BRITISH PORTLANDIAN OSTRACODS

A Thesis submitted for the
Degree of Doctor of Philosophy

by

Dennis Barker

University of Leicester    July, 1964.
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Acknowledgements

The author wishes to record his grateful thanks to Professor P.C. Sylvester-Bradley for his guidance and encouragement during the past four years.

A Research Scholarship of the University of Leicester, for which I am indebted to the University Authorities, provided my financial support during the last three years.

Numerous people have helped in various ways during this research and in particular I would like to thank the following people: the staff and technicians of the Department of Geology, University of Leicester for much help and encouragement; Dr. R.H. Bate of the British Museum of Natural History and Dr. F.W. Anderson of the Geological Survey for many helpful discussions and permission to examine the ostracod collections under their care; Dr. J.P. Harding of the British Museum of Natural History for help with the dissecting techniques of recent ostracods; Dr. F.S. Russell of the Laboratory of the Marine Biological Association and his staff for much help and encouragement during the study of the ostracods of the Tamar estuary; Professor H.P. Moon and Mr. H.F. Downton of the University of Leicester for many helpful discussions; Dr. P. Donze for his guidance around the exposures of Purbeckian facies near Chambery and for the loan of specimens; Dr. H.J. Oertli and Dr. Beata Moos for the loan of specimens, and finally, Mr. I.M. West for allowing me to
co-operate with him in his research into the Lower Purbeck Beds of Portesham Quarry, Dorset.

Thanks are also due to Miss Rosalind Thompson for typing the manuscript.

Lastly, and probably most important of all, I would like to thank most sincerely my parents and other members of my family, for their constant help and encouragement.
Introduction

Hitherto the only attempt to describe ostracods from the Portland Beds of England has been a short paper by F.W. Anderson (1941). This made incidental reference to a few species collected by Sylvester-Bradley from the top few feet of strata overlain by the "Swindon Series", which formed the main subject of the paper. The present survey is, therefore, the first to attempt a comprehensive description, and even now, (owing to paucity of exposures in the inland regions of the outcrop), it is not as complete a survey as could have been hoped.

The Portland Beds of Dorset were regarded by Arkell (1956) as the standard section ("stratotype") of the Portlandian Stage, but this has been disputed in recent years, and a nomenclatural controversy has been exacerbated by two stratigraphical discoveries of great importance:

1) The upper boundary of the Portland Beds has been found to vary from place to place, and to interdigitate with the Purbeck Beds; Swindon Roach is evidence of the
2.

last incursion of Portlandian facies from a sea lying to the south (P.C. Sylvester-Bradley et al., 1964).

2) The marine "Cinder Bed" of the Middle Purbeck sections is a marine intercalation recording the southward transgression of the Cretaceous sea that lay to the north (Casey and Bristow, 1964). See Figure 1.

The nomenclatural consequences of these discoveries have not yet been resolved, and the present position is summarised in Figure 2.

Particular attention has been paid in the present studies to the ostracods occurring in the strata which record the first of the two marine incursions. This has involved a study of their stratigraphical distribution throughout the Portland Beds in Dorset and in the lowermost Purbeck Beds. The corresponding facies at Swindon and Aylesbury have also been studied in detail. In both localities particular attention has been paid to their environmental preferences.

It has also been possible to explore the stratigraphical and environmental significance of some of the species over a wider field. A special attempt was made to study the critical area where the "Portlandian" and "Purbeckian" facies pass into "Tithonien" and "Berriasien".

The whole thesis can be divided into six sections as below:
Fig. 1. Diagram to show the variation in facies of the Portland and Purbeck Beds along their outcrop from Aylesbury to Dorset.
3.

1) **The Jurassic-Cretaceous boundary around Chambery, Savoie.**

   This section outlines the geology of the area in question and summarises the results of my investigation. Since the results obtained were inconclusive it is not intended to publish them. The general geology and a statement of the problem were published in "Petros", the student journal of the Leicester University Geological Society, 1963, Vol. III, Part 1, pp. 4-6.

2) **The size range of *Cypridea dunkeri* and its stratigraphical significance.**

   Specimens of *Cypridea dunkeri* from numerous localities have been measured and found to separate easily into subspecies, each characteristic of a particular horizon. Conclusions have been made about the significance of this size difference.

3) **Ostracods from the Lower Purbeck Beds of Portesham Quarry, Dorset.**

   The vertical distribution of the ostracods is indicated and the ostracod fauna described. Some comparison is made with environmental conditions determined by petrological techniques.

4) **Ostracods from the Portland and Purbeck Beds of the Aylesbury district.**

   This section is being submitted to the Bulletin of the British Museum of Natural History for publication; it
Fig. 2. Table to show the various interpretations of Portlandian and later deposits in North West Europe.
<table>
<thead>
<tr>
<th>Dorset after Arkell, Casey 1963</th>
<th>Swindon after Arkell, Casey</th>
<th>Spilsby after Case 1963</th>
<th>Paris Basin after Oertli</th>
<th>French Jura after Donze</th>
<th>Arkell 1956</th>
<th>Casey 1962</th>
<th>British Mesozoic Committee</th>
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<tr>
<td>Wealden Beds</td>
<td>Claxby Beds</td>
<td>Barremien</td>
<td>Valanginien</td>
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<tr>
<td>Upper Purbeck Beds</td>
<td>Upper Spilsby Sandstone</td>
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<tr>
<td>Middle Purbeck Beds</td>
<td>Whitchurch Sands</td>
<td>Lower Spilsby Sandstone</td>
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<tr>
<td>Lower Purbeck Beds</td>
<td>Swindon Series</td>
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<tr>
<td>Portland Stone</td>
<td></td>
<td>&quot;Portlandian&quot;</td>
<td></td>
<td></td>
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<tr>
<td>Portland Sand</td>
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<td>&quot;Portlandian&quot;</td>
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<tr>
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<tr>
<td>Middle Kimmeridge Clay</td>
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<td></td>
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<td></td>
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<tr>
<td>Lower Kimmeridge Clay</td>
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<td>&quot;Kimmeridgian&quot;</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
4.

describes the ostracods and stratigraphy of the beds in question and presents evidence for the passage of Portland into Purbeck Beds. The Lower Purbeck Beds are shown to be equivalent in age to the top of the Portland Stone and are therefore a facies of the Portland Stone.

5) Size and its relationship to salinity in fossil and recent euryhaline ostracods.

This section has been published; J. mar. biol. Ass. U.K., 1963, 43, 785-795, text figs. 1-4. The work described here was begun in order to test two hypotheses put forward in section four. These were:

a) that there was a passage from Portland to Purbeck conditions in the Aylesbury district,
b) that the euryhaline ostracods found in the passage beds varied in size according to the salinity of the environment.

The size distribution of two euryhaline ostracods from the Portland and Purbeck Beds of the Aylesbury district are compared to two recent euryhaline species from the Tamar estuary. The causes of variation in size in euryhaline ostracods are discussed and it is suggested that the most effective is variation in salinity.

6) Ostracods from the Portland Beds of Dorset.

Ostracods from the Portland Stone and Portland Sand of Dorset are described for the first time. Samples from
5.

the Portland Stone were very poor in ostracods but together with those obtained from the Portland Sand they allow tentative conclusions to be made about conditions during Portland times. This section is to be submitted to the Bulletin of the British Museum for publication.

Sections 2 and 3 form the Ostracod chapter of a joint paper on "The Ecology of the Lower Purbeck Beds of Portesham Quarry, Dorset". This is under the editorship of Professor P.C. Sylvester-Bradley and the Petrology is described by I.M. West, the Land Plants by Christine Brown and Sylvia C. Bugg, and the Charales by Jean Costain. It is being submitted to Palaeontology for publication.
The Jurassic-Cretaceous Boundary

Around Chambery, Savoie

The Upper Jurassic and Lower Cretaceous rocks of the area around Chambery can be separated into two palaeogeographic regions, a Tethyan province with its marine Tithonian and Berriasian rocks to the south-east, and the lagoonal-lacustrine assemblage of the Jura and North-West Europe to the north-west. In this region the characteristic rocks overlap and interfinger and it should be possible to compare the two sequences. However, there are difficulties in the correlation because of the lack of ammonites in both regions and the only other macrofossils represented are of poor stratigraphical value. Of the microfossils, ostracods appear to be of most use for dating the Purbeck deposits and are also to be found in the Berriasian. By using ostracods and the few ammonites which have been found, together with petrological techniques, Donze (1958) was able to divide the area around Chambery into a series of facies. The first four are as follows:

Facies 1 Argillaceous marls with the "Calcaire Grossier". These are marine, the "Calcaire Grossier" being a typical shelly limestone.
7.

Facies 2 Transition zone, marine and brackish water limestones with thin freshwater bed.

Facies 3 Mixed freshwater, brackish and marine beds with a little dolomite.

Facies 4 Freshwater, brackish and marine beds with dolomites at the base.

The boundaries between these facies run more or less parallel to the dividing line between the Tethyan and North-West European provinces which runs roughly NE-SW through Chambery.

Of the facies which Donze postulated, the four mentioned here are the most important, since in this area, the change from marine Tethyan conditions to the continental margin deposits of the Purbeck takes place. Figure 3 indicates the position on the map of these facies and shows how they cut across the structure of the area in a NE direction. The outcrops of Jurassic and Cretaceous rocks occur in the cores of anticlines, the general trend of which can be easily seen on the diagram.

Figure 4 shows the section at one locality in each of the facies. There is a notable increase in dolomites and freshwater beds towards the higher facies.

The sea retired to the SE at the beginning of Purbeck times to deposit the "Calcaire Grossier" in the subalpine regions and form a complex lagoonal-lacustrine assemblage
Figure 3

To show the position of the outcrops from which samples were collected and the approximate boundaries of the first four facies of Donze.
8.

in the Jura, the whole area becoming covered by the sea again only at the beginning of the Valanginian. Thus the "Calcaire Grossier" indicates the NW limit of Tethys during Berriasian times and the Purbeck beds are the continental margins, often marine or brackish and sometimes lacustrine becoming more and more continental in facies towards the NW.

The structure of the region is not very complicated and consists of a series of anticlines to the NW of Chambery trending more or less NNW-SSE which meet the boundary of the slightly thrusted subalpine zone trending NNE-SSW, to the SE of Chambery. There is little or no overfolding, dips of over 90° being found only occasionally.

The morphology of the region is governed by its structure. Chambery is situated in a valley between the subalpine massifs of the Bauges to the north and the Chartreuse to the south. The subalpine massifs consist mainly of N-S folds which become slightly more complex near Chambery.

Tectonically the western area belongs to the Jura Mountains, the major anticlines forming high ridges with sharp crests exposing Jurassic rocks in the cores of the anticlines. These ridges are separated by wide smooth valleys infilled with young sediments.

In France, Donze, 1958, has shown that during Middle
Figure 4

To show comparative sections from localities in each of the first four facies of Donze.
Berriasien times a general regression occurred in the Jura. The "Calcaire Grossier" containing Middle Berriasien ammonites is the equivalent of the Purbeck Beds to the north-west. After the "Calcaire Grossier" the deep water conditions re-established themselves and at the Cluse du Chailles ammonites are found at the top of the Purbeckian to indicate the new transgression. The beds a couple of feet below contain *C. dunkeri sowerbyi* and are therefore Lower Purbeck in age giving the transgression indicated by the marine beds above an age approximately equivalent to the Cinder Bed.

The ammonites *Berriasella lorioli* and *B. richteri* have a wide range but *B. cf. privasensis* is Berriasien, thus confirming the age of the transgression. These discoveries of Donze were of such importance that it was decided to visit the French Jura and collect from the most important sections in order to compare the Portlandian and Tithonien ostracod faunas. The visit was made in the summer of 1962 and Dr. Donze kindly showed me over the critical sections from which collections were later made. The following is a short report of the work done on this problem.

Collections were made bed by bed, (following as near as possible the divisions indicated by Donze, 1958) from seven localities indicated on Figure 3 and listed as follows:
10.

1) Col du Pertuiset  
2) Montagnole  
3) Col de l'Epine  
4) Mont l'Epine  
5) Cluse du Chailles  
6) Col du Chat  
7) Cluse du Fier  

All the samples were examined for ostracods but only nine samples had any at all.

**Col du Pertuiset**

A sample from the Berriasien inférieur contained a rich fauna of new species, notably species of Cytherelloidea, Bairdia, and Protocythere together with about six species which it was difficult to identify without more specimens.

A sample from the Berriasien supérieur also contained a rich new fauna having species of Cytherella, Cytherelloidea, Bairdia, Paracypris and two other species of doubtful affinities.

These two faunas have been described by Dr. Donze and are in the process of being published.

**Col de l'Epine**

Only three samples contained ostracods from this locality and these correspond to Beds 2 and 5 of Donze, 1958. The ostracods obtained were Fabanella polita, Orthonotocythere rimosa, Theriosynoeicum forbesii, and Macrodentina (Dictyocythere) retirugata.

**Cluse du Fier**

Four samples from this locality contained ostracods
and these correspond to Beds 47, 45, 44. *Fabanelia polita* was obtained from all, but Bed 44 also contained *Cypridea praecursor* and *Cypridea dunkeri sowerbyi*.

**Conclusions**

From the field work it was possible to confirm the lithological groupings of Donze. The few ostracods found confirmed some of Donze's work but the most critical locality, Cluse du Chailles, proved sadly lacking in fossils of any kind, probably because of the relatively short time spent at the exposure. Donze had been collecting specimens at these localities over many years and has come to know them intimately. The Cluse du Fier section however, is in the same facies as the Cluse du Chailles and *Cypridea dunkeri sowerbyi* is to be found a few feet below the massive Valanginian limestones but this time without the ammonites to date the beds accurately.
The size range of *Cypridea dunkeri* Jones

and its stratigraphical significance.

The most abundant ostracod in the Charaphyte Chert of the Lower Purbeck Beds in Portesham Quarry, Dorset, was identified by West (1961) as *Ulwellia papulata*. So far this species has only been found in England in the Swindon Series of Swindon and therefore the new evidence caused West to correlate the Swindon Series with the lowermost Purbeck Beds of Dorset.

Arkell and Sylvester-Bradley (1941) discussed the age of the Swindon Purbeck Beds and came to no definite conclusion, though Arkell favoured a Middle Purbeck age and Sylvester-Bradley a Lower or Portlandian age. Thus, this discovery gave the first definite indication of an age for the Swindon Series. The justification for this correlation is here examined in some detail.
Cypridea dunkeri sensu lato, was described initially by Jones (1885) from the Middle and Upper Purbeck Beds of Dorset. Although Jones mentioned in his description the wide variation in convexity and tubercles, he was unable to separate the various forms in his samples. He said that this species was common in Wealden Beds and was also to be found in the Purbeck Beds of Swindon. At the present time Cypridea dunkeri sensu stricto can be found at many horizons both above and below the Cinder Bed in the Middle Purbeck, over an area stretching from Dorset to the Weald.

The most characteristic ostracod in the Purbeck Beds of Swindon was described by Anderson (1941) under the name of Ulwellia papulata. Anderson compared this species with a variety from the Middle Purbeck of Dorset which he called U. papulata var. poxwellensis. (Ulwellia is now usually regarded as a subgenus of Cypridea).

Subsequently Sylvester-Bradley (1949) showed that the Dorset form was identical with the species described long ago by Jones as Cypridea dunkeri. Sylvester-Bradley was of the opinion that Cypridea dunkeri and Cypridea papulata were
specifically distinct; Anderson had thought them varieties of the same species. Oertli (1963) has reviewed the occurrence of *C. dunkeri* in Europe, and has concluded that neither *C. papulata* nor a form described under the name *C. carinata* Martin (1940) are specifically distinct from *C. dunkeri*. Martin (1940) also described *C. sowerbyi* for the first time and in the following account this is shown to be intermediate in size and stratigraphic position between *C. dunkeri* and *C. papulata*.

Clearly, it is important to determine whether the distinction that Anderson noted between *C. papulata* and *C. dunkeri* has stratigraphical significance, and this is attempted below. It will be shown that *C. dunkeri* ss., *C. papulata* and *C. sowerbyi* vary in a number of characters, including size, shape and tuberculation. Of these, only size shows significant correlation with stratigraphic horizon. The size distinction is considered to be sufficiently important to warrant the recognition of three subspecies of *C. dunkeri* each characteristic of a different horizon, as follows:

a) *C. dunkeri papulata* from the bottom of the Lower Purbeck and top of the Portland Beds.

b) *C. dunkeri sowerbyi* from the Lower Purbeck of France and Germany and presumed to be intermediate in stratigraphical horizon between a) and c).
c) *C. dunkeri dunkeri* from the top of the Lower Purbeck of Dorset, Sussex and the Swiss Jura.

By the kindness of Drs. Beata Moos, J.H. Oertli, F.W. Anderson and P. Donze, Mr. M.J. Hooper and Professor Sylvester-Bradley samples of *C. dunkeri* have been examined from the following localities and horizons:

A. Roadside excavations and auger borings one mile north of Whitchurch on the Buckingham Road. Collected by Sylvester-Bradley in 1939;
1) [NWF 4]*, 2) [NWF 5], 3) [NWC 8 ft. - 9 ft.], 4) [NWC 9 ft. 9 ft. 6 ins.], 5) [NWC 9 ft. 6 ins. - 10 ft.].

B. Samples from the Bugle Pit, Hartwell near Aylesbury, now filled in, but collected by Sylvester-Bradley in 1939;
6) [BP 3]*, 7) [BP 6], 8) [BP 7].

C. Samples from the Town Gardens Quarry, Swindon. (See Sylvester-Bradley, 1940).
9) TGA' 1a, 10) TGA' 1c, 11) TGA' 5, 12) TGA 9, 13) TGC 1, 14) TGB 8.

D. Samples from Portisham Quarry collected by D. Barker, 1963;
15) [PT 8]*, 16) [PT 17], 17) [PT 18].

* Reference numbers in square brackets indicate unpublished field collection numbers of the people concerned.
E. Samples from the Purbeck Beds of the French Jura collected by P. Donze (see Donze 1958);
18) [No. 2] Purbeckien de Vaux et Chantegrue (W. du lac de St.-Point).
19) [No. 3A] Purbeckien de la cluse du Doubs (coupe 103): niveau 12.
20) [7A] Purbeckien de Gour-les-Uziers, près Pontarlier (coupe 123): vers la ferme.
21) [7B] sur la reservoir.

F. Samples from borings at Nenndorf Pr.a. Germany sent by B. Moos.
22) [19202] 33 m., 23) [19204] 37 m.

G. Samples from borings in the Paris Basin sent by H.J. Oertli. This includes the original material for Oertli 1963.
24) [22]: Villemoyen 2; 1024 m.
25) [23]: Villemoyen 2; 1022 m.
26) [24]: Villemoyen 2; 1026 m.
27) [25]: Villemoyen 2; 1026 m.
28) [32]: Villemoyen 2; 1042 m.
29) [42]: AEt 101; 1012 m.
30) [52]: ACr 102; 932 m.
31) [53]: ACr 102; 932 m.
32) [55]: ACr 102; 936 m.

H. Samples from the Purbeck Beds of Feurtille,
S.W. Baulmes, Switzerland, from H.J. Oertli.
33) [RO76].

I. Specimens from the Marly Freshwater and soft Cockle Beds in the collections of the Geological Survey which Dr. F.W. Anderson kindly gave me permission to study.
34) [183]*, 35) [1823], 36) [128], 37) [187] 38) [278 and 279], 39) [980], 40) [1775], 41) [1770].

J. Sample from below the cherty beds on Warbarrow Tout collected by Sylvester-Bradley;
42) [WT 67e]*

K. Samples from the lower part of the Middle Purbeck of Upwey, Dorset collected by M.J. Hooper;
43) [A 27°], 44) [A 27].

L. Samples from the cherty series of Poole road cutting in Dorset. (See Sylvester-Bradley 1949);
45) PC 36, 46) PC 37, 47) PC 38a, 48) PC 38b, 49) PC 43.

M. Sample from a shale below the Cherty Bed at Durdle Door collected by Sylvester-Bradley;
50) DD.

* Reference numbers in square brackets indicate unpublished field collection numbers of the
Table 1. To show the size variation of Cypridea dunkeri s.l.
<table>
<thead>
<tr>
<th>Sample Description</th>
<th>Number of Samples</th>
<th>Number of Specimens</th>
<th>Mean of $\bar{x}$</th>
<th>Mean of $\bar{\bar{x}}$</th>
<th>S.E. of $\bar{x}$</th>
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<td></td>
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<tr>
<td>Upper part of the Middle</td>
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<td>3</td>
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<td>0.76</td>
<td>0.0083</td>
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<tr>
<td>Purbeck of Dorset (above the Cinder Bed)</td>
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<tr>
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<td>14</td>
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<tr>
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<td>55</td>
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<td>2</td>
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<td>Purbeck of the Paris Basin (Oertli's zone 6)</td>
<td>53</td>
<td>4</td>
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<tr>
<td>Purbeck of the French Jura</td>
<td>52</td>
<td>3</td>
<td>0.86</td>
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<td>Purbeck of the French Jura</td>
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<td>0.83</td>
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<td>Upper part of the Lower</td>
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<td>8</td>
<td>0.86</td>
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<td>9</td>
<td>0.86</td>
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<td>Purbeck of the French Jura</td>
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<td>14</td>
<td>0.97</td>
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18.

**N.** Specimens from the Cherty Series in the collections of the Geological Survey which Dr. F.W. Anderson kindly gave me permission to study;

51) [128 and 130], 52) [132], 53) [133], 54) [274], 55) [280], 56) [1748 and 1757],
57) [1756 and 1747].

**O.** Samples from above the Cinder Bed in the Foxwell road cutting in Dorset. (See Sylvester-Bradley 1949);

58) PC 10, 59) PC 22, 60) PC 28.

The lengths and heights of the right valves of about 900 specimens have been measured and the results from various beds and localities compared.

Statistics (representing the length of the right valve of adult instars measured in millimetres) are shown in Table 1. Size in ostracods is likely to vary from both phenotypic and genotypic causes. Some ostracods show a correlation between size and salinity (Barker, 1963), and therefore suggest that their size variation is controlled by ecological environment. In the case of *C. dunkeri* the size variation shows evidence of correlation with stratigraphical position and is therefore likely to be genotypic. In this case there is a gradual decrease in size as we go up the sequence (Plate 1).
The size distribution of *Cypridea dunkeri* s.l. is indicated for the samples from the lowest Purbeck to the Middle Purbeck horizons as follows:

8) Upper part of the Middle Purbeck of Dorset (above the Cinder Bed).

7) Lower part of the Middle Purbeck of Dorset and the Weald (below the Cinder Bed).

6) Upper part of the Lower Purbeck of Dorset and the Weald.

5) Purbeck of the Swiss Jura.

4) Serpulit? of Nenndorf.

3) Purbeck of the French Jura.

2) Upper part of the Lower Purbeck of the Paris Basin (Oertli's zone 6).

1) The lower part of the Lower Purbeck of Portesham and the Purbeck of Aylesbury and Swindon.

The photographs are specimens approximately of mean size and specimen 1 is *Cypridea dunkeri papulata*, specimens 2, 3 and 4 are *Cypridea dunkeri sowerbyi*, specimens 5, 6, 7, and 8 are *Cypridea dunkeri dunkeri*. 
There is also a considerable variation in shape (Plate 1 and Plate 2, Figures 1-15, Plate 3, Figures 26, 27), but in this case no significant correlation with horizon could be detected, though the variation seems to be more regular in *C. dunkeri papulata* than in the later subspecies.

Variation in ornament affects the strength of the dorsal ridge (Plate 2, Figures 1-15), the size and intensity of puncta (Plate 2, Figures 1-15), and the number and size of tubercles (Plate 2, Figures 1-15, Plate 3, Figures 26, 27). Again, there seems to be a greater variation in *C. dunkeri* s.s. and *C. dunkeri sowerbyi* than in *C. dunkeri papulata*. Some specimens of the former two subspecies are almost smooth, others strongly tuberculate.

The British ostracods do not show the strong variation in shape and ornament which is characteristic of the two continental subspecies.

[Plate 3 referred to above can be found after the faunal descriptions pp. 20-42]
PLATE 2

Sub species of Cypridea dunkeri Jones

1-5 *Cypridea dunkeri sowerbyi* Martin

1) Right valve from the Swiss Jura, R).76; length = 0.89 mm.
2) Right valve from the Paris Basin, Villemoyenn 24; length = 0.95 mm.
3) Right valve from Nenndorf, Germany, sample number 19202; length = 0.91 mm.
4) Right valve from Nenndorf, Germany, sample number 19202; length = 0.98 mm.
5) Right valve from Nenndorf, Germany, sample number 19204; length = 0.91 mm.

6-11 *Cypridea dunkeri dunkeri* Jones

6-9) Lectotype of *Cypridea dunkeri dunkeri* from the British Museum, In 39023; length = 0.86 mm.
6) right side, 7) left side, 8) dorsal view, 9) ventral view.

10-11) Holotype of *Ulwella papulata* var. *poxwellensis* of Anderson 1941, here referred to as *Cypridea dunkeri papulata*; length = 0.84 mm. 10) left side, 11) right side.

12-16 *Cypridea dunkeri papulata* (Anderson)

12-15 Carapace from Swindon [TGA' 5]; length = 0.97 mm.
12) left side, 13) right side, 14) dorsal view, 15) ventral view.

16) Internal view by transmitted light of right valve from Swindon; length = 1.04 mm.
Ostracods from the Lower Purbeck Beds of Portesham Quarry, Dorset

Fourteen species of ostracod, in addition to *Cypridea dunkeri*, have been recognised from the Purbeck Beds shown in Figure 5. These can be divided into three groups on the basis of salinity preference: marine, euryhaline and freshwater-oligohaline, as shown in Table II.

All the beds of the section ascribed to the Purbeck (i.e. all except Beds y and z) were searched for ostracods, but none were found in those not listed. Euryhaline forms were found in all beds containing ostracods except Bed 1, in which only marine forms occur, and Bed 17 (the Charophyte Chert) in which *C. dunkeri* was the only species found. Beds 4 and 8 are interesting in that they show a mixture of freshwater, euryhaline and marine forms. These are "dirt beds", and contain pebbles of the pene-contemporaneous marine Portland Beds. The marine ostracods in them are therefore likely to have been derived.
Text Figure 5

Vertical section of part of the Portesham Quarry exposure, including most of the Lower Purbeck Caps and part of the Portland Stone. Selected petrographical characteristics and their distribution or variation are shown on the right. The petrographical rock types, mostly limestones, are represented as follows:

- **Micrite**
- Secondary limestone, a replacement of calcium sulphate
- Algal limestone
- Gypsum conglomerate replaced by secondary limestone
- Pelsparite or pelmicrite
- Intrasparsite
- Marl
- Carbonaceous shales or dirt beds
- Chert
**Fig. 5.** Section to be found at Portesham Quarry. (after West in Sylvester-Bradley et al)
Table 2. To show the vertical distribution of the ostracods in Portesham Quarry.
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The figures indicate the number of specimens found whole or fragmentary.
Systematic Descriptions
Superfamily CYPRIDACEA
Family CYPRIDIDAE
Subfamily CYPRIDEINAE Martin, 1940

Genus Cypridea Bosquet, 1852

Cypridea dunkeri Jones, 1885

Diagnosis: Carapace obovate in lateral outline with scattered tubercles. The right valve overreaches the left and there is a strong anteroventral beak and notch. There are also more or less strongly developed dorsal keels in both valves and a ventral keel in the right valve.

Cypridea carinata n. sp. Martin, 1940, p. 294-295, Tab. 1, figs. 9-12.
Ulwellia papulata var. poxwellensis nov., Anderson, 1941, p. 382, pl. 18, fig. 9.
Cypridea (Ulwellia) dunkeri (Jones), Sylvester-Bradley, 1949, pp. 145-6.

Cypridea dunkeri Jones, 1885, Oertli, 1963, p. 15, pl. 1, figs. 5, 7.


Diagnosis: Length of adult right valve $0.80 \pm 0.1$ mm.

Distribution: See pp. 14, 15.

Remarks: The lectotype is the specimen figured by Oertli, 1963, pl. 1, fig. 7. The horizon is wrongly noted in the caption as "Purbeckien inférieur, Angleterre".
The specimen is from the Middle Purbeck of Jones' collection (Jones' No. 61A. 16). In the Swiss Jura normal specimens of *C. dunkeri* ss. (Plate 3, Figure 27) are associated with more elongate ones (Plate 1, No. 6).

*Cypredia dunkeri* sowerbyi Martin, 1940

*Cypridea sowerbyi* n. sp., Martin, 1940, p. 295, pl. 1, figs. 13-17.

*Cypridea dunkeri* Jones, 1885, Oertli, 1963, p. 15, pl. 1, figs. 3, 4, 8.

**Holotype:** Senck. Mus. Nr. X/E 191. Right valve L = 0.90 mm., H = 0.57 mm.

**Diagnosis:** Length of adult right valve 0.92 ± 0.05 mm.

**Distribution:** see pp. 14, 15.

**Remarks:** according to Martin, 1940 *C. sowerbyi* is distinguished from *C. carinata* by means of its elongated posterior and diminished tubercles. In Germany *C. sowerbyi* is smaller than *C. carinata* and occurs at 779 m. in Thoren boring W.A.1, as against *C. carinata* at 782 m. This subspecies shows a wide variation in shape having the normal individuals (Pl. 1, No. 3, Pl. 2, fig. 3, Pl. 3, fig. 2, 8), well rounded ones (Pl. 1, Nos. 2, 3, Pl. 2, figs. 2, 5) and elongate (Pl. 1, Nos. 2, 4, Pl. 2, figs. 1, 4).

*Cypredia dunkeri* papulata (Anderson)

*Pl. 1, fig. 1. Pl. 2, figs. 12-16.*
Ulwellia papulata sp. nov., Anderson, 1941, p. 381, pl. 18, fig. 8.

Cypridea dunkeri Jones, 1885 Oertli, 1963, p. 15, pl. 1, fig. 6.

Holotype: Geol. Surv. Mus. No. 70357.

Diagnosis: Length of adult right valve $0.99 \pm 0.05$ mm.

Description: The lateral outline is subelliptical with its greatest height to anterior of the centre. The dorsal outline is acutely elliptical with the greatest inflation to the posterior of centre. The posterior outline is smaller and more acutely curved than the anterior. In lateral view the venter is slightly sinuous and in the right valve the ventral margin is bent back upon itself, the angle of the bend being inflated so that a carina is produced. In lateral view the dorsum is slightly convex and the dorsal margin is bent over producing a longitudinal dorsal sulcus. The angle of the bend is inflated to form a carina as along the venter.

The right valve is larger than and over-reaches the left valve on all margins. The beak projects below the venter in both valves but the notch and groove is stronger in the right valve and continues to over half the height.

The surface is usually glossy and punctate in the central area. Small spines are found away from the
central area in general. There are numerous fine straight radial pore canals to be seen in the anterior border with fewer to the posterior. There are four oval muscle scars in the centre of each valve, three in front with their longer axis horizontal and one behind with a more or less vertical axis. Also there is a very small round scar just ventral of the three main scars. The hinge of the right valve has a median groove about half the length of the valves which is dilated at both ends to make a scalloped recess behind which the selvage is strongly developed. There is a long straight ridge in the left valve which is angled and higher at each end. In the right valve the selvage is strongly infolded and at the beak forms an open tube. In the posterior ventral corner it is produced into a sharp posteriorly projecting angle. There is a well developed antero ventral vestibule, the line of concrescence runs parallel to the outer margin and round the beak, thus giving the vestibule a sinuous shape. There is also a slightly developed postero-ventral vestibule.

Remarks: This species does not show any variation in the specimens examined.
Cypridea praecursor Oertli 1963

Cypridea valdensis (Fitton 1836), Martin, 1940, pp. 288-9, pl. 1, figs. 1-4.

Cypridea valdensis praecursor n. ssp. Oertli, 1963 pp. 16-17, pl. 3, figs. 13-19, pl. 4, fig. 20.


Material: 51 specimens from Bed 17.

9 specimens from Bed 8.

Measurements:

<p>| | | |</p>
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<td>Right valve</td>
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Description: The lateral outline is subelliptical with its greatest height to anterior of centre. The dorsal outline is acutely elliptical with greatest inflation to posterior of centre. The ventral margin is straight or slightly sinuous with a beak and notch at the anterior end. The dorsal margin is convex and continuous with the posterior margin and also strongly inturned forming a dorsal sulcus. The posterior is more acute than the anterior and the left valve over-reaches the right on all margins. In the left valve there is a slight posterior ventral projection of the valve towards the posterior formed by
the selvage. At the position of greatest height there is an antero-dorsal angle in both valves.

The carapace is thin shelled and the surface covered by many small puncta arranged very often in a reticulate pattern. There are about thirty fine straight radial pore canals on the anterior border. There are four oval muscle scars in the centre of each valve, three in front with their longer axis horizontal and one to posterior with its axis more or less vertical and very often another small scar is found ventrally of the three scars. The hinge is typical for the genus consisting of a median groove dilated at both ends in the left valve and a straight ridge angled and slightly raised at each end. The selvage is strongly infolded and forms a slight open tube at the beak and at the posterior ventral corner it is produced into a posteriorly projecting angle. There is a well developed antero-ventral vestibule, the line of concrescence running parallel to the outer margin around the beak giving the vestibule a sinuous shape. There is also a poorly developed postero-ventral vestibule.

Remarks: Some indication of the variation in size and shape in specimens from other localities is given by Oertli (1963).
Family Limnocytheridae Klie, 1938
Genus Theriosynoecum Branson, 1933

Theriosynoecum forbesii (Jones, 1885)

Metacypris forbesii Jones, 1885, p. 345, pl. 8, figs. 11, 13, 15, 16.

Metacypris forbesii Jones, Martin, 1940, p. 336, pl. 6, figs. 89-94.

Gomphocythere forbesii forbesii Wicher, 1957, p. 270, pl. 1, figs. 3a-c.

Bisulcocypris forbesii Jones, Pinto and Sanguinetti, 1962, p. 39, pl. 111, figs 1-14, Pl. XII, fig. 1a-d.

Material: 13 juvenile carapaces from Bed 4, and 2 from Bed 7.

Remarks: the identification of these juvenile specimens is based on a comparison with juveniles and adults from other localities. This is probably the lowest horizon at which this species has been recorded in England.

According to Pinto and Sanguinetti Theriosynoecum differs from Bisulcocypris in having a more poorly defined hinge, and accommodation groove and velate ridges and is considered to be of Middle Jurassic age in England if not in the United States. The problem appears to be whether the differences of hinge and accommodation groove are of sufficient importance to separate two genera, especially as the velate ridge is well developed in T. forbesii. The evidence is not strong enough to separate the two genera in the case of forbesii and therefore the older generic name has been chosen.
well developed in T. forbesii. The evidence is not strong enough to separate the two genera in the case of forbesii and therefore the older generic name has been chosen.

Subfamily Cypridinae Baird 1845

Genus Mantelliana Anderson (New genus in press).

(For diagnosis see Anderson in appendix p.)

Mantelliana purbeckensis (Forbes)

Cypris purbeckensis Forbes MS. July 18, 1851; MS. July 23, 1854.


Cythere boloniensis Jones, 1882, fig. A (d, e).

Cypris purbeckensis Forbes, Jones 1885, p. 347, 348, pl. 9, figs. 1-6.

Cypris purbeckensis Forbes, Jones, 1886, p. 147, pl. VI, fig. 5, abc.

Cypris purbeckensis Forbes, Anderson in Arkell 1947, p. 129, fig. 28, No. 7.
29.

?Eucypris sp. Martin 1940, p. 356, Taf. 8, figs. 117, 118.

"Cypris" purbeckensis (Forbes) 1855, Oertli 1963, p. 18, pl. 5, figs. 28-32.

**Type specimen**: Carapace from original rock fragment in Geological Survey Museum designated by F.W. Anderson as Lectotype. G.S. Mik (m) 2090.

**Material**: 47 valves and carapaces from beds indicated on Table II.

**Diagnosis**: Subreniform in lateral outline, greatest inflation medially.

**Description**: Dimensions in mm. Proportions Specimen

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>H</th>
<th>I</th>
<th>L</th>
<th>H</th>
<th>I</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carapace</td>
<td>1.02</td>
<td>0.67</td>
<td>0.52</td>
<td>1.00</td>
<td>0.66</td>
<td>0.51</td>
<td>G.S. Mik (m) 2090</td>
</tr>
</tbody>
</table>

$L =$ length, $H =$ height, $I =$ inflation

Lateral outline subreniform. Dorsal, anterior and posterior are smoothly arched with a slight angle just anterior of the centre at the position of greatest height in the left valve, but the right valve is more truly reniform. The posterior is more sharply curved near the venter but the anterior margin is broadly and smoothly curved. The ventral margin is slightly concave in the central region. The dorsal view is acutely oval with the greatest inflation medially. The left valve over-reaches the right.
The surface is smooth; no pore canals could be distinguished. The specimens are seldom well preserved but the selvage is parallel to the outer margin around the anterior and venter but cuts inwards round the posterior ventral corner. In some translucent specimens there is some suggestion of a narrow vestibule at the anterior ventral corner and anterior border.

Remarks: Forbes first used the name "Cypris" purbeckensis in manuscript 1851 but it was not until 1885 that this species was adequately described and illustrated by Jones. For many years there has been indecision about the generic position of "G" purbeckensis due to a lack of internal detail because of poorly preserved material. During recent years good material has been found and the following results have allowed a new genus to be erected, Mantelliana, with the type species M. mantelli Jones designated and described by Anderson in appendix.

In a few specimens of M. purbeckensis obtained from the Aylesbury district the muscle scar pattern can be observed (see figure 6). They are typical of the subfamily Cypridinae Baird and very similar to species of Eucypris and Cypricercus which this species resembles in body-shape. In the Aylesbury specimens details of the duplicature can be seen (figure 6).
There is a distinct vestibule in the anterior and antero-ventral region in well preserved specimens. **Environment:** *M. purbeckensis* is probably a euryhaline ostracod since it is reported from supersaline deposits on the south coast (Anderson 1958) and is found in brackish to freshwater-Oligohaline deposits in the Aylesbury district (See Section 4). I have not been able to detect any change in size due to variation in salinity as yet because of the poor preservation of the specimens in most beds.

**Family CYTHERIDAE Baird 1850**

**Genus Fabanella** Martin 1961

*Fabanella polita* (Martin)

P. 3, fig. 24.

Not *Cythere boloniensis* Jones 1882 fig. A (a and e).

?*Cythere boloniensis* variety Jones 1882, fig. B (a, b, c).

*Gandona bononiensis* Jones 1885, p. 348-349, pl. 9, fig. 7, 8.

*Cyprideis polita* Martin 1940, p. 352-353, pl. 7, figs. 110-113, pl. 9, figs. 149-151.


*Fabanella polita polita* (Martin 1940), Martin 1961a, p. 186-187, see also 190-192, Taf. 1, figs. 1-4, 10-12.
Fabanella polita polita (Martin) Martin 1961b, p. 113, pl. 14, fig. 9.
Fabanella polita polita (Martin 1940) Oertli 1963, p. 21, pl. 7, fig. 46-52.


Material: 245 specimens from the beds indicated in Table II.

Description: Dimensions in mm. Proportions Specimen number

<table>
<thead>
<tr>
<th>Carapace</th>
<th>L</th>
<th>H</th>
<th>I</th>
<th>L</th>
<th>H</th>
<th>I</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.52</td>
<td>0.82</td>
<td>0.78</td>
<td>1.00</td>
<td>0.52</td>
<td>0.57</td>
<td>B.M. I1674</td>
</tr>
<tr>
<td>Carapace</td>
<td>1.26</td>
<td>0.70</td>
<td>0.66</td>
<td>1.00</td>
<td>0.55</td>
<td>0.52</td>
<td>B.M. In 48858</td>
</tr>
<tr>
<td>Carapace</td>
<td>1.30</td>
<td>0.72</td>
<td>0.62</td>
<td>1.00</td>
<td>0.55</td>
<td>0.47</td>
<td>B.M. In 48859</td>
</tr>
</tbody>
</table>

L = length, H = height, I = inflation.

Lateral outline sub-oblong with a straight dorsal margin except at the cardinal angle, where it is slightly depressed. Ventral margin concave over middle half. Smoothly rounded anterior and posterior margins, the anterior being the larger. Ovate in dorsal view. Greatest height and inflation to posterior of centre. Ventral surface with a slight rounded longitudinal keel in the posterior half of each valve, externally paralleled by faint ridges extending the whole length of the venter.

Hinge lophodont. There are four adductor muscle scars in an arc concave to anterior and situated
to anterior of the centre of the valves. Single antennal and mandibular scars are situated a short distance to anterior of the adductor and opposite top and bottom scars of arc. Pore canals not clearly seen. Duplicature poorly developed.

Remarks: when Jones first described the species Cythere boloniensis he figured two specimens A and B of which A was Cythere boloniensis and B a variety of it. In outline specimen A is similar to specimens called "Cypris" purbeckensis and B to specimens called Gandona bononiensis in Jones 1885. In this paper Jones 1) made an invalid alteration of the specific name from boloniensis to bononiensis; 2) selected the specimen described as a "variety" of his original species as typical of it. This is contrary to the Code of Zoological Nomenclature (Article 72) and must be rejected; 3) altered the genus from Cythere to Gandona, a rather unfortunate decision as it is in fact much more clearly related to Cythere than to Gandona. Specimen A is now lost, but the very inadequate figure suggests it is a junior synonym of Mantelliana purbeckensis. The species described in 1885 compares in all details with Fabanella polita Martin 1940 which is therefore the valid name.

However, Dr. Anderson has suggested (personal
communication) that since there are numerous specimens of *C. bononiensis* named by Jones in the collections of the Geological Survey, London, there can be no doubt about what Jones meant when he used the name *bononiensis*. Therefore, Anderson suggests, even though this is an invalid correction the first name Jones used, *boloniensis* must remain and Martin's name *polita* become invalid.

Technically this argument cannot hold since one must abide by the Rules of Zoological Nomenclature and therefore I have used the name *polita*. It is probable, however, that *boloniensis* may well be used for many years as a synonym of *polita*.

Family CYTHERIDAE Baird 1850

Genus *Fabanella* Martin 1961

*Fabanella ansata* (Jones)  
*P.l. 5, fig. 23.*

*Gandona ansata* Jones 1883, p. 349, pl. 9, figs. 9-12.  
*Gandona ansata* Jones, Anderson in Arkell 1947, p. 129, fig. 28, No. 9.  
*Fabanella ansata* (Jones 1883) Oertli 1963, p. 22, pl. 6, fig. 43-45.

*Type specimen:* left valve from South Oving here designated as Lectotype B.M. I 1654.

*Material:* 92 specimens from the beds indicated in Table II.
35.

**Description:** Dimensions in mm. Proportions Specimen number

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>H</th>
<th>I</th>
<th>L</th>
<th>H</th>
<th>I</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Left valve</td>
<td>0.92</td>
<td>0.58</td>
<td>1.00</td>
<td>0.63</td>
<td>B.M. I 1654</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carapace</td>
<td>0.96</td>
<td>0.62</td>
<td>0.50</td>
<td>1.00</td>
<td>0.62</td>
<td>0.52</td>
<td>B.M. In 48669</td>
</tr>
</tbody>
</table>

$L =$ length, $H =$ height, $I =$ inflation

Lateral outline subreniform with greatest height towards anterior and greatest inflation medially. The anterior and posterior margins are obliquely curved and slightly sharper towards the venter. The ventral margin is concave and slightly inturned. Acutely elliptical in dorsal view. The left valve is slightly larger than and over-reaches the right valve.

The external is smooth with a few normal pores irregularly spaced. Numerous fine and straight radial pore canals are closely spaced around the anterior, posterior and venter. Adductor muscle scars are in a vertical row offour situated just anterior of the centre. An antennal and a mandibular scar are situated to the anterior of the adductors opposite the top and bottom scars. In some specimens a small fifth scar can be seen above and in line with the four adductors.

**Remarks:** This species was first described as *Gandona ansata* by Jones 1885, but has long been known to have a Cytherid type of muscle scar pattern and therefore is not a member of the Cypridacea.
36.

Differs from Fabanella polita in being smaller and having a strongly concave venter producing an angle at its junction with the posterior margin.

Environment: in an earlier paper (Barker 1963) I have been able to show that the size of Fabanella polita and F. ansata varies with the salinity. They are thought to be euryhaline ostracods capable of living in environments of varying salinity, from almost freshwater in parts of the Aylesbury district to supersaline on the south coast (Anderson 1958). In the Aylesbury district the largest forms are found in marine conditions with smaller ones in brackish water and still smaller in freshwater-oligohaline conditions.

Super family Cytheracea Baird 1850
Family Brachycytheridae Puri 1954
Genus Macrodentina Martin 1940
Sub genus Macrodentina Martin 1940

Macrodentina (Macrodentina) rugulata (Jones)
(Cythere retirugata sp. nov. var. rugulata Jones 1885,
   p. 350, pl. 9, figs. 17, 18, 19, 20.
        Cythere retirugata Jones var. rugulata Jones.
   Anderson 1941, p. 373, pl. 18, fig. 1.)
Dictyocythere (Rhysoocythere) rugulata (Jones).
Sylvester-Bradley 1956, p. 18, pl. 4, figs. 1, 2, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15.

Macrodentina (Macrodentina) rugulata (Jones). Malz 1958, p. 18, pl. 6, figs. 83, 84, 85, 86.

Lectotype: British Museum No. I 1655. Carapace L = 0.96, H = 0.58, I = 0.54, figured in Jones 1885, pl. 9, fig. 19. (Lectotype of Sylvester-Bradley 1949). Jones Nos. 256, No. 2 and 258, No. 6, are missing from the British Museum collection.

Material: 14 specimens in Bed 1 consisting of fragments and juveniles and one fragment from Bed 4.

Remarks: specimens have characteristic smooth outer surface and longitudinally ridge venter.

Sub genus Dictyocythere Sylvester-Bradley 1956

Macrodentina (Dictyocythere) retirugata Jones
(Not figured)
Cythere retirugata sp. nov. Jones 1885, p. 350, pl. 1x, figs. 21, 22, 23.

Cythere retirugata sp. nov. var textilis Jones 1885 p. 350, pl. 1x, fig. 24.

Macrodentina retirugata (Jones) Martin 1940, p. 330, pl. 5, figs. 74-78.
38.

*Gythere retirugata* Jones var. *textilis* Jones Anderson 1940, p. 374, pl. 18, figs. 2, 3.

*Dictyocythere (Dictyocythere) retirugata* (Jones) Maiz 1958, p. 25, pl. 6, figs. 87, 88.

**Lectotype:** a right female valve from the British Museum (N.H.) No. In 48601. Figured Jones 1885, pl. 9, fig. 23.

**Material:** one female carapace and a fragment from Bed 4.

**Remarks:** has characteristic reticulate ornament.

---

Family *Cytheruridae* G.W. Müller 1894

Genus *Orthonotacythere* Alexander 1933

*Orthonotacythere rimoso* Martin

(Not figured.)

*Orthonotacythere rimoso* Martin 1940, p. 335, pl. 6, figs. 84, 85, 86.

*Orthonotacythere cf. rimoso* Martin. Martin 1961 p. 117, pl. 14, fig. 21, a-c.

**Material:** one incomplete right valve from Bed 1.

**Remarks:** specimen has marginal rim as in *O. rimoso* but the sulcus is not so deep as in *O. interrupta* Triebel.

---

Family *Progonocytheridae* Sylvester-Bradley 1948

Sub family *Protocytherinae* Lyubimova 1955

Genus *Klieana* Martin 1940
Klieana alata Martin 1940
pl. 3, fig. 20, 21.

Klieana alata n.s. n. sp. Martin 1940, p. 322-325,
pl. 5, fig. 64-73, pl. 11, fig. 158-161.

Klieana alata Martin 1940, Schimdt 1955, p. 60,
pl. 7, fig. 53-56.

Material: 3 male specimens and 4 female specimens from Bed 18.
Remarks: the sexual dimorphism is obvious.

Genus Protocythere Triebel 1938

Protocythere serpentina (Anderson)

Cythereis serpentina n. sp. Anderson 1940, p. 375,
pl. 19, fig. 12.

Holotype: Geological Survey Museum No. 70343 now Mik (m)
723. Left valve L = 0.70, H = 0.40, I = 0.21

Material: 2 specimens from Bed 8.
Remarks: the two right valves and fragment correspond to
Anderson's description.

Family Progonocytheridae Sylvester-Bradley 1948
Sub family Protocytherinae Lyubimova 1955

Genus Paraschuleridea Swartz and Swain 1946

Paraschuleridea buglensis sp. nov.

(not figured)
Cytheridea politula Jones and Sherborn 1888, Anderson 1940, p. 375-376, pl. 19, fig. 14.

[Not Cytheridea politula Jones and Sherborn 1888, p. 265, pl. 5, fig. 7.]

**Derivation of Name:** from the Bugle Pit, Hartwell near Aylesbury.

**Holotype:** a left valve from the Town Garden Quarry, Swindon.

G.S. Mik (m) 724 formerly 70344.

**Material:** 6 valves and carapaces from beds indicated in Table II.

**Diagnosis:** elliptical in dorsal outline with a subreniform lateral outline. Hinge antimerodont. Outer surface smooth and left valve is larger than and over-reaches the right all round.

**Description:** Dimensions in mm. Proportions Specimen number

<table>
<thead>
<tr>
<th>Left valve</th>
<th>L</th>
<th>H</th>
<th>L</th>
<th>H</th>
<th>Specimen number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.75</td>
<td>0.40</td>
<td>1.00</td>
<td>0.53</td>
<td>G.S. Mik (m) 724</td>
</tr>
</tbody>
</table>

The carapace is subreniform, robust and well-inflated with the dorsal margin convex and ventral margin concave. The posterior and anterior ends are smoothly rounded though the posterior is the smaller. The carapace is oval in dorsal view. The greatest length is just dorsal of venter and the greatest height through the centre. The outer surface is smooth, with well spaced normal pore canals. The left valve is larger than
41.

and over-reaches the right valve all round. The hinge is antimerodont with a slight accommodation groove in the left valve. There are four adductor muscle scars in a vertical row medially at the position of greatest height and one round scar to the anterior opposite the centre of the group. About 8 faint radial pore canals are to be found in the anterior border but none in the posterior. The selvage is strongly developed in the right and the flange is strongly developed in the left valve due to the strong overlap of the valves.

Remarks: Cytheridea politula was described by Jones and Sherborn from the Fullers' Earth (Middle Jurassic) in 1888. The specimens described here resemble C. politula only vaguely in lateral outline and it is necessary to re-name the species first described by Anderson (1940).

This species is placed in the genus Paraschuleridea because of the similarity in hinge and muscle scar pattern to the type species. However, the shape is even more smoothly rounded especially in dorsal view. No sexual dimorphism has been observed so far. The only other genus which this species resembles is Galliaecytheridea, but it differs in lateral outline and is therefore not considered to be related.
42.

Family uncertain

Genus *Scabriculocypris* Anderson 1940

*Scabriculocypris acanthoides* Anderson 1941

*Scabriculocypris acanthoides* sp. nov. Anderson 1940, 

Material: 5 right valves and one carapace from Bed 18.

A carapace, a left and a right valve and a fragment 
from Bed 8.

Remarks: the internal details are generally obscured, the 
surface being covered in fine reticulations and having 
a number of small blunt spines grouped mostly in the 
posterior half of the valve.

Family and Genus and Species indeterminate

*"Macrocypris" sp.*

*Macrocypris horatiana* Jones and Sherborn. Anderson 

1940, p. 380, pl. 19, fig. 16.

Material: 5 complete and 6 incomplete carapaces from Bed 
2 and 2 incomplete carapaces from Bed 1.

Remarks: the hinge and muscle scars were not observed so 
no conclusions were reached about its taxonomic position 
except that it corresponded closely in size and shape 
to *M. horatiana* of Anderson.
FIGURE 6

1) Muscle scars of right valve of *Mantelliana purbeckensis* from the outside.

2) Longitudinal section through *Mantelliana purbeckensis*
   Length = 1.21 mm.

3) Transverse section through venter of *Mantelliana purbeckensis*.

4) Transverse section through venter of *Mantelliana purbeckensis*.

5) Longitudinal section through *Mantelliana purbeckensis*
   Length = 1.1 mm.
17) Scabriculocypris acanthoides from Bed 8. Right valve of carapace, length = 0.68 mm.

18) Protocythere serpentina from Bed 8. Right valve, length = 0.68 mm.

19) Wolburgia visceralis from Bed 8. Right valve, length = 0.70 mm.

20) Klieana alata from Bed 18. Left valve, length = 0.60 mm.

21) Klieana alata from Bed 18. Left valve, length = 0.66 mm.

22) Cypridea praecursor carapace from Bed 18. Left valve, length = 1.22 mm.

23) Fabanella ansata carapace from Bed 8. Left valve, length = 1.06 mm.

24) Fabanella polita carapace from Bed 6. Left valve, length = 1.38 mm.

25) Mantelliana purbeckensis carapace from Bed 6. Right valve, length = 1.38 mm.

26) Cypridea dunkeri dunkeri carapace from the Swiss Jura. Right valve, length = 0.81 mm.

27) Cypridea dunkeri sowerbyi carapace from Villemoyenne 23. Right valve, length = 0.91 mm.

28) Thin section of the charophyte chert showing charophyte remains and lutecite pseudomorphs after lenticular crystals of gypsum.
Ostracods from the Portland and Purbeck Beds of the
Aylesbury District

The Portland and Purbeck Beds of the Aylesbury District have been the subject of study by geologists since the middle of last century. At that time Morris (1856) was able to demonstrate with the aid of the lithology and macrofaunas of the beds exposed in the Bugle Pit, Hartwell, a change from marine Portland conditions through estuarine to freshwater Purbeck conditions. Jones (1885) described the ostracods from the Lower Purbeck Beds of this area and thought that the mingling of the marine with freshwater ostracods would repay careful study. Jukes-Browne, (in Woodward 1895) Chapman, (1899) Merrett (1924) and Sylvester-Bradley (1941) have each noted a transition from marine Portland to freshwater Purbeck based on the study of the ostracods. Some geologists such as Jones (1885), Chapman (1899) and Merrett (1924) have suggested that Middle and even Upper Purbeck ostracods may be present in places. This has not been confirmed in the present investigation, though Casey and Bristow (1963) believe sands (previously regarded as Cretaceous in age) containing Middle Purbeck lamellibranchs, in the Whitchurch and Stewkley area, can
be interpreted as the transgressive margin of the Cinder Bed. Casey (1963) mentions that Purbeck conditions are foreshadowed in the Portland Stone of the Aylesbury district. The Cinder Bed he considers to be the "ideal base to the Cretaceous in Southern England", so that the terms Lower and Middle Purbeck become confusing since they refer to separate systems. He suggests a new classification: Lulworth Beds of the Portlandian for the sequence Portland Stone to Cinder Bed, and Durston Beds of the Wealden for the sequence Cinder Bed to Hastings Bed.

The present paper attempts to investigate the nature of the transition from Portlandian to Purbeckian conditions in the Aylesbury district by means of a study of the ostracod fauna. The work is based mainly on the field work and collections made by Professor P.C. Sylvester-Bradley in the Thame Valley during the summer of 1939. Samples were examined from exposures at the following localities;

1) AY Aylesbury. A pit about half a mile southwest of Walton Court Farm - on the footpath that leads from Bishopstone to Ceely Road, Southcourt Estate, 42/806112.

2) BP Bugle Pit, Hartwell near Aylesbury, 42/794121.

3) CH Coneyhill. Field Pit near lodge to Eythorpe, 42/759151.
45.

4) CL Creslow. Small overgrown pit near cottages, 42/811219

5) CP Cuddesden Palace. Field Pit north-east of Cuddesden Palace, 41/602032.

6) CW Long Crendon. CWA,B Auger borings by the site of the old Windmill, 693093. CWC,D,E, small pits by the side of the road, 41/689093.

7) GN Garsington Village, Clinkards Farm. Excavation to north side of the village on the west side of the ridge, GNA-G, 41/586028.

8) HD Haddenham. Pit one mile east of Haddenham on the lower Aylesbury Road, HDA,B, 41/763096.

9) HG Hurdlesgrove Farm. Field pit a little south of Hurdlesgrove Farm about one mile north of Whitchurch on the Buckingham Road, 42/804228.

10) NW Excavations one mile north of Whitchurch on the Buckingham Road, NWA-F, 42/805225.

11) OV Pit at Oving south of North Marston Road, 42/793212.

12) TW Towersey, half a mile north of the village on the eastern side of the Kingsey Road, 41/735059.

13) WH Warren House Farm near Stewkley, pit south of farm, 42/851242.

The sections then extant are now filled in or overgrown. The three most complete sections are described below.
Facies

Davies (1899) stated that he used the term Purbeck as a facies name and not a time name. This use of the term is followed here and five successive facies are distinguished in the Portland and Purbeck Beds of the Aylesbury district. These facies are listed in ascending order as follows:

A. At the base massive cream-coloured limestones of the Portlandian containing ammonites such as *Titanites giganteus* (J. Sowerby) *Titanites pseudogigas* (Blake) which were described from this area. Woodward (1895) noted large lamellibranchs which he identified as *Perna Bouchardi*, *Cardium dissimile*, *Pecten lamellosus*, *Trigonia gibbosa var. manselli*. Marine ostracods are also to be found. This is referred to as the Portland facies.

B. Laminated marls and limestones with according to Woodward (1895) *Trigonia gibbosa var. manselli*, *Ostrea expansa*, together with fish remains and a mixture of marine and euryhaline ostracods. This is referred to as the marine Purbeck facies.

C. Laminated marls and limestones containing gastropods which Davies (1899) tentatively suggested to be species of *Paludina*. Fitton (1836) reported *Cyclas parva*, *modiolae*, *Planorbis* and *mytilli* from these beds. Fish remains and euryhaline ostracods are also to be found. This is the brackish Purbeck facies.
D. Marls and limestones becoming sandy upwards with *Paludina* and small *modiolae* and a *Cyclas?* reported by Fitton (1836). Freshwater beds of a similar age at Swindon have yielded (Sylvester-Bradley 1940) *Physa bristovii* (Forbes MS.) Phillips, *Valvata helicoides* (Forbes MS.) de Loriol, *Viviparus inflatus* (Sandberger), *Clavator reidi* Groves, *Clavator grovesi* Harris. This is the freshwater Purbeck facies.

E. Sands and sandstones of the Whitchurch region containing marine lamellibranchs. Casey has recently identified some specimens first collected by Bristow as Middle Purbeck in age. (Casey and Bristow 1963). No ostracods have been obtained from these beds as yet.

These five facies demonstrate a gradual change from marine Portland to more or less freshwater beds of the Lower Purbeck and back again to the marine sands of the Middle Purbeck.

The beds classed as Middle or Upper Purbeck in age by Jones, Chapman and Merrett were of facies D, i.e. freshwater-oligohaline. The Jones's record of Middle Purbeck ostracods is based on two figures of *Cypridea granulosa var. paucigranulata* Jones in his paper of 1885. The specimens on which the figures are based come from a locality called Whitchurch, the existence and position of which is very doubtful, (see Sylvester-Bradley 1949). I
have not found any specimens of *Cypridea granulosa* or its varieties in the Aylesbury district.

In many descriptions of the Purbeck Beds, the terms freshwater, marine, estuarine and brackish have been used without discussion. The present author considers ostracods to be marine or freshwater, partly on account of relationships to living representatives of known habitat, partly according to their association with other fossils, and partly on account of the lithological conditions of the beds enclosing them. In this case the term freshwater is intended to include both freshwater and oligohaline ostracods. Those ostracods which are to be found in both freshwater-oligohaline and marine conditions are considered to be euryhaline, i.e. capable of existing under widely varying conditions of salinity. When euryhaline forms are found in the absence of marine or freshwater-oligohaline ostracods, it would appear that conditions of salinity variation were at their maximum. In the beds under discussion the marine ostracod fauna is characterised by:

- *Macrodentina (Macrodentina) rugulata* (Jones)
- *Macrodentina (Macrodentina) transiens* (Jones)
- *Macrodentina (Dictyocythere) retirugata* (Jones)
- *Protocythere serpentina* (Anderson)
- "*Macrocypris*"? sp. Anderson
- *Paraschuleridea buglensis* sp. nov.
Orthonotacythere rimosa Martin
Protocytheropteron stewkleyensis sp. nov.
Wolburgia visceralis (Anderson)
The euryhaline fauna is characterised by:
Fabanella polita Martin
Fabanella ansata (Jones)
Mantelliana purbeckensis (Forbes)
The freshwater-oligohaline fauna is characterised by:
Cypridea praecursor Gertli
Cypridea dunkeri papulata (Anderson)
Klieana alata Martin
Scabriculaocypris trapezoides Anderson
Darwinula leguminella (Forbes)
Rhinocypris jurassica (Martin)
Limnocythere fragilis Martin
Limnocythere decipiens Anderson
The ostracod faunas for the sections described below are given in Tables 3, 4, 5, which show the number of valves found in the beds which contain ostracods.

The Bugle Pit Hartwell
The Bugle Pit seems to have been first mentioned in the literature by Morris in 1856. Since then it has been described repeatedly. A comparison of the sections obtained by Woodward 1895, Merrett 1924 and Sylvester-Bradley 1939
is shown in Table 1.

On the 15th May, 1939 Professor Sylvester-Bradley examined the exposure and collected carefully from all the beds present. The material was subjected to a preliminary examination in the production of his papers of 1940 and 1941. This section is important in that it exposed the thickest continuous section in the Portland and Purbeck Beds of this area. The section has now almost disappeared under tip; only about three feet of the upper beds could still be seen at the south-east of the quarry in 1962.

The ostracods obtained from the Bugle Pit have been plotted as shown in Figure 2. In this figure the sections at the three localities are drawn to scale and the relative percentages of the three faunas indicated for each bed in which ostracods are found. Four of the five facies indicated above are well developed in the Bugle Pit; facies E and the upper part of facies D are absent.

The Bugle Pit, Hartwell

| B.F. 22  | Very coarse grit (infilling what is apparently a solution pipe in the beds below) |
| B.F. 21  | Fine grained limestone, with occasional disseminated shells |
Table 3. To show the vertical distribution of the ostracods at the Bugle Pit, Hartwell.
|                | 1  | 2  | 3  | 4  | 5  | 6a | 6b | 6c | 7  | 8  | 9  | 10 | 11a | 11b | 11c | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|----------------|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|
| Macrodentina  |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |
| Macrodentina rugulata | 33 |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |
| Macrodentina Macrodentina transiens | 16 | 1 | 17 | 303 | 49 | 51 |    | 45 | 288 | 4 | 86 | 6 |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Macrodentina Dictyocythere retirugata | 50 |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Protocythere serpentina | 26 | 3 | 82 | 98 | 12 | 68 | 1 |    | 39 | 3 | 111 | 1 |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| "Macrocypis"? sp. |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Paraschuleridea buglenis | 22 | 3 | 36 | 4 | 24 | 68 | 10 | 11 | 11 | 68 |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Orthonotocythere rimosae | 1 | 14 |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Protocythereopteron stekleyensis | 7 |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Wolburgia visceralis | 54 |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Fabanella polita | 1 |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Fabanella ansata | 2 | 5 |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Mantelliana purbeckenis |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Cypridea praecursor |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Cypridea dunkeri papulata |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Klieana alata |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Darwinula leguminella |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Ilyocypris (Rhinocypris) jurassica |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Limnocythere fragilis |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
| Limnocythere decipiens |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |    |    |    |    |    |    |    |    |    |    |    |
The Bugle Pit, Hartwell (cont.)

<table>
<thead>
<tr>
<th>B.P.</th>
<th>Description</th>
<th>ft.</th>
<th>ins.</th>
</tr>
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<tbody>
<tr>
<td>20</td>
<td>Soft grey marl</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>19</td>
<td>Grey pebbly marl</td>
<td>up to</td>
<td>4</td>
</tr>
</tbody>
</table>

This bed cuts down and across an extremely uneven and eroded surface of the beds below.

---

<table>
<thead>
<tr>
<th>M. 10</th>
<th>B.P. 18 Marly subsoil seen to</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>M. 9</td>
<td>B.P. 17 Thin bedded broken shelly limestone</td>
<td>7</td>
</tr>
<tr>
<td>M. 8</td>
<td>B.P. 16 Soft grey marl</td>
<td>7</td>
</tr>
<tr>
<td>M. 7</td>
<td>B.P. 15 Rubbly white chalky marl</td>
<td>3</td>
</tr>
<tr>
<td>M. 7</td>
<td>B.P. 14 Clayey brown marl</td>
<td>1½</td>
</tr>
<tr>
<td>M. 6</td>
<td>B.P. 12 Marly shale with alternating layers of marlstone, ostracods at the base.</td>
<td>1</td>
</tr>
<tr>
<td>M. 5</td>
<td>B.P. 11c Ostracod marl with fish</td>
<td>2</td>
</tr>
<tr>
<td>M. 4</td>
<td>B.P. 11b Laminated shales with fish</td>
<td>10</td>
</tr>
<tr>
<td>M. 3</td>
<td>B.P. 11a Ostracod marl with shells and fish</td>
<td>6</td>
</tr>
<tr>
<td>M. 2</td>
<td>B.P. 10 Soft black or brown shale</td>
<td>6</td>
</tr>
</tbody>
</table>

* Beds brought in by a small fault at the north end of the exposure.
W.10 N. 1  B.P. 9  Laminated blue hearted cementstone with plant and insect remains along partings  9-10

W.9  B.P. 8  Tough highly bituminous shaley marl with large oysters and other lamellibranch casts.  8

W.8  B.P. 7  Hard fine grained limestone with a band of Trigonia casts seen near the base  1  0

(B.P. 6a  Marly shale with a layer of lamellibranchs at the top  2
(B.P. 6b  Black shales  2-3

W.7  (B.P. 6c  Marly shale  2-3

W.6  (B.P. 5  Blue-hearted marly limestone with large Portland lamellibranchs  2  6

(B.P. 4  Brown clay with serpulæ  3
(B.P. 3  Blue-hearted rather soft marly limestone, Trigonia etc.  3  0

W.5  B.P. 2  Hard blue hearted limestone with oysters, the bottom 3" fossil casts  2  0

W.4  B.P. 1  Yellow brown sand seen to  9
North Whitchurch

In 1939 Professor Sylvester-Bradley with the aid of a grant from the Critical Sections Committee of the British Association, opened up trenches close together by the roadside north of Whitchurch. The accompanying section is a composite one made up from the sections exposed in the trenches and at a pit in the field south of Hurdlesgrove Farm. The diagram Figure 7, shows the section and the proportions and ranges of the three ostracod faunas. Facies A, B, C and D can be recognised in this section and facies E reported to be present near Whitchurch itself, (see Casey and Bristow).

The samples were collected from excavations one mile north of Whitchurch on the Buckingham road, also from a field pit a little south of Hurdlesgrove Farm, about one mile north of Whitchurch on the western side of the Buckingham road.

N.W.D. - Trench dug into bank beside road. ft. ins.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>Sand and slipped material</td>
</tr>
<tr>
<td>34</td>
<td>Yellow sandy clay</td>
</tr>
<tr>
<td>33</td>
<td>Tough grey sandy clay</td>
</tr>
<tr>
<td>32</td>
<td>Yellow sand</td>
</tr>
<tr>
<td>31</td>
<td>Tough sandy clay</td>
</tr>
<tr>
<td>Macroductina</td>
<td>Macroductina rugulata</td>
</tr>
<tr>
<td>Macroductina</td>
<td>Macroductina transiens</td>
</tr>
<tr>
<td>Macroductina</td>
<td>Dictyocythere retigata</td>
</tr>
<tr>
<td>Protocythere</td>
<td>serpentina</td>
</tr>
<tr>
<td>Paraschuleridea</td>
<td>buglensis</td>
</tr>
<tr>
<td>Protocytheropteron</td>
<td>stanhagensis</td>
</tr>
<tr>
<td>Cythere sp.</td>
<td></td>
</tr>
<tr>
<td>Fabanella</td>
<td>polita</td>
</tr>
<tr>
<td>Fabanella</td>
<td>ansata</td>
</tr>
<tr>
<td>Mantelliana</td>
<td>peregrinensis</td>
</tr>
<tr>
<td>Cypridea</td>
<td>praecursor</td>
</tr>
<tr>
<td>Cypridea</td>
<td>dunkeri papulata</td>
</tr>
<tr>
<td>Scabriculocypris</td>
<td>trapezoides</td>
</tr>
</tbody>
</table>
54.

ft.  ins.

30 Soft white marl  6
29 Grey clay  3
28 Yellow sand and clay  10
27 Black clay  1-2
26 Crumbly white marl and clay  1  2
25 Grey marlstone  seen to  6

Possible gap in section

N.W.E. - Pit dug in grass verge

24 Crumbly white marl  9
23 Marlstone  1
22 Marly and sandy clay  8
21 Marlstone and soft marl  2  4
20 Grey sand and clay  5
19 Crumbly hard marlstone, top a mass of
gastropod casts  6

N.W.F. - Pit dug in grass verge a little to the north of
N.W.E.

18 Thinly laminated grey sand and clay
in alternate layers  1  6
17 Black clay  6
16 Mottled red and green clay and marl
with oysters  6
15 Brittle marlstone  1  10
14 Hard fine grained limestone or calcite
mudstone  11
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>ft.</th>
<th>ins.</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Laminated marl and clay</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>Hard brittle marlstone, greenstained down joints</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>11</td>
<td>Soft grey clayey marl</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Sandstone</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Loose sand, highly bituminous smell</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Shelly clay with boulders and pebbles of limestone</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>7c</td>
<td>Shelly oolite with large lamellibranchs</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>7b</td>
<td>Hard laminated Pendle</td>
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<td>0</td>
</tr>
<tr>
<td>7a</td>
<td>Soft Pendle, alternating layers of marlstone and ostracods (ooliths?)</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Shelly clay</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Roach, Trigonia casts etc.</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Soft shaley marl with perished shells and large oysters</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Rubbly limestone full of lamellibranch casts</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>As above but finer grained with fewer fossils</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>Sand</td>
<td>seen to</td>
<td>4 0</td>
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</table>
Warren House Farm, Stewkley

The old pit to the south of this farm forms the most northerly outcrop of the Portland and Purbeck Beds in England. It is a very small outlier and is probably preserved due to being downfaulted at some time. The section exposed in 1939 is shown below in Table 5. The quarry is now overgrown and only about three feet, of the topmost beds are to be seen. It was first described by Fitton in 1836 and in 1962 C.R. Bristow and M.J. Hughes were able by means of excavation to expose beds containing large Portland lamellibranchs (Bristow personal communication), beds 2 and 3 of Table 5. The diagram Figure 7, shows that marine influence is strong all through the section. The marine ostracod fauna is present throughout but is soon joined first by the euryhaline and then the freshwater ostracod faunas.

The earliest appearance of freshwater-oligohaline ostracods is notable since they are to be found in a bed (WH.7) containing Trigonia and Protocardia sp. (Nos. 11928-11931 in University Leicester collection). This is the only bed containing a few Cypridea sp. the fauna being mainly euryhaline with some marine ostracods. It would appear that some form of mixing had occurred or that seasonal variation in salinity and fauna was possible so that Cypridea could live in the same place as the marine...
ostracods. A surprising feature of the bed WH.7 is its similarity to the Swindon Roach, the differences being in the ostracod faunas. This is the bed referred to by

Macrodentina Macrodentina rugulata
Macrodentina Macrodentina transiens
Macrodentina Dictyocythere retirugata
Protocythere serpentina
"Macrocypris"? sp.
Paraschuleridea buglensis
Orthonotacythere rimosa
Protocytheropteron stewkleyensis
Wolburgia visceralis
Fabanella polita
Fabanella ansata
Mantelliana purbeckensis
Cypridea praecursor
Klieana alata
Scabriculocypris trapezoides
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<th>2</th>
<th>3</th>
<th>4</th>
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<th>7</th>
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<th>9</th>
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<td>23</td>
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<td>116</td>
<td>89</td>
<td>10</td>
<td>33</td>
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<tr>
<td>Macrodicta Macrodicta transiens</td>
<td>20</td>
<td>16</td>
<td>1</td>
<td>20</td>
<td>3</td>
<td>7</td>
<td>3</td>
<td>20</td>
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<tr>
<td>Macrodicta Dictyocthyere retinugata</td>
<td>21</td>
<td>21</td>
<td>6</td>
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<td>6</td>
<td>10</td>
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<td>9</td>
<td>2</td>
<td>3</td>
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<tr>
<td>&quot;Macroclyris&quot;? sp.</td>
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<td>8</td>
<td>5</td>
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<td>Paraschuleridea bugensis</td>
<td>4</td>
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<td>4</td>
<td>12</td>
<td>4</td>
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<td>Scabrielocythry trapezoides</td>
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<td></td>
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</tbody>
</table>
ostracods. A surprising feature of the bed WH.7 is its similarity to the Swindon Roach, the differences being in the ostracod faunas. This is the bed referred to by Jones (1885 p. 328) as containing Trigonia and as being underlain by a cypridiferous marl.

The freshwater-oligohaline faunas in the rest of the beds do not contain Cypridea and form about twenty per cent or less of the whole fauna.

Bed WH.8 is a shelly marl containing Ostrea expansa (11926-11927 in the University Leicester collection) and lamellibranchs together with a dominantly marine ostracod fauna. This is a typical marine deposit.

Beds WH.8, 10, 11 have a dominantly marine ostracod fauna with both euryhaline and freshwater-oligohaline ostracod species present. Whereas bed WH.9 has a dominantly euryhaline ostracod fauna with small percentages of marine and freshwater-oligohaline ostracods. In both cases some form of mixing or seasonal variation in salinity and faunas could have occurred.

The conclusions to be made are as follows:
1) conditions of deposition were rapidly changing;
2) the limestones of beds WH.1, 2, 3, can be easily correlated with similar beds at the Bugle Pit and at North Whitchurch. This is facies A. The rest of the beds can be classed as facies B, but of a more changeable region,
possibly a shallow embayment with a river emptying into it. Facies C and D are missing but facies E comes in at the top in the form of bed WH.14.3.

3) A likely explanation for the mixing of the faunas is the erosion and redeposition of freshwater-oligohaline and euryhaline ostracods into deposits of marine ostracods.

Warren House Farm, Stewkley

<table>
<thead>
<tr>
<th>WH. - Quarry to the south of the farm house</th>
<th>ft.</th>
<th>ins.</th>
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</thead>
<tbody>
<tr>
<td>14  Red subsoil</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>13  Grey marl</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>12  Crumbly white and grey marl</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>11  Shaley marl with layers of ostracods</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>10  Grey marl</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>9   White laminated marl with ostracods and disseminated vegetation specks</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>8   Crumbly shelly marl, <em>Ostrea expansa</em> and medium sized lamellibranchs</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>7   Marlstone with <em>Trigonia</em> and <em>Protocardia</em> species</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5   Grey marl ostracods abundant</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>5   Shaley shelly marl with large oysters</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>4   Shelly limestone with <em>Trigonia</em> etc.</td>
<td></td>
<td>5-7</td>
</tr>
<tr>
<td>3   Shaley shelly marl with large oysters</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>2   Rubbly limestone with <em>Trigonia</em>, <em>Protocardia</em>, <em>Pecten</em>, <em>Exogyra</em> species etc.</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>1   Sand seen to</td>
<td></td>
<td>9</td>
</tr>
</tbody>
</table>
Summary of Results

The major marker-horizon in all three sections is the Crendon Sand at the base. Above this are the Creamy Limestones with large lamellibranchs and ammonites, some of which Buckman (1923, 24, 26), had described from localities nearby. He thought that ammonites from the topmost beds in the Long Crendon area were younger than any from the Dorset coast. This marine facies is followed by the rest of the facies as indicated earlier, especially in the Bugle Pit and at North Whitchurch. At Warren House Farm conditions have changed, facies C and D are missing and facies B is modified to take their place.

An examination of the ostracods shown in the diagram Figure 7 indicates that the euryhaline forms Fabanella polita and Fabanella ansata are to be found in facies B, C, and D. On the Dorset coast Fabanella polita and Mantelliana purbeckensis are to be found in supersaline conditions, (Anderson 1958).

Since the ostracods Fabanella ansata and Mantelliana purbeckensis are characteristic of the Lower Purbeck Beds of Dorset and as they appear in the upper part of the Creamy Limestones of the Aylesbury district, it would appear that Lower Purbeck conditions had set in before the end of Portland times in the Aylesbury district, (c.f. Casey 1963, p. 4).
No evidence has been found of Middle or Upper Purbeck ostracods in these sections but Middle Purbeck Lamellibranchs have been obtained from the so-called Wealden Beds above the Purbecks of this region, (Casey and Bristow 1963 and 1964).

In conclusion it can be stated that the transition from Portland to Purbeck conditions is marked by a series of facies which can be recognised by means of lithology, macrofauna and ostracods.
Text Figure 7

The lithological variation for the three major sections are drawn to scale. All the beds were examined for ostracods and the proportions of marine, euryhaline and freshwater-oligohaline ostracods extracted are shown by shaded rectangles.

The various lithologies can be determined by referring the numbers on the diagram to the numbers in the description of the sections.
61. Systematic Descriptions

Superfamily Cypridacea

Family Cyprididae

Subfamily Cypridinae Baird 1845

Genus Mantelliana Anderson

*Mantelliana purbeckensis* (Forbes) Pl. 4, fig. 5.

*Cypris purbeckensis* Forbes MS. July 18, 1851, MS. July 23, 1854


?*Cythere boloniensis* Jones 1882, fig. A (d, e).

*Cypris purbeckensis* Forbes, Jones 1885, p. 347, 348, pl. 9, figs. 1-6.

*Cypris purbeckensis* Forbes, Jones 1886, p. 147, pl. vi fig. 5a, b, c.

*Cypris purbeckensis* Forbes, Anderson in Arkell, 1947 p. 129, fig. 28, No. 7.

?*Eucypris* sp. Martin 1940, p. 356, Taf. 8, figs. 117, 118. "*Cypris*" purbeckensis (Forbes 1855), Oertli 1963, p. 18, pl. 5, figs. 28-32.
**Lectotype:** Geological Survey Museum No. Mik (m) 2090.

**Material:** 239 valves and carapaces from the Bugle Pit (see Table 3). 326 valves and carapaces from North Whitchurch (see Table 4). 217 valves and carapaces from Warren House Farm, Stewkley (see Table 5). Other specimens were also obtained from similar horizons at Haddenham and Towersey.

**Remarks:** this species is believed to be euryhaline in the Aylesbury district. It is seldom well preserved but muscle scars have been seen and cross sections through the shell have indicated the shape and size of the duplicature and vestibule (see Sylvester-Bradley et al. 1964).

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**Subfamily Cyprideinae**

**Genus Cypridea Bosquet 1952**

*Cypridea dunkeri papulata* (Anderson) Pl. 4, figs. 1, 2.

*Ulwella papulata* sp. nov., Anderson 1941, p. 381 pl. 18, fig. 8.

*Cypridea dunkeri* Jones 1885, Oertli 1963, p. 15, pl. 1, fig. 6,

*Cypridea dunkeri papulata* (Anderson) Barker 1964, in Sylvester-Bradley et al.

**Holotype:** Geological Survey and Museum No. 70357
Diagnosis: Cypridea dunkeri dunkeri, length of adult right valve 0.80, 0.1 mm.
Cypridea dunkeri papulata, length of adult right valve 0.99, 0.05 mm.

Material: 6 valves and carapaces from the Bugle Pit (see Table 3). 5 valves and carapaces from North Whitchurch (see Table 4). 1 carapace from Haddenham.

Remarks: specimens of Cypridea dunkeri papulata from the Aylesbury district were used in compiling the size range of Cypridea dunkeri s.l. in a previous study (Barker 1964, in Sylvester-Bradley et al.).
Cypridea dunkeri papulata is characteristic of the freshwater-oligohaline facies but few specimens are usually found.

Cypridea praecursor Oertli 1963 Pl. 4, fig. 4.
Cypridea valdensis (Fitton 1836), Martin 1940, pp. 288-9, pl. 1, figs. 1-4.
Cypridea valdensis praecursor n. ssp. Oertli 1963 pp. 16-17, pl. 3, figs. 13-19, pl. 4, fig. 20.
Cypridea praecursor Oertli, Barker 1964 in Sylvester-Bradley et al.

Holotype: Senkenberg Museum Nr. X/E 295.

Material: 45 valves and carapaces from the Bugle Pit (see Table 3). 41 valves and carapaces from North
Whitchurch (see Table 4). 10 valves and carapaces from Bed 7 at Warren Farm, Stewkley. 83 valves and carapaces from similar beds at Haddenham, and 34 specimens at Towersey.

Sizes:

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Proportions</th>
<th>Specimen Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>H</td>
<td>I</td>
</tr>
<tr>
<td>Carapace</td>
<td>1.17 0.71 0.51</td>
<td>1.00 0.61 0.44</td>
</tr>
<tr>
<td>Left valve</td>
<td>1.17 0.73 -</td>
<td>1.00 0.62 -</td>
</tr>
<tr>
<td>Right valve</td>
<td>1.02 0.61 -</td>
<td>1.00 0.60 -</td>
</tr>
</tbody>
</table>

Remarks: this species is characteristic of the freshwater-oligohaline facies. The species is not common and the specimens are often broken. There is some variation in lateral outline as suggested by Oertli 1963

Subfamily Ilyocypridinae Kaufman 1960
Genus Ilyocypris Brady and Norman 1889
Subgenus Rhinocypris Anderson 1940
Ilyocypris (Rhinocypris) jurassica Martin Pl.4, figs. 17, 18.
Ilyocypris jurassica jurassica Martin 1940, p. 312, pl. 4, figs. 51-54.
Rhinocypris scabra var. hamata Anderson 1940, p. 378, 379, pl. 19, fig. 19.
Rhinocypris jurassica jurassica (Martin 1940), Oertli 1963, p. 18, pl. 5, figs. 25-27.

Holotype: Geological Survey Museum No. 70351 now Mik (m)

731. Complete carapace Length = 0.475 mm., H = 0.250 mm., I = 0.170 mm. (exclusive of spines), length of spines = 0.30 mm.

Material: 6 valves from Bed 16 at the Bugle Pit.

Description:

<table>
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<tr>
<th></th>
<th>Dimensions in mm.</th>
<th>Proportions</th>
<th>Specimen number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L     H   I</td>
<td>L     H   I</td>
<td>British Museum</td>
</tr>
<tr>
<td>Left valve</td>
<td>0.51  0.24 -</td>
<td>1.00  0.47 -</td>
<td>Io 1260</td>
</tr>
<tr>
<td>Right valve</td>
<td>0.49  0.24 -</td>
<td>1.00  0.49 -</td>
<td>Io 1261</td>
</tr>
</tbody>
</table>

The carapace is a thin shell with a sub elliptical lateral outline. The anterior margin is slightly larger than the posterior and both are evenly and smoothly curved. The dorsal margin is slightly convex and the ventral margin slightly concave. The greatest height is halfway between the center and the anterior. The left valve over-reaches the right valve except on the dorsal margin.

The outer surface is covered by many small pustules closely arranged and of uniform size. There are three major spines or hollow tubercles near the dorsal margin separated by two transverse grooves, one medially from the dorsal margin to the centre of the valve where it forms a hollow externally and another
smaller groove to the anterior of this. There are about six to eight smaller spines of more or less equal size situated mainly to posterior of the large anterior spine. The ones nearest the posterior dorsal margin are curved to posterior. The hinge is simple adont in type. The line of concrescence is parallel to and a short distance from the outer margin. There is a slight vestibule around the anterior border and at the posterior ventral corner. Muscle scars are seen internally on a central node but are not distinct. Normal and radial pore canals are not clearly distinguishable.

Remarks: Mandelstam 1956 has described what appears to be the same genus under the name *Origoilycypris*. The specimen figured by Oertli 1963 as *Rhinocypris jurassica jurassica* (Martin 1940) appears to be much smoother and not so spinose as the specimens described here.

Family Cytheridae Baird 1850
Genus *Fabanella* Martin 1961

*Fabanella polita* (Martin) Pl. 4, fig. 7.

*Cythere boloniensis* variety Jones 188a, fig. B (a, b, c).
[Not *Cythere boloniensis* Jones 188a fig. A (d, e).]
67.

*Candona bononiensis* Jones 1885, p. 348, 349, pl. 9, figs. 7, 8.

*Cyprideis polita* Martin 1940, p. 352, 353, pl. 7, figs. 110-113, pl. 9, figs. 149-151.


*Fabanella polita polita* (Martin 1940), Martin 1961a, p. 186, 187, see also 190-192, Taf. 1, figs. 1-4. 10-12.

*Fabanella polita polita* (Martin), Martin 1961b, p. 113, pl. 14, fig. 9.

*Fabanella polita polita* (Martin 1940) Oertli 1963, p. 21, pl. 7, figs. 46-52.

*Fabanella polita* (Martin), Barker 1964 in Sylvester-Bradley et al.

**Lectotype:** British Museum No. I 1674.

Length = 1.52 mm., Height = 0.82 mm., Inflation = 0.78 mm.

**Material:** 506 valves and carapaces from various beds at the Bugle Pit, (see Table 3). 380 valves and carapaces from various beds at North Whitchurch (see Table 4). 362 valves and carapaces from various beds at Warren House Farm, Stewkley (see Table ISI). Beds of similar age have yielded 388 valves and carapaces at Haddenham, 99 valves and carapaces at Towersey and 7 valves and carapaces at Coneyhill.
Remarks: In the Aylesbury district Fabanella polita has been shown to be a euryhaline ostracod capable of existing in various environments (Barker 1963). It is smallest in the freshwater-oligohaline facies and largest in the marine facies.

**Fabanella ansata** (Jones) Pl. 4, fig. 8.

*Candona ansata* Jones 1885, p. 349, pl. 9, figs. 9-12.

*Candona ansata* Jones, Anderson in Arkell 1947, p. 129, fig. 28, No. 9.

**Fabanella ansata** (Jones 1885), Oertli 1963, p. 22, pl. 16, figs. 43-45.

**Fabanella ansata** (Jones), Barker 1964, in Sylvester-Bradley et al.

**Lectotype**: British Museum No. I 1654.

Left valve length = 0.92 mm., height = 0.58 mm.

**Material**: 955 valves and carapaces from various beds at the Bugle Pit (see Table 3). 530 valves and carapaces from various beds at North Whitchurch. 436 valves and carapaces from various beds at Warren House Farm, Stewkley. Beds of similar age have yielded 510 valves and carapaces at Haddenham, 180 valves and carapaces at Towersey and 7 at Coneyhill.

**Description**: Dimensions in mm. Proportions Specimen

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<th>I</th>
<th>number</th>
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<tbody>
<tr>
<td>Carapace</td>
<td>1.17</td>
<td>0.73</td>
<td>0.59</td>
<td>1.00</td>
<td>0.63</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>Left valve</td>
<td>1.00</td>
<td>0.73</td>
<td>-</td>
<td>1.00</td>
<td>0.73</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Right valve</td>
<td>0.95</td>
<td>0.56</td>
<td>-</td>
<td>1.00</td>
<td>0.59</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Carapace</td>
<td>0.96</td>
<td>0.62</td>
<td>0.50</td>
<td>1.00</td>
<td>0.65</td>
<td>0.52</td>
<td>In 48669</td>
</tr>
</tbody>
</table>
The lateral outline is subreniform with the greatest height towards the posterior and the greatest inflation centrally. The anterior and posterior margins are obliquely curved slightly sharper towards the venter. The ventral margin is concave and slightly inturned. The dorsal margin is slightly inturned and more or less straight. The dorsal view is acutely elliptical. The left valve is larger than and over-reaches the right valve.

The external surface is smooth with a few normal pore canals irregularly spaced. The numerous radial pore canals are fine, straight and closely spaced round the anterior, posterior and ventral borders. The adductor muscle scars are in a vertical row of four situated just anterior of the centre. Antennal and mandibular scars are situated to the anterior of the adductors opposite the top and bottom scars. In some specimens a small fifth scar can be seen above and in line with the four adductors; this may be the "fulcral point" (Van Morkhoven 1962, p. 48) rather than a muscle scar. The hinge is lophodont. There is a small vestibule to the anterior border widest anteroventrally and a narrow vestibule to the posterior border parallel to the outer margin.

**Remarks:** this species is characteristic of the euryhaline
conditions in the Aylesbury district and varies in size according to the salinity. It is smallest in size in the freshwater-oligohaline facies and largest in the marine facies (Barker 1963).

Family Cytheridae
Subfamily Cytherideinae Sars 1925
Genus Galliaeocytheridea Oertli 1957

Galliaeocytheridea crendonensis sp. nov., Pl. 5, figs. 7-11.

Holotype: Carapace from Bed CWE 2 at Long Crendon
Length = 0.68 mm., Height = 0.39 mm., Inflation = 0.31 mm

Diagnosis: the left valve is greater in height than the right but the right valve is greater in length due to a pronounced caudal process.

Material: 6 valves from Bed CWE 2 and 1 valve from Bed CWE 3 at Long Crendon. Also 6 valves from Bed CH 8 and 1 valve from Bed CH 7 at Coneyhill.

Description: Dimensions in mm. Proportions Specimen

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<thead>
<tr>
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<th>H</th>
<th>I</th>
<th>number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left valve</td>
<td>0.70</td>
<td>0.43</td>
<td>-</td>
<td>1.00</td>
<td>0.61</td>
<td>-</td>
<td>Io 1258</td>
</tr>
<tr>
<td>Right valve</td>
<td>0.73</td>
<td>0.35</td>
<td>-</td>
<td>1.00</td>
<td>0.48</td>
<td>-</td>
<td>Io 1259</td>
</tr>
</tbody>
</table>

The carapace is asymmetrically subelliptical in lateral outline. The right valve has a pronounced caudal process. The dorsal margin of the right valve
is more or less straight and converges posteriorly with the ventral margin. The anterior margin is obliquely curved, sharper towards the venter. The left valve has a more rounded outline with a very much reduced and rounded caudal process. The dorsal margin is more or less straight converging towards the posterior with a convex ventral margin. The anterior margin is smoothly and obliquely curved slightly sharper towards the venter. The greatest height is situated centrally. In dorsal view the outline is elliptical with the greatest inflation medially.

The outer surface is ornamented by irregularly spaced and sized pits, the larger usually being near the centre. In both valves there is a slight furrow just behind the anterior margin. The line of concrescence and the inner margin coincide throughout. The selvage forms the outer margin all round except anteriorly in the right valve where it runs a short distance inside the outer margin. The pore canals are not seen. The hinge hemimerodont consisting of two terminal teeth in the right valve subdivided into six or seven toothlets and connected by a smooth narrow groove. The left valve has complementary elements and also an accommodation groove behind the median ridge. There are four adductor muscle scars in a vertical row slightly concave to the
front. There are an antennule scar opposite to the top adductor and a rather large mandible scar somewhat below and anterior to the bottom adductor. This scar could possibly be made up of two scars as the shapes of all the scars are difficult to determine.

The left valve is higher than the right and the right valve is longer than the left. The left valve over-reaches the right valve strongly on the dorsal and ventral borders.

Remarks: sexual dimorphism has not been observed in this species. *G. crendonensis* differs from the type of the genus in the shape of its posterior which is much sharper and equipped with a spine in the right valve. So far this species has only been found at Long Crendon.

Family Limnocytheridae Klie 1938
Genus *Limnocythere* G.S. Brady 1856

*Limnocythere fragilis* Martin Pl. 4, figs. 19, 20.

*Limnocythere fragilis* n. sp. Martin 1940, p. 348, 349, pl. 7, figs. 105-109, pl. 9, figs. 152.


Material: 6 valves from Bed BP.16 at the Bugle Pit (see Table 3).
Description: the valves are thin and fragile and are subreniform in lateral outline. The dorsal margin is straight and the ventral margin longer but sinuous. The ends are obliquely rounded, the posterior being the larger, and both are slightly compressed near the margins. The surface of the valves is smooth but they have a subcentral sulcus near the venter just posterior of centre and another very faint one near the dorsal margin just above the muscle scars. There are few normal pore canals which are sieve type and distributed irregularly. There are about ten radial pore canals to the posterior margin and fewer to the anterior. They are fairly straight and irregularly spaced. The hinge is very weakly developed lophodont. There are four adductor muscle scars arranged in a slight curve concave to the anterior just anterior of centre. A small scar opposite the top adductor with possibly a fulcrum point just below it. There are two mandibular scars arranged anterior ventrally to the adductors. The line of concrescence runs parallel to the outer margin and a short distance inside it forming a vestibule to the anterior and posterior ventral borders. The left valve over-reaches the right.

Remarks: very few specimens of *L. fragilis* have been found but it compares very closely with the type.
Family Limnocytheridae Klie 1938
Genus *Limnocythere* G.S. Brady 1856

*Limnocythere decipiens* (Anderson) Pl. 4, figs. 15, 16.

*Cytherella? decipiens* sp. nov. Anderson 1941, p. 380, 381, pl. 19, figs. 20, 21.

**Holotype:** Geological Survey Museum No. 70354 now Mik (m)

Right valve Length = 0.47 mm., Height = 0.25 mm.

Inflation single valve = 0.12 mm.

**Material:** 3 valves from Bed BP.16 at the Bugle Pit (see Table 3).

**Description:** the valves are thin and fragile and are sub-reniform in lateral outline. The dorsal margin is straight and the ventral margin longer and concave medially. The posterior is larger more obliquely rounded than the anterior and both are slightly flattened round the margins. The surfaces of the valves are covered by numerous discontinuous ridges more or less parallel to the outer margins. There is a slight subcentral sulcus just posterior of centre and a much fainter one near the dorsal margin just above the muscle scars. There are a few normal pore canals of the sieve type and distributed irregularly. There are about ten radial pore canals to the posterior margin and fewer to the anterior. They are fairly straight and irregularly spaced. The hinge is poorly developed lophodont. There are four
adductor muscle scars in a slight curve concave to the anterior and situated just anterior of the centre. There is also a frontal scar and two mandibular scars though they are difficult to see because of the ornament. The line of concrescence runs parallel to the outer margin and a short distance inside it forming a vestibule to the anterior and posterior ventral borders. The left valve over-reaches the right.

**Remarks:** *L. decipiens* is easily distinguished from *L. fragilis* by means of its lateral outline and its distinctive ornament. This species also is very rare.

Family Limnocytheridae Klie 1938

Genus *Theriosynoecum* Branson 1933

*Theriosynoecum forbesii* (Jones 1885) Pl. 4, fig. 6, Pl. 5, figs. 11, 12.

*Metacypris forbesii* sp. nov. Jones 1885, p. 344-346, pl. 8, figs. 11-16.

*Metacypris forbesii* Jones, Martin 1940, p. 336, pl. 6, figs. 89-94.

*Gomphocythere forbesii forbesii* Wicher 1957, p. 270, pl. 1, fig. 3 a, b, c.

*Bisulcocypitlis forbesii* Jones, Pinto and Sanguinetti 1962, p. 39, pl. 3, figs. 1-4, pl. 12, figs. 1 a-d.
Lectotype: British Museum of Natural History No. In 39021 (Jones slide 123A3). Right valve of a female figured Jones 1885, pl. 8, fig. 16.

Material: 5 carapaces and 6 valves from Bed Tw 2 at Towersey. 27 carapaces and 31 valves from Bed HDB 1a at Haddenham.

Remarks: according to Pinto and Sanguinetti Theriosynoecum differs from Bisulcocypriis in having a more poorly defined hinge, an accommodation groove and velate ridges and is considered to be of Jurassic age in England if not in the U.S.A. The species considered here has no accommodation groove but otherwise corresponds to Theriosynoecum.

Pinto and Sanguinetti also describe M. forbesii and M. forbesii var. verrucosa of Jones 1885 as separate species based on a study of the Jones material. From figs. 11, 12, pl. 3, it will be seen that the species B. verrucosa described by Pinto and Sanguinetti is a juvenile of T. forbesii which varies in tuberculation from being quite smooth to tuberculate.

Family Progonocytheridae Sylvester-Bradley 1948
Subfamily Progonocytherinae Lyubimova 1955
Genus Klieana Martin 1940
Klieana alata Martin 1940, Pl. 4, figs. 10-14.

Klieana alata n.g. n. sp. Martin 1940, p. 322-325, taf. 5, figs. 64-73, Taf. 11, figs. 158-161.

Klieana alata Martin 1940, Gertli 1963, p. 22, pl. 7, figs. 53-56.

Klieana alata Martin 1940, Barker 1964 in Sylvester-Bradley et al.


Diagnosis: Carapace small with distinct sexual dimorphism. The left valve is larger than the right valve. Females have the stronger wing-like process towards the venter of each valve. The ornament is an almost reticulate pitting. The hinge is hemimerodont and the muscle scars are in a vertical row of four.

Material: 592 valves and carapaces from various beds at the Bugle Pit (see Table 3). 70 valves and carapaces from various beds at North Whitchurch. 26 valves and carapaces from various beds at Warren House Farm, Stewkley. Beds of similar age have yielded 330 valves and carapaces at Haddenham and 265 valves and carapaces at Towersey.

Description: Dimensions in mm. Proportions Sample Number

<table>
<thead>
<tr>
<th></th>
<th>L</th>
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<th>British Museum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carapace ♀</td>
<td>0.56</td>
<td>0.39</td>
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Dimension in mm. Proportions Sample Number

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<th>L</th>
<th>H</th>
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<tbody>
<tr>
<td>Left</td>
<td>0.59</td>
<td>0.41</td>
<td>-</td>
<td>1.00</td>
<td>0.69</td>
<td>-</td>
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<tr>
<td>Right</td>
<td>0.76</td>
<td>0.39</td>
<td>-</td>
<td>1.00</td>
<td>0.51</td>
<td>-</td>
<td>L 1250</td>
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<tr>
<td>Left</td>
<td>0.69</td>
<td>0.37</td>
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<td>1.00</td>
<td>0.54</td>
<td>-</td>
<td>L 1249</td>
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</tbody>
</table>

**Females**: lateral outline subdeltoidal with the greatest height to anterior of centre. Dorsal outline similar to a broad arrow head with the greatest inflation to the posterior of the centre. The anterior margin is slightly swollen, smooth and obliquely rounded, sharpest to venter. The posterior margin is similar but not so swollen as the anterior. There is a strongly developed wing-like process near the ventral margin and directed posteriorly. This process is smooth and shiny showing only faint relics of pitting. There is a flat ventral surface with four subparallel longitudinal ridges to each valve. The dorsal margin is slightly convex. The left valve is larger than and over-reaches the right.

**Males**: the dorsal outline is irregularly elliptical with the greatest inflation to the posterior of the centre. Both the anterior and posterior margins are slightly swollen, smooth and obliquely curved sharpest to venter. The flat ventral surface has four subparallel longitudinal ridges to each valve. The dorsal margin is slightly concave and the left valve is larger than and overlaps the right.
Both the males and females have the lateral surfaces covered by small pits, almost reticulate in pattern in the case of the female but much finer in the male. There are about six straight evenly spaced radial pore canals to the anterior border and three similarly to the posterior. Four muscle scars are placed centrally in a vertical row slightly concave to the anterior. The hinge is hemimerodont. The line of concrescence following the inner margin all round and the selvage forming the principle ridge round the contact margin. It is developed into a strong lip medially on the female venter and just posteriorly on the male venter.

Remarks: these specimens show the characteristic features of *Klieana alata*, but occasionally there is some variation in ornament. In some specimens the posteriorly directed wing-like process is reduced so that the valve becomes almost smoothly rounded. There may also be some reduction in the strength of the pitting. The pitting is often reduced or lost completely near the margins of normal specimens.

Subfamily Protocytherinae Lyubimova 1955

Genus *Protocythere* Triebel 1938
Protocythere serpentina (Anderson) Pl. 6, figs. 13-18.

Cythereis serpentina sp. nov. Anderson 1941, p. 375, pl. 19, fig. 12.

Protocythere sigmoidea n. sp. Steghaus 1951, p. 219, 220, pl. 15, figs. 42-45.

Protocythere bireticulata n. sp. Malz 1958, p. 39, pl. 11, fig. 69.

Protocythere sigmoidea Steghaus 1951, Fernet 1960, pl. 1, figs. 11-13.

Protocythere serpentina (Anderson 1941), Oertli 1963, p. 22, 23, pl. 7, fig. 57.

Holotype: Geological Survey Museum No. 70343 now Mik (m) 723. Left valve length = 0.70 mm., height = 0.40 mm. inflation = 0.21 mm.

Material: 455 valves and carapaces from beds at the Bugle Pit (see Table 3). 80 valves and carapaces from various beds at North Whitchurch. 14 valves and carapaces from various beds at Warren House Farm, Stewkley. Beds of similar age have yielded 23 valves and carapaces at Haddenham. 78 valves and carapaces at Towersey. 338 valves and carapaces at Long Crendon and 206 valves and carapaces at Coneyhill.

Description: carapace subrectangular in outline with dorsal and ventral margins almost parallel. Anterior margin broadly rounded and denticulate on the inner edge. The
posterior margin is angular with the ventral part denticulate. The ventral margin is more or less straight whereas the dorsal margin is straight with a dorsal bulge forming a prominent anterior hinge ear or eye tubercle. The left valve is larger than and over-reaches the right valve.

The major ornament consists of two ribs, one parallel to the dorsal margin, one parallel to the ventral margin. A third rib runs from the posterior dorsal corner to the anterior ventral corner just before which it usually swells to form a node. The ribs make a continuous Z shape on the lateral surface and are usually roughly rounded and increase in size from dorsal to ventral. The anterior margin is well rounded and inflated. The surface is usually covered with fine reticulations. There are occasional small tubercles in various positions. The strength and variation in shape and ornament is shown in figure 6. The normal pore canals are not seen. There are about thirteen radial pore canals around the anterior margin associated with the denticles. There are also about fifteen radial pore canals on the posterior ventral margin also associated with denticles. The adductor scars are in a vertical row of four situated on the posterior side of a pit in the anterior part of the shell. The hinge is hemimerodont.
The line of concrescence follows the inner margin all round.

Remarks: *P. serpentina* has been described by Oertli 1963 from Middle Kimmeridge to Lower Purbeck Beds in Villemoyenne 2. *P. bireticulata* was described from twelve metres below Purbeck ostracods in the Ile d'Oleron by Malz. *P. sigmoidea* was described from the Kimmeridge 3a of Fuhrberg by Steghaus. In England *P. serpentina* has so far been described from the uppermost Portland beds.

*P. bireticulata* has the fine reticulation and distinct lateral outline of *P. serpentina* but the dorsal outline is symmetrically arched. *P. sigmoidea* differs from *P. serpentina* in having a more rounded posterior and a posteriorly sloping margin. However, figure shows all these differences in one population from the Aylesbury district. Therefore the three species are gathered together under the name *P. serpentina*.

Family Progonocytheridae Sylvester-Bradley 1948
Subfamily Protocytherinae Lyubimova 1955
Genus Paraschuleridea Swartz and Swain 1946

*Paraschuleridea buglensis* Barker, Pl. 6, figs. 5, 6, 7.

[Not Cytheridea politula Jones and Sherborn 1888, p. 265, pl. 5, fig. 7.]
Cytheridea politula Jones and Sherborn 1888, Anderson 1941, p. 375, 376, pl. 19, fig. 14.
Paraschuleridea buglensis sp. nov. Barker 1964 in Sylvester-Bradley et al.

Holotype: Geological Survey Museum Mik (m) 724 formerly 70344. Figured by Anderson 1941, pl. 19, fig. 14.

Material: 257 valves and carapaces from various beds at the Bugle Pit (see Table 3). 254 valves and carapaces from various beds at North Whitchurch (see Table 4). 54 valves and carapaces from various beds at Warren House Farm, Stewkley (see Table 5). Beds of similar age have yielded 56 valves and carapaces at Haddenham, 55 valves and carapaces at Towersey, 156 valves and carapaces at Long Crendon and 89 valves and carapaces at Coneyhill.

Remarks: a robust reniform carapace in lateral outline, characteristic of the marine facies in the Aylesbury district.

Superfamily Cytheracea Baird 1850
Family Brachycytheridae Puri 1954
Genus Macrodentina Martin 1940
Subgenus Macrodentina Martin 1940

Macrodentina (Macrodentina) rugulata (Jones) Pl. 5, figs. 16, 17.
Cythere retirugata sp. nov. var. rugulata Jones 1885
p. 350, pl. 9, figs. 17, 18, 19, 20.
Cythere retirugata Jones var. rugulata Jones, Anderson 1941, p. 373, pl. 18, fig. 1.

Dictyocythere (Rhysocythere) rugulata (Jones) Sylvester-Bradley 1956, p. 18, pl. 4, figs. 1, 2, 5, 6, 7, 8, 1, 10, 12, 13, 14, 15.

Macrodentina (Macrodentina) rugulata (Jones) Malz 1958, p. 18, pl. 6, figs. 83, 84, 85, 86.

Macrodentina (Macrodentina) rugulata (Jones) Barker 1964 in Sylvester-Bradley et al.

**Lectotype:** British Museum (N.H.) No. In 48600.

**Diagnosis:** The carapace is subtrapezoidal in outline, strongly rounded with smooth lateral surfaces, ridged venter and fairly strong sexual dimorphism. The left valve is larger than and over-reaches the right.

**Material:** 606 valves and carapaces from various beds at the Bugle Pit (see Table 3). 297 valves and carapaces from various beds at North Whitchurch (see Table 4). 564 valves and carapaces from various beds at Warren House Farm, Stewkley (see Table 5). Beds of similar age have yielded 113 valves and carapaces at Haddenham, 10 valves at Towersey and 20 valves and carapaces at Coneyhill.

**Description:** Dimensions in mm. Proportions Specimen number

<table>
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<tr>
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<th>L</th>
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<th>L</th>
<th>H</th>
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<th>British Museum</th>
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<tbody>
<tr>
<td>Carapace ♂</td>
<td>0.83</td>
<td>0.54</td>
<td>0.49</td>
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<tr>
<td>Left valve ♂</td>
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<td>0.56</td>
<td>—</td>
<td>1.00</td>
<td>0.59</td>
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</tbody>
</table>
The lateral outline is subtrapezoidal with greatest height to the anterior of the centre. The carapace has an inflated elliptical shape in dorsal view with the greatest inflation medially and towards the venter. The ventral surface has about eight subparallel longitudinal ridges. The dorsal and ventral margins are slightly convex outwards. The anterior and posterior margins are obliquely rounded and sharper towards the venter. The left valve is larger than and over-reaches the right valve on all except the dorsal margins.

The lateral surface is smooth except near the ventral margin where there are three long ridges similar to those on the ventral surface but decreasing in length towards the centre of the valve. The normal pore canals are regularly spaced all over the valves. The radial pore canals are straight, about twenty being

<table>
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<th>Proportions</th>
<th>Specimen number</th>
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<tr>
<td><strong>Dimensions in mm.</strong></td>
<td>L  H  I</td>
<td>L  H  I</td>
</tr>
<tr>
<td>Left valve</td>
<td>0.88 0.56  -</td>
<td>1.00 0.64  -</td>
</tr>
<tr>
<td>Right valve</td>
<td>0.83 0.54  -</td>
<td>1.00 0.65  -</td>
</tr>
<tr>
<td>Right valve δ</td>
<td>0.90 0.51  -</td>
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</tr>
<tr>
<td>Carapace</td>
<td>0.96 0.58 0.54</td>
<td>1.00 0.60 0.56</td>
</tr>
<tr>
<td>Left valve</td>
<td>0.88 0.58  -</td>
<td>1.00 0.66  -</td>
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<tr>
<td>Carapace</td>
<td>0.78 0.48 0.45</td>
<td>1.00 0.62 0.58</td>
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</table>
irregularly spaced around the anterior border and very few on the posterior border. There are four adductor muscle scars in a vertical line medially just anterior of the centre. The hinge is paramphidont. The line of concrescence is parallel to the outer margin forming a slight vestibule to the anterior ventral corner.

Remarks: this subgenus differs from Dictyocythere in its hinge and in the left valve which is larger than and over-reaches the right.

Macrodentina (Macrodentina) transiens (Jones) pl. 5, figs. 1-6.
Cythere transiens sp. nov. Jones 1885, p. 349, pl. 9, figs. 13, 14, 15, 16.
Dictyocythere (Rhysocythere) transiens (Jones), Sylvester-Bradley, 1956, p. 19, pl. 3, figs. 11, 12, 13.
Macrodentina (Macrodentina) transiens (Jones), Malz 1958, p. 17, pl. 6, figs. 81, 182.

Lectotype:

Material: 483 valves and carapaces from various beds at the Bugle Pit (see Table 3). 114 valves and carapaces from various beds at North Whitchurch (see Table 4). 90 valves and carapaces from various beds at Warren House Farm, Stewkley (see Table 15). Beds of similar
age have yielded 42 valves and carapaces at Haddenham, 193 valves and carapaces at Towersey, 357 valves and carapaces at Long Crendon and 220 valves and carapaces at Coneyhill.

**Diagnosis:** small reticulate *Macrodentina* tapering strongly to the posterior in lateral view. Sexual dimorphism not seen.

**Description:**

<table>
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<tr>
<th>Dimension in mm.</th>
<th>Proportions</th>
<th>Specimen Number</th>
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<tr>
<td>Carapace</td>
<td>L 0.61 0.37 0.32 1.00</td>
<td>0.61 0.52</td>
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<tr>
<td>Carapace</td>
<td>L 0.59 0.37 0.32 1.00</td>
<td>0.63 0.49</td>
</tr>
<tr>
<td>Right valve</td>
<td>L 0.61 0.32  -   1.00</td>
<td>0.52  -</td>
</tr>
<tr>
<td>Left valve</td>
<td>L 0.59 0.37  -   1.00</td>
<td>0.63  -</td>
</tr>
</tbody>
</table>

The lateral outline is asymmetrically very broadly ovate, greatest height being to anterior of the centre. In dorsal view the sides are subparallel and the ends rounded, the posterior being more pointed. The dorsal margin is straight or very slightly convex and slopes down towards the posterior. The ventral margin is slightly convex and the ventral surface slightly ridged longitudinally. The anterior margin is more broadly rounded than the posterior. The left valve over-reaches the right valve all round.

The surface is strongly pitted arranged in rows near the margins but more irregularly towards the
centre. On the left valve there is a small posteriorly directed spine at the posterior ventral corner. Normal pore canals are situated in each pit. Radial pore canals are present but difficult to distinguish. There are four adductor muscle scars in a vertical line about the centre of the valves. The hinge is paramphidont in type and it was described by Sylvester-Bradley in 1956.

Remarks: this species is smaller than and easily distinguished from the other species of Macroductina by means of its shape.

Subgenus Dictyocythere Sylvester-Bradley 1956

Macrodentina (Dictyocythere) retirugata (Jones) Pl. 5, figs. 18-22.
Cythere retirugata sp. nov. Jones 1885, p. 350, pl. 9, figs. 21-23.
Cythere retirugata sp. nov. var. textilis Jones 1885, p. 350,
Cythere retirugata Jones var. textilis Jones, Anderson 1941.
Cythere retirugata Jones var. decorata Anderson 1941, p. 374, pl. 18, fig. 4.
Dictyocythere (Dictyocythere) retirugata (Jones), Sylvester-Bradley 1956, p. 15, pl. 3, figs. 7-10, pl. 4, figs. 3, 4, 11, 16, 17.
Dictyocycythere (Dictyocycythere) decorata (Anderson)  
Sylvester-Bradley 1956, p. 17, pl. 3, fig. 1.

Macrodentina (Dictyocycythere) retirugata (Jones), Malz  
1958, p. 25, pl. 6, figs. 87-88.

Macrodentina (Dictyocycythere) textilis (Jones), Malz  
1958, p. 26, pl. 6, figs. 89, 90, 91.

Lectotype: British Museum (N.H.) No. In 48601.

Diagnosis: carapace subtrapezoidal in lateral outline and with variable ornament of fine reticulations to circular pits.

Material: 527 valves and carapaces from various beds at the Bugle Pit (see Table 3). 263 valves and carapaces from various beds at North Whitchurch (see Table 34). 66 valves and carapaces from various beds at Warren House Farm, Stewkley (see Table 15). Beds of similar age have yielded 6 valves at Coneyhill.

Description: Dimensions in mm. Proportions Specimen

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<th>Number</th>
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<tr>
<td>Right valve</td>
<td>0.90</td>
<td>0.54</td>
<td>-</td>
<td>1.00</td>
<td>0.60</td>
<td>0</td>
<td>In 48602</td>
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<tr>
<td>Carapace</td>
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<td>0.58</td>
<td>0.50</td>
<td>1.00</td>
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<td>0.52</td>
<td>I 1669</td>
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<td>Carapace</td>
<td>0.87</td>
<td>0.51</td>
<td>0.48</td>
<td>1.00</td>
<td>0.59</td>
<td>0.55</td>
<td>70340</td>
</tr>
</tbody>
</table>

Lateral outline subtrapezoidal with greatest height to anterior of centre. Pyriform in dorsal view with greatest inflation towards the posterior. The dorsal margin is straight and the ventral margin sinuous, slightly concave medially. The anterior
margin is smoothly and obliquely rounded, sharper
towards venter. The posterior margin is smaller and
almost straight towards the dorsal with which it makes
an angle of about $130^\circ$. The left valve overlaps the
right on the anterior and anterior ventral margins.
The inflation is greatest towards the venter so that
the ventral surface is almost horizontal with about
six rows of elongate reticulae more or less parallel
to its length.

The surface is strongly reticulate, arranged in
rows parallel to the margins near the venter, posterior
and anterior but irregularly elsewhere. The normal
pore canals are large and situated in each cell of
the reticulum. Inside these polygonal areas fine
"second order" reticulations can often be seen. In
some specimens the reticulation has been smoothed
out to form circular pits instead of polygonal ones
and with faint indications of the fine reticulations
in some places. The radial pore canals are sparse
and straight, with about twelve to the anterior border
and eight to the posterior. There are four adductor
muscle scars in a vertical line medially and just
posterior of the position of greatest height. There is
one antennal scar in front of and in line with the second
adductor from the dorsal end of the series and in the
position of greatest height. The hinge is holamphidont. The line of concrescence is not clear but there are vestibules around the anterior and at the posterior ventral corner. The right valve overlaps the left around the anterior half of the carapace and the left valve overlaps the right around the posterior half of the carapace.

Remarks: Sylvester-Bradley 1956 considered the genus *Dictyocyt here* retirugata (Jones) to consist of two subgenera, *Dictyocyt here* and *Rhysocyt here*, differentiated on the basis of the hinge structure. Malz (1958) showed that *Rhysocyt here* is a junior synonym of Martin's genus *Macrodentina*. Malz subdivided the genus *Macrodentina* into three subgenera on the basis of differences in the hinge structure, *Macrodentina* ss. *Macrodentina* (*Dictyocyt here*) and *Macrodentina* (*Polydentina*). Volume Q of the Treatise on Invertebrate Paleontology considered the differences between the three subgenera of Malz to be strong enough to raise them to full generic level.

The variation in ornament in this species is so continuous when a large number of specimens are examined that it is impossible to separate the three morphological types shown in plate 2.
Superfamily Cytheracea
Family Cytheruridae G. W. Müller 1894
Genus *Procytheropteron* Lyubimova 1955

*Procytheropteron stewkevenses* sp. nov., Pl. 5, figs. 23-26.

**Holotype:** right valve from Bed 8 at the Bugle Pit, Hartwell.
Length = 0.45 mm., Height = 0.23 mm.

**Diagnosis:** the carapace is inflated near the venter forming a sharp angle with the concave base. The posterior is slightly elongate and the lateral surfaces are covered by faint reticulations.

**Material:** 235 valves and carapaces from various beds at the Bugle Pit (see Table 3). 72 valves and carapaces from various beds at North Whitchurch (see Table 14). 5 valves from beds 4 and 6 at Warren House Farm, Stewkley (see Table 15). Beds of similar age have yielded 10 valves and carapaces at Haddenham, 2 valves at Long Crendon.

**Description:** Dimensions in mm.

<table>
<thead>
<tr>
<th>Specimen</th>
<th>L</th>
<th>H</th>
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<th>L</th>
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<th>I</th>
<th>number</th>
</tr>
</thead>
<tbody>
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<td>0.48</td>
<td>0.29</td>
<td>0.29</td>
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<td></td>
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<tr>
<td>Left valve</td>
<td>0.47</td>
<td>0.29</td>
<td>-</td>
<td>1.00</td>
<td>0.62</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

The smooth and glossy carapace has a sub-circular lateral outline drawn out slightly to the posterior, and with the greatest height to the anterior. In dorsal view it is swollen with the greatest inflation.
centrally. The anterior margin is obliquely curved, sharpest towards the venter. The posterior margin is drawn out in a projection. Both valves are strongly swollen near the ventral margins and form an angle with the ventral surface which is concave with three or four longitudinal subparallel ridges to each valve. The dorsal margin is convex and the left valve over­reaches the right valve.

The ornament consists of faint longitudinal reticulations on the lateral surfaces. There are many regularly distributed normal pore canals. There are about seven straight radial pore canals to the anterior border. The line of concrescence and the inner margin coincide. The hinge is antimerodont. There are four poorly distinguished adductor muscle scars in a vertical row just anterior to the centre. The outer margin forms a lip centrally on the ventral margin. The posterior projection is slightly hollow to form a slight tube with the opposite valve.

Remarks: this species differs from species of Cytheropteron by having a smooth median portion to the hinge and a more rounded lateral outline.

Family Cytheruridae G.W. Müller 1894
Genus Orthonotacythere Alexander 1933
Orthonotacythere rimosa Martin Pl. 5, figs. 12, 13.

Orthonotacythere rimosa Martin 1940, p. 335, pl. 6, figs. 84, 85, 86.

Orthonotacythere c.f. rimosa Martin, Martin 1961, p. 117, pl. 14, fig. 21 a-c.

Orthonotacythere rimosa Martin, Barker 1964 in Sylvester-Bradley et al.

Holotype: Senk.-Mus. Nr. X/E 344 broken carapace.

Material: 78 valves and carapaces from various beds at the Bugle Pit (see Table 3). 4 valves from beds 6 and 11 at Warren House Farm, Stewkley.

Description: Dimensions in mm. Proportions Sample Number

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<tr>
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<th>L</th>
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<th>L</th>
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<th>I</th>
<th>British Museum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carapace</td>
<td>0.59</td>
<td>0.34</td>
<td>0.32</td>
<td>1.00</td>
<td>0.58</td>
<td>0.54</td>
<td>Io 1242</td>
</tr>
<tr>
<td>Right valve</td>
<td>0.73</td>
<td>0.39</td>
<td>-</td>
<td>1.00</td>
<td>0.53</td>
<td>-</td>
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</tr>
<tr>
<td>Left valve</td>
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<td>-</td>
<td>1.00</td>
<td>0.56</td>
<td>-</td>
<td>Io 1243</td>
</tr>
</tbody>
</table>

Subtrapezoidal in lateral outline with the dorsal and ventral margins subparallel. The greatest height and greatest inflation are to posterior of centre. The anterior margin is obliquely rounded sharper to venter but the posterior margin is subtriangular forming a caudal process to the posterior dorsal corner. The ventral margin is slightly convex whereas the dorsal margin is longer and straight.

The ornament consists of an irregular reticulate
rib pattern with a few strong ridges radiating from the ventral margin just posterior of centre where the inflation is greatest. The major ridge is inside but more or less parallel to the anterior, ventral and posterior margins. A few short radial pore canals are to be seen in the anterior and posterior margins. The muscle scars are not clear. The hinge is antimerodont. The inner margin and the line of con
crescence coincide.

Remarks: the rib pattern appears to be slightly stronger than the figured specimens of Martin 1940, but since these specimens are larger than those of Martin the difference may be one of age.

O. rimosa differs from O. cylindrica Triebel by having weaker ornament and a straight dorsal margin. The sulcus is not so deep in O. rimosa as it is in O. interrupta Triebel.

Superfamily Cytheracea
Family uncertain
Genus Wolburgia Anderson in press?

Wolburgia visceralis (Anderson) Pl. 5, figs. 14, 15.

Cythere visceralis Anderson 1940, p. 374, pl. 19, fig. 11.
Holotype: right valve from Town Gardens Quarry, Swindon in Geological Survey and Museum No. Mik (m) 722 formerly 70342. Length = 0.67 mm, height = 0.36 mm.

Diagnosis: subtrapezoidal with ornament comparable to a length of coiled intestine.

Material: 76 valves and carapaces from various beds at the Bugle Pit (see Table 3). 1 valve from Bed WH 6 at Warren House Farm, Stewkley (see Table 15). Beds of similar age have yielded 77 valves and carapaces at Long Crendon and 103 valves and carapaces at Coneyhill.

Description: Dimensions in mm. Proportions Specimen

<table>
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</thead>
<tbody>
<tr>
<td>Carapace</td>
<td>0.56</td>
<td>0.34</td>
<td>0.34</td>
<td>1.00</td>
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<td>Right valve</td>
<td>0.69</td>
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<tr>
<td>Left valve</td>
<td>0.64</td>
<td>0.34</td>
<td></td>
<td>1.00</td>
<td>0.53</td>
<td>-</td>
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</table>

Lateral outline subtrapezoidal with the greatest height medially. The anterior margin is obliquely rounded, sharpest towards the venter. Posterior margin oblique forming a rounded angle with the dorsal margin. The left valve is slightly larger than the right valve over-reaching it at the dorsal corners. The greatest inflation is medially and the carapace is subelliptical in dorsal view.

The ornament consists of rounded ridges constricted irregularly and arranged concentrically around the margins.
The anterior margin is the thicker and is separated from the lateral surfaces by a furrow. There are many normal pore canals arranged irregularly over the surface. About 9 radial pore canals are evenly spaced around the anterior margin and 5 around the posterior margin. The hinge is adont and is a long straight groove about $\frac{2}{3}$ the length narrowing to the posterior in the right valve. In the left valve there is a ridge narrowing to the posterior and possibly slightly serrate in the posterior third. The inner margin and line of concrescence are coincident.

**Remarks:** this species is characteristic of the marine horizons in the Aylesbury district.

---

**Superfamily Cytheracea**

**Family, Genus uncertain**

*Cythere* sp., Pl. 6, figs. 9, 10.

**Holotype:** carapace from Bed HDB 8 at Haddenham. Length = 0.60 mm., height = 0.31 mm., inflation = 0.23 mm.

**Material:** 4 carapaces from Bed NW 5 at North Whitchurch (see Table 4). 268 carapaces from various beds at Haddenham of similar age to the North Whitchurch.

**Description:** characteristic elongate shape with greatest height just anterior of centre. The dorsal margin is
short and straight or slightly convex. The ventral margin is longer and concave. The anterior margin is obliquely curved, sharpest towards the venter. The left valve over-reaches the right valve all round. The carapace is smooth on the external surface.

The internal details have not been seen but in some specimens there are faint indications of elongate muscle scars in a vertical row of four at the position of greatest height.

Family?
Genus *Scabriculocypris* Anderson 1941

*Scabriculocypris trapezoides* Anderson 1941 Pl. 4, fig. 3.

*Scabriculocypris trapezoides* sp. nov. Anderson 1941, p. 377, pl. 18, fig. 5.

*Scabriculocypris trapezoides* Anderson 1941, Oertli 1963, p. 20, pl. 6, figs. 37, 38, 39.

**Holotype:** Geological Survey No. 70347 now Mik (m) 727.

Carapace, length = 0.56 mm., height = 0.37 mm., inflation = 0.22 mm.

**Material:** 97 valves and carapaces from various beds at Warren House Farm, Stewkley (see Table 5).

**Remarks:** specimens have characteristic fine reticulate ornament and asymmetrical view from anterior and
posterior. Inflation less than that indicated in Oertli figure 39 b.

Suborder PLATYCOPIA Sars 1866
Family Cytherellidae Sars 1866
Genus Cytherelloidea Alexander 1933

Cytherelloidea hartwellensis sp. nov., pl. 6, figs. 1, 2.

Holotype: right valve from Bed CWE 2b Long Crendon.
Length = 0.64 mm., Height = 0.37 mm.

Other material: 6 valves from Bed CWE 2 and 1 valve from Bed CWE 3 at Long Crendon.

Description: a species of Cytherelloidea showing external and internal features characteristic of that genus but being more rectangular in outline and having a straight ventral margin. The ornament consists of a continuous ridge just interior of and parallel to the outer margin and tending to be most prominent towards the posterior and venter. There is a slight depression situated centrally in each valve. Each female valve also has two shallow posterior cavities internally, one posterior ventral and one posterior dorsal. The right valve has a slight groove internally round the margin of the valve which is deeper towards the dorsal and ventral.

Remarks: this species is very similar in shape and of similar age to C. paraweberi Oertli but differs in being not quite so long and having a more arched dorsal margin and a straighter ventral margin.
PLATE 4

1) **Cypridea dunkeri papulata** carapace from Bed NWF 15,
   British Museum Io 1220; length = 0.97 mm.

2) Right valve.

3) **Scabriculocypris trapezoides** carapace from Bed NWE 22,
   British Museum Io 1220; length = 0.64 mm.

4) **Cypridea praecursor** carapace from Bed HDA 3, British
   Museum Io 1226; length = 1.20 mm.

5) **Mantelliana purbeckensis** carapace from Bed NWF 14,
   British Museum Io 1226; length = 1.20 mm.

6) **Theriosynoeceum forbesii** left valve from Bed TW 2, British
   Museum Io ; length = 0.83 mm.

7) **Fabanella polita** left valve from Bed HG 4, British
   Museum Io 1231; length = 1.56.

8) **Fabanella ansata** right valve from Bed BP 12, British
   Museum Io 1235; length = 1.00 mm.

9) **Darwinula leguminella** left valve from Bed BP 6, British
   Museum ; length = 0.64 mm.

10) **Klieana alata** right valve internal from Bed BP 3, British
    Museum Io 1250; length = 0.77 mm.

11) **Klieana alata** right valve external from Bed BP 3, British
    Museum Io 1247; length = 0.56 mm.

12) **Klieana alata** right valve external from Bed BP 3 British
    Museum ; length = 0.58 mm.

13) **Klieana alata** dorsal view from Bed BP 3, British Museum
    Io 1245; length = 0.64 mm.
Klieana alata dorsal view from Bed BP 3, British Museum; length = 0.56 mm.

Limnocythere decipiens left valve internal from Bed BP 6, British Museum Io 1265; length = 0.41 mm.

External of left valve.

Rhinocypris jurassica right valve internal from Bed BP 6, British Museum Io 1261; length = 0.50 mm.

Left valve external from Bed BP 6, British Museum Io 1260; length = 0.52 mm.

Limnocythere fragilis right valve from Bed BP 6, British Museum Io 1263; length = 0.47 mm.

Internal of right valve.
1) Macroductina (Macroductina) transiens, carapace right valve from Bed BP 4, British Museum Io 1239; length = 0.60 mm.
2) Left valve.
3) Internal view of right valve from Bed BP 4, British Museum Io 1241; length = 0.64 mm.
4) Internal view of left valve from Bed BP 4, British Museum Io 1240; length = 0.64 mm.
5) Dorsal view of carapace, British Museum Io 1239.
6) Ventral view of carapace, British Museum Io 1239.
7) Galliaecytheridea crendonensis, dorsal view of carapace, from Bed CWE 2, British Museum Io 1257; length = 0.67 mm.
8) Left valve of carapace, British Museum Io 1257.
9) Right valve of carapace, British Museum Io 1257.
10) Internal view of right valve from Bed CWE 2, British Museum Io 1259; length = 0.73 mm.
11) Internal of left valve from Bed CWE 2, British Museum, Io 1258; length = 0.72 mm.
12) Orthonotacythere rimosae, internal view of right valve from Bed BP 3, British Museum Io 1244; length = 0.70 mm.
13) Right valve external, British Museum Io 1244.
14) Wolburgia visceralis, left valve from Bed BP 3, British Museum; length = 0.58 mm.
15) Internal view of right valve from Bed BP 3, British Museum; length = 0.68 mm.
PLATE 5 continued

16) *Macrodentina (Macrodentina) rugulata*, left valve from Bed BP 10, British Museum Io 1237; length = 0.89 mm.

17) Internal view of left valve, British Museum Io 1237.

18) *Macrodentina (Dictyoxythere) retirugata*, dorsal view of right valve from Bed 6 C, British Museum; length = 0.87 mm.

19) Left valve from Bed BP 6 C, British Museum;
length = 0.77 mm.

20) Right valve from Bed 6 C, British Museum; length = 0.87 mm.

21) Left valve from Bed BP 8, British Museum;
length = 0.89 mm.

22) Right valve internal from Bed BP 6 C, British Museum;
length = 0.89 mm.

23) *Protocytheropteron stewkleyensis*, internal view of the left valve from Bed BP 8, British Museum;
length = 0.47 mm.

24) Left valve, British Museum

25) Internal view of right valve from Bed BP 8, British Museum;
length = 0.45 mm.

26) Right valve, British Museum
1) **Cytherelloidea hartwellensis**, right valve from Bed CWE 2
   British Museum Io 1255; length = 0.62 mm.
2) Internal view of right valve, British Museum Io 1255
3) "Macrocypria"? carapace right valve from Bed WH 4,
   British Museum ; length = 0.85 mm.
4) Dorsal view of carapace, British Museum
5) **Paraschuleridea bugensis**, right valve from Bed 6a,
   British Museum Io 1229; length = 0.70 mm.
6) Internal view of left valve from Bed 6a, British
   Museum Io 1228; length = 0.60 mm.
7) Dorsal view of carapace, British Museum Io 1227; length
   = 0.68 mm.
8) **Protcythereopteron stewkeyensis**, dorsal view of carapace
   from Bed BP 8, British Museum ; length = 0.47 mm.
9) "Cythere" sp. dorsal view of carapace from Bed HDB 8,
   British Museum Io 1256; length = 0.58 mm.
10) Right valve, British Museum Io 1256
11) **Theriosynoeecum forbesii**, dorsal view of sample fauna
    from Bed HDB 1a, British Museum ; length of left
    specimen = 0.89 mm.
12) **Theriosynoeecum forbesii**, lateral view of sample fauna,
    from Bed HDB 1a, British Museum ; length of top
    left hand specimen = 0.83 mm.
13) **Protocythere serpentina**, sample fauna of left and right
    valves from Bed CWE 2, to show variation in ornamentation.
    British Museum ; length of top left specimen = 0.77 mm.
14) *Protocythere serpentina*, internal view of right valve from Bed BP 6 C, British Museum Io 1252; length = 0.75 mm.

15) Left valve from Bed BP 4, British Museum Io 1253; length = 0.81 mm.

16) Internal view of left valve from Bed BP 6 C, by transmitted light, British Museum; length = 0.85 mm.

17) Dorsal view of carapace from Bed BP 6 C, British Museum Io 1251; length = 0.74 mm.

18) Ventral view of carapace from Bed BP 6 C, British Museum Io 1251.
Size in Relation to Salinity in Fossil and Recent Euryhaline Ostracods

Fossil Ostracods

During a recent study of the ostracod faunas of the Portland and Purbeck Beds of the Aylesbury district (a full account of which is in preparation) a euryhaline ostracod fauna was reported. The ostracods in question are *Fahanelia polita* Martin and *Fahanelia ansata* (Jones). A study was made of their vertical distribution at three localities: (a) at the Bugle Pit, Hartwell, (b) at a temporary roadside section 1 mile north of Whitchurch on the west side of the Buckingham road, and at (c) Warren House Farm, Stewkley.

It was found possible to subdivide the beds at these localities into a number of facies characterized in the main by ostracod faunas. At the base are (i) the massive cream coloured limestones of the Portlandian with marine ostracods and referred to as the Portland facies. Above these are (ii) laminated marls and limestones with a mixture of marine and euryhaline ostracods referred to as the marine Purbeck facies, (iii) laminated marls and limestones with euryhaline ostracods referred to as the brackish Purbeck facies, and (iv), marls
Fig. 8. The relative lengths of specimens of *Fabarella ansata* from beds in the three sections. The range ($X \pm 2s$) is indicated for each bed.
and limestones becoming sandy upwards with freshwater-oligohaline ostracods referred to as the freshwater Purbeck facies. These facies demonstrate a gradual change from marine Portland conditions to the more or less freshwater beds of the Purbeck.

*Fabanelia* was found in facies (i), (ii) and (iii) and it was noticed that there seemed to be a slight difference in size between specimens in each of the three facies.

All the specimens of *Fabanelia* were measured from the bed in each facies with the largest number of specimens; the results for each locality are shown in figures 8 and 9. Histograms are drawn for the lengths of the ostracods from the various beds at each locality. Inspection shows that the range of length of the instars overlap. To calculate the separate statistics for the instars represented, the results were plotted on arithmetic probability paper. A normal distribution plotted on this paper produces a straight line, and if a bimodal or polymodal distribution is made up from a series of normal distributions then a curve will be produced which is the resultant of two or more straight lines. Using a method described by Harding (1949) the position of these straight lines can be found and from them can be obtained the proportions, means and standard deviations of the respective populations.

The means of the various populations in each bed obtained
Fig. 9. The relative lengths of specimens of *Fabanelia polita* from beds in the three sections.
The range (\(X \pm 2\sigma\)) is indicated for each bed.
in this way have been superimposed on the histograms. The ranges \( (\bar{X} \pm 2s) \) have also been calculated and are indicated.

From figures 2 and 3 it can be deduced that there is a significant difference between the mean lengths of the largest instars present at any particular horizon in the Bugle Pit. The results can be easily compared, e.g. the histograms for the Bugle Pit show a gradual decrease in size from the marine facies at the base (Bed 8) through the euryhaline to the freshwater-oligohaline beds at the top (Bed 19). This gradual decrease in size is not so distinct at the other two localities.

On comparing the size distribution of both species from the Bugle Pit with those from the two other localities it is found that some of the samples are too small to give a clear indication of the size distribution.

In the North Whitchurch section specimens of Bed 15 have a similar size distribution to Bed 19 of the Bugle Pit and so probably represent freshwater-oligohaline conditions. Beds 6 and 8 at North Whitchurch, however, have a similar size distribution to Bed 8 at the Bugle Pit and so probably represent marine conditions.

The specimens from Warren House Farm, Beds 8 and 11, have a similar size distribution to Bed 12 of the Bugle Pit and probably indicate brackish or fluctuating conditions,
Fig. 10 The relationship between the size distributions of Figs. 1 and 2, and, in the central column, the proportions of the ostracod faunas in each bed.
whereas Bed 2 has a distribution similar to Bed 8 of the Bugle Pit and probably indicates marine conditions. At this locality the marine ostracods are found throughout the section and at the higher horizons they are associated with euryhaline and even freshwater-oligohaline ostracods. This suggest some form of post-mortem mixing which might occur in three ways: (a) re-working of the freshwater-oligohaline and possibly euryhaline ostracods, so that they are redeposited in a marine environment; (b) in times of flood, the washing of freshwater-oligohaline and euryhaline ostracods into the marine environment; (c) seasonal variation in salinity so that the various faunas could live in the same locality at different times of the year.

Specimens of other genera obtained from each bed can be separated into faunas according to whether they are freshwater-oligohaline, euryhaline or marine species, and the percentages of each in the particular beds dealt with earlier worked out. In figure 19, the relative percentages of the three faunas are compared to the standard deviations of the Fabanella in each bed. It can be seen that a dominantly marine fauna is associated with large-sized Fabanella, a dominantly euryhaline fauna with medium-sized Fabanella, and a freshwater-oligohaline fauna with the small Fabanella.

From the above it would seem that it is possible to distinguish the environment of a particular bed according to
the size distribution of the euryhaline ostracods present in the bed.

It is interesting to note that in the report by Kruit & Andel (1955) on the Sediments of the Rhone Delta, the ostracod Cyprideis littoralis (Brady) forma littoralis (Brady) occupies a similar environment to that postulated for the species of Fabanella in the Portland and Purbeck Beds. Kruit and Andel came to the conclusion that specimens of Cyprideis littoralis in the marine environment of the Rhone Delta slope were re-worked from terrestrial deposits close by, i.e. they were allochthonous. However, this species is also found in the lakes of the Rhone Delta under conditions varying from oligohaline to supersaline. Fabanella species have also been found in supersaline deposits of the Lower Purbeck Beds of the Dorset coast (Anderson, 1958, p. 128). This, together with the evidence suggested above, would indicate some similarity between Fabanella and Cyprideis species.

Recent Ostracods from the Tamar Estuary

On account of this curious change in size in the fossil ostracods, I decided to examine recent euryhaline faunas to see if a similar size distribution is to be found. The estuary of the River Tamar was chosen because Percival (1929) had reported on the fauna of the Tamar and Lynher, excluding
the ostracods but including a salinity gradient up the estuary which later workers have found to be reasonably characteristic of a fine summer. During 1963-1964 several workers at the Plymouth Laboratory of the Marine Biological Association carried out extensive physical and faunistic studies of the Tamar estuary (see Milne, 1938; Spooner & Moore, 1940). With the permission of the Director of the Plymouth Laboratory, and with the help of the staff, I was able to collect mud samples from the sea at Drake's Island and from other places as far inland as Gunnislake, at which point the river has become freshwater. Samples were taken from between the tide marks except at Saltash and Gunnislake. Samples were collected from Drake's Island about 2 hours before High Water. From Cremyll about 90 minutes before High Water, from the channel below Saltash bridge about one hour before High Water, and from Neil Point and Cargreen about half an hour before and during High Water. The samples from Weirquay and above were collected from below water in the inter tidal areas. The sample from Gunnislake was collected from sandy gravel beneath the eastern arch of the bridge. The mud samples were washed and dried to bring them to conditions similar to fossil specimens and the ostracods picked out.

The following species of ostracods were obtained from localities with marine salinities as determined by Percival:
Carinocythereis sp. Ruggieri, Pterygocythereis jonesi (Baird), Loxoconcha guttata (Norman), and Costa sp. Neviani.

The following species were obtained from a number of localities with salinities varying from marine to oligohaline: Leptocythere castanea Sars, and Loxoconcha impressa (Baird).

Aurila convexa (Baird) was found in marine to mesohaline conditions only. Candona candida (O.F. Müller) was the only ostracod obtained from a freshwater environment.

Figure 11 indicates the localities on the River Tamar from which collections were made. Also on this diagram is a simplified version of the salinity gradient obtained by Percival. The size distributions of Leptocythere castanea Sars and Loxoconcha impressa (Baird) obtained from various localities are shown as histograms. The histograms show a sharp decrease in size between Cargreen and Weirquay, which correlates with a sharp decrease in salinity on the salinity gradient.

It should also be noted that the collections of recent ostracods were made during August and September 1961 and that collections made at other times of the year may not be quite the same, owing to variations in the breeding and feeding habits of the ostracods throughout the year, and to the reduction of salinity during winter spates.
Fig. II. A composite diagram to show the collection points on the River Tamar compared to a graph of the variation of salinity with distance from the sea and also to the size distributions of *Loxocochna impressa* and *Leptocythere castanea* at the various localities.
Factors Controlling Size

The evidence of both fossil and recent ostracod faunas indicated above shows a significant correlation between salinity and size. Salinity, however, is not necessarily the controlling factor since other environment conditions may be correlated with salinity and these may be responsible for the variations in size, for example temperature, current action and pH.

Salinity:

Faunas which are adapted to narrow ranges of salinity would be unable to adapt themselves to other salinities. Features such as stunting might develop and eventually the animals would die off. However, the euryhaline faunas capable of existing in a wide range of salinities might be able to make use of the increased salts in the more saline waters for the construction of larger carapaces.

In the Portland and Purbeck sediments determination of the salinity can be made between broad limits indicated by the association of fossils, minerals and sedimentation.

In the River Tamar the effect of the tide is very strong, carrying large quantities of fine grade material in suspension, some of which is left behind as it retreats. Amongst the suspension could be ostracod larvae some of which could be stranded by the tide but continue to exist in the interstitial water which in an estuary at low tide is more
saline than the water above it (Reid, 1930, 1932; Alexander, Southgate & Bassindale, 1932). When the larvae become strong enough they would be able to migrate downstream to more saline conditions with the help of later tides. In this way marine forms might adjust themselves to freshwater conditions, but it would be more difficult for freshwater forms to adjust themselves to salt water. Also, only the smaller juvenile forms would be found upstream. It is difficult to determine from the histograms in figure II whether the decrease in size is in the adult form or due to juvenile moult stages. This could only be determined by further sampling but just from inspection it would appear that the change in size was in the adult form.

Temperature:

The most important competitor to salinity is probably the effect of differences in temperature. This is borne out by the evidence of Elofson (1941) who verified Skogsberg's 1920 findings that *Philomedes globosus* was larger in the colder waters near Greenland than in the North Sea and the Skagerak. He also found that *Cytherura nigrescens* (Baird) from one locality were larger in each instar in winter than in summer.

Fischer-Piette (1931, 1933) compared the distribution of various species (not ostracods) mainly occurring on rock substrata in the Rance estuary, France. Observations
during unusually wet and unusually dry years showed that salinity and not temperature is the factor controlling the limit of penetration of many estuarine species.

Milne (1938) showed that there was an increase in the range of temperature from Drake's Island to Saltash. Sharp changes of temperature would cause reduced activity and if this occurred during moulting some reduction in growth could be expected. In the summer large changes in temperature would occur, e.g. when the tides washed over the hot mud flats. Extremes of temperature would occur on the whole infrequently and only for a short period, longer periods of course would be lethal. Salinity decreases upstream and for an ostracod in a particular place and season is fairly constant since they live mostly in the interstitial water. The most constant control is salinity, any changes in which would affect the ostracods for long periods.

Current action:

In fossil forms there is the possibility of current action which would sort the valves into sizes. However, the modes of the histograms, especially that of the Bugle Pit, occur in intermediate positions, i.e. in figure 9, the mode for the largest forms in Bed 12 of the Bugle Pit section is between the largest two modes of Bed 8, and is just in front of the largest mode in Bed 19. No method of current sorting could create modes between instars.
III.

In a normal river there is a decrease in size of sediment downstream. However, in tidal estuaries sedimentation is also from the sea, the finest sediment being carried farthest upstream in the tidal region. There is also some grading of the sediment across a river or estuary with the finest sediment being near the bank and the coarsest in the main river channel. Thus two systems of sedimentation are at work and the sediment is passed up and down the river, being reworked all the time. The samples were in all cases from the muddy silty material. Therefore, since the ostracods are much larger in size than the silt they are found in, the effect of sediment sorting would be of consequence in juvenile and larval stages as mentioned earlier.

Preparation of samples:

As all samples were prepared in the same manner any effect of preferential breakage of the larger specimens should give the same results in each sample.

Other factors:

Little is known about the effects of redox potential and hydrogen ion concentration on size. Milne (1938) showed that in the Tamar estuary there was apparently no correlation between pH and salinity.

Conclusion

From the above discussion it is suggested that the
variation in the size of euryhaline ostracods is likely to be caused by changes in the salinity of the water. This decrease in size with decrease in salinity is corroborative evidence for the idea that in the Aylesbury district there was a transition from marine Portland conditions to fresh-water conditions towards the end of the Jurassic period.
Ostracods from the Portland Beds of Dorset

Ostracods have been examined from Portland Beds at the following localities in Dorset; Poxwell Quarry SY/743835, Hounstout Cliff, SY/952772, Friar Waddon from beside the track above Corton Farm SY/636855 and West Weare Cliff SY/681720. Samples from other localities were also examined but yielded no ostracods.

Samples from the Cherty Series to the Lower Purbeck Beds of Poxwell Quarry have yielded the fauna shown in figure 12.

An interesting feature of this diagram is the way the ostracod fauna indicates the Portland Purbeck boundary. The Roach and beds below it contain a marine ostracod fauna described below, whereas the laminated limestones and the beds above contain a brackish water fauna. Cypridea dunkeri papulata occurs at the very top of the section.

Samples from the Portland Sand also have a characteristic fauna. Beds from ten feet below the Massive Bed to the Lower Parallel Band at Hounstout Cliff have yielded the ostracods shown in figure 13. At West Weare Cliff beds from ten feet below the Black Nore Sandstone to the Basal Shell Bed have yielded the ostracods shown in figure 14.
The Portland Sand at Friar Waddon consists of about twenty-five feet of green cementstones with occasional *Exogyra* scattered through them. These beds mark the upper middle part of the Portland Sand and they have a fauna slightly different from those of Hounstout Cliff and West Weare Cliff. This is probably because the beds are more sandy. The ostracods obtained are shown in figure 15. Samples of the sands beside the track at Coryates SY/630857, just west of Corton farm were also collected. These sands are below the cementstones mentioned above but did not contain ostracods.

From the diagram figure 15 it can be seen that this set of samples from Friar Waddon has a reduced fauna which shows similarities to both the Portland Stone and the Portland Sand faunas. It would appear therefore that it is not yet possible to separate the Portland Sand and Stone by using the ostracods alone.
Key to figures 12 - 15

x = Sampling position

Massive limestone

Thinly bedded limestone

Shaly limestone

Marl

Black clays

Sandstone

Exogyra Bed

Black shales

Alternating sands and shales

Nodules

Dirt bands

Tufa
Paraschuleridea eusarca
Protocythere serpentina
Progonocythere bicosta
Orthonotocythere laevis
Orthonotocythere rimosa
Macrodentina (M) transiens
Macrodentina (D) retirugata
Macrodentina (N) rugulata
Paracypris sp. ?
Mantelliana purbeckensis
Fabanella ansata
Fabanella polita
Theriosynoeum forbesii
Cypridea dunkeri papulata

Fig. 12. Diagram to show the distribution of the ostracod fauna in the section at Foxwell Quarry.
Fig. 13. Diagram to show the distribution of the ostracod fauna in the section at Hounstout Cliff.
Fig. 14. Diagram to show the distribution of the ostracod fauna in the section at West Weare Cliff.
Fig. 15. Diagram to show the distribution of the ostracod fauna in the section at Friar Waddon.
Paracypris? s. B. Schmidt

Paracypris? sp. B. Schmidt, 1955, p. 52, pl. 1, figs. 3-4.

Paracypris? sp. B. Schmidt, Oertli 1957, p. 653, pl. 1, figs. 19-22.

Material: one carapace and one valve from Bed P.Q. 7 and eight valves from Bed P.Q. 12 at Poxwell Quarry.

Description: Dimensions in mm. Proportions Specimen Number

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<th>L</th>
<th>H</th>
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<td>-</td>
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<td>Left valve juvenile</td>
<td>0.64</td>
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<td>-</td>
<td>1.00</td>
<td>0.39</td>
<td>-</td>
<td>Io 2169</td>
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Carapace is elongate, tapering to a pointed posterior. The dorsal margin is convex and smoothly curved, while the ventral margin is straight and very slightly concave. The greatest height is to anterior of the centre and the anterior margin is smoothly rounded. The carapace is narrowly pyriform in dorsal view, greatest inflation being at the position of greatest height and narrowing to the posterior.
Remarks: The few specimens (9 valves and fragments and 1 carapace) of Paracypris do not show any internal details and were found only in the Portland Stone of Poxwell Quarry.

Superfamily Cytheracea Baird 1850
Family Brachycytheridae Puri 1954
Genus Macrodentina Martin 1940
Subgenus Macrodentina Martin 1940

Macrodentina (Macrodentina) rugulata (Jones)
Syngeneic retirugata sp. nov. var. rugulata Jones 1885
p. 350, pl. 9, figs. 17, 18, 19, 20.

Cythere retirugata Jones var. rugulata Jones, Anderson
1941, p. 373, pl. 18, fig. 1,

Dictyocythere (Rhysocythere) rugulata (Jones) Sylvester-Bradley 1956, p. 18, pl. 4, figs. 1, 2, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15.

Macrodentina (Macrodentina) rugulata (Jones), Malz 1958,
p. 18, pl. 6, figs. 83, 84, 85, 86.


Description: Dimensions in mm. Proportions Specimen

<table>
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<th>Number</th>
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</thead>
<tbody>
<tr>
<td>Right</td>
<td>0.71</td>
<td>0.45</td>
<td></td>
<td>1.00</td>
<td>0.63</td>
<td></td>
<td>Io 2160</td>
</tr>
</tbody>
</table>
### Dimensions in mm. Proportions Specimen

<table>
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</thead>
<tbody>
<tr>
<td>Left valve</td>
<td>0.71</td>
<td>0.47</td>
<td>—</td>
<td>1.00</td>
<td>0.66</td>
<td>—</td>
<td>Io 2159</td>
</tr>
<tr>
<td>Right valve</td>
<td>0.60</td>
<td>0.35</td>
<td>—</td>
<td>1.00</td>
<td>0.58</td>
<td>—</td>
<td>Io 2161</td>
</tr>
<tr>
<td>Right valve (juv.)</td>
<td>0.47</td>
<td>0.27</td>
<td>—</td>
<td>1.00</td>
<td>0.57</td>
<td>—</td>
<td>Io 2162</td>
</tr>
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</table>

**Remarks:** specimens of *Macrodentina (M) rugulata* are only found in the Roach of Poxwell Quarry. These specimens as can be seen from the diagram figure 16, are much smaller than the specimens described from the Aylesbury district and Portesham Quarry, (Barker 1964 a and b). The largest forms from Poxwell have a paramphidont hinge and are therefore thought to be adult. The reasons for this reduction in size must be left unexplained until more specimens have been obtained from the Portland Stone of other localities.

*Macrodentina (Macrodentina) transiens* (Jones)  
*Cythere transiens* sp. nov. Jones 1885, p. 349, pl. 9, figs. 13, 14, 15, 16.

*Dictyocythere (Rhysocythere) transiens* (Jones)  
Sylvester-Bradley 1956, p. 19, pl. 3, figs. 11, 12, 13.

*Macrodentina (Macrodentina) transiens* (Jones), Malz 1958, p. 17, pl. 6, figs. 81, 82.

**Material:** fourteen valves and sixty-seven carapaces from
various beds on West Weare Cliff (see figure 13). 117 valves from various beds at Poxwell Quarry (see figure 12).

A carapace from Bed P.Q. 12 had the following dimensions:

Length = 0.58 mm., Height = 0.35 mm., Inflation = 0.33 mm.

Remarks: these specimens correspond in all details to those described in earlier sections.

Subgenus Dictyocycythere Sylvester-Bradley 1956

Macroductina (Dictyocycythere) retirugata (Jones)

Cythere retirugata sp. nov. Jones 1885, p. 350, pl. 9, figs. 21, 23.

Cythere retirugata sp. nov. var. textilis Jones 1885, p. 350, pl. 19, fig. 24.

Cythere retirugata Jones var. textilis Jones, Anderson 1941, pl. 18, fig. 3.

Cythere retirugata Jones var. decorata Anderson 1941, pl. 18, fig. 4.

Dictyocycythere (Dictyocycythere) retirugata (Jones)

Sylvester-Bradley 1956, p. 15, pl. 3, figs. 7-10, pl. 4, figs. 3, 4, 11, 16, 17.

Dictyocycythere (Dictyocycythere) decorata (Anderson)

Sylvester-Bradley 1956, p. 17, pl. 3, fig. 1.
119.

**Macrodentina (Dictyocythere) decorata** (Jones), Malz 1958, p. 25, pl. 6, figs. 87, 88.

**Macrodentina (Dictyocythere) textilis** (Jones), Malz 1958, p. 26, pl. 6, figs. 89, 90, 91.

**Material:** five valves from Bed P.Q. 12 at Poxwell Quarry.

61 valves and 3 carapaces from various beds at Hounstout Cliff (see figure 13). 158 valves and ten carapaces from various beds at Friar Waddon (see figure 15).

36 valves and 4 carapaces from Bed W.W. 9 at West Weare Cliff.

**Description:** Dimensions in mm. Proportions Specimens

<table>
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<tr>
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<th>I</th>
<th>Number</th>
</tr>
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<tbody>
<tr>
<td>Right valve ♀</td>
<td>0.70</td>
<td>0.45</td>
<td>-</td>
<td>1.00</td>
<td>0.64</td>
<td>-</td>
<td>Io 2153</td>
</tr>
<tr>
<td>Left valve ♀</td>
<td>0.70</td>
<td>0.52</td>
<td>-</td>
<td>1.00</td>
<td>0.74</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Carapace ♀</td>
<td>0.73</td>
<td>0.49</td>
<td>0.45</td>
<td>1.00</td>
<td>0.67</td>
<td>0.62</td>
<td>Io 2152</td>
</tr>
<tr>
<td>Carapace ♂</td>
<td>0.81</td>
<td>0.47</td>
<td>0.41</td>
<td>1.00</td>
<td>0.58</td>
<td>0.51</td>
<td>Io 2154</td>
</tr>
</tbody>
</table>

**Remarks:** these specimens correspond to those from the Aylesbury district in most respects except size in which they are smaller. They are presumably adult since they have the adult hinge.

**Subgenus Polydentina** Malz 1958

**Macrodentina (Polydentina) rudis** Malz 1958, p. 31, 32, pl. 12, figs. 1-8.

**Material:** three carapaces and 37 valves from Bed H. 7 and 3 carapaces from Bed H. 8 at Hounstout Cliff (see
figure 13). 4 valves from Bed W.W. 9 at West Weare Cliff (see figure 14).

<table>
<thead>
<tr>
<th>Description</th>
<th>Dimensions in mm.</th>
<th>Proportions</th>
<th>Specimen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L</td>
<td>H</td>
<td>I</td>
</tr>
<tr>
<td>Left valve</td>
<td>0.62</td>
<td>0.39</td>
<td>-</td>
</tr>
<tr>
<td>Carapace</td>
<td>0.68</td>
<td>0.39</td>
<td>0.33</td>
</tr>
<tr>
<td>Carapace</td>
<td>0.66</td>
<td>0.39</td>
<td>0.31</td>
</tr>
<tr>
<td>Carapace</td>
<td>0.73</td>
<td>0.37</td>
<td>0.31</td>
</tr>
</tbody>
</table>

The carapace is somewhat triangular in lateral outline. The dorsal margin is more or less straight, sloping down towards the posterior. The ventral margin is very slightly convex. The anterior margin is smoothly curved and meets the dorsal margin at a slight angle. At this position there is a slight swelling formed by the anterior hinge teeth and socket. The posterior margin is smaller than the anterior and bluntly rounded. The valves are inturned slightly on the dorsal margin. The ventral borders are inturned to form a concave ventral surface with straight margins to the valves. The greatest inflation is to the posterior. In dorsal view the sides are rather flat and the ends slightly pointed. The ventral margins of both valves are also slightly inturned. The left valve is larger than and over-reaches the right valve all round, most strongly to the anterior and
posterior. The males are longer than the females.

The lateral surfaces are reticulate, the dominant pattern being concentric round the margins and more or less vertical in the central region. There are many irregularly spaced normal pore canals to be found but no radial pore canals. Muscle scars are not seen. The hinge is paramphidont. The anterior socket in the left valve has a well developed dorsal margin and the anterior end of the median element is strongly developed. There are slight anterior and posteroventral vestibules. The line of concrescence follows the outer margins all round.

Remarks: this is the first recorded occurrence of Macrodentina (Polydentina) rudis in England.

Family Cytheruridae G.W. Müller 1894
Genus Orthonotacythere Alexander 1933

Orthonotacythere rimosa Martin
Pl. 11, figs. 7, 8, 11, 12.
Orthonotacythere rimosa Martin 1940, p. 335, pl. 6,
figs. 84, 85, 86.
Orthonotacythere cf. rimosa Martin, Martin 1961, p. 117,
pl. 14, fig. 21 a-c.

Material: 3 valves from Bed P.Q. 7 and 2 carapaces and 20
valves from Bed P.Q. 12 at Poxwell Quarry (see figure 12). 12 carapaces and 58 valves from various beds on Hounstout Cliff (see figure 13).

Measurements of two specimens are:

<table>
<thead>
<tr>
<th>Dimensions in mm.</th>
<th>Proportions</th>
<th>Specimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>H</td>
<td>I</td>
</tr>
<tr>
<td>Carapace</td>
<td>0.50</td>
<td>0.27</td>
</tr>
<tr>
<td>Right valve fragment</td>
<td>0.54</td>
<td>0.33</td>
</tr>
</tbody>
</table>

Remarks: these specimens correspond in all details with those described in earlier sections but the valves are usually badly encrusted.

Orthonotacythere labevis sp. nov.

Holotype: left valve from Poxwell Quarry. Length = 0.45 mm. Height = 0.25 mm.

Other Material: 3 right and 3 left valves from Bed P.Q. at Poxwell Quarry. Two right and 4 left valves from Bed H. 7 at Hounstout Cliff.

Diagnosis: Orthonotacythere with rounded caudal region and well rounded, smooth lateral surfaces.

Description: lateral outline subtrapezoidal with dorsal and ventral margins subparallel. Anterior margin is smoothly and evenly rounded, with the posterior margin obliquely rounded sharpest towards the dorsal margin. The greatest height is just posterior of the centre and
The greatest inflation is at the position of the greatest height.

The lateral surface is covered by many small, faint puncta. The valves are swollen more towards the ventral margins and most of all near the postero-ventral margin. The radial and normal pore canals are not seen, neither are the muscle scars. The hinge is antimerodont, and the inner margin and line of concretion coincide.

**Remarks:** this species is distinguished from other *Orthonotacythere* by its more rounded outline and smooth lateral surfaces.

*Orthonotacythere elongata* sp. nov.

_Pl. 12, figs. 9-11.

**Holotype:** left valve from Poxwell Quarry Bed P.Q. 12.

Length = 0.45 mm., Height = 0.25 mm.

**Other Material:** 108 valves and 25 carapaces, adults and juveniles from various beds at Hounstout Cliff (see figure 13).

**Diagnosis:** this species has the long straight hingeline of the genus but with valves which narrow quickly to the posterior. Adults have a reticulate ornament with a central sulcus from the dorsal border towards the venter. Juvenile forms have strong spines the most obvious of which is postero ventral.

**Description:** the lateral outline is somewhat triangular, the dorsal margin being long and straight, the ventral margin
Fig. 16. Diagrams to show the size distributions of Galliaecytheridea postrotunda from Bed H.8, Orthonotocythere elongata and O. rimosa from Bed H.7, and also Macrodentina (Macrodentina) rugulata from P.Q.8.
being slightly irregularly convex and closing with the dorsal margin forming a blunt point. The anterior margin is smoothly rounded but forms a slight angle with the dorsal margin. The greatest inflation is centrally since the dorsal outline is sub rectangular and the greatest height is near the anterior.

The lateral surfaces are reticulate with a major ridge running parallel to the dorsal margin just ventral of the centre of the valve and ending before reaching the anterior and posterior borders. Towards the posterior this ridge becomes stronger to form a slight ala and may be at the position of greatest inflation. There is a central deep narrow sulcus from the dorsal margin almost to the venter of each valve.

The internals of the valves are not seen but the hinge consists of notched terminal teeth with straight connecting crenulate socket. The line of concrescence appears to be parallel to the inner margin.

Remarks: this species of Orthonotocythere differs from other species by its characteristic shape, see plate 16. Proportions of adults and juveniles are given in figure 16.

Family Progonocytheridae Sylvester-Bradley 1948
Subfamily Progonocytherinae
Genus Progonocythere

Progonocythere bicosta sp. nov.


Length = 0.54 mm., height = 0.29 mm.

Other material: 23 left valves and 12 right valves from various beds at Poxwell Quarry.

Diagnosis: subelliptical in lateral outline with a concave ventral surface and a sharp ventro-lateral angle. The lateral surfaces are smooth except for a slight ridge running just below middle height.

Description: Dimensions in mm. Proportions Specimen

<table>
<thead>
<tr>
<th>Specimen</th>
<th>L</th>
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<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left valve</td>
<td>0.45</td>
<td>0.29</td>
<td>-</td>
<td>1.00</td>
<td>0.65</td>
<td>-</td>
<td>Io 2751</td>
</tr>
<tr>
<td>Left valve</td>
<td>0.49</td>
<td>0.31</td>
<td>-</td>
<td>1.00</td>
<td>0.63</td>
<td>-</td>
<td>Io 2750</td>
</tr>
</tbody>
</table>

Lateral outline subelliptical. Both the dorsal and ventral margins are smoothly and strongly convex. The anterior is slightly pointed and the posterior is slightly drawn out to a point, particularly in the left valve. The right valve is longer but less high than the left.

Both valves are strongly swollen near the ventral margins to form a sharp angle or ridge and a ventral surface which is flat and slopes inwards. The inner ventral margin of the valves is almost straight. On the lateral surface there is a slight sigmoidal shaped
ridge a short distance above the antero-ventral margin. The lateral surfaces are smooth. Muscle scars are in a vertical row of four to the anterior of the centre at the position of greatest height. The normal and radial pore canals are not seen. The hinge is entomodont and the line of concrecence coincides with the inner margin.

**Remarks:** this species can be easily recognised by its characteristic shape, particularly the sharp angle between the lateral and ventral surfaces.

Subfamily Protocytherinae

Genus **Protocythere** Triebel 1938

**Protocythere serpentina** (Anderson)

*Cythereis serpentina* sp. nov. Anderson 1941, p. 375, pl. 19, fig. 12.

**Protocythere sigmoidea** n. sp. Steghaus 1951, p. 219, 220, pl. 15, figs. 42-45.

**Protocythere bireticulata** n. sp. Malz 1958, p. 39, pl. 11, fig. 69.

**Protocythere sigmoidea** Steghaus 1951, Fernet 1960, pl. 1, figs. 11-13.

**Protocythere serpentina** (Anderson 1941), Oertli 1963, p. 22, 23, pl. 7, fig. 57.
Material: 75 valves and 7 carapaces from various beds at Poxwell Quarry (see figure 13). 2 valves from Bed W.W. 9 and 2 carapaces from Bed W.W. 13 at West Weare Cliff. 11 valves and 2 carapaces from various beds at Friar Waddon (see figure 15).

Remarks: these specimens show the same wide variation of ornament as was indicated for the specimens from the Aylesbury district.

Description: Dimensions in mm. Proportions Specimen

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</thead>
<tbody>
<tr>
<td>Left valve</td>
<td>0.79</td>
<td>0.41</td>
<td>-</td>
<td>1.00</td>
<td>0.52</td>
<td>-</td>
<td>Io 2747</td>
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<tr>
<td>Right valve (juv)</td>
<td>0.54</td>
<td>0.25</td>
<td>-</td>
<td>1.00</td>
<td>0.46</td>
<td>-</td>
<td>Io 2745</td>
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<tr>
<td>Left valve (juv)</td>
<td>0.62</td>
<td>0.33</td>
<td>-</td>
<td>1.00</td>
<td>0.53</td>
<td>-</td>
<td>Io 2171</td>
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<tr>
<td>Right valve</td>
<td>0.83</td>
<td>0.43</td>
<td>-</td>
<td>1.00</td>
<td>0.52</td>
<td>-</td>
<td>Io 2746</td>
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</table>

Family Cytheridae

Subfamily Cytherideinae Sars 1925

Genus Galliaecytheridea Oertli 1957

Galliaecytheridea wolburgi (Steghaus 1951)

Cyprideis wolburgi n. sp. Steghaus 1951, p. 213, pl. 14, figs. 24, 25; pl. 15, fig. 26.

Cyprideis wolburgi wolburgi (Steghaus 1951), Schmidt 1955.
127.

*Cyprideis wolburgi minuta* n. subsp. Schmidt 1955

p. 58, pl. 2, fig. 27-30.

*Galliaecytheridea wolburgi* (Steghaus 1951), Oertli 1957, p. 657, 658, pl. 2, figs. 56-60, pl. 3, figs. 61-68.

**Material:** numerous valves and carapaces from various beds at Hounstout Cliff (see figure 13). 62 valves and 16 carapaces from various beds at West Weare Cliff (see figure 14).

**Remarks:** these numerous specimens are characteristic of the species in shape and hinge but are much larger than the French material, \( \bar{x} \pm 2s \) for 24 males = 1.00 \( \pm 0.12 \) mm., \( \bar{x} \pm 2s \) for 52 females = 0.83 \( \pm 0.06 \) mm.

**Description:** Dimensions in mm. Proportions Specimen

<table>
<thead>
<tr>
<th>Carapace</th>
<th>L</th>
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<th>I</th>
<th>Number</th>
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<tbody>
<tr>
<td>🌞</td>
<td>0.83</td>
<td>0.50</td>
<td>0.39</td>
<td>1.00</td>
<td>0.60</td>
<td>0.47</td>
<td>Io 2158</td>
</tr>
<tr>
<td>Right valve</td>
<td>🌞</td>
<td>0.83</td>
<td>0.45</td>
<td>-</td>
<td>1.00</td>
<td>0.54</td>
<td>-</td>
</tr>
<tr>
<td>Left valve</td>
<td>♂</td>
<td>0.97</td>
<td>0.54</td>
<td>-</td>
<td>1.00</td>
<td>0.56</td>
<td>-</td>
</tr>
<tr>
<td>Right valve</td>
<td>♂</td>
<td>0.96</td>
<td>0.49</td>
<td>-</td>
<td>1.00</td>
<td>0.51</td>
<td>-</td>
</tr>
<tr>
<td>Carapace</td>
<td>♂</td>
<td>1.12</td>
<td>0.60</td>
<td>0.49</td>
<td>1.00</td>
<td>0.54</td>
<td>0.44</td>
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</table>

This is the first time *Galliaecytheridea wolburgi* has been recorded in England.

*Galliaecytheridea postrotunda* Oertli

p. 656, 657, pl. 2, figs. 45-55.
Material: numerous specimens from various beds at Hounstout Cliff (see figure 3).

Remarks: these specimens correspond to the type and the size distribution as indicated in figure 3, showing a slight difference in length between males and females.

<table>
<thead>
<tr>
<th>Description</th>
<th>Dimensions in mm.</th>
<th>Proportions</th>
<th>Specimen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L</td>
<td>H</td>
<td>I</td>
</tr>
<tr>
<td>Left valve</td>
<td>0.73</td>
<td>0.41</td>
<td>-</td>
</tr>
<tr>
<td>Carapace</td>
<td>0.66</td>
<td>0.39</td>
<td>0.29</td>
</tr>
<tr>
<td>Carapace</td>
<td>0.50</td>
<td>0.29</td>
<td>0.21</td>
</tr>
</tbody>
</table>

This is the first time *Galliaecytheridea postrotunda* has been recorded from England.
Genus *Paraschuleridea* Swartz and Swain

*Paraschuleridea eusarca* (Anderson)  
Pl. 10, figs. 2, 3, 9, 10.  
*Cytheridea eusarca* sp. nov. Anderson 1941, p. 376,  
pl. 19, fig. 15.

**Material:** over 200 valves and carapaces from various beds  
at Poxwell Quarry (see figure 12). 2 carapaces and 5  
valves from Bed F.W. 7 and 3 valves from Bed F.W. 11  
at Friar Waddon.

**Description:** Dimensions in mm.  
Proportions  
Specimen

<table>
<thead>
<tr>
<th></th>
<th>L</th>
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<th>L</th>
<th>H</th>
<th>I</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Left valve</strong></td>
<td>0.68</td>
<td>0.37</td>
<td></td>
<td>1.00</td>
<td>0.54</td>
<td></td>
<td>10 2748</td>
</tr>
<tr>
<td><strong>Left valve</strong></td>
<td>0.60</td>
<td>0.39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>fragment</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Left valve</strong></td>
<td>0.56</td>
<td>0.29</td>
<td></td>
<td>1.00</td>
<td>0.52</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The lateral outline is subelliptical with the  
dorsal margin being more convex than the ventral. The  
anteor is slightly blunter than the posterior. The  
ventral margin is slightly sinuous, i.e. it becomes  
slightly concave just below the muscle scars. The  
dorsal outline is elliptical and the left valve over-  
reaches the right valve. The right valve is less  
high than the left valve but only slightly shorter in  
length. The right valve has a slightly concave  
venter and the greatest height to anterior of the centre.  
The surface is smooth with some irregularly spaced
normal pore canals. There are about 18 straight irregularly spaced radial pore canals to the anterior border and up to 10 on the posterior border. The hinge is hemimerodont. The line of concrescence and inner margin coincide and the selvage forms a fairly strong lip in the left valve. Muscle scars are a vertical row of four just anterior of the centre, with one large frontal scar.

Remarks: this species has been placed in the genus *Paraschularidea* because of its hemimerodont hinge, otherwise its lack of distinctive features makes it difficult to place generically.

Family Cytherellidae Sars 1866
Genus *Cytherelloidea* Alexander 1933

*Cytherelloidea paraweberi* Oertli


**Material:** 1 carapace from Bed W.W. 9 at West Weare Cliff. 3 valves and 1 carapace from Bed F.W. 4 at Friar Waddon.

The carapace from Bed W.W. 9 measures:
Length 0.68 mm, height 0.39 mm., inflation 0.25 mm.

**Remarks:** very few specimens are found but they correspond closely with the type specimen.
Explanation to Plate 7

*Macrodentina (Dictyocythere) retirugata*

All specimens from Hounstout Cliff, Bed 6 and now stored in the collections of the British Museum.

1) Left view of carapace ♀, length = 0.79 mm., Io 2152
2) Internal view of right valve ♀, length = 0.70 mm., Io 2153
3) Right view of carapace ♀, Io 2152
4) Dorsal view of carapace ♀, Io 2152
5) Right view of carapace ♂, length = 0.83 mm., Io 2154
6) Dorsal view of carapace ♂, Io 2154
7) Left view of carapace ♂, Io 2154
8) External view of right valve, Io 2153
Explanation to Plate IV

Galliaecytheridea wolburgia

All specimens from Hounstout Cliff, Bed 7 and now stored in the collections of the British Museum.

1) Internal view of left valve ♂, length = 1.02 mm., Io 2155
2) External view of left valve ♂, Io 2155
3) Dorsal view of carapace ♂, length = 1.12 mm., Io 2156
4) Internal view of right valve ♂, length = 0.98 mm., Io 2157
5) External view of right valve ♂, Io 2157
6) Left view of carapace ♀, length = 0.85 mm., Io 2158
7) Right view of carapace ♀, Io 2158
8) Dorsal view of carapace ♀, Io 2158

Macrodentina (Macrodentina) rugulata

All specimens from Hounstout Cliff, Bed 6 and now stored in the collections of the British Museum.

9) External view of left valve, length = 0.72 mm., Io 2159
10) External view of right valve, length = 0.73 mm., Io 2160
11) External view of right valve juvenile, length = 0.62 mm., Io 2161
12) External view of right valve juvenile, length = 0.46 mm., Io 2162

Macrodentina (Macrodentina) transiens

Specimens from Poxwell Quarry, Bed 12 and now stored in the collections of the British Museum.

13) Right view of carapace, length = 0.79 mm., Io 2163
14) Left view of carapace, Io 2163
15) Dorsal view of carapace, Io 2163
Explanation to Plate 19.

Galliaecytheridea postrotunda
All specimens from Hounstout Cliff, Bed 8 and now stored in the collections of the British Museum.

1) Right view of carapace, length = 0.66 mm., Io 2164
2) Right view of carapace juvenile, length = 0.50 mm., Io 2165
3) Dorsal view of juvenile carapace, Io 2165
4) Left view of carapace, Io 2164
5) Left view of carapace juvenile, Io 2165
6) External view of left valve, length = 0.73 mm., Io 2166

Cytherelloidea paraebergeri
Specimens from Friar Wadden, Bed 5 and now stored in the collections of the British Museum.

7) Right view of carapace, length = 0.68 mm., Io 2167
8) Dorsal view of carapace, Io 2167
9) Left view of carapace, Io 2167

Paracypris sp.
All the specimens are from Poxwell Quarry, the carapace from Bed 1 and the valves from Bed 12. They are now stored in the collections of the British Museum.

10) Right view of carapace, length = 0.79 mm., Io 2168
11) Left view of carapace, Io 2168
12) External view of juvenile left valve, length = 0.64 mm., Io 2169
13) External view of left valve, length = 0.75 mm., Io 2170
Explanation to Plate 16

Protocythere serpentina

All specimens are from Poxwell Quarry, Bed 12 and now stored in the collections of the British Museum.

1) External view of juvenile left valve, length = 0.62 mm., Io 2171
2) External view of juvenile right valve, length = 0.50 mm., Io 2745
3) External view of right valve, length = 0.79 mm., Io 2746
4) External view of right valve, length = 0.79 mm., Io 2746
5) Internal view of right valve, Io 2746
6) External view of left valve, length = 0.83 mm., Io 2747
7) Internal view of left valve, Io 2747

Paraschuleridea eusarca

All specimens from Poxwell Quarry, Bed 12 and now stored in the collections of the British Museum.

2) External view of left valve, length = 0.68 mm., Io 2748
3) Internal view of left valve, Io 2748
4) External view of juvenile right valve, length = 0.56 mm., Io 2749
5) Internal view of right valve, Io 2749
Explanation to Plate I)

Progonocythere bicosta
All specimens from Poxwell Quarry, Bed 12 and now stored in the collections of the British Museum.
1) Internal view of left valve, length = 0.48 mm., Io 2750
2) External view of left valve, Io 2750
3) External view of left valve, length = 0.43 mm., Io 2751
4) Dorsal view of left valve, Io 2750
5) External view of right valve, length = 0.54 mm., Io 2752
6) Ventral view of right valve, Io 2752
9) Dorsal view of right valve, Io 2752

Orthonotacythere rimosa
All specimens from Poxwell Quarry, Bed 12 and now stored in the collections of the British Museum.
7) External view of right valve, length = 0.52 mm., Io 2753
8) Right view of juvenile carapace, length = 0.50 mm., Io 2754
11) Left view of juvenile carapace, Io 2754
12) Dorsal view of juvenile carapace, Io 2754

Orthonotacythere laevis
All specimens from Poxwell Quarry, Bed 12, and now stored in the collections of the British Museum.
10) Internal view of left valve, length = 0.45 mm., Io 2755
13) External view of left valve, Io 2755
14) External view of left valve, length = 0.45 mm., Io 2756
Explanation to Plate 12

Macrodentina (Polydentina) rudis

All specimens are from Hounstout Cliff, Bed 7 and are now stored in the collections of the British Museum.

1) Left view of carapace ♂, length = 0.73 mm., Io 2757
2) Right view of carapace ♂, Io 2757
3) Left view of carapace ♀, length = 0.66 mm., Io 2758
4) Right view of carapace ♀, Io 2758
5) Dorsal view of ♂ carapace, Io 2757
6) External view of ♀ left valve, length = 0.64 mm., Io 2759
7) Internal view of ♀ left valve, Io 2759
8) Dorsal view of ♀ carapace, Io 2758

Orthonotacythere elongata

All specimens are from Hounstout Cliff, Bed 7 and are now stored in the collections of the British Museum.

9) Left view of carapace, length = 0.52 mm., Io 2760
10) Dorsal view of carapace, Io 2760
11) Right view of carapace, Io 2760
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