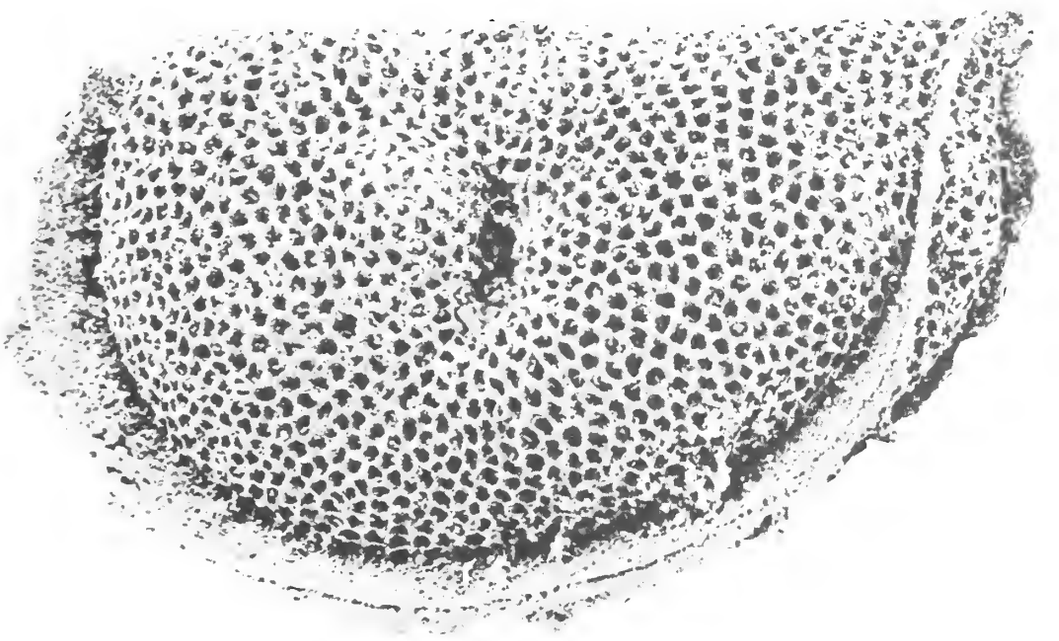
A Stereo-Atlas of Ostracod Shells

edited by J. Athersuch, D. J. Horne, D. J. Siveter,
and J. E. Whittaker



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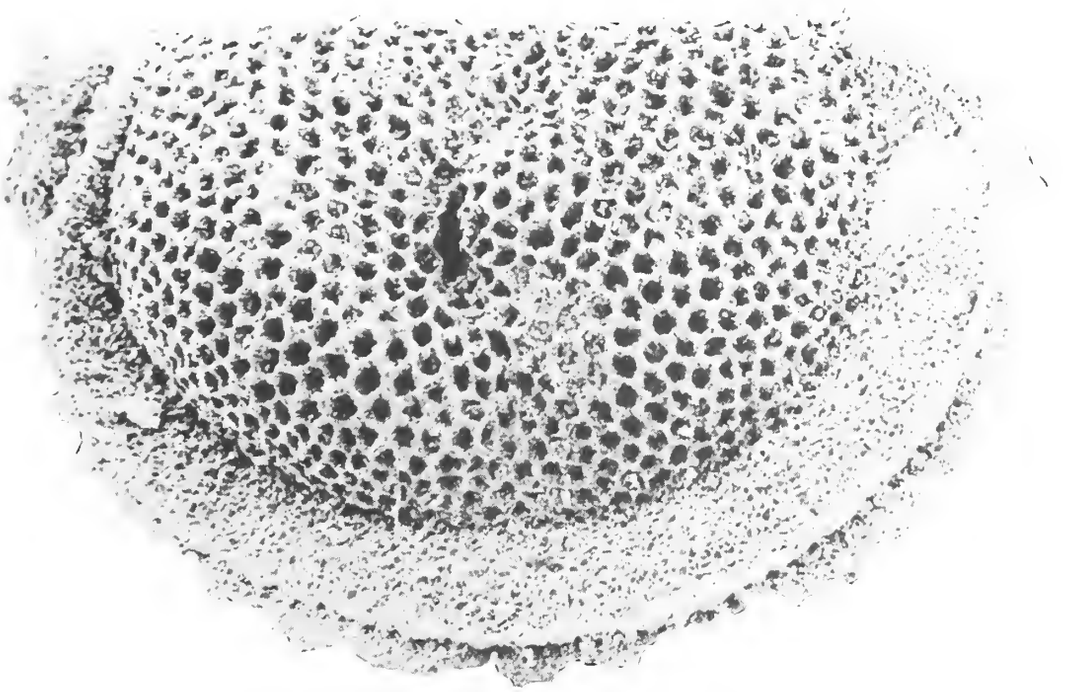

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Instructions to Authors

Contributions illustrated by scanning electron micrographs of Ostracoda in stereo-pairs are invited. Format should follow the style set by the papers in this issue. Descriptive matter apart from illustrations should be cut to a minimum; preferably each plate should be accompanied by only one page of text. Blanks to aid in mounting figures for plates may be obtained from any one of the Editors or Editorial Board. Completed papers should be sent to one of the Editors. All contributions submitted for possible publication in the *Stereo-Atlas of Ostracod Shells* are reviewed by an appropriate international specialist.

The front cover shows a male left valve (upper) and a female right valve (lower) of *Eurybolbina bispinata* (Harris, 1957) from the middle Ordovician Edinburg Formation of Virginia, U.S.A. British Museum (Natural History), nos. OS14028 and OS13536 respectively. Photographed by M. Williams and C. Giles Miller.

595.337.14 (118.22) (420 : 162.006.50): 551.35

ON *CYTHEROMORPHA DIAMPHIDIA* MAYBURY sp. nov.

by Caroline A. Maybury
(Institute of Earth Studies, University of Wales, Aberystwyth)

Cytheromorpha diamphidia sp. nov.

Holotype: The Natural History Museum, London [BMNH] no. **OS 14217**; ♀ RV. [Paratypes nos. **OS 14218–OS 14221**].

Type locality: Sample no. 1, Vicarage Pit, St. Erth, Cornwall, England (5° 26′ W, 50° 10′ N; Nat. Grid Ref. SW 556352); Upper Pliocene.

Derivation of name: Greek, διαμφιδιος—*diamphidios*—utterly, entirely different; referring to the marked dimorphism of this species.

Figured specimens: The Natural History Museum, London [BMNH] nos. **OS 14217** (holotype, ♀ RV: Pl. **20**, 2, fig. 1), **OS 14218** (paratype, ♀ LV: Pl. **20**, 2, figs. 2, 3), **OS 14219** (paratype, ♂ RV: Pl. **20**, 2, fig. 4; Pl. **20**, 4, fig. 1), **OS 14220** (paratype, ♂ LV: Pl. **20**, 4, figs. 2, 3), **OS 14221** (paratype, ♀ LV: Pl. **20**, 4, fig. 4). All paratypes are from the same sample as the holotype, with the exception of paratype **OS 14220** which is from sample no. 29 (Blue Clay), from the type locality. See C.A. Maybury, *Taxonomy, Palaeoecology and Biostratigraphy of Pliocene Benthonic Ostracoda from St. Erth and NW France*, unpub. PhD thesis, Univ. Wales, **1**, 3–6, 1985 for further sample details.

Diagnosis: A medium-sized, strongly dimorphic *Cytheromorpha*. Female subovate in lateral view and male subreniform. Ornament of reticulae of varying shape, but predominantly subcircular in outline.

Explanation of Plate 20, 2

Fig. 1, ♀ RV, ext. lat. (**OS 14217**, 650 μm long); Figs. 2, 3, ♀ LV, dors. and ext. lat. (**OS 14218**, 660 μm long); Fig. 4, ♂ RV, ext. lat. (**OS 14219**, 730 μm long).
Scale A (200 μm; ×91), figs. 1–3.

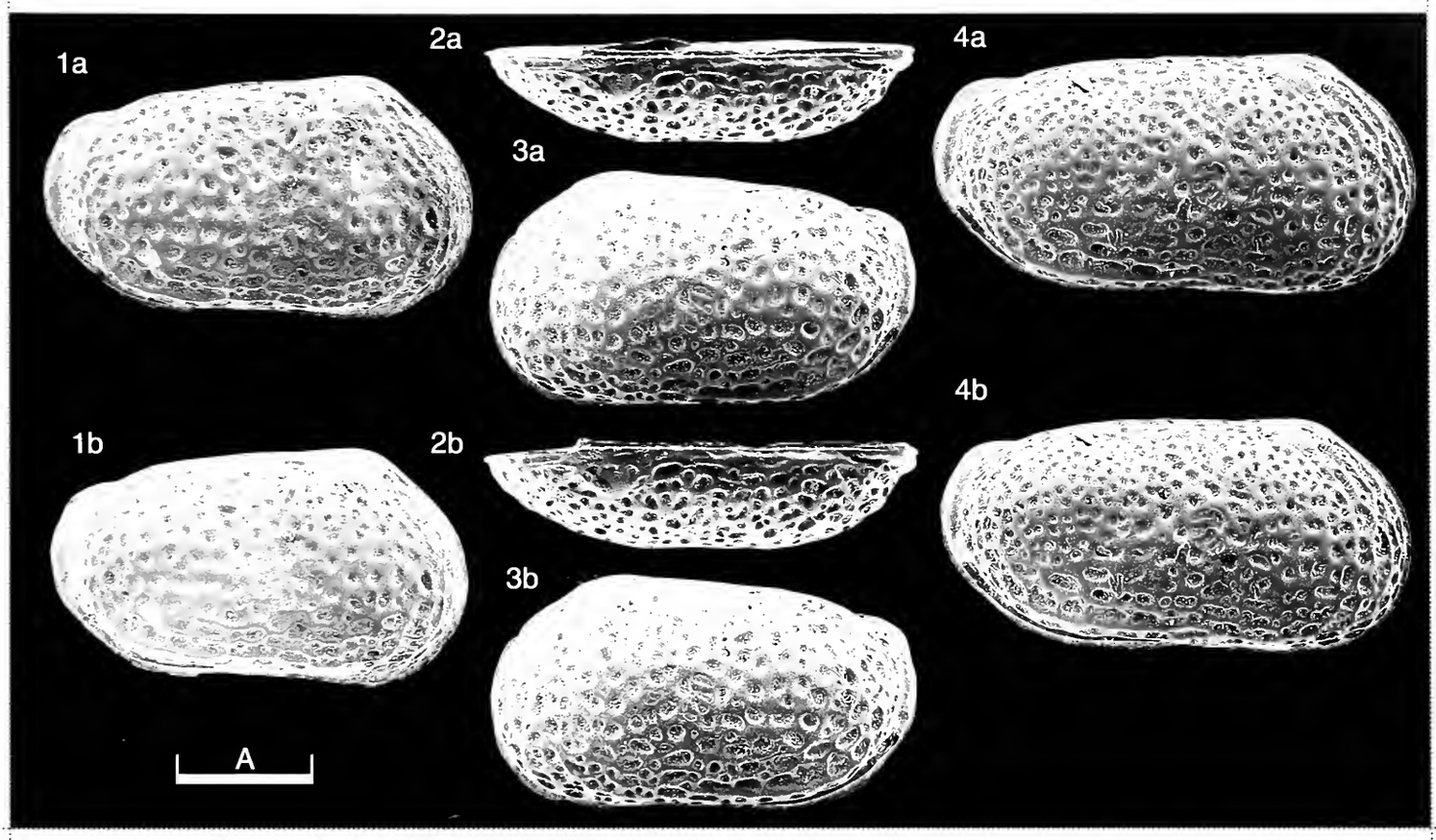
Reticulae are ordered concentrically peripherally; but centrally and dorsomedianly they are more irregularly disposed. Posterior marginal rim narrow. Male valves are unusual in that their ornament is not precisely complementary to that of the female valves: the males having a somewhat punctate appearance medianly.

Remarks: This species is similar to *Cytheromorpha macchesneyi* (Brady & Crosskey) (*Geol. Mag.*, **8**(80), 63, pl. 2, figs. 1, 2, 1871), in overall shape and ornament. Like *C. diamphidia*, the ornament of *C. macchesneyi* differs between sexes: males possessing more rounded and numerous punctae than females. The two species differ in size (the type material of *C. macchesneyi* measures: length—500 μm). The valves of the latter are also more tapered posteriorly and possess a series of longitudinal furrows parallel with their free margins and a distinct, smooth area ventromedianly. In addition, oral incurvature is better developed in the right valves of *C. macchesneyi*. In contrast to the new species, *C. macchesneyi* is a distinct cold water indicator. It has not been recorded south of latitude 62.46° N (see T.M. Cronin *et al.*, *U.S. Geol. Surv., Open File Report*, **91-355**, 51pp, 1992 for detailed distribution data). Subsequent to the publication of this report it has also been described by Hartmann (*Mitt. hamb. zool. Mus. Inst.*, **89**, 185–186, pl. 1, figs. 5–10; pl. 2, fig. 1, text-figs. 1–11, 1992) from Recent and subfossil material from N Spitzbergen. *C. macchesneyi* has a general range from Quaternary to Recent.

Distribution: Upper Pliocene deposits of St. Erth, Cornwall, England (sample nos. 1–4, 7, 10–12, 14, 16, 18, 21, 23, 25–29) and Upper Pliocene (Redonian) deposits of Apigné (Le Temple du Cerisier), NW France. See C. Maybury (*op. cit.*) and J.-P. Margerel, *Les Foraminifères du Redonien. Systématique, Répartition stratigraphique, Paléoécologie*, Nantes, **1**, 8–26, 1968 for details of the British and French samples, respectively.

Explanation of Plate 20, 4

Fig. 1, ♂ RV, int. lat. (**OS 14219**, 730 μm long); Figs. 2, 3, ♂ LV, (**OS 14220**, 690 μm long): fig. 2, ant. hinge element; fig. 3, post. hinge element; Fig. 4, ♀ LV, musc. sc. (**OS 14221**, 620 μm long).
Scale A (200 μm; ×91), fig. 1; scale B (100 μm; ×220), figs. 2, 3; scale C (40 μm; ×512), fig. 4.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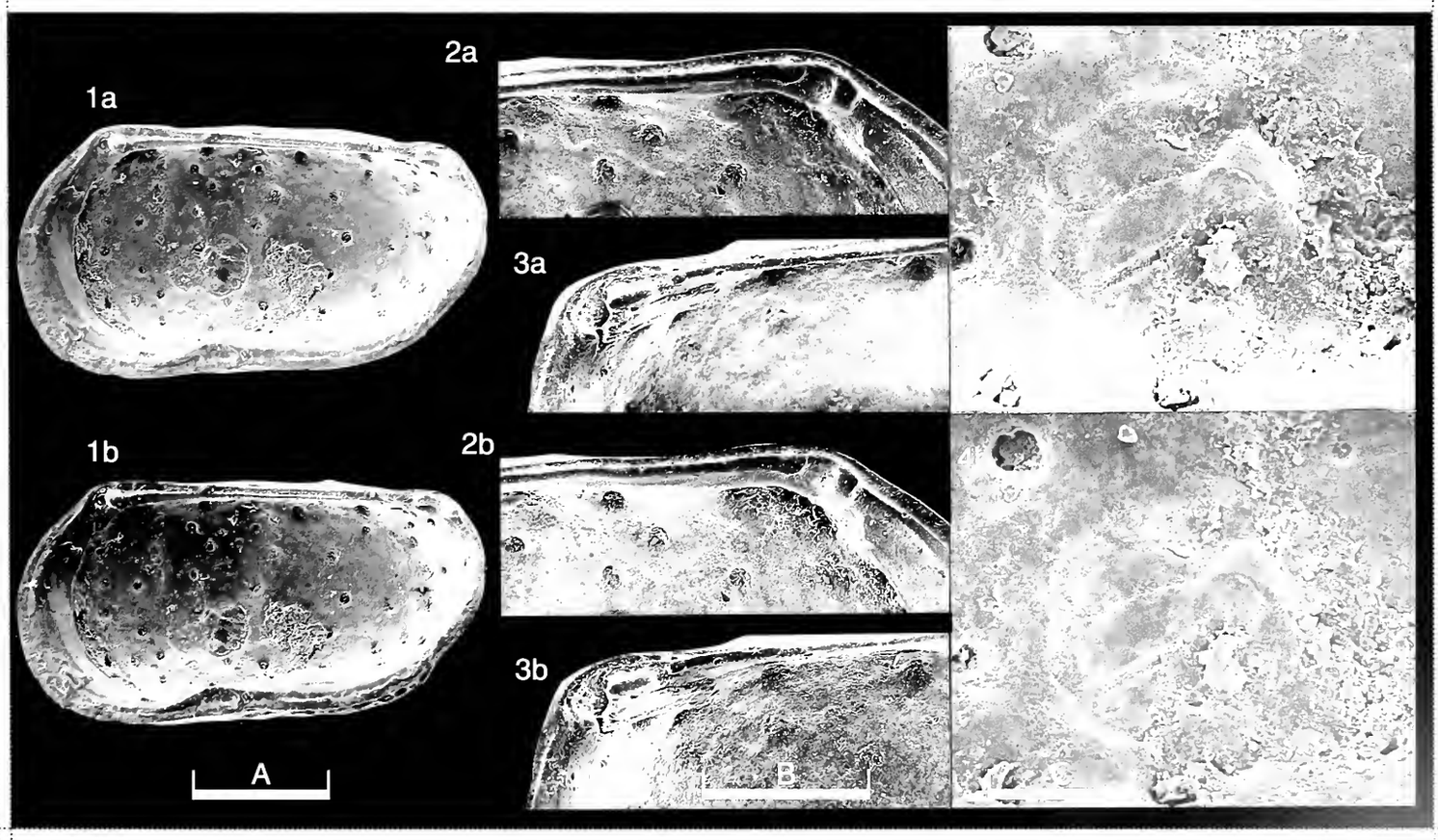
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595.337.14 (118.22) (420 : 162.006.50): 551.35

ON *SEMICYTHERURA PARACLAUSI* MAYBURY sp. nov.

by Caroline A. Maybury
(Institute of Earth Studies, University of Wales, Aberystwyth)

Semicytherura paraclausi sp. nov.

Holotype: The Natural History Museum, London [BMNH] no. **OS 14222**; ♀ RV. [Paratypes nos. **OS 14223–14225**].

Type locality: Sample no. 7, Vicarage Pit, St. Erth, Cornwall, England (50° 26′ W, 50° 10′ N; Nat. Grid Ref. SW 556352); Upper Pliocene.

Derivation of name: Latin, referring to the similarity of the new species to *Semicytherura clausi* (Brady, 1880) (*Rep. scient. Results. Voy. Challenger*, Zoology, **1**(3), 134, pl. 32, figs. 8a–d).

Figured specimens: The Natural History Museum, London [BMNH] nos. **OS 14223** (paratype, ♀ LV: Pl. **20**, 6, fig. 1), **OS 14222** (holotype, ♀ RV: Pl. **20**, 6, fig. 2), **OS 14224** (paratype, ♂ LV: Pl. **20**, 6, fig. 3), **OS 14225** (paratype, ♂ RV: Pl. **20**, 8, fig. 1), **OS 14226** (paratype, ♂ LV: Pl. **20**, 8, fig. 2), **OS 14228** (♀ RV: Pl. **20**, 8, fig. 3), **OS 14227** (♀ LV: Pl. **20**, 8, fig. 4), **OS 14229** (♀ LV: Pl. **20**, 8, fig. 5). All paratypes are from the same sample as the holotype, with the exception of paratype **OS 14226** which is from sample no. 1, but from the type locality and horizon. See C.A. Maybury, *Taxonomy, Palaeoecology and Biostratigraphy of Pliocene Benthonic Ostracoda from St. Erth and NW France*, unpub. PhD thesis, Univ. Wales, **1**, 3–6, 1985 for further sample details.

Explanation of Plate 20, 6

Fig. 1, ♀ LV, ext. lat. (**OS 14223**, 530 μm long); Fig. 2, ♀ RV, ext. lat. (**OS 14222**, 560 μm long); Fig. 3, ♂ LV, ext. lat. (**OS 14224**, 600 μm long).
Scale A (200 μm; ×110), figs. 1–3.

Diagnosis: A small to medium sized *Semicytherura* with prominent keel-like alar process and posteroventral concavity. Ornament of reticulae, punctae and micropunctae with 3 horizontal, anteromarginal ridges. Pore conuli more numerous in the anterior half of the valve.

Remarks: The new species closely resembles *Semicytherura clausi* (Brady, *op. cit.*), a Recent species dredged from Simon's Bay, S Africa from depths of 15 to 20 fms and reported also from the coast of New Zealand (N. de B. Hornibrook, *Pal. Bull. N.Z. Geol. Survey*, **18**, 51, pl. 15, figs. 242–244, 1952). The two species are similar in shape, size and gross ornamental configuration; but *S. paraclausi* differs from *S. clausi* in its more variable ornament and in its possession of micropunctae and three lateral ridges which terminate at the anterior margin. *C. clausi* has only two ridges.

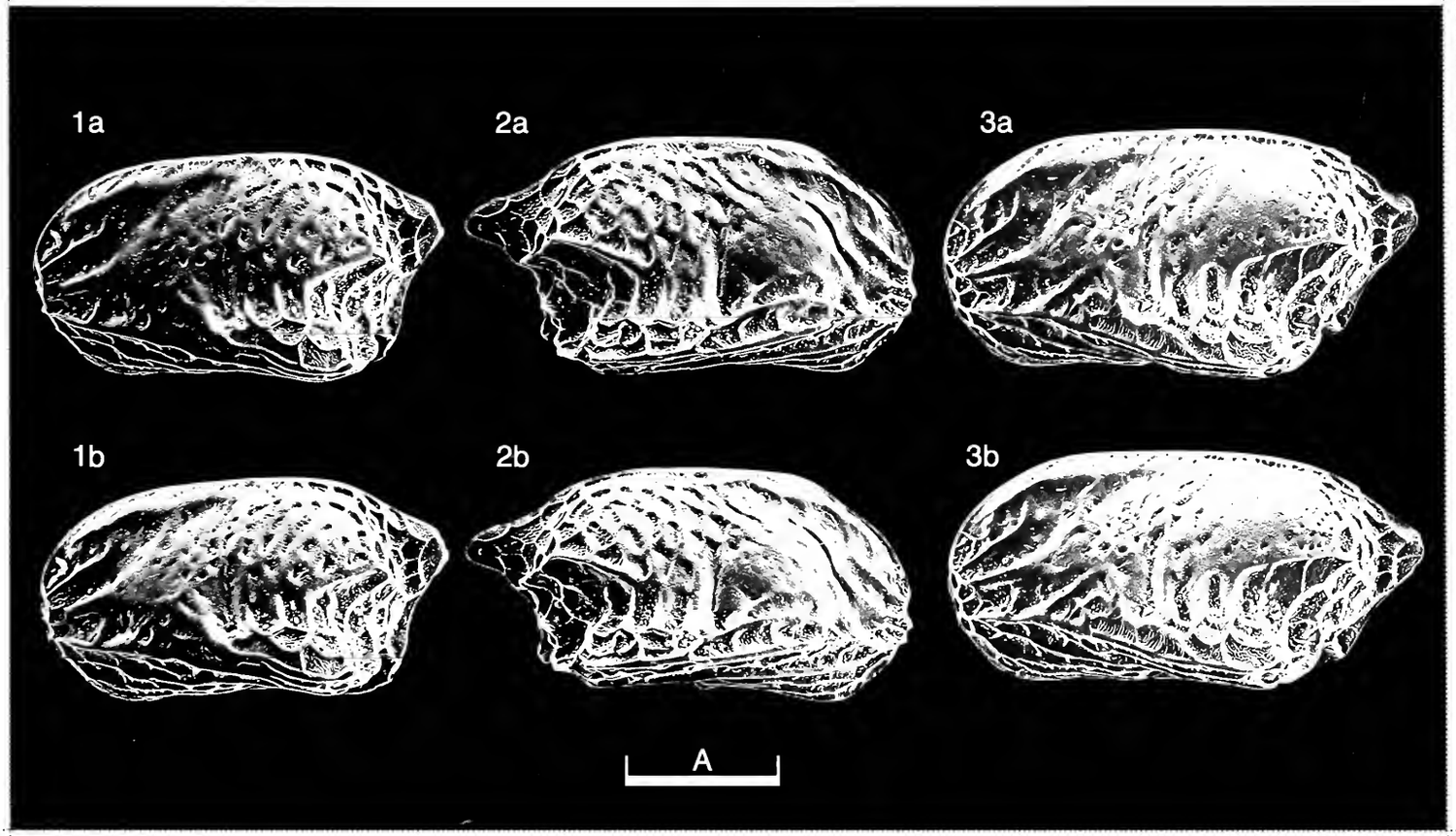
Semicytherura reticulata Blondeau, 1971 (M.-A. Blondeau, *pub. PhD thesis, Univ. Nantes*, 86, pl. 9, figs. 11–14), a Lutetian (Middle Eocene) species from Campbon, France is also similar and perhaps ancestral to the new species. It differs from *S. paraclausi* in size (the holotype of *S. reticulata* measures: length 370 μm and height 210 μm) and in the less pronounced development of its alar process. It also bears a prominent, trifurcating lateral rib; which is absent in *S. paraclausi*.

Ornamental variants of *S. paraclausi* are illustrated in Pl. **20**, 8, figs. 3–5. These are less reticulate than *S. paraclausi sensu strictu* and are smaller in size; characters which might could be interpreted as juvenile, were not both forms represented by complete suits of instars and given the adult development of the hinge and inner lamella as shown in Pl. **20**, 8, fig. 5.

Distribution: Upper Pliocene deposits of St. Erth, Cornwall, England (sample nos. 1–4, 7, 10–16, 18, 21–23, 25–29) and Upper Pliocene (Redonian) deposits of Apigné (Gîte d'Apigné, Borehole II, Le Temple du Cerisier), Beugnon (sample no. 1), Le Bosq d'Aubigny, Le Bosq d'Aubigny (Manche) and Palluau II (670 cm), NW France. See C. Maybury (*op cit.*) and J.-P. Margerel, *Les Foraminifères du Redonien. Systématique, Répartition stratigraphique, Paléoécologie*, Nantes, **1**, 8–26, 1968 for details of British and French samples, respectively.

Explanation of Plate 20, 8

Fig. 1. ♂ RV, ext. lat. (**OS 14225**, 600 μm long); Fig. 2, ♂ LV, int. lat. (**OS 14226**, 620 μm long); Fig. 3, ♀ RV, ext. lat. (**OS 14228**, 460 μm long); Fig. 4, ♀ LV, ext. lat. (**OS 14227**, 450 μm long); Fig. 5, ♀ LV, int. lat. (**OS 14229**, 450 μm long).
Scale A (200 μm; ×110), figs. 1–5.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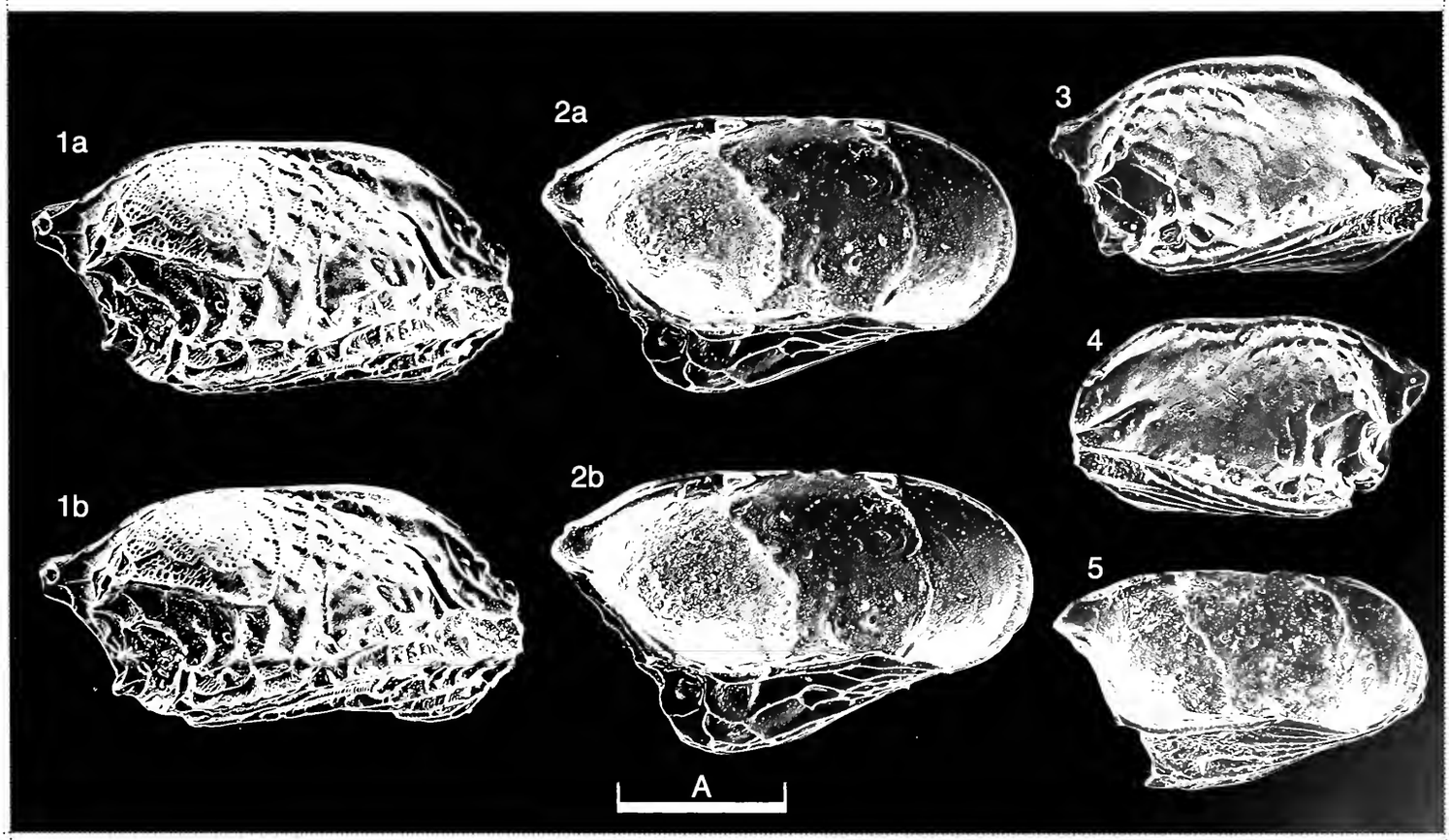
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Stereo-Atlas of Ostracod Shells 20 (3) 9–12 **(1993)**
336.11 (113.331) (47 : 161.023.58): 552.54 + 551.351

ON *KILTSIELLA ROSENSTEINAE* (SARV)

by David J. Siveter & Lembit I. Sarv
(University of Leicester, England & Institute of Geology, Estonian Academy of Sciences, Tallinn, Estonia)

Genus *KILTSIELLA* Sarv, 1968
Type-species: (by original designation): *Craspedobolbina? rosensteini* Sarv, 1962

Diagnosis: Finely reticulate, essentially non-lobate Zygobolbinae (?) with a diminutive slit-like adductorial sulcus. Lobel area forms a low, gently curved profile above the hinge line. Velum flange-like, of more or less constant width between cardinal corners in tecnomorphs. Cruminae discrete, unornamented, elongate sausage shaped, from mid-anterior to just behind mid-venter; overhangs ventral margin in lateral and ventral views for most of its length; has velum attached simply, both anteriorly and posteriorly. At its mid-length the crumina possibly breaks through the valve margin. Torus lacking in both dimorphs.

Remarks: Although Sarv (1968 *op. cit.*) assigned *Kiltsiella* to the Zygobolbinae Ulrich & Bassler, 1923 (Beyrichiacea, Palaeocopa), its subfamilial/familial taxonomic assignment is equivocal. Only one female specimen of *Kilsiella* is known (Pl. **20**, 10, figs. 1–5), the subcruminal morphology of which seems to be broken away in the regions of the valve margin adjacent to the ventral and anterior ends of the crumina. Alternatively, this arrangement could be the true morphology of the species; if so, it would represent a narrowing and loss of a strip of the valve margin by virtue of the (diagnostically zygobolbinine) encroachment of the adjacent (ventral and anterior) parts of the crumina. However, no clear dolonoid scar (*sensu* Martinsson, *Bull. geol. Instn Univ. Uppsala.*, **41**, 1962), in the form either of a fold or fissure, is apparent in this subcruminal region in the female in question, thus suggesting that damage is the more likely explanation for the observed morphology.

In lateral view the lobal, cruminal and velar morphology and ornament of *Kiltsiella* is very similar to the beyrichiacean craspedolbolbinine *Clintiella* Martinsson, 1962. Tecnomorphs of *Kiltsiella* also have much in

Explanation of Plate 20, 10

Figs. 1–5, ♀ LV (**Os 5163**, 1050 μm long); fig. 1, post.; fig. 2, ext. lat.; fig. 3, syllobial ornament; fig. 4, int. obl. vent.; fig. 5, vent. Scale A (200 μm; ×48), figs. 1, 2, 4, 5; scale B (50 μm; ×145), fig. 3.

common with beyrichiacean treposellid tecnomorphs belonging to genera such as *Garniella* and especially *Retisacculus* (both Martinsson 1962). *Kiltsiella* differs from both craspedobolbinines and treposellids in apparently lacking traces of the dolonoid closing mechanism of the crumina (i.e. dolonoid scars or "treposelline bridges" respectively).

Kiltsiella rosensteinae (Sarv, 1962)

1962 *Craspedobolbina? rosensteini* (*sic*) sp. nov. L.I. Sarv, *Eesti NSV Tead. Akad. Geol. Inst. Uurim.*, **9**, 126, pl. 7, figs. 5–9.
1968 *Kiltsiella rosensteinae* (Sarv); L.I. Sarv, *Ostracode families Craspedobolbinidae, Beyrichiidae and Primitiopsidae in the Silurian of Estonia.* Eesti NSV Tead. Akad. Geol. Inst. Tallinn, 30, pl. 3, figs. 7–9.

Holotype: Institute of Geology, Estonian Academy of Sciences, Tallinn, no. **Os 5162**; male left valve.

Type locality: Old quarry near Kiltsi, about 3 km SW of Haapsalu, approx. lat. 58° 58′ N, long, 23° 32′ E, NW Estonia. Juuru regional "stage" (G_{1-2}), lower part of the Llandovery Series, Silurian.

Figured specimens: Institute of Geology, Estonian Academy of Sciences, Tallinn, nos. **Os 5162** (holotype, ♂ LV: Pl. **20**, 12, figs. 1–4), **Os 5163** (♀ LV; pl. **20**, 10, figs. 1–5) and **Os 5172** (tecnomorph LV: Pl. **20**, 12, figs. 5, 6). All topotype specimens.

Diagnosis: As for the genus (monotypic).

Remarks: Specimens **Os 5162** and **Os 5163** are the originals of Sarv 1962, pl. 7, figs. 8 and 9 respectively. The original of Sarv 1962, pl. 7, figs. 5–7 (**Os 5164**: small tecnomorphic carapace) is now lost.

As noted by Sethi (*in*: Jaanusson, V. *et al.* [eds.], *Sver. geol. Unders. Afh.*, ser. C, **272**, 162), the smooth/finely punctate *Kiltsiella sarvi* Copeland (*Bull. geol. Surv. Can.*, **241**, 23, 1974) has a much less well defined crumina than *K. rosensteinae* and should be assigned to another genus.

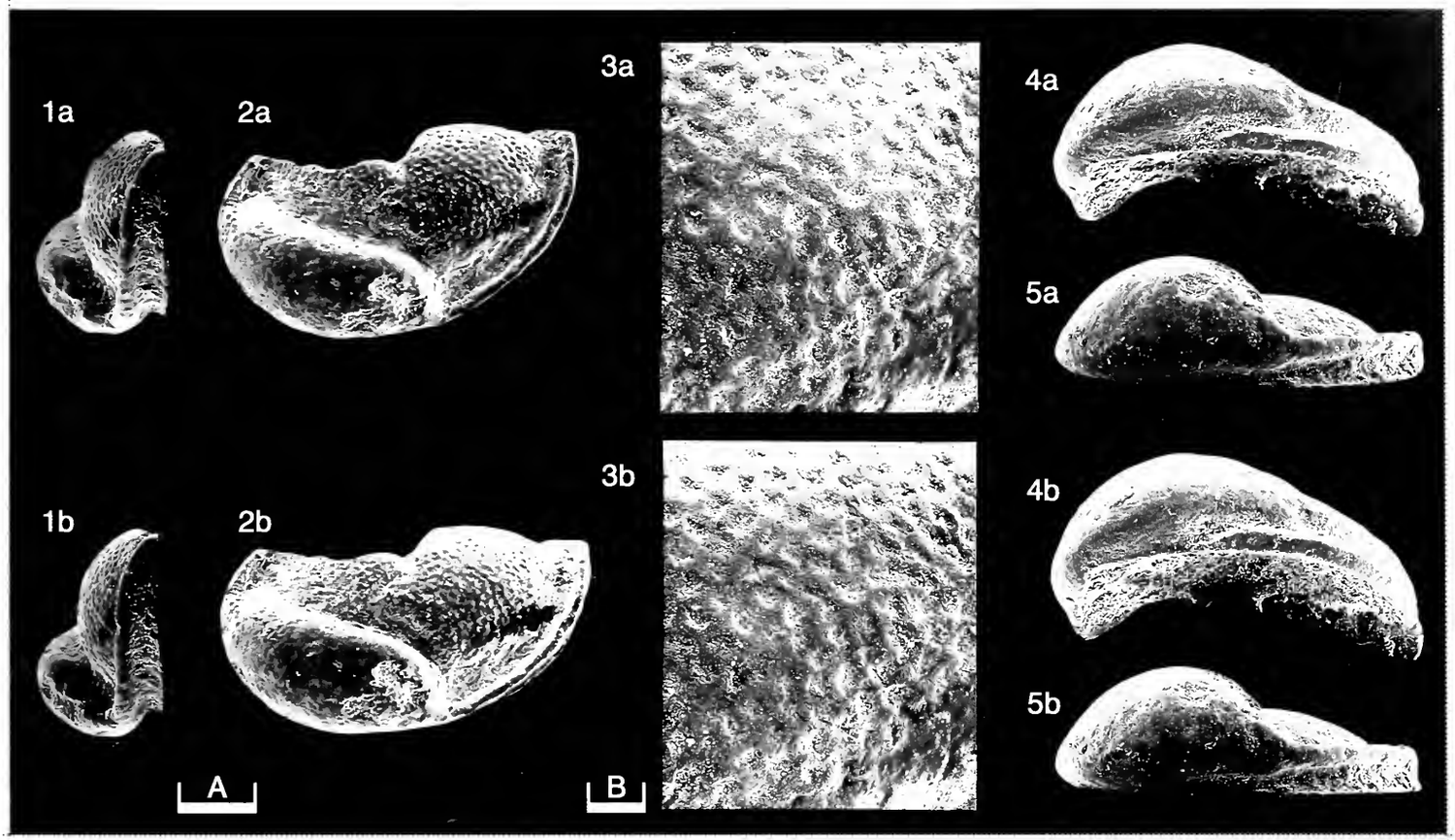
K. rosensteinae is the only known beyricheacean ostracod from the type locality, where it associates are mostly unstudied podocopids including *Medianella* cf. *lubricei* (Stumber). *Bolbiprimitia*? *tamsaluensis* Sarv, 1962 and *Aitilia senecta* Sarv, 1968 are two beyrichiaceans which occur at a similar horizon to *K. rosensteinae*, but on the island of Huumaa in northern Estonia.

Distribution: Known only from the type locality; about 15 specimens, collected by E. Rosenstein in about 1938.

Acknowledgement: Support from the NATO collaborative research programme is gratefully acknowledged.

Explanation of Plate 20, 12

Figs. 1–4, ♂ LV (holotype, **Os 5162**, 1030 μm long): fig. 1, post.; fig. 2, ext. lat.; fig. 3, ant.; fig. 4, vent. Figs. 5, 6, tecnomorphic LV (**Os 5172**, 800 μm long): fig. 5, ext. lat.; fig. 6, ant.
Scale A (200 μm; ×48), figs. 1–4; scale B (200 μm; ×57), figs. 5, 6.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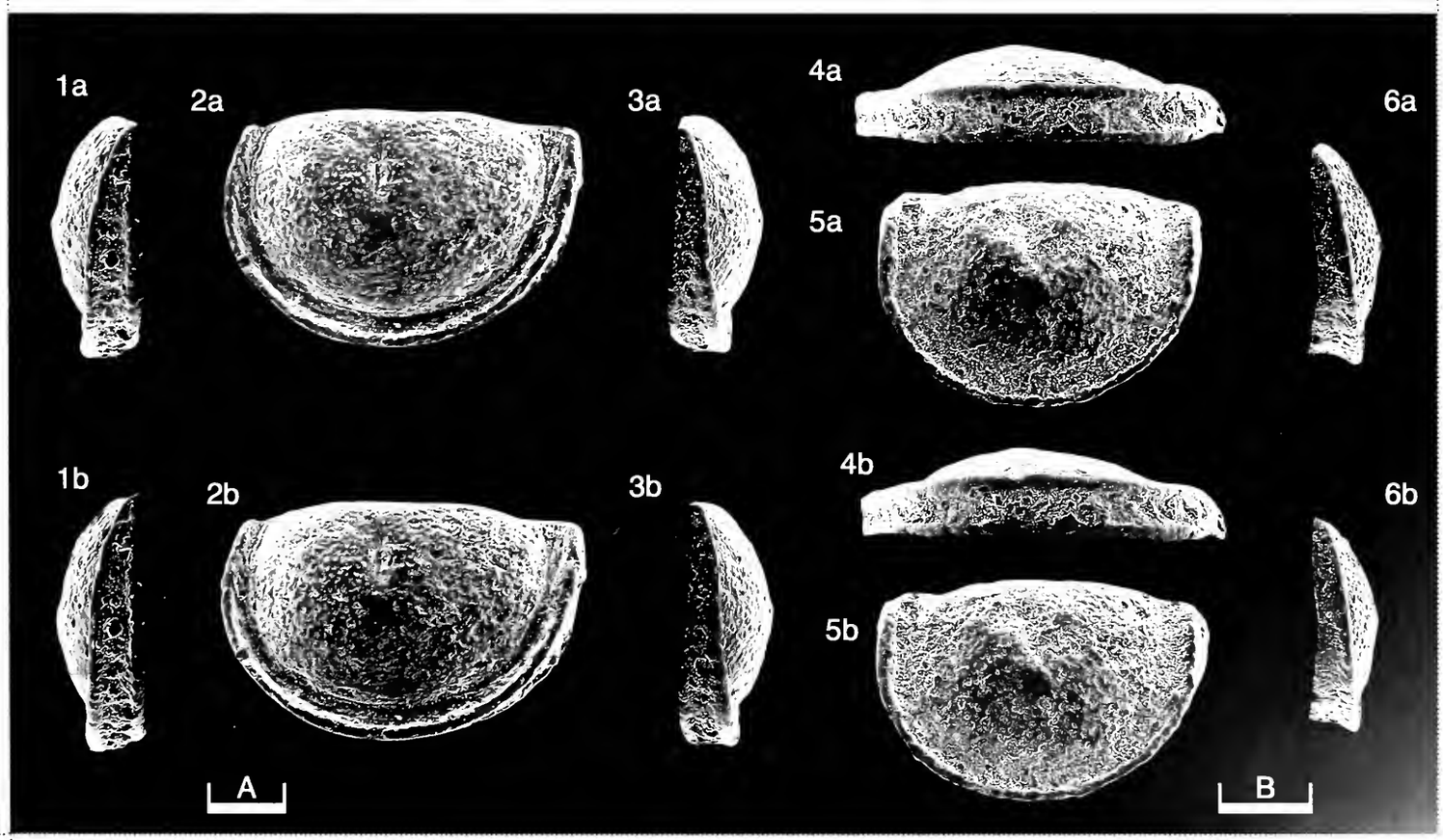
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ON *SULCELLA HUECOENSIS* DEWEY & KOHN sp. nov.

by Christopher P. Dewey & Peter Kohn
(Mississippi State University, Mississippi, U.S.A.)

Sulcella huecoensis sp. nov.

Holotype: Dunn Seiler Museum of Geology, Mississippi State University, U.S.A., no. **3341-9a**; adult female carapace.

[Paratypes nos. **3341-9b**, **3341-9c**, **3341-9d**; one adult female carapace, one female right valve and one juvenile carapace].

Type locality: Unnamed canyon, Sec. 30, T22S, R1E, Dona Ana County, Picacho Mountain Quadrangle, New Mexico, U.S.A.; lat. 32° 21′ 51″ N, long. 106° 52′ 44″ W. Upper part of the Hueco Formation, Wolfcampian, Lower Permian; 100.84 m above the base of the measured section, in olive-grey shale. Shale contains spirorbid worms, fenestrate bryozoans, crinoid columnals, small rostroconchs and endothyrid foraminifera. Shallow marine.

Derivation of name: After the Hueco Formation, being the stratigraphic unit in which this species was first recorded.

Figured specimens: Dunn-Seiler Museum of Geology, Mississippi State University, U.S.A., nos. **3341-9a** (holotype adult car.: Pl. **20**, 14, figs. 1–4), **3341-9b** (adult car.: Pl. **20**, 16, figs. 5–7), **3341-9c** (♀ RV: Pl. **20**, 16, fig. 4), **3341-9d** (juv. car.: Pl. **20**, 16, figs. 1–3). All from olive-grey fossiliferous shale, side of canyon wall, at the type locality.

Explanation of Plate 20, 14

Figs. 1–4, adult car. (holotype, **3341-9a**, 0.72 mm long): fig. 1, RV ext. lat.; fig. 2, ext. dors.; fig. 3, ext. vent.; fig. 4, LV ext. lat.
Scale A (250 μm; ×72), figs. 1–4.

Diagnosis: Small, elongate, ellipsoidal carapace. Dorsal margin broadly arched, gently sloping towards anterior. Anterior end evenly rounded, posterior margin bluntly pointed. Posteroventral border slopes steeply from just above midheight to ventral margin. Slight concavity in midventral outline of right valve. Right valve overlaps left, overlap conspicuous around entire margin. Greatest overlap along ventral margin. Internal contact groove around free margin of right valve. Hinge stragulate. Small, shallow, pit-like sulcus located just above midheight and anterior of midlength. Dorsal margin of right valve pinched above and anterior of sulcus, most pronounced in females. Dimorphic; females cuneate in dorsal aspect, maximum width posterior, with interior limen. Surface ornament consists of small-celled, thin-walled reticulation.

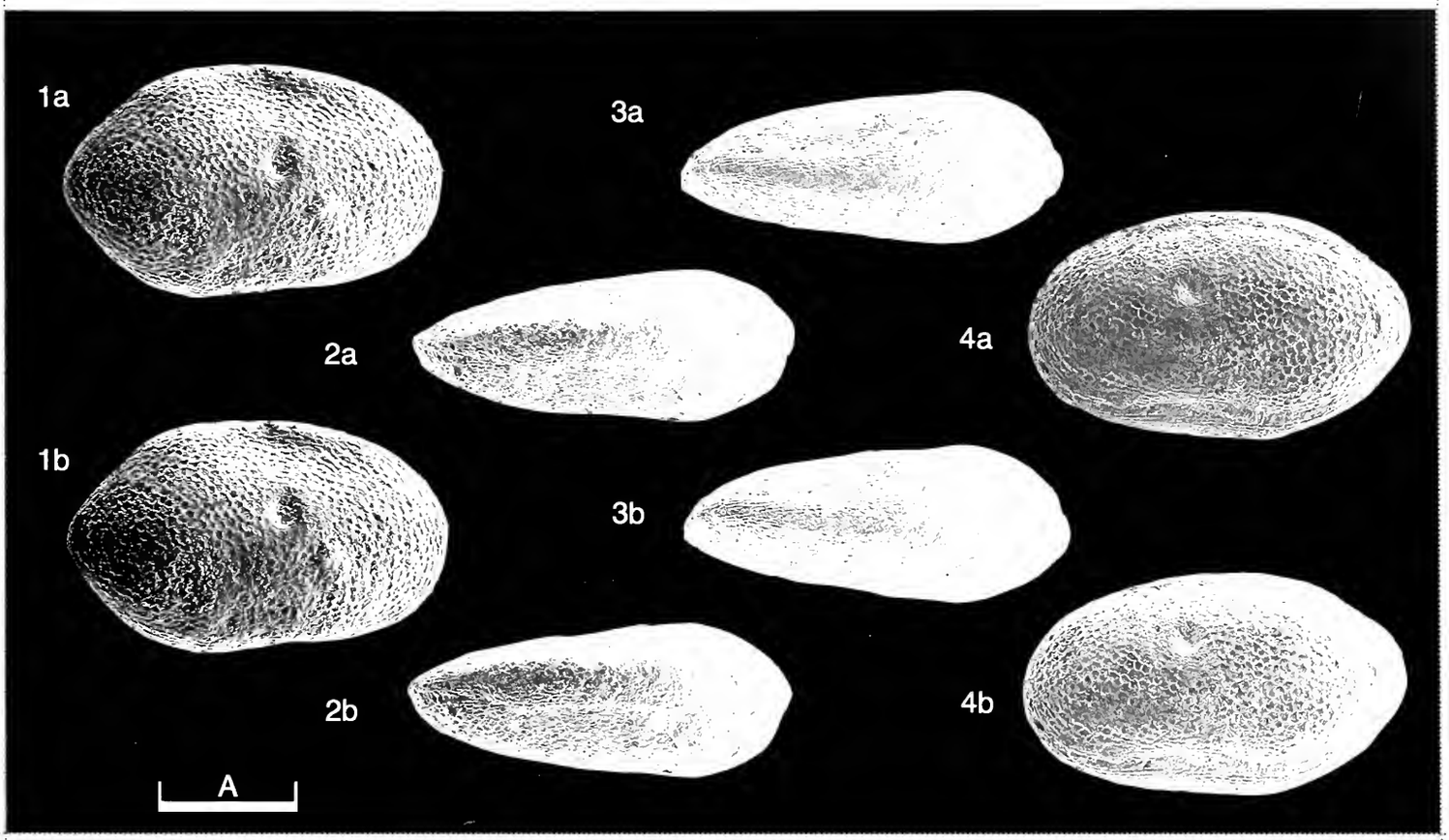
Remarks: According to Benson *et al.* (*Treatise on Invertebrate Paleontology*, Geol. Soc. Amer. & Kansas Univ. Press, Q370, 1961), the cavellinid genus *Sulcella* Coryell & Sample, 1932 only occurs in Carboniferous strata. The presence of *Sulcella huecoensis* in the Hueco Formation of New Mexico therefore extends the range of the genus into the Lower Permian. Of congeneric taxa only *Sulcella* cf. *indistincta* (Tschigova, 1958) *sensu* Robinson (*Geol. J.* (Special Issue) **8**, 134, pl. 3, figs. 6a–b, 1978), from the Tournaisian, Lower Carboniferous of England, is known to have a reticulate surface. *S. huecoensis* differs from *S.* cf. *indistincta* in lateral outline. In particular, the outline of *S. huecoensis* has a greater length to height ratio than *S.* cf. *indistincta*, is more rounded and less quadrate, has a more pronounced posterior acumination and possesses a medial concavity in the ventral margin of the right valve.

Distribution: U.S.A.; Hueco Formation, Wolfcampian Series, Lower Permian.

Acknowledgement: CD acknowledges the financial support given by the Donors of the Petroleum Research Fund administered by the American Chemical Society.

Explanation of Plate 20, 16

Figs. 1–3, juv. car. (paratype, **3341-9d**, 0.62 mm long): fig. 1, ext. dors.; fig. 2, LV ext. lat.; fig. 3, RV ext. lat. Fig. 4, ♀ RV (paratype **3341-9c**, 0.66 mm long): RV int. (note post. limen). Figs. 5–7 adult car. (paratype **3341-9b**, 0.70 mm long): fig. 5, ext. dors.; fig. 6, LV ext. lat.; fig. 7, RV ext. lat.
Scale A (250 μm; ×72), figs. 1–7.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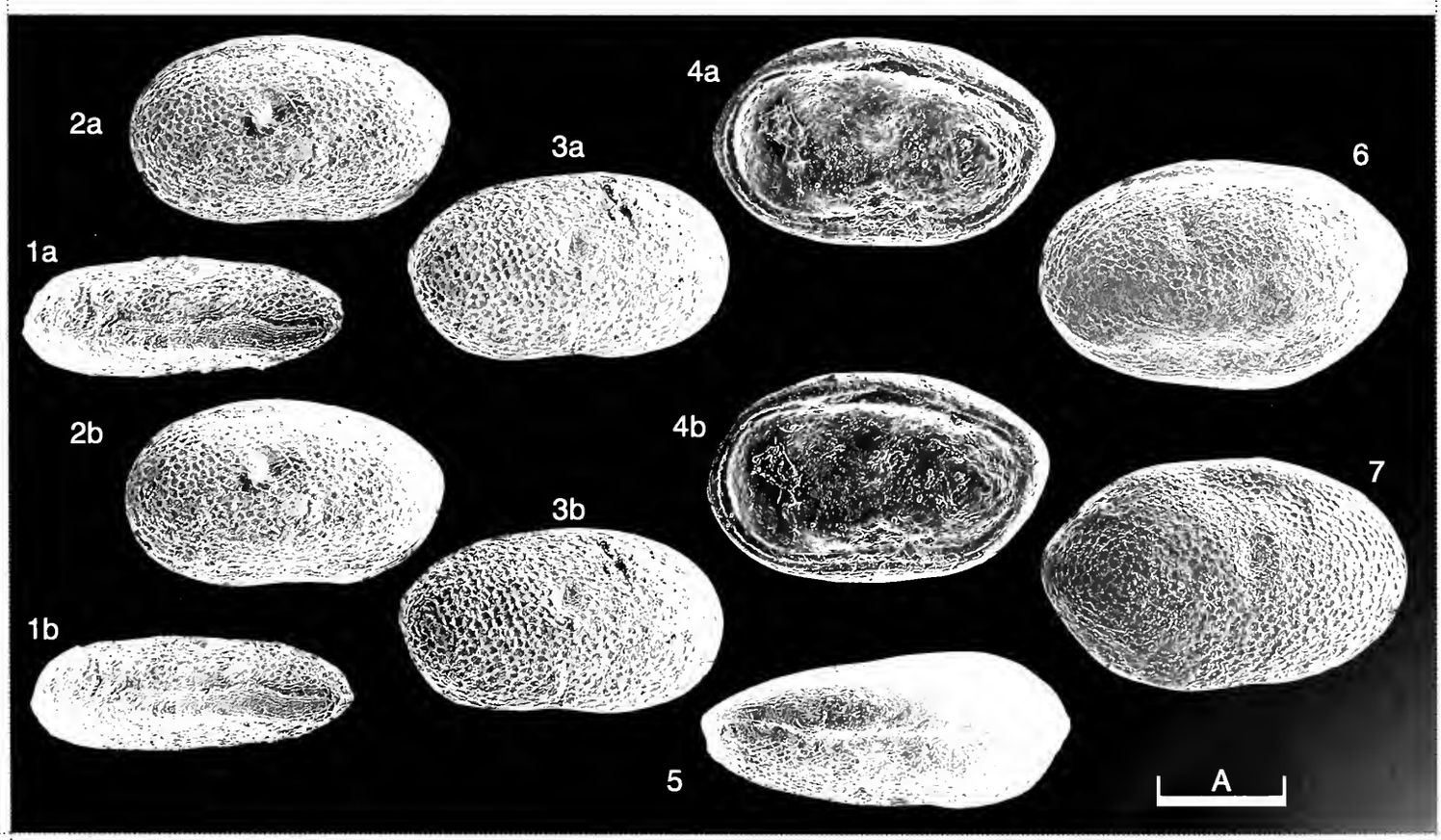
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ON *NIPPONOCYTHERE COLALONGOAE* (CIAMPO)

by Victoria Drapala & Michael A. Ayress
(Department of Geology, Australian National University, Canberra)

Nipponocythere colalongoae (Ciampo, 1986)

1976 *Nipponocythere* sp. K. Ishizaki & F.J. Gunther, *Sci. Rep. Tohoku Univ.* 2nd Ser. (Geol.), **46**, 25, pl. 9, fig. 15; pl. 10, figs. 15–17.

1986 *Flexuocythere colalongoae* n. sp. G. Ciampo, *Boll. Soc. paleont. ital.*, **24**, 85, pl. 6, figs. 4–6, pl. 18, fig. 5.

Holotype: Department of Earth Sciences, University of Naples, Italy; **COC n. 412**; male RV.

Type locality: Rio Mazzapiedi section, Piedmont, Italy; *Globorotalia mediterranea* subzone, Messinian, Upper Miocene.

Figured specimens: National Museum of Victoria (Australia) nos. **P 197916** (♂ car. (disarticulated into LV & RV): Pl. **20**, 18, figs. 1, 2; Pl. **20**, 20, fig. 2, Pl. **20**, 24, fig. 2), **P 197917** (♀ RV: Pl. **20**, 18, fig. 3; Pl. **20**, 20, fig. 1; Pl. **20**, 22, figs. 1, 2), **P 197918** (♂ LV: Pl. **20**, 20, fig. 3; Pl. **20**, 24, fig. 1; text-fig. 1). All from *Eltanin* core PC55-6; Otway Basin, off Victoria, Australia (lat. 38°51′S, long. 141°03′E); Late Quaternary foraminiferal-nannofossil ooze, water depth 2346 m. Specimen **P 197916** is from interval 29–30 cm, **P 197917** is from 39–40 cm and **P 197918** is from 99–100 cm.

Diagnosis: A moderately well-inflated, subtriangular to sub-rectangular species of *Nipponocythere* with fine punctation mainly confined to the centre of the valve and very fine reticulation around the margins; smooth elsewhere. Short posterodorsal ridge reaches above hinge line. Females higher than males.

Explanation of Plate 20, 18

Fig. 1, ♂ car., ext. lat. (**P 197916**, 400 μm long); Fig. 2, ♂ car. dors. (**P 197916**, 400 μm long); Fig. 3, ♀ RV, ext. lat. (**P 197917**, 400 μm long).

Scale A (100 μm; ×140), figs. 1–3.

Remarks: *Nipponocythere* is closest to *Heinia* Bold, 1985 (*J. Paleont.*, **59**, 1). These genera share the same modified gongylodont hinge type, both having asymmetrical posterior elements. A comparison of the type species of both genera show distinct differences in shape: *Nipponocythere bicarinata* (Brady, 1880) (*Rep. scient. Results Voy. Challenger*, (Zoology), **1**(3), 70, pl. 16, figs. 6a–d) is ovate in lateral outline and the inflation is relatively even, whereas *Heinia howei* has a more rectangular outline and strongly compressed marginal regions. However, the outline of some other species included in *Nipponocythere* is very similar to that of certain other species assigned to *Heinia* e.g. a rectangular outline in *Nipponocythere nagaseae* Ishizaki & Gunther, 1976 (*Sci. Rep. Tohoku Univ.*, 2nd Ser. (Geol.), **46**, 24) and *Heinia caudata* (Bold, 1966) (*Verh. K. ned. Akad. Wet.*, (1), **23**, 20); or a subtriangular shape in *Nipponocythere* sp. Tabuki, 1986 (*Bull. Coll. Ed., Univ. Ryukyus*, **29**, 105) and *Heinia* sp. aff. *H. howei* Bold (*J. Paleont.*, **59**, 6).

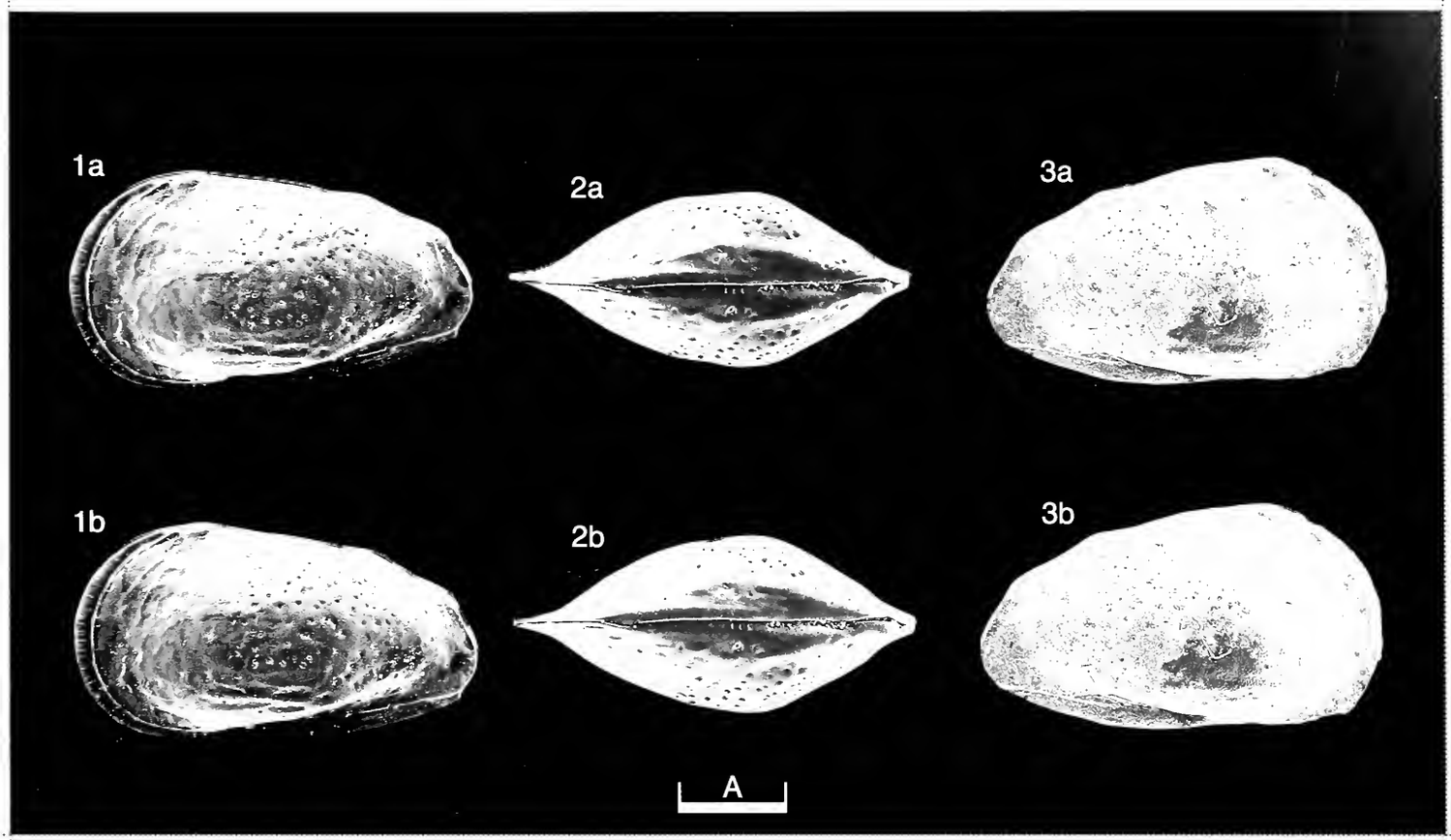
After examination of the type specimens of *Heinia howei* and a consideration of all published species of both genera, we conclude that *Heinia* is perhaps separable on the basis of the enlarged upper two adductor muscle scars (see Ayress & Correge, *Stereo-Atlas Ostracod Shells*, **20**, 25–28, 1993), it usually lacks a ventral ridge and the reticulation is usually more strongly developed. Several species of *Nipponocythere*, including *N. colalongoae*, have an elongated dorsomedian adductor muscle scar, which may represent an intermediate stage in development towards the *Heinia* muscle scar pattern. However, these differences are probably insufficient to separate at generic level and we therefore consider *Heinia* to be a junior synonym of *Nipponocythere*.

Loxoconchidea Bonaduce, Ciampo & Masoli, 1975 (*Pubbl. Staz. zool. Napoli*, **40**, 112) also has the same hinge type and is presumably closely related. It differs from *Nipponocythere* in having a symmetrically convex posterior.

Explanation of Plate 20, 20

Fig. 1, ♀ RV, int. lat. (**P 197917**, 400 μm long); Fig. 2, ♂ car., dissarticulated LV int. lat. (**P 197916**, 400 μm long); Fig. 3 ♂ LV, adductor musc. scar detail (**P 197918**, 400 μm long).

Scale A (100 μm; ×140), figs. 1, 2; scale B (20 μm; ×650), fig. 3.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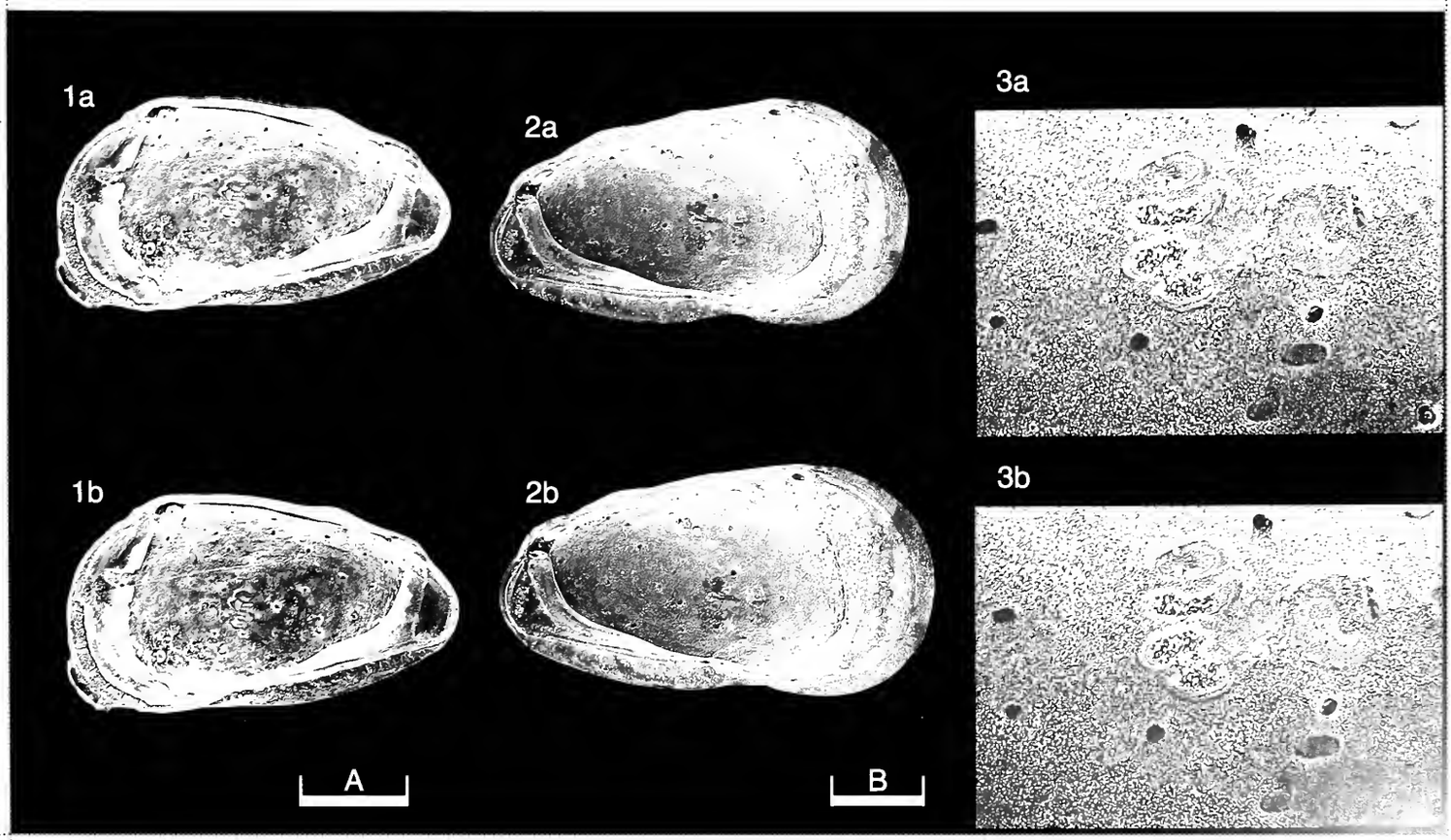
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Although details of the muscle scars have not been described or illustrated, the type species of *Flexuocythere* Ciampo, 1986 (*Boll. Soc. paleont. ital.*, **24**, 85), "*Buntonia*" *parva* Colalongo & Pasini, 1980 (*Boll. Soc. paleont. ital.*, **19**, 68), is considered by us to belong to *Heinia* (= *Nipponocythere*).

Nipponocythere sp. Tabuki, 1986 (*Bull. Coll. Ed., Univ. Ryukyus*, **29**, 105, pl. 19, figs. 14, 15; text-fig. 19-7) is similar to *N. colalongoae* but can be distinguished by its slightly more triangular outline, its narrower posterior and slightly stronger ornamentation. The female specimen of *N. nagaseae* Ishizaki & Gunther (*op. cit.*), is also very similar in shape to *N. colalongoae*. However, the male of *N. nagaseae* is much more elongate and also differs in having more extensive ornamentation.

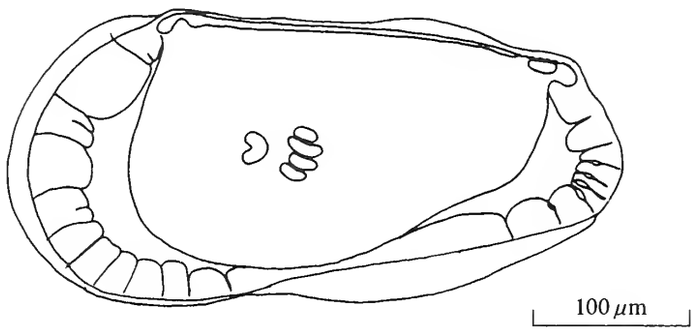
Distribution: Previous records of this species are from bathyal sediments (1404 m) of the Gulf of Panama (Ishizaki & Gunther, *op. cit.*) and from the Pleistocene of Italy (Ciampo, *op. cit.*). We have found it in Late Quaternary sediments from deep-sea cores surrounding Australia: off Victoria, *Eltanin* core PC55-6, 38° 51.2′ S, 141° 33.8′ E, water depth 2346 m; Tasman Sea, BMR core 71 GC044, 29° 30.90′ S, 153° 54.79′, water depth 1298 m; Timor Sea ODP Site 262, 10° 52.19′ S, 123° 50.78′ E, present water depth 2298 m.

Acknowledgements: We would like to thank the Electron Microscope Unit (ANU) for their assistance and use of their scanning electron microscopes.

Explanation of Plate 20, 22

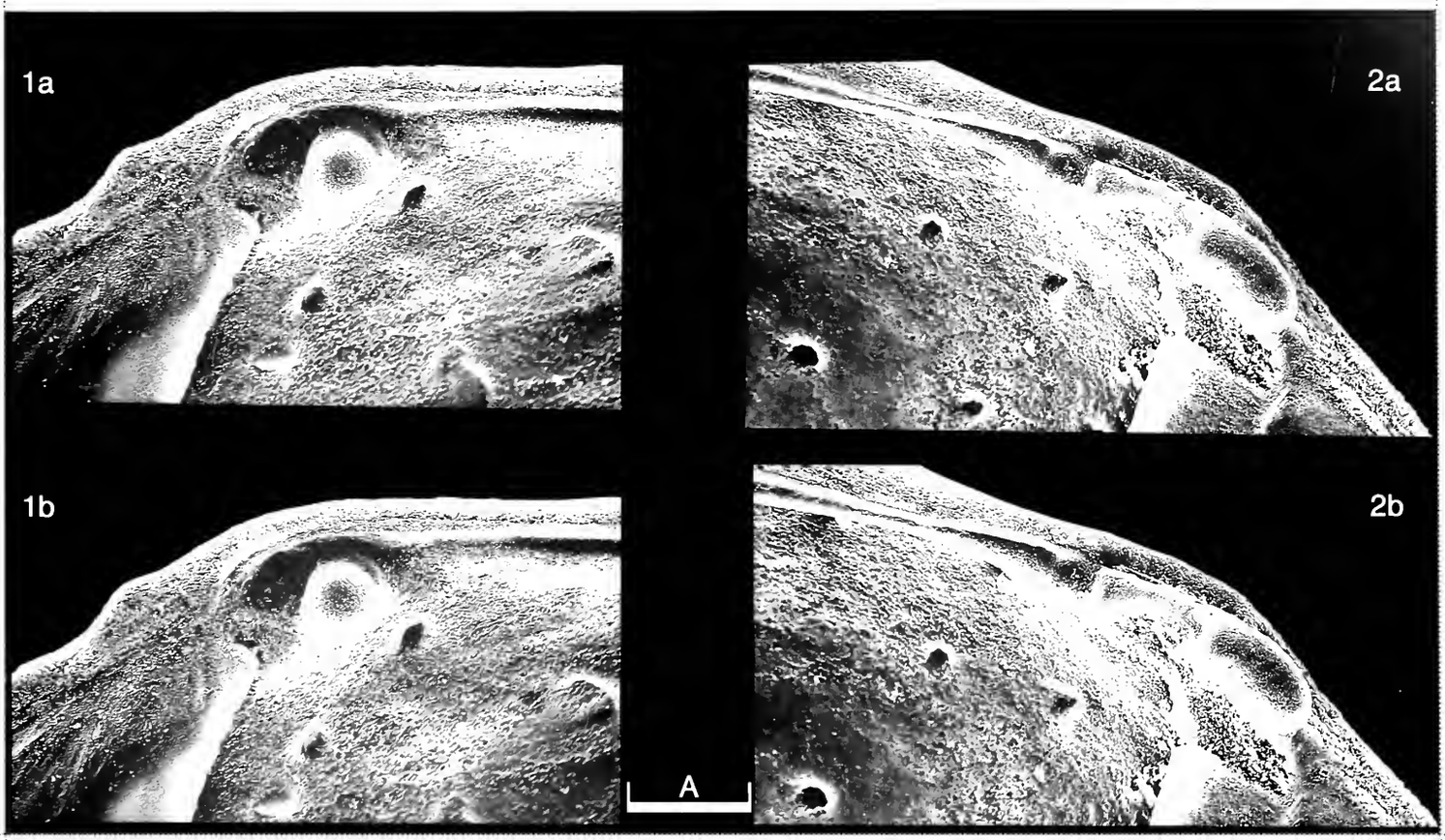
Figs. 1, 2, ♀ RV (**P 197917**, 400 μm long): fig. 1, ant. hinge detail; fig. 2, post. hinge detail.
Scale A (20 μm; ×800), figs. 1, 2.

Text-fig. 1, Internal features observed through transmitted light. Male LV (**P 197918**, 400 μm long).



Explanation of Plate 20, 24

Fig. 1, ♂ LV, post. hinge detail (**P 197918**, 400 μm long); Fig. 2, ♂ car., dissarticulated LV, ant. hinge detail (**P 197916**, 400 μm long).
Scale A (20 μm; ×750), fig. 1; scale B (20 μm; ×1500), fig. 2.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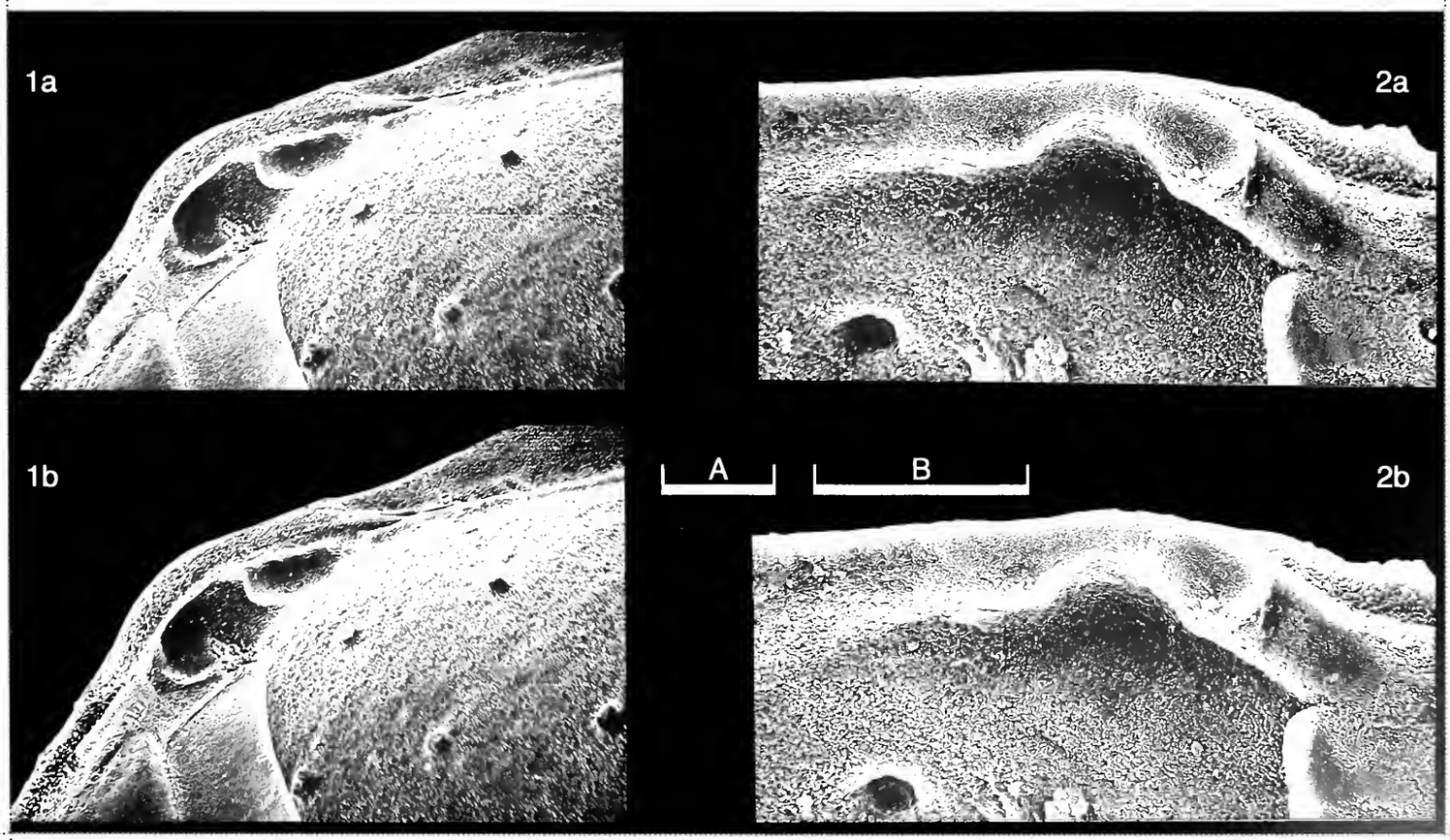
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2b

595.337.14 (119.1) (265.7 : 163.146.25): 551.352 + 552.52

ON *NIPPONOCYTHERE CUNEATA* AYRESS & CORREGE sp. nov.

by Michael A. Ayress & Thierry Correge
(Department of Geology, Australian National University, Canberra)

Nipponocythere cuneata sp. nov.

1985 *Heinia* sp. aff. *H. howei* Bold, *J. Paleont.*, **59**, 6, figs. 6.6, 6.8, 6.9.

Holotype: National Museum of Victoria, Melbourne, Australia, no. **P 197927**.

Type locality: Coral Sea, ODP Site 822, core 3, section 5, interval 60–62 cm, water depth 955 m. Latitude 16° 25.379′ S, longitude 146° 12.904′ E. Late Pleistocene foraminiferal ooze.

Derivation of name: From Latin, *cuneatus*, wedge-shaped; referring to the outline in lateral view.

Figured specimens: National Museum of Victoria, Melbourne, Australia, nos. **P 197927** (holotype, LV: Pl. **20**, 26, figs. 1, 3, Pl. **20**, 28, fig. 2), **P 197928** (paratype, RV: Pl. **20**, 26, fig. 2, Pl. **20**, 28, figs. 1, 3); both from the type locality.

Diagnosis: A wedge-shaped species of *Nipponocythere* with dense reticulation, in which the horizontal muri predominate and secondary punctation anteriorly. A short dorsal rib overreaches dorsal margin posterodorsally. Caudal process well developed subventrally. Sexual dimorphism not apparent.

Remarks: The type specimens of *Heinia howei* Bold, 1985, the type species of *Heinia*, have been examined by us and display internal features identical to those of *N. cuneata*. In addition to Bold's observations on *Heinia*, the asymmetrical posterior hinge elements, in which the tooth in the RV

Explanation of Plate 20, 26

Fig. 1, LV, ext. lat. (**P 197927**, 353 μm long); Fig. 2, RV, ext. lat. (**P 197928**, 353 μm long); Fig. 3, LV, subcentral musc. scars (**P 197927**, 353 μm long).
Scale A (100 μm; ×170), figs. 1, 2; scale B (10 μm; ×1000), fig. 3.

is positioned in the anterior half of the socket and the enlarged upper two adductor muscle scars appear also to be characteristic of *Heinia*. The former feature is shared with *Nipponocythere* Ishizaki (1971, *Sci. Rept. Tohoku Univ.*, 2nd Ser. (Geol.), **43**, 88) and only the latter feature appears to be unique to *Heinia*. We regard this sole feature insufficient to separate the two genera and thus we consider *Heinia* to be a junior synonym of *Nipponocythere* (for further discussion of affinities see Drapala & Ayress, *Stereo-Atlas Ostracod Shells*, **20**, 17, 1993). The dorsal surface of the posterior terminal hinge element of *N. howei* and *N. cuneata* sometimes has weak lobation but this is never developed as strongly as it is in *Kuiperiana* (considered here to be the senior synonym of *Myrena* Neale 1967, *Scient. Rep. Br. Antarct. Surv.*, **58**, 19).

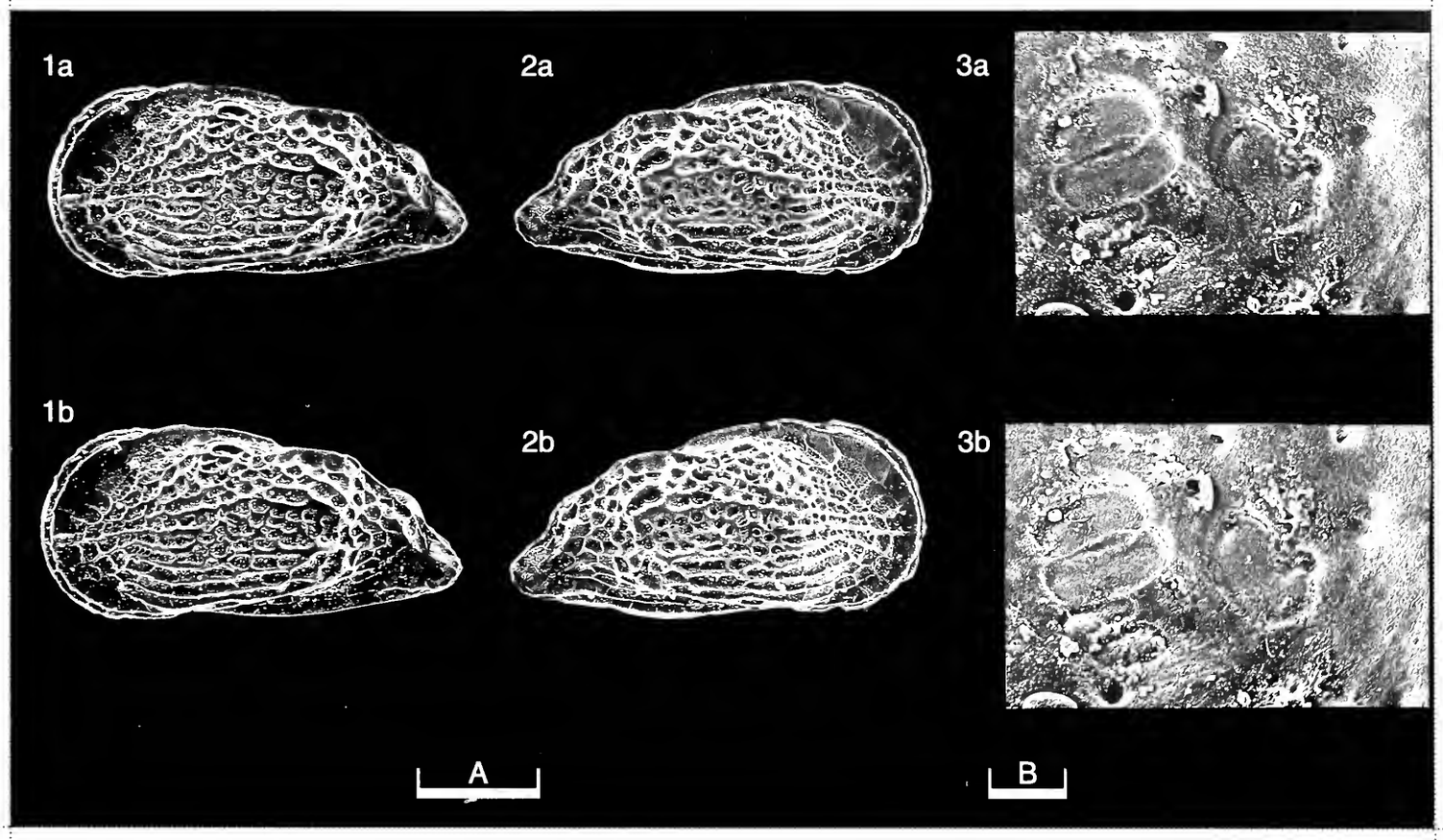
N. cuneata differs from *N. howei* mostly in its more triangular lateral outline and stronger ornament in the posterior half of the carapace. A closely similar species, *N. parva* (Colalongo & Pasini, 1980) (*Boll. Soc. paleont. ital.*, **19**, 68, pl. 21, fig. 9) from the Pleistocene of Calabria, Italy, differs in its more rectangular shape and weaker ornament. *N. caudata* (Bold, 1985) is also somewhat similar but that species is more rectangular and its reticulum is more regularly developed lacking secondary punctation. Other species recorded by Bold, 1985 (*op. cit.*) and left in open nomenclature, differ mainly in detail of the surface ornament.

Distribution: Bold (1985) recorded this species in the Pliocene of the Caribbean and Gulf of Mexico. We have encounted it in the late Pliocene of ODP Site 815, water depth 465.5 m and in the late Pleistocene of ODP Site 822, water depth 955 m, both in the Coral Sea, SW Pacific.

Acknowledgements: We would like to thank the staff of the Electron Microscope Unit (ANU) for their technical assistance and Professor Whatley for critically reviewing the manuscript.

Explanation of Plate 20, 28

Fig. 1, RV, int. lat. (**P 197928**, 353 μm long); Figs. 2, 3, LV (**P 197927**, 353 μm long): fig. 2, int. lat.; fig. 3, post. hinge.
Scale A (100 μm; ×170), figs. 1, 2; scale B (10 μm; ×1200), fig. 3.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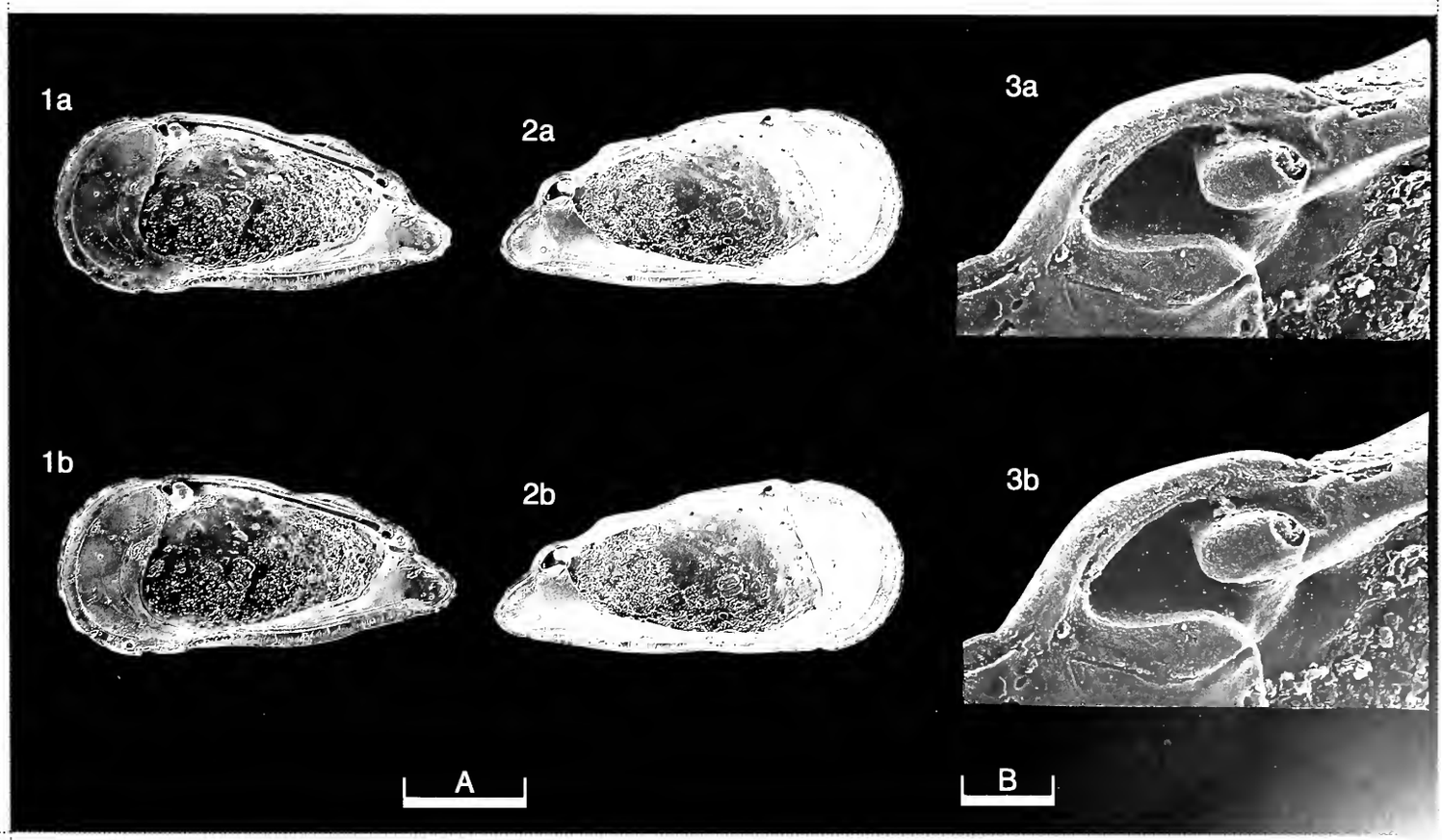
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595.337.14 (119.1) (265.7 : 163.138.34 + 141.39): 551.352 + 552.52

ON *KUIPERIANA DRYPPA* (WHATLEY & COLES)

by Michael A. Ayress & Victoria Drapala
(Department of Geology, Australian National University, Canberra)

Kuiperiana dryppa (Whatley & Coles, 1987)

1987 *Heinia dryppa* sp. nov. R.C. Whatley & G. Coles, *Revta esp. Micropaleont.*, **19**, 75, pl. 4, figs. 20–23.
1988 *Palmoconcha*? sp. 2 R.C. Whatley & M.A. Ayress, *in* Hanai, T. (*et al.*) (Eds.), *Evolutionary Biology of Ostracoda, its Fundamentals and Applications*, Kodansha, Tokyo, etc., 742, p. 2, figs. 10a, b.

Holotype: The Natural History Museum, London [BMNH] no. **OS 12495**; ♀ RV.
Type locality: DSDP Site 607 (lat. 41° 00.07′ N, long. 32° 47.44′ W); core. Water depth 3427 m. Late Pliocene (NN Zone 16).
Figured specimens: National Museum of Victoria (Australia) nos. **P 197919** (adult RV: PL. **20**, 30, fig. 1) and **P 197920** (adult RV: Pl. **20**, 32, figs. 1, 2, 3) from intervals 35–36 cm and 56–57 cm respectively of BMR core 67 GC03, lat. 37° 33.0′ S, long. 138° 35.0′ E; **P 197921** (adult LV: Pl. **20**, 30, figs. 2, 3) from interval 24–25 cm of *Eltanin* core PC55-6, lat. 38° 51.2′ S, long. 141° 03.8′ E.
Diagnosis: A species of *Kuiperiana* with wide compressed margins and ornament of reticulae and secondary punctae in which the horizontal muri predominate. Caudal process moderately well developed.

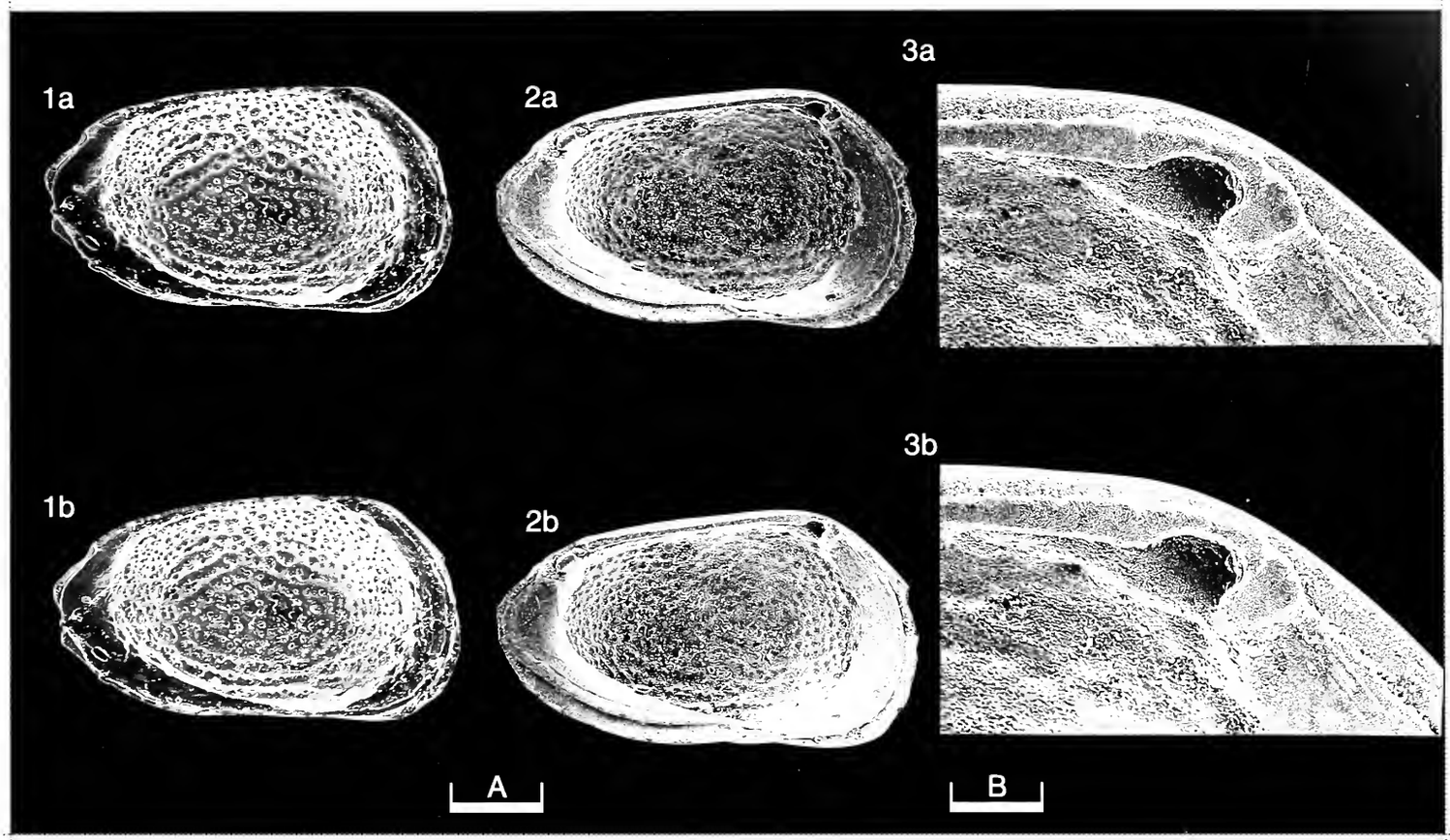
Explanation of Plate 20, 30

Fig. 1, adult RV, ext. lat. (**P 19719**, 440 μm long); Figs. 2, 3, adult LV (**P 197921**, 450 μm long): fig. 2, int. lat.; fig. 3, ant. hinge detail. Scale (100 μm; ×130), figs. 1, 3; scale B (20 μm; ×600), fig. 3.

Remarks: The well preserved specimens of this species, which we have encountered in deep-sea cores adjacent to Australia, show clearly the detail of internal features important for a consideration of the generic placement of this species. In previous works *K. dryppa* has been placed in *Heinia* and *Palmoconcha*. However, we show here that the hingement of this species is inconsistent with those genera. Both lack the strongly denticulate dorsal border of the posterior tooth in the right valve, and on this basis it clearly belongs to *Kuiperiana*. *Heinia* (= *Nipponocythere*, see Drapala & Ayress, *Stereo-Atlas Ostracod Shells*, **20**, 17–24, 1993) also differs significantly in its ventral caudal process, in its enlarged upper two adductor scars (see Ayress & Corrège, *Stereo-Atlas Ostracod Shells*, **20**, 25–28, 1993) and in its discontinuous selvage.
Distribution: This species is distributed worldwide in the deep-sea. We have recorded it in Pleistocene cores in the eastern Indian Ocean and Tasman Sea over a depth range of 1321 m to 2346 m.
Acknowledgements: We would like to thank the Electron Microscope Unit (ANU) for their assistance and use of their scanning electron microscopes.

Explanation of Plate 20, 32

Figs. 1–3, adult RV (**P 197920**, 430 μm long), fig. 1, int. lat.; fig. 2, post. hinge detail; fig. 3, adductor musc. scar detail. Scale A (100 μm; ×140), fig. 1; scale B (20 μm; ×600), fig. 2; scale C (20 μm; ×550), fig. 3.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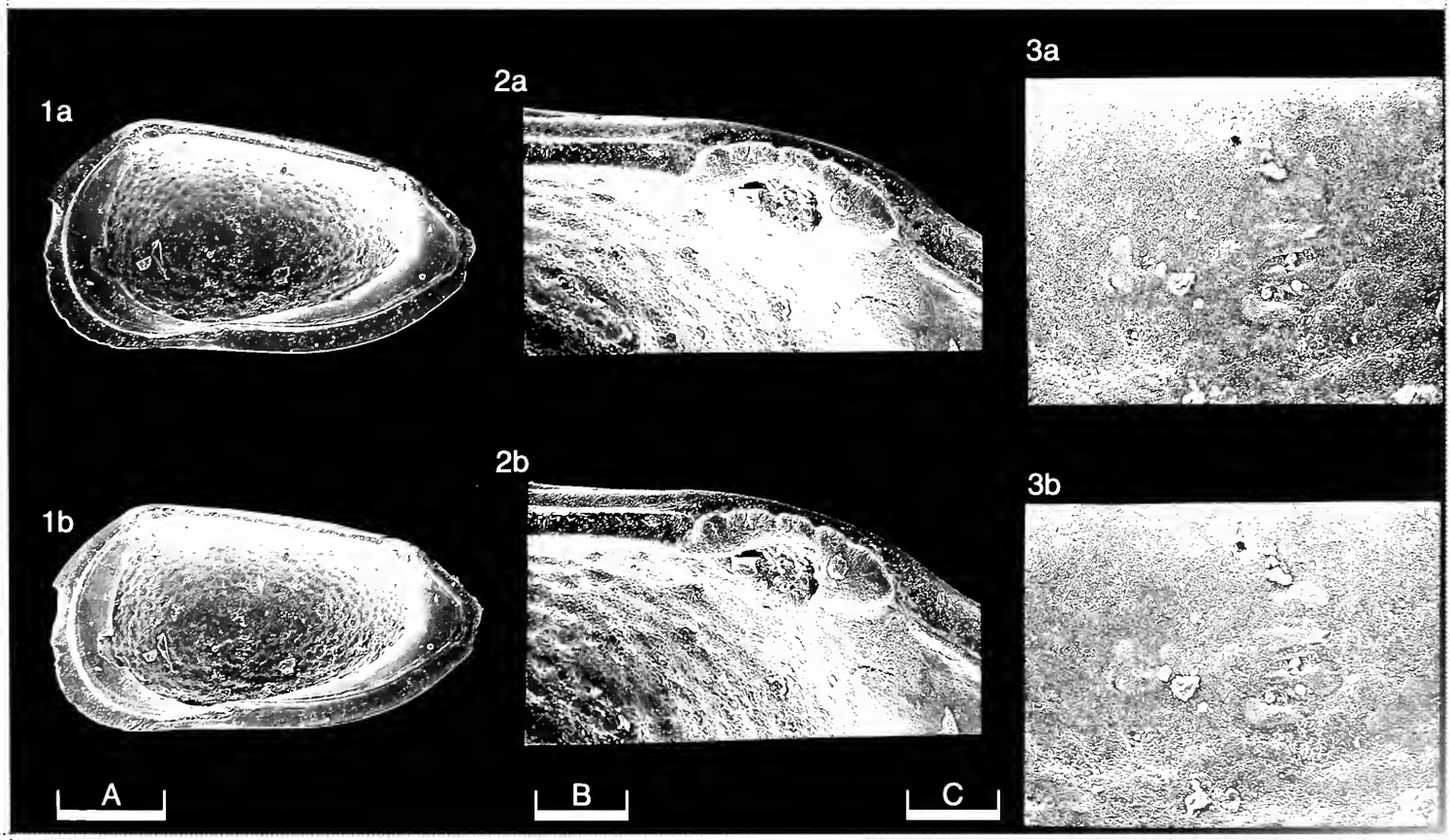
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595.337.1 (113.31) (71 : 162.047.50): 551.351 + 552.55

ON *ABOILIA BLESSI* BECKER & ADAMCZAK gen. et sp. nov.

by Gerhard Becker & Franciszek F. Adamczak
(University of Frankfurt am Main, Germany & University of Stockholm, Sweden)

Genus *ABOILIA* gen. nov.
Type-species: *Aboilia blessi* sp. nov.

Derivation of name: Play on the English term "a boil"; referring to the fanciful resemblance of the dorsal projection of the small valve. Gender, feminine.

Diagnosis: Strongly inequivalved podocopine genus with right valve larger and having a distinct bow-shaped projection (ventriculum) overlapping the left valve ventrally. Left valve provided with a pronounced, posterodorsally situated ridge-like swelling, occasionally overreaches the hinge margin. Dorsal margin convex (as seen in lateral aspect), whereas ventral margin is concave. Right hinge nearly tripartite in appearance.

Remarks: The bow-shaped projection, the almost tripartite hinge situated in a depression, the carapace outline, and the protruding end margins of the right valve of *A. blessi* indicate pachydomelmellid affinities (see Adamczak, F.J., *Senckenberg. leth.*, **57**, 332, 1976). However, the hitherto known representatives of this family characteristically show left-over-right overlap; thus, a reversed overlap for the early podocopines is reported here for the first time, from *Aboilia*.

The distinct valve asymmetry of *Aboilia* is not exceptional for the podocopines, several representatives of which (*Pseudorayella* Neckaja, 1960, *Bairdiocypris* Kegel, 1932, *Pachydomella* Ulrich, 1891) show this characteristic. However, the reason for this phenomenon may only be speculated upon; possibly it has

Explanation of Plate 20, 34

Figs. 1–3, adult car. (holotype, **RGM 414.009**, 580 μm long): fig. 1, lt. lat.; fig. 2, vent. obl.; fig. 3, post. Figs. 4, 5, adult car. (paratype, **RGM 414.010**, 640 μm long): fig. 4, lt. lat.; fig. 5, vent. obl.
Scale A (100 μm; ×107), figs. 1–5.

something to do with the absence, in larger valve of these forms, of an effective stop-structure (which could arrest possible excessive overlap).

Aboilia blessi sp. nov.

Holotype: Nationaal Natuurhistorisch Museum (RGM), Leiden, The Netherlands, no. **RGM 414.009**; an adult carapace.

Derivation of name: In honour of Dr Martin Bless (Heerlen), in recognition of his research on Palaeozoic Ostracoda.

Type locality: From a seamount (Orphan Knoll, see Ruffman, A. & van Hinte, J.E., *Geol. Surv. Pap. Can.*, **71–23**, 407, 1973), in the Labrador sea, approximately 500 km NE of Newfoundland. The material was obtained from a single dredge (LYNCH 7/11/71 cruise, biological dredge station no. D3-7-11-71) at *c.*0140 GMT, May 23rd 1971, at an average position of lat. 50° 33′ N, long. 46° 22′ W and an average depth of 1775 m (see Ruffman, A., *Geol. Surv. Canada*, open file **2065**, 1989). The silicified ostracods come from a single limestone pebble of middle to Upper Ordovician age.

Figured specimens: Nationaal Natuurhistorisch Museum (RGM), Leiden, The Netherlands, nos. **RMG 414.009** (adult car., holotype: Pl. **20**, 34, figs. 1–3; Pl. **20**, 36, fig. 4), **RGM 414.010** (adult car., paratype: Pl. **20**, 34, figs. 4, 5; Pl. **20**, 36, fig. 2) and **RGM 414.011** (adult RV, paratype: Pl. **20**, 36, figs. 1, 3, 5).

All of the figured specimens are from the type locality.

Diagnosis: As for the genus, which is monotypic.

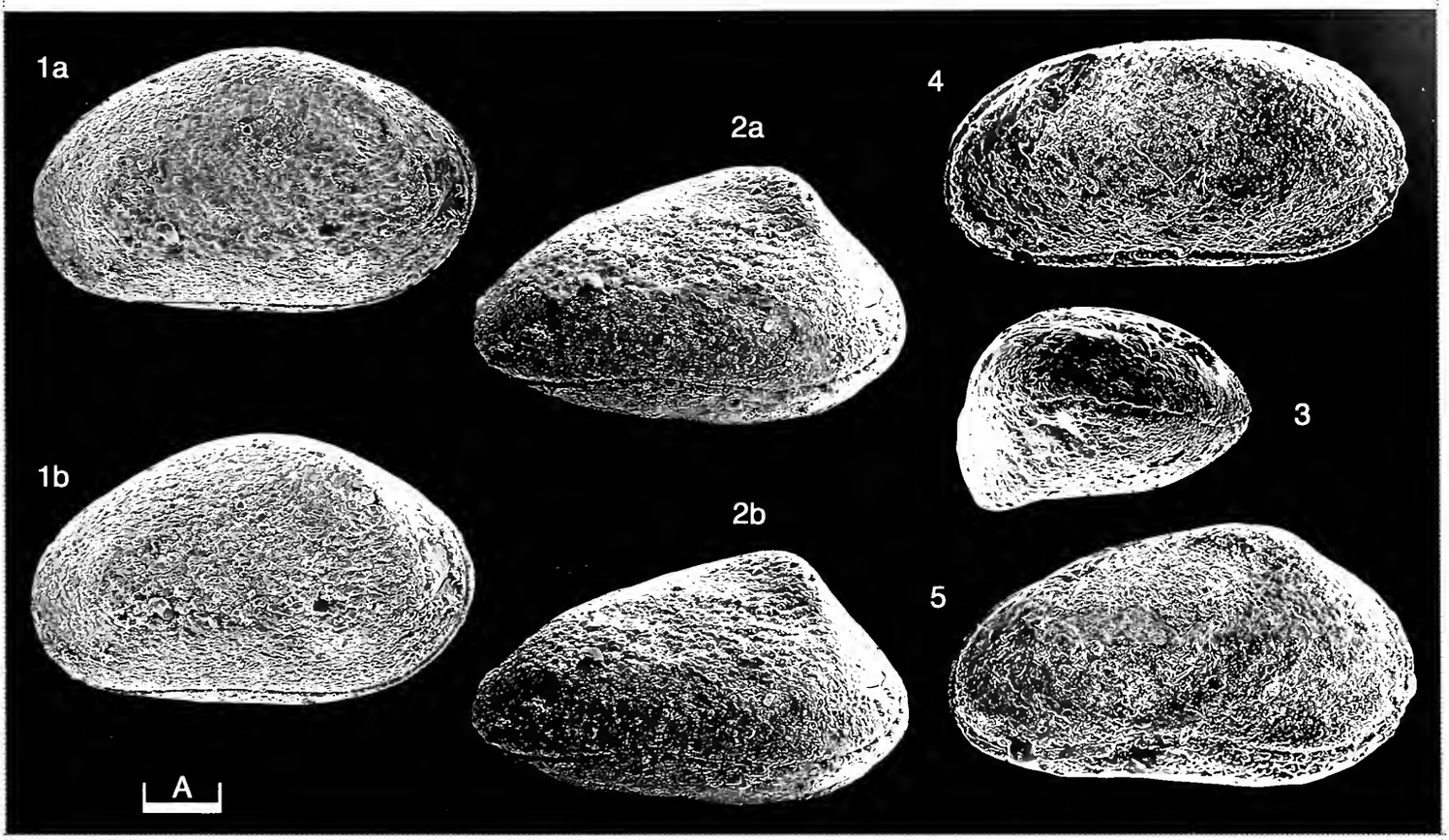
Remarks: The dorsal swelling is present in both adult and juvenile specimens in our material (13 specimens). In adult specimens variation of the size of the dorsal swelling occurs; the swelling influences the lateral outline of the valve if it is particularly pronounced and overreaches the dorsal margin (see Pl. **20**, figs. 1, 3). This variation may be both intraspecific and a product of variable preservation.

The species is considered to be benthic.

Distribution: Only known from the type locality; middle to upper Ordovician.

Explanation of Plate 20, 36

Figs. 1, 3, 5, adult RV (paratype, **RGM 414.011**, 630 μm long): fig. 1, int. lat.; fig. 3, int. vent. obl., ventriculum; fig. 5, int. dors. obl., hinge structure. Fig. 2, adult car., dors. (paratype, **RGM 414.010**, 640 μm long). Fig. 4, adult car., vent. (holotype, **RGM 414.009**, 580 μm long).
Scale A (100 μm; ×107), figs. 1–5.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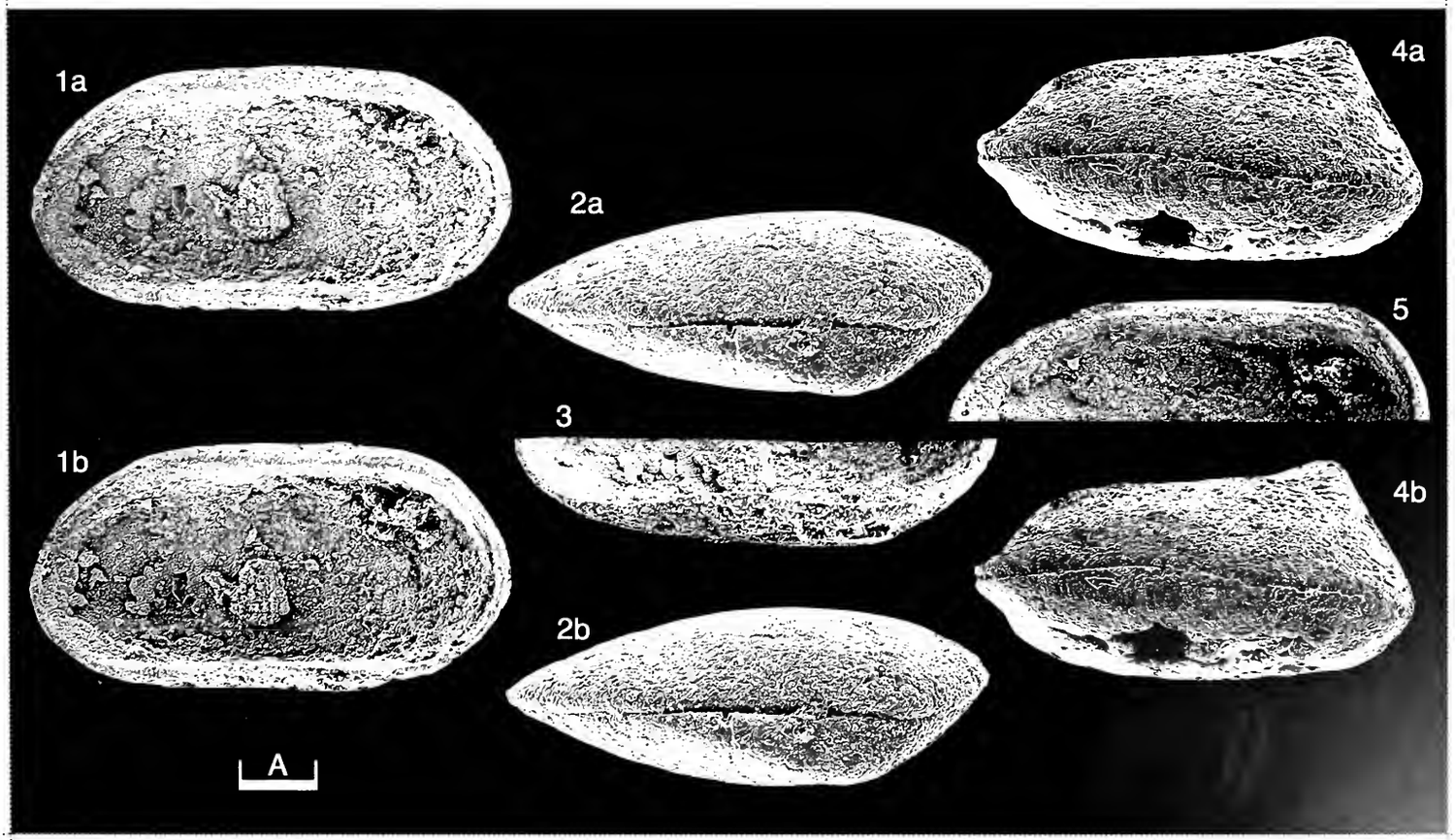
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Stereo-Atlas of Ostracod Shells 20 (9) 37–40 **(1993)**
595.336 (113.312) (766 : 162.097.34): 551.351 + 552.54

ON *BALTONOTELLA ELEGANS* (HARRIS)

by Mark Williams & Jean Vannier
(University of Leicester, England & Université Claude Bernard, Lyon, France)

Baltonotella elegans (Harris, 1957)

1957 *Macronotella elegans* n. sp., R.W. Harris, *Bull. Okla. geol. Surv.*, **75**, 184, pl. 4, figs. 12a–c.

Holotype: Museum of Comparative Zoology, Harvard University, U.S.A., no. **MCZ 4574**; a juvenile carapace.

Type locality: From Decker's Bed 64 (see Harris 1957, *op cit.*), Oil Creek Formation, Simpson Group, middle Ordovician. West Spring Creek locality, Secs. 7 and 8, T2S, R1W, Arbuckle Mountains, Oklahoma, U.S.A.; approximately lat. 34° 30′ N, long. 97° 20′ W.

Figured specimens: Museum of Comparative Zoology (MCZ) , Harvard University, U.S.A., no. **MCZ 4574** (juv. car. holotype: Pl. **20**, 38, figs. 1–4). Natural History Museum, London [BMNH] no. **OS 13637** (car.: Pl. **20**, 40, figs. 1–4). **MCZ 4574** is from the type locality and horizon. **OS 13637** is from the Oil Creek Formation, collected approximately 100 m above the base of the Formation at the type locality.

Diagnosis: Both valves with coarse puncta concentrically arranged around a central smooth (adductor muscle) spot. Marginal areas smooth. Left valve with a row of marginally situated minute denticles. Right valve with an overlap frill demarcated from the ventral valve surface of the right valve by a groove. Overlap contact straight.

Explanation of Plate 20, 38

Figs. 1–4, juv. car. (holotype, **MCZ 4574**, 0.64 mm long): fig. 1, LV ext. lat.; fig. 2, RV ext. lat.; fig. 3, dors. obl.; fig. 4, RV ext. lat. obl.

Scale A (150 μm; ×84), figs. 1–4.

Remarks: *Baltonotella elegans* clearly differs from *Macronotella*, which is dimorphic (see Kesling *et al.*, *Contr. Mus. Paleont. Univ. Mich.*, **10**, 83–100, 1960). *B. elegans* is very similar to Baltic species of *Baltonotella*, particularly to the type species *Baltonotella kuckersiana* (Bonnema, 1909) (see Sarv 1959, *Eesti NSV Tead. Akad. Geol. Instit. Uurim.*, **4**, pl. 32, fig. 17).

Features of *B. elegans* which are characteristic of all *Baltonotella* species include the right over left valve overlap, the straight contact margin, the presence of marginal structures on the left valve, the overreach of the left valve over the right valve dorsally and the subcircular carapace outline. In addition, species of *Baltonotella* are among the most widespread leiocopes (Aparchitidae) in the Ordovician of N America and Europe.

Adults and juveniles of *B. elegans* show great difference in the development of ornament, with punctation being much reduced in adults. Variation of ornament between adults and juveniles appears to be a common feature of *Baltonotella* species.

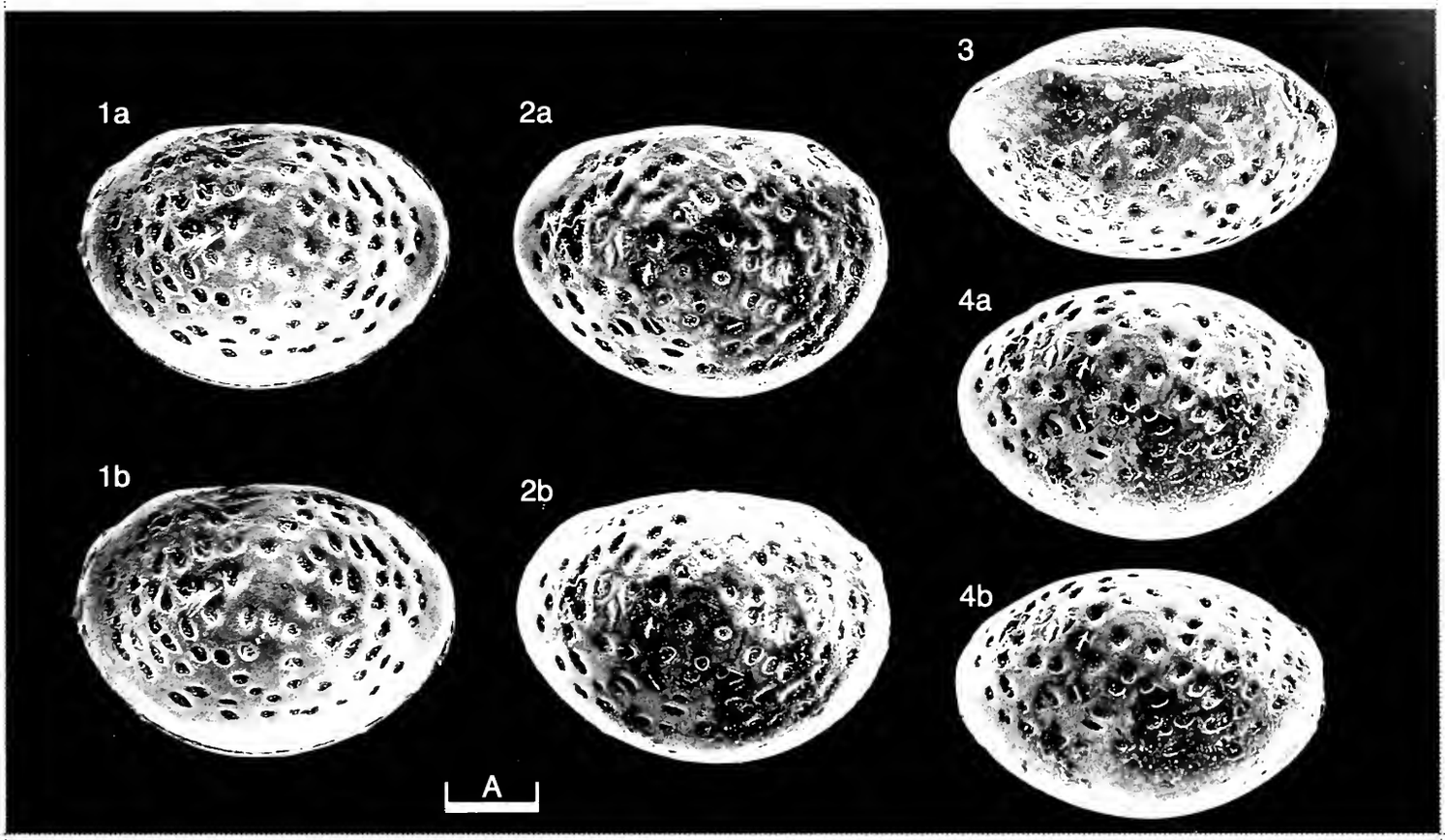
Distribution: Only in the Oil Creek Formation, Simpson Group, middle Ordovician, Arbuckle Mountains, Oklahoma, U.S.A.

Acknowledgements: M. Williams acknowledges support from N.E.R.C., the Alexander von Humboldt Foundation, Bonn, and the Université Claude Bernard, Lyon. Dr J.M. Berdan and Mr M.A. Miller are thanked for loan of specimens.

Explanation of Plate 20, 40

Figs. 1–4, car. (**OS 13637**, 1.30 mm long): fig. 1, LV ext. lat.; fig. 2, vent.; fig. 3., ant.; fig. 4, close-up of marginal structure (LV = top).

Scale A (200 μm; ×39), figs. 1, 2; scale B (200 μm; ×42), fig. 3; scale C (500 μm; ×117), fig. 4.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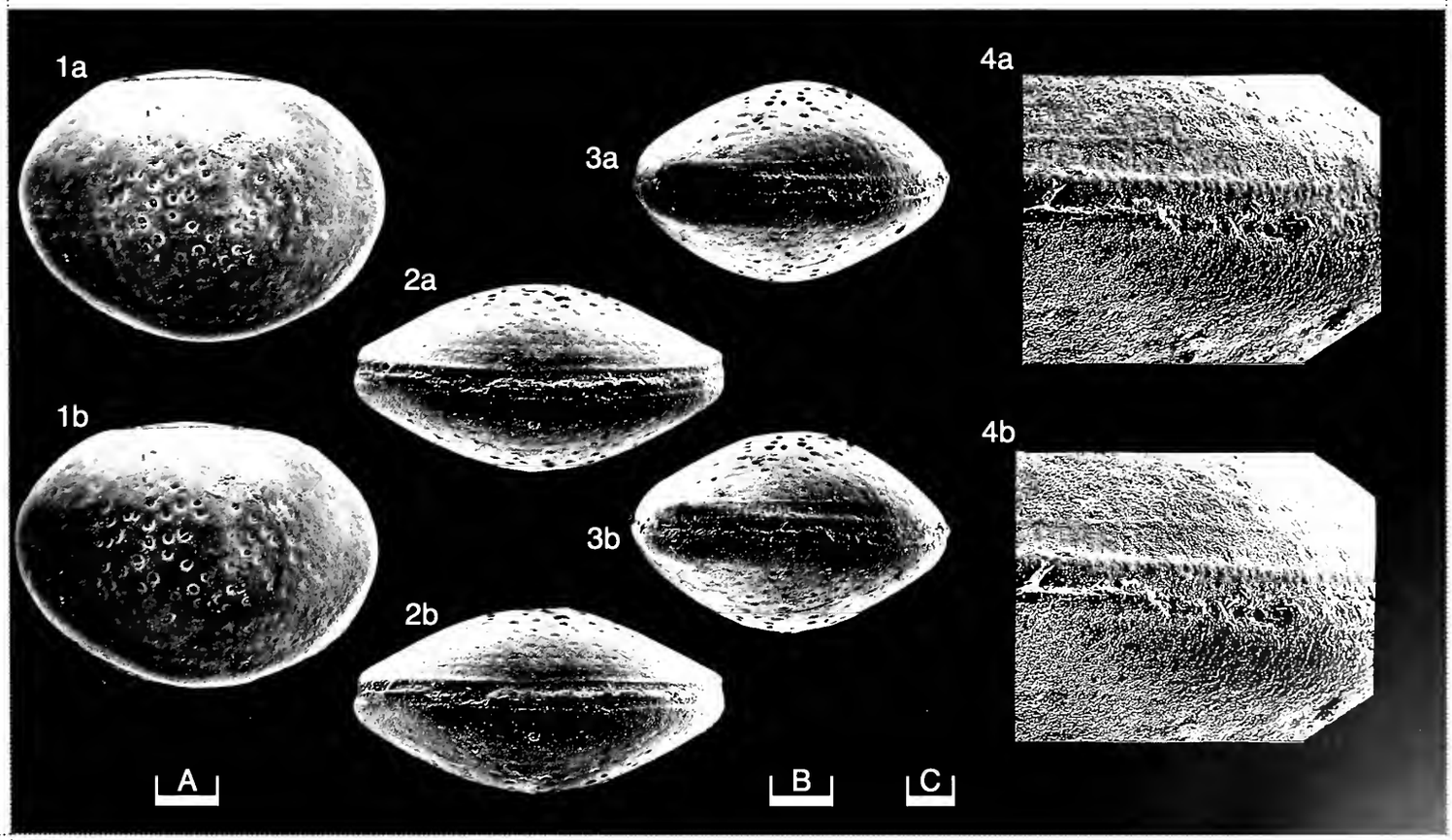
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Stereo-Atlas of Ostracod Shells 20 (10) 41–44 **(1993)**
595.336 (113.312) (776 : 162.096.34): 551.351 + 552.54

ON *KAYINA HYBOSA* HARRIS

by Mark Williams & Jean Vannier
(University of Leicester, England & Université Claude Bernard, Lyon, France)

Genus *KAYINA* Harris, 1957
Type-species (by original designation): *Kayina hybosa* Harris, 1957

Diagnosis: Postplete to sub-amplete. Valves strongly asymmetric; left valve having a pronounced posterodorsal node, can extend above dorsal margin. Left valve weakly overlaps right valve. Contact margin straight. No sulcation or adventral structures.

Remarks: Schallreuter (*Neues Jb. Geol. Paläont., Mh.*, **11**, 690, 1971) assigned *Kayina* to his leiocope family Jaanussoniidae, based primarily on valve asymmetry manifested by a posterodorsally situated node on the left valve. However, *Kayina* does not conform to the typical morphology of jaanussoniids (Vannier, *Lethaia*, **23**, 103, 1990): it has a leperditellid outline (its width and height increase posteriorly) and its carapace is far more elongate than typical jaanussoniids; it shows left over right valve overlap (the opposite is normal in jaanussoniids); its degree of overlap (Text-fig. 1) is, unusually for leiocopes, very slight. *Kayina* appears to be more closely related to the non-leiocope *Leperditella* (Berdan, *Mem. Bur. Mines Mineral Resourc., New Mex.*, **44**, 287, 1988).

Distribution: Middle Ordovician of U.S.A. and possibly the Baltic region.

Kayina hybosa Harris, 1957

1957 *Kayina hybosa* n. sp., R.W. Harris, *Bull. Okla. geol. Surv.*, **75**, 160, pl. 3, figs. 11a–d.
1965 *Kayina hybosa* Harris; M.J. Copeland, *Bull. geol. Surv. Can.*, **127**, 38.
1971 *Kayina hybosa* Harris; R.E.L. Schallreuter, *Neues. Jb. Geol. Paläont. Mh.*, **11**, 254.
1988 *Kayina hybosa* Harris; J. Vannier, *Stereo-Atlas Ostracod Shells*, **15**, 139.

Explanation of Plate 20, 42

Figs. 1–3, car. (holotype, **MCZ 4530a**, 1.08 mm long); fig. 1, LV ext. lat.; fig. 2, LV ext. lat. obl.; fig. 3, RV ext. lat.
Scale A (150 μm; ×57), figs. 1–3.

Holotype: Museum of Comparative Zoology, Harvard University, U.S.A., no. **MCZ 4530a**; a carapace.

Type locality: From Decker's Bed 36 (see Harris 1957), the Bromide Formation, Simpson Group, middle Ordovician. Highway 99 locality, Sec. 11, T1S, R3E, Arbuckle Mountains, Oklahoma, U.S.A.: approximately, lat. 34° 35′ N, long. 96° 41′ W.

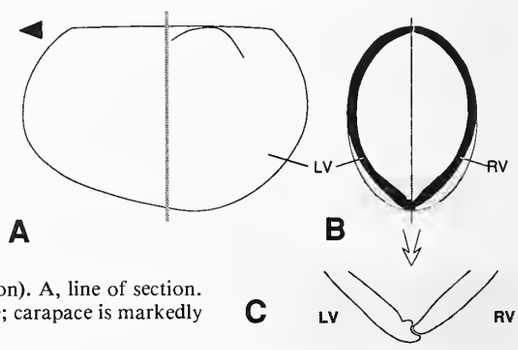
Figured specimens: Museum of Comparative Zoology (MCZ), Harvard University, no. **MCZ 4530a** (holotype, car.: Pl. **20**, 42, figs. 1–3, Pl. **20**, 44, figs. 2, 4); from type horizon and locality. Natural History Museum, London, no. **OS 13571** (car.: Pl. **20**, 44, figs. 1, 3, 5); from Mountain Lake Member, 38 m below top of Bromide Formation at type locality.

Diagnosis: Markedly postplete *Kayina* with pronounced posterodorsal node on left valve; when fully developed over-reaching dorsal margin. No marginal structures. Valve surfaces gently convex, smooth.

Remarks: The relationship of N American and Baltic species assigned to *Kayina* needs to be verified. *K. hybosa* differs considerably from the Baltic *K. subampleta* Schallreuter, 1971 by being distinctly more postplete; by having the dorsal node situated more posteriorly and more distally from the hinge; and by being wider posteriorly. The coeval (Simpson Group) *K? porosa* Harris (1957, *op cit.*) is poorly known; the holotype (**MCZ 4531**) is a crushed carapace with very distorted valve overlap. It appears to differ from *K. hybosa* in being punctate and having a less distinct posterodorsal node.

Distribution: Only in the Bromide Formation, Oklahoma.

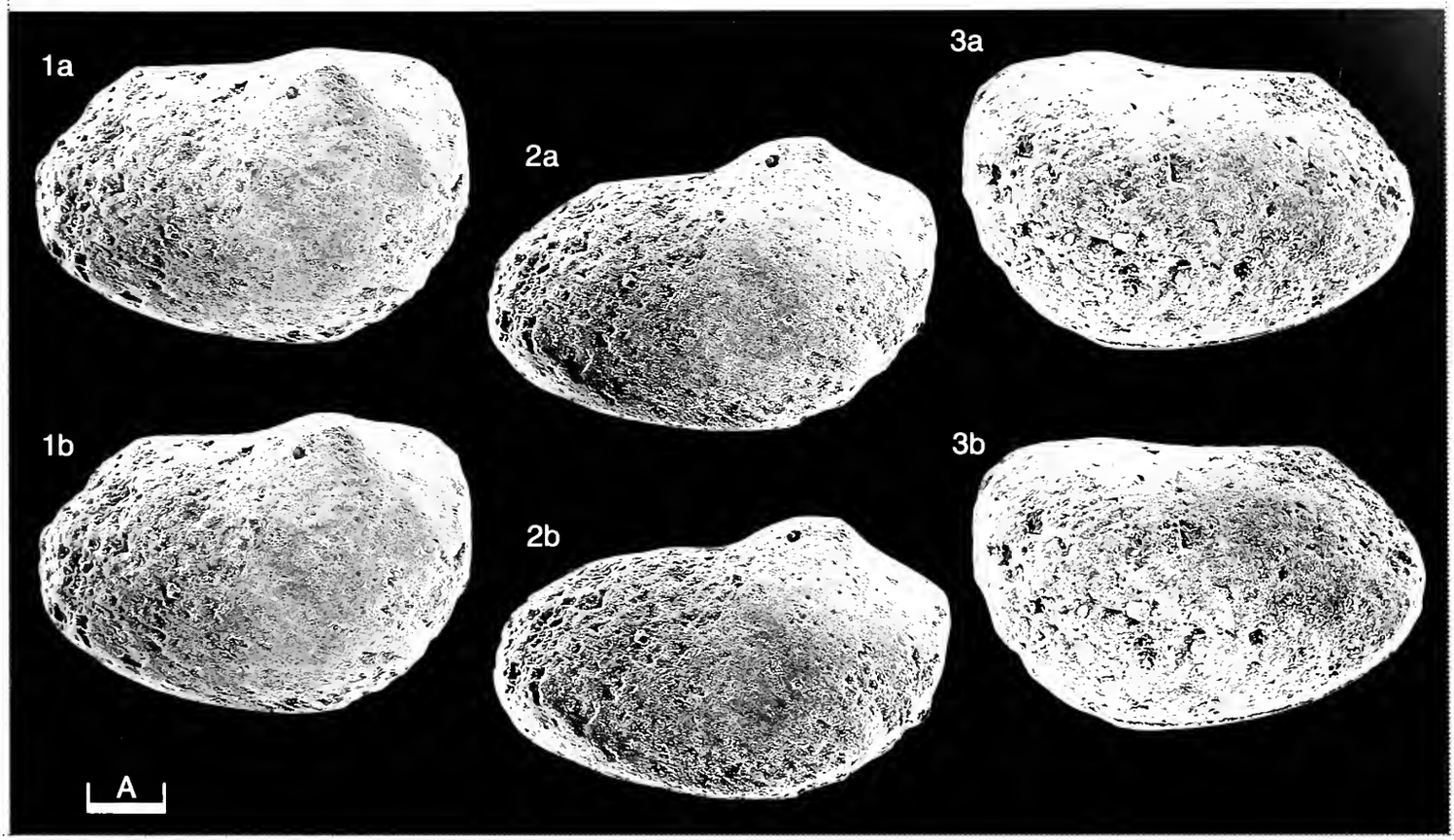
Acknowledgements: M. Williams gratefully acknowledges support from N.E.R.C., the Alexander von Humboldt Foundation, Bonn and the Université Claude Bernard, Lyon. Dr J.M. Berdan is thanked for the loan of specimens.



Text-fig. 1. Carapace of *K. hybosa* in thin section (specimen **FSL 575052**; collections at Lyon). A, line of section. B, thin section, indicating morphology relative to a theoretical ellipse enclosing the carapace; carapace is markedly narrower ventrally. C, ventral overlap structures.

Explanation of Plate 20, 44

Figs. 1, 3, 5, car. (**OS 13571**, 1.00 mm long): fig. 1, LV dors. obl.; fig. 3, close-up of ventral surface; fig. 5, post. detail showing dorsal node. Figs. 2, 4, car. (holotype, **MCZ 4530a**, 1.08 mm long): fig. 2, dors.; fig. 4, RV ext. lat. obl.
Scale A (150 μm; ×63), fig. 1; scale B (150 μm; ×57), figs. 2, 4; scale C (150 μm; ×76), fig. 3; scale D (100 μm; ×93), fig. 5.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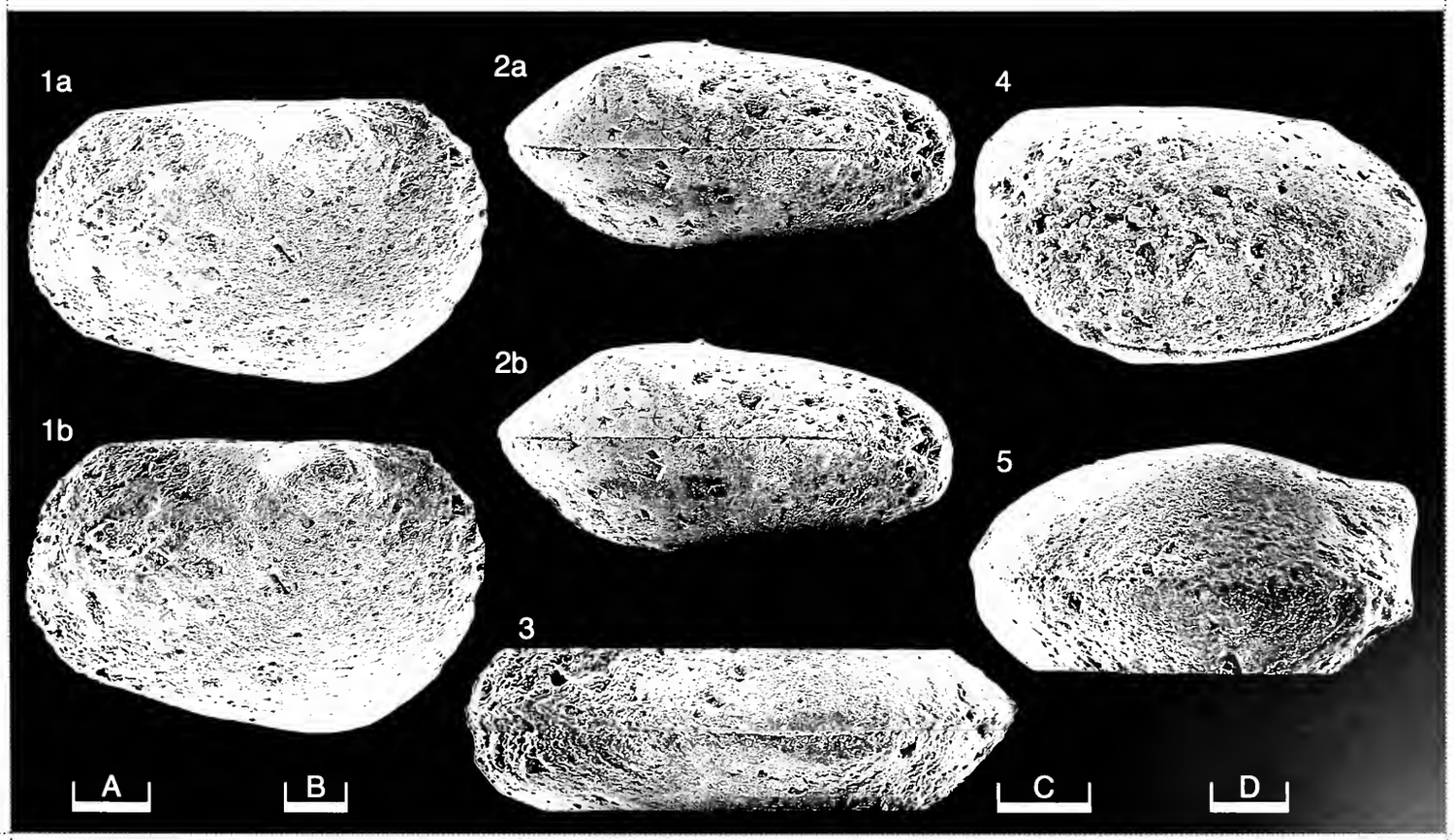
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595.336 (113.312) (766 : 162.097.34): 551.351 + 552.54

ON *PUNCTOSCHMIDTELLA PAUCIPERFORATA* (HARRIS)

by Mark Williams & Jean Vannier
(University of Leicester, England & Université Claude Bernard, Lyon, France)

Punctoschmidtella pauciperforata (Harris, 1957)

?1931 *Aparchites perforata* n. sp., R.W. Harris, *Bull. Okla. geol. Surv.*, **55**, 87, pl. 5, figs. 4a, b.
1957 *Paraschmidtella pauciperforata* n. sp., R.W. Harris, *Bull. Okla. geol. Surv.*, **75**, 173, pl. 4, figs. 15a, b, 16.
1957 *Paraschmidtella perforata* (Harris); R.W. Harris, *Bull. Okla. geol. Surv.*, **75**, 174, pl. 4, figs. 17a, b.
1988 *Punctoschmidtella perforata* (Harris); J.M. Berdan, *Mem. Bur. Mines Mineral Resourc., New Mex.*, **44**, 287.

Holotype: Museum of Comparative Zoology, Harvard University, U.S.A., no. **MCZ 4550**; a carapace.

Type locality: From Decker's Bed 59 (see Harris 1957), the Oil Creek Formation, Simpson Group, middle Ordovician, West Spring Creek locality, Secs. 7 and 8, T2S, R1W, Arbuckle Mountains, Oklahoma, U.S.A.; approximately, lat. 34° 30′ N, long. 97° 20′ W.

Figured specimens: Museum of Comparative Zoology (MCZ), Harvard University, U.S.A. nos. **MCZ 4550** (car. holotype: Pl. **20**, 46, figs. 1, 2, 5; Pl. **20**, 48, figs. 2, 3) and **MCZ 4552** (juv. car.: Pl. **20**, 48, fig. 1). Université Claude Bernard (FSL), Lyon, no. **FSL 575051** (RV; Pl. **20**, 46, figs. 3, 4). **MCZ 4550** (holotype) is from the type horizon and locality. **MCZ 4552** is from the type locality, Decker's Bed 50, Oil Creek Formation. **FSL 575051** is from the Oil Creek Formation, South Interstate 35 locality (see Fay, R.O. *et al.*, *Paleont. Contr. Univ. Kans., Monograph*, **1**, Section 3, 1982), approximately 150 m below the top of the Formation at this locality.

Diagnosis: *Punctoschmidtella* with external smooth adductor muscle spot anteriorly delimited by a shallow sulcal depression. Inner umbonal surface of the smaller right valve with a low dorsocentral node.

Explanation of Plate 20, 46

Figs. 1, 2, 5, car. (holotype, **MCZ 4550**, 1.05 mm long): fig. 1, ext. lt. lat.; fig. 2, ext. lt. lat. obl.; fig. 5, dors. obl. Figs. 3, 4, RV (**FSL 575051**, 1.17 mm long): fig. 3, int. detail of contact groove; fig. 4, int. detail of hinge.
Scale A (150 μm; ×63), figs. 1, 2, 5; scale B (200 μm; ×53), figs. 3, 4.

Remarks: Like many schmidtellids *P. pauciperforata* has thick valves. The relationship of *P. pauciperforata* to other species of *Punctoschmidtella* is indicated in Text-fig. 1. Features constant in definitive species of *Punctoschmidtella* include right over left valve overlap and the presence of a contact groove in the right valve. No adventral structures are present and sulcation is absent or only weakly developed. The dorsum is invariably umbonate and the hinge of the left valve has a groove (see also Berdan 1988).

Berdan (1988) assigned *Paraschmidtella perforata* (Harris, 1931) to her genus *Punctoschmidtella*, presumably on the basis of published figures of this species in Harris 1957 (pl. 4, figs. 17a, b = **MCZ 4552**; herein Pl. **20**, 48, fig. 1). The holotype of *Aparchites perforata* Harris 1931 (pl. 5, figs. 4a, b = **MVZ 7446**) was figured as being punctate but is in fact a severely abraded specimen which cannot be clearly identified and is herein considered a *nomen dubium*. Although a juvenile, Harris' 1957 (**MCZ 4522**) figured specimen referred to *P. perforata* is clearly conspecific with *Paraschmidtella pauciperforata* Harris, 1957 (holotype **MCZ 4550**; see Pl. **20**, 46, figs. 1, 2, 5, Pl. **20**, 48, figs. 2, 3).

Distribution: Only in the Oil Creek Formation, Oklahoma.

Acknowledgements: M. Williams gratefully acknowledges support from N.E.R.C., the Alexander von Humboldt Foundation, Bonn and the Université Claude Bernard, Lyon. Dr J.M. Berdan is thanked for the loan of type specimens.

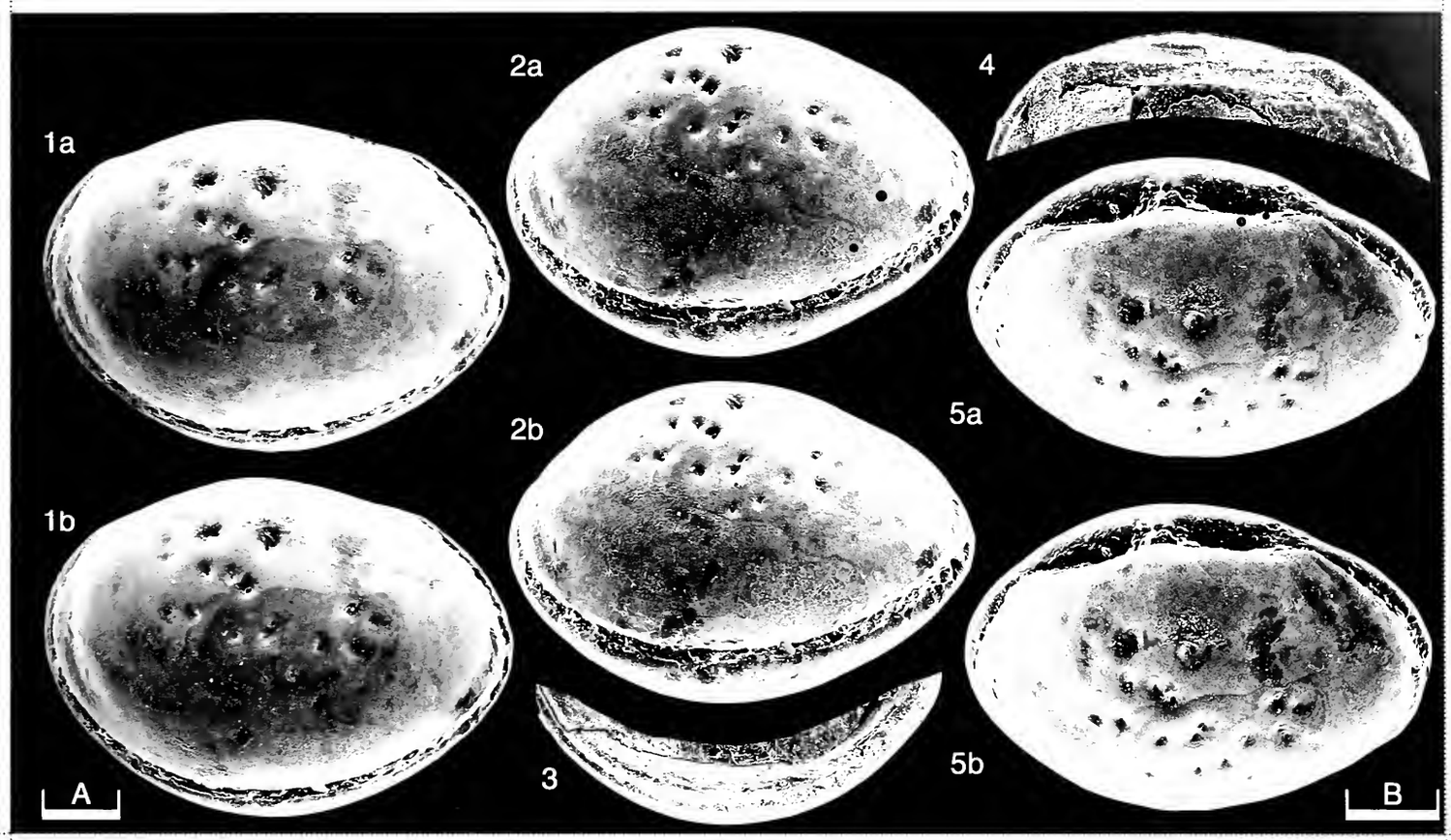
FEATURES / SPECIES	Geometry: size *		carapace outline		Domiciliar features: sulcal structures	muscle spot	margin of lateral surface		latero-dorsal structures			Extradomiciliar features: marginal rim		marginal flattening			internal features	ornament	
	same	larger	smaller	subcircular	angulate equilateral	absent	present	absent	present	flattened	channeled	opisthine dorsum	umbo	mid-dorsal inflation	present	absent	weak	anteriorly distinct	posteriorly distinct	LV more distinct	RV more distinct	both valves equal	contact groove (LV)	hinge groove (RV)	muscle scar	coarse punctation	fine punctation
P. pauciperforata (Harris)	—●—		■				■		■	■		■					■		■				■			■	
P. major Berdan		■		■			■		■	■		■					■		■		■		■	■		■	■
P. minor Berdan	■			■			■		■		■	■			■				■			■	■		■		■
P.? multicavata (Harris)		■		■			■		■	■		—●—				■			■		—●—		internal morphology not known		■		
P. ? reticulata (Harris)		■			■		■		■		■	—●—					■				—●—					■	

* = relative to *P. pauciperforata* —●— only known from a single valve

Text-fig. 1. Carapace features of species of *Punctoschmidtella*.

Explanation of Plate 20, 48

Fig. 1, juv. car., ext. lt. lat. (**MCZ 4552**, 0.72 mm long). Figs. 2, 3, car. (holotype, **MCZ 4550**, 1.05 mm long): fig. 2, ext. rt. lat.; fig. 3, ext. rt. lat. obl. Scale A (100 μm; ×88), fig. 1; scale B (150 μm; ×63), figs. 2, 3.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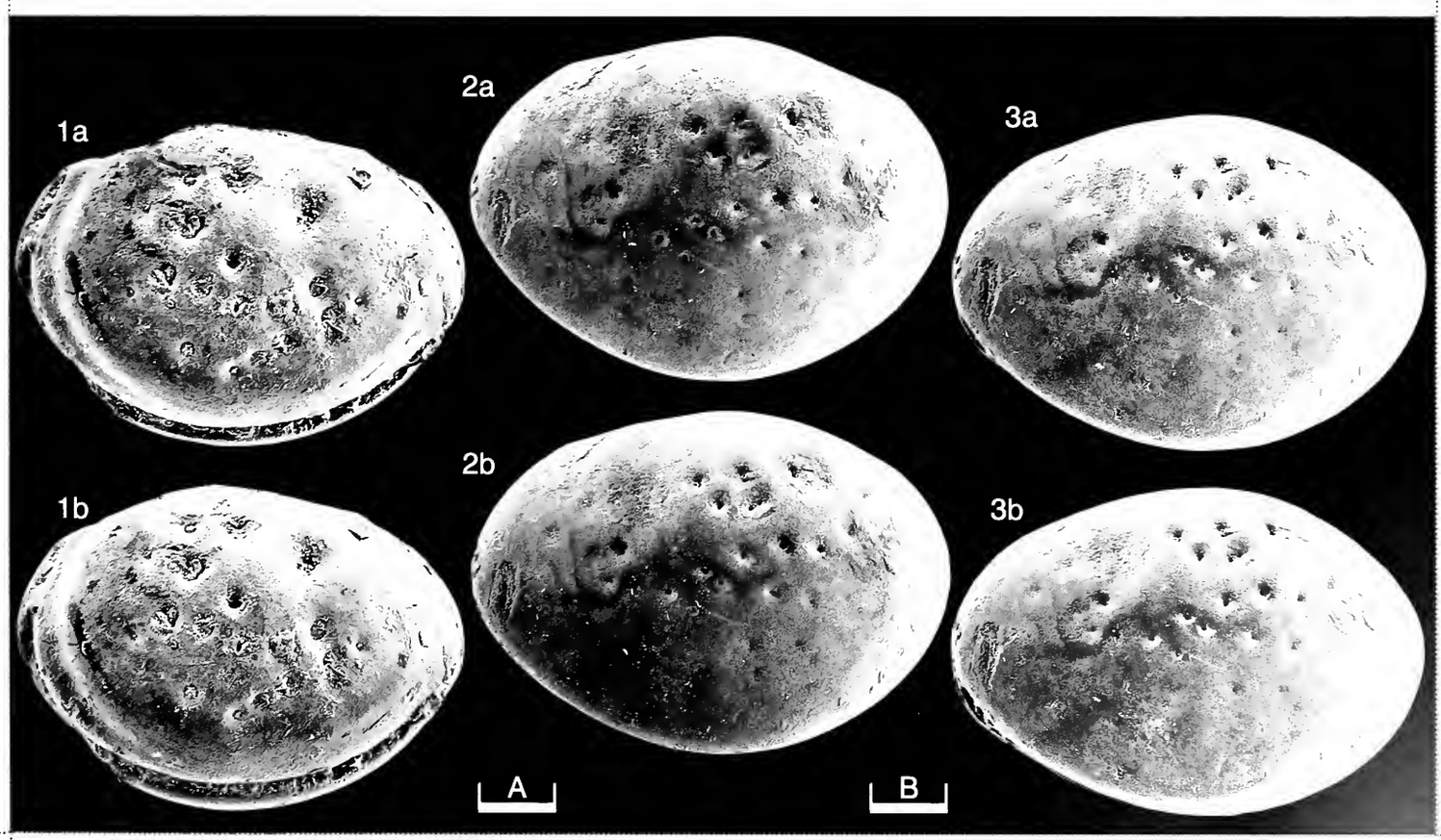
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595.337.23 (113.331) (420 : 162.003.52): 551.351 + 552.52

ON *WENLOCKIELLA PHILLIPSIANA* (JONES & HOLL)

by Robert F. Lundin & Lee E. Petersen
(Arizona State University, Tempe & Anadarko Petroleum Corporation, Houston, U.S.A.)

Genus *WENLOCKIELLA* gen. nov.
Type-species: *Bairdia phillipsiana* Jones & Holl, 1869

Derivation of name: For the type Wenlock Series of the Silurian, in which the genus is abundant.

Diagnosis: Smooth Thlipsuracea with subreniform to subtriangular outline in lateral view and subtriangular to ovate transverse outline. Typically with strong dorsal L/R overreach. Ventral commissure straight in the anterior/posterior direction. Contact groove in left valve poorly developed or absent; where present, best developed along anteroventral and posteroventral contact margin. Hinge distinctly inclined to longitudinal axis of carapace.

Remarks: The type-species and similar related species are homeomorphs with the Middle Devonian genus *Bairdiocypris* Kegel, 1932. The discovery of a calcified inner lamella in *Bairdiocypris* (Adamczak, F. *in*: J.W. Neale (Ed.), *Taxonomy, Morphology and Ecology of Recent Ostracoda*, Oliver & Boyd, Edinburgh, 93, 1969) and Adamczak's subsequent (*Senckenberg. leth.*, **57**, 265, 1976) analysis of several species of the same genus demonstrates that the Silurian and probably the early Devonian forms referred to herein are not members of *Bairdiocypris*. *Wenlockiella* differs from *Bairdiocypris* in lacking a calcified inner lamella, in having a unipartite hinge and in lacking a bow-shaped projection (ventriculus). In addition, in most species of *Wenlockiella* the hinge is distinctly inclined to the longitudinal axis of the carapace whereas in *Bairdiocypris* the hinge is typically parallel or subparallel to the longitudinal axis of the carapace. *Wenlockiella* is distinguished from *Silenis* Neckaja, 1958 by details of hingement and by valve relationships along the dorsum. It is distinguished from *Octonaria* Jones, 1887, to which it is ancestral (Petersen, L.E. & Lundin, R.F., *J. micropalaeontol.*, **6**(1), 77, 1987), by lack of shell sculpture.

We place the following species in *Wenlockiella*: *Bairdia phillipsiana* Jones & Holl, 1869; *Macrocypris crassula* Jones, 1887; *Bythocypris phaseolus* Jones, 1887; and *Bythocypris gotlandica* Jones, 1889. The following species are placed in

Explanation of Plate 20, 50

Figs. 1–4, car. (**ASU X-148**, 1429 μm long): fig. 1, ext. post.; fig. 2, ext. dors.; fig. 3, ext. vent.; fig. 4, ext. rt. lat. Figs. 5, 6, car. (holotype, **BMNH I 2066**, 1250 μm long): fig. 5, ext. rt. lat.; fig. 6, ext. lt. lat.

Scale A (200 μm; ×36), figs. 1–4; scale B (200 μm; ×40), figs. 5, 6.

Wenlockiella provisionally: *Bythocypris transversa* Roth, 1929; *Bairdiocypris*? sp. A of Lundin, 1965; *Bairdiocypris*? sp. B of Lundin, 1965; and *Kuresaaria blackstonensis* Berdan & Copeland, 1973.

The calcified inner lamellae reported by Lundin (*Bull. Okla. geol. Surv.*, **108**, 58, 1965) for *Bairdiocypris*? spp. A and B need to be verified by thin sections. It is possible that these species possess only thickenings of the shell along the anteroventral and posteroventral parts of the contact margin. These species and *Bythocypris transversa* Roth, 1929 have no bow-shaped projection and probably belong to *Wenlockiella*, but additional study is required to confirm this. We conclude from illustrations (Berdan & Copeland (*Prof. Pap. U.S. geol. Surv.*, **825**, 35, pl. 12, figs. 13–25, 1973) that the holotype of *K. blackstonensis* and all of the paratypes illustrated except the one in figure 22 (= a *Kuresaaria*), and possibly the one in figure 21, probably belong to *Wenlockiella*.

Wenlockiella is known from the Silurian of Great Britain, Gotland, the eastern Baltic area and Podolia. Species provisionally included in the genus are from the upper Silurian and lower Devonian of the North American Midcontinent (Oklahoma and western Tennessee) and the lower Devonian of northwestern North America (Alaska and the Yukon Territories).

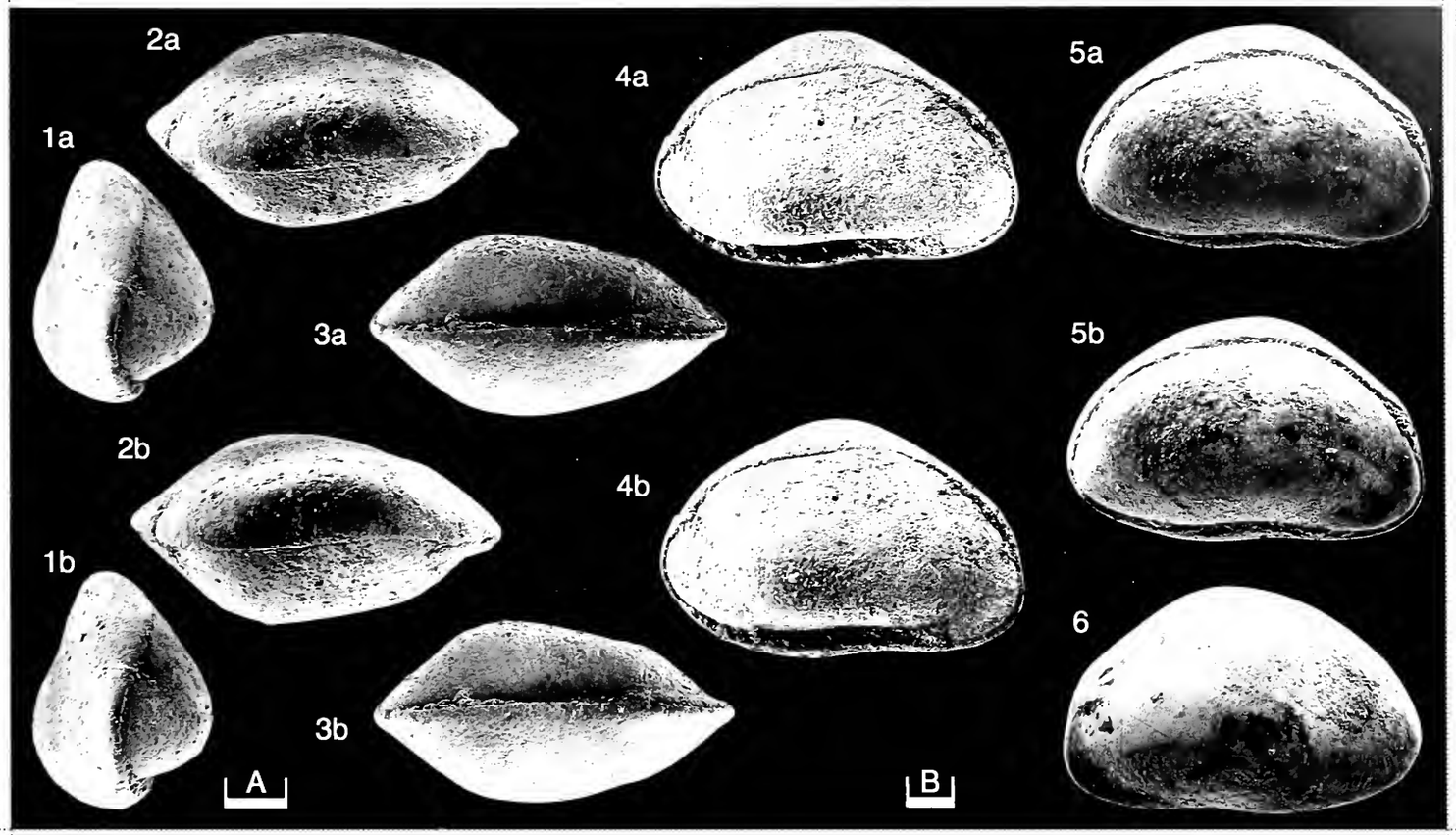
Wenlockiella phillipsiana (Jones & Holl, 1869)

1869 *Bairdia phillipsiana* sp. nov. T.R. Jones & H.B. Holl, *Ann. Mag. nat. Hist.*, (4), **3**, 213, pl. 14, figs. 7a–c.
1887 *Bythocypris phillipsiana* var. *typica* (Jones & Holl); T.R. Jones, *Ann. Mag. nat. Hist.*, (5), **19**, 187, pl. 5, figs. 4a–c.
non 1887 *Bythocypris phillipsiana* var. *major* (Jones & Holl); T.R. Jones, *Ann. Mag. nat. Hist.*, (5), **19**, 187, pl. 5, figs. 3a, b.
1923 *Bythocypris phillipsiana* (Jones & Holl); E.O. Ulrich & R.S. Bassler, *Maryland Geol. Surv.*, **Silurian**, 320, fig. 25:2.
non 1923 *Bythocypris phillipsiana* (Jones & Holl); E.O. Ulrich & R.S. Bassler, *Maryland Geol. Surv.*, **Silurian**, 702, pl. 63, fig. 9.
non 1960 *Bythocypris phillipsiana* (Jones & Holl); M.J. Copeland, *Palaeontology*, **3**, 101, pl. 23, figs. 21, 22 [*sic*], 19, 20.
non 1961 *"Bythocypris" phillipsiana* (Jones & Holl); D.M. Hoskins, *Bull. Pa topogr. geol. Surv.*, **G36**, 97, pl. 7, figs. 19–21.
1963 *Bairdiocypris phillipsiana* (Jones & Holl); V.S. Krandijevsky, *Fauna ostrakod silurijskich vidkladiv Podillia, Akad. Nauk Ukr. SSR* (in Ukranian), 114, pl. 11, figs. 1–4.
1971 *Bairdiocypris phillipsianus* (Jones & Holl); A.F. Abushik, *Ostracoda from Silurian-Lower Devonian key sections of Podolia*, in: A.F. Abushik, E.A. Gusseva & I.E. Zanina (Eds.), *Palaeozoic ostracodes from key sections in the European part of the USSR, Moscow Akad. Nauka* (in Russian), **117**, pl. 42, figs. 3–6.
1972 *Bairdiocypris phillipsianus* (Jones & Holl); A.A. Pranskevichius, *Trans. Lithuanian Scientific-Research Geol. Surv. Inst.* (in Russian), **15**, 138, pl. 28, figs. 1, 2.
1991 *"Bairdiocypris" phillipsiana* (Jones & Holl); R.F. Lundin, L.E. Petersen & D.J. Siveter, *J. micropalaeontol.*, **9**(2) (for 1990), pl. 2, fig. 13.

Explanation of Plate 20, 52

Figs. 1–3, car. (**ASU X-201**, 1429 μm long): fig. 1, ext. post.; fig. 2, ext. rt. lat.; fig. 3, ext. lt. lat. Figs. 4, 5, car. (**ASU X-202**, 1128 μm long): fig. 4, ext. vent.; fig. 5, ext. rt. lat.

Scale A (200 μm; ×36), figs. 1–3; scale B (200 μm; ×44), figs. 4, 5.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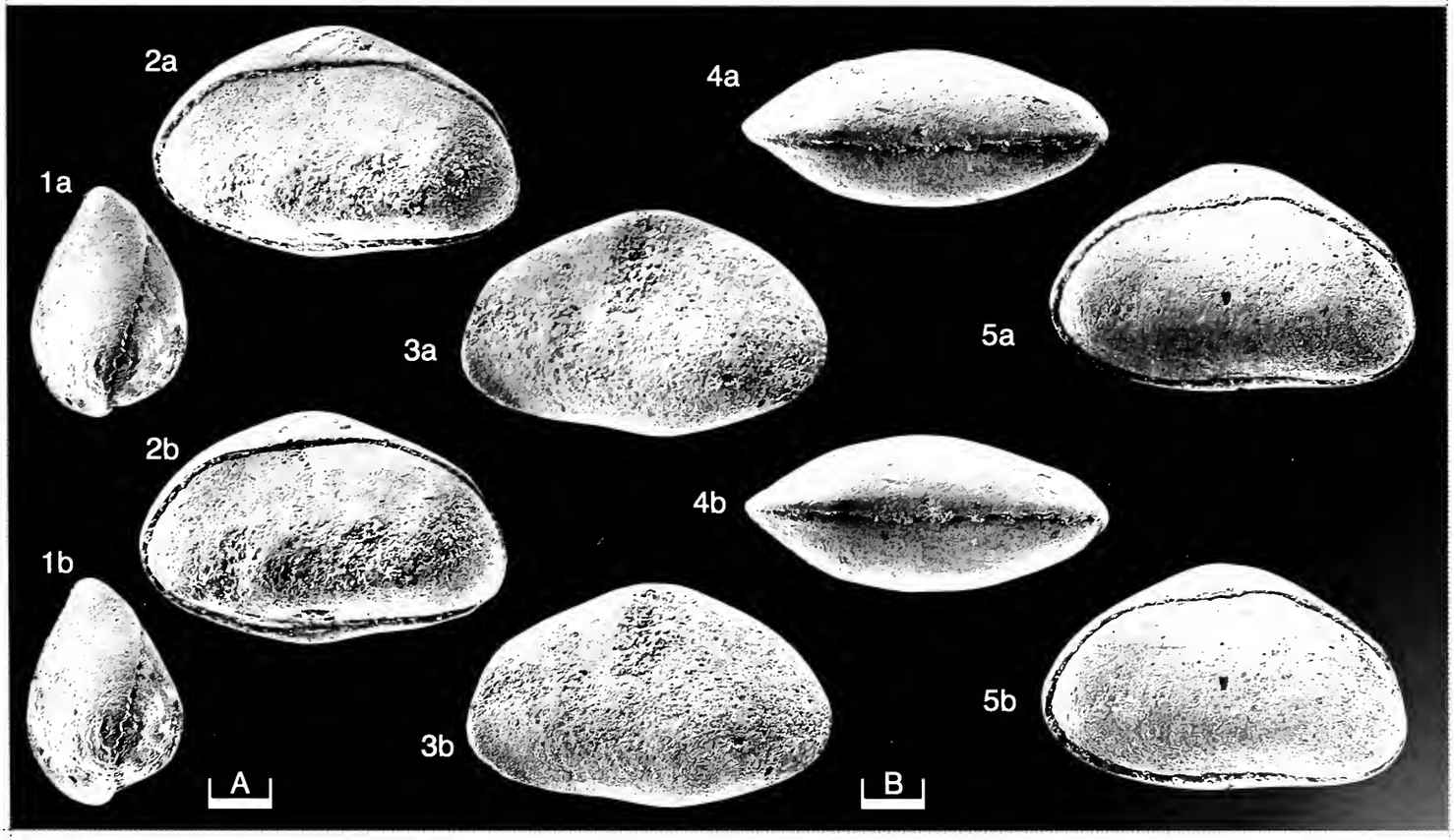
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Holotype: Natural History Museum, London **[BMNH]** slide no. **I 2066**; one carapace that agrees well with the original type figures.

Type locality: "Croft's Quarry," 0.5 km W of Malvern, Hereford & Worcester, England; approximately Nat. Grid. Ref. SO 757464, lat. 52°08′N, long. 2°18′W. Much Wenlock Limestone Formation, Wenlock Series, Silurian.

Figured specimens: Department of Geology, Arizona State University (**ASU**), nos. **X-148** (car.: Pl. **20**, 50, figs. 1–4), **X-201** (car.: Pl. **20**, 52, figs. 1–3), **X-202** (car.: Pl. **20**, 52, figs. 4, 5), **X-203** (car.: Text-fig. 1a) and **X-204** (car.: Text-fig. 1b). Natural History Museum, London **[BMNH]**, no. **I 2066** (holotype, car.: Pl. **20**, 50, figs. 5, 6).

ASU X-148 is from the Farley Member of the Coalbrookdale Formation below the east end of Benthall Edge, Shropshire; lat. 52°37′N, long. 2°29′W. **ASU X-201. X-202, X-203**, and **X-204** are from the Much Wenlock Limestone Formation at Lincoln Hill near Ironbridge, Shropshire; lat. 52°38′N, long. 2°29′W. All specimens are from the Homerian, Wenlock Series, Silurian.

Diagnosis: Large *Wenlockiella* with subtriangular lateral and transverse outlines. Dorsum strongly arched and L/R overreach along hinge line strong. Perimarginal ridge present along anteroventral margin of right valve of many specimens. Adductor muscle field marked on interior of valves by circular depression posterior to which is a low limen-like ridge.

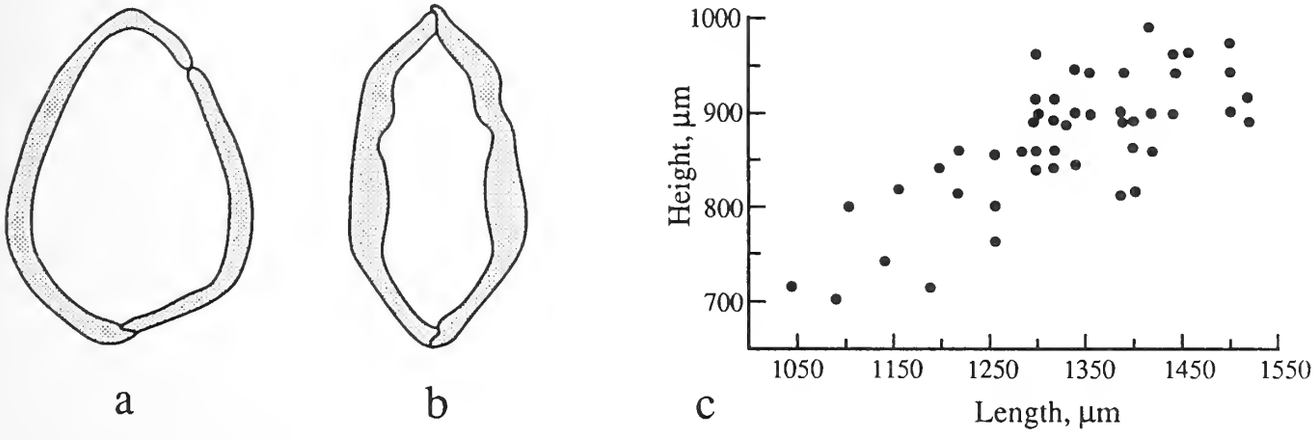
Remarks: The species described here is most similar to *W. gotlandica* (Jones, 1889), from which it can be distingushed by its larger size, its more angular lateral and transverse outlines and by the distinctly greater L/R overreach along the hinge line. All of the approximately 1000 British specimens studied are carapaces. Accordingly, the contact margin features and interior features are known only from thin sections (Text-figs. 1a, b) and by inference from the interior morphology of the close relative, *W. gotlandica*. Maximum width is more posterior on some specimens of the British species than on others (compare Pl. **20**, 50, figs. 2, 3 with Pl. **20**, 52, fig. 4). We have no evidence that this character is dimorphic nor do we have any evidence from numerous single valves of *W. gotlandica* that the limen-like ridge is a dimorphic character. Variation in size and length/height ratio of *W. phillipsiana* is indicated in Test-fig. 1c.

Jones' (1887, *op. cit.*) report of a variety of the species, *Bythocypris phillipsiana* var. *major*, needs to be checked. We conclude from the original illustrations of this form that it does not belong to this species and probably does not belong to *Wenlockiella*.

Distribution: Known from late Llandovery to Ludlow strata of Britain and has been reported from rocks of the same age in the eastern Baltic area and Podolia.

Acknowledgements: We gratefully acknowledge support from NATO (Grant No. 870445) and the National Science Foundation (Grant No. EAR-8200816).

Text-fig. 1, Outline drawings from photographs of transverse (fig. 1a, **ASU X-203**, posterior view, ×63, sample MS 531) and longitudinal (fig. 1b, **ASU X-204**, ventral view, ×37, sample MS 533) thin sections and a scatter diagram (fig. 1c) for 48 carapaces (sample MS 514) from the Farley Member of the Coalbrookdale Formation at Tickwood (cf. locality 44 of Lundin, Petersen & Siveter, 1991, *op. cit.*).



595.33.12 (113.331) (420 : 162.003.52): 551.351 + 552.52

ON *PARULRICHIA DIVERSA* (JONES & HOLL)

by David J. Siveter & Robert F. Lundin
(University of Leicester, England & Arizona State University, Tempe, U.S.A.)

Genus *PARULRICHIA* Schmidt, 1941
Type-species (by original designation): *Primitia diversa* Jones & Holl, 1986

Diagnosis: Quadrilobate Drepanellacea with weak anterior lobe (L1), node-like L2 and L3, one or both of which may be ventrally confluent with L1. L4 a posteroventral node to dorsoventrally oriented lobe. S1 and S3 weak. S2 oval to arcuate around dorsal, posterior and rarely ventral side of L2.

Remarks: Scott (1961, *op. cit.*) placed *Parulrichia* in the Richinidae, an assignment based on the erroneous premise that *P. diversa* is bilobate; a new familial designation must await study of related forms. Of the taxa which Schmidt (1941, *op cit.*) placed in *Parulrichia* we retain only the type-species—the only quadrilobate form—within the genus. The only congeneric species known to us is *P. bispinosa* Lundin & Siveter (*Stereo-Atlas Ostracod Shells*, **20**, 59, 1993), from the Ludlow Series of Tennessee. *Parulrichia inarguta*, *Parulrichia minuta* and *Parulrichia* ? *tabulata* (all Neckaja 1966) and *Parulrichia minima* Sarv, 1956 belong outside *Parulrichia*. The species from the Devonian of the U.S.A. which Lundin and Petersen & Lundin referred to *Parulrichia* (*Bull. Okla. geol. Surv.*, **116**, 1968 and **145**, 1992 respectively) belong to a new genus.

Parulrichia diversa (Jones & Holl, 1886)

1886 *Primitia cornuta* sp. nov., T.R. Jones & H.B. Holl, *Ann. Mag. nat. Hist.*, **17**, 411, pl. 14, figs. 12a, 12b, 13.
1886 *Primitia diversa* sp. nov., T.R. Jones & H.B. Holl, *Ann. Mag. nat. Hist.*, **17**, 412, pl. 14, figs. 10a–c.
1941 *Parulrichia diversa* (Jones & Holl); E.A. Schmidt, *Abh. senckenb. naturforsch. Ges.*, **454**, 66.
1961 *Primitia diversa* Jones & Holl; H.W. Scott, *in* R.C. Moore & C.W. Pitrat (Eds.), *Treatise on Invertebrate Paleontology*, Kansas Univ. Press, Q132, figs. 4a–c.
1978 *Parulrichia diversa* (Jones & Holl); D.J. Siveter, *in* R. Bate & E. Robinson (Eds.), *Geol. J.* (Special Issue), **8**, 72, pl. 2, figs. 9, 10, tab. 3.
1981 *Parulrichia diversa* (Jones & Holl); R.J. Aldridge, K.J. Dorning & D.J. Siveter, *in* Neale, J.W. & Brasier, M.D. (Eds.), *Microfossils from Recent and Fossil Shelf Seas*, Ellis Horwood, Chichester, 21, pl. 2.1, fig. 16.
1985 *Parulrichia diversa* (Jones & Holl); J.E. Mabillard & R.J. Aldridge, *Palaeontology*, **28**, 98, text-figs. 8, 9c, 10.
1988 *Parulrichia diversa* (Jones & Holl); D.J. Siveter, *British Micropalaeontological Society Field Guide*, **2**, 31, text-fig. 7, pl. 2, fig. 19.

Explanation of Plate 20, 56

Figs. 1–3, RV (**OS 14162**, 1130 μm long): fig. 1, ext. lat.; fig. 2, vent.; fig. 3, post. Figs. 4, 5, juv. RV (**OS 14163**, 770 μm long): fig. 4, ext. lat.; fig. 5, vent. Figs. 6–8, RV (**OS 14166**, 1050 μm long): figs. 6, ext. lat.; fig. 7, vent.; fig. 8, post.
Scale A (200 μm; ×46), figs. 1–3, 6–8; scale B (200 μm; ×51), figs. 4, 5.

Neotype: Of the syntypes of *P. diversa* (Vine Collection; Natural History Museum, London) the referred specimens XXXVII and LXIV (Jones & Holl 1886, 412) are extant (= **I 1944** [4 valves] and **IN 52449** [6 valves] respectively). The lectotype (Schmidt 1941; = Jones & Holl 1886, pl. 14, fig. 10a, a left valve; Vine coll. XXXVI$_3$) is lost; the labelled slide contains a broken *right* valve. Of the other originals of *P. diversa* (= Vine Coll. XXXVI$_1$ and $_2$) that of pl. 14, fig. 10b is reported to be **IN 52433** (N.M.H. catalogue) but is absent from the collections and that of pl. 14, fig. 10c is also not present or even catalogued. We here designate the largest and only complete valve from slide **I 1944** (from the type bed no. 37) as neotype of *P. diversa*. Based on its lectotype (here designated; Jones & Holl 1886, pl. 14, figs. 12a, 12b = carapace **I 1942**, Vine coll. XXXV) *Primitia cornuta* is synonymous.

Type locality: Vine's "bed" no. 37 = Buildwas Fm., Silurian, upstream from bridge over River Severn at Buildwas, Shropshire, England (Vine, G.R., *Proc. Yorks. geol. polytech. Soc.*, **9**, 233, 1887); lat. 52.39N, 2.33W.

Figured specimens: Natural History Museum, London [BMNH], **I 1942** (lectotype of *Primitia cornuta*, carapace: Pl. **20**, 58, fig. 4), **I 1944** *pars* (neotype LV: Pl. **20**, 58, fig. 5), **OS 14162** (RV: Pl. **20**, 56, figs. 1–3), **OS 14163** (juv. RV: Pl. **20**, 56, figs. 4, 5), **OS 14164** (LV: Pl. **20**, 58, figs. 1–3), **OS 14165** (RV.: Pl. 20, 58, figs. 6, 7) and **OS 14166** (RV: Pl. **20**, 56, figs. 6–8). All from Buildwas Fm., Sheinwoodian Stage, Wenlock Ss., Shropshire; lat. 52.36N, long. 2.3W. **I 1942** from near type locality ("bed" no. 40; see Vine 1887). **OS 14162-5** from Harley Brook, near Domas; **OS 14162**, **OS 14163** from loc. 36 of Siveter 1980 (*Palaeontogr. Soc.* [*Monogr.*], **1**), **OS 14164**, **OS 14165** from *c.*50 m S of loc. 36 (Nat. Grid Ref. *c.*SJ 5922 0030). **OS 14166** from Buildwas (loc. 35 of Siveter 1980).

Diagnosis: Weakly punctate *Palulrichia*; posteroventral node-like, to dorsoventrally ridge-like, L4.

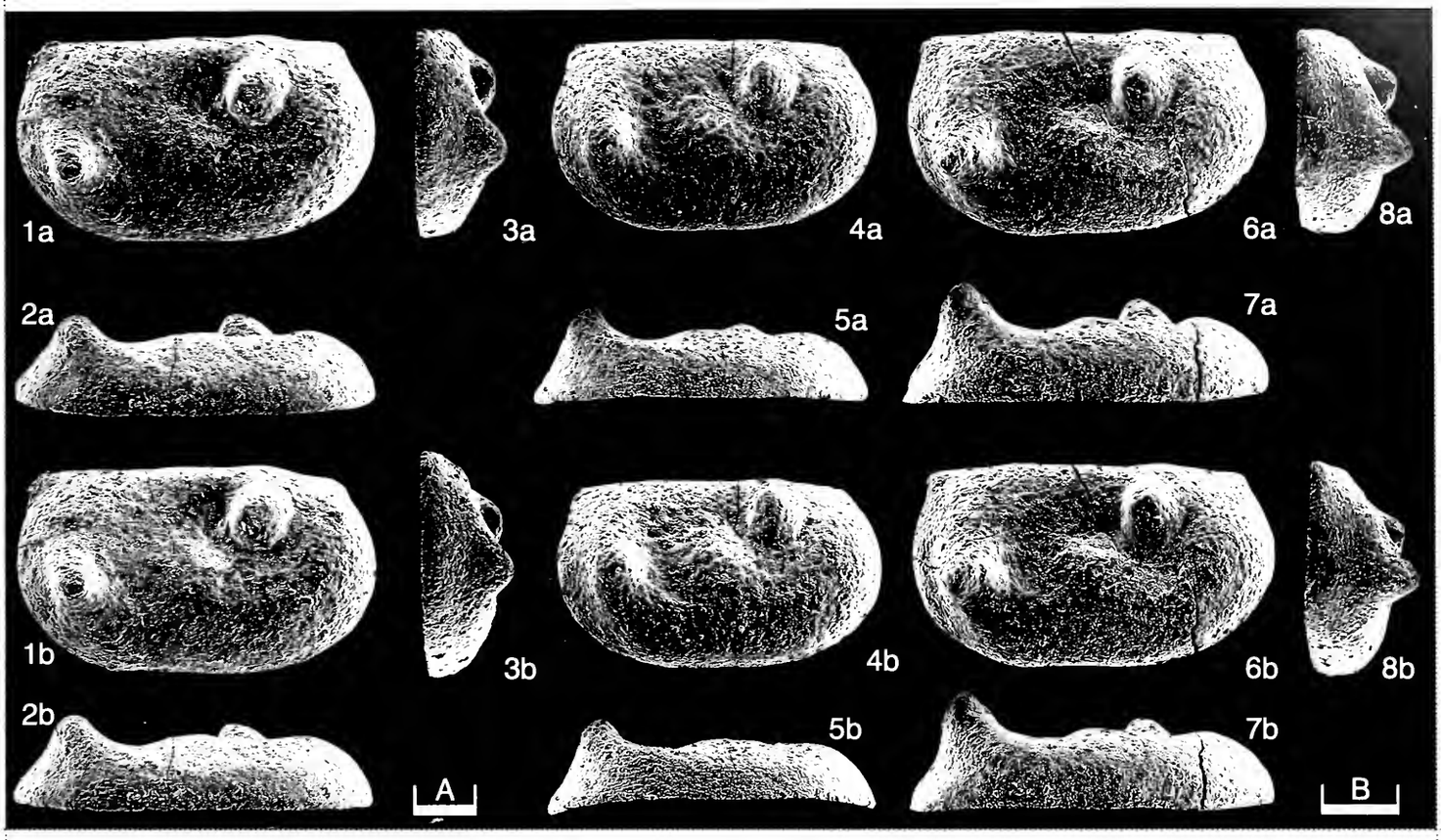
Remarks: L4 shows much intraspecific variation; typically a posteroventral node (Pl. **20**, 56, figs. 1–5), in all specimens of some samples it is a well developed dorsoventrally aligned lobe (Pl. **20**, 58, figs. 1–3, 6, 7). Many single samples contain both morphotypes; in still other samples one morphotype or the other occurs with an intermediate form having a dorsoventrally elongate, but not fully developed, L4 (Pl. **20**, 56, figs. 6, 7). *P. bispinosa* differs in having a posterodorsal spine, in lacking puncta and in details of lobation and sulcation.

Distribution: Low to middle part of Sheinwoodian Stage, Wenlock Ss., Buildwas Fm., *C. centrifugus* & *C. murchisoni* zones, Shropshire; localities given above, plus Siveter 1980 loc. 37, "Domas" and "Buildwas" of Lundin *et al.* (*J. micropalaeontol.*, **9**, 178, 1991) and "Leasows" of Mabillard & Aldridge (1985). Also in basal part of Brinkmarsh Fm. (basal Wenlock), Tortworth inlier, Avon; and Barr Limestone Mbr. (*M. riccartonensis* Zone), Coalbrookdale Fm., Walsall, W Midlands (= Siveter 1980, locs 12 & 25 respectively).

Acknowledgements: We thank NATO and Arizona State University for support.

Explanation of Plate 20, 58

Figs. 1–3, LV (**OS 14164**, 1125 μm long): fig. 1, post.; fig. 2, ext. lat.; fig. 3, vent. Fig. 4, carapace, lt. lat. (**I 1942**, 1240 μm long). Fig. 4, RV ext. lat. (neotype, **I 1944** *pars*; 970 μm long). Figs. 6, 7, RV (**OS 14165**; 1080 μm long): fig. 6, ext. lat.; fig. 7, vent.
Scale A (200 μm; ×46), figs. 1–3, 6, 7; scale B (200 μm; ×42), fig. 4; scale C (200 μm; ×49), fig. 5.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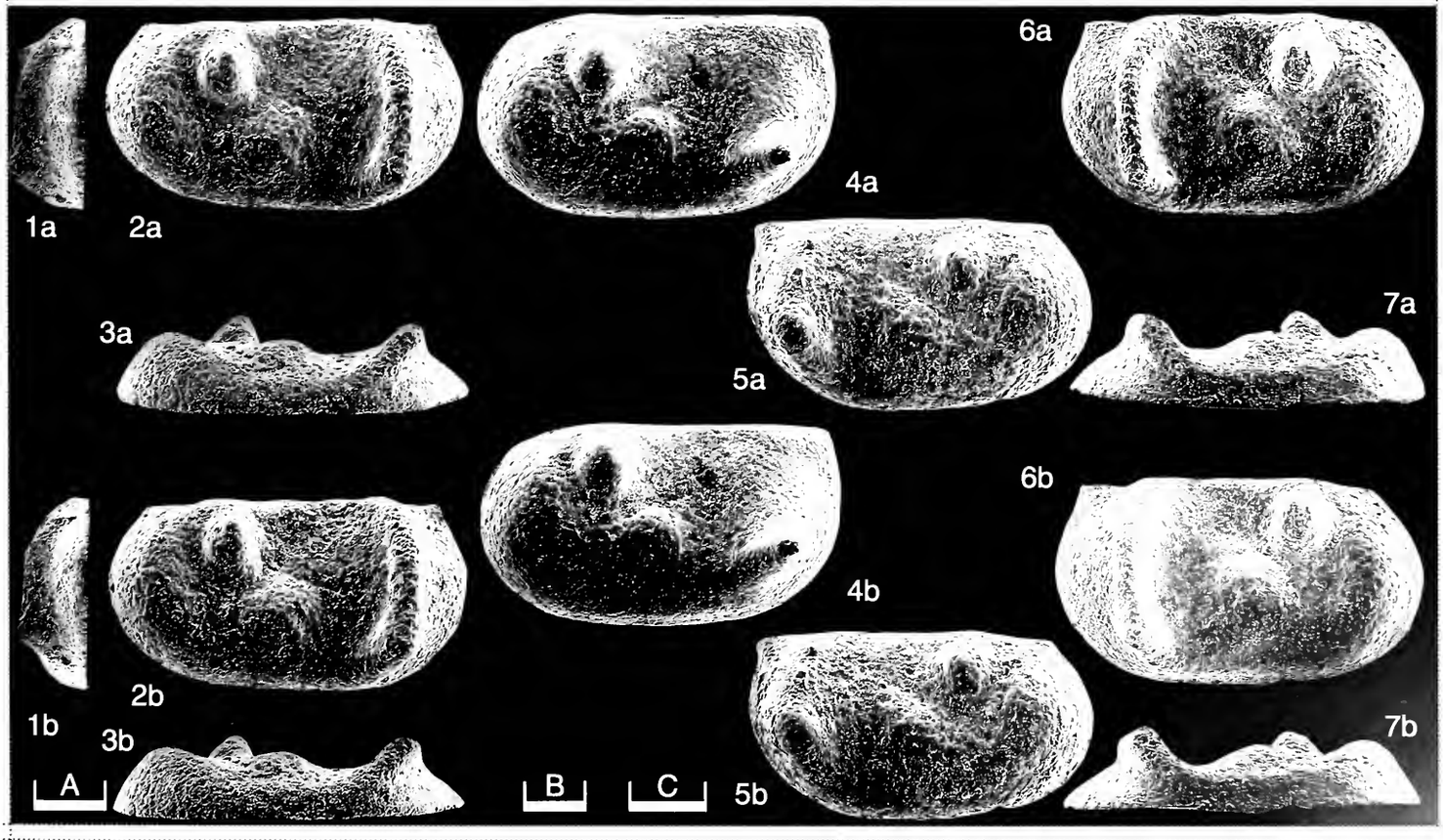
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595.336 (113.33) (768 : 162.089.35): 551.351 + 552.54

ON *PARULRICHIA BISPINOSA* LUNDIN & SIVETER sp. nov.

by Robert F. Lundin & David J. Siveter
(Arizona State University, Tempe, U.S.A. & University of Leicester, England)

Parulrichia bispinosa sp. nov.

Holotype: Department of Geology, Arizona State University (**ASU**), no. **ASU X-104**; RV. [Paratypes: Arizona State University nos. **ASU X-101–X-103**].

Type locality: Section P5, glade SE of Decaturville, Perryville Quadrangle, Tennessee, U.S.A.; lat. 35° 30′ 49.5″ N, long. 88° 3′ 24″ W. Holotype from sample P5–9, 15.1 m above the base of the Brownsport Fm, late Ludlow Series, Silurian.

Derivation of name: Latin *bi*, two, and *spina* thorn, referring to the posterodorsal thorn-like spines.

Diagnosis: *Parulrichia* with node-like L2, L3, and L4. Large posterodorsal spine on each valve above poorly developed S3. The posteroventral node is spine-like on some specimens. S2 pit-like to slightly arcuate around posterodorsal side of L2. L2 and L3 ventrally confluent with L1.

Figured specimens: Department of Geology, Arizona State University (**ASU**), nos **X-104** (holotype, RV; Pl. **20**, 60, figs. 1, 2), **X-103** (paratype, LV: Pl. **20**, 60, figs. 3–5), **X-101** (paratype, RV: Pl. **20**, 62, figs. 1, 2), **X-102** (paratype, juv. LV: Pl. **20**, 62, figs. 3–5). All specimens from same sample as holotype.

Remarks: *Parulrichia bispinosa* is distinguished from the type-species, *P. diversa* (Jones & Holl, 1886) (see Siveter & Lundin, *Stereo-Atlas Ostracod Shells*, **20**, 55, 1993), in having a posterodorsal spine on each valve. In other respects, the two species are quite similar. We consider that *P. bispinosa* was

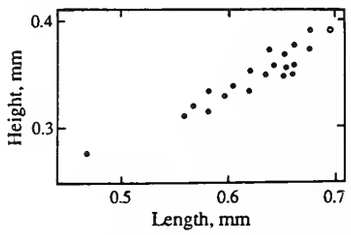
Explanation of Plate 20, 60

Figs. 1, 2, RV (holotype, **ASU X-104**, 695 μm long): fig. 1, ext. lat.; fig. 2, ext. vent. Figs. 3–5, LV (**ASU X-103**, 658 μm long); fig. 3, ext. dors.; fig. 4, int. lat.; fig. 5. ext. lat. All measurements exclusive of spines and nodes.
Scale A (200 μm; ×91), fig. 1; scale B (200 μm; ×88), figs. 2, 3; scale C (200 μm; ×90), figs. 4, 5.

derived from *P. diversa* or a close descendant of it. Lundin (*Bull. Okla. geol. Surv.*, **116**, 45, 1968) has discussed the relationships of *Parulrichia* to a complex of early Devonian species which must have been derived from *P. bispinosa* or a close descendant. The occurrence of *Parulrichia* in western Tennessee strengthens the link between British and North American midcontinent ostracod faunas of Silurian age (see also *Xystista auricularis* and *X. graffhami; Stereo-Atlas Ostracod Shells*, **12**, 77–80 & **12**, 81–84, 1985; by Siveter and Lundin & Siveter respectively). This link, though generally considered weak, is significant to Silurian ostracod biogeography.

Distribution: Known from four samples from two localities in the Brownsport Fm, Ludlow Series, Silurian, of Perryville and Olive Hill quadrangles, western Tennessee. The samples range from 12.3 m to 15.1 m above the base of the Brownsport Formation.

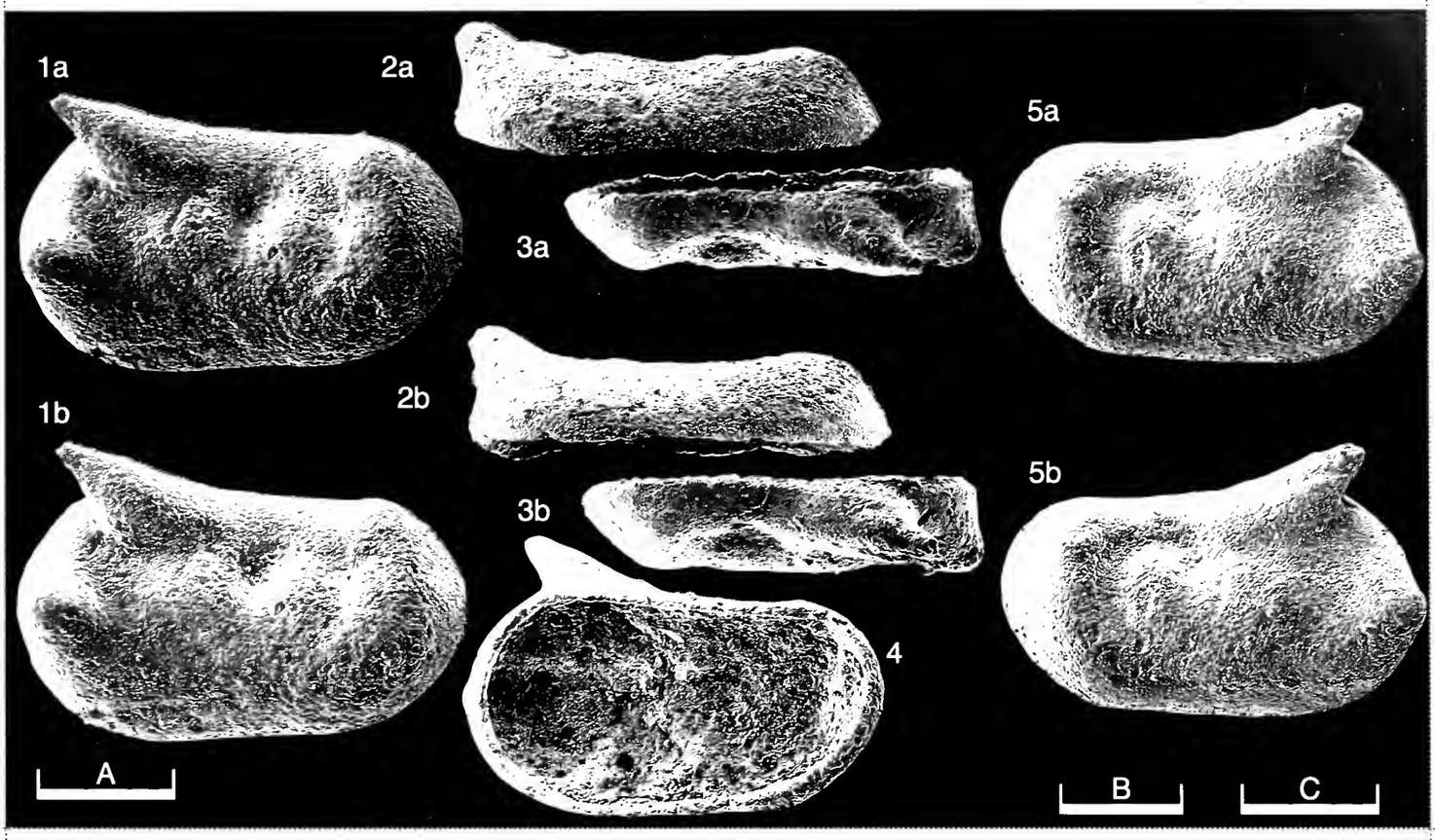
Acknowledgements: The authors acknowledge support from NATO for their collaborative research programme. RFL also acknowledges support of the College of Liberal Arts and Sciences, Arizona State University.



Text-fig. 1. Size dispersion diagram of twenty-two right and left valves of *P. bispinosa* from sample P5–9, Brownsport Formation, western Tennessee (see Type locality). Open circle (top right) represents the holotype.

Explanation of Plate 20, 62

Figs. 1, 2, RV (**ASU X-101**, 677 μm long): fig. 1, ext. lat.; fig. 2, ext. post. Figs. 3–5, juv. LV (**ASU X-102**, 469 μm long): fig. 3, ext. dors.; fig. 4, ext. vent.; fig. 5, ext. lat. All measurements exclusive of spines and nodes.
Scale A (200 μm; ×89), fig. 1; scale B (200 μm; ×90), fig. 2; scale C (200 μm; ×128), figs. 3–5.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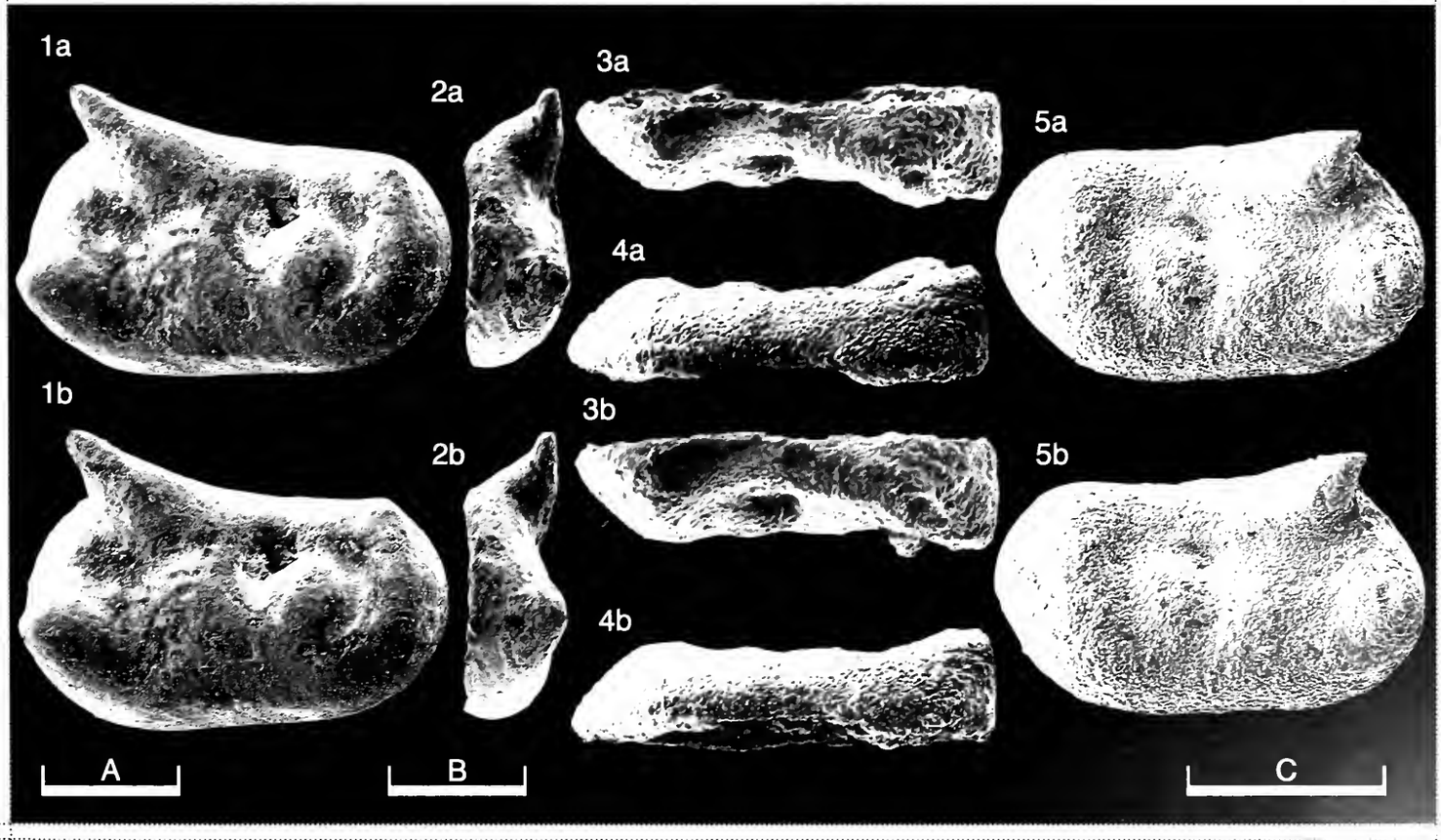
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