acta
geologica
polonica

Vol. 26, No. 1 Warszawa 1976

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Some Valanginian ostracodes of the genus *Protocythere* Triebel, 1938, from Central Poland

ABSTRACT: Two new species of the genus *Protocythere* Triebel, viz. *Protocythere vonvalensis* sp. n. and *Protocythere lewinskii* sp. n. (including forma *lewinskii* and forma *bireticulata*), from Valanginian deposits of Wąwał are erected. In addition, *Protocythere helvetica* Oertli for the first time is reported from Poland. The morphology and the distribution patterns of normal pore-canals of the species under description are also discussed.

INTRODUCTION

The Wąwał clay-pit near Tomaszów Mazowiecki, on the northwest, Mesozoic margin of the Holy Cross Mts is the best exposure of the Neocomian strata in Central Poland. The deposits exposed at Wąwał are developed as black claystones, some of which contain phosphatic and sideritic nodules. The assemblage of reported ammonites points to Lower and Upper Valanginian age of the claystones (Lewiński 1932, Kokoszyńska 1956, Witkowski 1969).

The knowledge of the ostracode genus *Protocythere* Triebel from Wąwał has hitherto been limited to the records by Liszka (1948), Sztejn (1957) and Małecki (1960). The present paper describes these species of *Protocythere* which are new, or reported for the first time from this locality. An exceptionally good state of preservation of the collected specimens has made it possible to obtain some new data on the normal pore-canals of the genus *Protocythere* Triebel.

Acknowledgements. The author is greatly indebted to Professor A. Urbanek, University of Warsaw, and Dr. J. Szczechura, Polish Academy of Sciences, who guided her first steps in the ostracodes studies; she is also most obliged to Dr. H. J. Oertli, SNPA — Centre de Recherches in Pau, and to Dr. P. Donze, Laboratoire de Géologie, University of Lyon, for their valuable suggestions and providing comparative materials. A special expression of thanks is due to Geological and Mineralogi-

cal Institute at Leiden for supporting SEM-work; especially to Mr. H. Kammeraat, scan-operator, Mr. W. C. Laurijssen, chief photographer, and Mr. W. A. M. Deville, assistant photographer, for their technical advice and professional help.

DESCRIPTION OF THE MATERIAL

For the meaning of descriptive terms used in the present paper the reader should refer to Sylvester-Bradley & Benson (1971).

All the material figured in this paper is deposited in the collection of the Institute of Geology, University of Warsaw, under the numbers: W. 1. 275—276, 141, 144; W. 2. 135, 142—150, 265, 268—274; W. 10. 267; W. 12. 136—140, 266; W. 12a. 559—560, 562—565; W. 12b. 561.

The following abbreviations are used in the text:

C — carapace: *IV* — left valve, *RV* — right valve
n-1 penultimate instar; the younger instars indicated with *n-2*... *n-6* respectively
Sp — specimen measured
N — number of observations
Me — measurement: L — length, H — height
$\bar{X}$ — arithmetic mean
s — standard deviation
OR — observed range
GR — growth factor

Order **Podocopida** Müller, 1894
Suborder **Podocopina** Sars, 1886
Family **Cytheridae** Baird, 1850
Subfamily **Protocytherinae** Mandelstam, 1960
Genus *PROTOCYTHERE* Triebel, 1938
Type species: *Cytherina triplicata* (Roemer, 1840)
Protocythere helvetica Oertli, 1966
(Text-fig. 2H; Pl. 1, Figs 10—14; Pl. 5, Fig. 1a-b)

1966. *Protocythere helvetica* Oertli; Oertli, p. 107, Pl. 3, Figs 22—29.

Material. — More than one hundred valves and carapaces of adult instar and a few of penultimate instar.

Dimensions (in mm):

Sp	N	Me	$\bar{X}$	s	OR	L/H
LV_{σ}	24	L	0.863	0.0247	0.800–0.900	1.639–1.816
		H	0.491	0.0145	0.475–0.538	
LV_{φ}	25	L	0.783	0.0229	0.750–0.828	1.500–1.642
		H	0.499	0.0128	0.470–0.525	
RV_{σ}	22	L	0.848	0.0228	0.818–0.895	1.988–2.136
		H	0.414	0.0081	0.408–0.433	
RV_{φ}	32	L	0.779	0.0187	0.750–0.813	1.797–1.952
		H	0.417	0.0087	0.408–0.433	

Remarks. — There is little to add to the description by Oertli (1966, p. 107) of the species, except of some remarks on the juvenile specimens of penultimate instar, found in the investigated material from Wąwał (Pl. 1, Fig. 10). Juveniles differ from adults in more elongate outline of valves and less developed reticulation. The valve surface of the penultimate instar is reticulate over all, even in the region

of eye-tubercle which is smooth in adult. Adults apart from the first order reticulation corresponding with the reticulation of the juveniles possess second order reticulation (Pl. 1, Fig. 11b). Specimens from Wąwał are smaller in size than those from the Swiss Jura.

Occurrence. — Oertli (1966, Tab. 2) records the range of *Protocythere helvetica* from the Lower (except for the lowermost part) to the Upper Valanginian. At Wąwał, the species is common in strata of Lower through uppermost Valanginian age.

Protocythere vonvalensis sp. n.
(Text-fig. 2G; Pl. 1, Figs 1—9)

Holotype: C♂ (W. 1. 141), figured in Pl. 1, Fig. 1a-c.
Paratypes: LV♂ (W. 2. 143), LV♂ (W. 2. 147), LV♀ (W. 2. 145), LV♀ (W. 2. 146), C♀ (W. 2. 142), RV♀ (W. 1. 144), LV n-1 (W. 2. 149), RV n-1 (W. 2. 148); figured in Pl. 1, Figs 1—9.
Type horizon: Lower Valanginian, black claystones.
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: after type locality.

Diagnosis. — The species is characterized by its rather small carapace, valves inflated ventrally, median rib separated from the large muscle-scar node by the well-defined hemicircular depression, and pitted surface of the valves.

Material. — More than one hundred valves and carapaces of adult instar and a few of penultimate instar.

Dimensions (in mm):

Sp	N	Me	X̄	s	OR	L/H
LV♂	18	L	0.811	0.0129	0.790–0.838	1.780–1.622
		H	0.477	0.0123	0.463–0.500	
LV♀	29	L	0.756	0.0148	0.730–0.785	1.470–1.598
		H	0.494	0.0128	0.465–0.513	
RV♂	9	L	0.800	0.0148	0,780–0.823	1.960–2.084
		H	0.395	0.0075	0.382–0.410	
RV♀	18	L	0.737	0.0208	0.700–0.775	1.747–1.899
		H	0.405	0.0141	0.370–0.425	

Description. — Valves elongate, solid. Anterior end broadly rounded, posterior end of *LV* obtusely pointed dorsally, sometimes almost rounded, whereas posterior end of *RV* commonly pointed medially. Dorsal and ventral margins straight and subparallel. Lateral valve surface crossed by two longitudinal ribs. The dorsal rib is well-protruding. The median rib, separated from large muscle-scar node by well-defined hemicircular depression, contacts posteriorly with dorsal rib, forming in female valves a dorsal swelling. Valves inflated ventrally. Exterior of valves pitted (Pl. 1, Fig. 4b). The pits seem to be arranged in parallel rows to ventral margin in the ventral area of the valves (Pl. 1, Fig. 2). The anterior and posterior parts of valves rather smooth and topped (Pl. 1, Fig. 3b) with tiny tubercles which are the rimmed pore-canals. Anterior and posterior margins with short marginal denticles. There is some variation in coarseness of pitting among the studied specimens (cf. Pl. 1, Fig. 7 and 9). Inner margin and line of concrescence coincide. Marginal area moderately broad, anteriorly crossed by 24—26 simple radial pore-canals. Hinge structure and muscle-scar pattern like in the type species. Sexual dimorphism conspicuous; males are longer and narrower than females.

Ontogeny. — The juveniles of penultimate instar are similar in morphology of valves to the adults, however, they differ in the absence of the median rib and more

finely pitted valve surface. Muscle-scar node and hemicircular depression behind it, are well-marked in lateral surface of juvenile specimens.

Remarks. — In shape and valve morphology, especially of well-defined hemicircular depression and protruding muscle-scar node, the new species resembles *Protocythere* sp. 507 of Bartenstein & Brand (1951), and *Protocythere* aff. sp. 507 presented by Oertli (1966). It may be distinguished from these two forms by its larger valve size, more pronounced median rib and coarser pitting.

Occurrence. — The new species is common in Lower Valanginian, and rare in Upper Valanginian strata.

Protocythere lewinskii sp. n.
(Text-fig. 1; Text-fig. 2A-F; Tab. 1; Pl. 2, Figs 1—4; Pl. 3, Figs 1—6; Pl. 4, Figs 1—6; Pl. 6, Figs 1—6)

1957. *Cythereis senckenbergi* Trieb.; Sztejn, pp. 91—92, Pl. 14, Fig. 11la-c.
1960. *Protocythere propria* Sharapova; Małecki, pp. 110—111, Pl. 17, Fig. 1a-d.

Holotype: $C♂$ (W.2.268), figured in Pl. 2, Fig. 1a—c.
Paratypes: $LV♂$ (W.12.266), $LV♀$ (W.10.267), $C♀$ (W.2.265), figured in Pl. 2, Figs 1—14; juvenile forms (W.2.270—274), figured in Pl. 3, Figs 1—6 and $LV♂$ (W.12a.563), $LV♂$ (W.12b.561), $LV♀$ (W.12a.562), $RV♀$ (W.12a.560), $RV♀$ (W.12a.564), LV n-l (W.12a.559), figured in Pl. 4, Figs 1—6.
Type locality: Wąwał near Tomaszów Mazowiecki, Central Poland.
Derivation of the name: in honor of the late Professor Jan Lewiński, author of the classical monograph on the Neocomian of Poland.

Diagnosis. — The species is characterized by its large carapace, median rib which runs somewhat obliquelly across the lateral surface, being nearer the dorsal margin posteriorly wheares anteriorly it terminates immediately behind the muscle-scar node (in forma *lewinskii*) or joins with the muscle-scar node (in forma *bireticulata*), straight and subparallel dorsal and ventral ribs, and pitted (in forma *lewinskii*) or bireticulated (in forma *bireticulata*) ornamentation of the valves.

Material. — About three hundred valves and carapaces of various instars of forma *lewinskii* and 15 valves of adult and penultimate instar of forma *bireticulata*.

Dimensions. — The measurements of the specimens of *Protocythere lewinskii* sp. n., forma *lewinskii* are presented in the table to follow.

Description. — Valves elongate, massive. Anterior end broadly rounded, posterior end slightly truncate to rounded in *LV*, whereas in *RV* narrowly rounded. Dorsal and ventral margins straight and subparallel. Lateral surface crossed by three prominent longitudinal ribs. The dorsal and ventral ribs subparallel. The median rib joins posteriorly with dorsal rib, anteriorly it terminates immediately behind the muscle-scar node or joins with it. Ornamentation varied. Specimens may be pitted over all (Pl. 2, Fig. 2b) or bireticulated (Pl. 4, Fig. 3b); pits are arranged in rows parallel to ventral margin in the ventral surface of the valves (Pl. 2, Fig. 4). The anterior and posterior parts of the valves are topped with a few tiny tubercles (Pl. 2, Fig. 2b; Pl. 4, Fig. 2b) which are the rimmed pore-canals. Anterior and posterior margins with short, solid marginal denticles which bear terminal pores (Pl. 4, Fig. 2a). Inner margin and line of concrescence coincide. Marginal area moderately broad and crossed anteriorly by about 30 simple radial pore-canals. Hinge structure (Pl. 4, Fig. 4) and muscle-scar pattern like in the type species. Sexual dimorphism is conspicuous; the males are longer and narrower than the females.

Ontogeny. — Various changes in valve morphology of the studied specimens, apart from size (Fig. 1), have been observed within the recognized seven instars.

Sp	N	Ma	$\bar{X}$	s	OR	L/H	GR
LV♂	19	L	1.008	0.0196	0.973–1.060	1.645–1.778	1.355
		H	0.596	0.0140	0.583–0.613		1.209
LV♀	25	L	0.903	0.0210	0.850–0.935	1.468–1.560	1.214
		H	0.603	0.0156	0.558–0.603		1.223
LV n–1	52	L	0.744	0.0328	0.668–0.813	1.443–1.584	1.324
		H	0.493	0.0138	0.445–0.515		1.311
LV n–2	18	L	0.562	0.0165	0.533–0.595	1.447–1.534	1.298
		H	0.376	0.0102	0.365–0.393		1.314
LV n–3	11	L	0.433	0.0118	0.415–0.456	1.459–1.561	1.230
		H	0.286	0.0100	0.270–0.300		1.254
LV n–4	15	L	0.353	0.0177	0.330–0.380	1.484–1.614	1.197
		H	0.228	0.0116	0.210–0.250		1.117
LV n–5	7	L	0.294	0.0090	0.288–0.310	1.415–1.450	1.153
		H	0.204	0.0040	0.198–0.208		1.062
LV n–6	8	L	0.255	0.0070	0.250–0.270	1.300–1.385	
		H	0.192	0.0000	0.195–0.200		
RV♂	13	L	0.996	0.0173	0.963–1.033	1.945–2.083	1.387
		H	0.492	0.0088	0.475–0.503		1.208
RV♀	24	L	0.874	0.0157	0.843–0.903	1.741–1.849	1.217
		H	0.484	0.0076	0.470–0.493		1.189
RV n–1	41	L	0.718	0.0341	0.660–0.770	1.686–1.808	1.230
		H	0.407	0.0157	0.380–0.435		1.240
RV n–2	11	L	0.540	0.0168	0.518–0.570	1.604–1.723	1.265
		H	0.328	0.0093	0.305–0.338		1.317
RV n–3	5	L	0.427	0.0124	0.410–0.440	1.640–1.706	1.233
		H	0.249	0.0022	0.245–0.250		1.158
RV n–4	9	L	0.349	0.0092	0.335–0.363	1.600–1.675	1.167
		H	0.215	0.0086	0.203–0.225		1.125
RV n–5	6	L	0.299	0.0113	0.288–0.313	1.487–1.632	1.211
		H	0.191	0.0032	0.188–0.195		1.104
RV n–6	7	L	0.247	0.0151	0.230–0.270	1.353–1.461	
		H	0.173	0.0053	0.168–0.180		

of *P. lewinskii* sp.n., forma *lewinskii*. The main developments in the ontogeny are summarized as follows:

- A change in outline, as the result of the increase in height of anterior end (compare growth factors in height in Table).
- A steady replacement of narrow anterior and posterior marginal flanges, characteristic of the youngest instars (Pl. 3, Figs 5–6), by marginal denticles in instar *n*–3; instar *n*–2 possesses solid short denticles.
- A steady increase in the prominence of features of valve morphology: protruding posterodorsal and posteroventral spines observed in instars *n*–6 and *n*–5 (Pl. 3, Figs 5–6) turn into swellings topped with spines in instars *n*–4 and *n*–5, and, finally, into well-defined posterodorsal and posteroventral part of dorsal and respectively ventral rib. Median rib appears as a distinct feature of the valve morphology in instar *n*–2 (Pl. 3, Fig. 2).
- Presence of marked muscle-scar node in all instars studied.
- A steady replacement of normal pore-canals with raised openings by those the openings of which are flush with the external surface of the valve. In instars *n*–6 and *n*–5, all pore-canals are rimmed (in instar *n*–6 only some of them, *cf.* Pl. 3, Fig. 4), whereas in adult instar, only "*Porenkegel*" and pores in the anterior and posterior parts of the valve.
- Polymorphism of normal pores (*cf.* Pl. 6, Figs 1–2 and 3–4, 6).

— A steady but not regular increase in the number of normal pore-canals (observed in the lateral surface of *LV* in the successive instars) from 11 in instar *n—6* to 64 in adult; for other instars 13, 18, 26, 28, and 51 respectively.
— An increase in the valve dimensions (*cf.* the growth factors in Table).
— A probable occurrence of sexual dimorphism in instar *n—1* which is suggested by the greatest variability of valve dimensions among the various instars studied (*cf.* the standard deviations in Table).

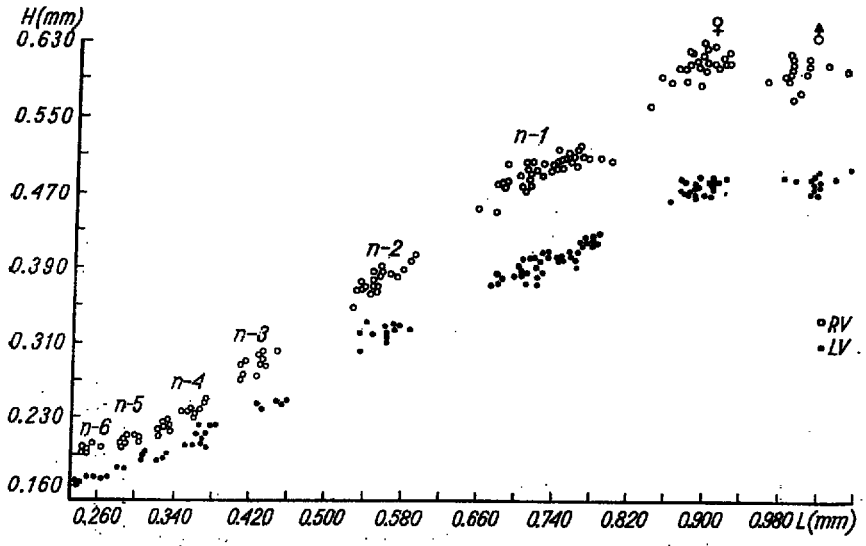

Fig. 1. Scattergram of height (*H*) and length (*L*) of valves of *Protocythere lewinskii* sp. n., forma *lewinskii*; all specimens from the same sample

Remarks. — The specimens included into the new species were previously regarded by Sztejn (1957) as *Cythereis senckenbergi* Trieb., although they differ considerably from the latter in hinge structure. Małecki (1960) assigned the forms described by Sztejn to *Protocythere propria* Sharapova basing on the specimens recorded from the Valanginian of Germany as *P. propria*, forms *a* and *b* by Bartenstein & Brand (1951). The German forms were redescribed by Bartenstein (1959, pp. 235—237) and referred to the subspecies *pseudopropria* and *saxonica*, respectively, of his species *P. pseudopropria*. The form described as *P. pseudopropria saxonica* by Bartenstein was subsequently placed by Oertli (1966) in *Protocythere saxonica* Bartenstein & Brand (1959). The species *P. lewinskii* sp. n. differs from *P. pseudopropria* s.s. primarily in the path of ventral rib which runs parallel to ventral margin in the first species and slightly hangs down in the latter. Additionally, both species differ in size, valve proportions and pitting of the valve surface. It may be distinguished from *P. saxonica* by its outline of the posterior margin which is pointed more ventrally in *P. saxonica*. On the other hand, *P. lewinskii*, forma *lewinskii* closely resembles in its valve shape *P. reicheli* Oertli (1966); however, it differs in a longer and more distinctively pronounced median rib and coarser pitting. It is similar to *P. vonvalensis* sp. n. in the valve morphology but is larger, has less inflated valves ventrally and more prominant median rib, moreover it differs in the number of the anterior radial pore-canals and the distribution of normal pore-canals (compare in Fig. 2: *C* and *A*, *G*). The specimens of *P. lewinskii* forma *bireticulata* are very similar in valve ornament to *P. entremontensis* Donze (1973). The main difference between both lies in outline of the posterior margin which is

more filled out posteroventrally, especially in *RV* of *P. entremontensiss*, and in valve proportions; specimens from Wąwał are higher and wider than the French specimens.

The slight differences in valve ornamentation of forma *lewinskii* and forma *bireticulata* seem to result from different ecological conditions.

Occurrence. — The species *P. lewinskii* sp. n., forma *lewinskii* is common in strata of Lower through Upper Valanginian age, whereas forma *bireticulata* is confined to the uppermost Valanginian.

GENERAL REMARKS ON THE MORPHOLOGY AND DISTRIBUTION PATTERNS OF NORMAL PORE-CANALS

According to van Morkhoven (1963), the genus *Protocythere* Triebel, 1938, posseses open type of normal pore-canals; however in the species *Protocythere lewinskii* sp. n., at least some of the pores (Pl. 6, Figs 3—6) are definitely of the sieve type. Normal pore-canals, supposedly of the sieve type (Pl. 6, Figs 1—2), observed in the juvenile specimens (Pl. 3, Figs 5 and 6a) of the species, are different from those observed in the adults. It seems that *P. helvetica* Oertli has open type of normal pore--canals (Pl. 5, Fig. 1a). On the wall of one of the pore-canals (Pl. 5, Fig. 1b), a particular pattern of "slots" has been noticed. It is difficult, however, to say if there is any relation between those slots and "tiny pores" (Pl. 1, Fig. 11b) surrounding normal pore-canals. As mentioned by van Morkhoven (1962), and showed by Plusquellec & Sandberg (1969) and Hanai (1970), the distribution pattern of normal pore-canals is, in general, very similar in all specimens of the same species. In the present paper, it is showed (Fig. 2B, D—F) for some specimens of the genus *Protocythere*.

The distribution patterns of normal pore-canals of the species under description refer to a defined area of the valve surface. The area chosen is enclosed by three rimmed normal pore-canals (the *"Porenkegel"* of Triebel, 1940), and a muscle-scar node. Three *"Porenkegel"* as well as the muscle-scar node have constant position on the valve surface of the *Protocythere* species (*cf.* Fig. 2; and Oertli 1966, Fig. 1). Moreover, the area under consideration is of marked differences in valve morphology among various species of the genus *Protocythere*.

The analysis of the distribution patterns of normal pore-canals shows (Fig. 2) that:

i) number of normal pores is almost identical for all species;

ii) distribution patterns are of a great similarity, still traceable between various species;

iii) there is a clear tendency of normal pores to follow prominent features of the valve morphology.

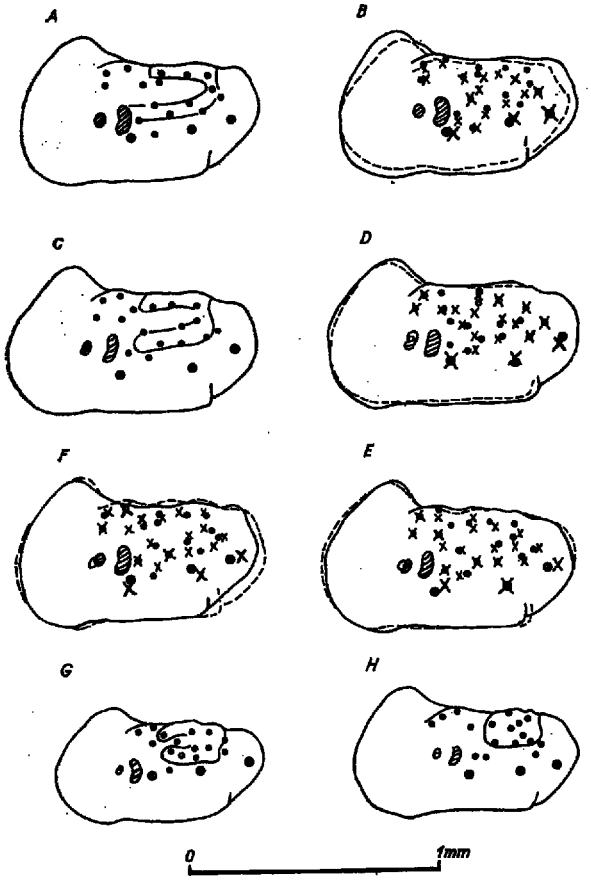

Fig. 2. Distribution patterns of normal pore-canals in the defined areas of the valves of *Protocythere* species (only LV♂)

P. lewinskii sp. n., forma *bireticulata*: **A** — specimen W.12a.565, **B** — W.12a.565, solid line; W.12a.563, broken line; uppermost Valanginian

P. lewinskii sp. n., forma *lewinskii*: **C** — W.12.266; Upper Valanginian; **D** — W.1.275, solid line; W.1.276, broken line; Lower Valanginian; **E** — W.12.266, solid line; Upper Valanginian; W.1.275, broken line; Lower Valanginian; **F** — specimen figured in *A* (solid line), in *C* (broken line)

P. vonvalensis sp. n.: **G** — W.2.150; Lower Valanginian; *P. helvetica* Oertli: **H** — W.12.136; Upper Valanginian

The hatched areas indicate positions of the muscle scars. Small black dots, or small crosses, represent relative positions of normal pore-canals, the larger ones represent positions of *"Porenkegel"*

Little is hitherto known about distribution patterns of normal pore-canals and polymorphism of pores among the known species of the genus *Protocythere* Triebel to discuss their importance in the taxanomy of this genus.

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MAŁŻORACZKI Z RODZAJU *PROTOCYTHERE* TRIEBEL Z WĄWAŁU KOŁO TOMASZOWA MAZOWIECKIEGO

(Streszczenie)

Przedmiotem pracy jest opis dwóch nowych gatunków małżoraczków: *Protocythere vonvalensis* sp. n. i *Protocythere lewinskii* sp. n. (forma *lewinskii* i forma *bireticulata*) oraz gatunku *Protocythere helvetica* Oertli, zasygnalizowanego po raz pierwszy z terenów Polski. Badany materiał pochodzi z iłów walanżynu (*por.* Lewiński 1932, Kokoszyńska 1956, Witkowski 1969) odsłaniających się w cegielni Wąwał k. Tomaszowa Mazowieckiego.

Doskonały stan zachowania okazów (*por.* fig. 1 oraz pl. 1—4) pozwolił na prześledzenie zróżnicowania morfologicznego kanałów porowych bocznych (pl. 5—6) oraz na analizę ich rozmieszczenia (fig. 2) na powierzchni skorupek. Obecność kanałów porowych bocznych typu sitowego (pl. 6, fig. 3—6), stwierdzona dla gatunku *Protocythere lewinskii* sp. n., pozwala na zmianę dotychczasowego poglądu (van Morkhoven 1963) o jedynie prostym typie tych kanałów, charakteryzującym rodzaj *Protocythere* Triebel.

PLATE 1

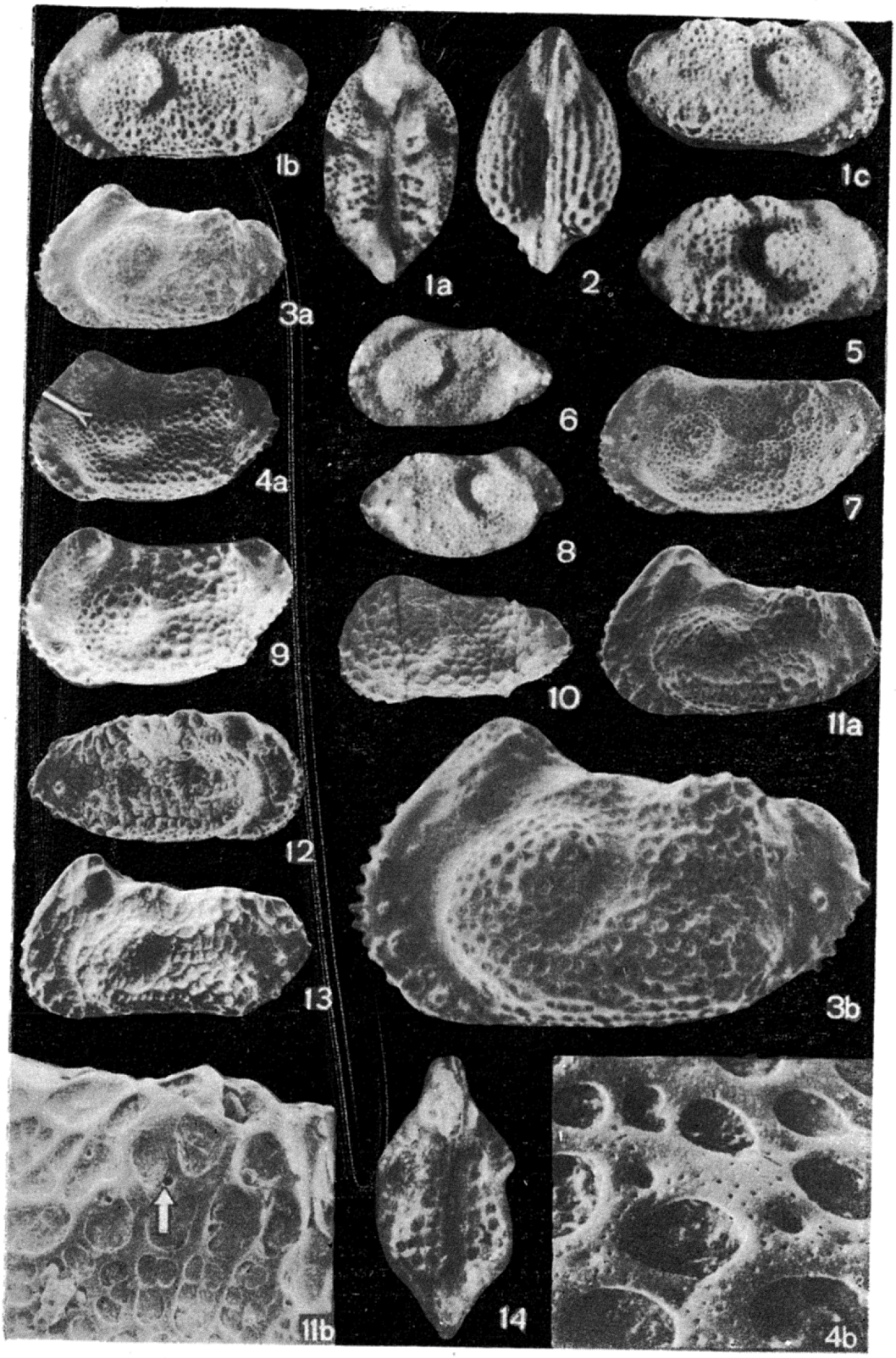
Protocythere vonvalensis sp. n.

1 C♂ (holotype): a dorsal, b left lateral, c right lateral view, × 50; W.1.141; 2 C♀ in ventral view, × 50; W.2.142; 3 LV♀: a lateral view, × 50; b lateral view, × 105; SEM.W.2.145; 4 LV♀: a lateral view, × 50; b close-up of surface ornamentation arrowed in *a*; × 175; SEM.W.2.146; 5 RV♀ in lateral view, × 50; W. 1.144; 6 LV n—1 in lateral view, × 50; W.2.149; 7 LV♂ in lateral view, × 50; SEM.W.2.143; 8 RV n—1 in lateral view, × 50; W.2.148; 9 LV♂ in lateral view, × 50; SEM.W.2.147; Lower Valanginian

Protocythere helvetica Oertli

10 LV n—1 in lateral view, × 50; SEM.W.12.137; Upper Valanginian; 11 LV♀: a lateral view, × 50, b surface ornamentation in posterodorsal area (arrow points to a normal pore figured in Pl. 5, Fig. 1 a—b), × 215; SEM.W.12.139, ibidem; 12 RV♂ in lateral view, × 50; SEM.W.12.138, ibidem; 13 LV♂ in lateral view, × 50; SEM.W.12.140, ibidem; 14 C♂ in dorsal view, × 50; W.2.135; Lower Valanginian

Figures taken by Steroscan indicated with SEM


1b
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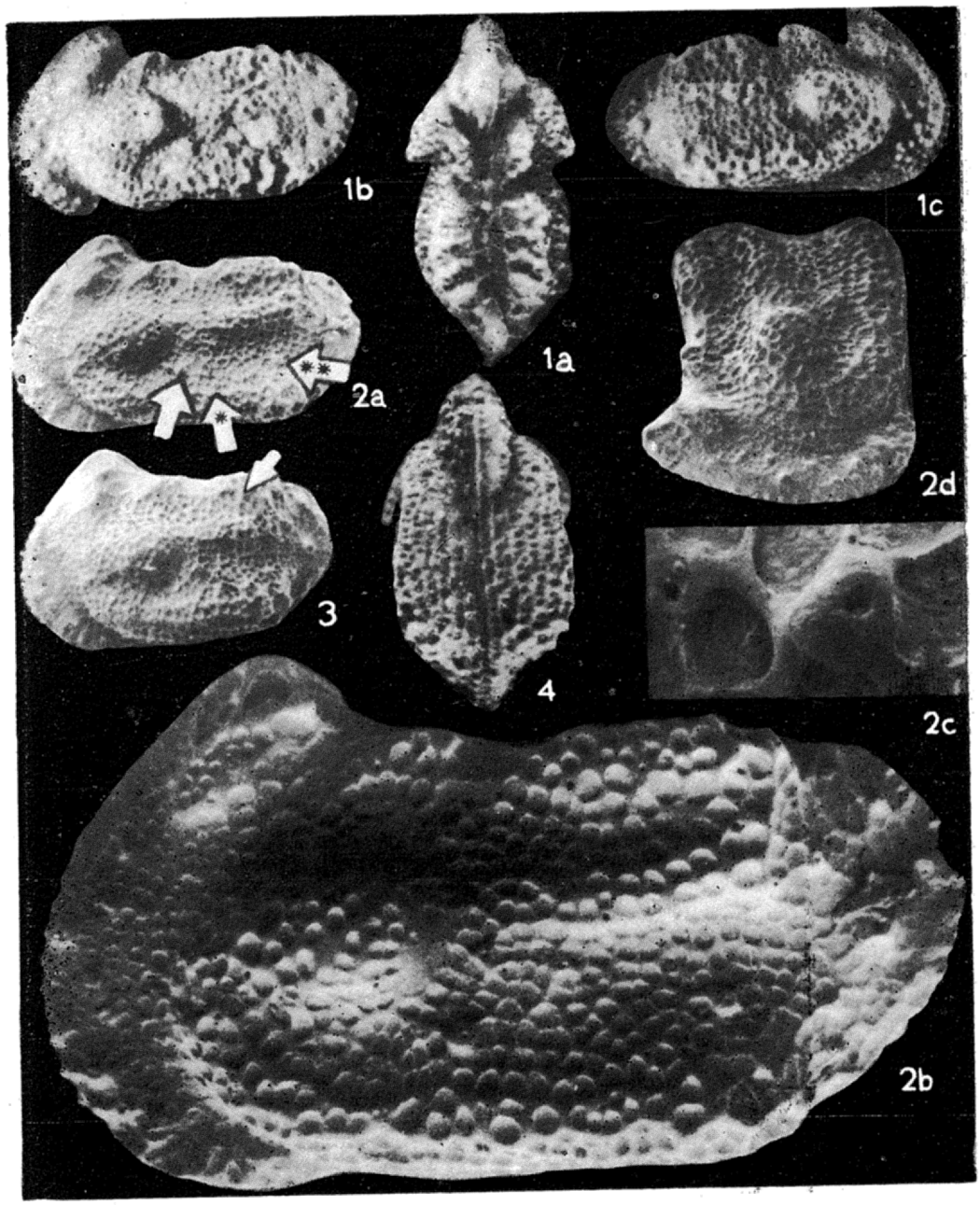
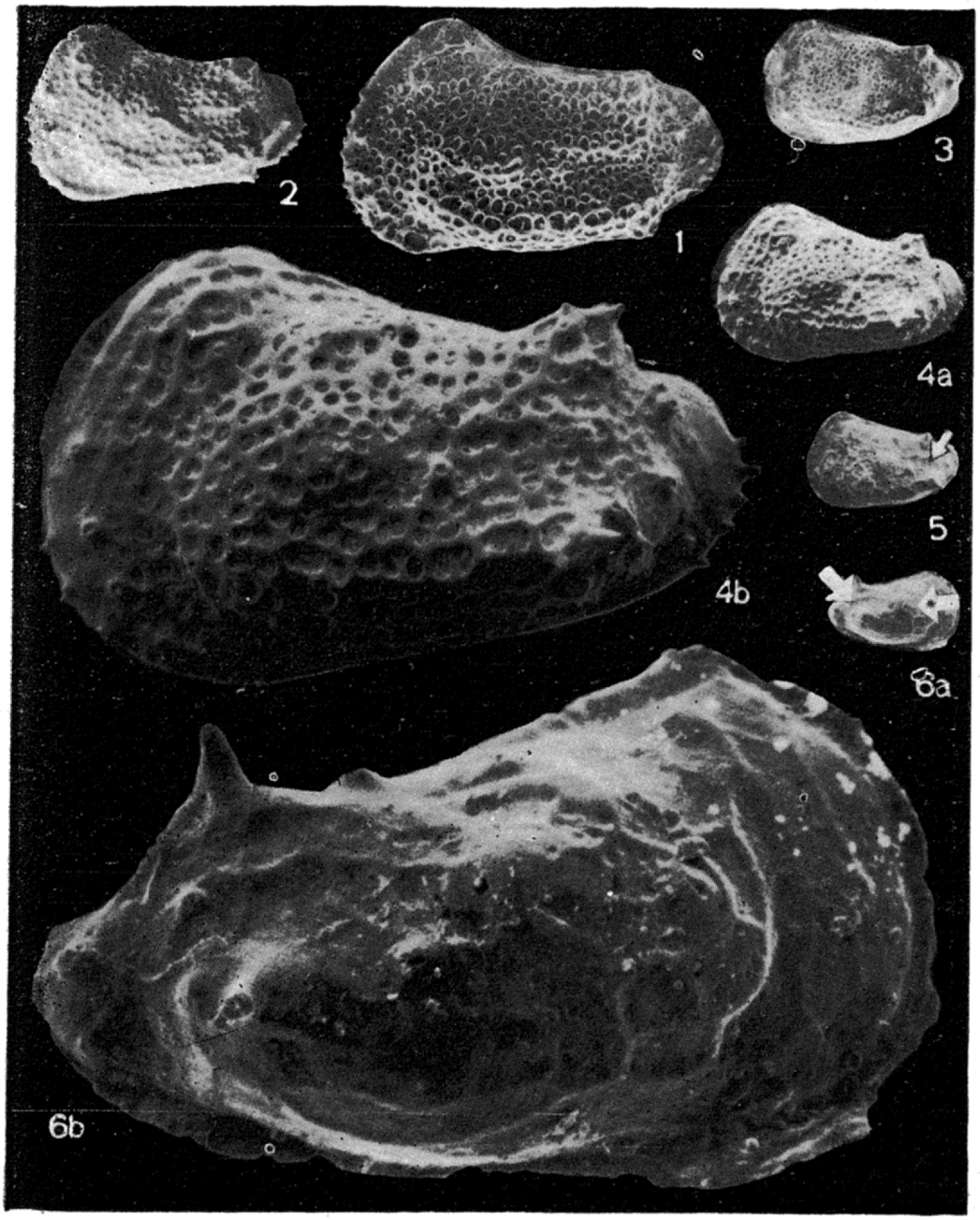


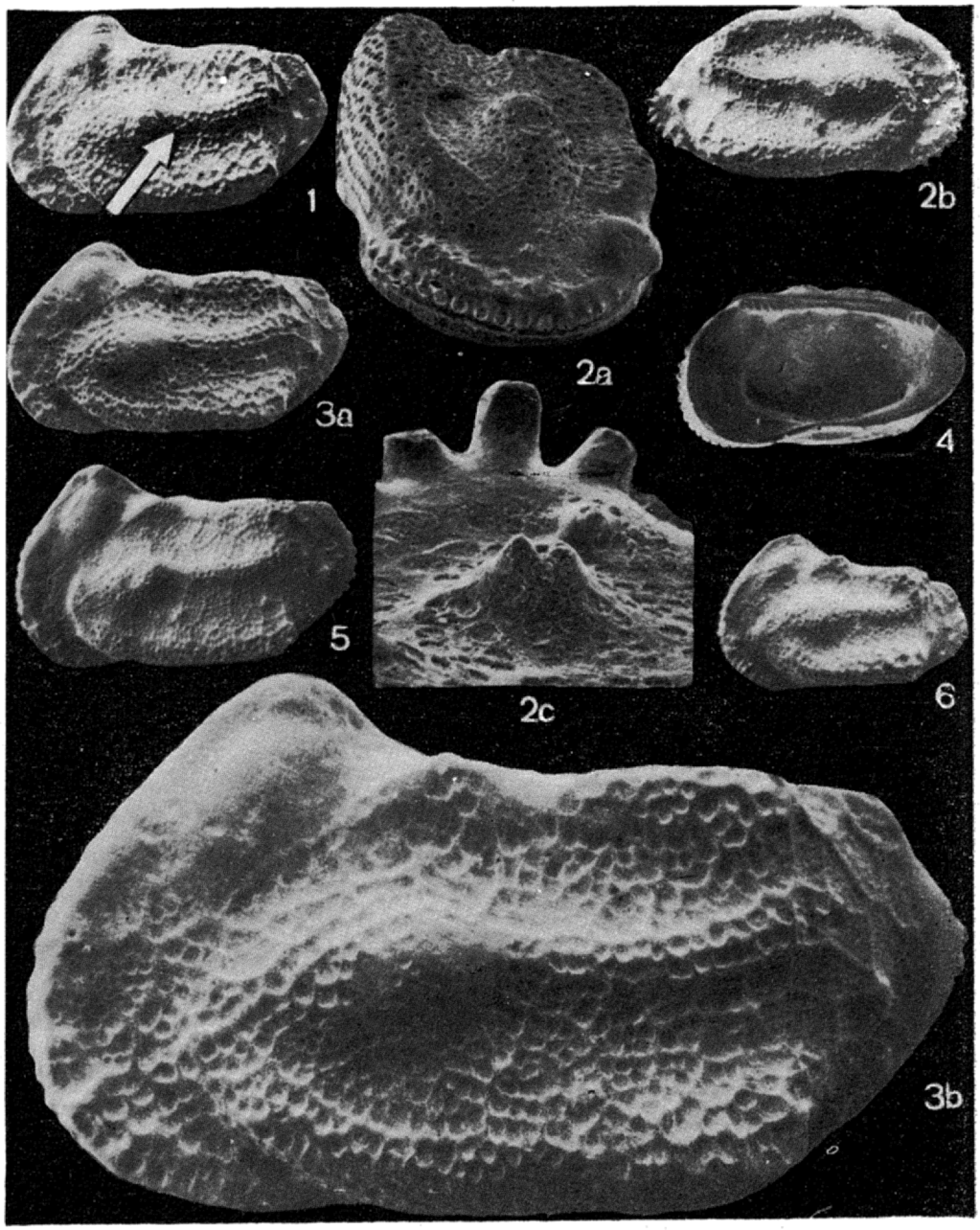
Protocythere lewinskii sp. n., forma *lewinskii*

1 C♂ (holotype): a dorsal, b left lateral, c right lateral view, × 50; W.2.268; Lower Valanginian; **2** LV♂: a lateral view (asterisked arrow points to a sieve-plate normal pore, figured in Pl. 6, Fig. 3, double asterisked to Pl. 6, Fig. 4), × 50, b lateral view, × 230, c rimmed sieve-plate normal pore (arrowed in *a*), × 500; d anterior view, × 70; SEM.W.12.266; Upper Valanginian; **3** LV♀ in lateral view (arrow points to a sieve-plate normal pore figured in Pl. 6, Fig. 6); × 50; SEM.W.10.267; ibidem; **4** C♀ in ventral view; W.2.265; Lower Valanginian
Figures taken by Ste.oscan indicated with SEM



Protocythere lewinskii sp. n., forma *lewinskii*

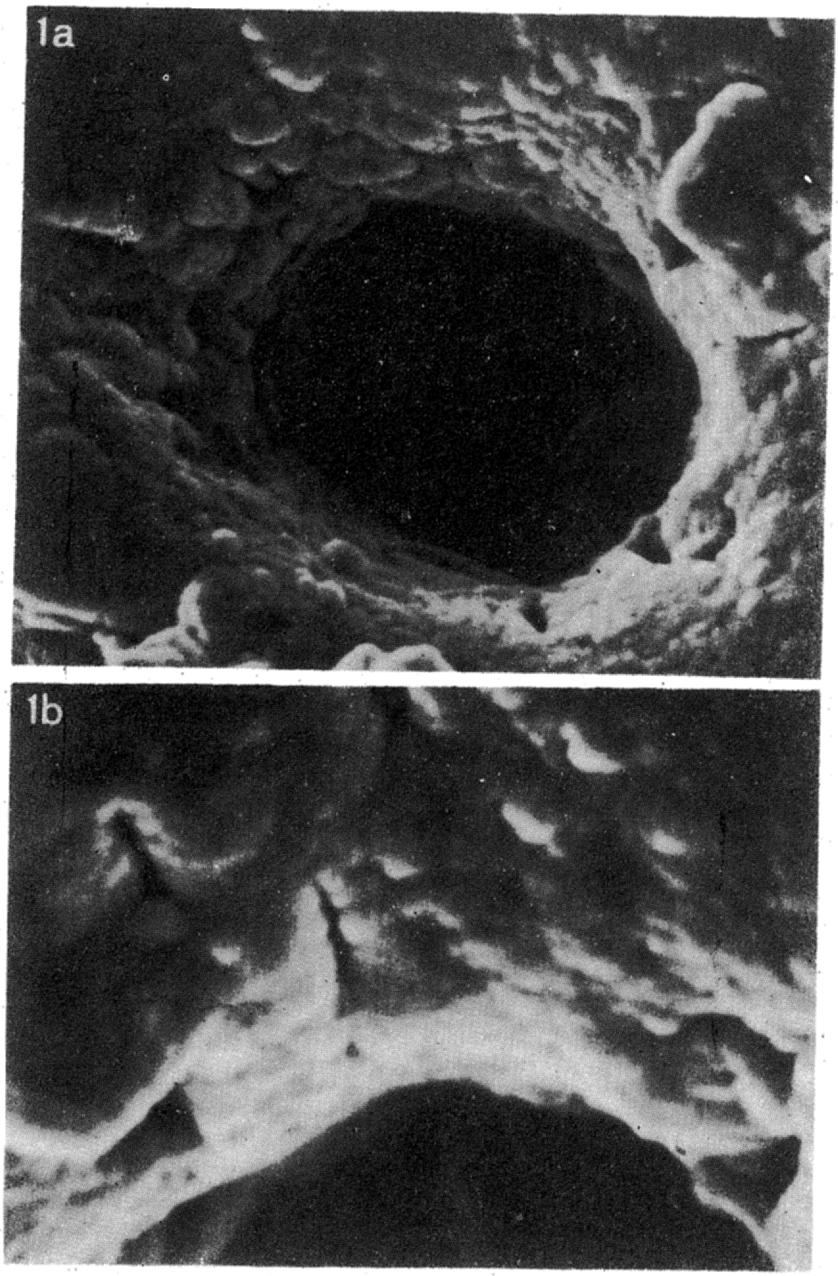
1 LV n—1 in lateral view, × 70; W.2.269; **2** LV n—2 in lateral view; × 70; W.2.270; **3** LV n—4 in lateral view; × 70; W.2.271; **4** LV n—3: a lateral view, × 70, b lateral view; × 200, W.2.272; **5** LV n—5 in lateral view, arrow points to a rimmed normal pore figured in Pl. 6, Fig. 2; × 70; W.2.273; **6** RV n—6: a lateral view, arrows point to rimmed normal pores (asterisked is the pore figured in Pl. 6, Fig. 1), × 70, b lateral view, × 450; W.2.274; Lower Valanginian
All figures taken by Stereoscan



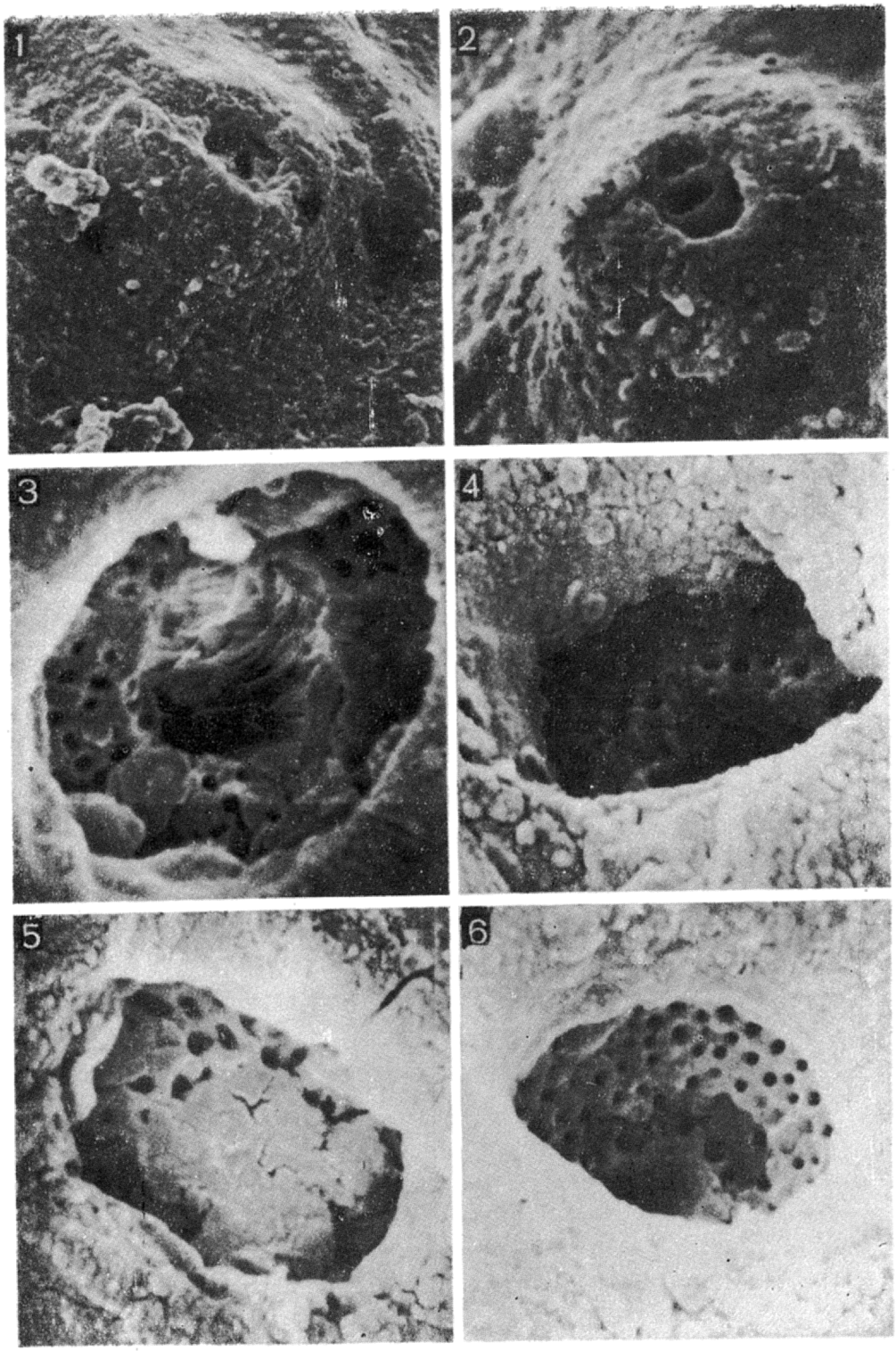
Protocythere lewinskii sp. n., forma *bireticulata*

1 LV♀ in lateral view (arrow points to a sieve-plate normal pore figured in Pl. 6, Fig. 5), × 50; W.12a.562; **2** RV♀: a anterior view, × 78, b lateral view, × 50, c rimmed normal pore, × 495; W.12a.564; **3** LV♂: a lateral view, × 50, b lateral view, × 230; W.12a.563; **4** RV♀ in lateral interior view, × 43; W.12a.560; **5** LV♂ in lateral view, × 50, W.12b.561; **6** LV n—1 in lateral view; × 50; W.12a.559; uppermost Valanginian

All figures taken by Stereoscan



1 rmal pore-canal (arrowed in Pl. 1, Fig. 11b), × 10,000; **1b** structure of the wall of a pore canal featured with a pattern of "slots", × 20,000



1 rimmed normal pore (arrowed with asterisk in Pl. 3, Fig. 6a), × 3750; 2 rimmed normal pore (arrowed in Pl. 3, Fig. 5), × 3750; 3 sieve-plate normal pore (arrowed with asterisk in Pl. 2, Fig. 2a), × 6800; 4 rimmed sieve-plate normal pore (arrowed with double asterisks in Pl. 2, Fig. 2a), × 6750; 5 sieve-plate normal pore (arrowed in Pl. 4, Fig. 1), × 6750; 6 sieve-plate normal pore (arrowed in Pl. 2, Fig. 3), × 6750

All figures taken by Stereoscan