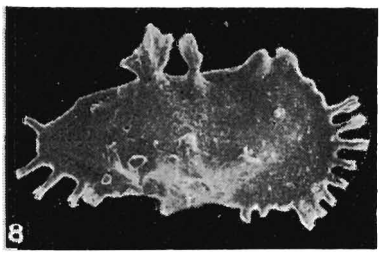
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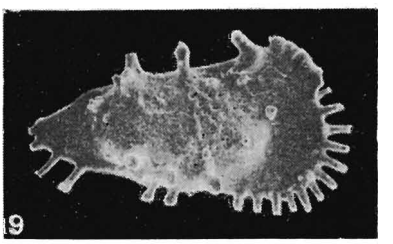
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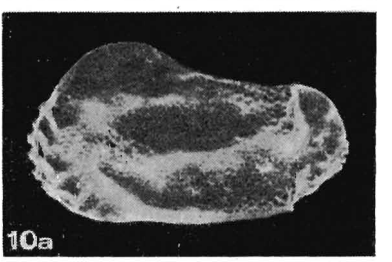
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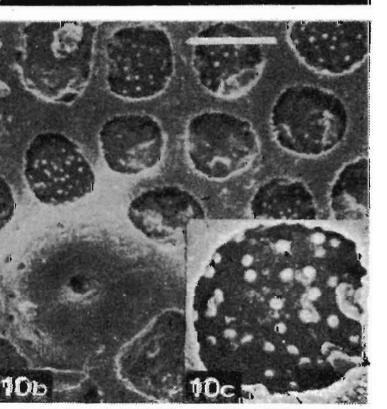
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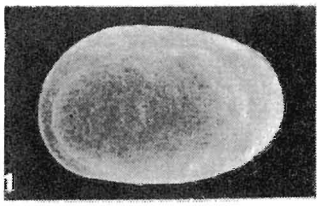
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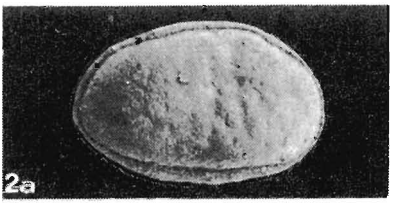
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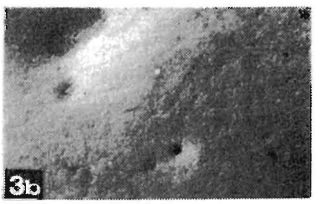
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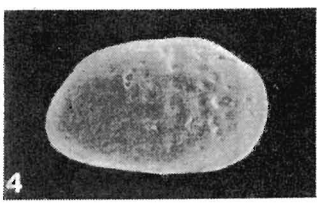
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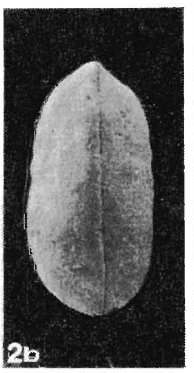
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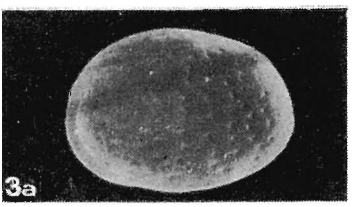
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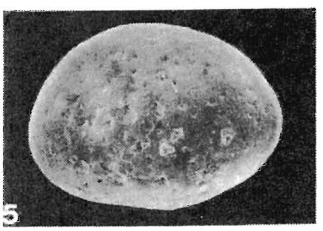
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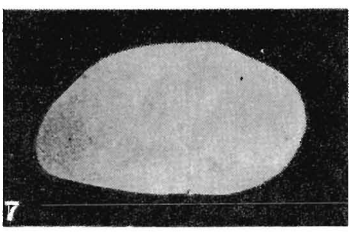
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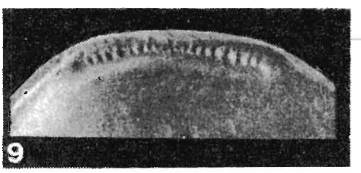
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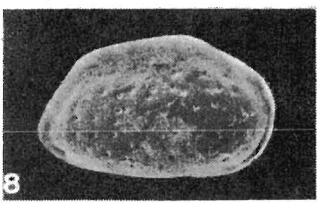
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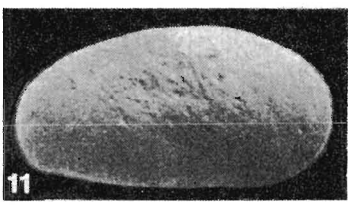
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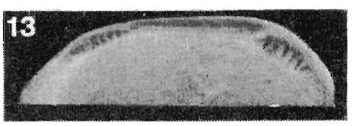
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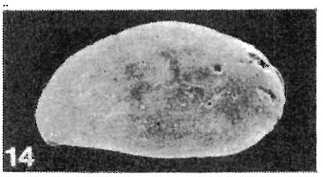
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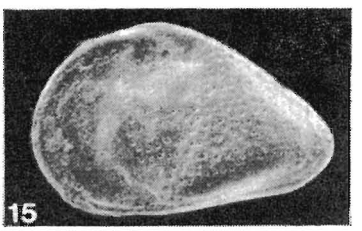
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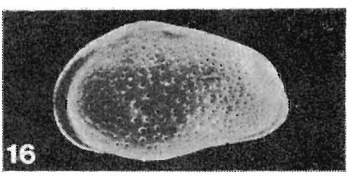
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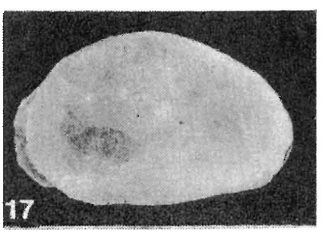
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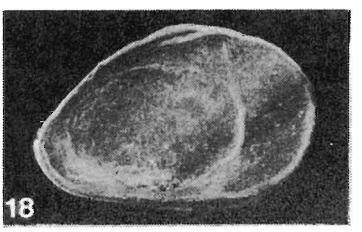
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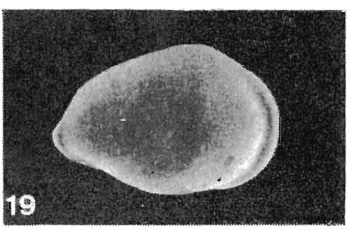
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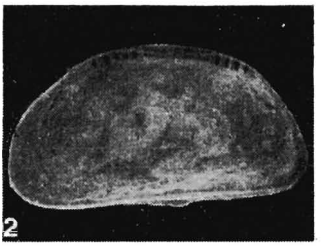
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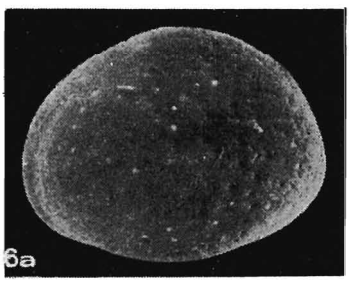
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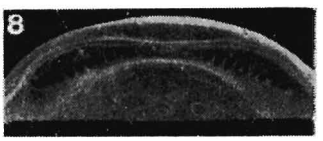
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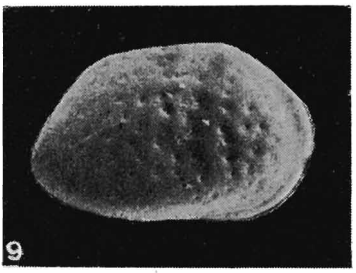
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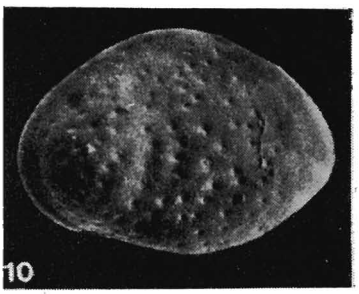
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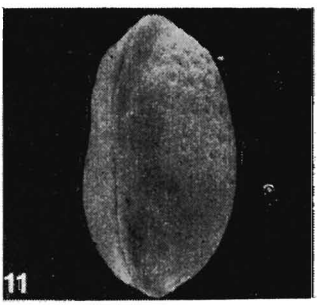
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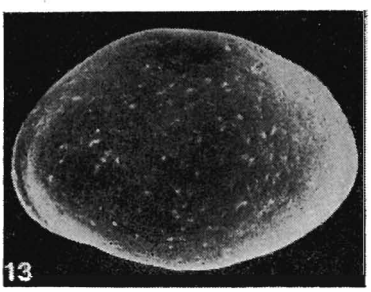
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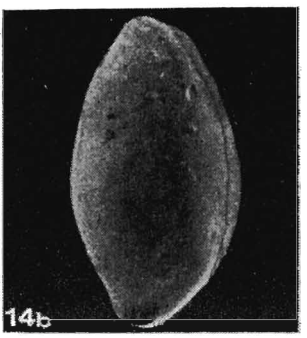
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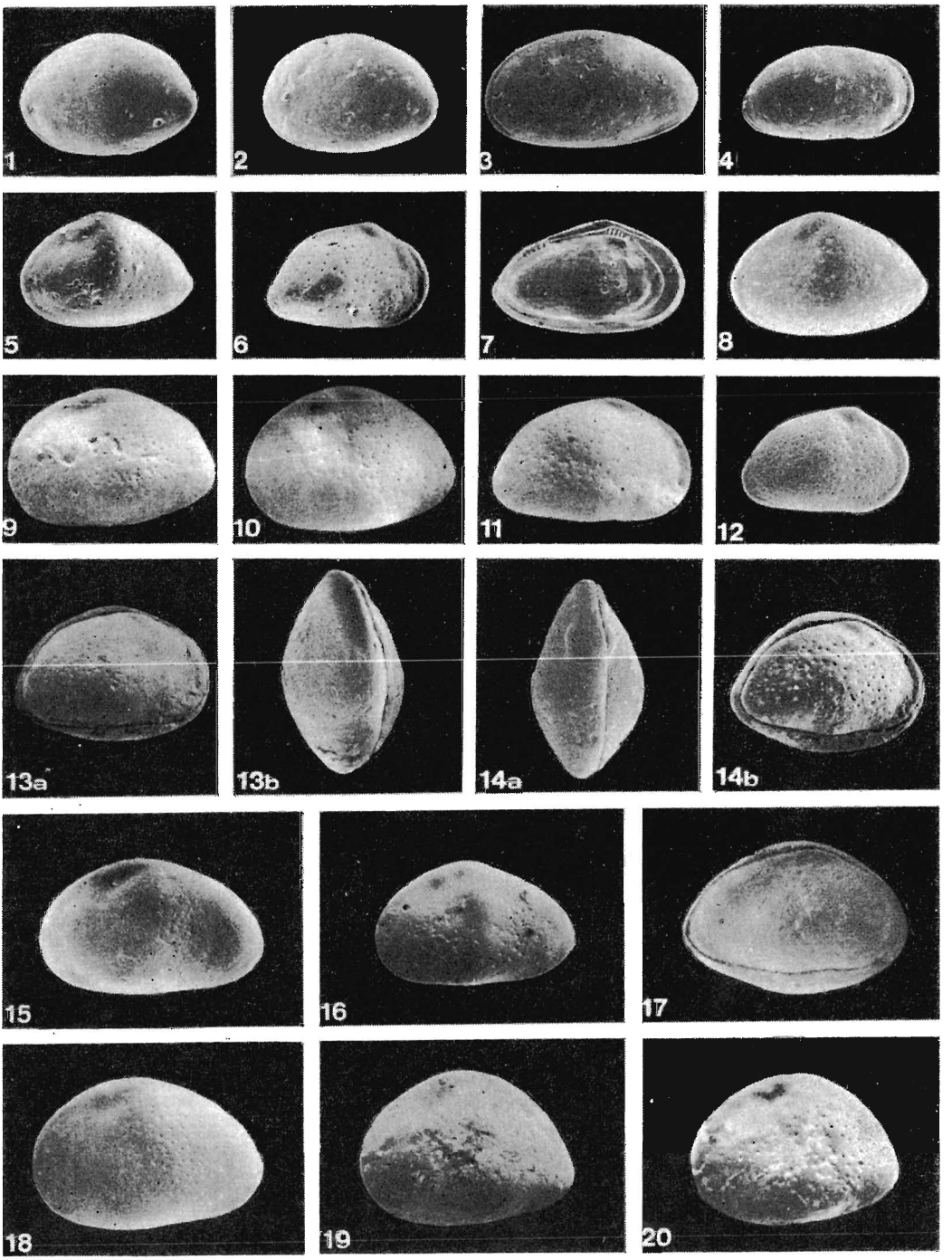
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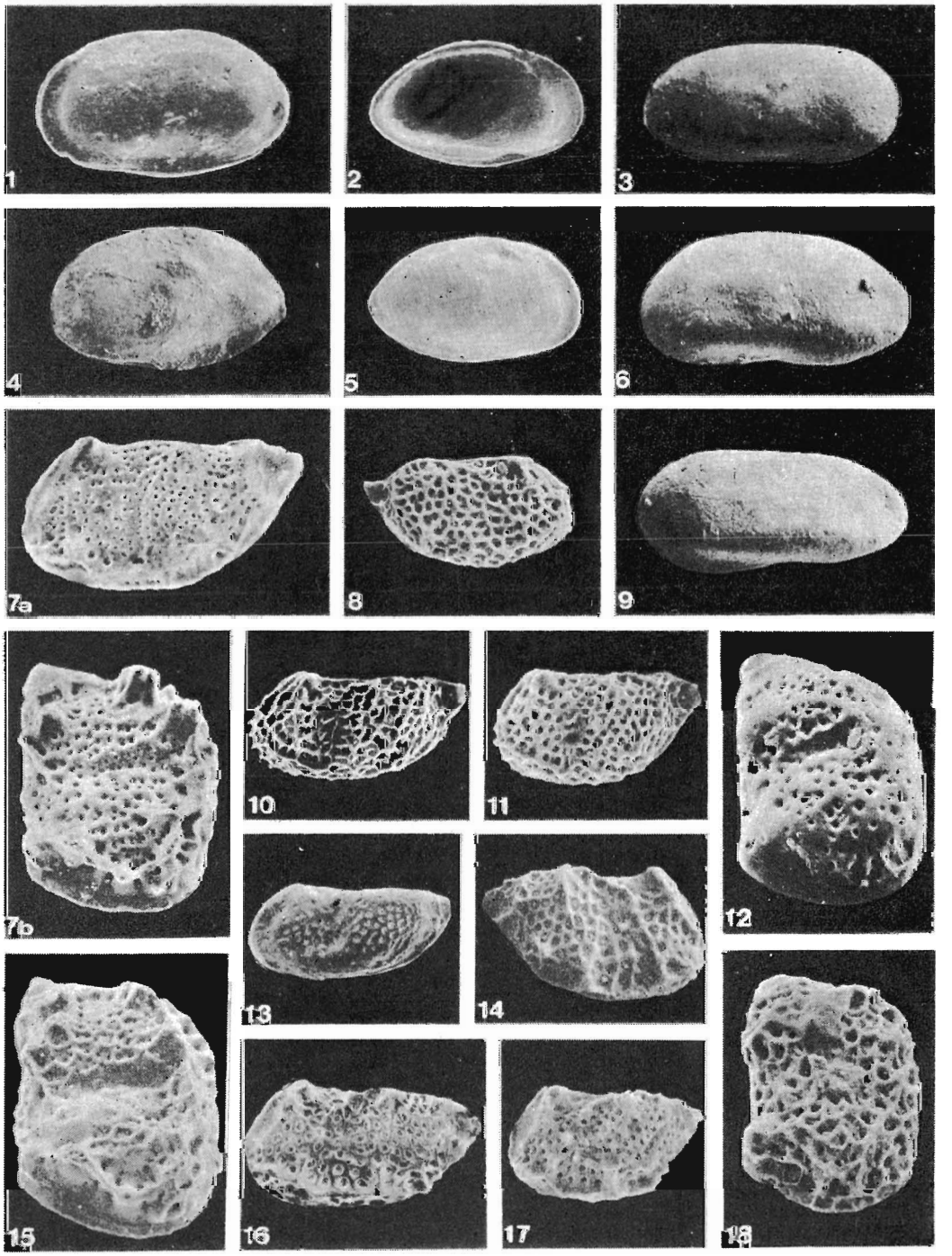
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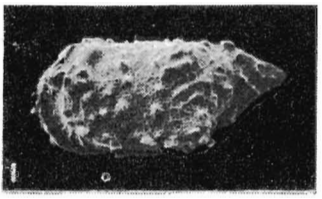
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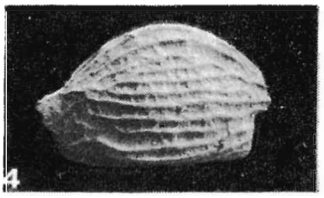
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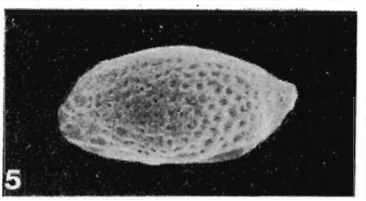
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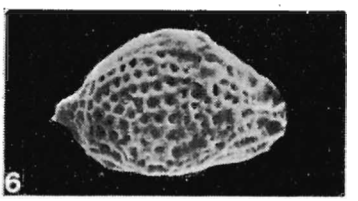
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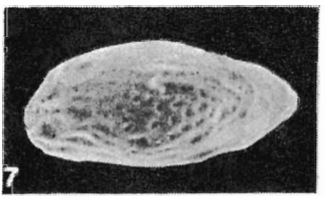
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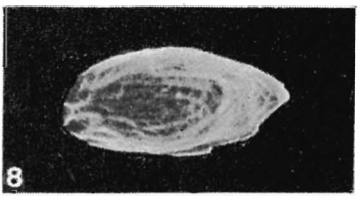
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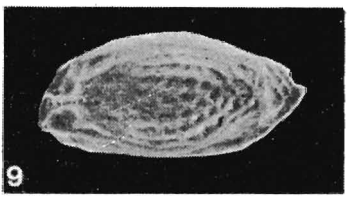
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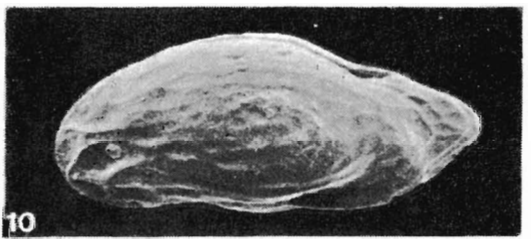
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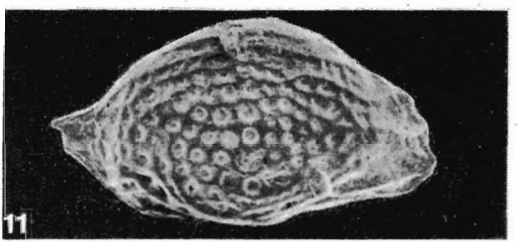
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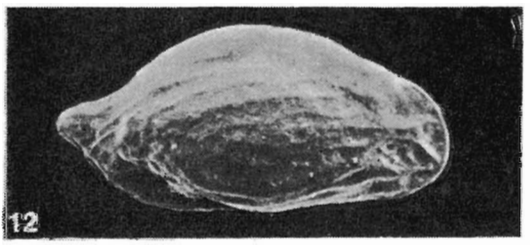
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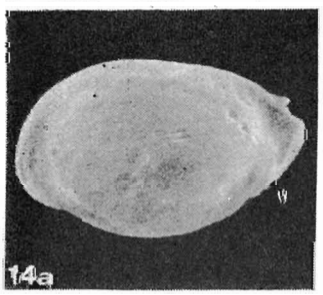
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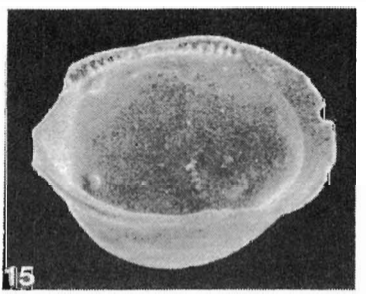
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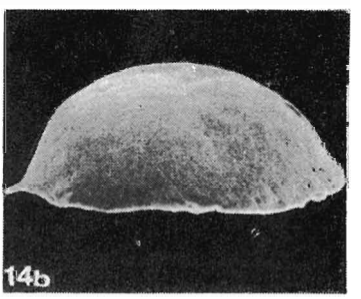
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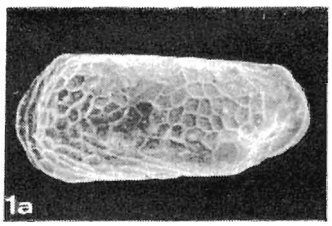
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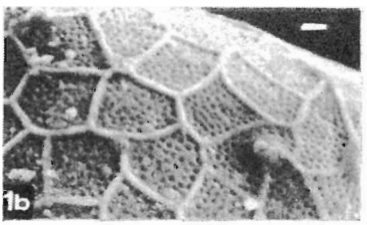
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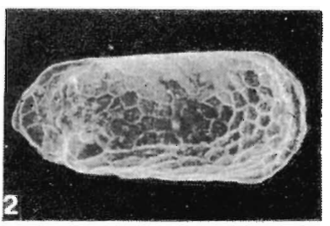
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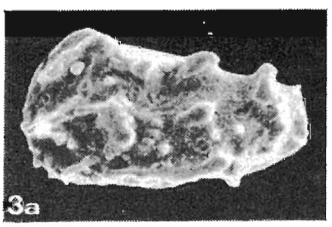
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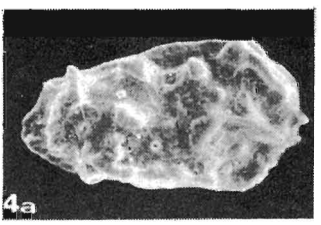
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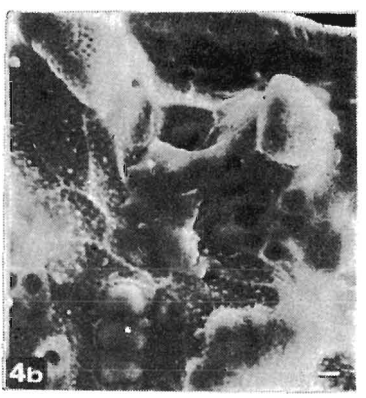
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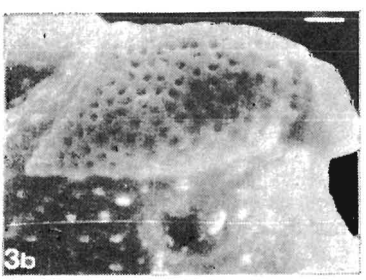
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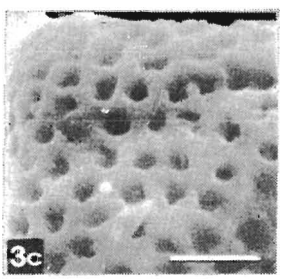
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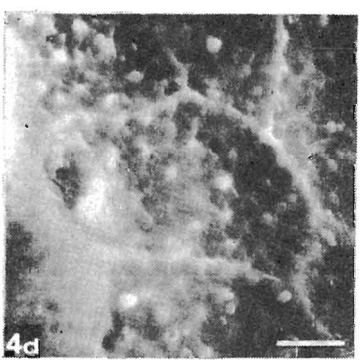
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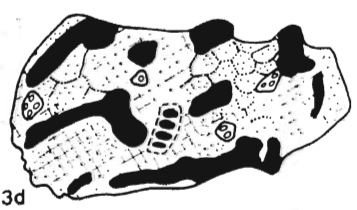
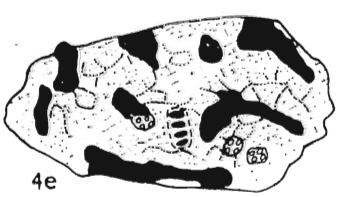

3d

muscle scars

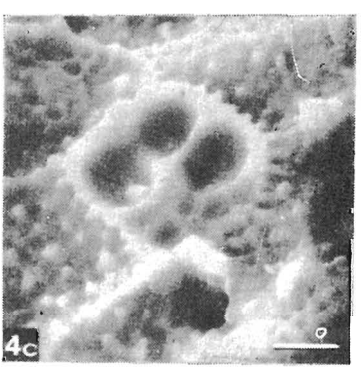
tegminal cover

0.3 mm

tegminal spot


4e

papillate fossae with finely reticulate sola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