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The Ostracod Fauna of the Interglacial Deposits at Sugworth, Oxfordshire

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Phil. Trans. R. Soc. Lond. B 1980 **289**, 99-106
doi: 10.1098/rstb.1980.0029

THE OSTRACOD FAUNA OF THE INTERGLACIAL DEPOSITS AT SUGWORTH, OXFORDSHIRE

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(*Communicated by F. W. Shotton, F.R.S. – Received* 16 *May* 1979)

[Plate 1]

CONTENTS

Twelve species of ostracod are described from the Sugworth channel deposits. *Scottia browniana* (Jones) s.s. is overwhelmingly dominant. The assemblage suggests an environment of small, weed-grown pools from which the shells were transported a short distance by the old river and redeposited in its channels. The fauna indicate a temperate to warm-temperate climate typical of the middle of an interglacial period that was certainly Hoxnian or earlier in date. The assemblage hints at a Cromerian age, a conclusion that agrees with the firmer evidence provided by plants and vertebrates.

1. The occurrence of the fauna

The samples from the Sugworth excavations that were studied for their ostracod fauna were those that had already been screened for Mollusca (Gilbertson 1980), so creating a useful parallelism for the two groups. Although representative of a wide range of stratigraphical positions in the sections, there was a broad uniformity in the lithologies, which was reflected in a rather uniform pattern in the microfauna. Most of the samples were iron-stained, mature sands, with rounded and well-polished grains, associated with fine, silty matrix. The coarser fraction often included twigs and plant fragments. None of the samples was of clay or mud grade sediment, the kind of material often most productive of rich ostracod faunas. From this and from the fauna itself there follows a conclusion of an environment of sluggish stream flow with a strong tendency to stagnation and vegetation overgrowth, broken by intermittent floodings.

When the Sugworth fauna was originally studied (1976), comparisons were made with specimens from the sections at West Runton. Some of the species were closely matched and several aspects of the environment for the two localities seemed to have been similar. Such

comparisons were based upon bulky channel samples from Norfolk that can now be seen to have blurred changes in conditions during the Late Beestonian and Early Cromerian. This has been demonstrated in the work of De Deckker (1979), who, in 1977, sampled the Goss Gap section at intervals of 2.5 cm in close correlation with the sampling of West and of Stuart for palynological and vertebrate interests. Not only do his 62 closely spaced samples demonstrate a fluctuating and changing environment, but also they provide a much better established record for early Middle Pleistocene ostracod fauna from what is a Beestonian–Cromerian stratotype. This very much strengthens the case for setting an age for the Sugworth fauna without having to press comparisons with more distant sites in central Europe, as was the case previously. I should like to acknowledge the generosity of P. De Deckker in making his findings freely available to me, prior to publication.

2. Taxonomic comment upon the ostracods recovered

In that which follows, a brief taxonomic description is given for the main species from the Sugworth samples, accompanied with remarks on points of interest to the questions of age of the deposit and conditions at the time of deposition. The ostracod species are not treated in a strict classification sequence based upon their classificatory position, but rather related to their abundance overall.

(*a*) Scottia browniana (*Jones*) (*figure* 8*a–e*, *plate* 1)

1850 *Cypris browniana* n.sp. Jones, pl. 3, fig. 1*a–d*

1889 *Scottia browniana* (Jones), Brady & Norman

1967 *Cyclocypris triebeli* Kempf, pl. 1, figs 11, 12

1968 *Scottia browniana* Lüttig, tab. 2

Diagnosis. Carapace, symmetrical in outline laterally, the anterior margin being slightly more bowed than the rectangular posterior margin; dorsum flat in mid-length, passing abruptly into the end margins; in dorsal aspect, valve flanks subparallel, with a tendency for position of greatest width to be behind mid length; duplicature well-formed, continuous and parallel with the valve outline about the entire margin; muscle scar, a compact cluster of three flat scars in a vertical row, fronted by one main scar; sex dimorphism, a slight difference in proportions.

Material. Valves abundant in the sands of Sugworth, and, as a rule, well preserved.

Description of plate 1

Specimens figured have been deposited in the Fossil Ostracod collection, British Museum (Natural History), and carry the registration numbers quoted.

Figure 1. *Darwinula stevensoni* (Brady and Robertson): (*a*) left valve, external aspect, OS7319; (*b*) left valve, internal aspect, OS7318; (*c*) dorsal aspect, carapace, OS7320. All magn. × 100.

Figure 2. *Eucypris* cf. *dulcifons* Diebel and Pietrzeniuk: left valve, external aspect, OS7316, magn. × 50.

Figure 3. *Candona* sp.: juvenile valve, left aspect, OS7326, magn. × 100.

Figure 4. *Candona compressa* (Koch): (*a*) right valve, external aspect, OS6877, magn. × 50; (*b*) right valve, internal aspect, OS7321, magn. × 50.

Figure 5. *Metacypris cordata* Brady and Robertson 1870: (*a*) right valve, dorsal aspect, OS7323; (*b*) left valve, external aspect, OS7324; (*c*) dorsal aspect, carapace, OS7322. All magn. × 100.

Figure 6. *Eucypris pigra* (Fischer): left valve, external aspect, magn. × 64.

Figure 7. *Potamocypris wolfi* Brehm: left valve, OS6873, magn. × 76.

Figure 8. *Scottia browniana* (Jones): (*a*) right valve, external aspect, OS6874, magn. × 50; (*b*) carapace, dorsal aspect, OS7314, magn. × 60; (*c*) left valve, external aspect, OS6875, magn. × 50; (*d*) right valve, internal aspect, OS6876, magn. × 60; (*e*) muscle scar, interior, right valve, OS6876, magn. × 350.

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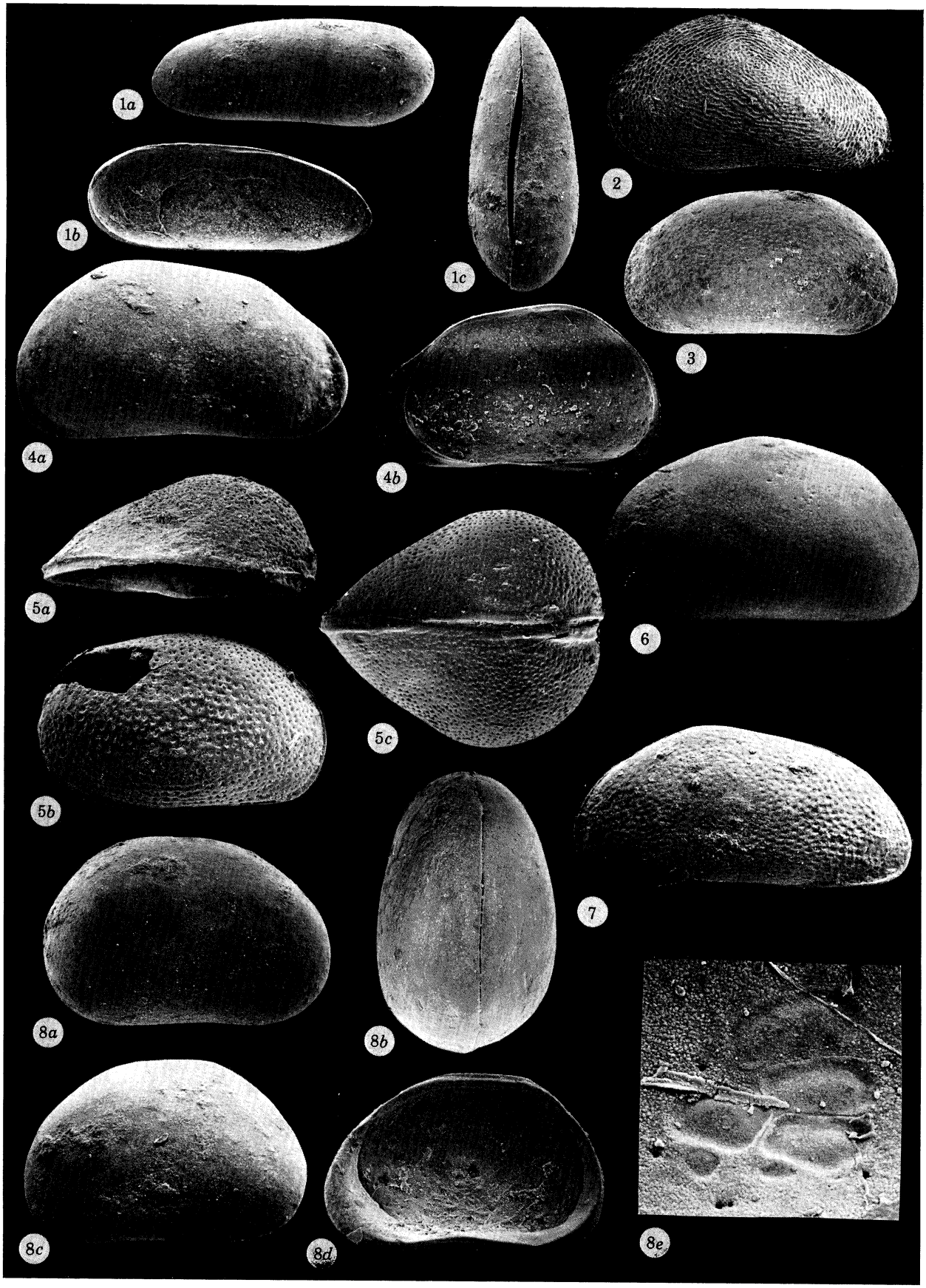

FIGURES 1–8. For description see opposite.

(*Facing p.* 100)

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Dimensions. Average of 30 valves: length 0.81 mm, height 0.520 mm.

Remarks. *Scottia* is by far the most abundant species in the fauna of most samples. When present, its valves can make up to 97 % of the total count of ostracods. This is not uncommon for the genus in its Pleistocene and Recent record, and similar observations have been made for the genus by Kempf (1971) and by Absolon (1973). Kempf has described it from Holstein-age Interglacials from sites ranging from the Rhine Valley (Tönisberg) to the Black Sea coast of Russia (Kujalnik near Odessa). The work of Kempf was important for establishing that there are three distinct species, *Scottia browniana*, *Scottia pseudobrowniana* and, less common, *Scottia tumida*, all of which had been previously considered to be *Scottia browniana*. In fact, *Scottia browniana* (Jones 1850) s.s. is essentially Lower and Middle Pleistocene, while *Scottia pseudobrowniana* Kempf is Upper Pleistocene to Recent in its time range. I am grateful to Dr Kempf for confirming that the Sugworth specimens are indeed *Scottia browniana* (Jones).

Apart from its possible age significance, *Scottia* as a genus has interesting ecological connotations, which can be best appreciated by reference to the work of Absolon (1973). Studying a wide range of localities of the late- and post-Pleistocene of Bavaria and Bohemia, Absolon has identified ostracod associations that represent environments including groundwater springs, shallow streams, ponds and lakes. Each has its own distinctive ostracod fauna, and, on the strength of knowledge of the life habits of related living species, these can be judged to be 'active swimmers' or 'weed crawling', and the conditions interpreted accordingly. From Absolon's study of sediment cores, ostracod histograms, reminiscent of the pollen diagrams that have become so familiar, chart changes in fauna, which represent changes in the environment. Often, such changes represent a vegetation overgrowth of once open water conditions. In these patterns, *Scottia* occurs in spring tufa deposits (association 'B' of Absolon), when such pools evolve into ponds. Then the calcareous marls are replaced by organic-rich loams or gyttja, in which the fauna is dominated by *Scottia*. The genus is to be regarded as an indicator of relatively small, shallow, permanent water bodies, with a marked tendency to weed growth and the ultimate development of a fen.

That it should occur in such numbers in the essentially sandy sediment of the Sugworth deposit requires some qualification. In the samples studied there was a marked predominance of single valves of adult size, and a corresponding absence of small juveniles. This is in contrast to the proportion of valves that would be found in a pond environment free from water movement, where discarded valves of all sizes would accumulate as 'fossil' (dead) assemblages. For Sugworth, it could be assumed that the *Scottia* valves had been transported from their pond environment into a final resting place more decidedly fluviatile (judging from its sediment-type). This interpretation is supported by the predominance of single valves, the two valves of the living animal having been in all probability separated after death, in transport. Of interest for the interpretation of the Sugworth fauna, is the record of the living *S. pseudobrowniana* Kempf, from islands of floating vegetation (*Carex*, *Typha*, and *Phragmites*) in lakes close to Bucharest (Danielopol & Vespremeanu 1964), where, clambering amid the waterlogged vegetation, it could extend its milieu to take in the semiaquatic (Kempf 1971, p. 56).

At West Runton, *Scottia browniana* has been recorded from Late Beestonian B to just above the top of Cromerian IIb (De Deckker 1979), but its dominance is confined to the period of Cromerian IIa. For this interval, of temperate forest (from the pollen assemblages) and mild in climate, *Scottia* can constitute up to 90 % of the total ostracod fauna: a situation very much akin to that at Sugworth.

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Candona neglecta *Sars*

Diagnosis. Carapace, large; outline, bean-shaped; the dorsum strongly upcurved behind mid-length to give characteristic 'hump-backed' form; the venter incurved centrally; end margins rounded, the anterior narrowly so.

Material. Several valves occurred in the samples rich in wood fragments and plant debris, D90, D100, D130.

Candona compressa (*Koch*) (*figure* 4*a*, *b*, *plate* 1)

Diagnosis. Carapace, medium-sized; outline, dorsally truncate and relatively short for the genus; greatest height close to the posterior margin, from which point the dorsum tapers regularly to the low anterior margin; venter, slightly concave centrally.

Material. A few valves in the organic-rich layers, D90, D100, D120, D130.

Remarks. According to Klie, *Candona compressa* prefers the shallow margins of large lakes, implying that it is not an active swimmer (Klie 1938).

Candona *sp*. (*figure* 3, *plate* 1)

In several samples from Sugworth, there occur numbers of small, immature valves, symmetrical in ouline and ornamented with a fine reticulation pattern. The shape is typical for *Candona* juveniles, with a possibility that they belong to the *Candona rostrata* group, but there are no appropriate adults to prove this supposition. Similar small valves occur at Süssenborn (Diebel & Pietrzeniuk 1969, p. 476).

Candona tricicatricosa *Diebel & Pietrzeniuk*

Remarks. Several fragments of valves were found in Sugworth samples that bore traces of the distinctive muscle scar of this species, described first from the Cromerian of Süssenborn near Wiemar. The usual set of two mandibular scars in most species of *Candona* are, in this species, replaced by an arcuate row of three distinct scars, thus making *Candona tricicatricosa* relatively easy to recognize. Unfortunately, only fragments were found, and the species has not been illustrated in this account.

Cyclocypris ovum (*Jurine*)

Diagnosis. Carapace short, tumid, boldly rounded posteriorly, slightly tapered anteriorly; dorsum uparched, symmetrical; venter straight, valves flattened towards this margin; valve flanks strongly convex, bulging.

Material. A number of valves and carapaces occurred at levels D90, D100.

Remarks. This is a species that can survive the drying out of small ponds; it lives clambering upon aquatic vegetation.

Herpetocypris reptans (*Baird*)

Diagnosis. Carapace very large, but delicate; elongate; dorsum straight, subparallel to the venter; valve margins bear broad duplicatures that strengthen the valves; muscle scars prominent, consisting of elongate subparallel scars aligned obliquely to the valve outline.

Materials. Few complete valves survive because of the thin valve walls away from the margins and because of the unusually large size of the valves. Fragments, however, are distinctive and can quickly be recognized. The species occurred in samples D10, D90, D100, D130 and D480.

Remarks. The species occurs most frequently in quiet waters rich in plant debris, requirements seemingly fulfilled at Sugworth (Klie 1938, p. 125).

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Eucypris pigra (*Fischer*) (*figure* 6, *plate* 1)

Diagnosis. Carapace triangular, rounded; valves strongly convex below mid-height; dorsum uparched, slightly pointed at mid-length; venter slightly concave at mid-length; well formed duplicature, widest at the lower part of the end margins; valve surface smooth.

Materials. A number of valves were found in sample D90.

Remarks. According to G. W. Müller, this species has a marked preference for shallow water, perhaps only a few millimetres above the bed of the lake (Müller 1900). *Eucypris pigra* belongs to association 'C' of Absolon (stream marls and shallow ponds), often pre-dating the onset of association 'D', which includes *Scottia*. Like *Herpetocypris*, this ostracod has delicate valves, and when it is found in sand samples, the valves are most often damaged. Fragments, however, are distinctive for the duplicature patterns of the end margins which, being reinforced, survive.

Eucypris *cf.* dulcifons *Diebel & Pietrzeniuk* (*figure* 2, *plate* 1)

Diagnosis. Carapace triangular with rounded angles; valves strongly convex at about mid-height; greatest height slightly in front of mid-length, the outline passing smoothly into a boldly rounded anterior margin, posterior margin more tapered; a broad duplicature parallels the anterior margin; valve surfaces covered with a deeply incised pattern of ornament with an overall concentric arrangement.

Materials. A number of valves were found in D90 and D100.

Remarks. *Eucypris* cf. *dulcifons* was described from the Interglacial at Süssenborn, and, although it has not been recorded from other sites as yet, it is a species that occurs in silts below the peaty layers of the Cromer Forest Beds at West Runton. Once again, the valves are delicate and frequently are broken, but even small fragments bearing the distinctive 'fingerprint' ornament can be attributed to the species.

Ilyocypris bradyi *Sars*

Diagnosis. Carapace, elongate with rounded end margins; dorsum, straight; venter, long, incurved at mid-length; anterior margin, boldly rounded, higher than the posterior margin, which is less quadrate in outline; valves bear two oblique sulci running from the dorsum to about mid-height; sulci deepen into aligned pits in most specimens; valve surface, ornamented with regular spaced pitting.

Materials. Single valves occurred in several samples without being numerically important.

Remarks. *Ilyocypris bradyi* is an ostracod of springs and shallow ponds (Klie 1938, p. 93), forming part of association 'C' of Absolon (1973, p. 84). Living forms are sluggish swimmers, clambering upon vegetation by preference. The genus *Ilyocypris* usually signifies still or slowly moving waters at the most. The species of the genus, including *I. bradyi*, have, according to present understanding, an apparently long time range, extending back to Lower Pleistocene from present day.

Potamocypris wolfi *Brehm* (*figure* 7, *plate* 1)

Diagnosis. Carapace, elongate triangular; dorsum, a low arched curve, greater height in front of mid-length, from which point the outline tapers to the posterior margin; venter, straight, slightly concave at line of greatest height; valve surface, ornamented with pitting, thinning centrally.

Materials. Three valves occurred in sample D90.

Remarks. The species of *Potamocypris* are difficult to determine and there are doubts about their

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extension back into the fossil record. These valves, however, have some of the proportions and characteristics of *Potamocypris wolfi* Brehm 1920, as illustrated by Diebel & Pietrzeniuk (1975), from Holocene travertines from Bad Langensalza in Thuringia. This species is more elongate in outline than *Potamocypris zschokkei* (Kaufmann 1900) or the relatively short species, *Potamocypris maculata* Alm 1916. Ecologically, all the species of this genus seem to be active swimming forms, capable of living in flowing waters of generally cool temperatures (De Deckker 1979).

Darwinula stevensoni (*Brady & Robertson*) (*figure* 1*a*, *b*, *c*, *plate* 1)

Diagnosis. Carapace, elongate, tapered anteriorly, cylindrical; dorsum, a low arched curve; venter, straight; valve surface, smooth.

Materials. Several valves occurred in samples D90, D100 and D130.

Remarks. *Darwinula stevensoni* has such simple valve characters that it is difficult to separate fossil valves from the extant species; this has the effect of extending the time range considerably. The living form is found burrowing within the upper surface deposits of lakes floors, particularly in settings where plant debris is abundant.

Metacypris cordata (*Brady & Robertson*) (*figure* 5*a*, *b*, *c*, *plate* 1)

Diagnosis. Carapace, small, grossly inflate and tumid, particularly posteroventrally; dorsum, straight, relatively short; venter, straight but tending to be overlapped laterally by inflate areas that hide the margin; valve surfaces, covered with a close spaced pattern of pitting.

Materials. Several specimens occurred in samples D80, D90, D100 and D120.

Remarks. This form is distinctive on account of its inflate character in the adult, but juveniles and adults alike can be further recognized by the ornamentation of the valve surface. Ecologically, *Metacypris* appears to take over lakes and ponds when they pass into a stage of fen carr and become choked with vegetation. In Absolon's core through the Preboreal of Seehaupt in Bavaria, the species occurs in his histogram as a late abundance immediately before the onset of an organic peat (Absolon 1973, p. 90, fig. 40) and has been similarly documented in the post-glacial history of Austrian alpine lakes (Löffler 1975).

3. Comment upon the age of the deposit

In the introduction to this comment upon ostracod fauna, it has been mentioned that the fauna from Sugworth was that of a stream channel. Further, in the remarks upon the individual species, it has been recorded that, in the samples, only the species *Scottia browniana* could be termed abundant, the other species being a comparatively small percentage of the total fauna. It has also been established that, from the size-sorting and predominance of single valves over two-valved carapaces, the ostracods have probably been displaced a short distance from their life environment. Altogether, this builds up for the Sugworth fauna a picture of an assemblage appropriate to a channel deposit not unlike those known from the sequence at Clacton (Hoxnian), or parts of the Cromer Forest Series (Cromerian). As noted above, however, the species of *Scottia* from Sugworth is *Scottia browniana* (Jones), the type species of which came from the Hoxnian Channel deposit at Clacton (Kempf 1971, p. 50); so, thanks to the revised definition of this species, we are entitled to say that Sugworth is at least Middle Pleistocene (Cromerian–Hoxnian). For more precise age determination, it is important to discover species that are not so facies-tied to the channel environment, but represent other environments in which evolution

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was producing time-limited species. At the well known locality of West Runton, on exposure of the Cromer Forest Bed, the dark organic beds yield a rich *Scottia* fauna and little else, but, in the silts below, there occurs a variety of ostracods that includes species recorded from the best described Cromerian site in Europe, Süssenborn near Weimar. It is unfortunate that so much of the Sugworth section seems to have been 'channel' and so little of the braided channel courses and temporary pools of the Cromer sequences (De Deckker 1979).

Turning to the small percentage of the Sugworth fauna other than *Scottia*, the following observations can be made: *Eucypris* cf. *dulcifons* Diebel & Pietrzeniuk, and *Candona tricicatricosa* Diebel & Pietrzeniuk (fragments only) are both forms that make up the fauna of the Late Beestonian in Norfolk, and the Cromerian *sensu lato* of Süssenborn. Of the other species of those assemblages, including adult valves of *Candona*, *Eucypris*, *Sclerocypris*, *Herpetocypris* and *Limnocythere*, valves may have been too delicate to have survived the transportation and movement of the Sugworth deposits. Otherwise, the sedgy banks favoured by *Ilyocypris* and *Limnocythere* may not have been part of the Sugworth ecology, so removing from the record species that could have been time-significant (Diebel 1968). It would have been satisfying to have seen more material, but that available does at least hint at a Cromerian age overall.

4. The environment of the Sugworth deposits

If tentative as to the age of the deposits, the cumulative evidence of the individual species builds a clear picture of the conditions that prevailed at the time of deposition. Most genera recorded, and those species that are extant, have a preference for waters at most sluggishly flowing and rich in either growing vegetation or accumulations of plant debris. What is more, from the temperature requirements of the same ostracods, it can be said that Arctic or Cold Temperate species are absent from the Sugworth fauna, while Temperate to Warm Temperate species are present. As often seems to be true, then, chiefly the middle climatic period of an Interglacial cycle may be represented here (Robinson 1978).

Absolon, in a review of the sequence of ostracod faunas found in the time period Late Glacial to Holocene, has distinguished between a cold '*Candona candida* Fauna', and a climatic optimum Boreal, '*Metacypris cordata* Fauna', the two being separated by a 'Transitional Fauna' (Absolon 1973, p. 91, tab. 2). Transferring this yardstick of the recent past back to the Interglacial, Sugworth fauna would accord best with the '*Metacypris*/Boreal' equivalent.

Scottia does not strictly belong to any of the climatically labelled associations of Absolon, but has been given an assessment by Kempf in his broad review of the distribution of the genus in Europe and Asia Minor. He found that in Interglacials such as Tönisberg (Holsteinian, Lower Rhine Valley) *Scottia* occurs in the temperate climatic range of the deposit, when judged in conjunction with Mollusca, fruits and spores (Kempf 1971, p. 57).

Since studying the fauna from Sugworth, other terrace deposits in the Thames Valley have been processed and considered. In particular, channel deposits within the gravels of the Summertown–Radley terrace around Stanton Harcourt, and others from the Flood Plain terrace at Brighthampton. These deposits, visibly channels of late Pleistocene Thames drainage, differ radically from the assemblages of Sugworth in the absence of *Scottia* and the substitution of *Ilyocypris*, *Potamocypris* and *Candona* in number. The contrast is very much an ecological one: the *Scottia* fauna is from a sluggish flow régime; the other fauna represents a stronger flow régime with lesser amounts of organic detritus.

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Reworked fauna

In almost every sample studied, there was a percentage of reworked material, usually Oxford Clay or Kimmeridge Clay species of the genera *Macrodentina* and *Galliaecytheridea*, not too difficult to distinguish from the Pleistocene forms by reason of their valve preservation. Other marine debris, including foraminifera, echinoid spines and plates, were undoubtedly from the same source, the nearby solid outcrops of Wheatley and Cumnor upstream.

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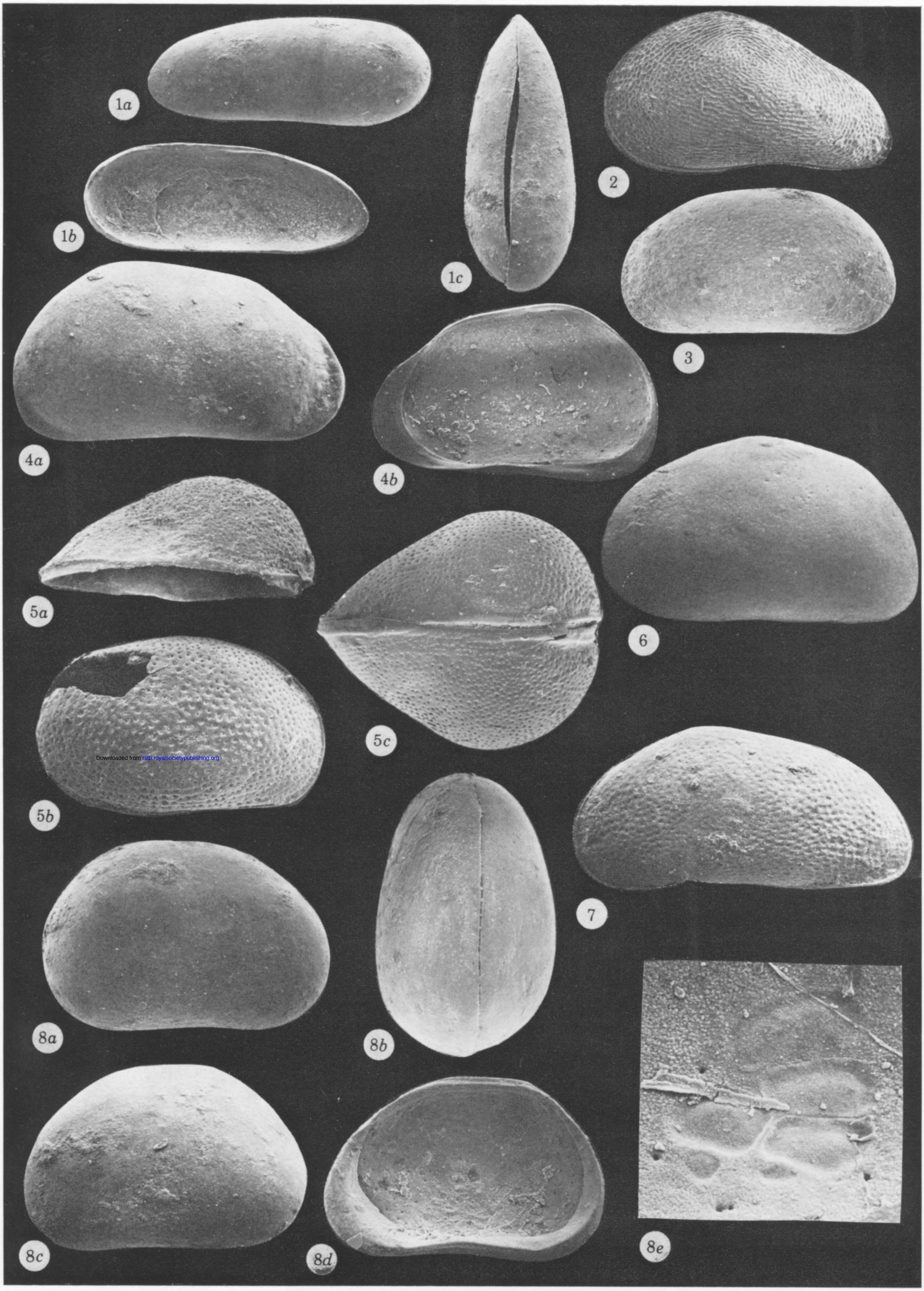

FIGURES 1–8. For description see opposite.