

Some species of the ostracod genus *Bythocythere* Sars from British waters

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ABSTRACT—A reappraisal of the genus *Bythocythere* shows that five species (*B. bradyi* Sars, *B. intermedia* Elofson, *B. zetlandica* sp. nov., *B. robinsoni* sp. nov. and *B. bradleyi* sp. nov.) live in British coastal waters. A sixth species, found in Quaternary deposits in Scotland and the North Sea, is not thought to live in this area today. Past records of *B. turgida* Sars and *B. constricta* Sars from the Recent of the British Isles are shown to be incorrect.

INTRODUCTION

Species of the genus *Bythocythere* are commonly encountered living in benthic marine environments around the British Isles. Since fossil examples of these and other *Bythocythere* species, frequently met with in Neogene and Quaternary deposits in NW Europe, are potentially useful as palaeoenvironmental indicators it is unfortunate that living examples have often been misidentified.

G.S. Brady, in his "Monograph of the Recent British Ostracoda" (1868), recorded two *Bythocythere* species, namely *B. constricta* and *B. turgida*, originally described by Sars (1866) from Norwegian coastal waters. Subsequent Recent British records of these two species include those of Brady (1870) and Brady & Norman (1889). Sars (1926) described a new species, *B. bradyi*, from Norway, stating that "this form has been erroneously described and figured by Brady as the male of *B. constricta*". Elofson (1941) cast doubts on the validity of British records of *B. constricta* and *B. turgida*. He suggested that the specimens identified as *B. constricta* by Brady & Norman were attributable to either *B. intermedia* Elofson or an undescribed species, and that the form illustrated by Brady (1868 and 1870) as *B. turgida* could only be referred to that species with some hesitation.

From our own studies of British material we have determined that five *Bythocythere* species live around the British Isles: *B. bradyi* Sars, *B. intermedia* Elofson, and three new species described herein, *B. zetlandica*, *B. robinsoni* and *B. bradleyi*. A sixth species, closely similar to *B. constricta*, occurs in Quaternary deposits in Britain and the North Sea. It is also recorded from the Recent of the Arctic, but is not thought to live in British waters today. Unfortunately we have been unable to obtain additional Norwegian material of either *B. constricta* or *B. turgida*, but comparisons of our specimens with Sars' (1926) excellent illustrations have

convinced us that neither of these two species occurs in any of the Recent British material at our disposal. To facilitate comparisons we have included outlines of carapaces and male copulatory appendages of *B. constricta* (Figs. 4 i-k, 5g) and *B. turgida* (Figs. 4 a-b, 5f) redrawn from Sars' (1926) illustrations.

MATERIAL

This study is based mainly on material housed in the G.S. Brady collection at the Hancock Museum, Newcastle-upon-Tyne, and in the A.M. Norman and T. Scott collections at the British Museum (Natural History), London. Sources of additional material are acknowledged in the text. Figured specimens have been deposited, as appropriate, in the Hancock Museum (three-part numbers), and in the Zoology Department (two-part numbers) and Palaeontology Department (numbers with the prefix IO) at the British Museum (Natural History).

SYSTEMATIC DESCRIPTIONS

Order Podocopida Müller, 1894

Family Bythocytheridae Sars, 1866

Genus *Bythocythere* Sars, 1866

Type species. *Bythocythere turgida* Sars, 1866 (designated by Brady & Norman, 1889).

Diagnosis. Carapace medium to large (0.6–1.0 mm long), subrhomboidal, inflated, often with ventrolateral swellings or alar expansions. Posteroventral marginal area compressed. Dorsal margin straight or convex, anterior margin broadly rounded. Ventral margin straight, convex or weakly sinuous. Posterior margin smooth or denticulate, with a subdorsal obtuse caudal process. Dorsomedian sulcus often present. Dimorphic; male proportionally more elongate and sometimes smaller than female. Inner lamella moderately wide anteriorly and posteroventrally, narrower elsewhere. Narrow anterior and posterior vestibula. Marginal pore-

canals moderately numerous (twenty to thirty anteriorly), simple, short and irregularly spaced. Hinge lophodont. Normal pore-canals simple, some with raised rims, but mostly recessed, giving valves a pitted appearance. Sieve pores absent. External surface ornamented by a delicate reticulum, often with strong longitudinal elements in the ventrolateral region, which imparts a distinctive "rippled" appearance to the shell. Five adductor muscle scars in a nearly vertical or sometimes arcuate row, with a sixth scar above and somewhat separated from the rest. Frontal scar ovate or reniform. Several other scars may be present above and below the central group. Fulcral point weak or absent. Antennula with seven podomeres, each bearing long, thin, flexible setae, except for the penultimate podomere which is devoid of setae. Antenna with four podomeres and three terminal chelate setae; spinneret seta with two joints. Respiratory plate on mandibular palp with up to eight setae. Respiratory plate on maxillula with two pairs of reflexed setae. Legs long, slender. First podomere of first leg (= maxilla) bears a respiratory plate postero-ventrally, consisting of four setae, two of which are plumose. Setal formulae of first podomeres of legs: (3(1+2):2:4), (1:1:1), (1:1:1). Male copulatory appendage with a rounded basal capsule, prominent *ductus ejaculatorius* and a blade- or leaf-like distal process.

Bythocythere bradyi Sars, 1926
(Figs. 4u-w, 5a; Pl. 2, figs. 9-11)

1926 *Bythocythere Bradyi* sp. nov.; Sars: 236, Pl. 108, fig. 2.

1969 *Bythocythere bradyi* Sars; Wall (MS): 46-49, Pl. 25, figs. a-j.

1980 *Bythocythere bradyi* Sars; Horne (MS): 73, Pl. 13 (figs. 1-2), fig. 5.7(a).

Diagnosis. Carapace medium-sized (0.6-0.75 mm long), moderately inflated. Greatest width near to mid-length. Compressed posteroventral marginal area relatively broad, posterior margin smooth. Dorsomedian sulcus absent. Male copulatory appendage with a short, broad distal process.

Type specimens. No type specimens are listed in the Sars collection (Zoological Museum, Oslo). However, Sars' description and illustrations leave no doubt as to the identity of this species.

Figured material. Two specimens were taken from faunal slides in the Brady collection (listed in Brady's notebook as *B. constricta*), and have been returned to the Hancock Museum on separate slides: no. 1.06.15 was taken from slide E₃ (2.12.38) (SW of St. Agnes, Scilly Isles, approx. lat. 49° 55'N, long. 6° 20'W, depth 40 fathoms (73 m), hard shelly sand); 1.06.16 came from slide K₁ (2.11.38) (Loch Fyne, W Scotland, approx. lat. 56° 10'N, long. 5° 20'W, depth 15-25 fathoms (27-

46 m), hard and muddy bottom). BM(NH) no. 1982.344 was collected alive by D.J. Horne from intertidal algae at Gore Point, Bristol Channel, approx. lat. 51° 14'N, long. 3° 37'W, on 23:6:78 (salinity 31.5‰, temperature 14.0°C, pH 8.4, measured on 24:6:78).

Type locality. Bukken, outside Stavanger Fjord, Norway, depth 40 fathoms (= 73 m), (approx. lat. 59° 00'N, long. 05° 30'E). Recent, marine.

Remarks. We believe that the form illustrated by Brady (1868) as the male of *B. constricta* is the male of *B. intermedia*, not *B. bradyi* as stated by Sars (1926).

Sars described and figured only female specimens of *B. bradyi*. Wall (MS, 1969) illustrated valves of both sexes from the Recent of Cardigan Bay, but recorded only a single living specimen, a juvenile (A-3). The male copulatory appendage of *B. bradyi* was first illustrated by Horne (MS, 1980) who found this species living amongst intertidal algae in the Bristol Channel.

Distribution. Recent, marine: Norway (Sars, *op. cit.*) and British Isles (herein). This is the only British *Bythocythere* species known to occur in the littoral zone, the others being restricted to sublittoral waters.

Bythocythere intermedia Elofson, 1938

(Figs. 1, 2, 3a-g, 4r-t, 5b; Pl. 2, figs. 1-4)

1868 *Bythocythere constricta* Sars; Brady (*pars*): 451-452, Pl. 35, figs. 48-52 only (*non* Pl. 35, fig. 47), (*non B. constricta* Sars, 1866).

1938 *Bythocythere intermedia* sp. nov.; Elofson: 10-15, text-figs. 14-21.

1969 *Bythocythere intermedia* Elofson; Wall (MS): 49-51, Pl. 26, figs. a-h.

Diagnosis. Carapace medium to large (0.75-0.85 mm long), moderately inflated, greatest width a little behind mid-length. Greatest height well behind mid-length. Dorsal margin convex, posterior margin denticulate. Dorsomedian sulcus weak. Male copulatory appendage with a relatively large, sub-triangular distal process.

Type specimens. Depository unknown. However, Elofson's description and illustrations adequately define this species.

Figured material. BM(NH) nos. 1982.345-348 are from Valentia, SW Ireland, approx. lat. 51° 55'N, long. 10° 20'W, and were taken from slides in the Norman collection (labelled "*B. constricta*"); nos. 1982.345, 1982.346, and 1982.347 came from slide no. 1900-3-6-379, no. 1982.348 from slide no. 1911.11.8 M3725. 1982.349, from the North Sea, approx. lat. 53°N, long. 02°E, was kindly provided by Dr. J.E. Robinson.

Type locality. The Mittskären, outside the mouth of Gullmar Fjord, W Sweden, (approx. lat. 58° 15'N, long. 11° 30'E), depth 25 m. Recent, marine.

Remarks. *B. intermedia* closely resembles *B. neerlandica*, described by Kuiper (1918) from the Miocene of the Netherlands; comparison of female specimens of the two species shows that *B. intermedia* is more elongate,

more tapered anteriorly, and has a weaker dorsomedian sulcus than *B. neerlandica*.

Of the specimens illustrated by Brady (1868) as *B. constricta*, his "male carapace" (Pl. 35, figs. 48–51) corresponds most closely to the male of *B. intermedia*, while his "female carapace" (Pl. 35, fig. 47) appears to be a female of *B. zetlandica* sp. nov.

Wall (MS, 1969) illustrated male and female valves of *B. intermedia* from the Recent of Cardigan Bay, but recorded no living specimens.

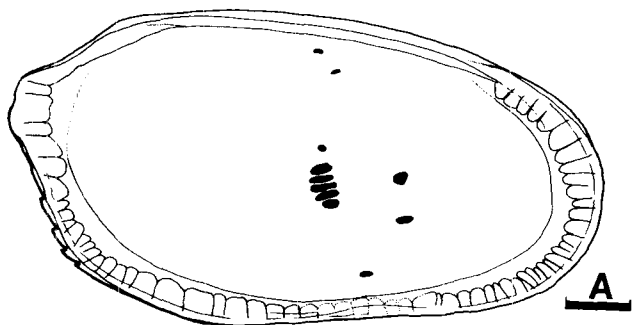


Fig. 1. *Bythocythere intermedia*; ♀ RV seen in transmitted light (drawing based on study of more than one specimen). Scale A = 100µm long.

Distribution. Recent, marine, sublittoral: W Sweden (Elofson, *op. cit.*), British Isles and Bay of Biscay (herein). Material in the Norman collection labelled "*B. constricta*" includes specimens of *B. intermedia* from off Aberdeen (Scotland), Valentia (Ireland) and Fosse de Cap Breton (SW France). In the Brady collection we have identified this species in material from between Seaham and Sunderland (NE England) and Lough Swilly (N Ireland). Dr. J.E. Robinson has shown us specimens of *B. intermedia* from the southern North Sea and the Moray Firth, off NE Scotland.

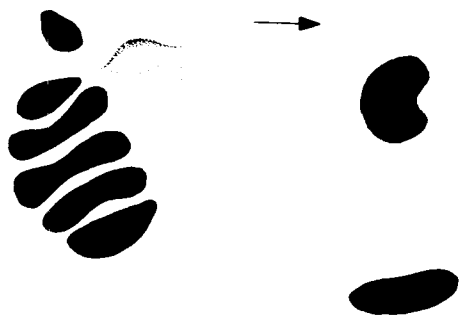


Fig. 2. *Bythocythere intermedia*; central muscle-scar pattern (arrow points to anterior).

Bythocythere zetlandica sp. nov.

(Figs. 4l–n, 5c; Pl. 2, figs. 5–8)

1868 *Bythocythere constricta* Sars; Brady (*pars*): 451–452, Pl. 35, fig. 47 only (*non* Pl. 35, figs. 48–52), (*non B. constricta* Sars, 1866).

1969 *Bythocythere cf turgida* Sars; Wall (MS): 43–46, Pl. 25, figs. k–n.

Derivation of name. From the type locality, Shetland (= Zetland).

Diagnosis. Carapace medium to large (0.75–0.80 mm long), strongly inflated, greatest width a little behind mid-length. Dorsal margin straight. Posterior margin smooth. Dorsomedian sulcus weak. Distal process of male copulatory appendage long, with convex anterior margin and almost straight posterior margin.

Holotype. Female carapace (valves disarticulated) + appendages, BM(NH) no. 1982.350. (Paratype: male carapace (valves disarticulated) + appendages, BM(NH) no. 1982.351.

Figured material. The holotype and paratype were taken from slide no. 1900-3-6-379 (labelled "*B. constricta*") in the Norman collection. 1982.352 and 1982.353 are from Valentia, SW Ireland, approx. lat. 51° 55'N, long. 10° 20'W, and were taken from Norman collection slide nos. 1900-3-6-379 and 1911.11.8 M3725 respectively (both labelled "*B. constricta*").

Type locality. Unst Haaf (fishing grounds off Unst), Shetland, (approx. lat 61° 00'N, long. 1° 30'W). Recent, marine sublittoral.

Remarks. The female of this species was figured by Brady (1868, pl. 35, fig. 47) as the female of *B. constricta* (see remarks on *B. intermedia*). *B. zetlandica* closely resembles *B. constricta* in lateral view, but in dorsal view it lacks the deep dorso-median sulcus which characterises the latter species. The male copulatory appendages of the two species are also very similar, but that of *B. constricta* has a more slender and symmetrical distal process than that of *B. zetlandica*. Both *B. intermedia* and *B. neerlandica* Kuiper, 1918 are more elongate than *B. zetlandica*, while *B. bradyi* is smaller and less inflated. The valves illustrated by Wall (MS, 1969) under the name of *B. cf. turgida* clearly belong to *B. zetlandica*.

Distribution. Recent, marine, sublittoral: Shetland, British Isles (herein). We have recognised *B. zetlandica* in material labelled "*B. constricta*" in the Norman collection from Valentia (SW Ireland) and Shetland, in the Scott collection from the Firth of Forth and the Firth of Clyde (Scotland), and in the Brady collection from 5 miles off Red Cliff, Yorkshire, (NE England); Wall (MS, 1969) recorded a single live female (as *B. cf. turgida*) from the Recent of Cardigan Bay.

Bythocythere robinsoni sp. nov.

(Figs. 4f-h, 5d; Pl. 1, figs. 1-6)

1868 *Bythocythere turgida* Sars; Brady: 452-453, Pl. 34, figs. 35-38, (*non B. turgida* Sars, 1866).

1870 *Bythocythere turgida* Sars; Brady: 372, Pl. 13, figs. 1-4, (*non B. turgida* Sars, 1866).

Derivation of name. In honour of our friend and colleague Dr. J.E. Robinson.

Diagnosis. Carapace large (0.85-1.00 mm long), strongly inflated, with ventrolateral alar expansions. Greatest width well behind mid-length. Compressed posteroventral marginal area relatively broad. Posterior margin denticulate. Dorsomedian sulcus weak. Distal process of male copulatory appendage relatively large, proximally broad, distally narrow, with a sinuous posterior margin.

Holotype. Female carapace (valves disarticulated) + appendages, Hancock Museum no. 1.42.19. (Paratype; male carapace (valves disarticulated) + appendages, Hancock Museum no. 1.42.20).

Figured material. The holotype and paratype were taken from faunal slide X₂ (2.12.31) in the Brady collection, and were listed in Brady's notebook as "*B. turgida*". BM(NH) no. 1982.354, from the Moray Firth, NE Scotland, lat. 58° 31'N, long. 2° 28'W, depth 68 m, was kindly provided by Dr. J.E. Robinson.

Type locality. Rothesay Bay, Isle of Bute, Scotland, (approx. lat. 55° 50'N, long. 5° 05'W). Recent, marine, sublittoral.

Remarks. *B. robinsoni* is more elongate than either *B. turgida* or *B. bradleyi*. In lateral view the alar expansion is entirely within the valve outline, while in *B. turgida* and *B. bradleyi* it extends below and partly obscures the ventral margin. *B. robinsoni* may be distinguished from other British *Bythocythere* species by its large size and alar expansions.

Distribution. Recent, marine, sublittoral: British Isles (herein). We have found *B. robinsoni* amongst material labelled "*B. turgida*" in the Brady collection, from Rothesay Bay and Kilchattan Bay (both on the island of

Bute, Scotland), and between Seaham and Sunderland (NE England); in the Norman collection, from off Aberdeen (Scotland) and Valentia (SW Ireland); and in the Scott collection, from the Firth of Clyde (Scotland). Dr. J.E. Robinson has provided us with specimens from the Moray Firth (Scotland).

Bythocythere bradleyi sp. nov.

(Figs. 4c-e, 5e; Pl. 1, figs. 7-10)

1947 *Bythocythere turgida* Sars; Sylvester-Bradley: 721, text-fig. 2, (*non B. turgida* Sars, 1866).

Derivation of name. In honour of the late Professor P.C. Sylvester-Bradley.

Diagnosis. Carapace large (0.85-0.90 mm long), strongly inflated, with prominent ventro-lateral alar expansions. Greatest width a little behind mid-length. Compressed postero-ventral marginal area relatively narrow. Posterior margin denticulate. Dorso-median sulcus absent. Male copulatory appendage with a relatively small, subtriangular distal process.

Holotype. Female carapace (valves disarticulated), BM(NH) no. 1982.355. (Paratype: male left valve + appendages, BM(NH) no. 1982.356).

Figured material. The holotype and paratype were taken from slide no. 1900-3-6-380 in the Norman collection, labelled "*B. turgida*".

Type locality. Valentia, SW Ireland, (approx. lat. 51° 55'N, long. 10° 20'W). Recent, marine, sublittoral.

Remarks. *B. bradleyi* is closely similar to *B. turgida* Sars, the females of the two species being almost identical in lateral outline. In dorsal view, however, the alar expansions of *B. bradleyi* have an evenly rounded outline, while those of *B. turgida* are truncated posteriorly. The two species are easily distinguished by the shapes of the distal processes of their male copulatory appendages; that of *B. turgida* is long and asymmetrical, curving towards the posterior, while that of *B. bradleyi* is short and straight. See also Remarks on *B. robinsoni*.

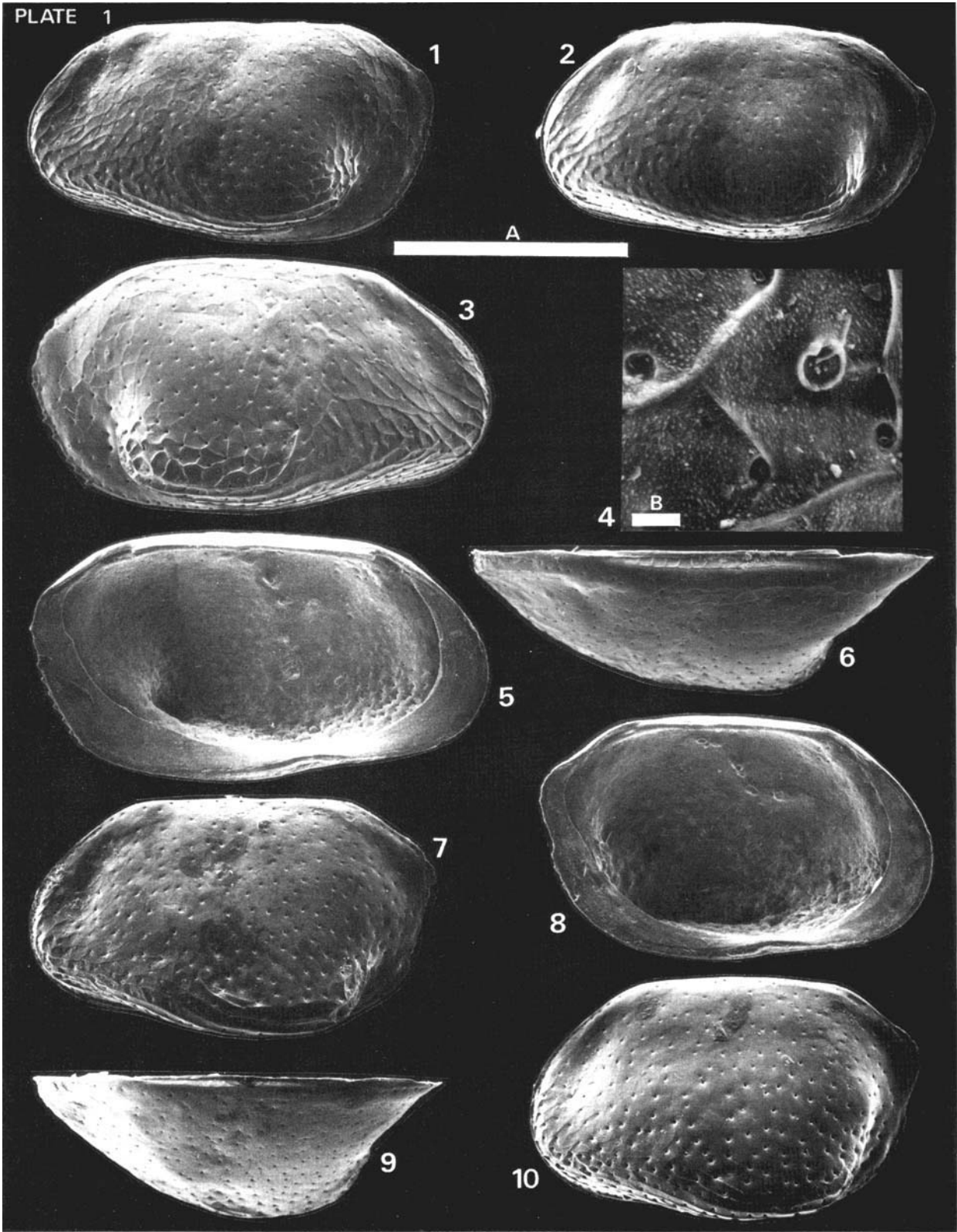
B. turgida s.s. does not appear to be present in British waters. Sylvester-Bradley's (1947) figured specimen of

Explanation of Plate 1

Scale A = 500 μm long; figs. 1-3, 5-10; scale B = 10 μm long; fig. 4.

Figs. 1-6. *Bythocythere robinsoni* sp. nov.: fig. 1, ♂ paratype, 1.42.20 (LV, ext. lat.); fig. 2, ♀, holotype, 1.42.19 (LV, ext. lat.); figs. 3-6, , 1982. 354; fig. 3, RV, ext. lat.; fig. 4, detail of ventromedian area of fig. 3 showing two types of normal pores; fig. 5, LV, int. lat.; fig. 6, LV, ext. dorsal.

Figs. 7-10. *Bythocythere bradleyi* sp. nov.: figs. 7, 9, paratype, 1982. 356; fig. 7, LV, ext. lat.; fig. 9, LV, ext. dorsal; figs. 8, 10, ♀, holotype, 1982. 355; fig. 8, LV, int. lat.; fig. 10, LV, ext. lat.



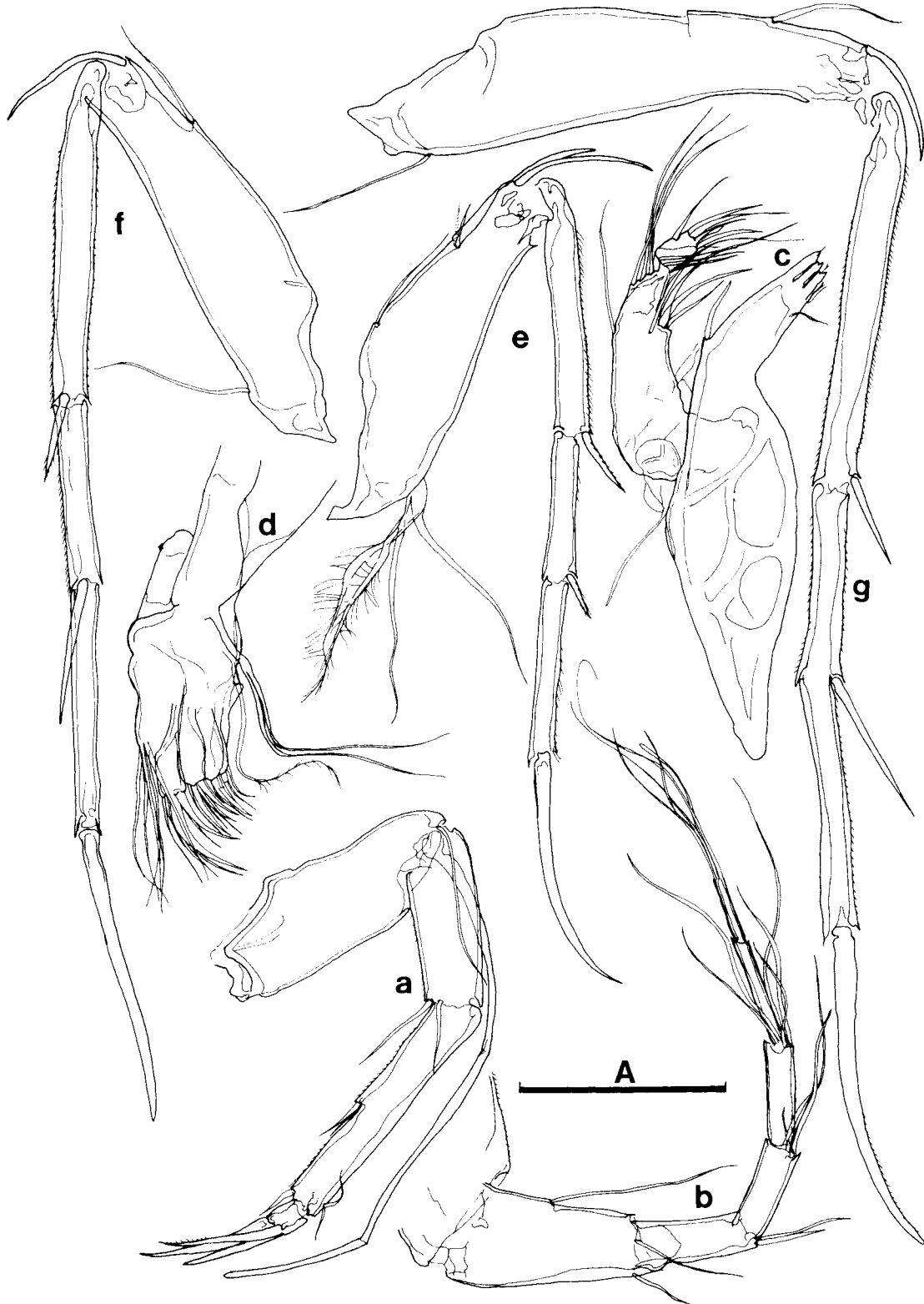


Fig. 3. *Bythocythere intermedia*; ♀ appendages (1982.349). a) antennula; b) antenna; c) mandible; d) maxillula; e) first leg; f) second leg; g) third leg. Scale A = 100 μ m long.

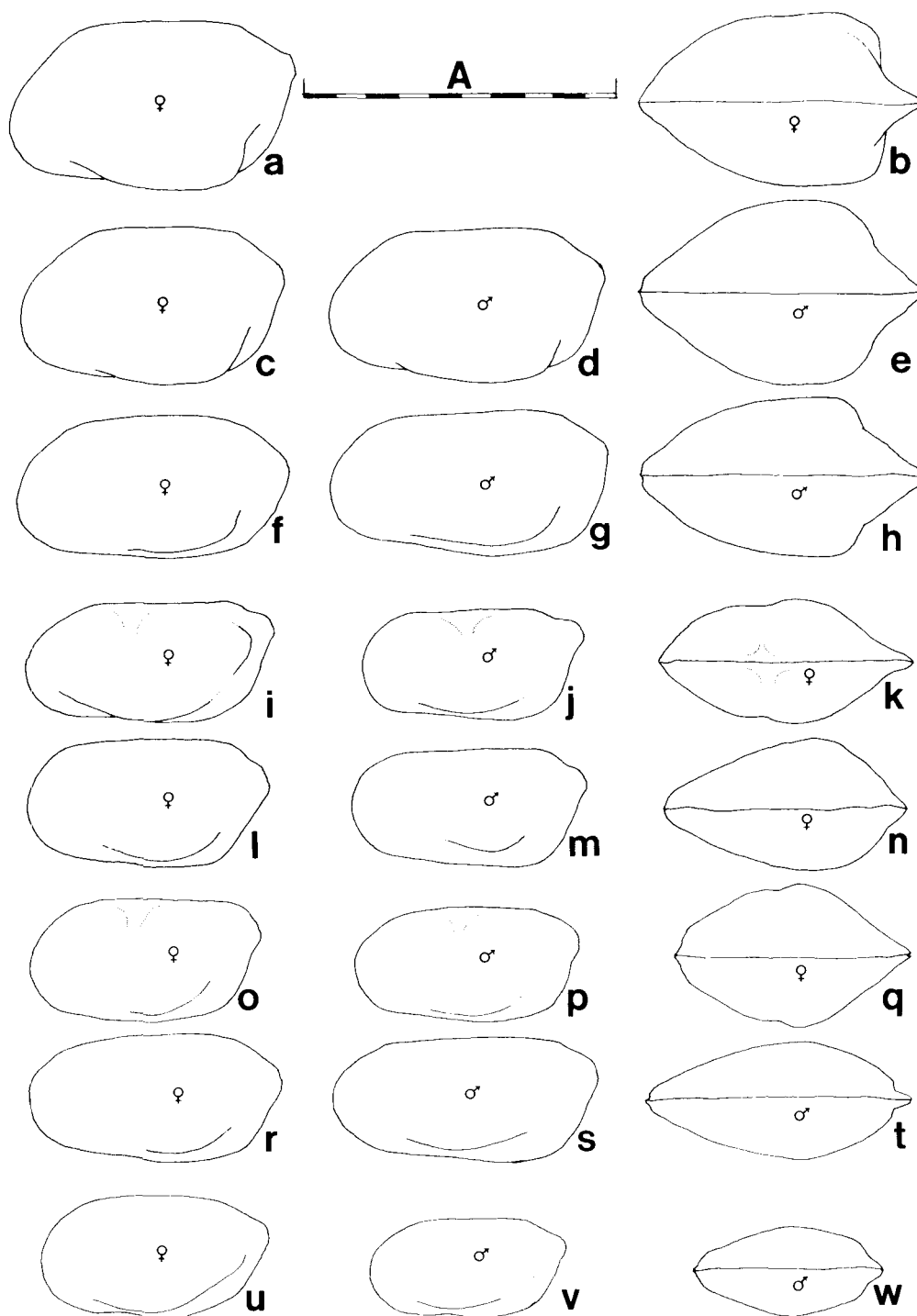


Fig. 4. Carapace outlines of eight species of *Bythocythere*; left and centre columns show left lateral views, right column shows dorsal views; anterior is to the left in all cases. (a-b) *B. turgida*; (c-e) *B. bradleyi*; (f-h) *B. robinsoni*; (i-k) *B. constricta*; (l-n) *B. zetlandica*; (o-q) *B. aff. constricta*; (r-t) *B. intermedia*; (u-w) *B. bradyi*. All drawn approximately to scale (Scale A = 1.00 mm long). The outlines of *B. turgida* and *B. constricta* are taken from Sars' (1926) illustrations; the rest are originals.

“*B. turgida*” (Norman collection, no. 1900-3-6-380B) was taken from the same slide as the type specimens of *B. bradleyi*.

Distribution. Recent, marine, sublittoral; British Isles. We have only seen material from the type locality.

Bythocythere sp. aff. *B. constricta* Sars, 1866
(Figs. 4o-q; Pl. 2, figs. 12–14)

?1874 *Bythocythere constricta* Sars; Brady, Crosskey & Robertson: 208–209, Pl. 16, figs. 9–10.

1975 *Bythocythere constricta* Sars; Neale & Howe: Pl. 4, fig. 4.

1981 *Bythocythere constricta* Sars; Masson, (MS): 13–15, Pl. 1, figs. 1–3, 6.

Figured material. Nos. **IO.6742**, **IO.6743** and **IO.6751**, all from Quaternary deposits in the North Sea (Forties Field, B.P. engineering borehole DB 9, lat. 57° 45'N, long. 0° 55'E, 30 m below surface, silty clay), were taken from the D. Masson collection, Geology Dept., Aberystwyth University and kindly sent to us by Dr. R.C. Whatley.

Remarks. A few valves from the Quaternary of the North Sea (from the Masson collection, Aberystwyth), sent to us by Dr. R.C. Whatley, correspond more closely than any other material we have seen to Sars' (1866, 1926) description and figures of *B. constricta*, especially in dorsal view. They also closely resemble the form illustrated by Brady, Crosskey & Robertson (1874) from the Quaternary of Helensburgh, Scotland, as *B. constricta*. Specimens of *B. constricta sensu* Neale & Howe (1975) (kindly provided by Dr. J.W. Neale) from the Recent of Novaya Zemlya (Arctic) appear identical with those from the North Sea. These specimens are less elongate, and have more convex dorsal and ventral margins than those illustrated by Sars; nevertheless,

they do have the deep dorsomedian sulcus characteristic of *B. constricta s.s.* Until further material, including appendages, becomes available, we prefer to withhold judgement on this species; at present there appears to be no evidence of this form or of *B. constricta s.s.* living in British waters.

ACKNOWLEDGEMENTS

We would like to thank Dr. G. Boxshall and Mr. A. Tynan for allowing us access to material in the British Museum (Natural History) and the Hancock Museum respectively. Drs. R.C. Whatley, J.W. Neale, J.E. Robinson and K. Wouters kindly provided us with comparative material from their collections. We are also grateful to Dr. R.C. Whatley for reading and criticising the manuscript.

Explanation of Plate 2

Scale A = 500 μ m long: figs. 1–14.

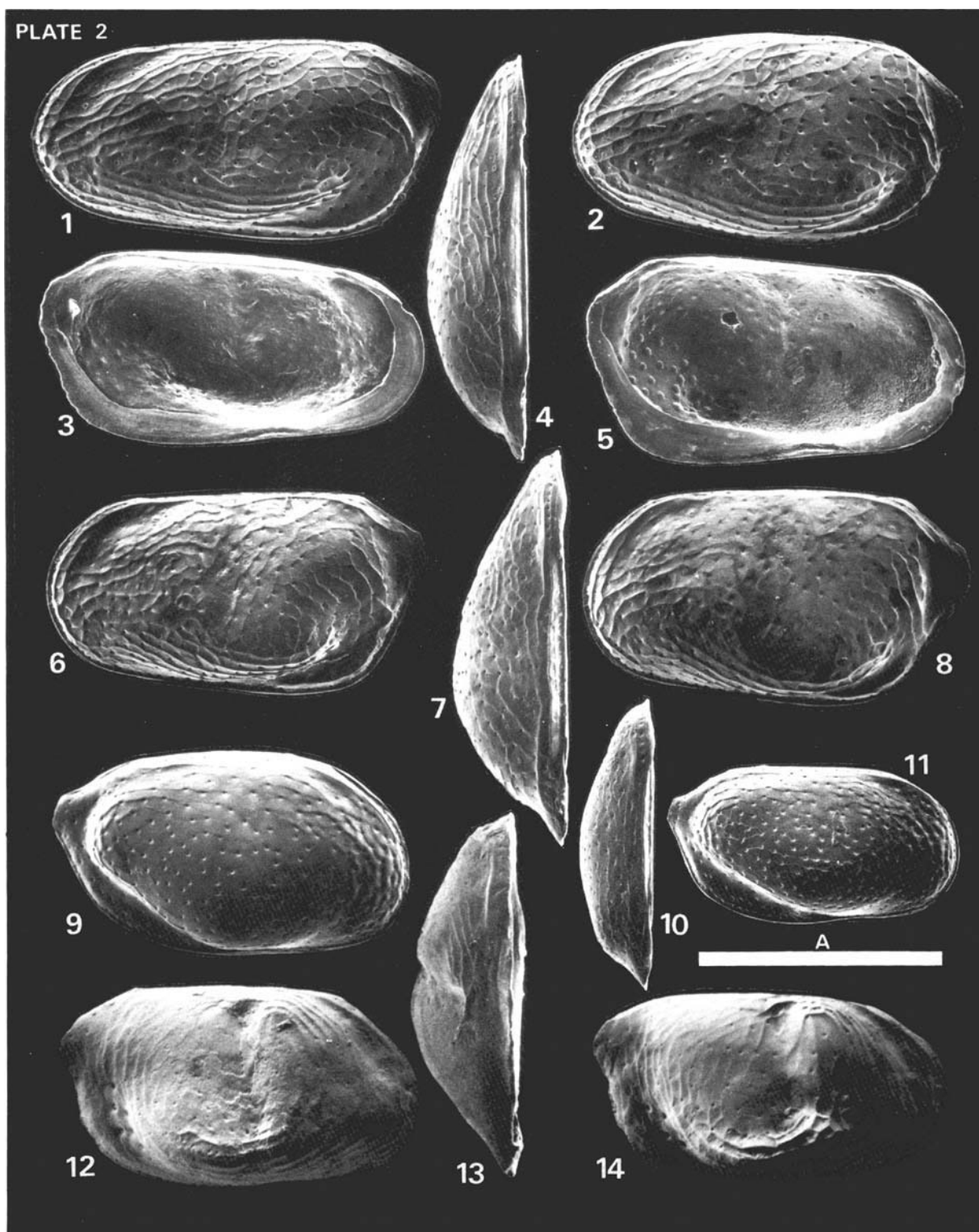
Figs. 1–4. *Bythocythere intermedia* Elofson: fig. 1, σ , 1982.348 (LV, ext. lat.); fig. 2, φ , 1982.346 (LV, ext. lat.); fig. 3, 1982.347 (LV, int. lat.); fig. 4, σ , 1982.345 (LV, ext. dorsal).

Figs. 5–8. *Bythocythere zetlandica* sp. nov.: fig. 5, σ , 1982.353 (LV, int. lat.); fig. 6, σ , paratype, 1982.351 (LV, ext. lat.); fig. 7, σ , 1982.352 (LV, ext. dorsal); fig. 8, φ , holotype, 1982.350 (LV, ext. lat.).

Figs. 9–11. *Bythocythere bradyi* Sars: fig. 9, φ , 1.06.16 (car., rt. lat.). figs. 10–11, σ , 1982.344: fig. 10, LV, ext. dorsal; fig. 11, RV, ext. lat.

Figs. 12–14. *Bythocythere* sp. aff. *constricta* Sars: fig. 12, φ , IO.6742 (RV, ext. lat.) fig. 13, φ , IO.6751 (LV, ext. dorsal). fig. 14, σ , IO.6743 (RV, ext. lat.).

PLATE 2



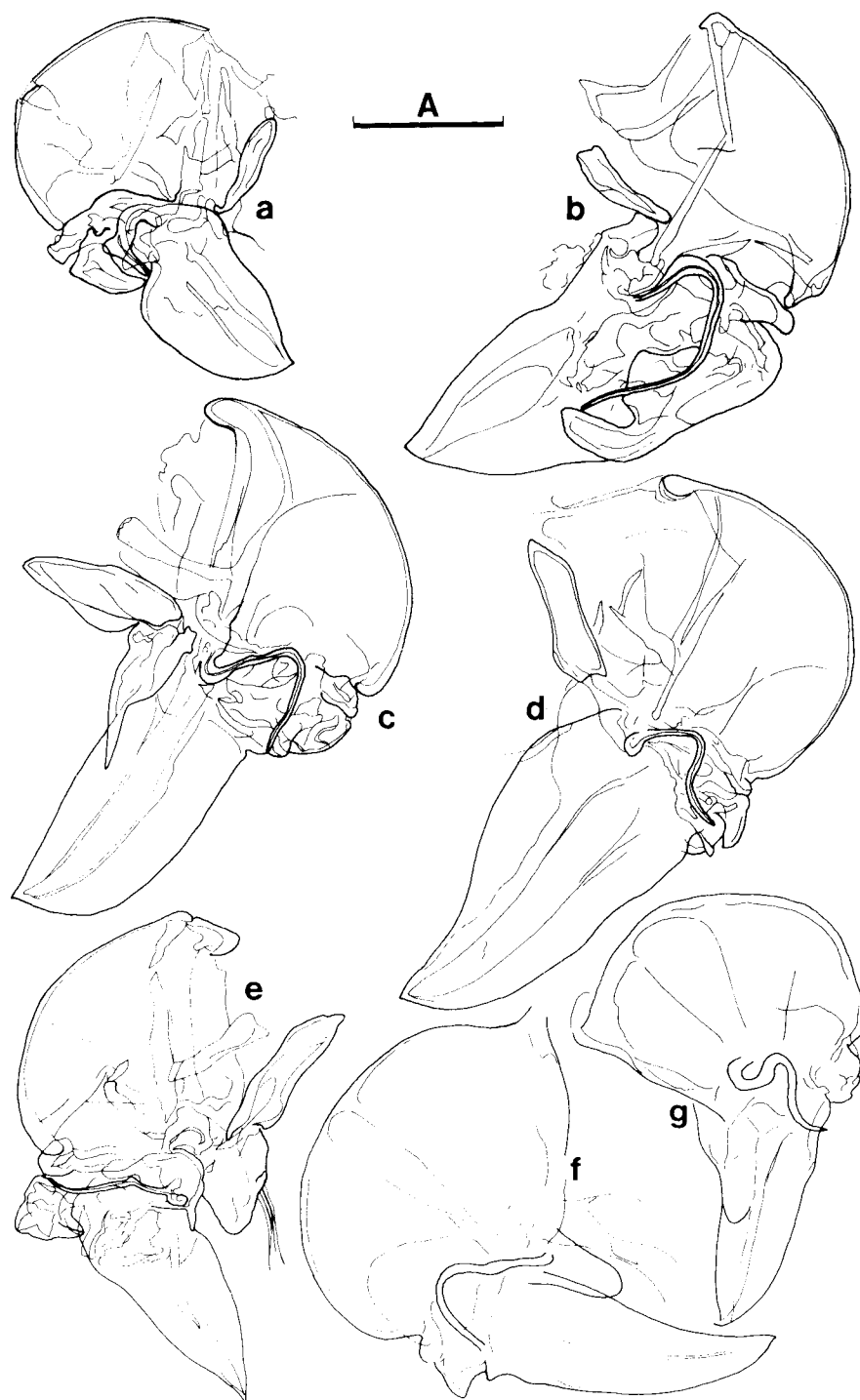


Fig. 5. Male copulatory appendages of *Bythocythere* species. a) *B. bradyi* (1.06.15); b) *B. intermedia* (1982.345); c) *B. zetlandica* (1982.352); d) *B. robinsoni* (1.42.20, paratype); e) *B. bradleyi* (1982.356, paratype); f) *B. turgida*; g) *B. constricta*. Scale A = 100 μ m (figs. a-e); the figures of *B. turgida* and *B. constricta* are taken from Sars' (1926) illustrations and are not to scale.

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