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Cenomanian Ostracoda from Southern England: their Taxonomy, Stratigraphy and Palaeoecology

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Cenomanian Ostracoda from Southern England : their Taxonomy, Stratigraphy and Palaeoecology.

by

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Thesis submitted for the Degree of Doctor of Philosophy of the Council for National Academic Awards.

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ABSTRACT

Eight sections of Cenomanian Chalk from Southern England have been examined for their Ostracoda. A total of 111 species and 3 sub-species have been found and these fall into 47 genera. 38 of these species have been previously described, 47 are new and the rest have been left under open nomenclature. A generalised distribution chart for some of the more important species has been drawn up and the distribution of species in each individual section has been compared to this chart. As a result it can be seen that Ostracoda can be very useful in stratigraphic work in the Cenomanian. Their stratigraphy has been related to the macrofossil zonations and in particular to the Foraminiferal zonation.

The Ostracoda indicate that normal marine salinities prevailed throughout the Cenomanian period in Southern England and that temperatures were probably in excess of $10^{\circ}C$. Distinct changes in the ostracod fauna during the Cenomanian may be due in part to an increasing temperature but some of the changes appear to be related to an increase in sea depth. The presence of numerous small specimens in the Middle and Upper Cenomanian may indicate very quiet conditions of deposition during which oxygen levels were reduced.

The ostracod fauna from Southern England has more affinity to the fauna described from the eastern part of the Paris Basin and the southern Alpine region of France than with other areas in France.

CHAPTER 1

INTRODUCTION

In recent years there has been a great deal of interest in mid-Cretaceous stratigraphy and a project has been set up within the International Geological Correlation Programme (I.G.C.P.) entitled "Mid-Cretaceous Events". This project represents an attempt to bring together all the available information on biostratigraphical zonations of the mid-Cretaceous (Albian to Coniacian interval), and to synthesise these into one framework. Van Hinte,(1976) produced an extensive paper on the biostratigraphical zonation of the Cretaceous period but there is still much work to be done, particularly on Upper Cretaceous Ostracoda. Our knowledge of this group from the Upper Cretaceous of Western Europe is rather patchy. Many recent papers have been produced on Cenomanian and Turonian Ostracoda from France (Fig. 1:1),and Maastrichtian Ostracoda have been extensively studied by Van Veen (1932 - 1938),Herrig (1966),and Deroo (1966). In this work Cenomanian Ostracoda from Southern England are examined and their stratigraphy is related to the macrofaunal stratigraphy produced by Kennedy (1969, 1970),and to the foraminiferal stratigraphy produced by Hart and Carter (1975),and Carter and Hart (1977).

The first reference to British Cenomanian Ostracoda is in a work by Williamson (1848), in which 5 species were figured from the chalk detritus (mainly Cenomanian) from Charing, Kent. Later Jones (1849),and Jones and Hinde (1890),described many species of Ostracoda from the British Cretaceous. Quite a few of their species were of Cenomanian age, coming from the chalk detritus from Charing or from the Lower and Middle Cenomanian from Didcot,(Berks) and Dover, Kent. Chapman (1898) also described Cenomanian Ostracoda from the Cembridge Greensand of Cambridgeshire. Apart from some revisions of these early works by Kaye (1964c) the only other work on British Cenomanian Ostracoda is by Keen and Siddiqui (1971) in which 9 species are described from the Carr's Glen Shell Bed, Belfast.

Studies of lower Cretaceous Ostracoda from Britain have, however, been extensive. Neale (1960, 1962) described the Berriasian to Barremian Ostracoda from Yorkshire, whilst Kaye (1964b) and Kaye and Barker (1965) have examined Aptian Ostracoda from England. Albian Ostracoda were listed by Chapman and Sherborn (1893), and more recently have been studied in detail by Kaye (1963 - 1965). Apart from the works of Keen and Siddiqui (1971), Kaye (1964c), and the early work of Jones (1849) and Jones and Hinde (1890) the only other account of Upper Cretaceous Ostracoda from Britain is in an unpublished Ph.D. thesis on the Upper Campanian and Maastrichtian Ostracoda from Norfolk by King (1968).

On the Continent there has been considerable interest in Cretaceous Ostracoda. The early work was completed by Bosquet (1847, 1852), Cornuel (1846, 1848), Reuss (1845-1874) and Roemer (1838, 1840). This has been followed up by a vast amount of papers over the last 80 years. The works which are most relevant to this study are shown in Fig. 1:1. This shows that most of the studies of Cenomanian Ostracoda have centred on France. Papers by Babinot (1970, 1971), Colin (1973, 1974a, 1974b), Damotte (1971a, 1971b, 1975), Damotte and Grosdidier (1963), Donze and Porthault (1972) and Donze and Thomel (1972) have shown how Cenomanian Ostracoda can be

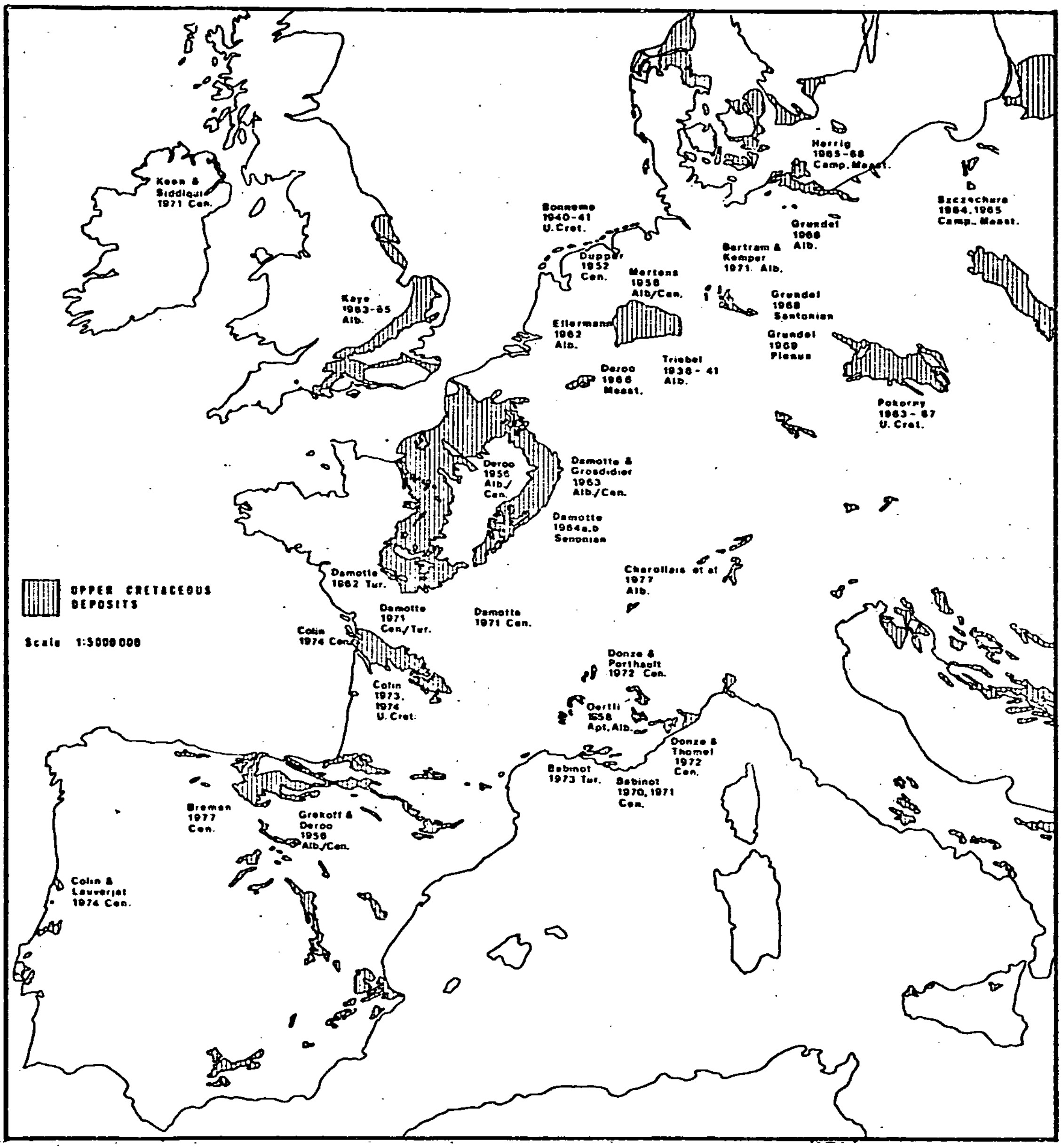


Fig.1:1 Outcrop of Upper Cretaceous deposits in Western Europe, with some of the more important publications on Middle and Upper Cretaceous Ostracoda which have appeared in the last 40 years.

important both stratigraphically and palaeoecologically. A paper summarising the stratigraphy and palaeoecology of Cenomanian Ostracoda from France has recently been produced by Babinot et.al.(in press). This work has revealed distinct "ostracod provinces" during the Cenomanian. Unfortunately the Cenomanian ostracod fauna from Germany has not been fully described but the species which have been recorded, (Gründel 1966), show a good correlation with the British forms.

From outside of Western Europe there are numerous papers on Cretaceous Ostracoda. At the species level however there is poor correlation between Western Europe and other areas during the Cenomanian. Ascoli (1976) has shown that there is a reasonable correlation between the ostracod faunas of Europe and the Scottian Shelf, off E.Canada, up to the beginning of Cenomanian times but after this the faunas become increasingly dissimilar. This fact is obviously related to the opening of the north Atlantic at this time. At the generic level there is a good comparison between north America and western Europe during the Cretaceous period and the works of Alexander (1929), Berry (1926), Van den Bold (1946), Brown (1957), Butler and Jones (1957), Benson and Tatro (1964), Holden (1964), Hazel and Poulson (1964) and Crane (1965) are useful for comparison. Similar comparisons can be made between western Europe and Russia with the work of Ljubimova (1955, 1965), Mandlestam (1956), Andreev and Oertli (1970) and between Western Europe and Africa with the works of Bischoff (1963), Reyment (1960, 1966), Bassoulet and Damotte (1969), Bate and Bayliss (1963), Dingle (1969, 1971) and Damotte and Saint-Marc (1972). However some of the southern African faunas show some major differences even at the generic level. These differences are emphasised in faunas described from further afield e.g. from Australia by Bate (1972) and Neale (1975).

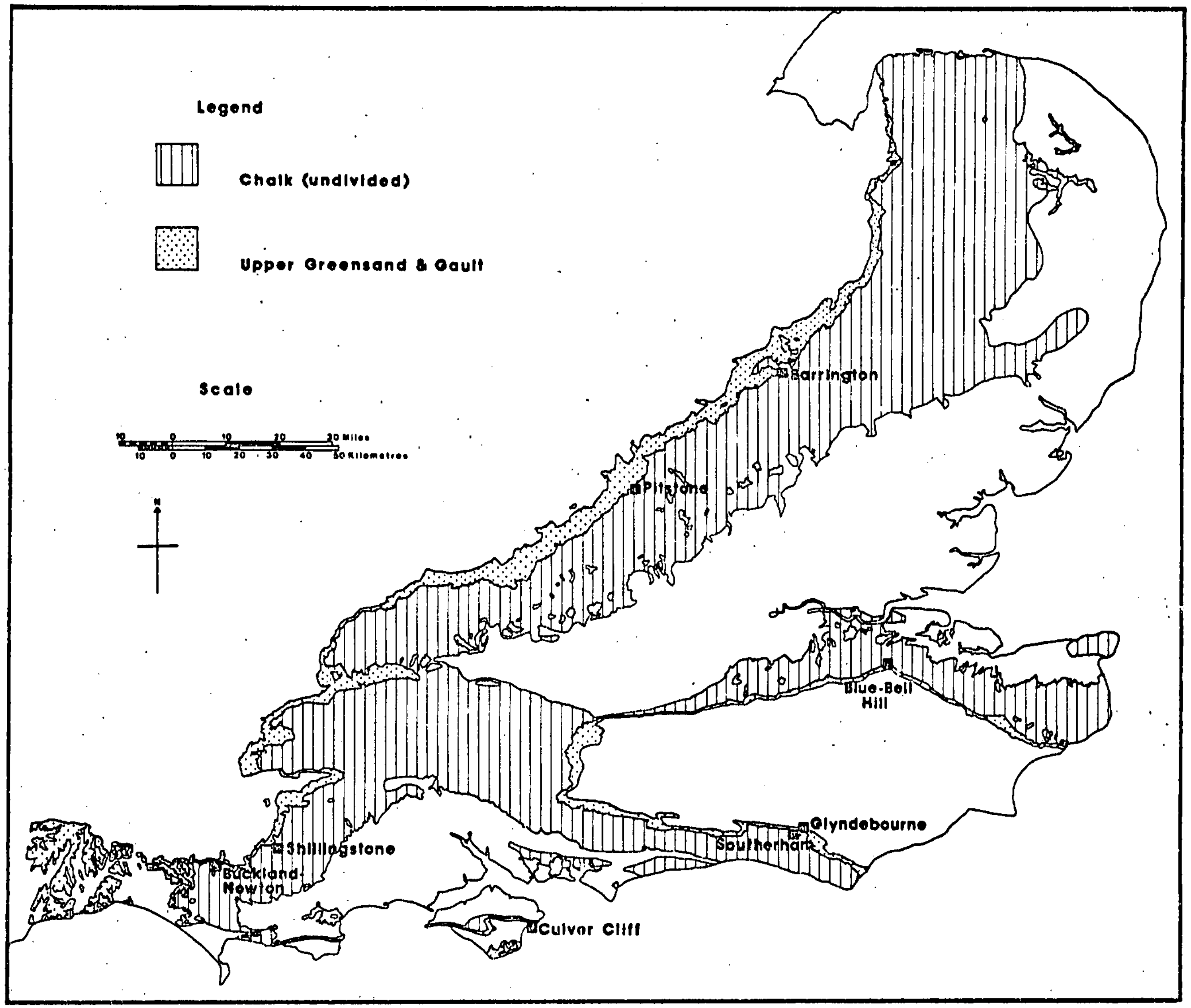
The full value of Ostracoda as stratigraphic markers was not always realised by the early workers. Mertens (1956) was the first to use Ostracoda to denote the Albian-Cenomanian boundary but it was not until the work of Gründel (1966) that distribution charts were given for a complete ostracod fauna. Gründel's chart shows the distribution of 87 species of ostracod through the Albian of East Germany. Further stratigraphic charts were produced for Lower Cretaceous Ostracoda from England by Neale (1973) and for the whole of the marine Cretaceous of France by Damotte (1971b). Kemper, Bertram and Deiters (1975) have also produced some distribution charts of Aptian/Albian Ostracoda from Western Germany and they have been able to show the effects of a changing environment on the fauna. Two major works on the stratigraphy of Upper Campanian and Maastrichtian Ostracoda have been carried out by Deroo (1966) and Herrig (1966). These workers have shown that Cretaceous Ostracoda are almost as useful, stratigraphically, as Foraminiferida, and Deroo has been able to correlate numerous sections using Ostracoda. The work of Babinot et. al. (in press) has shown that Ostracoda are also stratigraphically useful in the Cenomanian. Indeed, they not only show a good stratigraphic distribution, but they also reveal distinct 'ostracod provinces' during the Cenomanian period in France.

Ostracoda are very useful in determining palaeoenvironments since their distribution is governed by salinity, temperature, substrate and depth (Neale 1964). The Cenomanian deposits from Southern England represent open marine conditions and correspondingly all the species encountered appear to be marine. Temperature may have affected their distribution. As Neale (1973) has shown this may have been an important factor during the Lower Cretaceous where the distribution of the genus Cytherelloidea indicates a gradual warming of the seas with a south-north temperature gradient. Changes in the ostracod fauna in the middle of the Cenomanian may be correlated with a depth increase or a temperature increase at this level whilst the reasons for the drastic reduction in the ostracod fauna in the middle of the Plenus Marls are not fully understood.

The present study is therefore an attempt to examine the Cenomanian Ostracoda from Southern England from the points of view of both stratigraphy and palaeoecology, and to interpret these results with reference to the numerous papers produced on Albian Ostracoda from Western Europe and in particular with reference to the recent work on French Cenomanian Ostracoda. It is realised that the basis of any stratigraphic or palaeoecological study must be a good taxonomy and considerable attention has been given to this part of the work.

Six localities have been chosen which show good sections of Cenomanian chalk and one borehole has been obtained from the I.G.S. The localities cover a broad geographic area from Buckland Newton, (Dorset) in the west to Glyndebourne,(Sussex) in the east, and from Culver Cliff,(Isle of Wight) in the south to Barrington, (Cambridgeshire) in the north (Fig.1:2). From these localities a total of 218 samples have been examined for Ostracoda. In all 111 species have been obtained, 38 of which have previously been described, 47 of which are described as new and 26 of which are left in open nomenclature. Most of the previously recorded species are found in the Lower Cenomanian whilst many of the new forms make their first appearance in the Upper Cenomanian. These distinctive changes in the ostracod fauna through the Cenomanian may be directly or indirectly related to the

Fig.1:2 Outcrop of Middle and Upper Cretaceous deposits in Southern England with locations of sections used in this work.



facies change from marl to chalk which presumably is related to a deepening of the seas at this time. Several of the species appear to be useful stratigraphically and have been used to produce an ostracod zonal scheme which can be applied across Southern England. It is interesting to note however that there are considerable differences between the Cenomanian ostracod fauna from Southern England and the Cenomanian faunas from France - even from the Paris Basin.

Repository: All the figured material is deposited in the British Museum (Natural History), London

CHAPTER 2

CENOMANIAN STRATIGRAPHY

Lithostratigraphy

In 1847 D'Orbigny decided that on palaeontological grounds the Turonian Stage would be better regarded as two separate stages. The lower one he called the Cenomanian Stage. The type region for the Cenomanian is regarded as the Sarthe region of France, but this region is rather unsatisfactory because of poor exposure and the fact that the Cenomanian here is represented by marginal facies. Nevertheless no satisfactory alternative has been accepted and the Sarthe must be regarded as the type area.

The Cenomanian Period marks the onset of chalk deposition over large regions of Western Europe, but this change to carbonate deposition was a slow process and so most of the lower beds of this Stage cannot properly be called chalks. In South-eastern England the base of the Cenomanian is represented by the Glauconitic Marl or Basement Bed. This unit is usually only a few metres thick and apart from containing abundant glauconite grains it is often rich in phosphate nodules. In Cambridgeshire the basement bed is referred to as the Cambridge Greensand which is younger than the Glauconitic Marl to the South-east (Hart 1973a). The chalk Basement Bed is generally separated from the underlying Upper Greensand or Gault Clay of the Upper Albian by an omission surface (Kennedy and Garrison 1975), but in some areas there appears to be a transition between the two stages (Carter and Hart 1977). Carter and Hart have been able to show that the Basement Bed is a diachronous unit, even in South-east England. In the Folkestone/Dover area the succession is almost complete but when traced towards Eastbourne, or inland to Betchworth (Surrey), the age of this bed becomes younger. At Fetcham Mill(Surrey), (Gray et.al.1965), the foraminiferal evidence suggests that the top part of the Upper Greensand may be of Cenomanian age (Carter and Hart 1977). This has been partly confirmed by new ammonite discoveries in the North Downs by Owen (1975).

The chalk Basement Bed is followed by up to 50m. of very marly chalks usually represented as a limestone/marl sequence (Kennedy and Garrison 1975) with an average carbonate content of about 50% or less (Destombes and Shepard-Thorn 1971). These beds are always strongly bioturbated (Kennedy 1967), (Fig3:4) and sponge beds may be present (e.g. in the Isle of Wight sections). This unit is termed the Chalk Marl and it extends up to the Totternhoe Stone or, where this is absent, up to the mid-Cenomanian non-sequence (Carter and Hart in discussion of Kennedy 1969, Hart and Tarling 1974, Carter and Hart 1977). The term Chalk Marl is somewhat unsatisfactory because there are areas (e.g. parts of Cambridgeshire) where beds of this age are much more chalky and contain very little marl. Over most of South-east England however it remains a useful lithostratigraphic term.

The Totternhoe Stone (locally termed the Burwell Rock in Cambridgeshire or the Chilton Stone in the Chilterns) is a hard rock band which occurs from the Chilterns northwards into Yorkshire. It is a winnowed calcarenitic rock-band (Kennedy and Garrison 1975) which contains small phosphate nodules and is associated with a rich fauna of Orbirhynchia mantelliana (Sowerby),(Jeans 1968). Indeed, where the Totternhoe Stone is not present, a band rich in O.mantelliana can still be found at the same level (Carter and Hart 1977). At the top of the O.mantelliana band a profound change occurs in the microfauna. This has been recorded in the foraminifera by Hart and Carter (1975) and Carter and Hart (1977) but striking changes also occur in the ostracod population at this level. Also at this level the chalk becomes much more carbonate rich (Destombes and Shepard-Thorn 1971, Engineering Geology Ltd., pers.comm.) and at many localities looks for the first time like a true chalk. Carter and Hart have related these changes to a sudden deepening of the seas at this time with a preceding shallower phase during which O.mantelliana became established. This theory also accounts for widespread changes towards the margins of the basin, in South-west England at this time. The level at which the microfaunal change occurs is called by Carter and Hart the 'mid-Cenomanian non-sequence' and it appears to be the most significant microfaunal level in the British Cenomanian.

Above the mid-Cenomanian non-sequence is a lithological unit called the Grey Chalk. This unit may be 20-30 metres thick and it consists of fairly pure chalks varying from soft to hard in nature. This unit may be rhythmically bedded and is always strongly bioturbated but both features are less obvious than in the Chalk Marl because of the more homogenous composition - the carbonate content is usually well over 80% and reaches 90-95% (Destombes and Shepard-Thorn 1971).

The top of the Grey Chalk is marked by a strong erosion surface (Kennedy and Garrison 1975) above which are the Plenus Marls. These beds have been described in detail by Jefferies (1962, 1963). They consist of an alternating series of limestones and marls, and, where complete, a total of 8 beds can be distinguished. The maximum thickness reached by these beds in Southern England is 8.5 metres but their occurrence across South-eastern England is a constant feature. Apart from the erosion surface at the base of the Plenus Marls there is a further strong erosion surface at the base of Bed 4 (Jefferies 1962,1963).

In South-west England the lithology of the Cenomanian is very different due to the fact that this was a marginal area. The junction between what has been termed the South-West Province and the South-East Province (Carter and Hart 1977) runs along the Mid-Dorset Swell (Drummond 1970, Kennedy 1970), roughly from Swanage to Yeovil. South-west of this line the onset of chalk deposition became progressively later in a westerly direction. Thus at Buckland Newton (Dorset) there is 34 m. of Middle and Upper Cenomanian chalk whilst at Membury chalk deposition did not begin until Bed 1 of the Plenus Marls (Hart 1975). Carter and Hart (1977) have documented the ages of the chalk 'Basement Bed' in the various exposures in this area and it has also been shown that some of the Chert Beds (Upper Greensand) in this region may be of Cenomanian age (Hart 1973b, Carter and Hart 1977, Hamblin and Wood 1976). South-west of a line from Membury to Weymouth the Cenomanian is represented by the Cenomanian limestones and sands (Smith 1957, 1961).

Unfortunately the Chert Beds and Cenomanian limestones of the south-west are too hard to yield any ostracods whilst the Cenomanian sands are decalcified to a considerable depth. This means that in south-west England an ostracod fauna can only be obtained from the Upper Cenomanian chalks in the region of the mid-Dorset swell and the locality used is at Buckland Newton.

The area of the present study is also defined to the north by the "North-Norfolk Swell" (Carter and Hart 1977). In this region the Cenomanian again forms a condensed sequence with a total thickness of about 15 m. at Hunstanton. The lithology here is a very hard limestone from which it is impossible to remove any ostracods.

Biostratigraphy

Traditionally the Cenomanian has been divided into two zones - the zone of Schloenbachia varians (J. Sowerby) and above this the zone of Holaster subglobosus Leske. This is the zonation set up by Jukes-Browne and Hill (1903). In this work they took the base of the stage as being at the base of the Glauconitic Marl and the top of the stage to be the base of the Melbourn Rock, thus including the Plenus Marls in the zone of H. subglobosus. More recent work on Cenomanian macrofossils has shown Jukes-Browne and Hill's zones to be inadequate and Kennedy (1969) erected a new zonation based on ammonite zones and assemblage zones (Fig. 2:1). By use of this zonation Kennedy (1969, 1970) was able to correlate Lower Chalk sections across southern England. The assemblage zones used by Kennedy have now been raised to full zonal status by Casey et al. (see Kennedy and Garrison 1975, fig. 3).

The base of the Cenomanian in the type area of Sarthe in Western France is drawn at the base of the "argille glauconieuse à minerai de fer". Unfortunately these beds are decalcified and so microfaunal correlation is not possible. However, Hancock (1959) has suggested that these beds form the base of the Mantelliceras mantelli zone - the zone used by Kennedy (1969) to mark the base of the Cenomanian in southern England. In Southern England, Hart and Carter (1975) and Carter and Hart (1977) have shown that the base of the M. mantelli zone is coincident with the first appearance of the planktonic Foraminifera Rotalipora evoluta Sigal and Praeglobotruncana delrioensis (Plummer).

Whilst Jukes-Browne and Hill took the base of the Turonian at the base of the Melbourn Rock Spath (1926), Wright (1951) and Jefferies (1962, 1963) all regarded the Plenus Marls as being of lowest Turonian age. In the type area of Touraine, France, Sornay (1957) defined the base of the stage as the base of the Inoceramus labiatus zone whilst Lecointre (1959) defined the type section of the Turonian to include beds below those in which I.labiatus s.s. makes its first appearance. Following Sornay's work, Juignet, Kennedy and

<table>
<tr><td colspan="5">Glauconitic Marl / Chalk Marl</td><td colspan="4">Grey Chalk</td><td colspan="2">Plenus Marls</td><td>Melbourn Rock</td><td colspan="2">Lithostratigraphy</td></tr>
<tr><td colspan="10">CENOMANIAN</td><td colspan="2">TURONIAN</td><td>Stage</td><td rowspan="4">Stratigraphy used in this work</td></tr>
<tr><td colspan="4">LOWER</td><td colspan="4">MIDDLE</td><td colspan="2">UPPER</td><td colspan="2"></td><td>Substage</td></tr>
<tr><td>7</td><td>8</td><td>9</td><td>10</td><td>11i</td><td colspan="2">11ii</td><td>12</td><td>13</td><td>14i</td><td>14ii</td><td></td><td>Benthonic Foram. Zones (see Carter and Hart 1977)</td></tr>
<tr><td colspan="5">R. evoluta/P. delrioensis</td><td colspan="5">R. cushmani/P. stephani</td><td colspan="2"></td><td>Planktonic Foram. Zones (see Carter and Hart 1977)</td></tr>
<tr><td colspan="2">H. carcitanensis</td><td>M. saxbii</td><td>M. dixoni</td><td>T. costatus</td><td>T. acutus</td><td colspan="2">A. jukesbrownei</td><td>C. naviculare</td><td>M. geslinianum</td><td>M. gourdoni</td><td>Horizon A</td><td>Macrofaunal Zones (see Kennedy and Garrison 1975)</td><td rowspan="2">Recent macrofaunal zonations</td></tr>
<tr><td colspan="4">M. mantelli</td><td colspan="4">A. rhotomagense</td><td>C. naviculare</td><td colspan="3">S. gracile</td><td>Macrofaunal Zones (see Hancock 1975)</td></tr>
</table>

Fig. 2:1 Cenomanian stratigraphy

Wright (1973) placed the beds preceding those with _I. labiatus_ into the Cenomanian as a zone called 'Horizon A' which lies above the zone of _Metoicoceras gourdoni_ (Grossouvre). 'Horizon A' was later included in the zone of _Sciponoceras gracile_ by Hancock (1975). Carter and Hart however, have followed Lecointre's definition of the type section and shown that, so defined, the planktonic foraminiferal genus _Rotalipora_ Brotzen is restricted to the Cenomanian. This agrees with the work of Marks (1967) and Hart (1976). Correlated back to Britain this indicates a Cenomanian/Turonian boundary at the base of Bed 4 in the Plenus Marls (Carter and Hart 1977). This level is characterised by several other important microfaunal changes, not least in the Ostracoda, and it is used here as the Cenomanian/ Turonian boundary.

In summary, the following stratigraphy is used in this work:-

(1) The base of the Cenomanian is taken as the base of the macrofossil zone of _Mantelliceras mantelli_. This coincides with the base of the benthonic foraminiferal Zone 7 of Carter and Hart (1977) and the first appearance of the planktonic Foraminifera _Rotalipora evoluta_ and _Praeglobotruncana delrioensis_. Over most of south-east England this boundary coincides with the Gault Clay (or Upper Greensand)/Glauconitic Marl junction.

(2) The lower Cenomanian contains the macrofossil zones of _Hypoturrilites_, _carcitanensis_, _Mantelliceras saxbii_ and _Mantelliceras dixoni_ and the benthonic foraminiferal Zones 7, 8, 9 and 10 of Carter and Hart (1977). The Middle Cenomanian contains the macrofossil Zones of _Turrilites costatus_, _Turrilites acutus_ and _Acanthoceras jukesbrownei_, and the benthonic foraminiferal Zones 11i, 11ii and 12 of

Carter and Hart (1977). Between the zones of T. costatus and T. acutus. (= 11i/11ii benthonic foraminiferal boundary), is the mid-Cenomanian non-sequence. This level coincides with the base of the Rotalipora cushmani (Morrow), Praeglobotruncana stephani (Gandolfi) planktonic foraminiferal Zone. The Upper Cenomanian contains the macrofaunal Zones of Calycoceras naviculare and Metoicoceras geslinianum and the benthonic foraminiferal Zones 13, 14i and 14iia.

(3) The base of the Turonian is taken for micropalaeontological convenience as the base of the macrofossil zone of Metoicoceras gourdoni. This coincides with the base of the benthonic foraminiferal zone 14iib. of Carter and Hart (1977) and the appearance of the planktonic Foraminifera Praeglobotruncana hagni Scheibnerova in large numbers. This boundary coincides with the junction between beds 3 and 4 in the Plenus Marls.

CHAPTER 3

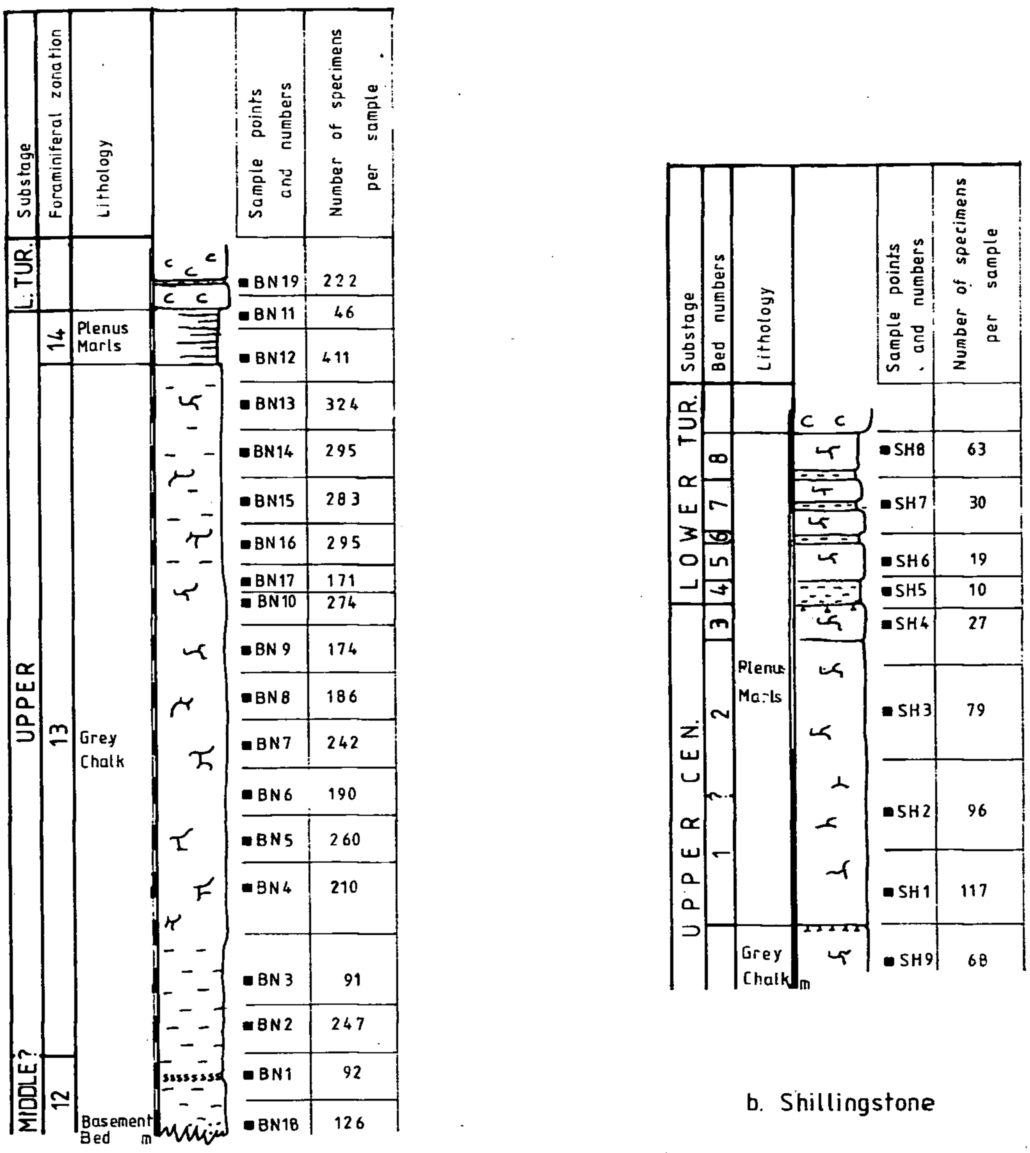
SECTION DESCRIPTIONS

Sections have been chosen to give a distribution across Southern England, so that stratigraphically useful species can be tested over as wide an area as possible. An attempt has also been made to choose sections which are well described, so that comparisons can be made between macro- and micro-faunal studies. All the quarry sections have been described by Jukes-Browne and Hill (1903) and Kennedy (1969, 1970). Samples have been taken at 2 m. intervals except from Pitstone where a 1 m. interval was used.

Buckland Newton (ST703051), (Fig.3:1a).

This quarry is situated about 2 km. east of the road junction at Buckland Newton, Dorset. It was mentioned by Jukes-Browne and Hill (1903, p.114), and has been described in detail by Kennedy (1970) and Carter and Hart (1977).

The section, as described by Kennedy (1970), showed a chalk Basement Bed containing phosphatised cobbles of hard glauconitic sandstone resting on an uneven surface of Upper Greensand. Above the Basement Bed is about 34 m. of Middle and Upper Cenomanian chalk with 2.3 m. of Plenus Marls capped by Melbourn Rock at the top. Kennedy (1970) and Carter and Hart (1977) have shown that the basement bed contains a Middle Cenomanian fauna together with Lower Cenomanian elements. Above the basement bed the chalk is of Upper Cenomanian age (Zones 13 and 14 of Carter and Hart). Unfortunately the quarry is now disused and the basement bed is no longer accessible. The lowest part of the section shows about 8 m. of fairly soft white chalk with a distinct sponge bed about 2.5 m.



a. Buckland Newton

b. Shillingstone

Fig.3:1. Lithology and sample details of Buckland Newton, Dorset and Shillingstone, Dorset.

above the base. The rest of the section is reached from the track and shows about 15 m. of more greenish, slightly harder, chalk, with 10.5 m. of soft marly chalk above. The Plenus Marls consist of 2.3 m. of soft greenish-grey marl, which is mottled and intensely burrowed. At the top of the Plenus Marls there is a sharp junction with the hard, nodular, Melbourn Rock.

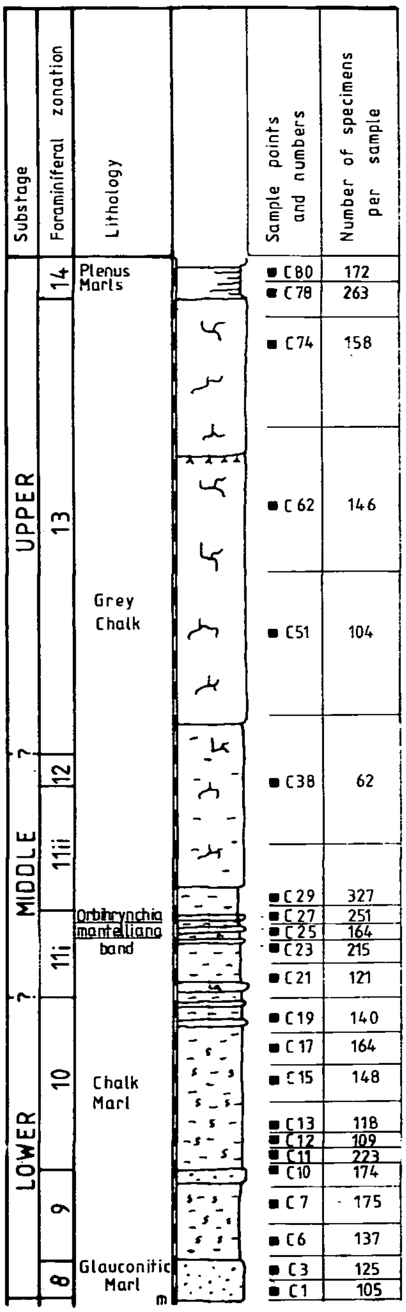
<u>Shillingstone</u> (ST 824098),(Fig.3:1b).

This quarry, known as 'Shillingstone Limeworks' is situated 8 km. north-west of Blandford Forum, Dorset. The section details have been given by Carter and Hart (1977, fig.22). Only the very top of the Grey Chalk and the Plenus Marls have been sampled. As usual the Plenus Marls consist of a series of alternating marls and limestones. There are strong erosion surfaces at the base of Beds 1 and 4 and Beds 1 and 2 are thicker than the other Beds.

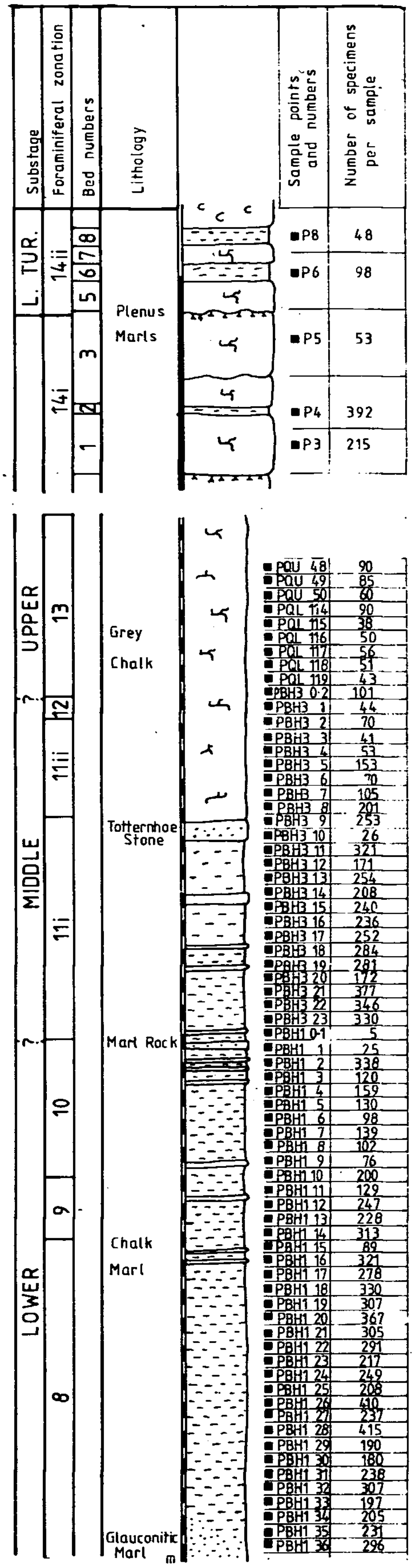
<u>Culver Cliff</u> (SZ 630855),(Fig.3:2a).

Culver Cliff is situated at the eastern end of the Isle of Wight and displays an extensive coastal exposure of Cenomanian chalk. The succession here dips at about 40° to the north. The section has been described by Jukes-Browne and Hill (1903) and by Kennedy (1969).

The "Glauconitic Marl" at the base of the Lower Chalk rests on Upper Greensand, but the junction is complicated by the marl being piped down into the Greensand. The "Glauconitic Marl" is a hard, sandy, marl with lenticular concretions and scattered phosphate nodules. Above this there is about 24 m. of Chalk Marl which consists of alternating limestone/marl units (Fig. 3:3). The marls are generally thicker than the limestones and in the lower part the limestones are rich in sponges. Phosphates are common in the lower part and higher up there are one or two distinctive limestone



a. Culver Cliff



b. Pitstone

Fig.3:2. Lithology and sample details of Culver Cliff, I.O.W. and Pitstone, Herts.

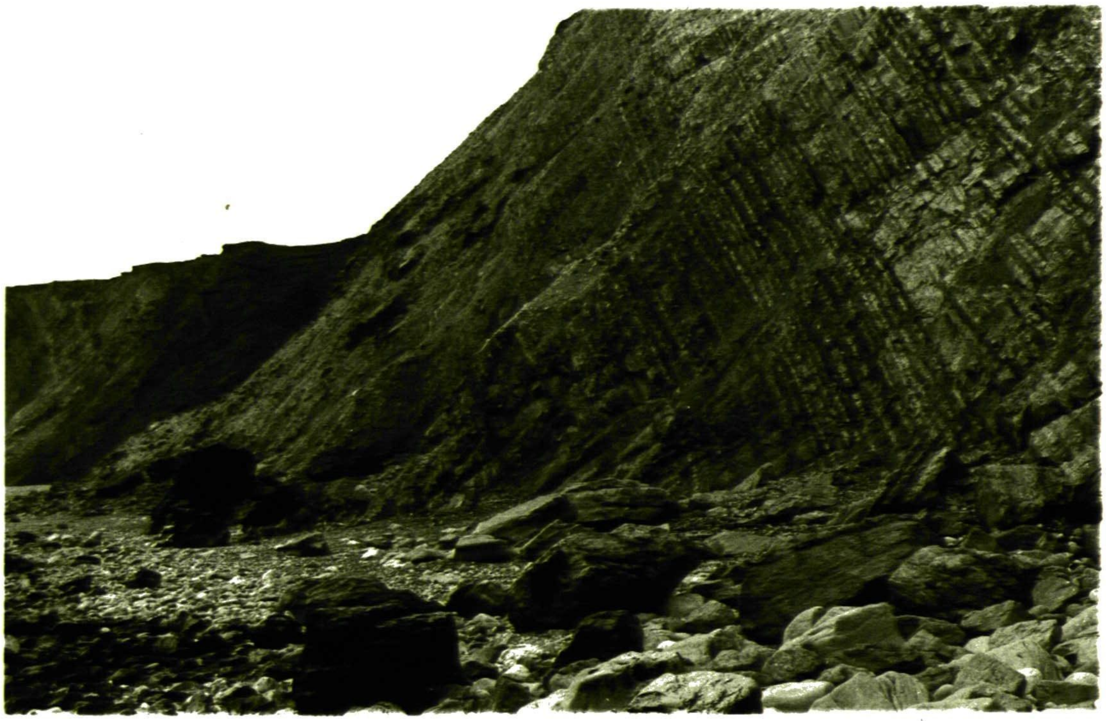


Fig.3:3 The Lower Chalk at Culver Cliff, Isle of Wight, showing the distinction between the Chalk Marl and the Grey Chalk above.

Fig.3:4 The Middle Cenomanian Chalk at Barrington, Cambridgeshire. Note the paler colour of the top level above the Burwell Rock.

bands which are rich in phosphates. At this locality the change in lithology from marls to more chalky beds is not coincident with the top of the O. mantelliana band but occurs some 2.5 m. above. Above this change in lithology the Grey Chalk is about 38 m. thick. As we pass upwards the marl bands become less prominent whilst the limestones become thick and massive. The Plenus Marls are represented by almost 2 m. of soft grey marl.

Pitstone (SP 935148), (Fig.3:2b).

Pitstone lies 4 km. north - north-east of Tring, (Herts.) The series of quarries are worked by Tunnel Cement Co. Ltd. and cover an area of about 1 square kilometre. The section was mentioned by Jukes-Browne and Hill (1903) and by Blezard (1972) whilst Jefferies (1962, 1963) described the Plenus Marls section displayed in the quarry.

Samples from this quarry were supplied by Engineering Geology Ltd., and comprise both borehole and quarry face material which make up a composite section. The base of one of the boreholes terminated in the "Glauconitic Marl" and so the junction with the underlying beds was not seen. Above the Glauconitic Marl there is about 50 m. of Chalk Marl. This is very marly in nature but there are some harder bands of sponges and limestone. 35 m. above the Glauconitic Marl is a hard rock band with some small phosphate nodules known as the Marl Rock. In the field this band contains many phosphatised ammonites. At the top of the Chalk Marl is the O. mantelliana band which in this area is associated with a hard, phosphate rich rock band known as the Totternhoe Stone. Above the Totternhoe Stone there is about 22 m. of Grey Chalk, this is whitish in colour and becomes more pure towards the top. The top of the section shows a good exposure of Plenus Marls about 1.2 m. thick;

this is overlain by the hard white rubbly chalk of the Melbourn Rock, which, at this locality, is rich in Inoceramids.

Barrington (TL 398509), (Fig.3:5a).

Barrington lies 10 km. south-west of Cambridge and the quarry, which is operated by the Rugby Cement Company, is 1 km. north of the village. The section details were given by Forbes (1960), and Burnaby (1961) described the foraminifera from the quarry. Samples from the lower part of the section were also used by Hart (1973).

The base of the pit exposes Gault Clay and above this there is about 50 cms. of Cambridge Greensand which is very rich in phosphate nodules. Above this a pit excavated in the quarry floor exposes 16 m. of very soft marly chalk, samples from which have been provided by M.B. Hart. The succeeding Middle Cenomanian chalk is somewhat harder and is much more carbonate rich. About 29 m. above the base of the section is the Burwell Rock. This unit is about 3 m. thick in this section and is a hard gritty rock band, rich in phosphate nodules. Above the Burwell Rock there is a further 6 m. of Middle Cenomanian chalk, this is exposed along the ledges at the N.W. end of the quarry. Fig.3:4..

Blue Bell Hill (TQ 737618), (Fig.3:5b).

Blue Bell Hill is situated 4 km. south of Chatham, Kent. The exposures here consist of five large pits which cut into the southern scarp of the North Downs. The section has been well described by Kennedy (1969) and was included in the Geologists Association guide to the London region (south of the Thames) by Hancock (1967).

Referring to Kennedy's notation of bays in the quarry (Fig.3:6) Cenomanian chalk can be seen in bays 1 - 6. The southern pit (pit 5) is very much overgrown and the extent of the section described by Kennedy is now reduced. The section in this pit is very difficult to interpret since bedding planes are not reliable.

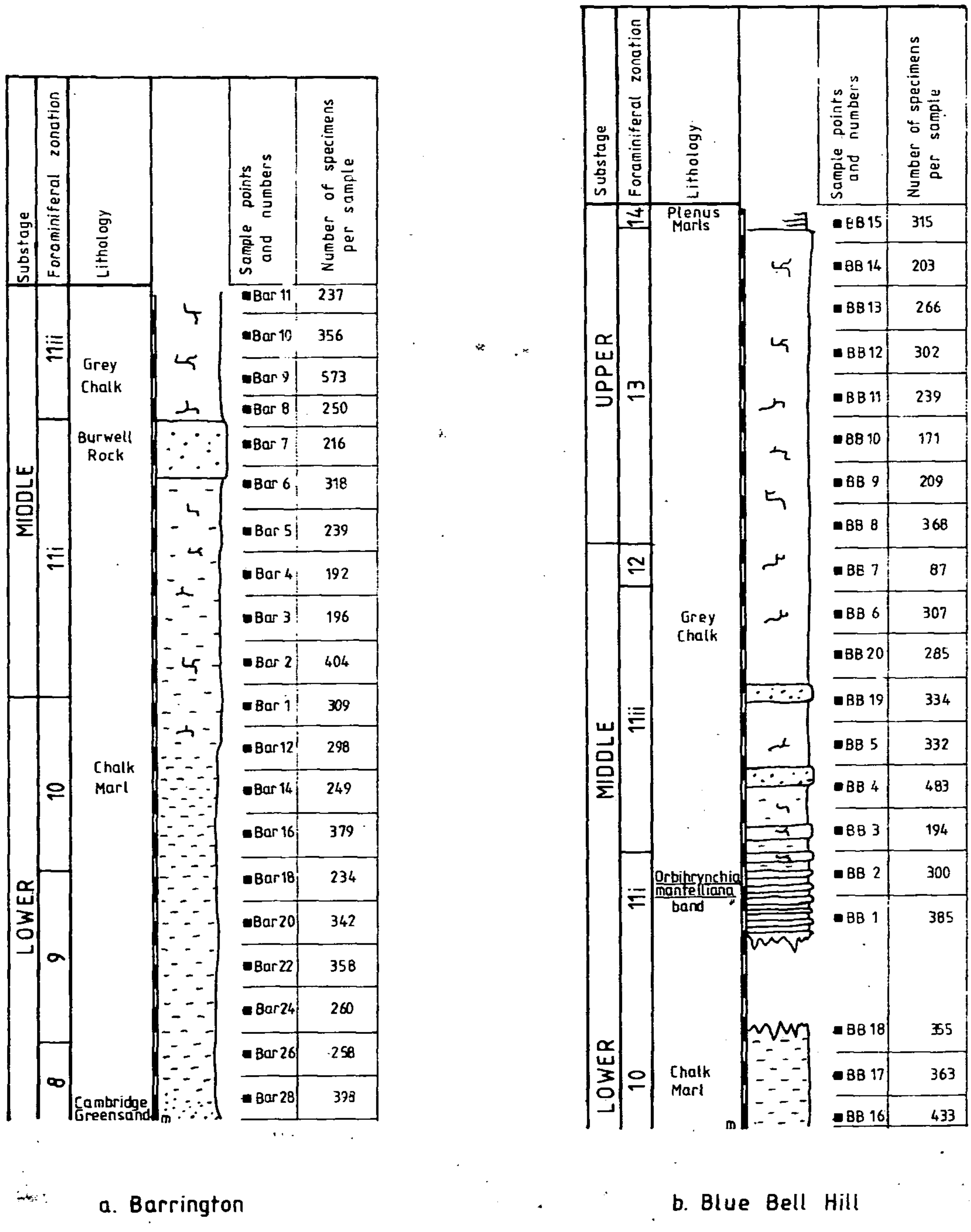


Fig.3:5. Lithology and sample details of Barrington, Cambs. and Blue Bell Hill, Kent.

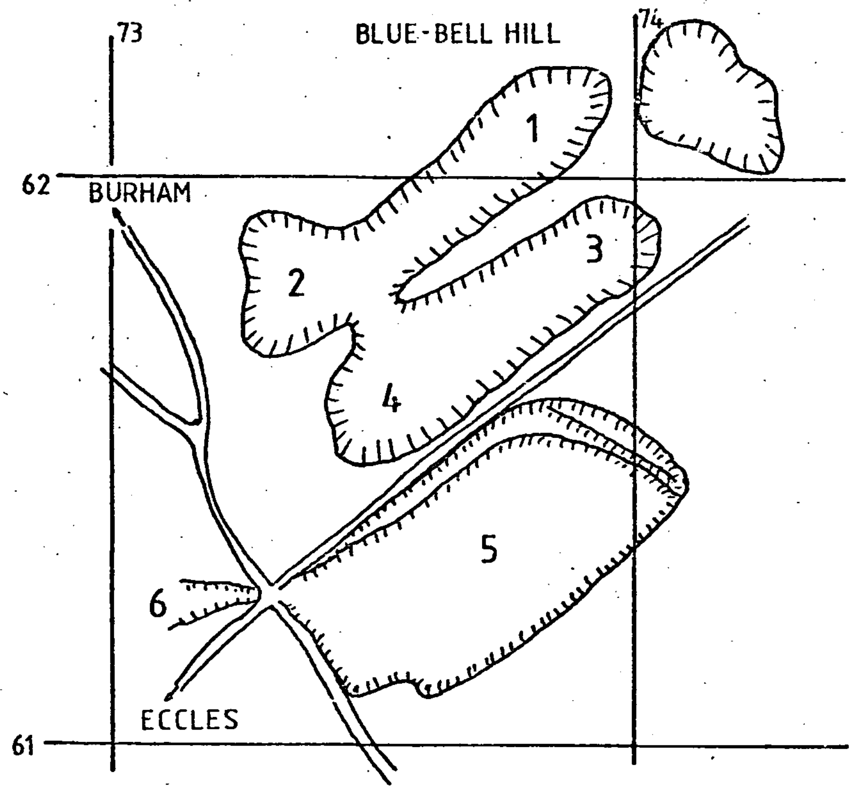


Fig.3:6. Layout of chalk pits in Blue-Bell Hill quarry, Kent, (after Kennedy 1969).

Many bedding planes are in fact low angle faults which coalesce when traced. In view of this only 3 samples were taken from this pit. The chalk in pit 5 is of Lower Cenomanian age and is pale and marly in nature. The O. mantelliana band can be found at the base of the bluff which separates bays 1 and 3 in the middle pit. This band consists of fairly hard marly chalk in rather thick units, and it contains abundant O. mantelliana particularly near the top. About 4 m. above the O. mantelliana band is a band rich in phosphate nodules. Above this the chalk becomes rather homogenous although the carbonate content increases towards the top. These levels can be most easily reached in bay 1, but even here the section is rather fragmentary. In the north-east corner of bay 1 the Plenus Marls can be seen but they are difficult to reach and only Bed 1 was sampled. 4m of Lower Cenomanian chalk was collected from pit 5, and 34m of Middle and Upper Cenomanian chalk were collected from pit 1.

Glyndebourne (TQ 442114),(Fig.3:7a).

This is a borehole section, samples from which were supplied by the Institute of Geological Sciences. The borehole was sunk in November 1973, in a position 1270 yards S.S.W. of Ringmer Church, Sussex. The final depth of the hole was 170.91 m. which includes 9.55 m. of hill wash, 38.81 m. of Lower Cenomanian chalk, 104.24 m. of Gault Clay and 8.31 m. of Lower Greensand. Samples represent sediment taken from a half metre spread and every fourth sample was used to give a coverage equivalent to the 2 m. interval used in the other sections.

The base of the Cenomanian is marked by 1.26 m. of "Glauconitic Marl" which contains shell fragments and phosphate nodules. Unfortunately most of the samples from this basal unit were retained by the I.G.S. Above the Glauconitic Marl the Lower Cenomanian consists of alternating marls and sponge beds with some hard-grounds in the lower part with alternating marls and chalks in the upper part.

Southerham (TQ 431091),(Fig.3:7b).

This quarry is situated just north of the A.27 road, 1 km. south-east of Lewes, Sussex. It is owned by the Rugby Cement Company and is often referred to as the "Southerham Grey pit". The section has been described by Barrois (1876), Jukes-Browne and Hill (1903), White (1926) and Kennedy (1969).

Since 1969, when Kennedy described the section, further excavations have revealed the O. mantelliana band with 8 m. of Middle and Lower Cenomanian chalk beneath. This part of the section consists of thick marls separated by thin limestone bands. The thickest marl is conspicuous because of its 'blue' colour and blocky nature. Bioturbation shows up particularly well in this

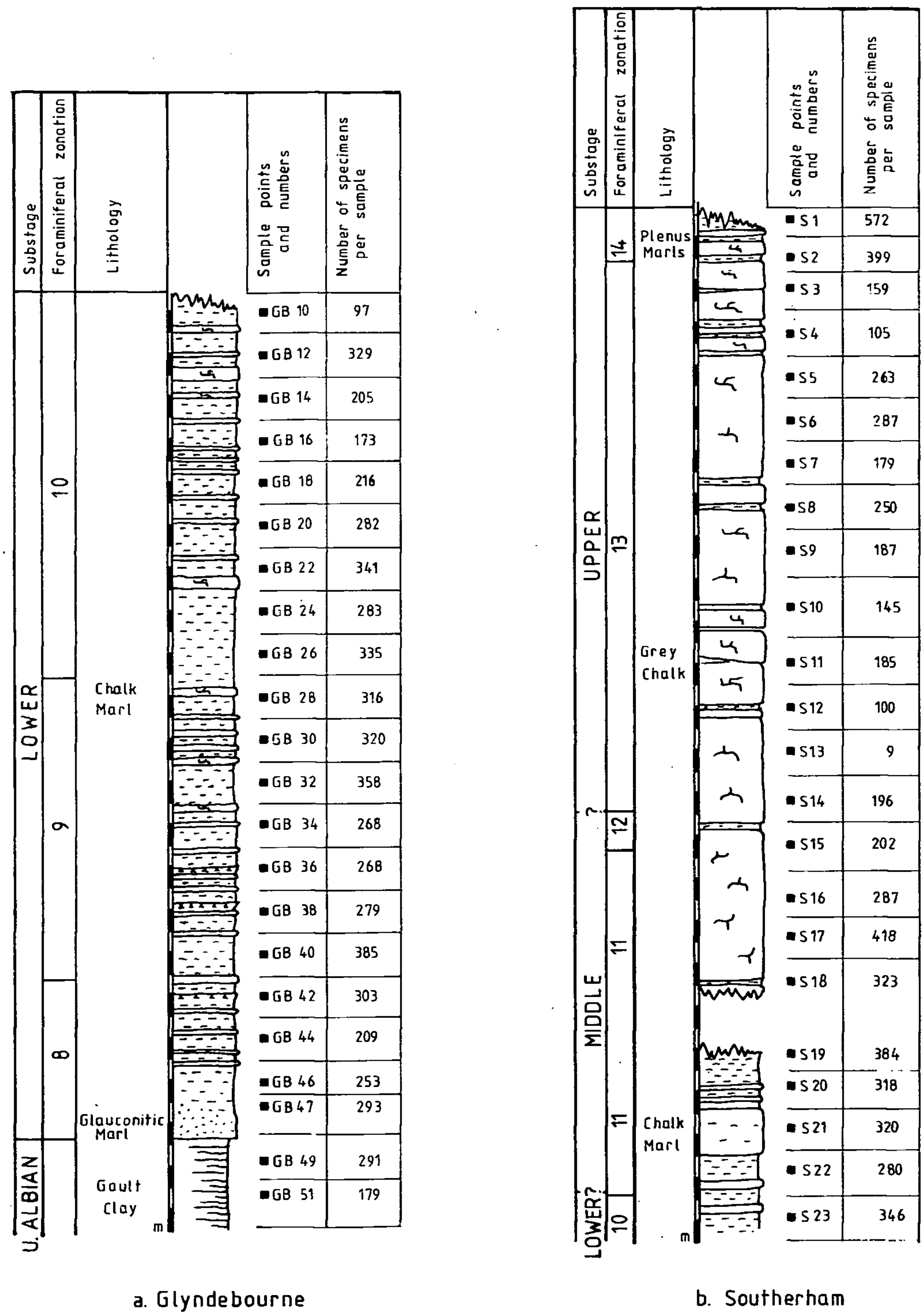


Fig.3:7. Lithology and sample details of Glyndebourne, Sussex and Southerham, Sussex.

Fig.3:8 Middle and Upper Cenomanian Chalk, Southerham, Sussex.
The Plenus Marls lie several metres below the top of the main face.

Fig.3:9 Intense bioturbation in a thick 'bluish' marl band in the Chalk Marl, Middle Cenomanian, Southerham, Sussex.

'blue band' (Fig.3:9) but it is present throughout the whole section. Fossils are very common in this lower unit, particularly near the top where O. mantelliana is particularly abundant. The main faces of the quarry are cut into the Middle and Upper Cenomanian chalk. This consists of massive, fairly hard chalk with thin marl bands. Macrofissils are not common, but a number are listed by Kennedy (1969). White (1926) suggested that the Plenus Marls were exposed in the north-west face of the quarry but Kennedy could not confirm this on macrofaunal evidence. Microfaunal studies however reveal that the highest 2 m. of accessible chalk are of A. plenus age. These beds can be reached at the top of the track in the north-eastern corner of the quarry.

CHAPTER 4

TECHNIQUES

Sampling

Samples from Pitstone were taken at 1 metre intervals whilst other sections were collected on a 2m. interval. This was thought to give an equally good coverage whilst allowing more time to study other sections. Individual samples weighing about 1 kg. were taken from the smallest vertical range possible to keep down the time range of the sample. Organic mixing however probably occurred to a considerable depth in the soft chalk sediment. The size of the sample was generally sufficient to allow a lithological reserve to be kept. Since ostracods can be removed easily from soft sediment, but with great difficulty from hard bands, the 2m. interval between samples was sometimes altered to allow collection of softer beds.

In the Plenus Marls samples were collected from each of the beds recorded by Jefferies (1962, 1963) and care was taken to exclude material from adjacent beds. This is particularly important when some of the beds are only a few centimetres thick.

Processing

The method of processing was very important to this study as any harsh treatment of the samples resulted in the breakup of many of the ostracods. There is considerable variation in the amount of processing which each group of ostracods can withstand. The Polycopidae, for example, are very weak, whilst the Cytherellidae are strong and are present in nearly every sample. The aim was therefore to begin with the least destructive method of processing and if this was unsuccessful to try progressively harsher treatments until the sample broke down.

By far the least destructive method is that using white spirit and this method was always tried first. The sample was broken into pieces about 2 - 3 cms. across and these were then dried. Whilst still warm white spirit was poured on to cover the sample and this was allowed to soak in for about 1 hour. The excess spirit was then poured off and cold water was added. Samples with a substantial proportion of clay minerals are easily disaggregated by this method and so it can be used for nearly all the Lower Cenomanian samples, as well as some Upper Cenomanian material. Samples from harder bands in the Lower Cenomanian, the Totternhoe Stone, and some of the Upper Cenomanian chalks are not affected by the white spirit method and so other methods must be tried.

Boiling pieces of the sediment in hydrogen peroxide was tried for some of the samples but this method was not very successful. It was generally found that if the sample could not be broken down by two or three attempts at the white spirit method then it was best to crush the sample under water. For some of the softer samples gentle crushing produced results which were almost as good as those achieved by the white spirit method. Some samples however required stronger crushing and the ostracod fauna of these was consequently reduced.

The disaggregated sediment was washed through a 75 micron sieve, dried and stored.

Picking

The residue of each sample was dry sieved into the following fractions: greater than 1.7 mm., 1.7mm.-500μ, 500μ - 250μ, 250μ- 212μ, 212μ - 180μ, 180μ - 125μ and 125μ - 75μ. The 1.7mm. sieve being used merely to remove any large unprocessed lumps. The sample was divided into fractions so that smaller specimens would not be overlooked by being hidden beneath larger grains. The residues on the 500μ, 250μ, 212μ and 180μ sieves were completely picked for adult ostracods, the specimens being removed and stored on one slide per sample. The 125μ sieve always retained a large residue which being fine grained required a long time to pick fully. This fraction was therefore picked until a representative fauna had been removed and the proportion of picked to unpicked residue was calculated by weighing. Normally about 10 - 20% of this fraction was picked to yield about 40 - 50 specimens. The 125μ - 75μ fraction did not contain any adult specimens.

Juvenile valves belonging to many of the species can be found at least in the softer samples but there are several exceptions, e.g. many of the Cytherurinae. In these species the juveniles are presumably too weakly calcified to be preserved. In samples where juveniles were particularly well preserved these have been picked and retained with the adults. In cases where size graphs have been drawn for the various moult stages of a species all the specimems have been taken from one sample. This ensures that the effects of variation in size with time are reduced to a minimum.

Specimen Preparation

The processing methods rarely removed all the sedimemt from the specimens and so further preparation was usually necessary. The fine grained sediment was often very difficult to remove, particularly since it infills not only the interior of the valves but also the fossae in the reticulation and the negative parts of the hinges. The easiest method of cleaning individual specimens was to hold them in a drop of water on a brush and to prod the sediment with a sharpened fine, tungsten needle. For more difficult specimens it was sometimes necessary to embed them in 'gum tragacanth' and then to wet them and prod with the needle. Final washing was done in a 15% solution of a laboratory detergent such as 'Extran 100' followed by washing in clean water.

Specimens for photographing under the S.E.M. were placed on stubs using 'Kodaflat' glue, and coated with about 100 Å of gold. The S.E.M. used was a JEOL JSM-PI5.

CHAPTER 5

SYSTEMATIC DESCRIPTIONS

The classification used here is based on that described in the Treatise of Invertebrate Palaeontology, Part Q Arthropoda 3 (eds. Moore and Pitrat 1961). Since 1961 there have been numerous attempts to revise the system of Ostracod classification e.g. Van Morkhoven (1962), Hartmann (1964), Hartmann and Puri (1974), Liebau (1975) and Gründel (1969, 1973, 1974a, 1974c, 1974e, 1976, 1976b). All of these systems of classification disagree with each other to a greater or lesser extent and none have been generally accepted. The system adopted in the Treatise is therefore still widely used and it is adopted here.

Order PODOCOPIDA Muller, 1894

Suborder PLATYCOPINA Sars, 1866

Family CYTHERELLIDAE Sars, 1866

Genus *CYTHERELLA* Jones, 1849

Type species: *Cytherina ovata* Roemer 1840

Cytherella ex. gr. *C. ovata* (Roemer 1840)

(Plate 1,figs.1-5;text-figs.5:1,5:2,5:7)

1840 *Cytherina ovata* Roemer : 104, pl.16, fig.21

1845 *Cytherina ovata* Roemer ; Reuss : 16, pl.5, fig.35

1849 *Cythere (Cytherella) ovata* (Roemer) Jones : 28, pl.7, figs.24b-g.

1851 *Cytherina ovata* Roemer; Reuss : 48, pl.17, figs. 2b,d.

non 1854 *Cytherella ovata* (Roemer); Bosquet : 45, pl.8, figs.1a-f.

(= *C.reniformis* Bosquet)

1874 *Cytherella ovata* (Roemer); Reuss in Geinitz : 151, pl.28,figs.4,5.

1880 Cytherella ovata (Roemer); Marsson : 28

1890 Cytherella ovata (Roemer); Jones and Hinde : 44, pl.3, figs.48-49, 51-54 : non fig.50 (= C.truncata Bosquet).

1890 Cytherella obovata Jones and Hinde : 46, pl.3, figs.46,47.

1898 Cytherella ovata (Roemer); Chapman : 343

1899 Cytherella ovata (Roemer); Egger : 186, pl.27, fig.54 - 56.

1910 Cytherella (Cytherina) ovata (Roemer); Egger : 93, pl.6, figs. 5,6.

1910 Cytherella obovata Jones and Hinde; Egger : 92, pl.6, figs. 7,8.

non 1932 Cytherella ovata (Roemer); Alexander : 303, pl.28, figs.1,2. (= C.navarroensis Alexander).

non 1933 Cytherella ovata (Roemer); Upson : 15, 16, pl.2, figs.9a,b.

1940 Cytherella ovata (Roemer); Bonnema : 93, pl.1, figs.1-16.

? 1948 Cytherella ovata (Roemer); Schmidt : 405, pl.61, fig.3.

1952 Cytherella ovata (Roemer); Dupper : 106, pl.5, fig.3.

1956 Cytherella ovata (Roemer); Deroo : 1508, pl.1, figs. 4-6.

1956 Cytherella cf. comanchensis Alexander; Grekoff and Deroo : 217, pl.36, figs. 1,2.

1958 Cytherella ovata (Roemer); Howe and Laurencich : 251

1958 Cytherella ovata (Roemer); Oertli : 1502, pl.1, figs.10-29

1960 Cytherella ovata (Roemer); Malecki : 101

? 1964 Cytherella ovata (Roemer); Baynova and Talev: 20,pl.1,figs.4-6

1966 Cytherella ovata (Roemer); Gründel : 12, pl.1, fig.2

1966 Cytherella ovata (Roemer); Herrig : 718-729, pl.2, figs. 1-7, pl. 44, figs. 6-8, text-fig.18

1969 Cytherella ovata (Roemer); Gründel : 83, pl.1, fig.1

1971b Cytherella ovata (Roemer); Damotte : 55, pl.1, figs. 2-7

non 1971 Cytherella cf. ovata (Roemer); Keen and Siddiqui : 62, pl.1, figs. 1, 9.

1976 Cytherella "ovata" (Roemer); Bremen : 82, pl.1, figs. 1a,b. (? fig.1d, non fig.1c: ? pl.2, fig. 1e).

Diagnosis: An ovate species of Cytherella, about 1½ times longer than high. Ventral margin straight to slightly convex, anterior and posterior margins broadly rounded. Dorsal margin convex. Greatest height in the middle, greatest breadth at 3/5 length.

Material: Several hundred valves and carapaces, some of which are mounted as OS 9324 to OS 9350

Measurements (mm)		Length	Height	Width
Female, left valve	OS 9324	0.800	0.472	0.200
Female, right valve,	OS 9325	0.852	0.593	0.200
Male, right valve,	OS 9326	0.835	0.516	0.187

Description: A heavily calcified species of Cytherella with an ovate outline. Anterior margin broadly rounded, the posterior margin is a little more narrowly rounded. The ventral margin varies from straight to weakly convex in females and from straight to weakly concave in males. In the right valve the dorsal margin is convex but varies from being broadly rounded to almost pointed in some specimens (Fig.5:2). In females the convexity of the dorsal margin of the right valve is symmetrical but in males the posterior part of the dorsal margin curves down more steeply. The dorsal margin of the left valve is asymmetrically arched, usually with a gently inclined, nearly straight posterior half and an anterior half which curves sharply down towards the anterior. The greatest height of the carapace lies at mid-length, the greatest width lies at 3/5 length. The right valve overlaps the left around the entire margin but the overlap is more pronounced in the dorsal and ventral regions.

Remarks: This species is one of the most common and most recorded of Cretaceous ostracods. It has had a rather confused

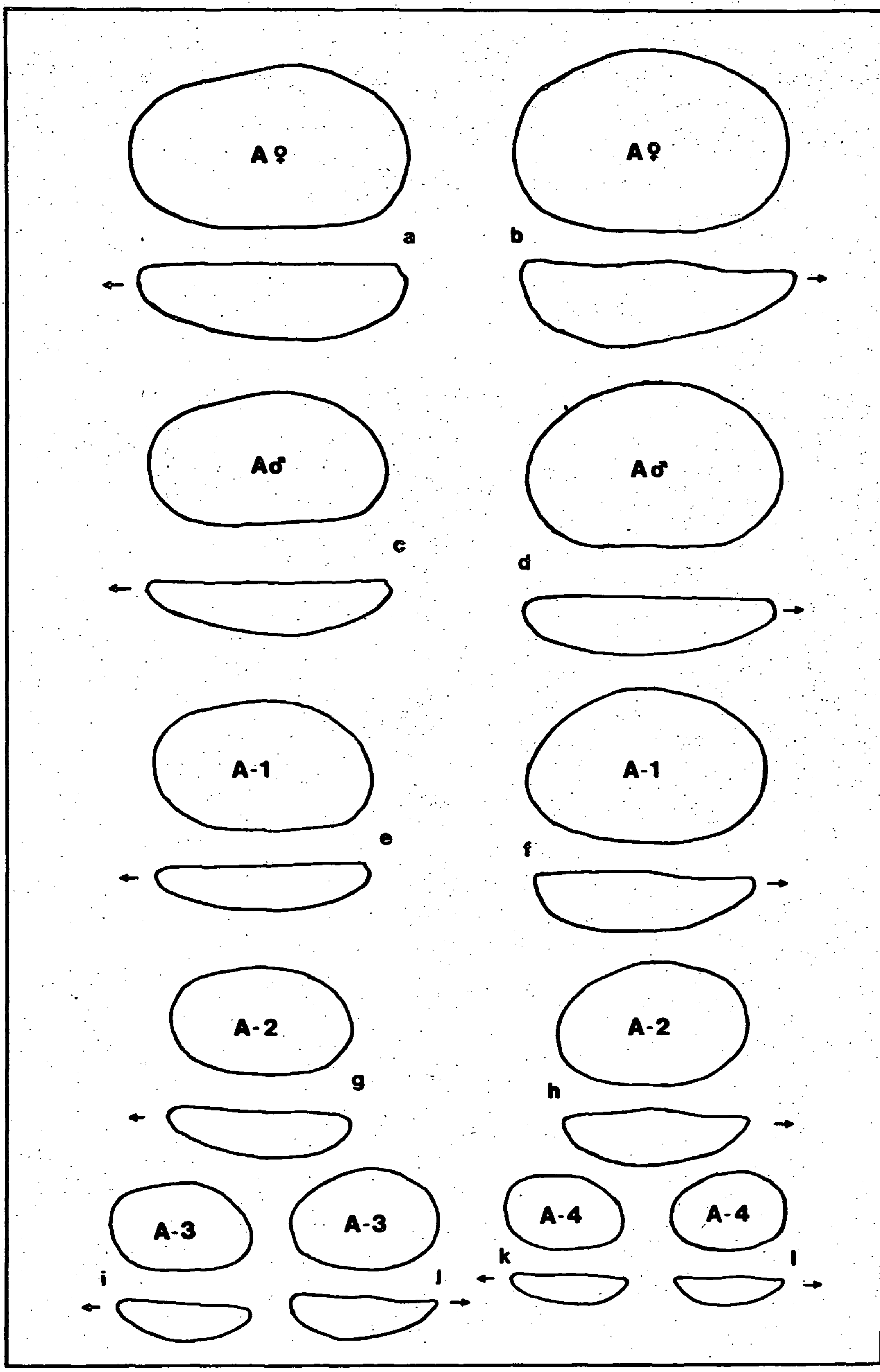


Fig.5:1. Lateral and dorsal outlines of growth stages in <u>Cytherella</u> ex.gr.<u>C.ovata</u>. Specimens a-l numbered consecutively OS 9329 to OS 9340. All specimens from sample PBH1 12. (x51).

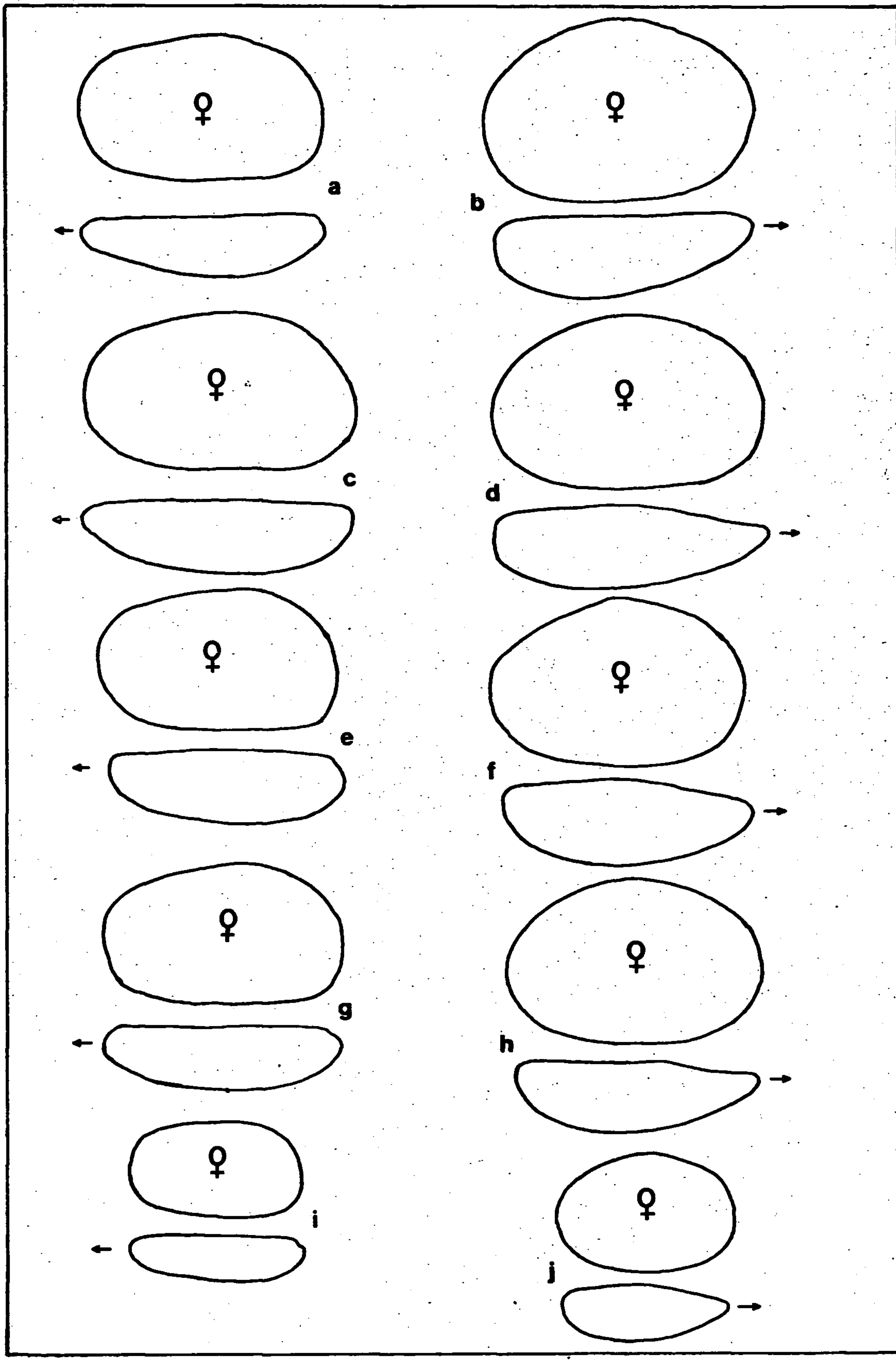


Fig. 5:2. Lateral and dorsal views of specimens of Cytherella ex.gr.C.ovata showing variation in shape. Specimens a,b from sample Bar 20; c,d from sample S 23; e,f from sample Bar 11; g-j from sample BB 8. Specimens a-j numbered consecutively OS 9341 to OS9350. (all figs. x51).

past because Roemer's type specimens have been lost, and because of its wide variability in size and shape. Some of the variations in size and shape through the Cenomanian can be seen in Fig. 5:2 . Intermediates between the forms figured can be found and so a subdivision is not thought possible. The small form (Fig. 5:2i,j) is similar to the specimens in Fig.5:2g,h but is much smaller. Both types can be found in the same samples, but in this case no intermediates have been found.

Fig. 5:7 shows a graph of the ontogeny in the species. The general form of the graph agrees with those produced by Herrig (1966) for Maastrichtian specimens, but the size of the Cenomanian specimens is much smaller. Gründel (1966) has shown that size is a variable factor in adult specimens of this species and even during the Cenomanian there is considerable variation in size amongst the adults. In the Barrington section, for example, adult specimens vary from 0.78 mm. to 0.934 mm. long, whilst from Blue Bell Hill specimens can be found up to 1 mm. long.

Occurrence: This species occurs throughout the British Cenomanian. It is sometimes extremely common and is present in most samples.

Cytherella cantabrigensis n.sp.

(Plate 2,figs.1-5,12; text-figs.5:3,5:7)

Derivation of name: Cantabrigia - Latin = Cambridge - a city 10 km. S.W. of the Barrington quarry.

1849 Cytherella truncata (Bosquet); Jones : 30, pl.7, figs. 25a-c (non figs. 25 d, e)

1890 Cytherella münsteri (Roemer); Jones and Hinde : 46, pl.3, figs. 63, 66, 67 (non figs. 64, 65)

Diagnosis: Elongate *Cytherella* with a concave ventral margin and concave to convex dorsal margin. Greatest breadth near the posterior.

Holotype: A female right valve OS 9351. Sample BB8, 13.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: 9 valves and carapaces, OS 9352 to OS 9360, from the same horizon and locality.

Other Material: 160 adult valves and carapaces and numerous juvenile valves, some of which are mounted as OS 9361 to OS 9372.

Measurements (mm)		Length	Height	Width
Holotype, female right valve,	OS 9351	0.857	0.500	0.230
Paratype, female left valve,	OS 9352	0.835	0.418	0.203
Paratype, male right valve,	OS 9353	0.800	0.429	0.187

Description: An elongate species of *Cytherella* showing marked sexual dimorphism. In females the right valve has a concave ventral margin and a gently arched dorsal margin. The left valve has a concave ventral margin and a weakly concave dorsal margin. In males the dorsal margin is more strongly concave in the left valve and the dorsal margin of the right valve is less arched or even straight. All valves have broadly rounded anterior and posterior margins. The greatest height in females lies in the centre but in males it lies at one quarter length. In dorsal view the sides of the valves are straight and converge towards the anterior. The greatest breadth lies just behind ¾ length.

Juveniles are common and are similar in shape to the adults (Fig. 5:3).

Remarks: Specimens of this species were first recorded by Jones (1849) from the chalk detritus of Charing (Cenomanian), and these can still be seen in the B.M.N.H. slides In51589, In51590,

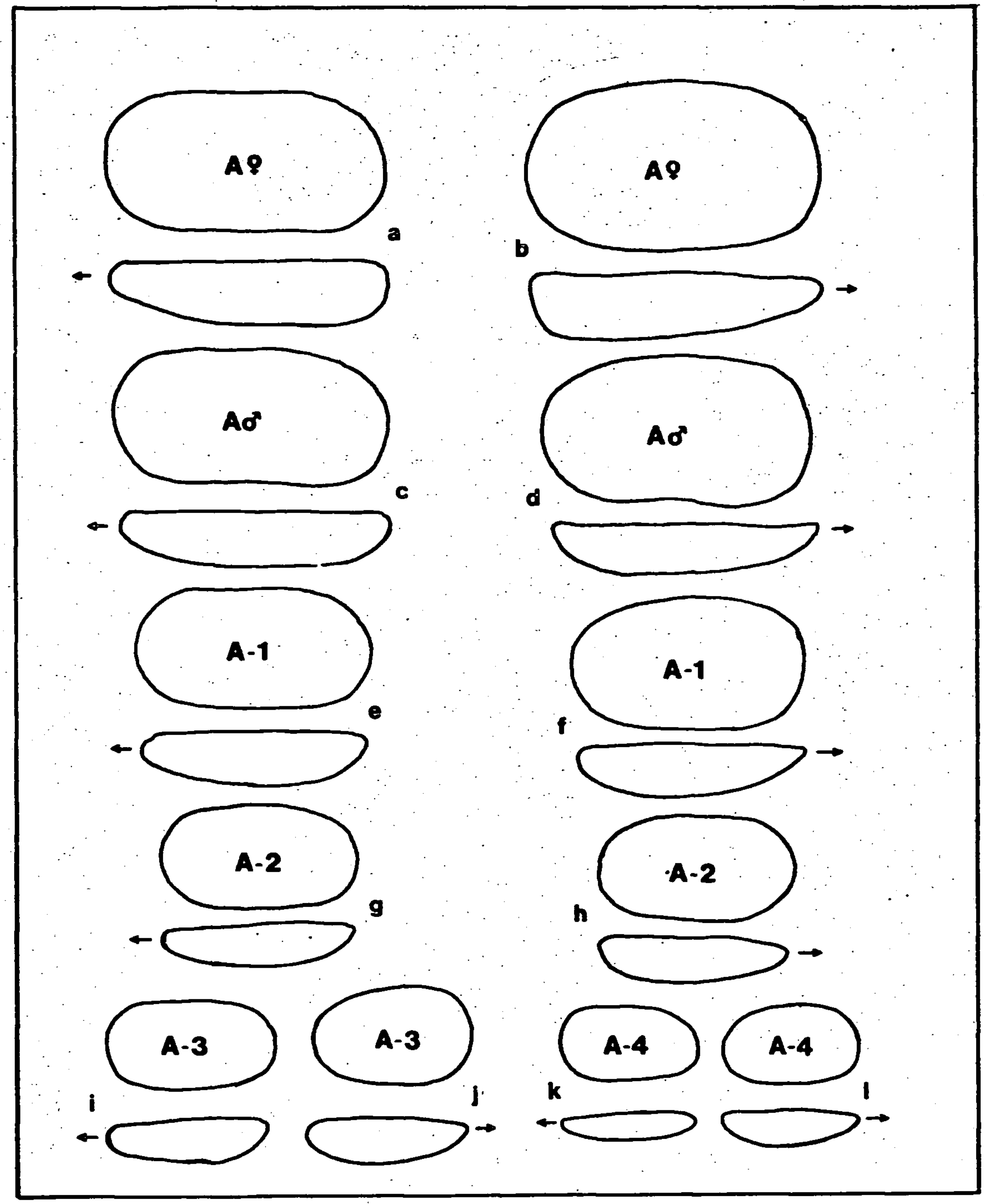


Fig.5:3 Lateral and dorsal outlines of growth stages in <u>Cytherella cantabrigensis</u> n.sp. Specimens a – l numbered consecutively OS 9361 to OS 9372. All specimens from sample BB 11 (x51).

In51596. Jones referred these specimens to C.truncata Bosquet but also included two specimens which are not co-specific. These specimens were later placed in C.munsteri (Roemer) by Jones and Hinde (1890). Bonnema (1940) included Jones' material in C.parallela Reuss a species which has been used to cover a wide range of forms with parallel or sub-parallel long margins. Interpreted in terms of the original description this species has straight, parallel dorsal and ventral margins and is only 0.5 mm. long. In any case Jones' material does not appear to be co-specific with Bonnema's and these forms now require a new name.

C.cantabrigensis can be distinguished from C.contracta contracta Veen, from the Maastrichtian of S. Limburg, by the shape of the dorsal margin which is concave in C.c.contracta but weakly convex in female valves of C. cantabrigensis. Figures of C.c.contracta given by Herrig (1966) show that in dorsal view males differ from males of C.cantabrigensis by being more compressed and having convex long margins.

Occurrence: This species occurs throughout the Cenomanian of Southern England but it is generally more common above the mid-Cenomanian non-sequence.

Cytherella aff. C. contracta contracta Veen 1932

(Plate 3,figs.8-13; text-fig.5:4)

? 1932 Cytherella contracta Veen : 342, pl.8, figs. 1 - 18

1969 Cytherella contracta contracta Veen; Gründel : 83, pl.1, figs.8,9

Diagnosis: A medium sized, elongate species of Cytherella with weakly concave long margins. Valves rather fragile.

Material: 120 adult valves and carapaces and many juvenile valves, some of which are mounted as OS 9373 to OS 9385.

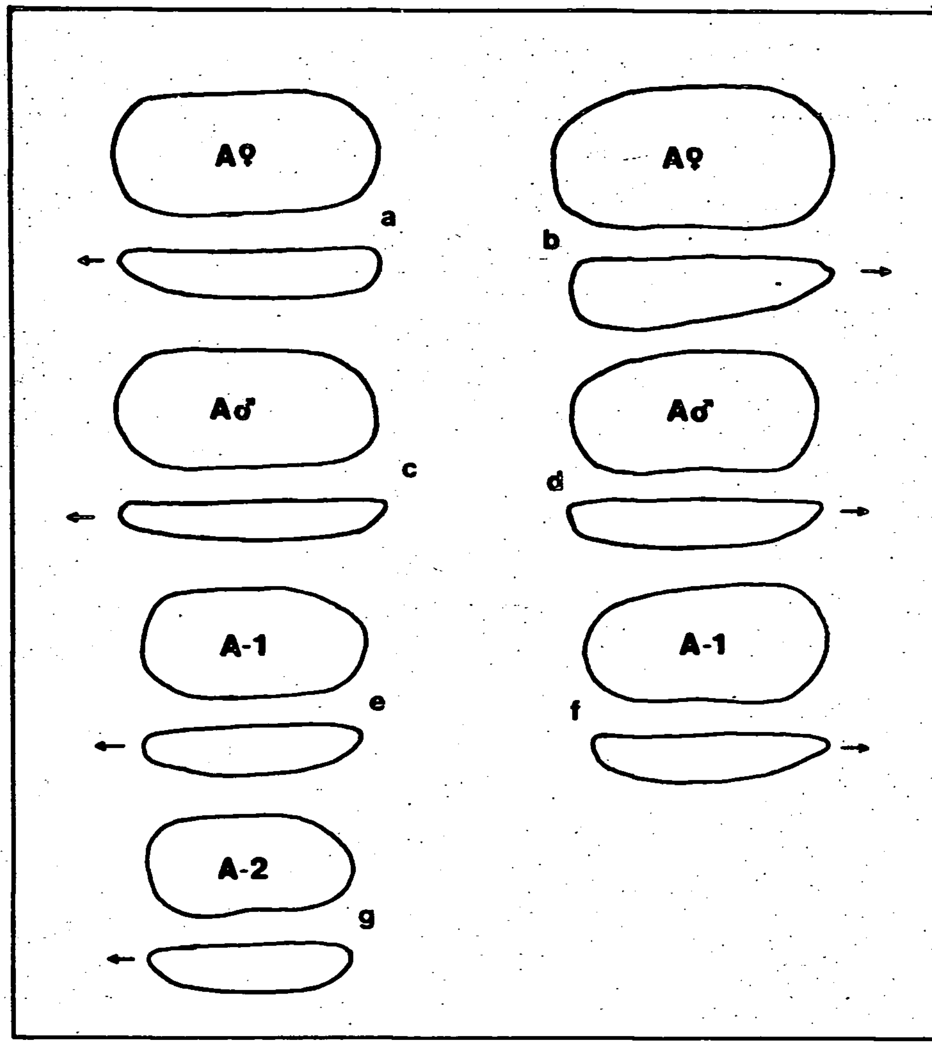


Fig.5:4 Lateral and dorsal outlines of growth stages in Cytherella aff.C. contracta contracta Veen. Specimens a - g numbered consecutively OS 9379 to OS 9385. All specimens from sample BB 13. (x51).

Measurements (mm)		Length	Height	Width
Female, left valve,	OS 9373	0.660	0.319	0.143
Female, right valve	OS 9374	0.670	0.351	0.155
Male, right valve,	OS 9375	0.637	0.330	0.128

Description: Carapace elongate, the height is about half the length. Ventral margin concave, dorsal margin straight to weakly concave sub-parallel to the ventral margin. Anterior and posterior margins broadly rounded. In dorsal view the carapace has its greatest width just in front of the posterior end. The sides of the valves are straight and converge towards the anterior. Males are less inflated posteriorly so that in dorsal view the sides converge less strongly towards the anterior and the position of greatest width is less well defined.

Remarks: These forms are very similar to C.contracta contracta Veen from the Maastrichtian of South Limburg but are a little smaller and less high relative to their length. C.contracta contracta is a little wider in dorsal view with less tapered margins. Since these differences are all relative it seems unwise to erect a new species at the present time, though work on specimens from the intervening levels could show the Cenomanian forms to be distinct. Gründel (1969) recorded specimens from the Plenus Zone of Saxony as C.contracta contracta. These specimens appear to be identical to the British Cenomanian specimens.

This species differs from C.cantabrigensis by being smaller, and lacking the gently arched dorsal margin in the female right valves. C. aff. C.contracta contracta is also more thinly calcified and its juveniles can be distinguished from those of C.cantabrigensis in that they are less high and more fragile (Figs. 5:3 and 5:4).

Occurrence: Middle Cenomanian above the mid-Cenomanian non-sequence and Upper Cenomanian.

Cytherella damottae n.sp.

(Plate 4, figs.1-5)

Derivation of name: After Dr. R. Damotte in recognition of her contribution to the study of Cretaceous Ostracoda.

Diagnosis: A fairly small species of Cytherella with a deep muscle pit situated centrally on the outside of the valves. The position of greatest width lies below the muscle pit. Internally

Holotype: A female right valve, OS 9386. Sample BB14, 1.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: 5 valves, OS 9391 to OS 9395 from the same horizon and locality. Hypotypes Female, left valve OS 9387, sample S 19, Middle Cenomanian, Southerham, Sussex. Female carapace, OS 9390, sample P BH3 9, Middle Cenomanian, Pitstone, Herts.

Other material: 60 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, female right valve,	OS 9386	0.600	0.418	0.155
Hypotype, female left valve,	OS 9387	0.582	0.330	0.143

Description: Small, heavily calcified Cytherella. Ventral margin straight, dorsal margin weakly concave in left valves but arched in right valves, the anterior half of the dorsal margin is often concave in the right valves. Greatest height is at or just behind mid length. Posterior margin symmetrically rounded, anterior margin obliquely rounded. A distinct, deep muscle pit is seen centrally placed on the outside of the valves, above this the shell is flattened somewhat. The greatest inflation of the valves occurs ventrally below and a little behind the muscle pit, thus when the carapace is viewed from the anterior it has a triangular outline. Internally the posterior ends of the valves have two rounded depressions one above the other, but there is no external expression of these. Juveniles are much less inflated posteriorly but still possess the muscle pit and ventral inflation.

Remarks: As in *Cytherella atypica* Bate (1972) and *C. jonesi* Neale (1975), both from the Upper Cretaceous of W.Australia, this species has two posterior brood pouches. *C.atypica* can be distinguished by the reversed overlap of its valves, whilst *C.jonesi* lacks the central pit and has a less arched dorsal margin. The left valves of *C.damottae* are similar to left valves of *Cytherelloidea anomala* Kaye (1963b) from the Barremian of Yorkshire, but the right valve of *C.anomala* does not have an arched dorsal margin.

Occurrence: This species can be found sporadically throughout the Cenomanian, but it is never very common.

Cytherella gründeli n.sp.

(Plate 3,figs.1-7)

Derivation of name: In honour of Dr. J. Gründel who first recognised this species.

1969a *Cytherella* sp. Gründel : 83, pl. 1, figs. 6,7.

Diagnosis: A species of *Cytherella* of small size, with straight, parallel, dorsal and ventral margins, and a wedge-shaped outline in dorsal view.

Holotype: A right valve, OS 9396. Sample P BH3 12m., 2m. below the Totternhoe Stone, Middle Cenomanian, Pitstone, Herts.

Paratypes: 8 valves, OS 9397, OS 9398 and OS 9402 to OS 9407 from the same horizon and locality.

Other Material: Several hundred valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9396	0.593	0.341	0.120
Paratype, right valve,	OS 9397	0.550	0.280	0.120

Description: A small, rather fragile species of Cytherella with a rectangular shape. Dorsal and ventral margins are straight and parallel in both valves although they may weakly converge towards the anterior in some left valves. The anterior and posterior margins are broadly rounded but the rounding may be rather oblique especially in the left valves. Thus the antero-dorsal and postero-ventral corners are sharply rounded whilst the antero-ventral and postero-dorsal corners are more gently rounded. A flattened rim runs around the anterior margin of the left valves. In dorsal view the posterior end of the carapace is almost straight, the sides of the valves diverge slightly from the posterior to ¾ length and then converge to the anterior. In dorsal view the carapace is therefore wedge shaped. The right valve overlaps the left particularly along the dorsal and ventral margins. Sexual dimorphism has not been observed.

Remarks: This species of Cytherella was first recognised by Gründel (1969a) in the Plenus zone of Saxony though he did not give it a specific name. In the Cenomanian of Britain it is often extremely common but no juvenile or male valves have been found. Since the adults are rather fragile it is possible that the juveniles are too weakly calcified to be preserved.

Several specimens have been found in which the dorsal margin of the right valve is slightly arched. Some of these specimens may also be more strongly calcified (Plate 3 Figs.1-4), but for the time being it is thought best to classify them together since the left valves are identical and the outline in dorsal view is very similar.

This species can be distinguished from other species of Cytherella by its relatively small size, straight, parallel long margins and its thin shell. C.aff. C. contracta contracta has weakly concave long margins and has a different outline in dorsal view with C.gründeli being much more wedge shaped.

Occurrence: C.gründeli is common throughout the Cenomanian and it is often the most common species in the sample.

Cytherella medwayensis n.sp.

(Plate 2,figs.6-9,13; text-figs.5:5,5:7)

Derivation of name: Medway - A river valley in Kent on the north side of which is Blue Bell Hill - the type locality.

Diagnosis: An ovate, laterally compressed species of Cytherella with the ventral margin almost as convex as the dorsal margin. Greatest width at or just behind mid-length. Dorsal and ventral margins straight and parallel in the left valves.

Holotype: A female right valve, OS 9408. Sample BB20, 19.5m. below the base of the Plenus Marls, Middle Cenomanian, Blue Bell Hill, Kent.

Paratypes: 7 valves, OS 9411 to OS 9417 from the same horizon and locality. Hypotypes: A female carapace OS 9409 from sample BN 7, Upper Cenomanian, Buckland Newton, Dorset.

Other Material: 310 valves and carapaces some of which are mounted as OS 9418 to OS 9427.

Measurements (mm)		Length	Height	Width
Holotype, female right valve,	OS 9408	0.759	0.516	0.155
Hypotype, female carapace,	OS 9409	0.759	0.506	0.330
Paratype, female left valve,	OS 9411	0.714	0.407	0.165

Description: The right valve is oval in outline with the greatest height in the middle. The anterior margin is broadly rounded and the posterior margin is a little more narrowly so.

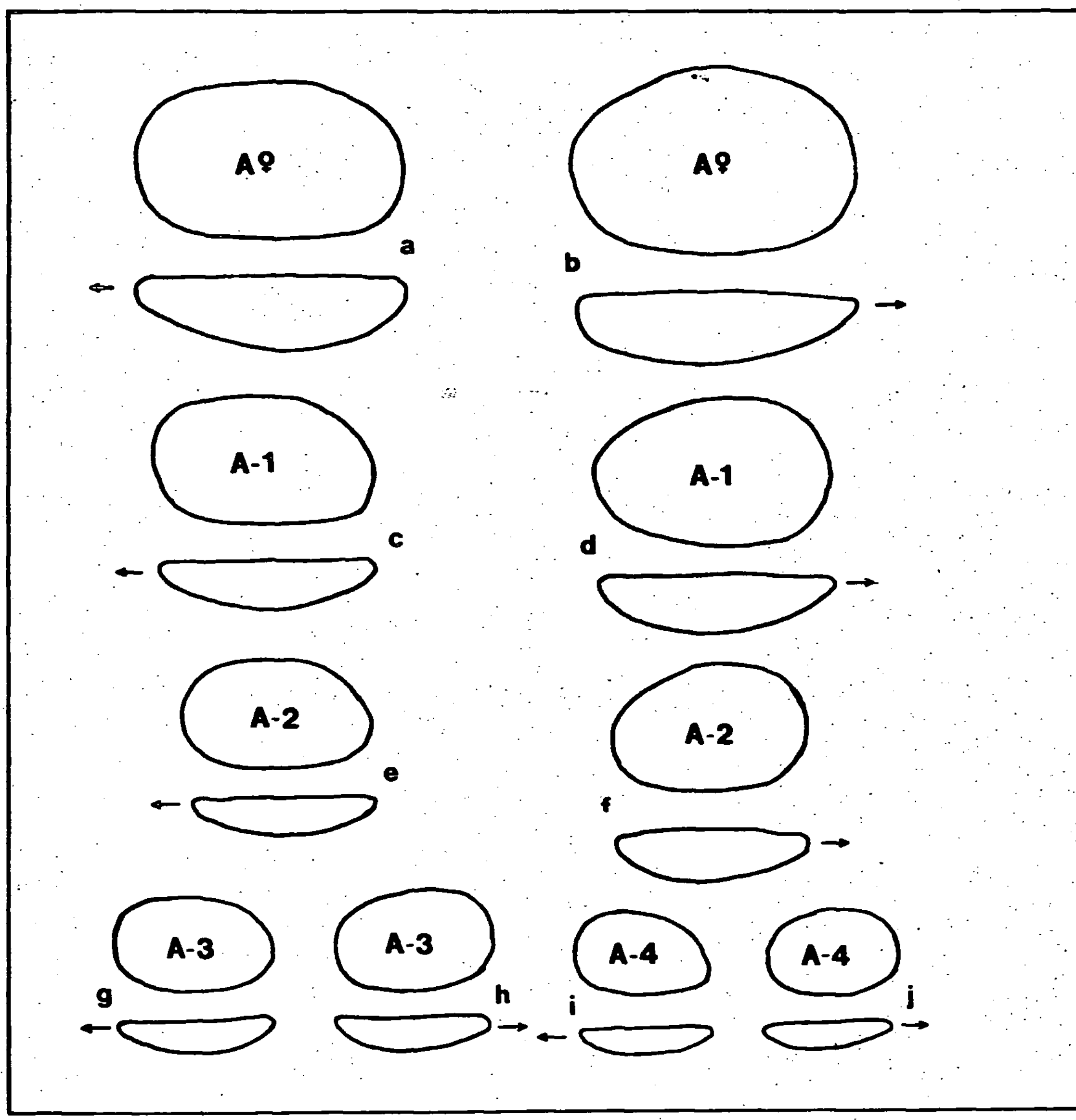


Fig.5:5 Lateral and dorsal outlines of growth stages in <u>Cytherella medwayensis</u> n.sp. Specimens a - j numbered consecutively OS 9418 to OS 9427. All specimens from sample PBH1 30. (x51).

Dorsal and ventral margins are almost equally convex. In left valves the dorsal and ventral margins are straight and parallel, and there is a narrow flattened rim around the anterior margin. In dorsal view the carapace is not very inflated. The position of greatest width lies at or just behind mid-length, and the sides of the valves converge away from this point. The valves converge more strongly towards the anterior than the posterior. The right valve overlaps the left particularly in the dorsal and ventral regions.

Juveniles differ from the adults in that the dorsal and ventral margins converge more strongly in the posterior part of the right valve (Fig.5:5).

Males not seen.

Remarks: Cytherella medwayensis can be distinguished from C.ovata by its more convex ventral margin and also in dorsal view by its much more compressed outline and more anteriorly situated position of greatest width. Left valves differ from C.ovata by having parallel long margins and a flattened anterior rim. C.cf.C.truncata differs by being larger, more inflated and more elongate. C.berthoui Colin and Lauverjat, from the Cenomanian of Portugal, and C.eosulcata Colin from the Turonian of the Dordogne, both have convex ventral margins in the right valve, but in dorsal view they both have the position of greatest width near the posterior.

Occurrence: C. medwayensis occurs throughout the Cenomanian but is more common in the Lower and Middle Cenomanian.

Cytherella cf. C. truncata (Bosquet)

(Plate 1, figs.6-12, Plate 2, fig.11; text-figs.5:6,5:7)

cf. 1847 Cythere truncata Bosquet : 7, pl.1, fig. 2a-c

1971 Cytherella cf. ovata (Roemer); Keen and Siddiqui : 62, pl.1, figs. 1 and 9.

Diagnosis: An elongate-ovate species of *Cytherella* with the lower half of the posterior margin of the right valve obliquely truncate. Left valve elongate with sub-parallel dorsal and ventral margins.

Material: 600 valves and carapaces, some of which are mounted as OS 9428 to OS 9444.

Measurements (mm)		Length	Height	Width
Female, left valve,	OS 9428	0.880	0.483	0.220
Female, right valve,	OS 9429	0.934	0.560	0.242
Male, right valve,	OS 9430	0.857	0.461	0.176

Description: A strongly calcified species of *Cytherella* with an elongate-oval outline. The anterior margin of the right valve is broadly rounded but the posterior margin is obliquely rounded so that the lower half appears truncate. The ventral margin is gently convex. The dorsal margin is symmetrically arched. The left valves are elongate with sub-parallel dorsal and ventral margins which converge slightly towards the posterior. Anterior and posterior margins are broadly rounded.

The greatest height of the carapace lies in the middle whilst the greatest breadth lies at 2/3 length.

Males are somewhat different to females. The right valves have a less arched dorsal margin and a weakly concave ventral margin. Relative to their length they are less high and less wide. The left valves of both sexes are similar but in males they are less wide and slightly less high.

Juvenile valves can be recognised down to the A-4 stage. In the A-1 and A-2 stages the truncation in the postero-ventral region can still be seen (Fig. 5:6).

Remarks: This species closely resembles *C.ovata* Roemer but it can be distinguished by its more elongate shape and its truncate

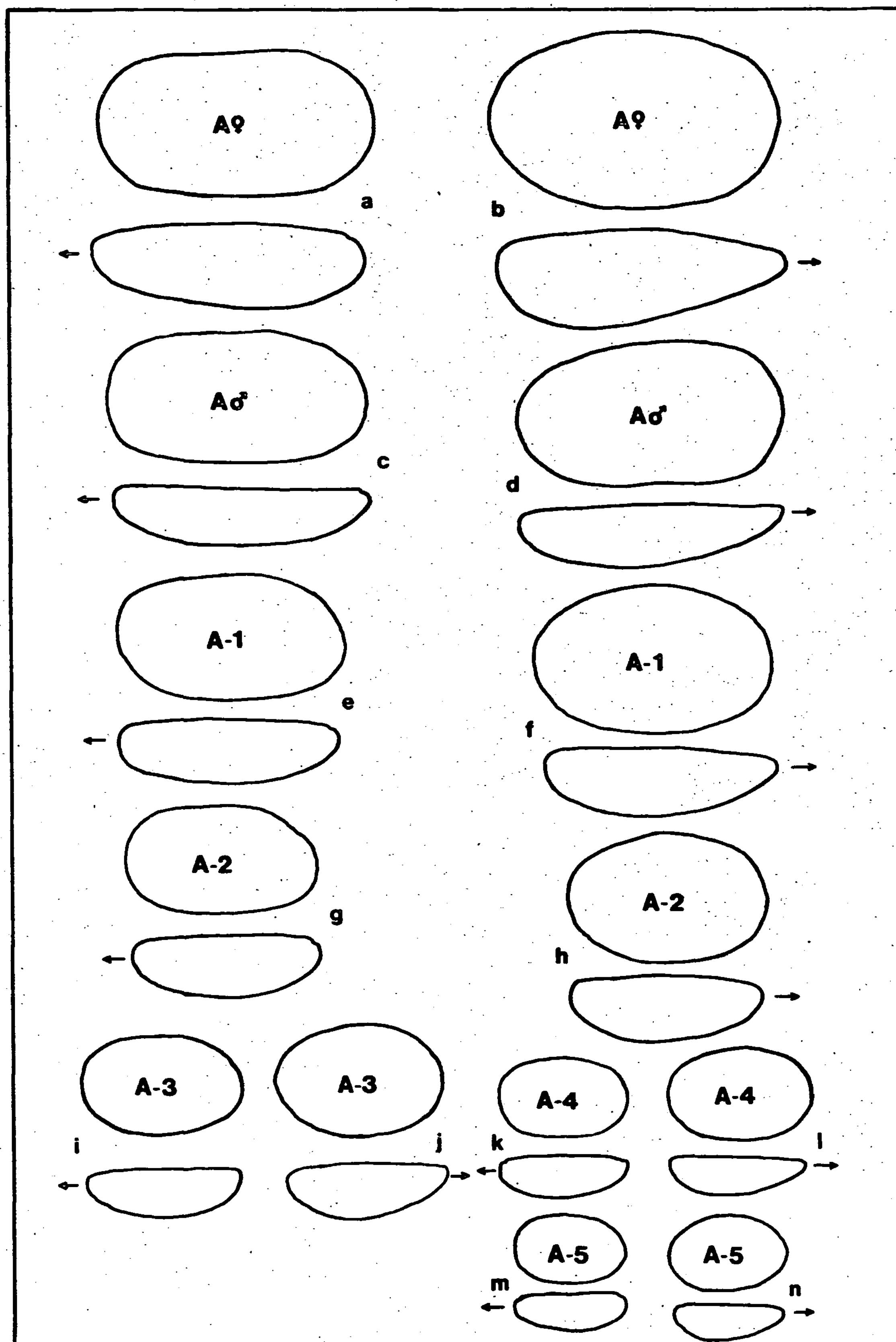


Fig.5:6 Lateral and dorsal outlines of growth stages in <u>Cytherella</u> cf. <u>C.truncata</u> (Bosquet). Specimens a - n numbered consecutively OS 9428 to OS 9444. All specimens from sample PBH1 30. (x51.).

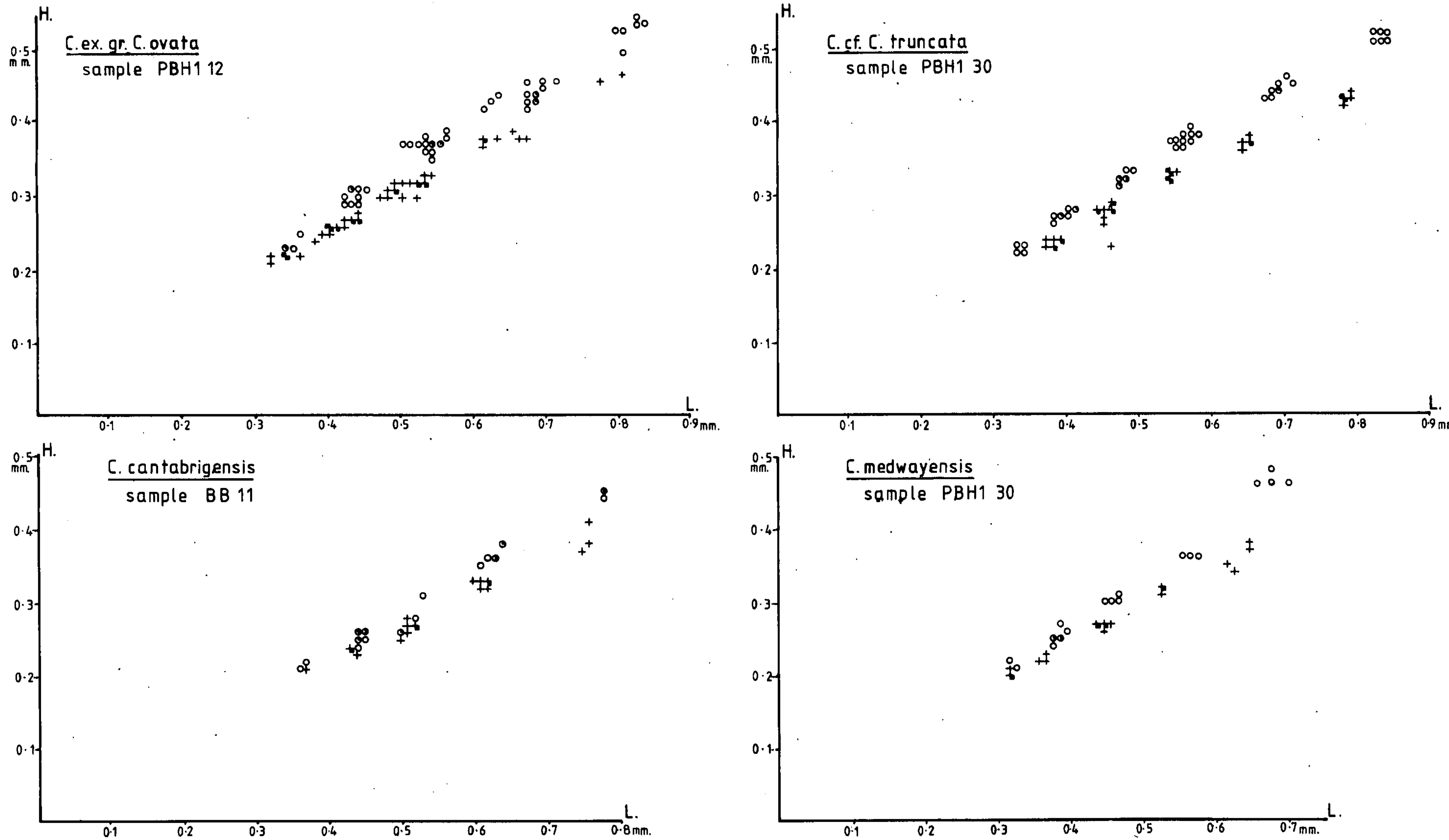


Fig. 5:7 Length/height measurements in 4 species of Cytherella. ○ right valve + left valve
(all adults shown = females) Number of specimens: ♀ 1 ♀ 2 ♀ 3

postero-ventral margin. Figs. 5 : 1 and 5 : 6 show that C. cf. C. truncata can be distinguished from C. ex.gr. C. ovata down to at least the A-4 stage.

Specimens from the Bosquet collection (Maastrichtian) in the British Museum show valves with a more pronounced postero-ventral truncation in the right valve. This, coupled with the wide stratigraphic interval between the Cenomanian and Maastrichtian, could indicate that the two forms belong to separate species. Since I have not seen a full population of Maastrichtian forms - including males and juveniles, the Cenomanian forms are, for the time being, tentatively referred to Bosquet's species.

The specimen figured by Keen and Siddiqui as Cytherella cf. ovata from the Cenomanian of Belfast belongs to this species. Keen and Siddiqui state that it is "longer in proportion to its height" than a true C.ovata, and their figure (pl.1, fig.1) clearly shows the posteroventral truncation of the right valve.

Occurrence: Common in the Lower and Middle Cenomanian but can also be found in the Upper Cenomanian.

Genus CYTHERELLOIDEA Alexander, 1929

Type species : Cytherella williamsoniana Jones, 1849

Cytherelloidea bonnemai n.sp.

(Plate 5, figs. 6, 7, 9, 10)

Derivation of name: In honour of J.H. Bonnema in recognition of his contribution to the study of Cretaceous Ostracoda.

pars 1940 Cytherelloidea circumvallata Bonnema : 104, pl.2, figs. 1-4 (? pl.2, figs. 5-11; non pl.1, figs. 48-56)

Diagnosis: An inflated species of Cytherelloidea with indistinct lateral ribs and a deep muscle pit.

Holotype: A female carapace, OS 9445. Sample BB12, 5.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: Two valves OS 9446 and OS 9447 from the same horizon and locality. Hypotypes: 10 valves and carapaces OS 9448 to OS 9457. Sample S6, Upper Cenomanian, Southerham, Sussex.

Other Material: 130 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, female carapace,	OS 9445	0.571	0.308	0.242
Paratype, female left valve	OS 9446	0.582	0.300	0.132
Paratype, male left valve,	OS 9447	0.527	0.275	0.110

Description: Valves elongate, subrectangular with a weakly concave ventral margin and a dorsal margin which is straight in the right valves but sinuous in the left valves. The anterior margin is semicircular whilst the posterior margin is weakly rounded. A narrow flattened rim runs around the anterior margin in the left valves. Two posterior swellings are present in female valves and these are joined by a vertical rib which is more apparent in male valves. Extending forward from the upper and lower ends of the vertical rib are indistinct longitudinal ribs. The upper one of these is rather short but the ventral rib extends forward to about 1/5 length where it merges with the inflated anterior area of the carapace. There is also an indistinct middle rib which runs beneath the deep muscle pit and merges with the inflated anterior area. Above the muscle pit is an oblique inflated area with depressed areas in front and behind it. In dorsal view the greatest width is across the posterior end in females whilst in males it lies across the middle. Juveniles have no evidence of ribbing but possess a deep muscle pit.

Remarks: Bonnema (1940) described and named the species Cytherelloidea circumvallata but he appears to have included at least two separate species under the same name. The specimens figured on pl.1, figs 48 - 56 from the 'Mergel' may be taken as typical in which case the remaining specimens (pl.2, figs. 1-11) from the 'Schreibkreide' require a new name. These specimens from the Schreibkreide appear very similar to specimens from the British Upper Cenomanian but as the figures are poor and I have not seen the actual specimens Bonnema's specimens are only tentatively referred to this new species.

The inflated carapace and indistinct lateral ribs make this species easily distinguishable from other species of the genus. In the Lower Cenomanian occasional larger specimens of this species can be found together with normal sized individuals.

Occurrence: Middle Cenomanian above the mid-Cenomanian non-sequence and Upper Cenomanian. A few larger specimens have also been found in the Lower Cenomanian.

Cytherelloidea globosa Kaye 1964

(Plate 5,figs.14-16)

1964c *Cytherelloidea globosa* Kaye : 71, pl.9, figs. 7,9,10.

Diagnosis: An inflated species of *Cytherelloidea* with a prominent vertical median sulcus limited ventrally by a longitudinal swelling.

Material: 7 valves, two of which are mounted as OS 9458 and OS 9459.

Measurements (mm)		Length	Height	Width
Female, left valve,	OS 9458	0.516	0.286	0.132
Female, right valve,	OS 9459	0.550	0.330	0.143

Description: Small inflated *Cytherelloidea* with semicircular anterior and posterior margins, and straight and parallel dorsal and ventral margins. The surface has swellings rather than ribs and the swellings are separated by sulci. A prominent deep sulcus extends down from the centre of the dorsal margin but is terminated ventrally at ½ height by the ventral swelling. From this central sulcus a less pronounced depression runs antero-ventrally dividing off the antero-lateral area. Posteriorly two large fused swellings occur, the dorsal one extending further forward. Both are separated from the ventral swelling by a further sulcus.

Juvenile valves lack the fused posterior nodes but the forward extension of the postero-dorsal node is retained.

Remarks: The replacement of ribs by swellings makes this species easily distinguishable.

Occurrence: This species has so far been recorded only from the Cambridge Greensand (Kaye 1964c). It does however also occur in the Glauconitic Marl from Culver Cliff (Isle of Wight).

Cytherelloidea hindei Kaye 1964

(Plate 5,figs.1-5,8)

1964c Cytherelloidea hindei Kaye : 72, pl.9, figs. 4,8,11.

1964b Cytherelloidea mariei Damotte : 236, pl.1, figs. 7a-d.

1971b Cytherelloidea hindei Kaye; Damotte : 57, pl.1, fig.13.

Diagnosis: A species of Cytherelloidea with a high ventral rib, anterior marginal rib, low sinuous dorsal rib and a high posterior rib all connected. All the ribs stand in from the margin leaving a sloping marginal area around the valves.

Material: 74 valves, four of which are mounted as OS 9460 to OS 9463.

Measurements (mm)		Length	Height	Width
Female right valve,	OS 9460	0.650	0.351	0.155
Female left valve,	OS 9461	0.630	0.334	0.155

Description: Valves strongly calcified, rectangular in outline. Dorsal margin straight, ventral margin weakly concave, anterior and posterior margins semicircular. The lateral surface is bounded by a continuous rib formed by the combination of a high straight ventral rib, a high arcuate anterior rib, a sinuous dorsal rib and a gently curved, high posterior rib which is most easily seen in males. In females the posterior rib is partly obscured by the postero-dorsal and postero-ventral nodes which lie at the junctions between the posterior rib and the dorsal and ventral ribs respectively. The muscle scar pit is fairly deep and beneath it runs a long arcuate median rib which does not connect to the other ribs. All the ribs lie in from the margins and thus a flat sloping surface is formed between the marginal ribs and the margin proper. This feature is more obvious in the larger right valve.

Remarks: This species has been regarded as being restricted to the Senonian, but a few poorly developed specimens have been found from the Middle Cenomanian of Southerham. This species occurs quite commonly in the Upper Beds of the Plenus Marls (Beds 4-8), and has also been noted from the Turonian. The specimens from the Plenus Marls have a slightly more pronounced anterior and dorsal shelf in the right valves than the type material but otherwise they are identical.

Occurrence: A few poorly developed specimens belonging to this species have been found near the base of the Southerham section (Middle Cenomanian). Apart from this, this species has not been found below Bed 1 of the Plenus Marls. It is common in the upper half of the Plenus Marls and has also been noted in the Turonian of Southern England and recorded from the Campanian of England and France.

Cytherelloidea kayei n.sp.

(Plate 4, figs.10-14)

Derivation of name: After Dr. P. Kaye in recognition of his contribution to the study of Cretaceous Ostracoda.

Diagnosis: A small species of *Cytherelloidea* with a strong anterior marginal rib, a short arcuate ventral rib and very reduced dorsal and middle ribs.

Holotype: A female right valve, OS 9464. Sample BB13, 3.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: 11 valves and carapaces, OS 9466 to OS 9476, from the same horizon and locality. Hypotype: A male carapace, OS 9465, from sample BB6, Middle Cenomanian, Blue Bell Hill, Kent.

Other Material: 330 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, female right valve	OS 9464	0.593	0.341	0.132
Paratype, female carapace	OS 9466	0.593	0.341	0.242
Hypotype, male carapace	OS 9465	0.571	0.319	0.200

Description: Anterior and posterior margins semicircular. Dorsal and ventral margins sub-parallel, valves being slightly higher anteriorly. Anterior margin has a flattened border which continues around the dorsal margin as a wider shelf and is just visible around the posterior margin, this border is less clear in the left valves. A very strong rib runs parallel to the anterior margin this continues as a shelf along the ventral margin. The ventral rib is well developed extending from ¼ to ¾ length, it is slightly arcuate and does not join the posterior rib. In males the development of the posterior rib can be seen, it forms a vertical ridge extending from the ventral shelf and dorsally it joins the short dorsal rib. In males the dorsal rib can be seen extending to 2/3 length, but in females it is obscured by the dorsal posterior node. An extremely weak middle rib is just visible parallel to the ventral rib and just below mid-height. Just above this rib at ½ length is a shallow muscle pit and above this pit is a slight swelling which may be a remnant of the reduced dorsal rib. In female valves the two posterior nodes occur in the corners of the posterior rib and they obscure the posterior and dorsal ribs.

Remarks: This species is similar to C.knaptonensis Kaye, from which it differs by having larger more rounded posterior nodes. The middle and dorsal ribs are more reduced in Cytherelloidea kayei and are barely visible. In dorsal view C. kayei is more inflated. C. kayei can be distinguished from C. stricta by its smaller size and absence of a long dorsal rib. C. stricta is also more laterally compressed. C. chapmani (Jones and Hinde) differs from C.kayei by having smaller posterior nodes, the ventral rib attached to the postero-dorsal node.

Occurrence C. kayei occurs throughout the Cenomanian of Southern England.

Cytherelloidea stricta (Jones and Hinde)

(Plate 4,figs.6-9)

? 1847 Cytherina serrata Williamson: 79, pl.4, fig.79

1849 Cytherella williamsoniana Jones: 31, pl.7, figs. 26a-d,g,h. (non figs. 26e,f.)

1890 Cytherella williamsoniana Jones; Jones and Hinde: 48, pl.3, figs. 57-62

1890 Cytherella williamsoniana stricta Jones and Hinde: 48, pl.3,fig.71

1893 Cytherella williamsoniana stricta Jones and Hinde; Chapman and Sherborn: 346

1898 Cytherella williamsoniana stricta Jones and Hinde; Chapman:344

non 1917 Cytherella williamsoniana stricta Jones and Hinde; Chapman: 58, pl.14, fig.21.

non 1929 Cytherelloidea williamsoniana stricta (Jones and Hinde) Alexander: 56, pl.2, fig.10

non 1951 Cytherelloidea williamsoniana stricta (Jones and Hinde); Sexton: 811, pl.116, fig.16.

? 1956 Cytherelloidea dalumensis Mertens: 180, pl.8, figs.1-3.

1956 Cytherelloidea stricta (Jones and Hinde); Deroo: 1509, pl.1,figs.7,8.

1958 Cytherelloidea stricta (Jones and Hinde); Howe and Laurencich: 270

1963b Cytherelloidea stricta (Jones and Hinde); Kaye: 117, pl.19, figs. 14,15-

1964c Cytherelloidea stricta (Jones and Hinde); Kaye: 74, pl.9, figs. 1-3, 5,6.

1966 Cytherelloidea stricta (Jones and Hinde); Gründel: 15, pl.1,fig.20

1971b Cytherelloidea stricta (Jones and Hinde); Damotte: 57, pl.1,fig.12.

Diagnosis: A species of Cytherelloidea with a prominent, long dorsal rib and a short ventral rib but no median rib. The dorsal rib joins the top of the vertical posterior rib. The median rib is unattached at both ends.

Material: 348 valves and carapaces

Measurements (mm)

		Length	Height	Width
Female carapace	OS 9477	0.736	0.418	0.242
Female right valve	OS 9478	0.714	0.407	0.155
Male carapace	OS 9479	0.725	0.384	0.209

Description: Carapace laterally compressed, surface smooth, but bearing about 8 short tubercles along the posterior margin of each valve. Anterior margin broadly rounded, posterior margin less broadly so. Dorsal and ventral margins sub-parallel due to the ventral margin curving down slightly near the anterior end. A prominent rib runs parallel to the anterior margin, just behind a thin marginal shelf. In males the true nature of the posterior rib can be seen, it runs as a vertical ridge just in from the posterior margin. At the dorsal end this rib joins the long dorsal rib which ends just beneath the dorsal extremity of the anterior rib. Above the dorsal rib is a broad flattened shelf seen particularly in right valves. A short ventral rib occurs separated posteriorly and anteriorly and separated from the ventral margin by a flattened shelf. A shallow muscle pit can be seen just beneath the dorsal rib in the centre of the valves. In females two prominent rounded swellings occur one above the other at the posterior end, they tend to obscure the posterior rib.

Remarks: As Kaye (1964) remarked this species "has a particularly confused past". It appears to have been first recognised by Williamson (1847) who gave it the name Cytherina serata. Jones (1849) appears to have grouped all species of Cytherelloidea into Cytherella williamsoniana but it was not until 1890 that Jones and Hinde introduced Cytherella williamsoniana var. stricta. Of the original figures produced by Jones (pl.7, figs 26a-h) fig. 26f. has been proposed lectotype for C.williamsoniana by Howe and Laurencich (1958), fig. 26e has been placed into C.parawilliamsoniana Kaye by Kaye (1963) and the rest (figs. 26 a-d, g, h) are regarded as belonging to C.stricta by Kaye 1964. The specimen belonging to fig. 26f. however was lost long before 1958 and so C.williamsoniana remains a nomen dubium (Kaye 1964c).

Occurrence: This species varies from very common to absent in Lower Cenomanian samples. It is less common in the Upper Cenomanian but it can be found as high as the Plenus Marls.

Genus PLATELLA Coryell and Fields, 1937

Type species: Platella gatunensis Coryell and Fields, 1937

Platella sp.A.

(Plate 5,figs.11-13)

Diagnosis: A species of Platella with a densely pitted surface and an elongate, sub-rectangular outline.

Material: 31 valves

Measurements (mm)		Length	Height	Width
Female left valve,	OS 9480	0.562	0.300	0.110
Female carapace,	OS 9481	0.600	0.332	0.231
Male left valve,	OS 9482	0.550	0.286	0.088

Description: Carapace elongate, sub-rectangular. Dorsal and ventral margins weakly concave, anterior margin semi-circular, posterior margin weakly curved to straight. The outer surface bears no ribs but is covered completely by a series of pits. In the centre of the valves is a muscle pit which is usually fairly shallow. Left valves have a narrow, flattened marginal rim at the anterior end. The postero-dorsal margin is truncate and this is emphasised in males. Female valves possess two posterior brood pouches which produce weak swellings on the outside of the valves. In dorsal view the sides of the valves are almost parallel but the greatest width lies across the brood pouches at the posterior in female valves.

Remarks: This species looks very similar to Cytherelloidea besrineensis Bischoff from the Aptian/Albian of Lebanon. C.besrineensis however does not have the flattened anterior marginal rim in the left valve which gives it a slightly different outline in dorsal view, and its pitting appears to be a little denser. The species described as Platella sp. Bate 1972, from the Campanian of W. Australia also lacks a flattened anterior marginal rim in the left valve, and is not rectangular in outline. Platella ? sp. Colin

1974, from the Upper Cenomanian of the Dordogne, has a slightly different shape and has the pits clearly arranged into rows.

Occurrence: Very rare in the Lower and Middle Cenomanian.

Suborder PODOCOPINA Sars, 1866

Superfamily BAIRDIACEA Sars, 1888

Family BAIRDIIDAE Sars, 1888

Genus BAIRDIA McCoy 1844

Type species: Bairdia curtus McCoy 1844.

Bairdia pseudoseptentrionalis (Mertens, 1956)

(Plate 6, figs. 1, 2, 5)

1840 Cytherina subdeltoidea Munster; Roemer: 105, pl.16, fig.22

1845 Cytherina subdeltoidea Munster; Reuss: 16, pl.5, fig.38

1849 Bairdia subdeltoidea (Munster); Jones: 23, pl.5, figs.15a-f.

1874 Bairdia subdeltoidea (Munster); Reuss: 140, pl.26, figs.5a-c.

1890 Bairdia subdeltoidea (Munster); Jones and Hinde: 5, pl.2, figs.31-34.

? 1927 Bairdia subdeltoidea (Munster); Alexander: pl.6, figs. 2, 4.

? 1929 Bairdia subdeltoidea (Munster); Alexander: 61, pl.3, fig.5.

1956 Bairdoppilita pseudoseptentrionalis Mertens: 182, pl.8, figs. 7-10, pl.13, figs. 89,90.

1956 Bairdoppilita roemeri Deroo: 1509, pl.1, figs. 9-12.

1958 Bairdoppilita ? roemeri Deroo; Howe and Laurencich; 82.

1965c Bairdia pseudoseptentrionalis (Mertens); Kaye: 223, pl.2, figs. 1, 3-6.

1966 Bairdia pseudoseptentrionalis (Mertens); Gründel: 15, pl.1, fig.18.

1971b Bairdia pseudoseptentrionalis (Mertens); Damotte: 58, pl.1, fig.15.

1971 Bairdia pseudoseptentrionalis (Mertens); Keen and Siddiqui: 63, pl.1, fig.2.

Material: several hundred valves and carapaces

Measurements (mm)		Length	Height	Width
Left valve,	OS 9483	1.140	0.759	0.384
Right valve,	OS 9484	1.120	0.626	0.275

Description: Carapace strongly calcified, valves very unequal in shape. Left valve with a symmetrically arched dorsal margin, rounded anterior end and gently convex ventral margin. At the posterior the ventral margin is sharply upturned towards the rounded caudal process. The upper margin of the caudal process is short and gently inclined down to the posterior. In the right valve the dorsal margin is short and horizontal, anterior to it is a long straight antero-dorsal margin which is inclined down to the rounded anterior end. The antero-ventral margin is gently convex and at its lower end it extends below the general line of the ventral margin. Posterior to this the ventral margin is straight and then curves up to the caudal process. The upper margin of the caudal process is short and horizontal. The valves are strongly inflated with the greatest width in the middle. The surface is faintly pitted. The left valve overlaps the right around the entire margin.

The hinge of the right valve bears a straight smooth groove situated between two smooth bars. In the left valve there is a straight hinge bar with an accommodation groove above.

The antero and postero-dorsal margins of the left valve project over the right valve in the closed carapace. Inside the lower ends of each of these projections is a row of about 7 very small sockets. The right valve has a raised area here with corresponding teeth along its summit.

The marginal zone is rather narrow. Small vestibules are developed at the anterior and posterior ends.

Pore canals and muscle scars could not be seen.

Remarks: Prior to 1956 most Cretaceous forms of the genus *Bairdia* were placed in *Bairdia subdeltoidea* (Munster) - a Tertiary species. Late in 1956 Deroo re-named these Cretaceous forms as *Bairdoppilita roemeri* but earlier in the same year Mertens had erected the species Bairdoppilita pseudoseptentrionalis for forms having a caudal process with a horizontal upper margin, and a straight dorsal margin in the right valves. B. pseudoseptentrionalis therefore takes preference over B. roemeri. The genus Bairdoppilita was erected for forms bearing small denticles at the anterior and posterior marginal angles of the valves, but as pointed out by Van Morkhoven (1962) these denticles do not form part of the hinge line and forms with and without them occur in other genera of the family Bairdiidae. This species is therefore placed in the genus Bairdia.

Occurrence: This species occurs throughout the Cenomanian in Southern England. In some samples it is extremely common.

Bairdia southerhamensis n.sp.

(Plate 6,figs.3,4,6,7)

Derivation of name: After the village of Southerham, Sussex - the type locality.

Diagnosis: A species of Bairdia with an elongate caudal process, and a ventral margin which is symmetrically curved from the anterior to posterior extremity in the left valve.

Holotype: A carapace, OS 9485. Sample S19, 38m. below the base of the Plenus Marls, Middle Cenomanian, Southerham, Sussex.

Paratypes: 2 carapaces and 2 valves, OS 9487 to 9490 from the same horizon and locality. Hypotype: A left valve, OS 9486 from sample P BH3 13, Middle Cenomanian, Pitstone, Herts.

Other Material: 67 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, carapace	OS 9485	1.173	0.759	0.571
Hypotype, left valve,	OS 9486	1.308	0.791	0.319

Description: Carapace large and heavily calcified; valves of unequal shape. The left valve has a high, strongly arched dorsal margin with long, weakly curved, inclined antero- and postero-dorsal margins. Anterior margin narrowly rounded, the ventral margin forms an almost symmetrical curve from the anterior to posterior extremities with a slight flattening along the mid-ventral margin. The caudal process is long with a horizontal upper margin which makes up to 1/8 of the total length. The right valve has a horizontal hinge margin with straight antero- and postero-dorsal margins. The anterior margin is narrowly rounded and the antero-ventral margin is gently convex. The middle of the ventral margin is straight but it bulges downwards anteriorly and curves up gently at the posterior to the caudal process. In dorsal view the outline is fusiform with pointed ends. The greatest width lies just in front of mid-length and at 1/5 height. The left valve overlaps the right around the entire margin but the overlap is barely perceptible at the anterior and posterior extremities.

The hinge consists of a straight ledge in the left valve into which the dorsal margin of the right valve fits. Marginal denticles are present at the anterior and posterior borders of the right valves these fit into corresponding pits in the left valves. The inner lamella is moderately wide with rather large crescentic anterior and posterior vestibules. Other internal details could not be seen.

Remarks: This species resembles B.pseudoseptentrionalis but can be distinguished by having a more drawn out caudal process, a more convex ventral margin in the left valve, and its greatest breadth lies at about 1/5 height which is much lower than in B.pseudoseptentrionalis.

Occurrence: B. southerhamensis is found chiefly in the Middle Cenomanian.

Genus BYTHOCYPRIS Brady, 1880

Type species: Bythocypris reniformis Brady 1880, = Bairdia bosquetiana Brady 1866.

Bythocypris sp.A.

(Plate 6,figs.8-10)

Diagnosis: A species of Bythocypris with a symmetrically arched dorsal margin in the left valve. Right valve very bairdioid in shape.

Material: 53 valves and carapaces.

Measurements (mm)		Length	Height	Width
Left Valve,	OS 9491	0.912	0.483	0.110
Right valve,	OS 9492	0.846	0.384	0.077

Description: Carapace a little less than twice as long as high. Surface smooth. In the left valve the dorsal margin curves symmetrically round from the semi-circular anterior margin to about ¾ length where it becomes straighter and falls steeply to the rounded posterior margin. The ventral margin is weakly concave, curving round at the ends into the anterior and posterior margins respectively. In the right valve the ventral margin is more concave, whilst the dorsal margin can be divided into 3 parts - the anterior third is straight and slopes down to the anterior. The middle third is straight to weakly convex and is inclined slightly towards the posterior. The posterior third is straight and slopes down to the posterior margin. In dorsal view the carapace is elliptical with the greatest width at about mid-length. The left valve overlaps the right particularly in the mid-dorsal and mid-ventral regions. The hinge consists of a simple ridge in the right valve corresponding to a simple groove in the left valve. Marginal zones are broad with large anterior and posterior vestibules. The muscle scar pattern appears to consist of at least 5 scars grouped closely together but the preservation of the scars is very poor in the few specimens in which they can be seen at all.

Remarks: Bythocypris sp.A is similar in shape to B.chapmani Neale 1976, from the santonian of W.Australia, but it is larger and more elongate. B.sp.A lacks the concave antero-dorsal margin in the left valve, seen in B.chapmani, but both species have a concave ventral margin.

Occurrence: This species is rare in the Cenomanian of Southern England. So far it has only been found in the Middle and Upper Cenomanian.

Family MACROCYPRIDIDAE Muller, 1912

Genus MACROCYPRIS Brady, 1867

Type species: Cythere minna Baird, 1850.

Macrocypris muensteriana Jones and Hinde 1890

(Plate 7, figs.1,2)

1849 Bairdia siliqua var. α Jones: 25, pl.5, figs. 16e-g.

1870 Macrocypris ? arcuata (Münster); Jones: 75, 77.

1890 Macrocypris muensteriana Jones and Hinde: 10; pl.2, figs.42,45-47.

1898 Macrocypris muensteriana Jones and Hinde; Chapman: 334.

1964c Macrocypris muensteriana Jones and Hinde; Kaye: 43, pl.4, figs.9,10.

Diagnosis: Macrocypris with a short ventral margin and strongly arched dorsal margin. Length/height ratio low for the genus.

Material: 111 valves and carapaces

Measurements (mm)		Length	Height	Width
Carapace,	OS 9494	1.140	0.483	0.418
Carapace,	OS 9495	1.170	0.490	0.418

Description: Carapace large, strongly inflated. The dorsal margin is strongly arched and meets the gently convex ventral margin at an acute angle, making the posterior bluntly pointed. The anterior margin is produced downwards into a hook like antero-ventral extension. The posterior half of the ventral margin is weakly convex whilst the anterior half is sinuous. The greatest height lies just behind mid-length and the greatest width lies at half length. Internally there are broad anterior and posterior vestibules.

Remarks: This species is easily recognised by its relatively low length/height ratio and by its antero-ventral extension. The posterior is not drawn out as in other Macrocypris species.

Occurrence: This species is found mainly in the Middle and Upper Cenomanian but occasional specimens can be found in the Lower Cenomanian.

Macrocypris siliqua (Jones 1849)

(Plate 6, figs. 11-13; Plate 7, fig. 3)

1849 Cythere (Bairdia) siliqua Jones: 25, pl. 5, figs. 16a-d (non figs. 16e-h)

1870 Macrocypris siliqua (Jones); Jones: 75, 77.

1890 Macrocypris siliqua (Jones); Jones & Hinde: 9, pl. 2, figs. 38-41.

1898 Macrocypris siliqua (Jones); Chapman: 333

1964c Macrocypris siliqua (Jones); Kaye: 43, 44, pl. 4, figs. 11, 14, 15, 18.

Diagnosis: Macrocypris with evenly arched dorsal margin and drawn out posterior end. Greatest height at mid-length.

Material: 200 valves and carapaces.

Measurements (mm)		Length	Height	Width
Carapace,	OS 9496	1.635	0.522	0.450
Carapace,	OS 9497	1.487	0.500	0.440
Right valve,	OS 9498	1.662	0.541	0.300

Description: Valves large with a drawn out posterior end. Ventral margin straight to weakly sinuous, dorsal margin arched but the posterior 1/3 of the dorsal margin converges with the ventral margin to give a pointed posterior extremity. In the left valve the middle part of the dorsal margin is straight. The right valve overlaps the left particularly in the mid-dorsal and mid-ventral regions. The positions of greatest height and greatest width lie at or just in front of mid-length. Interiorly the anterior and posterior vestibules are relatively broad.

Remarks: This species has been known since 1849 but it was not until 1964 that Kaye erected a lectotype from the Cenomanian. My specimens agree in all respects to the type material. *M. siliqua* can be distinguished from *M. muensteriana* Jones and Hinde by its greater length relative to its height and by its more drawn out posterior.

Occurrence: *M. siliqua* occurs sporadically throughout the Cenomanian in Southern England but is never very common.

Superfamily CYPRIDACEA Baird, 1845

Family PARACYPRIDIDAE Sars. 1923

Genus *PARACYPRIS* Sars, 1866

Type species: *Paracypris polita* Sars, 1866

Paracypris cf. *P. wrothamensis* Kaye 1965

(Plate 7, figs.4-7)

? 1965c *Paracypris wrothamensis* Kaye : 226, pl.9, figs. 10-14

Diagnosis: A species of *Paracypris* with an angular anterior cardinal angle and a drawn out posterior.

Material: 652 valves and carapaces

Measurements (mm)		Length	Height	Width
Left valve,	OS 9499	0.725	0.275	0.120
Right valve,	OS 9500	0.747	0.275	0.120

Description: Valves very elongate and fragile. The greatest height lies at 2/7 length which coincides with the anterior cardinal angle. Behind this the hinge margin is straight and inclined down towards the posterior. At 5/7 length is the posterior cardinal angle.

This is rounded and not so well defined as the anterior cardinal angle. The posterior is drawn to a point just above the ventral margin. The anterior margin is broadly rounded but there is a concave antero-dorsal margin in the right valve. The ventral margin is concave in the middle and this concavity is more pronounced in the right valves. The greatest width lies at 2/5 length. The left valve is larger than the right overlapping particularly dorsally and ventrally.

The inner lamella is very broad with a large crescentic anterior and triangular posterior vestibules. The hinge consists of a weak groove in the left valve into which fits the dorsal edge of the right valve. There is an extension of the antero-dorsal margin in the left valve which corresponds with the antero-dorsal notch in the right valve. Other internal details could not be seen.

Remarks: These specimens appear to be very close to P.wrothamensis from the Albian of Southern England. However, the Cenomanian forms show some variation in shape. Specimens which are less drawn out posteriorly, and others having more rounded anterior cardinal angles, can be found, but all intermediates occur even within one sample. All the specimens however are somewhat smaller than P. wrothamensis and have the position of greatest height a little further back.

Occurrence: This species is infrequent in the Lower Cenomanian but may become quite common in Middle and Upper Cenomanian samples.

Family PONTOCYPRIDIDAE Müller, 1894

Genus PONTOCYPRELLA Ljubimova, 1955

Type species: Bairdia harrisiana Jones, 1849

This genus was included in the Paracyprididae by Swain in the "Treatise" (1961, ed. Moore and Pitrat). Van Morkhoven (1962) regarded Pontocyprella as a synonym of Argilloecia Sars 1866 and placed this genus in the Pontocyprididae. This view was followed by Hartmann and Puri (1974) but they questioned the grouping of Pontocyprella with Argilloecia. In Argilloecia the right valve is larger than the left and sexual dimorphism is pronounced. Pontocyprella has the left valve larger than the right and has much less pronounced sexual dimorphism. The genus Pontocyprella is therefore maintained and it is here included in the Pontocyprididae.

Pontocyprella harrisiana (Jones 1849)

(Plate 7, figs.15,16)

1849 Cythere (Bairdia) harrisiana Jones: 25, pl.6, figs. 17a-c, ? figs. d,e; non fig. f.

non 1854 Cytheridea harrisiana (Jones); Bosquet: 63, pl.5, fig.5.

1870 Bairdia harrisiana (Jones); Jones: 75, 77.

non 1874 Bairdia harrisiana (Jones); Reuss: 141, pl.2, figs.6-7

1890 Bairdia harrisiana (Jones); Jones and Hinde: 8, pl.2, figs.52-55.

non 1929 Bairdia harrisiana (Jones); Alexander: 60, pl.2, figs.10-19.

1962 Pontocyprella harrisiana (Jones); Neale: 431-432, pl.6, fig.12; non fig.13.

non 1965a Pontocyprella harrisiana (Jones); Kaye: 73-74, pl.5, figs.3-4.

1966 Pontocyprella harrisiana (Jones); Gründel: 17, pl.2, fig. 9.

Diagnosis: An elongate species of Pontocyprella with an obliquely rounded anterior end and a bluntly pointed posterior end. Ventral margin concave.

Material: 500 valves and carapaces.

Measurements (mm)		Length	Height	Width
Left valve,	OS 9502	0.703	0.286	0.120
Right valve,	OS 9503	0.670	0.253	0.120

Description: Valves elongate more than twice as long as high. Dorsal margin gently convex curving down posteriorly to the bluntly pointed posterior which lies below half height. Ventral margin concave in the middle but curving up posteriorly. Anterior margin obliquely rounded with greatest protuberance just beneath the dorsal margin then curving more sharply beneath so that the antero-ventral margin is truncate. Left valve overlaps the right along the dorsal and ventral margins, at the anterior end there is no overlap. In dorsal view the carapace is elongate oval in shape, the sides of the valves are almost straight in the middle region. The left valve crosses the median line antero-dorsally. Greatest width lies at mid length.

The hinge consists of a groove in the left valve into which the dorsal edge of the right valve fits. The inner lamella is very broad anteriorly. The width of the fused zone is moderately broad and of the same width from anterior to posterior. There is a very broad vestibule at the anterior end and a smaller one at the posterior but the distance between the inner lamella and the outer lamella is very narrow. Other internal features could not be seen.

Remarks: This species was first erected by Jones, but he appears to have used it to cover a group of forms now regarded as separate species. The specimen figured by Jones as pl.6, fig. 17c has been taken as typical by Neale (1962) but no lectotype has so far been erected. This specimen which has been re-figured by Neale agrees in all respects with a group of specimens from the British Cenomanian. The specimens figured by Kaye (1965) are shorter and higher than true P.harrisiana specimens and may not be conspecific. A true interpretation of this species cannot be given until a lectotype is erected.

Occurrence: *P. harrisiana* occurs rarely in the Lower and Middle Cenomanian of Southern England, but it may become more common in the Upper Cenomanian.

Pontocyprella hindei n.sp.

(Plate 7, figs. 11, 13, 14)

Derivation of name: After G.J. Hinde in honour of his contribution to the study of Cretaceous Ostracoda.

1966 *Pontocyprella rara* Kaye; Gründel: 19, pl.2, figs. 5, 6, pl.9, fig.1.

Diagnosis: A species of *Pontocyprella* with a convex dorsal margin and straight ventral margin in the left valve. Posterior end rounded, anterior end slightly obliquely rounded.

Holotype: A left valve, OS 9504. Sample BB8, 13.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: 9 valves OS 9506 to OS 9514 from the same horizon and locality.

Other Material: 576 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9504	0.714	0.352	0.165
Paratype, right valve,	OS 9506	0.692	0.318	0.132
Male? left valve	OS 9505	0.770	0.319	0.176

Description: Valves about twice as long as high. In the right valve the dorsal margin is gently arched, curving more strongly at the posterior. The posterior margin is relatively broadly rounded, the posterior extremity lying at 1/3 height. The ventral margin is straight. The anterior margin is broadly rounded and only slightly oblique. In the right valve the anterior margin is more obliquely rounded, the ventral margin is weakly concave and the dorsal margin consists of two straight parts meeting at a rounded angle of about 170° just in front of mid-length. The greatest height lies at mid-length. In dorsal view the carapace is elliptical.

The hinge consists of a groove in the right valve into which fits an indistinct bar which is found in the left valve. The inner lamella is broad without a vestibule at the anterior end but with a small one at the posterior. Normal pores are small and widely spaced, marginal pore canals cannot be seen. The centre muscle scar area consists of 3 horizontally elongate scars with a further scar just behind the middle one.

There is some variability in shape within this species, some specimens being less high relative to their length. It is possible that these are male specimens.

Remarks: This species was figured and described by Gründel (1966) but he placed it in Pontocyprella rara Kaye. Kaye's species however has a less arched dorsal margin and a distinctly acute posterior end and the two forms are not regarded as conspecific. P. hindei can be distinguished from P. harrisiana by its less oblique anterior margin, more rounded posterior end, lower length/height ratio and straight ventral margin in the left valve. P. robusta n. sp. has a lower length/height ratio than P. hindei and it also has a more strongly arched dorsal margin and a more heavily calcified shell.

Occurrence: P. hindei is often fairly common in the Lower Cenomanian but occasional specimens can be found in the Middle and Upper Cenomanian.

Pontocyprella robusta n. sp.

(Plate 7,figs.8-10,12)

Derivation of name: Robustus - Latin = robust - referring to the strength of calcification.

Diagnosis: A strongly calcified species of *Pontocyprella* with a strongly arched dorsal margin, very low, rounded posterior and a length equal to less than twice the height.

Holotype: A left valve, OS 9515. Sample BB13, 3.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: 15 valves and carapaces, OS 9516 to OS 9530 from the same horizon and locality.

Other Material: Several hundred valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9515	0.725	0.418	0.176
Paratype, right valve,	OS 9516	0.727	0.357	0.160
Paratype, carapace,	OS 9517	0.747	0.418	0.341

Description: Valves large and strongly calcified. In the left valve the dorsal margin is strongly arched, it curves down steeply at the posterior to the narrowly rounded posterior margin. The posterior extremity lies at ¼ height. The ventral margin is straight and the anterior margin semi-circular. In the right valve the ventral margin is concave, the posterior part of the dorsal margin is arched whilst the anterior 2/5 is straight and inclined down to the anterior. The left valve overlaps the right particularly along the dorsal and ventral margins. In dorsal view the carapace is relatively broad with an oval outline, the sides converge slightly from the middle towards the ends of the carapace. The greatest breadth lies just behind mid-length.

The hinge of the right valve consists of a gently arched groove with a weak bar beneath it. In the left valve there is a corresponding bar.

The inner lamella is fairly broad anteriorly but rather narrow at the posterior. Vestibules are not developed.

The muscle scars consist of a vertical row of three horizontally elongate scars with a further scar just behind the middle one.

Remarks: P. robusta is similar to P. hindei but can be distinguished by its greater height in relation to its length, its more arched dorsal margin and its greater inflation. P. maynci Oertli 1958, from the Aptian/Albian of Apt, has a more compressed outline in dorsal view and a gently convex ventral margin.

Occurrence: This species is only found above the mid-Cenomanian non-sequence where it is often very common. Due to its robust nature it is one of the few species which can be removed from samples of hard chalk.

Pontocyprella ? bosquetiana (Jones 1849)

(Plate 8,figs.1,2)

1849 Cytherella ? bosquetiana Jones: 33, pl. 6, figs. 23a-c.

1870 Cythere bosquetiana (Jones) Jones: 76, 77.

1890 Cythere ? bosquetiana (Jones); Jones and Hinde: 15, pl.2, figs. 35-37.

? 1965a Pontocyprella semiquadrata Kaye: 224, pl.3, figs. 1-8.

Diagnosis: A species referred to the genus Pontocyprella with a sub-quadrate outline and broadly rounded anterior and posterior ends.

Material: 35 valves and carapaces

Measurements (mm)		Length	Height	Width
Left valve,	OS 9531	0.600	0.319	0.176

Description: Valves subrectangular in outline with a weakly convex dorsal margin and a weakly concave ventral margin. The anterior margin is semi-circular and the posterior margin is broadly rounded. In dorsal view the carapace is laterally compressed, the margins of the left and right valves diverge gradually from the anterior then become nearly parallel in the centre before converging more sharply at the posterior. The left valve overlaps the right around the entire margin.

Internal details were not seen.

Remarks: This species was based on a single carapace from the chalk detritus of Charing by Jones in 1849. Jones, however, placed it first in *Cytherella* and later in *Cythere*. Jones' specimen is identical with several specimens found during the present study. This species is similar in shape to *Pontocyprella semiquadrata* Kaye from the Albian of Southern England, but Kaye's specimens are a little higher relative to their length.

Occurrence: This species can be found rarely in the Lower Cenomanian of Southern England. It is more common in samples from Barrington than elsewhere.

Superfamily CYTHERACEA Baird, 1850

Family CYTHERIDEIDAE Sars, 1925

Subfamily CYTHERIDEINAE Sars, 1925

Genus *DOLOCYTHERIDEA* Triebel, 1938

Subgenus *DOLOCYTHERIDEA (PURACYTHERIDEA)* Gründel, 1971

Type species: *Pontocypris bosquetiana* Jones and Hinde 1890

Dolocytheridea (Puracytheridea) bosquetiana

(Jones and Hinde 1890)

(Plate 8, figs.7-10)

1849 *Bairdia angusta* (Münster); Jones: 26, pl.6, figs. 18a-f.

1890 *Pontocypris bosquetiana* Jones and Hinde: 4, pl.2, figs.65, pl.4, fig.3.

1890 *Pontocypris triquetra* Jones; Jones and Hinde: 4, pl.3, figs. 35-37

1890 Bythocypris reussiana Jones and Hinde: 12, pl.2, figs. 56, 61-63

1893 Pontocypris bosquetiana Jones and Hinde; Chapman and Sherborn: 346

1898 Pontocypris bosquetiana Jones and Hinde; Chapman: 332

1938 Cytheridea (Dolocytheridea) bosquetiana (Jones and Hinde) Triebel: 498, pl.5, figs.80-83, pl.6, fig.91

1956 Dolocytheridea bosquetiana (Jones and Hinde); Mertens: 196, pl. 10, figs. 45-47.

1956 Dolocytheridea bosquetiana (Jones and Hinde); Deroo: 1511.

1958 Dolocytheridea bosquetiana (Jones and Hinde); Oertli: pl.4, figs. 85,86.

1962 Dolocytheridea bosquetiana (Jones and Hinde); Ellerman: 401, figs. 14, 15.

1964c Dolocytheridea bosquetiana (Jones and Hinde); Kaye: 46, pl.1, figs. 18-20

1966 Dolocytheridea bosquetiana (Jones and Hinde); Gründel: 18, pl.2, fig. 14.

1971b Dolocytheridea bosquetiana (Jones and Hinde); Damotte: 110, pl. 7, fig. 16.

1971 Dolocytheridea (Puracytheridea) bosquetiana (Jones and Hinde); Grundel: 36, pl.4, figs. 7-11: text fig.9.

Diagnosis: A species of Dolocytheridea with a convex dorsal margin and a straight ventral margin. Hinge elements without crenulations.

Material: 222 valves and carapaces.

Measurements (mm)		Length	Height	Width
Female, left valve,	OS 9533	0.736	0.384	0.165
Female, right valve,	OS 9534	0.703	0.363	0.160
Male, right valve,	OS 9535	0.791	0.384	0.187

Description: Valves thinly calcified, often extremely well preserved. Ventral margin weakly concave, curving round into the broadly rounded anterior margin. The dorsal margin is gently convex with the curvature increasing towards the posterior especially in females where there is a distinct postero-ventral margin. The posterior extremity is very low - at about 1/5 height in females and about ¼ height in males. Valves are moderately inflated with a smooth surface. Greatest height lies at about mid-length and the greatest breadth lies just anterior to mid-length. In dorsal view the sides are almost straight. Sexual dimorphism is pronounced, males being less high than females.

There is a small vestibule at the anterior, otherwise the inner margin and line of concrescence coincide. The marginal zone is broad and is crossed by 40 marginal pore canals some of which are false. Posteriorly there are about 20 marginal pore canals. Normal pores are large and fairly widely spaced.

The hinge consists of, in the left valve, two smooth sockets separated by a smooth groove. The right valve is complementary.

The central muscle scars consist of an arcuate row of four oval scars with an anterior horse-shoe shaped scar.

Remarks: This species was included in Bairdia angusta (Munster) by Jones (1849) but it was later recognised as a distinct species by Jones and Hinde (1890). It has been well described by Triebel (1938) and Mertens (1956) and in 1964 Kaye erected a lectotype. The subgenus Dolocytheridea (Puracytheridea) was erected by Gründel (1971) for forms with smooth hinge elements and a posterior extremity to the valve which is almost in line with the ventral margin.

Occurrence: This species is chiefly known from the Middle and Upper Albian of North-west Europe but it can also be found in the

Glauconitic Marl and the succeeding few metres of the Lower Cenomanian in Southern England.

Dolocytheridea (Puracytheridea) cf. D. (P.) crassa
Damotte 1971
(Plate 8, figs. 11-13; Plate 9, fig. 1)

cf. 1971a Dolocytheridea crassa Damotte: 4, pl. 1. figs. 2a-c.

Diagnosis: A strongly calcified species of Dolocytheridea (Puracytheridea) with a strongly arched dorsal margin which becomes almost vertical at the posterior end.

Material: 20 valves and carapaces.

Measurements (mm)		Length	Height	Width
Female left valve,	OS 9537	0.835	0.500	0.200
Female right valve,	OS 9538	0.800	0.450	0.220
Male right valve,	OS 9539	0.945	0.440	0.200

Description: Valves strongly built, fairly large and inflated. In left valves the dorsal margin is convex without cardinal angles but there is a slight flattening along the hinge margin. The dorsal margin curves round sharply at the posterior end so that there is an almost vertical posterior margin. The posterior extremity lies at ¼ height. The ventral margin is straight and the anterior margin is broadly rounded. In the right valves the anterior and posterior parts of the dorsal margin are less curved and the ventral margin is weakly concave. In dorsal view the valves are oval in outline with the greatest width just behind mid-length. The greatest height lies just in front of mid-length.

The marginal zone is moderately broad with numerous marginal pore canals. At the anterior end there is a broad vestibule but the distance between the outer and inner lamellae is very narrow. There is also a small vestibule at the posterior end.

The hinge consists of a groove beneath the dorsal margin in the left valve. This is open at both ends and is bounded beneath by a short strong bar. No well preserved right valve hinges have been found but there appears to be a smooth bar without teeth at the ends. Preservation of muscle scars is not very good but there is a row of 4 adductor scars.

Remarks: This species is very similar to D.(P). crassa Damotte. Right valves are almost identical but the outline of left valves is a little different. The dorsal margin in the left valves of D.(P). crassa is less arched and the position of greatest height is a little further forward. These differences might be thought to be mere geographical variations except that internally the hinge is stronger in the British specimens and the marginal zone at the anterior is different. Specimens of D.(P.) crassa have a small anterior vestibule but in the British specimens there is a broad area where the inner and outer lamellae are not fused. It seems more likely therefore that the two forms are distinct from each other.

Occurrence: This species has only been found in one sample from just below the mid-Cenomanian non-sequence from Southerham, Sussex. In this sample it is fairly common and it is in association with other species which have not been found elsewhere in the British Cenomanian.

Genus CLITHROCYTHERIDEA Stephenson, 1936

Type species: Cytheridea garretti Howe and Chambers, 1935

? Clithrocytheridea aff. Haplocytheridea nana

Triebel 1938

(Plate 8, figs.3-6)

? 1938b Cytheridea (Haplocytheridea) nana Triebel: 491, pl.3, figs.58-62.

1963c ? Clithrocytheridea aff. Haplocytheridea nana Triebel; Kaye: 30, pl.1, figs. 14,15.

Diagnosis: A species similar in appearance to Haplocytheridea nana Triebel but with a hinge consisting of two crenulate sockets separated by a finely denticulate bar in the left valve. Above the bar is an accommodation groove.

Material: 484 valves and carapaces

Measurements (mm)		Length	Height	Width
Female left valve,	OS 9541	0.374	0.264	0.110
Female carapace	OS 9542	0.374	0.253	0.210
Male left valve	OS 9543	0.418	0.253	0.110

Description: Valves small but plump and strongly calcified. The anterior margin is broadly and obliquely rounded, it joins the hinge margin without a marked cardinal angle. The hinge margin is slightly flattened, more so in right valves. The posterior is narrowly rounded with the posterior extremity at 1/3 height. The ventral margin is straight to weakly convex. The position of greatest height lies just in front of mid-length. The surface of the valves is smooth.

Internally the marginal zone is moderately wide with a very small vestibule at the anterior end. There are about 15-20 thin marginal pore canals at the anterior end with two or three false marginal pore canals. At the posterior end there are about 10 marginal pore canals. Muscle scars are not well preserved but a vertical row of 4 adductor scars can be seen in a few specimens.

The hinge of the left valve consists of two elongate terminal crenulate sockets, separated by a denticulate bar. Above this bar is a broad accommodation groove. The right valve is complementary.

Males are fairly common. They are more elongate than females.

Remarks: In external appearance this species is very close to

Haplocytheridea nana Triebel, but Triebel and Mertens (1956) have recorded this species as having a median groove and not a median bar in the hinge of the left valve. Kaye (1963b) records specimens similar to the British Cenomanian forms, with a median bar in the hinge of the left valve. He refers to his forms as ?*Clithrocytheridea* aff. *Haplocytheridea nana*. This species is very similar to species of the genus *Asciocythere* (Swain) as listed by Damotte (1971) but in *Asciocythere* the median bar in the left valve is smooth and not finely crenulate. Following Kaye, this species is therefore tentatively referred to the genus *Clithrocytheridea*.

Occurrence: This species is generally rare, but in a few samples from the Lower and Middle Cenomanian it is very abundant. It has not been found higher than the mid-Cenomanian non-sequence.

Subfamily SCHULERIDEINAE Mandelstam,1959

Genus *SCHULERIDEA* Swartz and Swain,1946

Type species: *Schuleridea acuminata* Swartz and Swain, 1946.

Schuleridea jonesiana (Bosquet 1852)

(Plate 9,figs.2,3).

1849 *Cythere hilseana* (Roemer); Jones: 10, pl.1, figs. 1a-g.

1852 *Cytheridea jonesiana* Bosquet: 38.

non 1854 *Cytheridea jonesiana* Bosquet; Bosquet: 74, pl.8, figs. 5a-d.

1870 *Cytheridea perforata* (Roemer); Jones: 74.

1890 *Cytheridea perforata* (Roemer); Jones and Hinde: 29,pl.1,figs.1-4.

1893 *Cytheridea perforata* (Roemer); Chapman and Sherborn: 349

1893 *Cytheridea perforata insignis* Chapman and Sherborn: 349, pl.14, fig.10.

1893 *Cytheridea rotundata* Chapman and Sherborn: 349,pl.14, fig.11.

1893 *Cythere ? spinifera* Chapman and Sherborn: 348, pl.14, fig.3.

non 1935 *Cytheridea jonesiana* Bosquet; Veen: 2, pl.1, figs. 1-10.

1938b Cytheridea (Haplocytheridea) jonesiana Bosquet; Triebel: 480, pl. 2, figs. 21-25.

1954 Haplocytheridea jonesiana (Bosquet); Stchépinsky: pl.2, figs.13,14.

1956 Schuleridea jonesiana (Bosquet) Mertens: 193, pl.10, figs.38-40.

1956 Schuleridea jonesiana (Bosquet); Deroo: 1512, pl.2, figs.26-31.

? 1958 Schuleridea jonesiana (Bosquet); Oertli: 1507, pl.5, figs.105-113

1962 Schuleridea jonesiana (Bosquet); Ellerman: 401, figs. 13a-c.

1963c Schuleridea jonesiana (Bosquet); Kaye: 31, pl.2, figs.9-13.

1964c Schuleridea jonesiana (Bosquet); Kaye: 45,46, pl.1, figs.1-5

1966 Schuleridea jonesiana jonesiana (Bosquet); Gründel: 22, pl.3, figs. 12,13.

1971b Schuleridea jonesiana (Bosquet); Damotte: 112, pl.8, fig.5.

Diagnosis: A large species of Schuleridea with a strongly pitted surface and a prominent eye tubercle. Sexual dimorphism is well marked.

Material: 1000 valves and carapaces.

Measurements (mm)		Length	Height	Width
Female left valve	OS 9546	0.800	0.539	0.220
Male left valve	OS 9545	1.033	0.626	0.203

Description: Valves large and heavily calcified. The anterior margin is broadly and obliquely rounded. In the left valve there is no distinct anterior cardinal angle and the hinge margin is only slightly flattened. The posterior cardinal angle is rounded and behind it the postero-dorsal margin is almost straight and steeply inclined towards the posterior extremity which lies at ¼ height. In the right valve the anterior and posterior cardinal angles are rounded and the hinge margin is straight. The posterior extremity is rounded and the ventral margin is gently convex. A small but distinct eye tubercle is present. The valve surface is pitted. The position of greatest width lies just behind mid length at 3/5 height.

Internally the marginal zone is of moderate width, without vestibules. There are numerous marginal pore canals many of which are false. Normal pores are thick and numerous.

The hinge of the left valve consists of strongly crenulate terminal sockets separated by a narrow smooth groove. Immediately above this groove and often slightly overhanging it is a smooth bar, and above this is an accommodation groove. The hinge of the right valve is complementary.

Males are fairly common. They are longer and a little higher than females.

Remarks: This species was first described by Jones (1849) who included it in Dolocytheridea hilseana (Roemer). Bosquet (1852) recognised Jones' forms as being distinct and erected the species Cytheridea jonesiana. Jones (1870) and Jones and Hinde (1890), however, preferred to re-group their forms under Cytheridea perforata (Roemer), a Tertiary form. Several more species and sub-species were used by Chapman and Sherborn (1893) and these are now regarded as being conspecific with Bosquet's species (Kaye 1964). The forms described as Cytheridea jonesiana by Bosquet (1854) and Veen (1935) have been renamed as Aequacytheridea mosaensis by Deroo (1966). A lectotype for Schuleridea jonesiana was erected by Kaye in 1964 and specimens from the British Cenomanian agree perfectly with this.

Occurrence: This species is common up to the level of the mid-Cenomanian non-sequence but occasional specimens may be found above this level.

Schuleridea medwayensis n. sp.

(Plate 9, figs. 4-6)

Derivation of name: After the Medway valley on the north side of which is Blue Bell Hill - the type locality for this species.

Diagnosis: A small species of *Schuleridea* with a pitted surface and two spines at the posterior extremity in the right valves.

Holotype: A female left valve OS 9547. Sample Bar 4, 4·5 m below the base of the Burwell Rock, Middle Cenomanian, Barrington, Cambs.

Paratypes: 18 valves and carapaces OS 9548 to OS 9565 from the same horizon and locality.

Other material: 8 valves.

Measurements (mm)		Length	Height	Width
Holotype, female left valve,	OS 9547	0.560	0.384	0.150
Paratype, female right valve,	OS 9548	0.539	0.319	0.143

Description: Valves strongly calcified, moderately inflated. In the left valve the dorsal margin is arched with the greatest height just in front of mid-length. There is a slight flattening along the antero-dorsal margin but the margin is then broadly rounded at the anterior end. The anterior margin bears 5 indistinct spines. Behind mid-length the dorsal margin is only weakly convex, it curves round with an indistinct posterior cardinal angle into the postero-dorsal margin which is weakly convex. The posterior extremity lies at 1/3 height and the ventral margin is gently convex. In the right valve the dorsal margin is straight with obtuse cardinal angles and a straight postero-dorsal margin. There are 2 spines at the posterior extremity. The ventral margin is convex in the middle. There is a weak flattening of the valves around the anterior margin - particularly in the left valve. The surface of the valves bears a series of pits. The eye tubercle is very indistinct. The position of greatest width lies at ½ length.

The inner lamella is broad but there are no vestibules. The hinge of the right valve consists of low elongate terminal teeth which are strongly crenulate. These are separated by a smooth median bar. In the left valve the median groove is narrow with a thin bar above it. Above the bar is an accommodation groove. Other internal details could not be seen.

Remarks: This species is identical in shape with *S.jonesiana* (Bosquet). It can be distinguished, however, by its much smaller size, indistinct eye tubercle and the presence of small spines on the anterior margin of the left valves. The small size of *S.medwayensis* also distinguishes it from *S.bilobata* (Triebel), from the Lower Cretaceous of N.Germany. That species also lacks the spines at the posterior margin in the right valve. *S. hammi* (Triebel), from the Aptian of Hannover is much more laterally compressed than *S.medwayensis* and *S.rhomboidalis* Neale, from the Hauterivian of Yorkshire differs by having a more angular shape.

Occurrence: Rare, in the upper part of the Lower Cenomanian and lower part of the Middle Cenomanian.

Genus *HABROCYTHERE* Triebel, 1940

Type species: *Habrocythere fragilis* Triebel, 1940.

Habrocythere fragilis Triebel, 1940

(Plate 9, figs. 7-9)

1940 *Habrocythere fragilis* Triebel: 166, pl.1, figs.10-13, pl.9, fig.101.

1956 *Habrocythere fragilis* Triebel; Mertens: 198, pl.10, figs.51-52.

1963c *Habrocythere fragilis* Triebel; Kaye: 33, pl.3, figs. 8-9.

1965c *Habrocythere fragilis* Triebel; Kaye: 229, pl.6, figs. 7-13.

1966 *Habrocythere fragilis* Triebel; Gründel: 21, pl.3, fig. 5.

1971b *Habrocythere fragilis* Triebel; Damotte: 114, pl.8, fig.9.

Diagnosis: A small species with an arched dorsal margin, valves inflated in the middle with somewhat compressed ends.

Material: 188 valves

Measurements (mm)		Length	Height	Width
Left valve,	OS 9566	0.384	0.230	0.100
Right valve,	OS 9567	0.351	0.200	0.077

Description: Valves small, inflated with an arched dorsal margin. The right valve is notched antero-dorsally. The posterior extremity is rounded and lies at ¼ height. The ventral margin is straight and the anterior margin is broadly rounded. The valves are moderately inflated with the greatest inflation at 2/3 length. In dorsal view the outline is oval with a narrow compressed anterior area.

The hinge consists of a shelf in the left valve into which fits the dorsal edge of the right valve.

The marginal zone is very broad with a small vestibule at the anterior end. Marginal pore canals are extremely numerous. Other internal details could not be seen.

Remarks: This species has been well described in the past. It is quite distinctive and unlikely to be confused with any other species. This appears to be its' first recorded occurrence outside the Albian.

Occurrence: *H. fragilis* can be found throughout the Cenomanian of Southern England. It is never very common.

Subfamily EUCYTHERINAE Puri, 1954

Genus *EUCYTHERE* Brady, 1868

Type species: *Cythere declivis* Norman, 1865

Eucythere colini n.sp.

(Plate 9,figs.10-13)

Derivation of name: After Dr. J. P. Colin who first recognised this species.

1973 *Eucythere* sp.1. Colin: 25, pl.5, fig.5.

Diagnosis: A species of Eucythere with greatest height at 2/5 length and greatest width behind ½ length.

Holotype: A carapace, OS 9569. Sample S1. Plenus Marls bed 1, Upper Cenomanian, Southerham, Sussex.

Paratypes: 12 valves and carapaces OS 9573 to OS 9584 from the same horizon and locality. Hypotypes: 2 left valves OS 9570, OS 9572 from sample BN 12, Buckland Newton, Dorset.

Other Material: 318 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, carapace,	OS 9569	0.500	0.253	0.209
Hypotype, left valve,	OS 9570	0.445	0.235	0.110

Description: Valves elongate, sub-triangular, fairly strongly calcified. Ventral margin straight to weakly concave. Dorsal margin straight with rounded cardinal angles. The dorsal margin converges strongly with the ventral margin towards the posterior, behind the posterior cardinal angle the degree of convergence is increased. The posterior margin is narrowly rounded and lies at about 1/5 height. The anterior margin is broadly rounded and extends above to the position of greatest height at 2/5 length. In the right valve the upper part of the anterior margin is weakly concave. In dorsal view the outline is elongate oval with the position of greatest width just behind mid-length. The anterior end is slightly laterally compressed, and the hinge sunken beneath the dorsal parts of the valves. The left valve overlaps the right around the entire margin except for the hinge margin.

The hinge is very weak. In the left valve there is a weak, smooth median bar. In the right valve there is a corresponding weak groove with weak bars above and below it.

The marginal zone is broad with a crescentic vestibule at the anterior end. There are about 12 simple, straight marginal pore canals at the anterior end, and 5 - 6 at the posterior. Normal pores are very large and fairly common.

The central muscle scars consist of a vertical row of 4 scars but these are not well preserved and anterior scars cannot be seen.

Remarks: The hinge of this species appears to be like that of E.solitaria Triebel 1940, from the Albian of Germany in lacking terminal teeth. As van Morkhoven (1962) has pointed out, this appears to be a primitive character of the genus, post Cretaceous species usually having a much stronger merodont hinge. Other features are however identical with the genus characteristics and this species is included within the genus.

E. colini differs from E. solitaria by its lesser height in relation to its length, its straight ventral margin and its more pronounced posterior cardinal angle in the right valve, which is also situated further forward. E. trigonalis (Jones and Hinde,1890) is larger with its position of greatest height much further forward. It also has a less well defined posterior cardinal angle in the right valve. The form described as Eucythere sp.1. Colin, 1973 from the Cenomanian of the Dordogne appears to be identical with E.colini with which it has an overlapping range.

Occurrence: E.colini has only been found in Britain in Bed 1 of the Plenus marls. Here it is nearly always present and usually in large numbers.

Family BYTHOCYTHERIDAE Sars, 1926

Genus MONOCERATINA Roth, 1928

Type species: Monoceratina ventrale Roth, 1928

Monoceratina bluebellensis n.sp.

(Plate 11,figs.6-8)

Derivation of name: After Blue Bell Hill, Kent - the type locality.

Diagnosis: A species of Monoceratina with a very strong, long spine, and an antero-ventral node situated on a broad anterior rib. Median sulcus deep, situated behind a dorso-lateral inflation.

Holotype: A left valve, OS 9585. Sample BB16, 41m. below the base of the Plenus Marls, Lower Cenomanian, Blue Bell Hill, Kent.

Paratypes: 4 valves, OS 9586 to OS 9589, from the same horizon and locality.

Other Material: 130 valves.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9585	0.560	0.242	0.330
Paratype, right valve,	OS 9586	0.549	0.233	0.308

Description: Valves strongly built with an elongate, sub-rectangular shape. Dorsal and ventral margins straight and parallel. Posterior extremity just below the dorsal margin, postero-ventral margin long and curved. The anterior margin is broadly rounded and is marked by a broad, low inflated area. Postero-ventrally on this inflated area is a large rounded node which obscures the anterior margin in lateral view. The ventro-lateral spine is long and tapering, it has a stout reticulate proximal portion and a tapering smooth distal portion. The median sulcus ends just in front of the spine. The sulcus is made to look particularly deep by a round inflated area which limits it anteriorly.

The central area, distal part of the spine and the area from the inflation in front of the sulcus to the posterior are all smooth. The proximal part of the spine and the lower part of the posterior are normally reticulate whilst the lateral area in front of the spine excluding the dorso-lateral inflation is pitted. The pits appear to represent reduced sola the muri of which have become much thickened.

Internally the marginal zone is rather narrow with a small anterior vestibule which lies beneath the antero-ventral node. The hinge is adont with a simple bar in the left valve fitting into a groove in the right valve.

Remarks: M.bluebellensis is similar in shape to M.umbonata but can be distinguished by its longer and much stronger spine, its antero-ventral node and the pattern of its reticulation. M.montuosa (Jones & Hinde), from the Upper Cretaceous of England has a similar shape but it has nodes along the dorsal margin and a second ventro lateral spine.

Occurrence: M.bluebellensis is found chiefly in the Middle Cenomanian

Monoceratina bonnemai Kaye, 1964

(Plate 10,fig.11)

1964c Monoceratina bonnemai Kaye: 52,53, pl.3, figs.5,6.

Diagnosis: A species of Monoceratina with two lateral spines and a large dorso-lateral bulb behind the anterior margin.

Material: 9 valves.

Measurements (mm)		Length	Height	Width
Left valve,	OS 9590	0.660	0.311	0.230

Description: Valves elongate with sub-parallel margins. Ventral margin straight to weakly concave curving up sharply at the posterior to the posterior extremity which lies just below the dorsal margin. Anterior margin obliquely rounded, strengthened by a weak rib around the lower half which bears 4 blunt spines. The dorsal margin is long and straight with a distinct anterior cardinal angle. Ventrally there are two laterally directed spines, the posterior one is large and conical, anterior to it and joined at the base is a smaller spine. A vertical sulcus begins between the spines and runs to the dorsal margin. On the dorso-lateral area anterior to the sulcus is a large rounded bulb which bears some weak concentric ridges. A ridge runs back from the top of this bulb parallel to the dorsal margin. In ventral view the posterior spine bears four longitudinal ribs. A further short rib runs from beneath the anterior spine round onto the lateral surface where it appears as a swelling. The rest of the surface is smooth.

The hinge appears to be simple - a smooth bar in the left valve fits into a weak groove in the right valve.

Remarks: My specimens agree in all respects with Kaye's material. The species is very distinctive with its two lateral spines and antero-dorsal bulb and is unlikely to be confused with other *Monoceratina* species.

Occurrence: This species has only been found in the Glauconitic Marl of Southern England and the Cambridge Greensand from Cambridgeshire.

Monoceratina herrigi n. sp.

(Plate 10,figs.12-15)

Derivation of name: After Dr. E. Herrig who has made significant contributions to the study of the Bythocytheridae.

Diagnosis: A species of *Monoceratina* with a short, vertical antero-dorsal rib, an antero-ventral rib and a reticulate surface apart from a smooth, flattened, triangular posterior area.

Holotype: A right valve, OS 9591. Sample BB8, 13.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: 13 valves, OS 9592 to OS 9604 from the same horizon and locality.

Other material: 1240 valves.

Measurements (mm)		Length	Height	Width
Holotype, right valve,	OS 9591	0.692	0.322	0.203
Paratype, left valve,	OS 9592	0.730	0.332	0.264

Description: Carapace elongate and laterally compressed. Dorsal margin long and straight, ventral margin sub-parallel, concave in the middle. Postero-ventral margin long and gently convex with posterior extremity just below the dorsal margin. The posterior area is small, triangular and flattened. Anterior margin obliquely rounded, it is strengthened by a rib which begins at ½ height and runs to the ventral margin. This rib bears about eight spines which are directed forward and slightly outward. A further row of about twelve spines is found on the anterior margin around the line of junction of the valves. A weak rib runs along the dorsal margin, in dorsal view this rib is deflected outwards at half length by a large pit on the dorsal surface. There are a few smaller pits in a line towards the posterior along the dorsal surface. At the anterior end the dorsal rib turns sharply downward and increases in relief to become a short vertical rib. At its lower end this rib is divorced from the anterior margin and lies on the lateral surface. From the posterior area to the antero-ventral rib there is a narrow shelf along the ventral margin. There is a single row of very small tubercles along this shelf. At 2/3 length and 1/3 height the ventro-lateral spine arises, this is smooth and of moderate length. Ending in front of this spine is the weak median sulcus visible because it disrupts the reticulation.

The surface of the valves is covered with a series of deep pits between which run strong muri. Short spines are sometimes developed at the junctions of the muri.

The hinge consists of a very finely crenulate bar in the left valve with a corresponding weak groove in the right valve.

No terminal teeth can be seen.

The central muscle scars consist of an arcuate row of five scars. The middle three are longish whilst the upper and lower ones are more rounded and indistinct.

The inner lamella is rather narrow with a narrow vestibule at the anterior end.

Remarks: This species is similar in appearance to Bythoceratina pedata (Marsson) and to M. (subgen. n. ? 1) aff. pedata Herrig both from the Upper Chalk. M. herrigi can be distinguished from both of these species by its antero-ventral marginal rib and its short, vertical antero-dorsal rib. It also has a simple hinge without terminal teeth in the right valve.

Occasional specimens of M. herrigi can be found in the Lower Cenomanian. These specimens are rather poorly developed and look like laterally compressed specimens of M. umbonata except that they have the short, vertical antero-dorsal rib. It is possible that the two species have a common ancestor. The specimens which Kaye (1964c) referred to M. pedata pedata, from the lower Chalk almost certainly belong to M. herrigi.

Occurrence: M. herrigi can be found throughout the Cenomanian of Southern England. It becomes more common above the mid-Cenomanian non-sequence where it replaces M. umbonata as the most common species of Monoceratina.

Monoceratina longispina (Bosquet)

(Plate 11, figs. 4, 5)

1854 Cythere longispina Bosquet: 86, pl.6, figs. 7a-d.

1941 Monoceratina longispina (Bosquet); Bonnema: 40, pl.6, figs.69-76.

1964c Monoceratina cf. longispina (Bosquet); Kaye: 53, pl.3, fig.1.

1964 Monoceratina longispina (Bosquet); Szczechura: 388, pl.3, fig. 5, pl.11, fig.1.

1965c Monoceratina longispina (Bosquet); Kaye: 242, pl.1, figs.3-7.

Material: 98 valves and carapaces.

Measurements (mm)		Length	Height	Width
Left valve,	OS 9605	0.692	0.351	0.300
Right valve,	OS 9606	0.681	0.351	0.308

Description: Valves strongly inflated with the lateral surface drawn towards the ventro-lateral spine. Ventral margin weakly embayed otherwise parallel to the dorsal margin. Anterior margin semi-circular, posterior extremity just below the dorsal margin, posterior with a long curved lower margin. The lateral surface is very inflated but the anterior and postero-ventral areas are somewhat flattened. The degree of inflation increases towards the laterally directed ventro-lateral spine which lies just behind mid-length and partly obscures the ventral margin. The spine itself is rather short and conical and bears a series of concentric ribs around its circumference. A weak median sulcus runs down from near the dorsal margin to just in front of the base of the spine. In dorsal view the valves are distinctly triangular with slightly flattened anterior and posterior ends.

The hinge consists of a smooth groove in the right valve corresponding to a long smooth bar in the left valve. The inner lamella is rather narrow, apparently without vestibules. Other internal features cannot be seen.

Remarks: This species has been well described by Kaye who recorded it from the Middle and Upper Albian of Southern England. It is also known from several Upper Cretaceous localities across Western Europe.

Occurrence: This species can be found throughout the Cenomanian of Southern England but it is never common.

Monoceratina marginata n. sp.

(Plate 11, figs.1-3)

Derivation of name: Margo - Latin = margin - referring to the marginal rib in this species.

Diagnosis: A laterally compressed, smooth species of the genus Monoceratina. Almost the entire margin is bounded by a thin ridge which reaches its greatest development around the anterior margin.

Holotype: A left valve, OS 9607. Sample BB4, 25.5m. below the base of the Plenus Marls, Middle Cenomanian, Blue Bell Hill, Kent.

Paratypes: 2 valves, OS 9708 and OS 9709 from the same horizon and locality. Hypotype: a left valve OS 9710 from sample Bar 10, Middle Cenomanian, Barrington, Cambridgeshire.

Other Material: 33 valves

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9607	0.676	0.273	0.242
Paratype, right valve,	OS 9608	0.670	0.264	spine broken

Description: Valves elongate and laterally compressed. Dorsal and ventral margins straight and parallel. Postero-ventral margin long and gently inclined up to the posterior extremity which lies just beneath the dorsal margin. Anterior margin only gently rounded but strengthened by a ridge-like rib. In the antero-dorsal region of the left valve this rib diverges slightly from the margin. At the lower end the anterior rib continues along the ventral margin as a thin ridge which continues almost to the ventral extremity. Beginning just above its termination is another thin rib which runs forward along the dorsal margin to one third length. The ventro-lateral spine is situated just behind mid-length and just below mid-height. It is fairly long, pointed and frequently broken. Ending just in front of the spine is the median sulcus which is fairly broad and deep and ends dorsally beneath the anterior end of the dorsal rib.

The hinge consists of a simple bar in the left valve which fits into a groove in the right valve. The marginal zone is rather narrow. Other internal details could not be seen.

Remarks: The laterally compressed carapace, smooth surface and weak marginal ridges distinguish this species from all other species of *Monoceratina*. *M.nitida* Alexander 1934, from the Gober Chalk of Texas has a similar outline in lateral view and a dorsal ridge but in dorsal view it is much wider. It also possesses a ventro lateral ridge. *M.laevis* Marsson 1880, from the Maastrichtian of Rugen, is smooth with a marginal ridge, and is somewhat compressed, but it differs by its much larger size, its less drawn out posterior and its ventro-lateral spine is situated more posteriorly.

Occurrence: This species can be found throughout the Cenomanian but it is very rare below the mid-Cenomanian non-sequence.

Monoceratina pseudoutilazea n. sp.

(Plate 11, figs.15,16)

Derivation of name: Pseudo - utilazea - referring to the similarity to *Bythoceratina utilazea* Hornibrook, 1952.

Diagnosis: A distinctive species of *Monoceratina* with a bulbous ventro-lateral spine, anterior and dorsal marginal ribs, a broad median sulcus and numerous large pits grouped on the lateral surface.

Holotype: A left valve, OS 9611. Sample BB19, 21.5m. below the base of the Plenus Marls, Middle Cenomanian, Blue Bell Hill, Kent.

Paratypes: 2 valves OS 9613, OS 9614, from the same horizon and locality. Hypotype A right valve, OS 9612 from sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Other material: 66 valves.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9611	0.550	0.286	0.187
Hypotype, right valve,	OS 9612	0.538	0.273	0.187

Description: Valves sub-quadrate in shape. Dorsal and ventral margins straight and parallel. The ventral margin curves up at the posterior and the dorsal margin also curves down to form a rounded posterior extremity at 2/3 height. The anterior margin is only weakly curved, it is strengthened by a very broad, flat topped rib which bears about eight deep pits each one elongate in a direction at right angles to the rib margins. In anterior view a further row of elongate pits can be seen on the anterior side of this rib. At the top of the anterior rib joins a long dorsal rib which forms the dorsal margin. Ventro-laterally and extending well below the ventral margin is a large bulbous node. Joined to the base of this anteriorly is a sinuous ridge which crosses onto the lateral surface, diminishes in relief and joins the lower end of the anterior rib. In ventral view the base of the bulbous node is deeply indented. There are a series of weak ridges crossing the ventral surface and posteriorly these curve around the node and some become visible in lateral view. Ending above the ventral ridge just in front of the bulbous node is a broad median sulcus which terminates dorsally against the dorsal rib. The area in front of the sulcus is more inflated than the area behind it. The lateral surface bears a number of large rounded pits, these are quite closely grouped near the posterior and along the ventral ridge and down the inflated area in front of the sulcus, elsewhere they are widely spaced.

Internally the anterior rib, the bulbous node and ventro-lateral ridge are all hollow, whilst the median sulcus forms a positive area.

The hinge consists of a simple bar in the left valve which fits into an indistinct groove in the right valve. Other internal details could not be seen.

Remarks: This species bears an extraordinary resemblance to

Bythoceratina utilazea Hornibrook which has been described from Recent sediments off New Zealand. Externally B. utilazea has a reticulate ventro-lateral inflation and does not appear to have the pits on the lateral surface arranged into groups. In dorsal view B. utilazea is wider with a more pronounced ventro-lateral inflation and rib, and internally it has a merodont hinge.

Occurrence: This species is found chiefly in Upper Cenomanian samples, but it can also be found in the Middle Cenomanian from Southern England.

Monoceratina umbonata (Williamson, 1847)

(Plate 10, figs.1-6)

1847 Cytherina umbonata Williamson: 82, pl.4, fig. 78

1849 Cythere umbonata (Williamson) Jones: 12, pl.2, figs. 3a-g.

1870 Cytheropteron umbonatum (Williamson) Jones: 74, 76.

1872 Cytheroptera umbonata (Williamson) Williamson: 136

1890 Cytheropteron umbonatum (Williamson); Jones and Hinde: 40, pl.1, figs. 21;26

1893 Cytheropteron umbonatum (Williamson); Chapman and Sherborn: 347

? 1898 Cytheropteron umbonatum (Williamson) var acanthoptera (Marsson); Chapman: 342

non 1934 Monoceratina umbonata (Williamson) Alexander: 62, pl.8, fig.9.

? 1941 Monoceratina umbonata (Williamson); Bonnema: 29, pl.6, figs. 60-62 (non.pl.6, figs. 54-61).

1964c Monoceratina umbonata (Williamson); Kaye: 56, pl.4,figs.3,4,6-8.

1964b Monoceratina umbonata (Williamson); Gründel: 857, pl.2,figs.8-10.

non 1964 Monoceratina umbonata (Williamson); Szczechura: 391, pl.5, fig. 1-12, pl.10,figs.9-13, pl.11,fig.3.

1966 Monoceratina umbonata (Williamson); Gründel: 48, pl.8,figs.29-31.

non 1966 Monoceratina umbonata (Williamson); Herrig: 930 - 932, pl.36, figs. 2-8; pl.44, figs. 1,2, text figs. 114a,b, 115 : 3,4, 129.

Diagnosis: A species of Monoceratina with parallel dorsal and ventral margins, a reticulate surface and inflated valves.

Material: several hundred valves and carapaces.

Measurements (mm)		Length	Height	Width
Left valve,	OS 9615	0.560	0.275	0.230
Right valve,	OS 9616	0.560	0.264	0.209
Juvenile A-1 right valve,	OS 9620	0.461	0.220	0.200

Description: Valves sub-rectangular in outline, with a straight dorsal margin which is sub-parallel to the weakly concave ventral margin. The anterior margin is symmetrically rounded in the left valve but more obliquely rounded in the right valve. In left valves there is usually a small triangular extension at the anterior cardinal angle. A small thickening can often be seen antero-ventrally on the anterior margin and in some specimens this may be exaggerated into a node. At 2/5 height and 3/5 length there is a stout laterally directed spine. From in front of this a broad sulcus runs to the dorsal margin. Behind the sulcus just below the dorsal margin there is a short longitudinal rib. The surface of the valves is reticulate except for the small flattened posterior area and the spine.

The hinge consists of a smooth bar in the left valve with a corresponding groove in the right valve.

Remarks: This species was first recorded by Williamson from the chalk detritus of Charing (Cenomanian). It is very similar to B.umbonatoides (Kaye,1964c),from the Upper Cretaceous, but it can be distinguished by its reticulate area posterior to the median sulcus B.umbonatoides possesses a node on the lateral surface anterior to the sulcus and lacks the triangular process over the anterior cardinal angle in the left valve.

M. umbonata is a rather variable species. The size of the node on the antero-ventral margin varies and may sometimes be absent. The size of the adults is also variable with some much larger forms occurring in the Lower Cenomanian. Also in the lower part of the Cenomanian forms can be found which are much more heavily calcified. These forms have a strong lateral spine and lack the surface reticulation but in all other respects are similar to the reticulate forms (see Pl.10 Fig. 4).

Occurrence: This species occurs throughout the Cenomanian but it is more common in the Lower Cenomanian. It has also been recorded from the Albian.

Monoceratina sp. B.

(Plate 11, Figs. 9-11)

Diagnosis: A species of Monoceratina with a short ventro-lateral spine with two ridges extending forward from it. There is also a dorsal rib and a vertical swelling anterior to the sulcus.

Material: 30 broken valves

Measurements (mm)		Length	Height	Width
Left valve,	OS 9621	broken	0.319	spine broken
Right valve,	OS 9622	broken	0.300	0.209

Description: Shell thinly calcified, usually broken, surface smooth. Ventral margin straight at the anterior then convex but curving up sharply to the posterior. Posterior extremity rounded, lying just below the dorsal margin. Dorsal margin straight in the right valve to sinuous in the left valve. Anterior margin broadly rounded without a marginal rib. Ventro-lateral spine at 3/5 length, the spine is rather short and triangular, being broadest in a longitudinal direction. Running forward from this spine are two longitudinal ridges. The upper one arises from the anterior edge of the spine and runs obliquely upward, the lower one arises beneath the spine and is convex downward. The median sulcus is broad, it ends above the upper ridge in front of the spine. Anterior to the sulcus is a vertical inflation which accentuates the relief of the sulcus. At the top this inflation is joined to the short, sinuous dorsal rib which limits the sulcus dorsally. In ventral view there are three oblique ridges on the ventro-lateral spine, the innermost of these joins the lower ventro-lateral ridge.

The hinge appears to consist of a simple ridge in the left valve which fits into a very indistinct groove in the right valve, but in all specimens the hinge is damaged. Other internal details could not be seen.

Remarks: Thjs species is similar to M. jugosa Alexander, from the Santonian of Texas, but M. jugosa has five ridges on the anterior area of the valves all arising from a common point near the anterior border. There is no evidence of this group of ridges in M. sp. B. apart from the two ventro-lateral ridges which do not arise near the anterior border. A lack of complete specimens precludes the setting up of a new species at the present time.

Occurrence: The species is rare in the English Cenomanian. It seems to be restricted to the Upper Cenomanian and is most common in the Buckland Newton section.

Monoceratina sp. A.

(Plate 11, Figs. 12-14)

Diagnosis: A small species of Monoceratina without a ventro-lateral spine but with a curved ventro-lateral ridge, dorsal rib and an inflated area in front of the sulcus.

Material: 115 valves

Measurements (mm)		Length	Height	Width
Left valve,	OS 9624	0.483	0.209	0.110
Right valve,	OS 9625	0.496	0.225	0.110

Description: Valves small, sub-quadrate with parallel dorsal and ventral margins. Ventral margin straight to weakly concave, anterior margin gently rounded bearing a series of weak wrinkles. The posterior extremity is obliquely truncate with a straight to concave postero-ventral margin. Ventro-laterally there is a short inflated ridge which curves up at the posterior and runs parallel to the postero-ventral margin almost reaching the dorsal margin. Enclosed by this ridge is the broad median sulcus which is limited anteriorly by a broad inflated area. This inflated area bears two depressions one beneath the anterior end of the dorsal margin and one above the anterior end of the ventral margin. A dorsal rib extends along the dorsal margin.

The hinge consists of a very finely crenulate groove in the right valve with a corresponding ridge in the left valve though this ridge is often broken. The inner lamella is rather narrow, and there are no vestibules. Other internal details cannot be seen.

Remarks: The small size and lack of a ventro-lateral spine in this species suggests that it may be a juvenile form. The valves are fairly strongly calcified however, and juveniles are already known for most of the other species. Its description is therefore included here but it is left under open nomenclature for the time being.

M. sp. A most closely resembles *M.* sp. B but *M.* sp. A is smaller, with wrinkles around its anterior margin. *M.* sp. B has a ventro-lateral spine with two ribs extending forward from it. Juvenile valves of *M.* sp. B can be found which retain the ventro-lateral spine and *M.* sp. A does not appear to be a juvenile of *M.* sp. B.

Occurrence: This species appears to be restricted to the Upper Cenomanian but it is never very common.

Genus BYTHOCERATINA Hornibrook, 1952

Type species: Bythoceratina mestayerae Hornibrook, 1952.

Bythoceratina umbonatoides umbonatoides (Kaye, 1964).

(Pl. 10, Figs. 7-9).

1890 Cythere umbonatum acanthoptera (Marsson); Jones and Hinde: 41, pl.1, figs. 11-13; pl.4, figs.22-29.

1941 Monoceratina longispina Bosquet; Bonnema: 30, pl.6, figs.69-76.

1964c Monoceratina umbonatoides Kaye: 57, pl.4, figs. 2,5.

1965b Bythoceratina umbonatoides (Kaye) Damotte: pl.6, figs.5-8.

1967 Bythoceratina umbonatoides umbonatoides (Kaye); Herrig: 607, text figs. 1-6.

1971b Bythoceratina umbonatoides umbonatoides (Kaye); Damotte: 98, pl.6, fig. 10a-c, text fig.16.

Diagnosis: A species of Bythoceratina with an inflated antero-lateral area with a large node anterior of the median sulcus. The area posterior of the sulcus is generally smooth.

Material: several hundred valves and carapaces.

Measurements (mm)		Length	Height	Width
Left valve	OS 9627	0.600	0.319	0.286
Right valve,	OS 9628	0.615	0.308	0.300
Juvenile A-1 right valve,	OS 9629	0.500	0.253	spine broken

Description: Valves sub-rectangular, fairly strongly calcified. The dorsal and ventral margins are straight to weakly concave and are parallel. The anterior margin is symmetrically rounded in the left valve but obliquely rounded in the right valve. The anterior margin is thickened antero-ventrally and usually bears a series of small spines here. At the posterior end the ventral margin curves up sharply to the posterior extremity which lies just below the dorsal margin. The valves are often swollen in the mid-ventral region thus obscuring the ventral margin in lateral view. The ventro-lateral spine is strong with a broad base. The broad median sulcus runs from in front of the spine to the dorsal margin. In front of the sulcus is a distinct node on the antero-lateral surface and above this node is a shelf. Behind the sulcus a short but very distinct rib runs along the dorsal margin. The posterior part of the valves above the spine and behind the median sulcus is smooth or bears a few small spines. The rest of the valves is reticulate with rows of muri running along the ventral surface and up onto the antero-lateral surface.

Interiorly the marginal zone is rather narrow with a small crescentic vestibule at the anterior end. The hinge consists of a weakly crenulate hinge bar in the left valve with very small sockets at each end. In the right valve there is a narrow median groove with very indistinct teeth at each end.

Juvenile valves resemble the adults in shape but are thinner shelled with a less developed ornament.

Remarks: This species has been well described by Herrig (1967) who divided it into 'form groups' and also added a new sub-species B. umbonatoides insolata. The Cenomanian forms belong to B. umbonatoides umbonatoides and as such they represent by far the oldest record of this species. The Cenomanian specimens appear to be primitive in that the terminal teeth of their hinges are very weak, but small sockets can usually be seen in the left valves.

Occurrence: This species can be found throughout the Cenomanian but the older specimens are very similar to M. umbonata.

Genus NEMOCERATINA Gründel and Kozur, 1971.

Type species: Triceratina triassica Kozur, 1970

Nemoceratina tricuspidata (Jones and Hinde, 1890)

(Plate 11, figs.17,18)

1890 Cytheropteron cuspidatum tricuspidata Jones and Hinde: 38, pl. 3, figs. 6,7.

1936 Monoceratina tricuspidata (Jones and Hinde) Veen: 9, 42, 43, pl.2, figs. 4-11.

1941 Monoceratina tricuspidata (Jones and Hinde); Bonnema: 40, pl. 6, figs. 77-80.

1941 Monoceratina tricuspidata (Jones and Hinde); Triebel: 353

1958 Monoceratina tricuspidata (Jones and Hinde); Howe and Laurencich: 422

1964c Monoceratina tricuspidata (Jones and Hinde); Kaye: 56, pl.3, figs. 7,8.

1965b Monoceratina tricuspidata (Jones and Hinde); Kaye: 382, pl.48, fig. 13.

1966 Monoceratina ? tricuspidata (Jones and Hinde); Herrig: 916, pl.36, fig.10; pl.37,fig.1: text -figs.122,123

Diagnosis: A species of Nemoceratina with three strong ventral spines. Surface reticulate above posterior two spines. A broad median sulcus runs up from between the two anterior spines.

Material: 6 valves

Measurements (mm)		Length	Height	Width
Left valve,	OS 9631	broken	0.275	0.220
Right valve,	OS 9632	0.571	0.242	0.220

Description: Valves elongate, sub-rectangular in outline with straight, parallel dorsal and ventral margins. The anterior margin is gently rounded with a distinct angle where it meets the dorsal margin. The anterior margin is strengthened by a weak rib which bears about 10 spines. In the left valve there are more spines around the anterior cardinal angle and along the dorsal margin. In all specimens the posterior is broken but it appears to form a rounded caudal process with a short upper margin and concave lower margin which bears spines. Just below mid-height and running in a longitudinal line are three very strong laterally directed spines. The anterior one is very broad and is mammillate, the middle spine is conical and the posterior spine is long and bears second order spines. Other smaller tubercles occur, particularly in front of the anterior spine and there is also one above the depressed area between the two posterior spines. There is a broad sulcus which extends from the dorsal margin at 2/5 length to above and just behind the first spine. The areas in front of the anterior spine and below the row of spines are smooth but the rest of the surface is reticulate. The reticulation is most prominent above the posterior two spines. It takes the form of a series of arched longitudinal riblets with much weaker cross riblets running between them.

From the interior the large anterior spine can be seen to be hollow, there is a strong vertical ridge after it and an excavate area posterior to this. The hinge consists of a shallow crenulate socket with the terminal areas being slightly deeper in the right valve. The left valve is complementary. The marginal zone is rather narrow with no vestibules. Other internal details cannot be seen.

Remarks: This species was first recorded by Jones and Hinde (1890) who placed it in the genus *Cytheropteron*. The species was placed into *Monoceratina* by Van Veen in 1936 and in 1964 Kaye erected a lectotype. Although the lectotype comes from the Upper Chalk (*M. coranguinum* Zone) this species has been recorded from as low as the Upper Aptian (Kaye 1965) and as high as the Maastrichtian (Herrig 1966). The genus *Nemoceratina* has been erected by Gründel to accommodate forms such as *N. tricuspidata* with three stout ventro-lateral spines.

Occurrence: This species is very rare in the Cenomanian but specimens have been found from the Lower, Middle and Upper Cenomanian.

Family PROGONOCYTHERIDAE Sylvester-Bradley, 1948

Genus NEOCYTHERE Mertens, 1956

Subgenus NEOCYTHERE (NEOCYTHERE) Mertens, 1956

Type species: Neocythere vanveeni Mertens, 1956

Neocythere (Neocythere) vanveeni Mertens, 1956

(Plate 12, figs.1-3, 7)

1848 Cytherina ? Williamson: 79, pl.4, fig.77.

1849 Cythere punctatula (Roemer); Jones: 11, pl.1, figs. 2b, l, m, (? figs. 2a,e,e',i); (non figs. 2c,d,d', f-h, j,k,n).

1890 Cytheropteron concentricum (Reuss) Jones and Hinde: 31, pl.1, figs.7,10, (?figs.8,9);(non figs. 5,6)

part 1898 Cytheropteron concentricum (Reuss); Chapman: 341

1952 Cythere concentrica (Reuss); Dupper: 106, pl.4, fig.14.

1956 Neocythere vanveeni Mertens: 205, pl.12, figs.72-78, pl.14, figs. 100-102.

part 1956 Brachycythere concentrica (Reuss); Deroo: 1512, pl.3, figs. 35, 36.

1962 Neocythere vanveeni Mertens; Ellermann: 400, figs.11,12.

1963a Neocythere (Neocythere) vanveeni Mertens; Kaye: 276, pl.41, figs. 23, 25.

? 1964b Neocythere (Neocythere) vanveeni Mertens; Kaye: 324, pl.55, fig. 13.

1966 Neocythere vanveeni Mertens; Gründel: 32, pl.5, fig.23

1966 Neocythere ? pseudovanveeni Gründel: 33, pl.6, figs. 3,4.

1971b Neocythere (Neocythere) vanveeni Mertens; Damotte: 101, pl.7, fig.1, text-fig.18a.

1971 Neocythere vanveeni Mertens, Keen and Siddiqui: 63, pl.1,fig.10.

Diagnosis: A species of Neocythere (Neocythere) with a series of concentric ribs on the lateral surface. Hinge merodont to weakly amphidont.

Material: several hundred valves and carapaces.

Measurements (mm)		Length	Height	Width
Female left valve,	OS 9633	0.524	0.332	C.187
Female right valve,	OS 9634	0.522	0.308	0.150

Description: Valves strongly calcified, sub-ovate in outline with a strong ventral tumidity. Dorsal margin of the left valve strongly arched with the greatest height in front of the middle. Anterior margin broadly rounded, posterior margin more narrowly so. Ventral margin obscured in the middle by the ventro-lateral tumidity. Viewed from inside it is straight with an embayment at 1/3 length. Right valve with an almost straight dorsal margin with weakly developed cardinal angles. The valves are strongly inflated with the greatest breadth just behind mid-length and just above the ventral margin. The area just behind the anterior margin, small posterior area and dorsal edge of the left valve are all smooth and flattened. The inflated part of the valves bears a series of concentric ribs. The outermost ribs continue across the ventral surface of the valves. On the lateral surface just in front of mid-length is a low muscle node.

The inner lamella is moderately wide without vestibules. There are 6 straight marginal pore canals at the anterior and 3 at the posterior end. Normal pores are concentrated along the crests of the concentric ribs.

The hinge of the left valve consists of elongate terminal crenulate sockets separated by a denticulate bar. Above the median bar is a broad accommodation groove.

The central muscle scars consist of a vertical row of 4 elongate oval scars with an anterior oval scar.

Remarks: This species was first recognised by Williamson (1848) who referred it to the genus Cytherina without actually naming it. Jones (1849) referred all specimens with this general shape to

Cythere punctatula and therefore included specimens of N.(N.) vanveeni in that species. It was not until 1956 that Mertens erected these forms as a separate species. Gründel (1966), erected the species N.(N.?) pseudovanveeni for forms lacking the antero-median tooth in the left valve. However, even when fully developed, this tooth is never very prominent and Kaye (1963a) noted that "the amphidont nature of the hinge is not always apparent in the left valve but can always be seen in the right." The degree of development of this tooth may therefore be variable with specimens from younger samples often showing no antero-median tooth at all. It therefore seems unwise to maintain the species N. (N?) pseudovanveeni and the specimens from the British Cenomanian are included into N. (N.) vanveeni.

Occurrence: This species is common throughout the Lower and Middle Cenomanian up to the level of the mid-Cenomanian non-sequence.

Subgenus NEOCYTHERE (PHYSOCYTHERE) Kaye, 1963.

Type species: "Cythere" lingenensis Mertens, 1956.

Neocythere (Physocythere) kayei n. sp.

(Plate 12, figs.9-12)

Derivation of name: After Dr. P. Kaye, in recognition of his work on Albian Ostracoda.

Diagnosis: A species of the subgenus Neocythere (Physocythere) with the ornament of the lateral surface strongly reduced especially in the centre. Greatest height at 2/5 length.

Holotype: A female left valve, OS 9636. Sample BB13, 3.5m. below the base of the Plenus Marls, Blue Bell Hill, Kent.

Paratypes: 4 valves OS 9637 to OS 9640, from the same horizon and locality.

Other material: 125 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, female left valve	OS 9636	0.571	0.363	0.209
Paratype, female right valve,	OS 9637	0.593	0.319	0.200

Description: Valves fairly thinly calcified strongly tumid ventro-laterally. Dorsal margin strongly arched in the left valve with a rounded apex at 2/5 length. Posterior part of dorsal margin gently convex curving down at the posterior to the rounded posterior margin. In the right valve the dorsal margin is straight with rounded cardinal angles. Anterior margin rounded, ventral margin obscured in the middle by the ventral tumidity but seen from inside it is convex at the anterior end and curves up gently at the posterior. There is a narrow flattened margin around the anterior end which continues around the dorsal margin in the left valve. The posterior is also flattened. The lateral surface is strongly inflated with the greatest inflation at mid-length just above the ventral margin. This inflated area is almost smooth in the middle but feint ridges may just be visible. Towards the edges there are weak ribs which become more prominent ventrally. These ribs run across the ventral surface as three ridges, the innermost of which forks towards the anterior end.

The hinge in the left valve consists of two terminal, elongate sockets each with 5-6 crenulations, separated by a finely crenulate bar. Above the bar is a broad flat shelf. The right valve is complementary. The inner lamella is moderately broad, without vestibules. Other internal details could not be seen.

Sexual dimorphism is apparent with males being longer than females.

Remarks: *N. (P.) kayei* differs from *N. (N.) vanveeni* Mertens in having a less well defined ornament, a more arched dorsal margin and it lacks the flattened muscle node. It differs from *N.(P.) verbosa* Damotte by being smaller, having its greatest height further forward and its greatest width much lower.

Occurrence: N. (P.) kayei has only been found so far in samples from the upper part of the British Upper Cenomanian. It is often quite common in samples from Bed 1 of the Plenus Marls.

Neocythere (Physocythere) semiconcentrica

(Mertens, 1956)

(Plate 13, figs.7,8)

1949 Cythere punctatula (Roemer); Jones: 11, pl.1, figs. 2c,d,d',f-h,k. (?figs. 2a,e,e',n),(non figs.2b,i,j,l,m).

part 1870 Cytheropteron concentricum (Reuss) Jones: 74, 76.

1890 Cytheropteron concentricum; Jones and Hinde: 31, pl.1. fig.6, (?figs. 8,9), (non figs. 5,7,10).

part 1898 Cytheropteron concentricum (Reuss); Chapman: 341.

1956 "Cythere" semiconcentrica Mertens: 186, pl.9, figs.15-18.

? 1956 Brachycythere concentrica (Reuss); Deroo: 1512, pl.3,figs.35,36

1962 Cythere semiconcentrica Mertens; Ellermann: 397, text figs.5,6

1966 Physocythere semiconcentrica Mertems Gründel: 31, pl.5,figs.19-20

Diagnosis: A species of the subgenus Neocythere (Physocythere) with concentric ribs on the lateral surface which enclose a reticulate area in the centre. The ribs often bear small spines.

Material: several hundred valves and carapaces.

Measurements (mm)		Length	Height	Width
Left valve,	OS 9641	0.516	0.319	0.155
Carapace,	OS 9642	0.527	0.341	0.319

Description: Valves strongly inflated. Dorsal margin straight in the right valve with weak cardinal angles, weakly convex in the left valve. Anterior margin broadly rounded, often with very small marginal spines. Posterior margin narrowly rounded. Ventral margin obscured by the ventro-lateral tumidity, but seen from inside it is convex at the anterior, straight in the middle and curves up posteriorly. There is a narrow, smooth, flattened area around the anterior margin, and the posterior is also flattened and smooth. A low flattened eye tubercle lies just beneath the anterior end of the hinge. The valves are strongly inflated with the greatest width lying just behind mid-length and at about 1/3 height. This inflated area bears a series of concentric rounded ribs, the outer ones cross the ventral area. These ribs often bear numerous small spines along their length. In the centre of the valves,enclosed by the concentric ribs,the ornament becomes reticulate and spines may be formed at the junctions of the riblets. In dorsal view the carapace has an oval outline with narrow, laterally compressed anterior and posterior ends.

The inner lamella is moderately wide without vestibules. Marginal pore canals are widely spaced, simple and straight. There are about 8 at the anterior end. Normal pores are fairly common, they emerge along the crests of the ribs.

The hinge in the right valve consists of terminal weakly crenulate teeth. These are separated by a weakly crenulate groove. In the left valve there are elongate, terminal sockets separated by a weakly crenulate median bar. Above the bar is a moderately wide shelf.

The central muscle scars consist of a vertical row of 4 elongate scars with an obscure frontal scar.

Remarks: This species was referred to as a "young form" of Cythere punctatula (Roemer) by Jones (1849) and later as a"young form" of Cytheropteron concentricum by Jones (1870). It was not until 1956 that Mertens recognised it as a distinct species and referred it tentatively to the genus Cythere on the basis of its overall shape and merodont hinge. The subgenus Neocythere (Physocythere) was erected by Kaye (1963) for forms with the Neocythere shape but with a merodont hinge.

Occurrence: N. (P.) semiconcentrica is common up to the level of the mid-Cenomanian non-sequence but it is not found in the Upper Cenomanian of Southern England.

Neocythere (Physocythere) steghausi

(Mertens, 1956)

(Plate 13, figs.4-6)

1956 "Cythere" steghausi Mertens: 188, pl.9, figs.19-22.

1958 "Cythere" steghausi Mertens; Howe and Laurencich: 174

1962 Cythere steghausi Mertens; Ellermann: 398, text-figs.7a-c.

1963a Neocythere (Physocythere) hieroglyphica Kaye: 279, pl.41, figs. 8-12, 14.

1966 Physocythere steghausi Mertens Gründel: 32, pl.5, fig.11.

Diagnosis: A species of the sub-genus Neocythere (Physocythere) with strong concentric ribs on the inflated lateral surface, the ribs in the centre are connected by cross-ribs. Anterior and posterior ends broad, flattened and smooth.

Material: 89 valves and carapaces.

Measurements (mm)		Length	Height	Width
Female, left valve,	OS 9643	0.692	0.428	0.253
Female, right valve,	OS 9644	0.690	0.384	0.242

Description: Valves strongly calcified, elongate-oval in outline. Dorsal margin of the left valve varies from weakly convex,to straight, to weakly concave, in the right valve it is straight. Anterior margin obliquely rounded, posterior drawn out with a rounded posterior extremity and a concave postero-dorsal margin. Ventral margin obscured in the middle by the inflation of the valves but seen from within it is embayed at 1/3 length and curves up at the posterior. The valves are strongly inflated except for a strip around the anterior margin and the posterior area which are laterally compressed.

The dorsal margin of the left valve is also compressed and this area is strengthened. In dorsal view the laterally compressed ends can be clearly seen and the dorsal margin of the left valve is seen to be curved away from the right valve in the middle. The inflated area bears a series of concentric ribs, the outer ones of these end at the dorsal margin but some of the inner ones are continuous dorsally. Some of the ribs cross the ventral surface and in ventral view 4 strong ribs can be seen on each valve running parallel to the ventral margin. Antero-dorsally one rib is usually strengthened to form a high ridge. Towards the middle numerous cross-ribs are developed between the larger concentric ribs and the arrangement of the ribs becomes much more irregular.

The hinge of the left valve consists of two strong terminal sockets each with 5-6 crenulations, separated by a crenulate median bar. Above the median bar is a broad flat shelf. The right valve bears two strong elongate terminal teeth with 5-6 strong crenulations, separated by a locellate furrow.

The marginal zone is moderately broad and without vestibules. Marginal pore canals are thin and few in number - about 6 at the anterior and 3-4 at the posterior. Normal pores are quite common and emerge along the crests of the ribs.

The central muscle scars consist of a vertical row of 3 elongate scars with a more rounded scar beneath.

Sexual dimorphism is distinct. Males are longer than females.

Remarks: This species has been well described in the past. As Gründel (1966) pointed out, Kayé's specimens of N.(P.) hieroglyphica are identical with the figures and description given by Mertens.

Occurrence: This species is limited to the lowest few metres of the Cenomanian in Southern England.

Neocythere (Physocythere ?) sp.A.

(Plate 13, figs.1-3)

Diagnosis: A species referred to Neocythere (Physocythere) with concentric rows of small spines on the lateral surface. Hinge very weak with a smooth median bar in the left valve.

Material: 35 valves and carapaces

Measurements (mm)		Length	Height	Width
Left valve,	OS 9645	0.736	0.428	0.242
Carapace,	OS 9646	0.738	0.450	0.472

Description: Carapace large and well rounded. The dorsal margin is weakly convex in the left valve and straight in the right valve. The anterior margin is obliquely rounded with the anterior extremity at 1/3 height. In the right valves the anterior margin bears about 9 short spines but these are not present in the left valves. The posterior margin is broadly rounded and the ventral margin is almost straight with a weak embayment at 2/5 length. The ventral tumidity obscures the ventral margin in lateral view. The lateral surface bears very weak concentric ribs and along these small spines are developed. In ventral view these ribs continue across the ventral surface but no spines are developed here. In dorsal view the outline is oval with narrow, laterally compressed anterior and posterior ends. The greatest breadth lies at ½ length. The upper parts of each valve are smooth and distinct. Low eye tubercles are present. The left valve overlaps the right, particularly along the dorsal and postero-dorsal margins.

The inner lamella is moderately broad, without vestibules. There are about 10 straight marginal pore canals at the anterior end and about 6 at the posterior end of the valves. The hinge of the right valve consists of a very small crenulate posterior tooth and a smooth median groove which is open beneath. No anterior tooth can be seen. In the left valve there is a fairly strong, smooth median bar with a very weak posterior socket. Above the median bar is a flat shelf. Other internal details could not be seen.

Remarks: The hinge in this species is remarkable in that there appears to be no anterior tooth in the right valve, though there is a small posterior tooth. The median bar in the left valve is smooth and not crenulate as in other species of Neocythere. These features could indicate that only juvenile specimens have been found, but the specimens are rather large and the marginal zone appears to be well developed. Until further studies can be made this species is left in open nomenclature.

Occurrence: This species is restricted to the lowest few metres of the Cenomanian.

Subgenus NEOCYTHERE (CENTROCYTHERE) Mertens,1956

Type species: Centrocythere denticulata Mertens,1956

Neocythere (Centrocythere) posterospinosa n. sp.

(Plate 12, figs.4-8)

Derivation of name: Posterior - spinosus - Latin = thorny = thorny posterior.

Diagnosis: A species of Neocythere (Centrocythere) with weak concentric ribs on the lateral surface which bear stout spines along the posterior part of the valves. Hinge with a strongly crenulate median bar in the left valve.

Holotype: A female carapace, OS 9647. Sample G.B.42, 42metres below the surface, Lower Cenomanian, Glyndebourne, Sussex.

Paratypes: A female right valve OS 9648 from the same horizon and locality. Hypotypes: Two left valves, OS 9649, OS 9650 from PBH 1 14 metres, Lower Cenomanian, Pitstone, Herts.

Other material: 27 valves

Measurements (mm)		Length	Height	Width
Holotype, female carapace	OS 9647	0.637	0.363	0.395
Female right valve	OS 9648	0.600	0.341	0.200

Description: Valves strongly calcified, very similar to N. (N.) vanveeni in shape. The dorsal margin is straight and inclined down towards the posterior. The anterior margin is obliquely rounded and passes up to the position of greatest height at 2/5 length. 4 or 5 spines may protrude from the anterior margin especially in the right valves. The posterior margin is narrowly rounded with a straight postero-dorsal margin. A stout spine protrudes from the lower part of the posterior margin in both valves and one or two small spines may be seen just above this. Three rounded longitudinal ribs cross the ventral surface of each valve and continue onto the lateral surface at the anterior and posterior ends. At the posterior end these ribs bear a series of short thick spines. On the lateral surface are more weak ribs but towards the dorsal margin these become indistinct. There is a narrow, laterally compressed area around the anterior and posterior margins of the valves, and also along the dorsal margin of the left valve. In dorsal view the outline is ovoid with the greatest width at 3/5 length.

The inner lamella is moderately wide, without vestibules. There are 11 straight marginal pore canals at the anterior end and 4 at the posterior. Normal pores are common. The hinge of the right valve consists of a long, rounded anterior tooth, deep antero-median socket and a strongly crenulate median groove. The posterior tooth is rather flat and strongly crenulate. The left valve has a complementary arrangement with a flat shelf above the median elements. The central muscle scars consist of a vertical row of 4 oval scars with a rounded frontal scar.

Remarks: The hinge of this species places it in the subgenus Neocythere (Centrocythere) although it differs from the type species by having a completely crenulate median bar in the left valve. Its hinge therefore distinguishes it from N. (N.) vanveeni which it resembles in shape. It can be distinguished from N. (C.) denticulata (Mertens), from the Albian of N.W.Germany, by lacking the reticulate ornament of that species.

Occurrence: This species is not common but can be found in occasional samples of Lower Cenomanian chalk from Southern England.

Family PROTOCYTHERIDAE Ljubimova, 1955

Genus PROTOCYTHERE Triebel, 1938

Type species: Cytherina triplicata Roemer 1841

Protocythere lineata striata Grundel, 1966

(Plate 14, figs.3,4,7)

? 1849 Cythere (Cythereis) triplicata (Roemer); Jones: 18, pl.3, figs. 9a,b,e,f. (non figs. 9c,c', d,d' = V.pseudostriata)

? 1890 Cythereis triplicata (Roemer); Jones and Hinde: 19, pl.1, figs. 56,59,61 (non figs.57,58,60 = V.pseudostriata)

pars 1964c Protocythere lineata (Chapman and Sherborn); Kaye: 58, pl.5, figs. 1-3,5,7,8. (non figs.4,6 = V. pseudostriata)

1966 Protocythere lineata striata Gründel: 26, pl.4, figs.7-8,14,15.

Diagnosis: A sub-species of P.lineata with no intercostal reticulation. Riblets on the ventral rib well developed.

Material: 182 valves and carapaces.

Measurements (mm)		Length	Height	Width
Carapace,	OS 9651	0.880	0.461	0.483
Right valve,	OS 9652	0.759	0.418	0.242

Description: Shell heavily calcified. Ventral margin arcuate, weakly concave at 1/3 length in the right valve. Anterior semi-circular with a distinct rounded hinge ear at the top. Dorsal margin straight slightly upturned posteriorly in the left valve, but curving downwards at the posterior in the right valve. The posterior margin is triangular with a gently convex lower margin which continues round as the ventral margin. The postero-dorsal margin is straight in the left valve and concave in the right valve. A weak to indistinct swelling occurs on the hinge ear. The ribs vary in their degree of sharpness and in some specimens are very rounded. The dorsal rib is strongly arched at the anterior end with the top of the arch obscuring the dorsal margin.Behind,it runs postero-ventrally. The central muscle node lies just below the anterior termination of the dorsal rib, it appears as a wider part of the middle rib. Posteriorly the middle rib ends just beneath the termination of the dorsal rib. The ventral rib is always rounded. It is arcuate and obscures the mid part of the ventral margin in the right valve. It bears on its ventral surface 5 longitudinal riblets. The surface of the valves is smooth but the dorsal rib often has small nodes along its ventral side.

The hinge is antimerodont with elongate crenulate teeth separated by a crenulate groove in the right valve. There is a complementary arrangement in the left valve.

The central muscle scars consist of a vertical row of four scars. The upper two are elongate, especially the second one down which extends well forward: the lower two are more oval in shape. There is a heart-shaped anterior scar.

The inner lamella is broad anteriorly. The inner margin and line of concrescence coincide. The inner lamella is crossed by about 16 radial pore canals anteriorly, these are concentrated along the lower half of the anterior margin and the upper ones bend upwards in a fan-like fashion. The pore canals are widened at their distal ends. Posteriorly there are about 6 marginal pore canals which again widen distally.

Remarks: Kaye (1964) erected a lectotype for Protocythere lineata s.l. and defined it as having intercostal areas with an irregular network of cross ribs. Triebel's species, P. jonesi, which is synonymous with P. lineata was also defined as having a network of delicate ribs on the intercostal areas. Gründel (1966) erected the subspecies P. lineata striata for forms identical in shape but lacking the intercostal riblets. The Cenomanian specimens all belong to P. lineata striata, none of them have intercostal riblets but some specimens have remnant nodes on the ventral side of the dorsal rib.

Occurrence: Lower and Middle Cenomanian up to the level of the mid-Cenomanian non-sequence. It may also be found for a few metres above this level.

Protocythere siddiquii n.sp.
(Plate 14,figs.5,6,8,9)

Derivation of name: After Dr. Q.A. Siddiqui who together with Dr. M.C. Keen first recognised this species.

? 1971 Protocythere aff. albae Damotte and Grosdidier; Keen and Siddiqui: 64, pl.2, figs.4,8.

Diagnosis: A species of Protocythere with rounded longitudinal ribs and a longitudinal swelling on the ventral surface of the left valve only.

Holotype: A female left valve OS 9653. Sample S23, 45m. below the base of the Plenus Marls, Lower Cenomanian, Southerham, Sussex.

Paratypes: 13 valves and carapaces OS 9654 to OS 9666 from the same horizon and locality.

Other material: 15 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, female left valve,	OS 9653	0.780	0.450	0.220
Paratype, female carapace,	OS 9654	0.813	0.450	0.440
Paratype, male left valve,	OS 9655	0.956	0.483	0.253

Description: Valves heavily calcified, elongate, tapering posteriorly. Ventral margin gently convex,curving up posteriorly almost to the dorsal margin. Anterior margin obliquely rounded with a small rounded hinge ear at the top. The dorsal margin posterior to the hinge ear is straight to weakly concave in the left valve, and gently convex in the right valve. The posterior cardinal angle is well marked. The postero-dorsal margin is short,obliquely inclined, straight in the left valve and concave in the right valve.

The longitudinal ribs are not ridge-like but appear as swellings. The dorsal one is short and gently arched and obscures the middle part of the dorsal margin. The middle rib is straight and widens slightly into the muscle node at the anterior end. The ventral rib appears more as a longitudinal tumidity, gently arcuate and with a low indistinct node at its posterior end. All the ribs deflate gradually at their ends, leaving smooth anterior and posterior areas to the valves. Vertically above and below the anterior end of the middle rib are two rounded depressions. In the left valve only, a further swelling can be seen on the ventral surface running from 2/5 length to 4/5 length.

The left valve overlaps the right along the ventral and antero-dorsal margins but the right valve overlaps the left along the mid-dorsal margin. The greatest width lies just behind mid-length across the ventral rib. In dorsal view the outline is oval and the low nodes at the end of the ventral rib can be seen.

The inner lamella is fairly wide, without vestibules. At the anterior end there are at least 15 marginal pore canals. These are widened distally and the upper ones are curved upwards. At the posterior end there are about 12 closely spaced marginal pore canals, these again are widened distally. The hinge of the right valve consists of thick, elongate terminal teeth which are only weakly crenulate. These are separated by a weakly crenulate groove. The left valve has terminal sockets which are open beneath. These are separated by a weakly crenulate bar. Details of the muscle scars could not be seen.

Remarks: This species appears to be identical with P.aff. albae Keen and Siddiqui. P. siddiquii differs from P. albae Damotte and Grosdidier in lacking the ornament of surface pits and weak striations on the ventral rib. It also has a more convex ventral margin and a less well defined dorsal rib. P. lineata has distinct striations on the ventral rib and longitudinal ribs which are not so rounded. P.derooi Oertli, from the Albian of Apt, has dorsal and ventral ribs which are much more distinct and the ventral rib in this species extends forward onto the antero-lateral surface.

Occurrence: This species has been found in only one sample from the top of the Lower Cenomanian at Southerham, Sussex.

Protocythere speetonensis Kaye, 1963.

(Plate 13, fig.9; Plate 14, figs.1,2)

1963d Protocythere speetonensis Kaye: 232, pl.18, figs.4-6

1971 Protocythere speetonensis Kaye; Kemper: 411, pl.7, figs.8,9.

Diagnosis: A small species of Protocythere with the ventral rib raised slightly above the ventral margin in the left valve.

Material: 40 valves

Measurements (mm)		Length	Height	Width
Left valve,	OS 9667	0.582	0.363	0.176
Right valve,	OS 9668	0.582	0.308	0.176

Description: Valves small with an arched ventral margin, which curves up strongly at the posterior. Anterior margin obliquely rounded with about 10 very small forwardly directed spines. Hinge ear in the left valve triangular somewhat swollen. Dorsal margin straight but partly obscured by the dorsal rib especially in the right valve. Posterior margin rounded in the left valve but with a concave upper margin in the right valve. The lower margin of the posterior area bears 6 short spines.

The dorsal and middle longitudinal ribs are rather variable, varying from mere swellings to raised ribs, but the ventral rib always appears as an arcuate swelling. The dorsal rib is short, gently arched and obscures the dorsal margin in lateral view. The middle rib is also short and separates two rounded depressions at its anterior end. The three ribs converge towards the posterior end, where there are two small perforate spines - one just above the end of the ventral rib and one just below the end of the dorsal rib.

The surface is pitted. In dorsal view the greatest width lies at 3/5 length across the ventral rib.

The inner lamella is fairly wide, without vestibules. There are about 15 thin marginal pore canals at the anterior end. These are expanded at their distal ends and curve upwards in the antero-dorsal region. At the posterior there are 6 marginal pore canals which are expanded at their distal ends. The hinge of the right valve consists of large, triangular, crenulate terminal teeth separated by a finely crenulate groove. The left valve has a complementary arrangement. The central muscle scars consist of a vertical row of 4 slightly elongate, oval scars closely grouped together. An anterior scar could not be seen.

Remarks: The Cenomanian specimens are a little smaller than Kaye's specimens and in several of them anterior and posterior marginal spines can be seen. These were not mentioned by Kaye but since all other details are the same, including the number of anterior marginal pore canals, the two forms are grouped together.

Occurrence: This species is rare in the Cenomanian and has only been found in one or two isolated samples from the Lower and Middle Cenomanian.

Genus HOMOCYTHERE Kaye, 1963

Type species: Cythere harrisiana Jones, 1870

This genus was first erected to include H.reticulata Kaye, 1963d from the Albian of Yorkshire. This species is now regarded as a juvenile form of 'Cythere harrisiana' Jones with which it is always found in association (Malz, 1974). Unfortunately, Gründel (1964) erected the sub-genus Veenia (Mandocythere) to include Jones' species, but if H. reticulata is regarded as a juvenile form of 'C. harrisiana' then Homocythere Kaye,1963, takes precedence over Mandocythere Gründel, 1964.

Homocythere harrisiana harrisiana (Jones, 1870)

(Plate 16,figs.1-5)

1849 Cythere (Cythereis) interrupta (Bosquet); Jones: 16, pl.2, figs. 6a-g.

1849 Cythere (Cythereis) quadrilaterata (Roemer); Jones: pl.4, figs. 10h,i.

1870 Cythere harrisiana Jones: 75, 76 (new name)

1890 Cythere harrisiana Jones; Jones and Hinde: 16, pl.1,figs.47-52

1890 Cythere harrisiana reticosa Jones and Hinde: 18, pl.1, fig.46.

1890 Cythere harrisiana setosa Jones and Hinde: 17, pl.1,figs.43-45

1890 Cythereis auriculata (Cornuel); Jones and Hinde: 19, pl.1. figs. 53-55

1893 Cythere harrisiana Jones; Chapman and Sherborn: 346

1893 Cythere harrisiana reticosa Jones and Hinde; Chapman and Sherborn: 346

1893 Cythere auriculata (Cornuel); Chapman and Sherborn: 346

1893 Cythere lineatopunctata Chapman and Sherborn: 348, pl.14, fig.4.

1893 Cythere koninckiana (Bosquet); Chapman and Sherborn: 348, pl.14, fig.2.

1898 Cythere harrisiana Jones; Chapman: 335

1898 Cythere harrisiana reticosa Jones and Hinde; Chapman: 336

1898 Cythere harrisiana setosa Jones and Hinde; Chapman: 335, 336

1898 Cythere koninckiana (Bosquet); Chapman: 337, 338, figs.4a,b.

1898 Cythereis auriculata (Cornuel); Chapman: 338

1938a Protocythere auriculata (Cornuel) Triebel: 195, pl.2, figs. 27-31

1956 Protocythere triebeli Deroo: 1515 (new name)

1963d Veenia triebeli (Deroo) Kaye: 233, pl.18, figs.10,11.

1963d Homocythere reticulata Kaye: 234, pl.18, figs.8,9.

1964c Veenia harrisiana (Jones) Kaye: 61, pl.4, fig.1; pl.6,figs.4-11.

1966 Mandocythere (Mandocythere) harrisiana harrisiana (Jones) Gründel:29, pl.5, figs.5-6, 9-10; pl.10, fig.5; text-fig.9c-d; text-fig.12a-b.

1966 Homocythere reticulata Kaye; Gründel: 40, pl.7, fig.23

1968 Protocythere (Mandocythere) harrisiana harrisiana (Jones) Damotte: 389, pl.17, figs.12a-c.

1971b Protocythere (Mandocythere) harrisiana harrisiana (Jones); Damotte: 90, pl.5, fig.20

Diagnosis: A species of Homocythere with 3 rounded longitudinal ribs, a strong hinge ear and a smooth surface.

Material: several hundred valves and carapaces.

Measurements (mm)		Length	Height	Width
Female left valve,	OS 9670	0.703	0.450	0.220
Male left valve,	OS 9671	0.846	0.440	0.210

Description: Valves strongly calcified and inflated. The dorsal margin is straight but there is a strong hinge ear in the left valves. The ventral margin is weakly convex, but straight in male valves. The posterior extremity is rounded in the left valve but has a concave upper margin in the right valve. A strong spine is often present at the posterior extremity of the right valve. 3 or 4 small spines also occur along the lower margin of the posterior area in both valves. The anterior margin is broadly rounded and is strengthened by a low rib. This rib bears about 10 short, forward directed spines and about 6 low nodes on its lateral edge. The dorsal rib is thick, with a sharp outer edge. In the right valve it obscures the dorsal margin in lateral view. The middle rib is low and rounded, and is broadened at its anterior and over the muscle scar region. The ventral rib is inflated and bears a row of 4 stout spines at its posterior end. The surface of the valves is smooth. In dorsal view the ends of the carapace are laterally compressed but the middle portion is inflated with the greatest breadth across the centre of the middle rib. The 'outer tooth' at the anterior end of the hinge ear can be seen fitting into a notch on the outside of the right valve.

The inner lamella is moderately broad, without vestibules. There are about 22 thin and rather wavy marginal pore canals at the anterior end and about 8 at the posterior. Most of these are widened at their distal ends and at the anterior the upper ones curve upwards. The hinge of the right valve consists of a large, triangular, anterior tooth, bearing 4 distinct ridges, a small rounded antero-median socket, a crenulate median groove, and a triangular posterior tooth with weak ridges. In dorsal view, a notch can be seen in front of the anterior tooth which accommodates the 'outer tooth' of the left valve. The left valve has a complementary arrangement with the strong, rounded outer tooth in front of the anterior socket. The central muscle scars consist of a vertical row of 4 elongate oval scars with a rounded frontal scar.

Sexual dimorphism is pronounced with males being longer than females. Juveniles consist of two basic types; one being smooth and the other strongly reticulate. Both forms have a weak, short dorsal rib and a longitudinal, ventral swelling but lack the middle rib.

Remarks: This species has had a very confusing history, partly because juvenile valves are frequently found and these differ from the adults, and also from each other to a certain extent. Kaye (1964c) has shown that in the Albian the juveniles vary from completely smooth to reticulate with all intermediates being found. The reticulate forms are very similar to "Homocythere reticulata" but have a stronger dorsal rib. In the Cenomanian the smooth and pitted juveniles are very rare, whilst the form described as "H. reticulata" is common and is always found in association with H. harrisiana adults.

Early authors placed the adult forms in previously described species, with which they are not conspecific, and placed the juveniles in several species and subspecies depending on their ornament. 'Cythere harrisiana' was in fact the name given by Jones to juvenile forms of this species. The species has since been placed in the genera Protocythere, by Triebel 1938, Veenia, by Kaye 1963 and Mandocythere, by Gründel 1966. As described above Homocythere takes precedence over Mandocythere and is thus defined on the basis of the 'outer tooth' in the hinge of the left valve.

Occurrence: This species is common throughout the Lower Cenomanian of Southern England but is not found above the mid-Cenomanian non-sequence.

Homocythere ornata n.sp.

(Plate 16, figs.9-13)

Derivation of name: Ornatus - Latin = ornate.

Diagnosis: A species of Homocythere with a weak reticulation on the lateral surface. The sola bear numerous pits. The longitudinal ribs are notched.

Holotype: A female left valve, OS 9675. Sample S23, 45m below the base of the Plenus Marls, Lower Cenomanian, Southerham, Sussex.

Paratypes: 9 valves and carapaces, OS 9676 to OS 9684 from the same horizon and locality.

Other material: 20 valves.

Measurements:		Length	Height	Width
Holotype, female left valve,	OS 9675	0.800	0.472	0.230
Paratype, female right valve,	OS 9676	0.780	0.418	0.230
Paratype, male carapace,	OS 9677	0.880	0.440	0.440

Description: Valves heavily calcified, sub-quadrate in outline. The ventral margin is weakly concave at 2/5 length and is convex behind this. The anterior margin is broadly rounded and is strengthened by an anterior rib which bears 13 forward projecting spines and 7 laterally projecting nodes on each valve.

The hinge ear is small and rounded; behind it the dorsal margin is straight but with an upturned portion at the posterior in the left valve. In the right valve the anterior and posterior cardinal angles are well marked. There is a very small flattened posterior with a straight upper margin in the left valve and concave upper margin in the right valve. The lower margin of the posterior curves round into the ventral margin. There are 4-5 thin spines on the lower margin of the posterior but they are usually indistinct.

The dorsal rib is straight with a short, inclined anterior portion. It has 6 notches along its length. This rib runs parallel to the dorsal margin and obscures it in lateral view. The muscle node is rather broad and is joined to the middle rib which is also notched, the notches become more distinct towards the posterior where they divide the rib into a series of nodes. The most posterior node appears to be a pore cone and a further pore cone is found just below and behind the end of the rib. The ventral rib appears as an elongate tumidity which obscures the ventral margin in lateral view. Posteriorly it ends in two nodes. The ventral surface of each valve bears three longitudinal riblets.

The surface of the valves, except for the small posterior area which is smooth, is covered by a series of pits. On the intercostal and anterior areas and also on the ventral rib there is a weak reticulation and the pits here are grouped into the sola. On the dorsal and middle ribs and on the muscle node the pits are not grouped and are more widely spaced.

The greatest width lies at half length across the muscle node, but the carapace is equally as wide at 2/3 length across the ventral rib. Sexual dimorphism is marked, with males being less high and more elongate, the greatest width in males lies across the ventral rib at 2/3 length.

The hinge is paramphidont. The right valve has crenulate anterior and posterior teeth separated by a weakly crenulate groove, the anterior of which is a small smooth socket. The left valve is complementary. A small rounded 'tooth' anterior to the anterior socket in the left valve overlaps the right valve externally in dorsal view.

Inner margin and line of concrescence coincide. Marginal pore canals are widely spaced and expand distally. There are about 15 anteriorly and 6 posteriorly.

Details of the muscle scars could not be seen.

Remarks: H. ornata differs from other species of the genus in having a weakly reticulate ornament. It also differs from H. harrisiana Jones, in having notched longitudinal ribs. H. sp. A. n.sp. has a pitted surface but it has a different shape and ridge like longitudinal ribs.

Occurrence: This species has been found in only one sample from the top of the Lower Cenomanian at Southerham, Sussex.

Homocythere sp. A.

(Plate 16,figs.6-8)

Diagnosis: A species of Homocythere with ridge-like longitudinal ribs, the ventral one lying some distance above the ventral margin. The surface is pitted.

Material: 7 valves

Measurements (mm)		Length	Height	Width
Left valve,	OS 9685	0.780	0.429	0.209
Right valve,	OS 9687	0.736	0.363	0.200

Description: Valves sub-quadrate in outline. Ventral margin straight, anterior margin symmetrically arched, marked by an anterior rib which deflates at ¾ height. On the anterior rib there are two rows of spines, one row of 10 spines project anteriorly from the margin which lies in front of the anterior rib in the left valve. The other row of 6 spines lies on the anterior rib and projects laterally. The hinge ear in the left valve is low and rounded with a gently inclined posterior margin. The dorsal margin is straight and inclined down towards the posterior. The posterior is small, triangular and laterally compressed, its upper margin is weakly concave and its lower margin is gently convex. There are at least 3 spines on the lower margin of the posterior but these are usually broken.

The longitudinal ribs are ridge-like with scalloped sides.

The dorsal rib connects with the upper termination of the anterior rib by a weakly inflated area running under the hinge ear. This rib is contorted into a series of 'V' shaped folds along its length. The muscle node is low and broad, and connected to the middle rib which is thin and ridge-like. This rib has about 6 raised points on its outermost edge between which the rib thins somewhat. The posterior end of the dorsal rib turns vertically down and its lower end almost joins the posterior end of the middle rib. The ventral rib is again ridge-like and runs along the lateral surface above the ventral edge. It is also folded and divides into a series of 5 low spines towards the posterior. Three other low nodes may also be seen above and parallel to the posterior end of this rib. In ventral view the anterior rib is seen to continue as a ridge along the ventral margin. Outward to this is a further parallel ridge seen in lateral view as a step down from the ventral rib, and obscuring the ventral margin.

The lateral surface apart from the posterior area is covered by a series of pits. These pits are not grouped but are evenly distributed.

The hinge is paramphidont. In the right valve the anterior tooth is weakly crenulate, the antero-median socket is rather shallow and the median groove is crenulate. The posterior tooth is crenulate. The left valve is complementary but has a knob-like projection anterior to the anterior socket which overlaps the right valve externally.

The marginal zone is fairly broad, the inner margin and line of concrescence coincide. Marginal pore canals are very thin at the anterior end, where there are at least 18. Posteriorly they are more distinct, there are 6 in number and they are expanded distally.

The central muscle scars are indistinct.

Remarks: Since only 7 adult specimens of this species have been found it is not erected as a species at the present time.

H. sp. A. differs from other species of the genus by having ridge-like ribs and not low inflated ribs. Its muscle node is also distinct from its middle rib. H. ornata n. sp. has a similarly pitted surface but also shows a weak reticulation on the lateral surface and has low inflated ribs.

Occurrence: This species has only been found in samples from just above the mid-Cenomanian non-sequence from Barrington, Cambridgeshire.

Genus VEENIA Butler and Jones, 1957

Type species: Cythereis ozanana Israelsky, 1929

Veenia cf. V. ballonensis Damotte and Grosdidier, 1963

(Plate 15, figs.7-9)

? 1963 Veenia ballonensis Damotte and Grosdidier: 60, pl.3, figs.10a-h.

1971 Veenia cf. ballonensis Damotte and Grosdidier; Keen and Siddiqui: 66, pl.2, figs. 3, 12.

Diagnosis: A species of Veenia with very low median and ventral longitudinal ribs and a more pronounced dorsal rib. Valves smooth and rather small.

Material: 83 valves and carapaces.

Measurements (mm)		Length	Height	Width
Carapace,	OS 9688	0.626	0.384	0.300
Right valve,	OS 9689	0.615	0.341	0.150

Description: Ventral margin gently convex, anterior margin semicircular without a marginal rib. In the left valve there is a rounded hinge ear at 1/3 length. A low rounded eye tubercle is present on the hinge ear. Beneath the eye tubercle begins the dorsal rib, this obscures the dorsal margin in lateral view. It is straight and inclined down towards the posterior. Between the anterior of the dorsal rib and the hinge ear is a distinctive sulcus. The posterior is triangular, the posterior extremity forming an acute point at 1/3 height. The ventral margin of the posterior area bears 4 short spines. The ventral rib is rounded and diverges from the ventral margin towards the posterior onto the lateral surface. It terminates in an indistinct node. Diverging from the anterior end of this rib, and running ventral to it, is a further swelling which in the right valve partly obscures the ventral margin. This also has a pointed termination. A muscle node is not visible and the middle rib is very low and rounded and shorter than the other longitudinal ribs.

In dorsal view the carapace is fusiform, the greatest breadth lies just behind mid-length. The left valve can be seen overlapping the right at the anterior and posterior cardinal angles.

The hinge in the right valve consists of a high anterior tooth with a deep postjacent socket, the median groove appears to be smooth and the posterior tooth is large with very weak crenulations. The inner lamella is of moderate width, the line of concrescence and inner margin coincide. There are 30 - 40 marginal pore canals anteriorly grouped in 2's or 3's and 10 - 15 at the posterior end

Remarks: These forms appear to be identical to *V.* cf. *V. ballonensis* as described by Keen and Siddiqui from the Carr's Glen Shell Bed, Belfast. These two forms differ from *V. ballonensis* from the Middle Cenomanian of the Paris Basin in being smaller and lacking the two distinctive spines at the posterior end.

Occurrence: Middle Cenomanian.

Veenia inferangulata Donze, 1972

(Plate 15, figs.1-6)

1972 *Veenia inferangulata* Donze: In Donze and Porthault 1972, 368, pl.2, figs. 3-9

Diagnosis: A species *Veenia* with rounded longitudinal ribs and the posterior extremity at 1/5 height.

Material: 441 valves and carapaces.

Measurements (mm)		Length	Height	Width
Female carapace,	OS 9690	0.681	0.407	0.330
Female right valve,	OS 9691	0.626	0.330	0.165
Male left valve	OS 9692	0.770	0.410	0.176

Description: Carapace sub-rectangular, tapering slightly posteriorly. Ventral margin straight with a weak concavity near the anterior. Anterior margin bounded by a semi-circular rib bearing two rows of short stout spines, one set directed anteriorly and the other set laterally. The upper extremity of this rib forms the rounded hinge ear in the left valve. The dorsal margin is straight and converges slightly with the ventral margin posteriorly. The posterior is triangular, the posterior extremity forming an obtuse rounded point just below 1/5 height. The lower margin of the posterior area is convex and bears 3 - 4 indistinct blunt spines. The lateral surface has three rounded longitudinal ribs which bear tubercles. The dorsal rib begins below the eye tubercle and runs slightly upward thus obscuring the dorsal margin posteriorly. The most prominent tubercle on this rib rises above the dorsal margin at ½ length. The sub-central tubercle is low and rounded and not joined to the median rib. This rib is very rounded and rather short. The ventral rib is very rounded and begins just above the ventral extremity of the anterior rib. The eye tubercle is not prominent but there is a short rib beneath it. In dorsal view the left valve projects over the right valve just in front of the the tubercle. The surface of the valves bears a series of pore cones - the most obvious being the one at mid-length on the dorsal rib, and a row of 3 from the posterior cardinal angle to the end of the middle rib. Others occur along and at the ends of the longitudinal ribs. In ventral view the valves bear 3 - 4 indistinct longitudinal ridges which converge slightly towards the anterior.

The hinge of the right valve consists of an anterior tooth which appears to be high and smooth in most specimens. However certain other specimens show the anterior tooth to be variably crenulate, and in at least one specimen there are 5 strong ridges on it. Behind the anterior tooth is a rounded socket and a smooth postero-median groove. The posterior tooth is large and indistinctly crenulate. The left valve has a complementary arrangement. The inner lamella is moderately broad, without vestibules. Marginal pore canals are numerous, there are about 30 - 40 at the anterior end and 15 - 20 at the posterior. Details of the muscle scars could not be seen.

Sexual dimorphism is well marked with males being longer than females.

Remarks: This species was first recorded by Donze (1972) from S.E. France. Specimens from this area are almost identical to those from the British Cenomanian except that the posterior extremity is often more rounded in the British specimens. A few of the British specimens also show a variable amount of crenulation on the anterior tooth in the right valve.

Occurrence: Middle Cenomanian.

Veenia pseudostriata n. sp.

(Plate 14, figs.10-12; Plate 15, figs.10,11)

Derivation of name: The species resembles Protocythere lineata striata in appearance.

pars 1849 Cythere (Cythereis) triplicata (Roemer); Jones: 18, pl.3, figs. 9c, c', d, d' (?figs.9a,b,e,f.)

pars 1890 Cythereis triplicata (Roemer); Jones and Hinde: 19, pl.1, figs. 57,58,60 (?figs. 56,59,61)

pars 1964c Protocythere lineata (Chapman and Sherborn) Kaye: 58, pl.5, figs.4,6 (non figs.1-3,5,7,8 = P. lineata striata).

Diagnosis: A species of Veenia with longitudinal riblets on the ventral rib and a short middle rib. Marginal pore canals very numerous, particularly at the posterior.

Holotype: A male left valve, OS 9695. Sample PBH1 22m. 14m above the base of the Cenomanian, Lower C nomanian, Pitstone, Herts.

Paratypes: 3 valves OS 9696 to OS 9698 from the same horizon and locality. Hypotypes: 4 valves and 2 carapaces OS 9699 to OS 9704 from sample S 23, Lower Cenomanian, Southerham, Sussex.

Other Material: 20 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, male left valve	OS 9695	0.900	0.507	0.236
Paratype, female left valve,	OS 9697	0.857	0.527	0.230
Paratype, female right valve,	OS 9696	0.791	0.440	0.242

Description: Valves heavily calcified, sub-triangular, tapering towards the posterior. The ventral margin is gently convex, curving up posteriorly almost to the dorsal margin. It is obscured in the middle region by the tumid ventral rib, in the right valve there is a weak concavity at 1/3 length. The anterior margin is obliquely rounded in the left valve, semi-circular in the right valve. The hinge ear in the left valve is sub-triangular and bears a distinct swelling which from the interior is seen as the anterior socket of the hinge. The dorsal margin behind the hinge ear is long and straight in both valves but is obscured for most of its length by the dorsal rib. The posterior cardinal angle is well marked. The postero-dorsal margin of the posterior is short being straight in the left valve but concave in the right valve. The surface bears three longitudinal ribs, the dorsal one beginning behind the hinge ear is weakly arched at its anterior end. It obscures the dorsal margin along its entire length except at the extreme posterior in the left valve. The muscle node forms a broad extension of the middle rib. The middle rib is short, ending in front of the terminations of the other two ribs. The ventral rib is convex and bears on its ventral surface 4 - 5 longitudinal riblets. The surface of the valves is smooth. The greatest width lies at half length across the ventral rib. Males are longer than females.

The hinge is hemiamphidont. In the right valve the anterior tooth is large and smooth, it is followed by a broad shallow socket and then a crenulate median groove. The posterior tooth is broad and has a weak notch. The left valve has a complementary arrangement but just in front of the anterior socket is a knob-like extension which can be seen overlapping the dorsal edge of the right valve in dorsal view of a carapace.

The marginal zone is broad, the inner margin and line of concrescence coincide throughout. The marginal zone is crossed by numerous marginal pore canals - 15 - 20 anteriorly and about 20 closely grouped at the posterior. A few of the anterior marginal pore canals are false.

The central muscle scars consist of a vertical row of 4 oval scars with the second one down being more elongate. Anteriorly to these is an oblique undivided scar.

Remarks: V. pseudostriata closely resembles Protocythere lineata striata Gründel in external appearance, but internally V. pseudostriata can be distinguished by its amphidont hinge, and by the arrangement of the marginal pore canals which are lacking in the upper part of the anterior margin and fewer in number at the posterior margin in P. lineata striata. The right valves of V. pseudostriata are more tapered posteriorly and the middle rib is much shorter.

V. pseudostriata differs from V. ballonensis Damotte and Grosdidier by its much larger size, stronger longitudinal ribs and the riblets on its ventral rib.

Kaye (1964c) described, and erected, a lectotype for Protocythere lineata Chapman and Sherborn. On examination of his material, however, two of his specimens (figured Kaye pl.5, figs.4,6) can be seen to have strongly amphidont hinges and these belong in Veenia pseudostriata. According to Kaye these specimens were also figured by Jones (1849) and Jones and Hinde (1890) and indeed the amphidont nature of the hinges can be seen in Jones' figures. The other figures produced by Kaye are of true P. lineata specimens.

Occurrence: This species is rare and appears to be restricted to the Lower Cenomanian.

Family BRACHYCYTHERIDAE Puri, 1954.

Genus BRACHYCYTHERE Alexander, 1933

Type species: Cythere sphenoides Reuss, 1854

Brachycythere cf. B. laticristata (Bosquet)

(Plate 17, figs.1-3,5)

? 1854 Cythere laticristata Bosquet: 118, pl.7, figs. 11a-d.

? 1964c Brachycythere laticristata (Bosquet); Kaye: 50, pl.2, figs.1-4,6.

Diagnosis: A species of Brachycythere with a weak ventro-lateral ala and in dorsal view with the sides parallel just posterior to mid-length. Anterior margin with different spines in each valve.

Material: 68 valves

Measurements (mm)		Length	Height	Width
Left valve,	OS 9705	0.945	0.516	0.319
Right valve,	OS 9706	0.945	0.500	0.320
Carapace,	OS 9707	0.934	0.521	0.600

Description: Valves heavily calcified, dorsal and ventral margins weakly convergent posteriorly.Dorsal margin of the left valve with a weak, rounded hinge ear and a strengthened posterior, which projects up slightly. In the right valve the dorsal margin is straight. Eye tubercle prominent. Posterior pointed with a straight upper margin and convex lower margin, this lower margin bears 4 small spines. Ventral margin straight but obscured by the ventro-lateral spine in lateral view. Anterior margin broadly rounded, in the left valve there are at least 12 small spines around the anterior margin, whilst in the right valve there are only about 6 slightly larger spines. The valves are strongly inflated with the inflation increasing towards the ventro-lateral ala. This ala takes the form of an excavate carina of narrow width. At the end of the ala is a small obliquely backward directed spine. Along the posterior margin of the ala above the terminal spine are three more blunt spines. In ventral view the ventral surface of each ala bears three very weak longitudinal ridges, the outer two become more raised at their posterior ends where they also turn inwards. In dorsal view the sides of the valves diverge from the anterior, then at ½ length they become parallel up to the end of the ventro-lateral ala. The posterior end is laterally compressed.

The hinge in the right valve consists of a large anterior tooth with weak crenulations on its lower surface, a deep antero-median socket with a smooth median groove and a triangular crenulate posterior tooth. Above the median groove is a weak bar. In the left valve there is a large anterior socket, knob-like antero-median tooth, smooth median bar and elongate posterior socket. Above the median bar is a very narrow shelf. In front of the anterior hinge element in each valve is a deep eye orifice.

The marginal zone is moderately wide without vestibules.

Other internal details could not be seen.

Remarks: These specimens are very similar to Brachycythere laticristata (Bosquet) as interpreted by Kaye (1964c). In Kaye's specimens the left valves have a convex dorsal margin and in dorsal view the sides of the valves diverge up to the tip of the ventro-lateral ala. In the Cenomanian specimens the dorsal margin of the left valve is not so arched and the sides of the valves in dorsal view are parallel behind mid-length. All other features, however, are identical.

Occurrence: This species is often quite common in Beds 1 - 3 of the Plenus Marls but it can sometimes also be found in the beds just beneath the Plenus Marls.

Genus PTERYGOCYTHEREIS Blake, 1933

Subgenus (PTERYGOCYTHEREIS) Blake, 1933

Type species: Cythereis jonesii Baird, 1850.

Pterygocythereis (Pterygocythereis) phylloptera phylloptera Bosquet, 1854

1854 Cythere phylloptera Bosquet: 116, pl.7, figs. 10a-d.

Pterygocythereis (Pterygocythereis) phylloptera reducta n. ssp.

(Plate 17, figs.13-16)

Derivation of name: Reducta - referring to the reduced spines on the ventro-lateral ala.

Diagnosis: A sub-species of Pterygocythereis (P.) phylloptera with a weak anterior marginal rib and no spines along the crest of the ventro-lateral ala.

Holotype: A carapace, OS 9708. Sample PBH1 36 from the Glauconitic Marl, Lower Cenomanian, Pitstone, Herts.

Hypotypes: 2 valves OS 9709 and OS 9712 from sample Bar 10, Middle Cenomanian, Barrington, Cambs. 2 valves OS 9710 and OS 9711 from sample PBH3 18m., Middle Cenomanian, Pitstone, Herts.

Other Material: 8 valves

Measurements (mm)		Length	Height	Width
Holotype, carapace	OS 9708	0.725	0.407	0.600
Paratype, right valve	OS 9709	0.600	0.319	0.275

Description: Valves comparatively small for the genus. Dorsal and ventral margins straight and converging towards the posterior. The posterior cardinal angle is well developed. The postero-dorsal margin is weakly concave whilst the postero-ventral margin is convex and bears 4 long spines which are often broken. The anterior margin is broadly rounded and is strengthened by a weak marginal rib which bears a thin ridge from the top to 2/3 height. This ridge is directed forwards and slightly outwards. Beneath 2/3 height the ridge is divided to form blade-like spines which are usually broken. Behind this ridge on the dorsal edge in the left valves is a further row of 6 - 7 spines, these are more stout and are directed anteriorly. The eye tubercle is well developed in both valves, but in the left valve there is a dorsally-directed, blade-like spine just above and behind the eye tubercle. Also in the left valve only there is a similar, dorsally directed spine over the posterior cardinal angle. In both valves a stout dorsally directed but hooked backward spine is developed mid-way between the other two dorsal spines. The ventro-lateral ala is well developed, in dorsal view it is triangular with its posterior margin perpendicular to the length of the carapace. Its leading edge is thin and blade-like, and mid-way along its posterior margin is a short blade-like process.

The hinge of the right valve consists of a long anterior knob-like tooth with a postjacent rounded socket. The median groove is smooth and the posterior tooth is very weakly crenulate. The left valve is complementary.

The inner lamella is moderately broad and without vestibules.

Marginal pore canals are numerous, there are at least twenty at the anterior and ten at the posterior, some of them are grouped as pairs. Normal pores are rather widely spaced. Details of the muscle scars could not be seen.

Remarks: This sub-species differs from P.(P.) phylloptera phylloptera (Bosquet), from the Senonian of Limburg, by having a poorly developed anterior marginal rib and lacking the spines along the anterior crest of the ventro-lateral ala.

Occurrence: Lower, Middle and Upper Cenomanian, but very rare.

Subgenus (PTERYGOCYTHERE) Hill, 1954

Type species: Cypridina alata Bosquet, 1847.

Pterygocythereis (Pterygocythere) diminuta n.sp.

(Plate 17, figs.9-12)

Derivation of name: Diminuta - referring to the relatively small size of this species.

Diagnosis: A species of the genus Pterygocythereis with the right valve overlapping the left in the mid-dorsal region. Valves rather small.

Holotype: A carapace, OS 9713. Sample BN 6, 18m. below the base of the Plenus Marls, Upper Cenomanian, Buckland Newton, Dorset.

Paratypes: 5 valves OS 9714 to OS 9719 from the same horizon and locality.

Other Material: 67 valves

Measurements (mm)		Length	Height	Width
Holotype, carapace,	OS 9713	0.700	0.374	0.626
Paratype, left valve,	OS 9715	0.681	0.385	0.330
Paratype, right valve,	OS 9714	0.670	0.373	0.319

Description: Carapace rather small, valves sub-triangular. Dorsal margin of the right valve convex, in the left valve there is a rounded hinge ear with a straight margin behind, which rises slightly posteriorly. Postero-dorsal margin weakly concave, postero-ventral margin convex and strengthened by a weak rib which bears five spines. The posterior extremity lies just beneath the dorsal margin. The ventral margin is straight. The anterior margin is broadly rounded and strengthened by a rib which becomes more pronounced ventrally and bears five spines. In the left valve there is a row of 14 spines around the anterior margin, these are often broken. At the top of the anterior marginal rib is a small eye tubercle. The ventro-lateral ala is long and pointed. On the posterior margin of each ala are two thin ridges. Anteriorly the crest of the ala joins the anterior marginal rib. The right valve overlaps the left along the middle of the dorsal margin whilst the left valve overlaps the right antero- and postero-dorsally.

The hinge of the right valve consists of an anterior, smooth, knob-like tooth. This tooth has a low, anterior extension. Behind the anterior tooth is a deep rounded socket and running back from this is a shallow, smooth groove which is open beneath. The posterior tooth is squarish and weakly crenulate. Above the median elements in the right valve is a thin bar and above this is a distinct groove. In the left valve there is a deep anterior socket, high, rounded antero-median tooth and a smooth median bar. The posterior socket is deep and open beneath. Above the median bar is a narrow marginal shelf. In front of the anterior element in each valve is the eye orifice.

The inner lamella is rather narrow, without vestibules. Marginal pore canals are numerous, at the anterior end there are about 17, some of the upper ones are wavy and a few are widened distally. There are also two groups of three at the lower end. At the posterior end there are about 16 marginal pore canals grouped in two's. Other internal details could not be seen.

Remarks: The shape and hinge of this species suggest that it belongs in the subgenus Pterygocythereis (Pterygocythere), but it does belong to a group of species which have the accommodation groove in the right valve instead of the left. Hill (1954) erected the genus Diogmopteron for forms such as these, but it is now generally accepted (Van Morkhoven 1962, Hartmann and Puri 1974) that this character is not sufficient to warrant generic or sub-generic status.

P.(P.) diminuta is very similar in external appearance to Pterygocythereis (Diogmopteron) sp. Donze (1972), from the Upper Cenomanian of S.France, but the two cannot be compared further because the internal details of Donze's species are not known. P.(Pterygocythere) robusta is similar in general shape but is larger with the left valve overlapping the right along the mid-dorsal margin. It also has a dorsal rib.

Occurrence: Upper Cenomanian but usually rare.

Pterygocythereis (Pterygocythere) cf. P.(P.) robusta

(Jones and Hinde)

(Plate 17, figs. 4, 6-8)

? 1890 Cytheropteron alatum robustum Jones and Hinde: 36, pl.2,figs.24-27.

Diagnosis: A species of Pterygocythereis with a short dorsal rib in the left valve. Width of carapace across alae equal to its length.

Material: 219 valves

Measurements (mm)		Length	Height	Width
Left valve,	OS 9720	0.847	0.500	0.440
Right valve,	OS 9721	0.800	0.407	0.450
Carapace,	OS 9722	0.912	0.527	0.978

Description: Valves sub-quadrate to weakly tapering posteriorly. Dorsal margin weakly convex in the left valve, straight in the right valve. Posterior margin well rounded in the left valve, with a concave postero-dorsal margin in the right valve. The lower half of the posterior margin bears about 6 spines which are usually broken. The ventral margin is straight, but obscured in lateral view by the ventro-lateral ala. The anterior margin is broadly rounded and is strengthened by a rib, which bears at least 6 spines. This rib continues to the small eye tubercle and in the left valve it continues just beyond this as an indistinct ridge. A short straight dorsal rib occurs just below the dorsal margin, in the right valve this rib is indistinct or may be missing. The ventro-lateral ala is long and sharply pointed. In dorsal view it is triangular with its tip bent backwards. At half-length along its posterior margin is a sharp thin rib. The crest of the ala continues from the anterior rib, it is joined to the valve wall by strong struts with thinly calcified areas in between.

The hinge of the right valve consists of a strong conical anterior tooth with a rounded antero-median socket behind which is a smooth median groove. The posterior tooth is elongate and crenulate. In the left valve there is a deep anterior socket, knob-like antero-median tooth, smooth hinge bar and crenulate posterior socket. Above the median elements in the left valve is a well developed accommodation groove. In front of the anterior hinge element in each valve is a deep eye orifice.

The inner lamella is moderately wide without vestibules. There are at least 15 rather narrow, straight marginal pore canals at the anterior. At the posterior there are at least 10 marginal pore canals, some of these are grouped as twos.

Muscle scars indistinct, but there appears to be 4 elongate scars with a more distinct anterior 'V' shaped scar.

Remarks: These forms are very similar to P. (Pterygocythere) robusta Jones and Hinde, but as interpreted by Kaye (1964c), Jones and Hinde's forms lack the accommodation groove in the left valve. It seems likely, as Kaye has suggested, that Jones and Hinde included a group of closely related species under this name. Therefore; until a lectotype is erected no further progress can be made with this species.

The presence of the accommodation groove and crenulate posterior tooth in the right valve suggest that this species belongs in the sub-genus Pterygocythereis (Pterygocythere).

Occurrence: Lower, Middle and Upper Cenomanian, but usually rare.

Family TRACHYLEBERIDIDAE Sylvester-Bradley, 1948

Recent attempts have been made by Gründel (1973, 1974a) to sub-divide some of the genera in the Trachyleberididae and in particular the genus Cythereis. Damotte (1977) has criticised the setting up of some of these new genera and has concluded that Veeniacythereis and Parvacythereis should be retained, Cornicythereis should be demoted to become a sub-genus of Cythereis, Rehacythereis may not be recognisable even at subgeneric level and Chapmanicythereis is invalid and should not be used. As Damotte has pointed out the genus Rehacythereis shows few differences from Cythereis and its usage appears to give an artificial division of this group of species. It is therefore not used here. The genus Cornicythereis however appears to cover a natural grouping of species and it can be clearly distinguished from other genera by having a smooth surface and undivided, inflated longitudinal ribs.. Cornicythereis is therefore retained as a genus in this work. The division between Platycythereis and Chapmanicythereis is so slight that no true separation is possible and so Chapmanicythereis is not used here.

Genus CORNICYTHEREIS Gründel, 1973

Type species: Cythereis cornueli Deroo, 1956

Cornicythereis larivourensis

(Damotte and Grosdidier)

(Plate 22, figs. 2-6)

pars 1849 Cythereis quadrilatera (Roemer); Jones: 18, pl.4, figs.10j, 10j' (non pl.3,figs.10a-f, pl.4,figs.10g-i')

pars 1890 Cythereis quadrilatera (Roemer); Jones and Hinde: pl.1, figs. 74, 75, (non figs. 69-73)

1898 Cythereis quadrilatera (Roemer); Chapman: 339

? 1940 Cythereis bonnemai Triebel: 204, pl.7, figs. 67-70

1963 Cythereis ? larivourensis Damotte and Grosdidier: 59, pl.3, figs. 9a-i.

1971b Cythereis larivourensis Damotte and Gnosdidier; Damotte: 65, pl.2, fig.12.

1976 Cythereis larivourensis Damotte and Grosdidier; Damotte: 143, pl.1, fig. 1, pl.2, fig.15.

Diagnosis: A species of Cornicythereis with the ventral rib lying above the ventral margin in lateral view. Muscle node elongate and joined to the middle rib.

Material: several thousand valves and carapaces.

Measurements (mm)		Length	Height	Width
Female left valve,	OS 9723	0.473	0.275	0.090
Female right valve,	OS 9724	0.440	0.253	0.088
Male left valve,	OS 9725	0.511	0.275	0.090

Description: Carapace small, quite heavily calcified. The hinge ear in the left valve is poorly developed, it is rounded and extends back to ½ length. At its top the anterior marginal rib continues as an oblique rib which bears the small eye tubercle and eventually ends at the dorsal margin. This continuation of the anterior rib is also present in the right valve and it forms a high rounded area just behind the eye tubercle on the dorsal margin. The posterior area is small and triangular with a marginal rib. This rib bears a laterally directed perforate spine on its upper and lower margins and five small spines along its lower margin. The ventral margin is straight to weakly concave. The anterior margin is broadly rounded with a strong marginal rib which bears 5 - 6 small spines along its lateral edge but no anteriorly directed spines. In well preserved specimens there is a broad frill-like flange around the anterior margin. The dorsal rib begins beneath the eye tubercle, it is raised and ridge-like with its posterior half obscuring the dorsal margin in lateral view. In a few specimens there is a short vertical rib joining the posterior ends of the dorsal and middle ribs. There is a perforate spine beneath and behind the posterior end of the dorsal rib. The muscle node is distinct, it is prolonged forward by an elongate swelling and posteriorly it is continuous with the middle rib. Just beneath the middle rib behind the muscle node is a very small perforate spine and there is another one just beneath the end of the middle rib. The ventral rib is divided into two parts which both join the anterior rib - the lower rib forms the ventral margin whilst the upper rib runs parallel as a raised ridge along the lateral surface. In the right valve only the posterior part of the lower rib is present. On the ventral surface there is one weak ridge on each valve sagittal to the lower ventral rib. In dorsal view the sides of the valves are parallel with the greatest width lying along the middle rib. The surface of the valves is smooth.

The hinge of the right valve consists of a weakly crenulate anterior tooth, deep rounded antero-median socket, smooth median groove and a triangular weakly crenulate posterior tooth.

The marginal zone is fairly broad without vestibules. There are 20 - 25 thin, wavy to straight marginal pore canals at the anterior and about 10 - 15 at the posterior some of which widen distally.

The central muscle scars consist of a vertical row of 4 scars with the second one down being more elongate, and a 'V' shaped antennal scar which has a longer posterior branch.

Remarks: Jones (1849) and Jones and Hinde (1890) regarded this species as a juvenile of *Cythereis quadrilatera* (Roemer), and it was not until 1963 that Damotte and Grosdidier erected it as a separate species. *C. larivourensis* is very similar to *C. bonnemai* Triebel 1940, from the Albian of Germany, but *C.bonnemai* is larger and more elongate.

Occurrence: Lower and Middle Cenomanian.

Cornicythereis sp. A.

(Plate 22, figs. 7, 8)

Material: 10 valves

Measurements (mm)		Length	Height	Width
Carapace,	OS 9728	0.582	0.330	0.286
Left valve,	OS 9729	0.550	0.300	0.132

Description: Valves rather small and strongly calcified. The dorsal and ventral margins are straight and converge towards the posterior. The hinge ear in the left valve is low and rounded. The anterior margin is broadly rounded and has a low marginal rib which does not bear spines. A low eye tubercle lies at the top of this rib. The posterior is almost rounded with about 4 spines on the lower margin. The dorsal rib begins vertically above the muscle node but its anterior end is indistinct. It becomes more distinct behind ½ length. The middle rib is low and inflated with a weak notch between it and the broad, low muscle node. The ventral rib is also inflated. It joins the anterior rib at the anterior end and lies above the ventral margin in lateral view. The surface of valves is smooth. In dorsal view the greatest width lies across the muscle node.

Internal details cannot be seen.

Males are longer than females.

Remarks: The poor preservation and limited number of specimens of this species make a complete description impossible at the present time. Nevertheless the smooth surface and arrangement of the lingitudinal ribs suggest that the species belongs in the genus *Cornicythereis*.

This species differs from *C. larivourensis* by being more inflated (particularly antero-laterally), and having a slightly larger hinge ear. *Cornicythereis gatyensis* (Damotte and Grosdidier) from the Albian of theParis Basin is less inflated with anterior marginal spines and sharper ribs.

Occurrence: This species has been found in only one sample from just above the Glauconitic Marl from Culver Cliff, I.O.W.

Genus *CURFSINA* Deroo, 1966

Type species: *Cythereis major* Van Veen, 1936.

Curfsina? derooi n. sp.

(Plate 21, figs.10-12; Plate 22, fig.1)

Derivation of name: In honour of Dr. G. Deroo for his work on Cretaceous Ostracoda.

Diagnosis: A species referred to the genus *Curfsina* with reduced dorsal and middle ribs. Valves reticulate with 2 - 8 large pustules in each fossa.

Holotype: A left valve, OS 9730. Sample BN12, Plenus Marls Bed 1, Upper Cenomanian, Buckland Newton, Dorset.

Paratypes: 9 valves and carapaces, OS 9731 to OS 9739 from the same horizon and locality.

Other Material: 298 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9730	0.527	0.319	0.120
Paratype, right valve,	OS 9731	0.500	0.275	0.120

Description: Valves small, strongly calcified with a subrectangular outline. Dorsal and ventral margins straight, converging slightly towards the posterior. Posterior small and triangular, with a marginal rib which bears a small perforate spine on its upper margin and 4 spines along its lower margin. The anterior margin is broadly rounded with a marginal rib. This rib has a ridge running down its lateral edge from near the eye tubercle to about ½ height; beneath it is a row of about 3 small perforate spines. The anterior margin bears 5 - 6 fairly stout spines. Between the lateral ridge and the spines the anterior rib bears a series of elongate pits. The hinge ear is very low and barely rises above the dorsal margin. It has a straight upper margin. The eye tubercle is rather large with a short vertical inflation beneath it. The dorsal rib is reduced to two small perforate spines behind the eye tubercle which are followed by a short rib which ends in a large vertical block-like process. In front and just behind this process are perforate spines. The muscle node is large, rounded and smooth. It is separated from the middle rib which forms a low elongate node, behind which is a perforate spine. The ventral rib joins the anterior rib and becomes more prominent posteriorly, in the left valve it converges with the ventral margin posteriorly but in the right valve it is coincident with the ventral margin. In ventral view each valve bears two irregular longitudinal ridges. The greatest width lies across the muscle node.

The lateral surface of the valves apart from the muscle node is reticulate. The solum of each fossa bears from 2 - 8 large pustules which almost completely fill the fossae.

The hinge of the right valve consists of a long, peg-like anterior tooth which may be weakly lobed, a deep rounded antero-median socket, smooth median groove and an elongate, triangular, weakly crenulate, posterior tooth. The left valve has a complementary arrangement.

The inner lamella is moderately broad, without vestibules. Marginal pore canals are difficult to see but there are at least 15 at the anterior end. Other internal details could not be seen.

Remarks: Since the muscle scars and marginal pore canals cannot clearly be seen in this species its generic assignment remains uncertain. The detail of the ornament on the lateral surface is very similar to that in *Curfsina ? decorata decorata* Donze (1972) from the Cenomanian of S. France. However this species is much larger and has a stronger dorsal rib and a more pointed posterior. *Curfsina subparva* Pokorny (1967) from the Turonian of Bohemia also has a similar ornament but in this species the antero-dorsal margin in the left valve is much more rounded and the dorsal rib is more strongly developed.

Occurrence: Upper Cenomanian. Sometimes very common.

Genus *CYTHEREIS* Jones, 1849

Type species: *Cytherina ciliata* Reuss, 1846

Cythereis barringtonensis n. sp.

(Plate 20, figs. 4-7)

Derivation of name: After the type locality of Barrington, Cambridgeshire.

Diagnosis: A small elongate species of *Cythereis* with the middle rib reduced to a single node. Muscle node forms a small but distinct cone.

Holotype: A left valve, OS 9740. Sample Bar 10, 4.5m. above the top of the Burwell Rock, Middle Cenomanian, Barrington, Cambs.

Paratypes: 6 valves, OS 9741 to OS 9747 from the same horizon and locality.

Other Material: 64 valves.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9740	0.648	0.320	0.125
Paratype, right valve,	OS 9741	0.615	0.308	0.130

Description: Valves elongate, sub-triangular with a pointed posterior end. Dorsal margin weakly concave, converging strongly with the straight ventral margin towards the posterior. The hinge ear is poorly developed, it consists of a small triangular anterior portion with a lower posterior portion at the front of which is the indistinct eye tubercle. The posterior is drawn out and pointed, its upper margin is weakly concave and bears a pore cone, its lower margin is straight with a weak marginal rib which bears 5 small spines. In the left valve the postero-dorsal angle is somewhat thickened. The anterior margin is broadly rounded and strengthened by a rib. This rib bears a strong ridge on its lateral surface which continues to the eye tubercle at the top and just beyond up to the dorsal margin in both valves. On the front margin of the anterior rib at the top is a short ridge which divides below to form a row of about 12 spines. Sagittally to this row is a further row of numerous very small nodes. The dorsal rib begins vertically above the muscle node, at its anterior end it is very weak but bears two small pore cones. Posteriorly this rib diverges from the lateral surface and it ends in a vertical block-like process which bears two short vertical ridges. The upper surface of this rib is very flat. The middle rib is reduced to a single node which is well separated from the muscle node. The muscle node is small but it is distinct and conical in dorsal view. Just behind the muscle node is a large pore cone. The ventral rib begins beneath the muscle node, it forms a longitudinal swelling which becomes more prominent towards the posterior. Just above its posterior end is a short spine. In ventral view each valve has two very weak longitudinal ridges on the ventral surface.

The surface of the valves appears to be smooth but the S.E.M. reveals that the intercostal areas bear a series of small round pits. Groups of these pits often form circles, particularly behind the muscle node (Plate 20, Fig.7).

The hinge of the right valve consists of a fairly high anterior tooth, deep rounded antero-median socket, smooth median groove and triangular posterior tooth. The terminal teeth both appear to be smooth. The left valve has a complementary arrangement.

The marginal zone is moderately wide, without vestibules. Marginal pore canals could not be seen. Normal pores are fairly numerous often occurring in a row around the line of concrescence.

Central muscle scars could not be seen.

Remarks: C. barringtonensis is very similar to C. paranuda n.sp. C. barringtonensis can be distinguished by its smaller size with relatively more elongate shape and with a more drawn out and pointed posterior. It also has a very strong lateral ridge along the lateral edge of the anterior rib. In C. paranuda this is divided into nodes along the lower part. C. barringtonensis has small pits on its lateral surface whilst C.paranuda is smooth. C.divisa (Damotte) from the Lower Turonian of Touraine, is similar in size and shape but has a large eye tubercle, a lower lateral ridge on the anterior rib and a ventral rib which joins the anterior rib and is not coincident with the ventral margin.

Occurrence: Middle Cenomanian above the mid-Cenomanian non-sequence

Cythereis cantabrigensis n.sp.

(Plate 20, figs. 8-11)

Derivation of name: Cantabrigia, Latin = Cambridge - a city 10 km. N.E. of the type locality.

Diagnosis: A species of Cythereis with a large smooth muscle node, reduced dorsal and middle ribs and numerous round pits on the lateral surface.

Holotype: A female left valve, OS 9748. Sample Bar 9 2.5m. above the top of the Burwell Rock, Middle Cenomanian, Barrington, Cambs.

Paratypes: 5 valves and carapaces, OS 9750 to OS 9754 from the same horizon and locality.

Other Material: 64 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, female left valve,	OS 9748	0.560	0.341	0.143
Paratype, female right valve,	OS 9751	0.539	0.308	0.143
Paratype, male carapace,	OS 9750	0.600	0.330	0.253

Description: Valves small, heavily calcified, sub-rectangular with straight dorsal and ventral margins which converge slightly towards the posterior. Hinge ear in the left valve fairly strong with an almost flat top. Eye tubercle large with a short vertical rib beneath,at the base of which is a perforate spine. Posterior triangular with a weakly concave upper margin and gently convex lower margin. There is a posterior marginal rib which bears a perforate spine on its upper and lower margins and 5 downward directed spines along the lower margin. The anterior margin is broadly rounded and strengthened by a rib which bears 8 - 9 low nodes along its lateral edge and two rows of anteriorly directed spines. In the outermost row there are 8 indistinct nodes whilst the innermost row has about 12 small spines which are more distinct in the left valve.

Just below the dorsal margin vertically above the muscle node is a large perforate spine, behind and just above this is a larger perforate spine. The dorsal rib is reduced to a posterior block-like process which has a vertical ridge at the posterior end and a perforate spine in front. The middle rib may be weakly developed with a perforate spine at half length or this rib may be absent, in which case, the perforate spine appears somewhat larger. The middle rib does not join the muscle node, which is very large, protuberant and smooth. In front of the muscle node are two perforate spines and beneath and behind it is a further perforate spine. The ventral rib appears to join the anterior rib but it is very weak at the anterior end. It does not bear spines along its length and it ends as a short vertical ridge. The ventral surface of each valve bears three weak ribs with numerous cross ribs between them giving the appearance of a reticulate pattern. In dorsal view the greatest width lies across the muscle node.

The hinge of the right valve consists of a crenulate anterior tooth, deep rounded antero-median socket, smooth median groove and a triangular crenulate posterior tooth.

The marginal zone is fairly broad without vestibules.

Other internal details could not be seen.

Remarks: This species is similar in shape to Cythereis hindei. It can be distinguished however by having a distinct ventral rib, dorsal rib reduced to a large block-like posterior process and a surface covered with small pits. Planileberis sandersi n.sp. is of similar size to C. cantabrigensis but has a less pronounced hinge ear, a low muscle node and is much more laterally compressed in dorsal view.

Occurrence: Middle Cenomanian, but it is usually rare.

Cythereis coronata n. sp.

(Plate 18, figs. 8-11; Plate 19, fig.3)

Derivation of name: Corona - Latin - referring to the crown-like muscle node.

Diagnosis: A species of Cythereis with reticulation only between the middle and dorsal ribs. Greatest width across the large, spined, muscle node.

Holotype: A female left valve, OS 9755. Sample S 23, 45m. below the base of the Plenus Marls, Lower Cenomanian, Southerham, Sussex.

Paratypes: 9 valves and carapaces, OS 9756 to OS 9764 from the same horizon and locality.

Other material: 21 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, female left valve,	OS 9755	1.044	0.626	0.352
Paratype, female right valve,	OS 9756	1.110	0.600	0.340
Paratype, male left valve,	OS 9758	1.210	0.660	0.330

Description: A large, heavily calcified sub-rectangular species. Dorsal and ventral margins straight, converging slightly towards the posterior. Hinge ear triangular with two short ridges on top. Eye tubercle moderately large with a short ridge behind it in each valve and a wide, short rib beneath it. Posterior triangular, with a weakly concave upper margin which bears a perforate spine and a convex lower margin which bears 6 spines. Anterior margin broadly rounded and strengthened by a marginal rib. This rib bears 8 laterally positioned blunt spines, and two rows of anteriorly directed spines, on the inner row these spines are small and numerous, there are 8 - 9 in the outer row. The dorsal rib is reduced to a posterior block-like process which bears 5 short spines. In front of and separate from this is a further spine, in front and beneath which is a perforate spine. More small spines arise on the dorsal surface. The middle rib bears 6 blunt spines with a further spine beneath and behind the posterior spine. The muscle node is very large and not joined to the middle rib. It bears 5 or 6 nodes on its surface. The ventral rib consists of 5 anterior spines joined on a rib and having swellings on the top of their bases. Behind these are 4 double spines which are not joined by a rib. In ventral view the ventro-lateral margins diverge from the anterior to ½ length then weakly converge towards the end of the ventral rib. The left valve bears 3 longitudinal ridges on the ventral surface whilst the right valve bears 2, there is also a short outer ridge in each valve. In dorsal view the greatest breadth is across the spines on the muscle node. The carapace is the same width across the spines on the middle and ventral ribs. On the lateral surface only the area between the middle and dorsal ribs is reticulate, though there may be some weak muri beneath the middle rib. At the junctions of the muri short spines arise.

The hinge in the right valve consists of a squarish crenulate anterior tooth with a deep antero-median socket and smooth median groove. The posterior tooth is triangular but only weakly crenulate. The left valve has a complementary arrangement.

The inner lamella is moderately broad without vestibules. Marginal pore canals appear to be numerous, straight and rather thin. At the anterior there are at least 15 and there are at least 8 at the posterior.

There is a vertical row of 4 elongate muscle scars with a 'V' shaped scar in front.

Normal pores are not common.

Juveniles lack reticulation and the middle rib spines and they have a weak anterior marginal rib. They have the dorsal and ventral rib spines and the nodes on the muscle node.

Remarks: This species resembles C.thoerenensis Triebel, from the Albian of Germany, but it differs by being larger, more heavily calcified, and having less reticulation on the lateral surface. Its muscle node bears 5-6 nodes and its hinge ear does not bear spines. Its greatest width lies across the muscle node and not across the posterior end of the ventral rib as in C.thoerenensis. C.lerata Grundel rom the Albian of East Germany has more reticulation on the lateral surface, a more rounded hinge ear and its greatest width across the posterior end of the ventral rib.

Occurrence: This species is quite common just beneath the mid-Cenomanian non-sequence at Southerham. Elsewhere in Southern England it is rare, and has only been found in samples from the lowest Upper Cenomanian from Blue Bell Hill.

Cythereis hindei n. sp.

Derivation of name: After G.J. Hinde in recognition of his contribution to the study of Cretaceous Ostracoda.

Diagnosis: A small species of Cythereis with a weakly reticulate surface and a large rounded muscle node.

Cythereis hindei hindei n. ssp.

(Plate 20, fig. 12; Plate 21, figs. 1-5)

1849 Cythereis ciliata Reuss; Jones: 19, pl.4, fig.11 h' (non figs. 11a-h)

pars 1890 Cythereis ornatissima Reuss; Jones and Hinde: 21, pl.2; fig.16, pl.4, fig.8 (non pl.2, figs.1-7, 15: pl.4, fig.7)

Diagnosis: A small species of Cythereis with the dorsal and ventral ribs reduced to rows of spines. Muscle node large and lateral surface weakly reticulate.

Holotype: A female left valve, OS 9765. Sample PBH 3 12, 2m. below the Totternhoe Stone, Middle Cenomanian, Pitstone, Herts.

Paratypes: 14 valves and carapaces OS 9766 to OS 9779 from the same horizon and locality.

Other Material: several hundred valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, female left valve,	OS 9765	0.550	0.300	0.143
Paratype, female right valve,	OS 9766	0.550	0.286	0.155
Paratype, male left valve,	OS 9768	0.571	0.308	0.138

Description: Valves strongly calcified rather small, sub-rectangular in outline with the dorsal and ventral margins converging towards the posterior. The hinge ear is very small and the large eye tubercle almost reaches the dorsal margin. Behind the eye tubercle is a thickened area and in both valves this bears a thin ridge on its upper side. An inflated area extends down beneath the eye tubercle with a perforate spine at its base. Over the posterior cardinal angle in the left valve is a backward directed spine. The posterior is triangular with a marginal rib, this rib bears 5 spines on its lower margin and two posteriorly directed spines on its upper margin. It also bears one laterally directed perforate spine on the upper and lower margins. The anterior margin is broadly rounded, it bears a row of about 6 nodes along its lateral edge. Around the anterior margin there are two rows of spines in the left valve but only one row in the right valve. The outer row in the left valve and the row in the right valve bear about 6 spines whilst the inner row in the left valve bears about 9 spines. At the top of this rib is a short laterally directed ridge.

On the dorsal margin vertically above the muscle node, in the right valve only, is a small spine, beneath this on the lateral surface in both valves is a perforate spine. The dorsal rib is reduced to a spine near the dorsal margin above the posterior end of the muscle node. Behind this on the dorsal surface is a small spine and at the posterior end of the rib is a thickened area with a spine at its anterior end and a vertical ridge at the posterior. There are perforate spines beneath and behind this structure. The middle rib is present but rather low, it bears 4 spines, the posterior one being rather small. There is a perforate spine at the base of the second of these spines from the anterior. This rib is separated from the muscle node which is large and rounded and may bear up to 4 small nodes. In front of the muscle node are two perforate spines one above the other and in front of these are two more small perforate spines. Behind and below the muscle node is a large perforate spine. The ventral rib is indistinct, it joins the anterior rib and bears 6 small spines with a large process at the posterior. This posterior process bears two vertical ridges the anterior of which is divided. The ventral surface bears three indistinct longitudinal ridges in the left valve and two in the right valve. These ridges end posteriorly in sharp raised areas.

In dorsal view the greatest width lies equally across the muscle node and the posterior end of the ventral rib.

The surface of the valves is reticulate but the fossae are not very prominent.

The hinge of the right valve consists of a fairly high crenulate anterior tooth, deep rounded antero-median socket, smooth median groove and an elongate weakly crenulate posterior tooth which is lower at the front.

The marginal zone is rather narrow, without vestibules. There are about 22 thin, straight marginal pore canals at the anterior and 16 at the posterior. Normal pores are grouped along the longitudinal ribs and along the line of concrescence.

The central muscle scars consist of a vertical row of 4 scars, the upper one being small and rounded and the lowest two being elongate. The antennal scar is 'V' shaped.

Remarks: A single specimen of this species appears to have been regarded as a juvenile form of Cythereis ciliata (Reuss) by Jones (1849). Jones and Hinde later regarded this specimen as a juvenile (reticulate type) of Cythereis ornatissima.

C.h.hindei is similar in appearance to Spinoleberis petrocorica Damotte (1971a), from the Cenomanian of the Dordogne, but this species has continuous dorsal and ventral ribs and a different hinge ear The muscle scars are also more complicated in S.petrocorica. Matronella matronae is another species which has its longitudinal ribs reduced to rows of spines but this species is larger than C.h.hindei and has a smooth surface. According to Damotte (1974) the muscle scars in M.matronae are rather complicated.

Occurrence: Lower and Middle Cenomanian up to the level of the mid-Cenomanian non-sequence.

Cythereis hindei diminuta n.ssp.

(Plate 21, figs. 6-9)

Derivation of name: deminutio - Latin - referring to the reduction of the number of spines.

Diagnosis: A sub-species of Cythereis hindei with low dorsal, middle and ventral ribs. The spines along these ribs, which are present in the type sub-species are here reduced to nodes or are absent.

Holotype: A female carapace, OS 9780. Sample S 19, 38m. below the base of the Plenus Marls, Middle Cenomanian, Southerham, Sussex.

Paratypes: 2 valves OS 9782 and OS 9783 and a carapace, OS 9781 from the same horizon and locality.

Other Material: 25 valves.

Measurements (mm)		Length	Height	Width
Holotype, female carapace,	OS 9780	0.527	0.300	0.264
Paratype, female right valve,	OS 9782	0.516	0.275	0.132

Description: Hinge ear in the left valve rounded without any spines or ridges. Eye tubercle rather small. Muscle node moderately large and separated from the short middle rib. There is a low perforate spine at ½ length near the dorsal margin and behind this begins the dorsal rib. This is short and ends in front of the anterior cardinal angle. The ventral rib begins just behind the ventral end of the anterior rib. It is very low and only becomes distinct at the posterior end. The lateral surface apart from the muscle node and middle rib is reticulate. This reticulation is more obvious on the antero-lateral surface. Other details are the same as for C. hindei hindei n.ssp.

Remarks: The spines along the dorsal and ventral margins and the thin ridge behind the eye tubercle present in C. hindei hindei are absent in this sub-species. Apart from this, the shape and reticulation are identical in the two forms. To emphasise the close relationship between them they are grouped as sub-species. C. h. diminuta appears in the Cenomanian at the point where C. hindei hindei dies out.

Occurrence: C. hindei diminuta is rare in the Cenomanian of Southern England. It has only been found in samples from just above the mid-Cenomanian non-sequence.

Cythereis hirsuta Damotte and Grosdidier

(Plate 18,figs.1-4;Plate 19,fig.5;text-fig.5:8)

1963 Cythereis hirsuta Damotte and Grosdidier: 56, pl.2, figs.5a-g.

1964 Cythereis hirsuta Damotte and Grosdidier; Gründel: 35, pl.6, figs. 16, 20.

1971b Cythereis hirsuta Damotte and Grosdidier; Damotte: 65, pl.2, fig.11.

Diagnosis: A completely reticulate species of Cythereis with rather weak dorsal and ventral ribs which are divided into blunt spines.

Material: 377 valves and carapaces.

Measurements (mm)		Length	Height	Width
Female left valve,	OS 9784	0.880	0.516	0.275
Male left valve,	OS 9785	0.970	0.500	0.270

Description: Valves large and strongly calcified. Dorsal and ventral margins straight and converging slightly towards the posterior. Hinge ear rounded with a weak rib beneath the eye tubercle. The anterior margin is broadly rounded and bears two rows of spines on a low inflated marginal rib. One row of about 12 spines point forwards whilst a row of about 9 nodes lie on the lateral edge of the anterior rib. In the left valves only there is a further inner row of about 14 small nodes. The posterior is triangular with the posterior extremity just beneath 1/3 height. The upper margin of the posterior area bears a perforate spine whilst the lower margin bears about 8 spines. These spines lie on a marginal rib. The dorsal longitudinal rib is not well developed. It begins at 3/5 length but there are two perforate spines at ½ length near the dorsal margin. A series of small spines can be seen along the dorsal rib. The middle rib is well defined and bears 6 or 7 spines along its length. There is a distinct notch between the middle rib and the muscle node which is smooth and bears a few weak nodes. The ventral rib joins the anterior rib but is not pronounced. It is divided into a row of 8 or 9 double spines with the lower spine of each group being larger. The two posterior sets of double spines lie very close together. The intercostal and antero-lateral areas of the valves are reticulate, whilst the posterior area is smooth. In ventral view there are two longitudinal ridges on the ventral surface of the right valve and three in the left valve. There are weak cross ribs between these, and at the posterior end under the ventral rib there are two short ridges on each valve. The greatest width lies across the spines of the ventral rib just behind ½ length.

The hinge is paramphidont. There are at least 30 thin, marginal pore canals at the anterior end and 15 at the posterior. The central muscle scars consist of a vertical row of 4 elongate scars with the second one down being more elongate. The frontal scar is 'V' shaped.

Males are common. They are longer than females. Juvenile valves are strongly reticulate but lack the hinge ear, and dorsal and middle ribs, seen in the adult. They also have a weak muscle node, anterior rib and ventral rib.

Remarks: This species has been well described and figured by Damotte and Grosdidier. Gründel (1966) placed the specimens figured as *C.thoerenensis* Triebel, by Kaye (1964c) into this species but these specimens have much more strongly developed spines along the ventral rib and a smooth antero-lateral area on the valves. The hinge ear is also more spiny and the eye tubercle larger in Kaye's specimens.

The Cenomanian specimens are a little smaller than Damotte and Grosdidier's but in all other respects they are identical.

Occurrence: This species appears sporadically throughout the Lower Cenomanian but it can be abundant at certain levels.

Cythereis luermannae luermannae Triebel, 1940

(Plate 19, figs. 11-13)

1940 *Cythereis lurmannae* Triebel: 201, pl.6, figs.63-66

1956 *Cythereis lurmannae* Triebel; Deroo: 1516

1964c <u>Cythereis lurmannae</u> Triebel; Kaye: 66, pl.8,figs.11,12,14, 15, (non fig.13)

1966 <u>Cythereis luermannae</u> Triebel; Gründel: 36, pl.6, fig.23

1971b <u>Cythereis luermannae</u> Triebel; Damotte: 66, pl.2, figs.13a-c.

1971 <u>Cythereis luermannae luermannae</u> Triebel; Kemper: 37, 38, pl.1, figs. 1,2,5,6.

<u>Diagnosis</u>: A species of the genus <u>Cythereis</u> with a wedge shaped hinge ear, middle rib reduced to two nodes, and a weakly reticulate surface.

<u>Material</u>: 129 valves and carapaces.

<u>Measurements</u> (mm)		Length	Height	Width
Female left valve,	OS 9789	0.759	0.417	0.165
Female carapace,	OS 9790	0.736	0.395	0.286

<u>Description</u>: Valves sub-rectangular, dorsal and ventral margins straight and converging towards the posterior. Posterior triangular with a marginal rib. The upper margin is weakly concave and the lower margin is convex bearing 5 spines. Anterior margin broadly rounded, strengthened by a rib which bears a sharp ridge along its lateral edge. Near the top of the anterior rib and pointing forward, is another sharp ridge and sagittally to this begins a row of about 10 forward pointing spines around the anterior margin. The laterally directed ridge continues dorsally as an oblique ridge on which the rather small eye tubercle lies. Dorsal to this ridge in the left valve is the hinge ear, this is flattened and wedge shaped. The dorsal rib begins vertically above the muscle node, it is ridge-like with fluted sides and ends at the posterior in a downward directed block-like process which bears two short vertical ridges. The middle rib is reduced to two nodes with a perforate spine just behind the posterior one. The muscle node is moderately large. The ventral rib begins vertically below the muscle node. It is

ridge-like with fluted sides and ends in a short upward directed ridge. Just beneath the space between the anterior and ventral ribs is a short obliquely directed ridge. The ventral rib is not coincident with the ventral margin but lies on the lateral surface. There is therefore a sloping shelf between the two, at the posterior end of which is a small block-like process. The ventral surface of each valve bears two longitudinal ridges. Except for the antero-lateral and posterior areas which are smooth, the lateral surface of the valves is very weakly reticulate. This reticulation is often very difficult to see but coated specimens reveal a series of very low muri. The sola of the reticulation bear numerous small papillae.

The hinge of the right valve consists of a knob-like, weakly crenulate anterior tooth, deep rounded antero-median socket, smooth median bar and weakly crenulate, triangular, posterior tooth.

The marginal zone is moderately wide with at least 30 very thin straight marginal pore canals at the anterior. At the posterior there are 6 marginal pore canals and some of these are widened distally. Normal pores are fairly numerous.

The central muscle scars consist of a vertical row of 4 elongate scars with a 'V' shaped anterior scar.

Sexual dimorphism is present with males being longer than females.

Remarks: This species has been well described in the past and is easily recognisable by the large wedge-shaped hinge ear in the left valve. Gründel erected this species as the type species for his genus Rehacythereis but as Damotte (1977) has pointed out there is little difference between Cythereis and Rehacythereis and the species is therefore retained in Cythereis s.l.

Occurrence: Lower and Middle Cenomanian up to the level of the mid-Cenomanian non-sequence.

Cythereis luermannae bemerodensis Kemper, 1971

(Plate 20, figs. 1-3)

1964c Cythereis lurmannae Triebel; Kaye: 66, pl.8, fig.13.
(non figs.11,12,14,15)

1971 Cythereis luermannae bemerodensis Kemper: 39, pl.1,figs.3,4.

Diagnosis: A sub-species of C. luermannae with dorsal and ventral margins strongly converging towards the posterior. Valves shorter and wider than C. luermannae luermannae.

Material: 706 valves and carapaces

Measurements (mm)		Length	Height	Width
Female left valve,	OS 9791	0.681	0.400	0.133
Male carapace,	OS 9793	0.714	0.384	0.264

Remarks: C. luermannae bemerodensis differs from C. luermannae luermannae by being shorter and relatively higher, with a more rounded upper margin to the hinge ear. Kemper records a convex ventral margin but my specimens have almost straight ventral margins. The ridges on the anterior rib are much more raised in C.l.luermannae and the longitudinal ridges are also more raised. All other characters are identical in the two sub-species.

Occurrence: Lower and Middle Cenomanian up to the level of the mid-Cenomanian non-sequence.

Cythereis paranuda n.sp.

(Plate 19, figs. 6-10)

Derivation of name: para-nuda - alluding to the differences between this species and Cythereis nuda Jones and Hinde 1890.

1849 Cythereis ciliata (Reuss); Jones: pl.4, fig.11h'

1890 Cythereis ornatissima nuda Jones and Hinde: 23, pl.1, fig.76,
pl.2, fig.9 (non figs.8,12-14)

1898 Cythereis ornatissima nuda Jones and Hinde; Chapman: 339

1956 Cythereis nuda Jones and Hinde; Deroo: 1519, pl.4,figs.62-64.

1964c Cythereis nuda Jones and Hinde; Kaye: 67, pl.7, figs.11,16 (non fig.13)

Diagnosis: A species of Cythereis with a smooth surface. Hinge ear low with a 'V' shaped notch in its upper margin. Middle rib reduced to an elongate node.

Holotype: A female left valve, OS 9795. Sample PBH1 36, Glauconitic Marl, Lower Cenomanian, Pitstone, Herts.

Paratypes: 7 valves and carapaces OS 9798 to OS 9804 from the same horizon and locality. Hypotype: A male carapace, OS 9797 from sample PBH3 18, Middle Cenomanian, Pitstone, Herts.

Other Material: 735 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, female left valve,	OS 9795	0.759	0.450	0.160
Paratype, female right valve,	OS 9799	0.714	0.400	0.165
Hypotype, male carapace,	OS 9797	0.824	0.418	0.308

Description: Valves strongly calcified, sub-rectangular, dorsal and ventral margins straight and converging towards the posterior. The hinge ear in the left valve is low, it comprises a triangular anterior portion which is separated by a 'V' shaped notch from an elongate thickened posterior portion. This posterior portion bears the small eye tubercle behind which is an oblique sharp ridge which runs up to the dorsal margin. This ridge above the eye tubercle is also developed in the right valve. The posterior is triangular with almost straight upper and lower margins. The upper margin bears a perforate spine and the lower margin bears 5 spines. The anterior margin is broadly rounded and strengthened by a marginal rib. The upper half of this rib has a fairly sharp lateral edge, whilst the lower half bears about 5 indistinct laterally directed nodes. This rib also bears about 12 anteriorly directed spines. The dorsal rib begins vertically above the posterior end of the muscle node. Just in front of, and below this rib is a pore cone. The dorsal rib has a very straight upper margin, it becomes much more prominent posteriorly and ends in a strong vertical block-like process. The middle rib is reduced to an elongate node which is well separated from the muscle node. In dorsal view the muscle node is conical with a large pore cone beneath and behind it. The ventral rib begins beneath the muscle node and has a straight, lower margin, it becomes stronger posteriorly and ends in a vertical, upward directed, process. On the ventral surface there are three longitudinal ribs on the left valve and two on the right valve. These are joined by a few cross ribs. The lateral surface is entirely smooth.

The hinge in the right valve consists of an elongate crenulate anterior tooth, deep rounded antero-median socket, smooth groove and triangular,weakly crenulate posterior tooth. The hinge of the left valve has a complementary arrangement.

The marginal zone is moderately broad, without vestibules. There are about 25 thin, straight marginal pore canals at the anterior end and about 12 at the posterior end. Normal pores are fairly numerous particularly along the ventral rib.

The central muscle scars consist of a vertical row of 4 elongate scars with a 'V' shaped anterior scar.

Males are common and are longer than females.

Remarks: Kaye (1964c) appears to have included this species in Cythereis nuda Jones and Hinde. His figures (pl.7, figs.11 & 16) clearly differ from his figure of the lectotype (pl.7, fig.13). C. nuda has straight and almost parallel dorsal and ventral margins, a very rounded posterior extremity, a less strongly curved anterior margin and is smaller in size than C. paranuda. C. paranuda was included into Cythereis ciliata by Jones 1849 and some of Jones and Hinde's figures of Cythereis ornatissima var. nuda are also of this species.

C. paranuda is similar in appearance to C. luermannae bemerodensis Kemper but this species has a rounded hinge ear, a middle rib reduced to two spines and the dorsal and ventral margins more convergent towards the posterior.

Occurrence : Lower and Middle Cenomanian.

Cythereis aff. C. reticulata Jones and Hinde, 1890

(Plate 19, figs. 1, 2, 4)

aff. 1890 Cythereis ornatissima reticulata Jones and Hinde: 24, pl.1, fig.68; pl.4, figs. 9-12.

? 1972 Cythereis reticulata Jones and Hinde; Donze in Donze and Porthault; 367, pl.3, figs. 11-14.

Material: 27 valves

Measurements (mm)		Length	Height	Width
Left valve,	OS 9805	1.033	0.550	0.308
Right valve,	OS 9806	1.033	0.483	0.300

Description: Valves large and heavily calcified. Dorsal and ventral margins straight and weakly converging towards the posterior. The hinge ear is large and strong with a relatively small eye tubercle. There is a short thick rib beneath the eye tubercle. The anterior margin is broadly rounded and bears three rows of spines on a stout anterior marginal rib. The inner row consists of about 14 low nodes. There is then a row of about 10 forward pointing spines with a further row of 8 nodes on the lateral edge of the anterior rib. The posterior is triangular with a marginal rib which bears a perforate spine on its upper margin and 5 spines along its lower margin. There is a distinct notch between the hinge ear and the beginning of the dorsal rib. The dorsal rib consists of an anterior flange-like spine with a notched flange-like rib behind this. The middle rib consists of a row of 3 or 4 spines set on a low rib. There is a notch between this and the muscle node which is conical and bears two spines, and has a series of small perforate spines in front of it. The ventral rib is strong and almost becomes alate. It has fluted sides. The intercostal surface of the valves is strongly reticulate, but the posterior area is smooth and the antero-lateral area bears a series of small round pits and has an indistinct 'A' row of the reticulum. The ventral surface of each valve bears two longitudinal ridges with weak cross ridges. In dorsal view the greatest width lies across the posterior end of the ventral rib.

The hinge is paramphidont with weakly crenulate terminal teeth in the right valve. Other internal details could not be seen.

Males are longer than females. Juvenile valves can be found. These are strongly reticulate with thin but pronounced anterior and ventral ribs, a weak dorsal rib and the middle rib reduced to a single spine.

Remarks: This species strongly resembles C. reticulata but in that species the dorsal and middle ribs are more strongly developed and the ventral rib is not so alate. The series of pits on the antero-lateral area are not present in C. reticulata. The presence of only a few complete valves precludes the setting up of a new species at the present time. Donze and Thomel (1972) record a species as C. reticulata, from the Cenomanian of S.E. France, which has an alate ventral rib and a series of pits on the antero-lateral surface, and these specimens appear to be identical with the British Cenomanian forms. It would be interesting to see some juvenile valves of the French material since the juveniles are very distinctive.

C. aff. reticulata can be distinguished from C. thoerenensis Triebel by its much stronger hinge ear and anterior rib, and by its ventral rib which is not divided into spines. C. thoerenensis has a smooth antero-lateral surface. C. hirsuta has a smaller hinge ear and weaker dorsal and ventral ribs. It also has a simple reticulation on the antero-lateral surface of the valves. Juveniles of C. hirsuta lack the ribs and muscle node which are seen in juveniles of C. aff. reticulata.

Occurrence: This species is rare in the Cenomanian of Southern England. Several valves have been found from the Lower and Middle Cenomanian from Barrington and it also occurs just below the mid-Cenomanian non-sequence in Blue Bell Hill and Pitstone.

Cythereis thoerenensis Triebel, 1940

(Plate 18, figs. 5-7; text-fig. 5:8)

1849 Cythereis ciliata (Reuss); Jones: 19, pl.4, figs. 11a-e (non figs. 11 f-h).

1890 Cythereis ornatissima Jones; Jones and Hinde: 21, pl.2, figs.1-5

1940 Cythereis thorenensis Triebel: 195, pl.5, figs. 57-59

1962 Cythereis thorenensis Triebel; Ellermann: 404

1964c Cythereis thorenensis Triebel; Kaye: 68, pl.7, figs.14,15,17.

1966 Cythereis thoerenensis Triebel; Gründel: 37, pl.6, fig.22.

Diagnosis: A species of the genus Cythereis with the longitudinal ribs reduced or almost reduced to rows of spines. Antero-lateral surface of valves not reticulate.

Material: 608 valves and carapaces.

Measurements (mm)		Length	Height	Width
Female left valve,	OS 9808	1.033	0.600	0.318
Male right valve,	OS 9809	1.033	0.472	0.264

Description: Valves large sub-rectangular. Dorsal and ventral margins straight weakly converging posteriorly. In the left valve there is a raised area over the posterior cardinal angle. The hinge

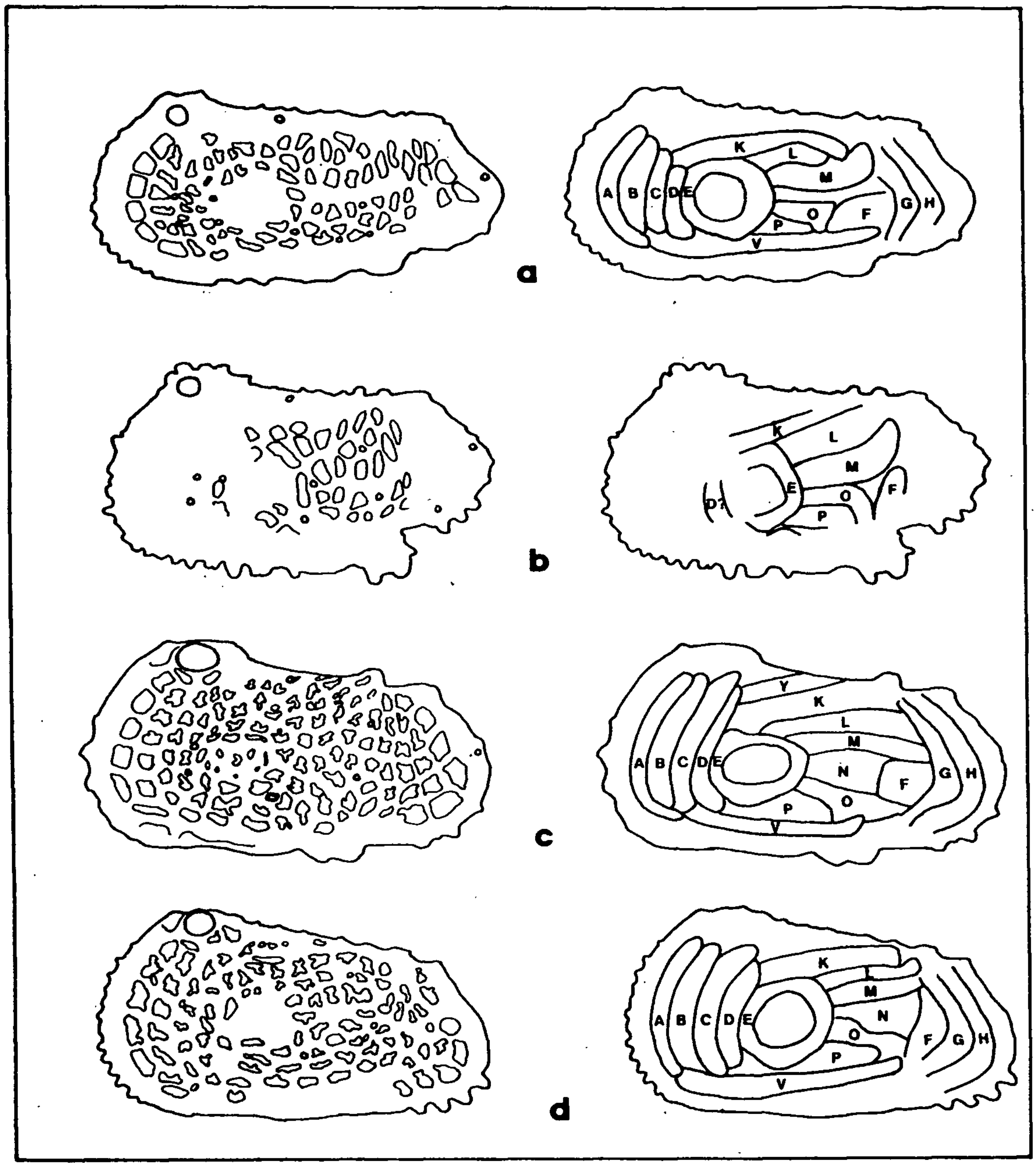


Fig.5:8. Shape and patterns of ornamentation in a) *Cythereis hirsuta* Damotte and Grosdidier, male OS 9785,sample PBH3 12. (x60). b) *Cythereis thoerenensis* Triebel, female, OS 9808, sample PBH1 36. (x53) c) *Limburgina ? alata* n.sp. holotype, OS 9848, sample BN 9. (x95). d) *Oertliella donzei* n.sp. holotype, OS 9855, sample BN 1. (x95) Notations of fossae groupings after Liebau, 1969.

ear is not very raised but is strongly calcified and bears five dorsally directed spines and a large eye tubercle. Posterior area triangular with a straight upper margin and convex lower margin. The upper margin bears a pore-cone and the lower margin bears 5 posteriorly directed spines. The anterior margin is broadly rounded and strengthened by a strong marginal rib. This rib bears three rows of spines, one row of 9 spines on the lateral edge directed laterally and two rows on the anterior margin directed forward. The outer of these two rows consists of 9 - 10 large spines whilst the inner consists of numerous very small spines. The dorsal rib is divided into a series of spines, from the posterior there is a small spine then two larger fused spines with three separate spines in front. The middle rib consists of a row of 6 spines, this row turns up posteriorly and beneath the third spine from the anterior is a large pore cone. This row is well separated from the muscle node which is very prominent and bears a crown of five nodes. In front of the muscle node are two pore cones, one above the other, a further pore cone occurs behind and beneath the muscle node. The ventral rib is continuous with the anterior rib and it is divided into 7 strong spines. The anterior 3 of these are joined on a rib, but the other 4 are separate. This row of spines continues from the outer anterior row on the anterior rib and the row of laterally directed spines on the anterior rib continues along the ventral rib such that each spine forms an inflated base on the upper side of the main spines. The posterior two spines of each row are much larger and their bases are fused to form a large process. In ventral view each spine of the longitudinal row has a further small node at its base. The left valve has three longitudinal ridges on the ventral surface and the right valve has two. Beyond the posterior end of these ridges each valve has two short thin raised ridges. The antero-lateral area and posterior area are entirely smooth, but the rest of the lateral surface is reticulate.

The hinge of the right valve consists of a fairly high, crenulate anterior tooth, deep antero-median socket and smooth median groove, with a triangular crenulate posterior tooth.

The inner lamella is fairly narrow without vestibules. Marginal pore canals are numerous with at least one to each marginal spine at the anterior end and about 15 at the posterior end. The central muscle scars consist of 4 elongate scars with a 'V' shaped frontal scar.

Juveniles of this species lack the reticulation but possess the spines seen in the adults. Males are longer than females.

Remarks: The division of the longitudinal ribs into spines and the smooth antero-lateral and posterior parts of the valves clearly place these specimens in *Cythereis thoerenensis* Triebel. The specimens from the British Cenomanian are identical with those figured by Kaye (1964b). Kaye's specimens, however, have been attributed to *C. hirsuta* Damotte and Grosdidier (1964), by Gründel (1966) and Damotte (1971b). Kaye's specimens differ from *C. hirsuta* in having smooth anterior and posterior parts on each valve, by having a weaker dorsal rib and by having a large double spine at the posterior end of the ventral rib.

This species was recorded from the Cenomanian of Southern England as *C. ciliata* (Reuss) by Jones in 1849 and later as *C. ornatissima* by Jones and Hinde (1890).

Occurrence: Lower and Middle Cenomanian up to the level of the mid-Cenomanian non-sequence.

Cythereis sp. A

(Plate 32, fig. 2)

Material: 6 valves, mostly broken

Measurements (mm)		Length	Height	Width
Right valve,	OS 9811	0.846	0.418	0.264

Description: Valves large and heavily calcified. Dorsal and ventral margins straight, converging slightly towards the posterior. The anterior margin is broadly rounded and is strengthened by a rib which bears anteriorly directed spines and a row of 8 nodes on its lateral edge. The posterior is triangular and has a marginal rib which bears at least 4 spines on its lower margin. The hinge ear is not very large. The dorsal rib is reduced to a posterior process which bears 3 spines with a short ridge extending forward from this. There is also a spine just behind ½ length along the dorsal margin. The middle rib bears 4 nodes along its length. It is upturned at the posterior and at the anterior there is a notch between it and the muscle node. The muscle node is large and smooth. The ventral rib consists of a row of 8 double spines which begin at the base of the anterior marginal rib. There are two longitudinal ridges on the ventral surface of each valve. The greatest width lies across the posterior end of the ventral rib. The entire surface of the valves is smooth.

The hinge appears to be paramphidont. Other internal details could not be seen.

Remarks: The presence of only one complete valve and several broken valves of this species makes a complete study impossible at the present time. This species differs from most other large, inflated species of *Cythereis* by having a smooth surface. It differs from *C. glabrella* Triebel by having its ventral rib divided into spines, having a reduced dorsal rib and by being more inflated. *Cythereis bleinensis sufflata* Donze (1972), from the Cenomanian of S. France is similar to this species but it has a better developed dorsal rib and a weaker muscle node and it is also much larger.

Occurrence: This species has so far only been found in the Plenus Marls.

Cythereis sp. B

(Plate 32, fig. 1)

Material: 2 valves

Measurements (mm)		Length	Height	Width
Left valve,	OS 9812	0.880	0.483	0.220

Remarks: Only one complete and one broken valve of this species have been found. The main distinguishing features are the posterior extremity which lies at 1/7 height which is rather low for this genus. A dorsal rib which is reduced to a very strong posterior portion, a muscle node which is very large and conical and marks the position of greatest width, a heavy, triangular hinge ear and an intercostal reticulation.

The above features distinguish this species from other large species of *Cythereis*. However, a single specimen from La Foux, S.E. France, which was given to the author by Dr. P. Donze appears to be identical. This specimen was labelled *Cythereis* aff. *reticulata* by Donze but it appears to differ from those recorded as *C.* aff. *reticulata* in Donze and Thomel (1972) since it has a much shorter and higher dorsal rib and a different outline, particularly in dorsal view.

Occurrence: The two specimens of this species both come from Bed 1 of the Plenus Marls from Buckland Newton.

Genus *IDIOCYTHERE* Triebel, 1958

Type species: *Idiocythere lutetiana* Triebel, 1958

Idiocythere donzei n.sp.

(Plate 22, figs. 9-11; Plate 32, fig. 4)

Derivation of name: In honour of Dr. P. Donze who first recognised this species.

1972 *Idiocythere* ? sp.A. Donze: 384, pl.3, figs. 17-19

Diagnosis: A species of the genus *Idiocythere* with a large flattened hinge ear, very strong anterior marginal rib, absent middle rib and pitted surface.

Holotype: A female left valve, OS 9813. Sample BB8, 13.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: 13 valves and carapaces OS 9815 to OS 9827, from the same horizon and locality.

Other Material: 239 valves and carapaces

Measurements (mm)		Length	Height	Width
Holotype, female left valve,	OS 9813	0.571	0.351	0.120
Paratype, female right valve,	OS 9815	0.539	0.275	0.120
Paratype, male right valve,	OS 9817	0.600	0.275	0.110

Description: Valves small, strongly calcified and laterally compressed. Dorsal and ventral margins straight and converging towards the posterior. There is a small process over the posterior cardinal angle in the left valve. The posterior is rounded with a marginal rib, it bears two pore cones on its lower margin and one on its upper margin. There are also 5 stout marginal spines. The anterior margin is gently rounded with a marginal rib which is raised into a high strong laterally directed ridge. On the anterior edge near the sagittal line each valve bears a row of 10 - 12 strong spines. The anterior rib ends at the base of the hinge ear. The hinge ear in the left valve is large, squarish and laterally compressed. The eye tubercle is absent. The dorsal rib is reduced to two large perforate spines situated near the dorsal margin, and a large triangular block-like node situated at the posterior. The muscle node is small rounded and smooth. The middle rib is absent but there are perforate spines well behind the muscle node and just beneath and behind it. The ventral rib begins vertically beneath the muscle node, it becomes more prominent towards the posterior. In ventral view the ventral surface of the ventral rib bears two weak longitudinal ridges. In dorsal view the greatest width lies across the posterior end of the ventral rib. The surface of the valves is covered with small rounded pits, these also cover the anterior rib and the longitudinal ribs but not the muscle node.

The hinge of the right valve consists of a fairly broad, short, weakly crenulate, anterior tooth, a small antero-median socket, smooth median groove and a smooth rounded posterior tooth. The left valve has a complementary arrangement but there is also an 'outer tooth' in front of the anterior socket which overlaps the dorsal margin of the right valve externally.

The inner lamella is moderately broad, without vestibules. Marginal pore canals could not be seen. The central muscle scars consist of a vertical row of 4 elongate scars with a 'V' shaped anterior scar.

Remarks: The specimen figured as Idiocythere ? sp.A. by Donze from the M.geslinianum zone of S. France appears to be identical with the British specimens. These forms differ from I. definata Herrig (1965) by having the dorsal rib reduced to a large postero-dorsal node with two large tubercles in front. I. replicata Herrig (1965) has a middle rib and has much smaller marginal spines than I. donzei.

Gründel (1973) proposed the subgenus I. (Herrigocythere) for species with a large hinge ear, but this single character is thought to be insufficient for the definition of a subgenus.

Occurrence: Upper Cenomanian.

Genus IMHOTEPIA Grundel, 1969

Type species: Cythereis marssoni Bonnema, 1941

Imhotepia euglyphea n.sp.

(Plate 22, figs. 12,13; Plate 23, figs. 1,2)

Derivation of name: euglypheus - Latin - distinctly marked

Diagnosis: A species of the genus *Imhotepia* with numerous longitudinal riblets between the main longitudinal ribs. Surface otherwise smooth.

Holotype: A left valve, OS 9828. Sample S1, Plenus Marls Bed 1, Upper Cenomanian, Southerham, Sussex.

Paratypes: 8 valves and carapaces OS 9829 to OS 9836 from the same horizon and locality.

Other material: 149 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9828	0.516	0.280	0.092
Paratype, right valve,	OS 9829	0.500	0.264	0.090

Description: Valves strongly calcified, sub-rectangular. Dorsal and ventral margins straight and converging towards the posterior. The posterior area is small, triangular, and laterally compressed with an indistinct marginal rib. The upper margin bears a small perforate spine whilst the lower margin bears 5 small spines. The anterior margin is broadly rounded and strengthened by a broad, rounded rib which is directed obliquely backwards at the top and ends on the dorsal margin at ½ length. The eye tubercle is very small and lies on this rib. In the left valve only, there is an elongate thickened area above the eye tubercle. The anterior margins of both valves bear a thin flange. The dorsal rib begins below and behind the eye tubercle and runs parallel to the posterior part of the anterior rib. Behind ½ length it forms the dorsal margin. Just beneath and parallel to this rib is a short rib. The muscle node is large and flattened and joined to the middle rib which is rather short and has a row of 3 perforate spines at its posterior end. Above this rib and also joined to the muscle node is another short rib and below the posterior half of the middle rib is a further short rib with a perforate spine just below its posterior end. There is a large perforate spine beneath and behind the muscle node. The ventral rib lies well up on the lateral surface, it begins beneath the muscle node and consists of two parallel closely spaced ribs with a further short rib beneath the middle. The ventral surface of each valve bears two parallel longitudinal ridges. In dorsal view the valves have almost parallel sides with the greatest width lying across the muscle node.

The hinge is holamphidont with smooth anterior and posterior teeth in the right valve. Each terminal tooth appears to be weakly notched. The median elements are smooth.

The marginal zone is moderately broad, without vestibules. There are about 20 fairly thick, straight marginal pore canals at the anterior end and about 8 - 10 at the posterior. Normal pores are common and fairly widely spaced.

Details of the muscle scars could not be seen.

Remarks: This species bears some affinity with the "*Cythereis marssoni*" group as described by Pokorny (1964). The longitudinal ribs, shape of the muscle node and position of the ventral rib are very similar in both species but *I. euglyphea* has an inflated anterior rib and lacks the surface reticulation. Gründel (1969) erected the genus *Imhotepia* for species similar to *Phacorhabdotus* but having a more complex ornament (extra short longitudinal ribs or reticulation), an anterior rib of variable strength, and a paramphidont to holamphidont hinge. *I. euglyphea* appears to fall within this genus.

Occurrence: In most areas this species only occurs in samples from the upper part of the Upper Cenomanian and Beds 1 - 3 of the Plenus Marls. Several carapaces of slightly larger size have however been found from the Lower Cenomanian of Culver Cliff, Isle of Wight.

Genus ISOCYTHEREIS Triebel, 1940

Type species: Isocythereis fissicostis

Isocythereis cf. I. grossouvrensis Donze, 1972

(Plate 23, figs. 3-5; Plate 32, fig. 3)

cf. 1972 Isocythereis grossouvrensis Donze in Donze and Thomel: 383, pl.3, figs. 11-16.

Diagnosis: A species of Isocythereis with a strong anterior rib which bears a ridge on its dorso-lateral edge. Longitudinal ribs thin and rather weak. Muscle node elongate.

Hypotype: A carapace, OS 9837. Sample BB8, 13.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Hypotypes: 8 valves OS 9840 to OS 9847 from the same horizon and locality. 2 valves OS 9838 and OS 9839 from sample BN12, Upper Cenomanian, Buckland Newton, Dorset.

Other Material: 975 valves and carapaces.

Measurements (mm)		Length	Height	Width
Hypotype, carapace	OS 9837	0.539	0.286	0.242
Hypotype, right valve,	OS 9838	0.527	0.275	0.120

Description: Valves rather small, elongate with straight dorsal and ventral margins which converge towards the posterior end. Posterior small and triangular with a marginal rib which bears a perforate spine on its upper margin and 4-5 spines on its lower margin. Anterior margin broadly rounded and strengthened by a strong rib. This rib bears a short ridge on its lateral edge running down from the eye tubercle. Below this ridge is a row of 4 indistinct nodes. There is a thin, frill-like, flange around the anterior margin of both valves, but this is often broken. The eye tubercle is small and the ridge on the anterior rib continues behind it to end at the dorsal margin. The dorsal rib begins beneath the eye tubercle and runs obliquely upward to meet the dorsal margin and then continues along the dorsal margin. There are two indistinct, perforate spines on the oblique part of this rib and a larger perforate spine beneath the horizontal part of the rib. The muscle node forms an elongate ridge which is lower and divides into 2 - 3 smaller ridges at the posterior end. The middle rib joins the muscle node, it is thin and ridge-like and converges towards the dorsal rib posteriorly. The posterior ends of the dorsal and middle ribs are joined by a vertical ridge. There are perforate spines beneath and behind the muscle node and beneath the middle rib. The ventral rib usually joins the anterior rib and runs along the lateral surface parallel to the ventral margin. Towards the posterior there is a short rib immediately above the ventral rib. In ventral view the ventral surface of the ventral rib is reticulate. The greatest width lies across the posterior end of the ventral rib.

The surface of the valves is strongly reticulate. Many of the fossae have a squarish outline and the inner sides of the muri often bear spines or swellings.

The hinge of the right valve consists of a small crenulate anterior tooth, rounded antero-median socket, smooth median groove, and a squarish crenulate posterior tooth.

The marginal zone is moderately wide, without vestibules.

Other internal details could not be seen.

Remarks: These specimens are very similar to I. grossouvrensis Donze from the Lower Turonian of S.E. France, but Donze's specimens are considerably larger. As Donze has pointed out this species is similar to species of the genus Dumontina Deroo. However I. grossouvrensis possesses an anterior marginal frill which suggests that it belongs in Isocythereis. Unfortunately no muscle scars can be seen in any of the specimens.

Occurrence: Middle and Upper Cenomanian above the level of the mid-Cenomanian non-sequence.

Genus LIMBURGINA Deroo, 1966

Type species: Cypridina ornata Bosquet, 1847.

Limburgina ? alata n.sp.

(Plate 24, figs. 1-3, 8, 11, 12; text-fig. 5:8)

Derivation of name: Alatus - Latin = winged.

Diagnosis: A species of Limburgina ? with the ventral rib strongly drawn out posteriorly. Dorsal rib reduced to a posterior node. Muscle node large and pitted.

Holotype: A left valve, OS 9848. Sample BN9, 12m. below the base of the Plenus Marls, Upper Cenomanian, Buckland Newton, Dorst.

Paratypes: 4 valves and carapaces, OS 9849 to OS 9852 from the same horizon and locality.

Other Material: 167 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9848	0.600	0.335	0.200
Paratype, right valve,	OS 9849	0.539	0.300	0.200

Description: Valves sub-rectangular in lateral view with straight dorsal and ventral margins which converge slightly towards the posterior. The hinge ear in the left valve barely rises above the dorsal margin, the eye tubercle is large and protuberant. The posterior area is small with a convex lower margin and short straight upper margin, there is a marginal rib which bears a perforate spine on its upper margin and 5 spines on its lower margin. The anterior margin is broadly rounded and strengthened by a rib which bears 3 low perforate spines on its lateral edge, and in the right valve 8 low anterior spines whilst the left valve bears 9 - 10 thicker, longer anterior spines. There is an anterior flange in the right valve. The dorsal rib is reduced to two perforate spines, an anterior one lying vertically above the muscle node, and a posterior conical spine with a reticulate base. This spine projects above the dorsal margin in lateral view. The muscle node is large and rounded with a reticulate surface, there are two perforate spines in front of it and one behind and beneath it. The middle rib is absent but there is a perforate spine well behind the muscle node and a further one just beneath the posterior spine of the dorsal rib. The ventral rib begins at the anterior margin and forms a ridge which extends laterally into a spine like projection at the posterior end. In ventral view the ventral surface is strongly reticulate. In dorsal view the greatest width lies across the posterior end of the ventral rib. The surface of the valves is strongly reticulate with the muri often having broad spines or swellings on their lateral margins.

The hinge of the right valve consists of a weakly crenulate anterior tooth which is as high as broad, a fairly shallow antero-median socket, smooth median groove, and a small triangular very weakly crenulate posterior tooth. The left valve has a complementary arrangement. The marginal zone is moderately broad without vestibules. Other internal details could not be seen.

Remarks: This species is very similar to L.? sarlatensis Colin from the Upper Cenomanian of the Dordogne which also has an alate ventral rib and large reticulate muscle node. It differs principally in the reticulation, the fossae are much smaller in Limburgina sarlatensis and the muri are broad with ingrowths into the fossae. L.sarlatensis also has a larger postero-dorsal node and a larger muscle node. Both species differ from true Limburgina species by the anterior tooth in the right valve which is much shorter and by the absence of dorsal and middle ribs. Unfortunately the details of the muscle scars are unknown in both species.

Occurrence: Middle and Upper Cenomanian but only above the mid-Cenomanian non-sequence.

Genus MATRONELLA Damotte, 1974

Type species: Cythereis matronae Damotte and Grosdidier, 1963.

Matronella matronae matronae

Damotte and Grosdidier

(Plate 25, figs. 1,2)

1940 Cythereis rudispinata Chapman and Sherborn; Triebel: 200, pl.4, figs. 47-50

1956 Cythereis rudispinata Chapman and Sherborn; Deroo: 1516

1963 Cythereis matronae Damotte and Grosdidier: 57, pl.3, figs.7a-f.

1964c Cythereis corrigenda Kaye: 62, pl.7, figs. 6,9.

1966 Cythereis corrigenda Kaye; Gründel: 33, pl.6, figs.7,8.

1966 Cythereis matronae Damotte and Grosdidier; Gründel: 36, pl.6, fig.11.

1971 Cythereis matronae Damotte and Grosdidier; Keen and Siddiqui: 66, pl.2, figs. 5,13.

1971b Cythereis matronae Damotte and Grosdidier; Damotte: 64, pl.2, fig.9.

1974 Matronella matronae Damotte and Grosdidier; Damotte: 182 pl.23, figs. 1-18; pl.24, figs.19-22

1976 Matronella matronae Damotte and Grosdidier; Damotte: 148, pl.1, fig.8; pl.4, figs.37-39.

Diagnosis: A species of Matronella with the longitudinal ribs reduced to spines. Middle rib reduced to a single spine.

Material: 4 valves

Measurements (mm)		Length	Height	Width
Right valve,	OS 9853	0.637	0.341	0.132
Left valve,	OS 9854	0.681	0.363	0.155

Description: Valves elongate, sub-rectangular with straight dorsal and ventral margins which converge towards the posterior. The hinge ear is reduced to a stout vertical spine placed sagittally to the large eye tubercle in the left valve. Behind the eye tubercle in both valves is a high, oblique spine-like, ridge. There is a short inflated rib running down beneath the eye tubercle which bears a perforate spine at its base. The posterior is triangular with a short straight upper margin and convex lower margin. The posterior boundary rib is very weak, it bears one laterally directed perforate spine on its upper and lower margins and 5 downward directed spines along its lower margin. The anterior margin is broadly rounded and strengthened by a marginal rib. This rib bears a row of 8 spines (perforate?) on its lateral side and a row of 6 stout spines on its anterior margin. There is a thin high ridge running from the upper anterior spine to the eye tubercle. A high flattened spine rises from the dorsal surface vertically above the muscle node and just beneath this spine is a perforate spine. The dorsal rib begins just behind this perforate spine but this rib is reduced to a row of 3 high spines, at the base of the posterior spine is a perforate spine. The dorsal rib ends posteriorly in a large downward directed process which bears a large spine on its upper end. The middle rib is reduced to a large conical spine, it lies well behind the muscle node which is large and bears 4 elongate spines. In front of the muscle node are two small perforate spines one above the other and behind and beneath the muscle node is a large, perforate spine. The ventral rib joins the anterior rib and is again divided into a row of 6 spines the posterior one being somewhat larger. On the ventral surface beneath the posterior spine are 2 long downward directed ridges, anterior to these is a longitudinal row of 3 short ridges with a further weak ridge sagittal to this. In dorsal view the greatest width lies across the posterior spine on the ventral rib and across the spines on the muscle node.

The hinge of the right valve consists of a fairly high weakly crenulate anterior tooth, deep, rounded antero-median socket, smooth median groove and an elongate crenulate posterior tooth, lower at the anterior end.

The marginal zone is rather narrow without vestibules. There are about 16 straight marginal pore canals at the anterior end and about 10 at the posterior end. Normal pores are concentrated along the dorsal and ventral ribs and along the line of concrescence.

Remarks: The Cenomanian forms from Britain are smaller than those from France but the distribution of spines is identical in both forms and they must be regarded as belonging to the same species.
M.m. exuberens Colin, from the Upper Cenomanian of the Dordogne is a little larger and has fewer spines along the dorsal margin whilst the rest of the spines are much longer than in M. m matronae.

Occurrence: This species has only been found in two samples from the British Cenomanian. Both of these come from just beneath the mid-Cenomanian non-sequence.

Genus OERTLIELLA Pokorny, 1964

Type species: Cythereis reticulata Kafka, 1896.

Oertliella donzei n.sp.

(Plate 24, figs. 4-7,9,10; text-fig. 5:8)

Derivation of name: After Dr. P. Donze who first recognised this species.

1972 Oertliella sp.A. Donze: 371, pl.2, figs.21-24

Diagnosis: A species of Oertliella with a large muscle node, middle rib reduced to a single spine, surface strongly reticulate.

Holotype: A left valve, OS 9855, Sample BN1, 2.5m. above the base of the Cenomanian, Middle Cenomanian, Buckland Newton, Dorset.

Paratypes: 8 valves and carapaces OS 9857 to OS 9864 from the same horizon and locality.

Other Material: 1151 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9855	0.593	0.324	0.155
Paratype, right valve,	OS 9858	0.560	0.300	0.148

Description: Valves sub-rectangular, strongly calcified. Dorsal and ventral margins straight and converging slightly towards the posterior. Hinge ear not developed, but there is a large eye tubercle which marks the highest point of the valves. Posterior margin bluntly triangular with a weakly concave upper margin and convex lower margin. There is a posterior marginal rib which bears a small perforate spine on the upper margin and 5 spines on the lower margin. The anterior margin is broadly rounded and strengthened by a marginal rib which bears 5-6 very low perforate spines along its lateral edge and about 15 small spines along its anterior edge. The dorsal rib begins below the dorsal margin, vertically above the muscle node with a perforate spine. There is a further perforate spine behind this, and both spines lie on a low rib which becomes stronger posteriorly. The rib is notched at the posterior end and terminates in a downward-directed process. The middle rib is reduced to a single spine though there is a perforate spine behind and below this. There is also a perforate spine between the middle rib spine and the dorsal margin. The muscle node is prominent and smooth. The ventral rib begins just behind the anterior margin but does not join the anterior rib, it bears 7 low nodes. The ventral rib lies just above the ventral margin in lateral view. In ventral view the outline is the shape of an arrow head with a compressed posterior end. The ventral surface is reticulate. In dorsal view the posterior end of the dorsal rib bears a row of fossae. The greatest width lies across the muscle node.

The hinge consists of a weakly crenulate anterior tooth, deep antero-median socket, smooth median groove and a smooth posterior tooth.

The surface of the valves, apart from the muscle node is strongly reticulate with broad rounded muri, often with irregular margins. The fossae form a ring around the middle rib spine.

The hinge of the right valve consists of a rounded, knob-like anterior tooth, a deep, antero-median socket, smooth postero-median bar and a rounded knob-like posterior tooth. The left valve has a complementary arrangement.

The inner lamella is fairly narrow, without vestibules. Marginal pore canals are straight and not very distinct. At the anterior end there are about 20 whilst there are about 10 at the posterior end.

The central muscle scars consist of two lower elongate scars with a more elongate scar above which is constricted in the middle. Above this is a scar which is divided into two rounded scars. The frontal scar is 'V' shaped.

Remarks: The general characters of the valves and the hinge place this species in *Oertliella*. The adductor muscle scars are identical with those described for *O. ingerica* by Damotte (1976), but in Damotte's species the frontal scar is divided. *O. donzei* is similar to *O. soaresi* Colin from the Cenomanian of Mamarrosa, Portugal, but that species is wider in dorsal view and has a different pattern of reticulation. In *O. soaresi* the A and B rows of fossae are combined and in the V row the fossae are very large. *Oertliella* sp.A. Donze 1972, from the Cenomanian of the Alpes Maritimes, France, appears to be identical to *O. donzei* and is therefore included in the synonomy.

Occurrence: This species is common above the mid-Cenomanian non-sequence but it can also be found in the Lower Cenomanian in some areas.

Genus PLANILEBERIS Deroo, 1966

Type species: Cythere lepida Bosquet, 1854.

Planileberis chathamensis n.sp.

(Plate 23, figs. 9-11, 13)

Derivation of name: After the town of Chatham, Kent, which is 10 kilometres from the Blue Bell Hill quarry.

1849 Cythere (Cythereis) cornuta (Roemer); Jones: 21, pl.5, figs.13c,d (non pl.5, figs.13a,b,e).

1890 Cythereis ornatissima var. nuda Jones and Hinde: 23, pl.2, figs.12,13, (non pl.1, fig.76; pl.2, figs. 9,14; pl.4, fig.14).

Diagnosis: A species of Planileberis with a relict first order reticulation on the lateral surface in which the fossae bear groups of round pits. Dorsal rib weak with a large posterior process.

Holotype: A female right valve, OS 9865. Sample PBH3 12m, 2m. below the Totternhoe Stone, Pitstone, Herts.

Paratypes: 3 valves and carapaces, OS 9866 to OS 9868 from the same horizon and locality.

Other Material: 170 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, female right valve	OS 9865	0.681	0.363	0.132
Paratype, female carapace,	OS 9867	0.714	0.395	0.253
Paratype, male left valve,	OS 9866	0.725	0.330	0.130

Description: Valves elongate, sub-triangular with the straight dorsal and ventral margins converging towards the posterior. The hinge ear is small and triangular with a pointed top. Behind this a short oblique ridge stands up from the dorsal margin, at the anterior of which is a fairly large eye tubercle. This ridge is also present in the right valve. The posterior is triangular, its margin is strengthened by a rib which bears an obliquely directed perforate spine on its upper and lower margins and 6 spines along the lower margin. The anterior margin is broadly rounded and strengthened by a marginal rib which bears 9 low spines (perforate?) along its lateral edge and 11 anteriorly directed spines along its anterior edge. At the top of the anterior margin between the two rows of spines is a thin ridge. This runs from the eye tubercle to near the upper spine in the anterior row. A short vertical rib runs down from the eye tubercle. The dorsal rib is indistinct, beginning with a perforate spine vertically above the muscle node. Behind this is a larger perforate spine followed by a small spine. These spines are linked by a weak ridge which ends at the posterior end in a large rectangular block which stands well out from the valve surface and bears two weak vertical ridges. In front of this block is another perforate spine. The middle rib is reduced to a single small spine with a perforate spine beneath and behind it. The muscle node is smooth, rounded and fairly prominent. Behind and beneath it is a perforate spine. The ventral rib begins beneath the muscle node, it consists of three elongate spines joined on a weakly inflated rib. At the posterior it ends in a triangular process which protrudes below the ventral margin. The ventral surface of each valve bears 3 weak longitudinal ridges.

The surface of the valves bears a very weak first order reticulation, the muri of which are indistinct and may only become clear after coating. The sola of each fossa bear up to 12 round pits often arranged in rows and themselves containing up to 6 papillae.

In dorsal view the carapace is laterally compressed with almost parallel sides. The greatest width lies across the posterior end of the ventral rib.

The hinge of the right valve consists of a weakly crenulate anterior tooth, deep rounded antero-median socket, smooth groove and a small triangular very weakly crenulate posterior tooth. The left valve has a complementary arrangement.

The marginal zone is moderately wide without vestibules. There are about 20-25 marginal pore canals at the anterior and about 10 at the posterior. They are straight and rather thin. Normal pores are fairly common, there is a row around the line of concrescence.

The central muscle scars consist of a vertical row of 4 scars with the second one down being rather elongate, and a 'U' shaped antennal scar.

Males can be found; they are longer and less high than females.

Remarks: Two specimens of this species were figured by Jones (1849) who included them in *Cythereis cornuta*. Later Jones and Hinde (1890) included these specimens together with other unrelated forms in *C. ornatissima var. nuda*. Kaye (1964c) erected a lectotype for *Cythereis nuda* and included the specimens figured as pl.2, figs. 12,13 of Jones and Hinde in *Cythereis luermannae* Triebel. On examination of these specimens they are found to differ from *C. luermannae* in lacking the ridge-like dorsal and ventral ribs, and the wedge-like hinge ear in the left valve. They also have a very different surface ornament.

Planileberis chathamensis can be distinguished from *P. praetexta arta* Damotte 1971 from the Cenomanian of the Dordogne, France, by its smaller size and less inflated ribs. *P. rectangularis* Colin 1973 from the Cenomanian of Le Fournet, S.E. France has a much more rectangular outline and its longitudinal ribs do not bear spines.

Occurrence: Lower and Middle Cenomanian up to the level of the mid-Cenomanian non-sequence.

Planileberis sandersi n.sp.

(Plate 23, figs. 6-8, 12)

Derivation of name: After Mr. M.K. Sanders, Co-director of 'Engineering Geology Ltd' who supplied the samples from Pitstone quarry.

Diagnosis: A small species of *Planileberis* with a densely pitted surface, reduced dorsal rib and weakly developed smooth muscle node.

Holotype: A left valve, OS 9869. Sample PBH3 12m. 2m. below the Totternhoe Stone, Pitstone, Herts.

Paratypes: 3 valves and carapaces OS 9870 to OS 9872 from the same horizon and locality.

Other Material: 178 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9869	0.571	0.319	0.110
Paratype, right valve,	OS 9870	0.568	0.286	0.110

Description: Carapace very small, laterally strongly compressed with almost parallel sides.. Dorsal and ventral margins straight and converging towards the posterior end. The hinge ear consists of an anterior portion which is trangular with a sharp top. Behind this is a lower flat area on the posterior of which is a sharp obliquely backward pointing ridge. This ridge is also present in the right valve and at its lower anterior end is the fairly prominent eye tubercle. The posterior is triangular with a marginal rib. Its upper margin is concave and it bears two perforate spines, the lower one being rather small. Its lower margin bears a row of 5 downward directed spines and 2 laterally directed nodes. The anterior margin is broadly rounded and is strengthened by a rib. This rib bears a sharp ridge along its lateral edge and this ridge bears about 10 very small perforate spines. Pointing forward from the anterior edge of the anterior rib are two rows of 8 - 10 spines each. The dorsal rib is strongly reduced and consists of a large triangular downward directed block at the posterior. In front of this block at the dorsal margin is a large perforate spine. The rib ends here, but vertically above the muscle node, near the dorsal margin is a perforate spine with a further larger perforate spine behind it. The middle rib is reduced to one small spine (perforate?) which lies well behind the muscle node. The muscle node is low and only clearly visible because it is smooth. Behind and beneath it is a large perforate spine. The ventral rib is also weak, it begins below the muscle node and runs backwards as a weak swelling which bears 2 - 3 low spines. It ends posteriorly in a vertical block-like process which extends just below the ventral margin in lateral view. On the ventral surface there is just one weak longitudinal ridge on each valve.

The lateral surface of each valve is covered with a series of rounded pits which apparently developed as a second order reticulation. The first order reticulation has almost completely disappeared though traces of the muri can be seen near the anterior end.

In dorsal view the carapace is strongly compressed laterally with nearly parallel sides. The greatest width lies across the block-like process at the posterior end of the ventral rib.

The hinge in the right valve consists of a very weakly crenulate anterior tooth which is about as long as wide, a rounded antero-median socket, smooth median groove and squarish very weakly crenulate posterior tooth.

The marginal zone is moderately wide without vestibules. There are about 25 thin, straight marginal pore canals at the anterior end and about 10 at the posterior end.

There is a vertical row of 4 muscle scars with the second one down being more elongate and the lower two being small and close together so that in some specimens they appear as one scar. The anterior scar is 'V' shaped.

Remarks: This species is placed in *Planileberis* because of its laterally compressed outline in dorsal view, weak muscle node, absent middle rib and pitted surface. This species can be distinguished from most other species of *Planileberis* by its small size and the reduction of its dorsal rib. *P. sandersi* can be distinguished from *P. chathamensis* by its less elongate shape, smaller, smooth muscle node and the lack of a weak reticulation.

Occurrence: Lower and Middle Cenomanian.

Genus *PLATYCYTHEREIS* Triebel, 1940.

Type species: *Cythereis excavata* Chapman and Sherborn, 1893

Platycythereis cf. *chapmani* Kaye, 1964c.

(Plate 25, figs. 3-6)

? 1964c *Platycythereis chapmani* Kaye: 69, pl.6, figs.16,18,20.

Diagnosis: A species of the genus *Platycythereis* with long dorsal and ventral ribs and a weak anterior rib.

Material: 57 valves and carapaces

Measurements (mm)		Length	Height	Width
Left valve,	OS 9873	0.670	0.35=	0.132
Right valve,	OS 9874	0.648	0.350	0.132

Description: Valves sub-rectangular, laterally compressed, dorsal and ventral margins straight and weakly converging towards the posterior. Posterior margin straight and vertical with up to 4 small spines which are often broken. The anterior margin is gently rounded with about 5 stout spines. There is a slightly thickened area on the lateral surface at the base of these spines which may represent the base of a broken anterior rib. There is a fairly small eye tubercle. The dorsal ridge-like rib begins beneath the eye tubercle and runs to the postero-dorsal angle. The ventral rib is also thin and ridge-like, it runs the length of the ventral margin. The muscle node is indistinct, it forms a small protuberance in dorsal view. The surface of the valves is strongly reticulate with large polygonal pits and broad muri. In ventral view the ventral surface is flat and reticulate. The carapace is strongly compressed laterally with almost parallel sides. The greatest width lies across the muscle node.

The hinge of the right valve consists of a small peg-like anterior tooth, rounded antero-median socket, smooth median groove and a small elongate, triangular, weakly crenulate posterior tooth. The left valve has a complementary arrangement. The marginal zone is narrow, without vestibules. Other internal details could not be seen.

Remarks: All the specimens of this species from the Cenomanian appear to have their fragile, frill-like ribs broken and hence it is difficult to assign them to a species. The shape of the valves and distribution of the weak ridges (rib bases?) which remain suggest that the specimens belong to *P. chapmani*.

Occurrence: This species is only found in the lowest few metres of the Cenomanian from Southern England.

Platycythereis cf. *P. gaultina* Jones, 1849.

(Plate 25, figs. 7-10)

? 1849 *Cythere (Cythereis) gaultina* Jones: 17, pl.2, figs.7a-c.

Diagnosis: A species very close to *P. gaultina* but of smaller size with distinct ventral riblets.

Material: 133 valves and carapaces.

Measurements (mm)		Length	Height	Width
Left valve,	OS 9877	0.483	0.264	0.100
Right valve,	OS 9878	0.472	0.253	0.100

Description: Carapace small, strongly calcified, sub-rectangular with straight dorsal and ventral margins which converge towards the posterior. The posterior margin is straight and vertical with two long spines and 3 - 4 small spines but these are often broken. The anterior margin is complex, there is a ridge-like anterior marginal rib which does not reach the ventral margin. Anterior to this at the top there are three stout spines which are all joined on a frill-like flange. This flange is not present lower down but there are 3 more, stout, ridge-like spines. The lower one of these continues as a thin ridge which forms the ventral margin to just posterior of mid-length. Another thin ridge begins above its posterior end and forms the ventral margin up to the posterior. Dorsal and middle ribs are absent, but there is a slightly inflated area near the postero-dorsal cardinal angle. The muscle node is small and hooked backwards in dorsal view. In ventral view there is a thin longitudinal ridge which is obscured in lateral view by the ventral ridges. The surface of the valves is strongly reticulate with deep, often rectangular-shaped fossae.

The hinge of the right valve consists of an indistinct (rounded?) anterior tooth, very weak antero-median socket and a smooth postero-median bar. The posterior tooth is crenulate. The left valve has a complementary arrangement. The inner lamella is moderately wide, without vestibules. Other internal details could not be seen.

Remarks: The species *P. gaultina* is well known and has been adequately described. The specimens from the Cenomanian are similar to *P. gaultina* but are smaller, less inflated and have ventral ribs which are more distinct than in *P. gaultina*. The fossae in the reticulation are also smaller and more elongate.

Occurrence: *P.*cf.*P.gaultina* is present only in the lowest few metres of the Cenomanian in Southern England.

Genus <u>TRACHYLEBERIS</u> Brady, 1898.

Type species: <u>Cythere scabrocuneata</u> Brady, 1880.

<u>Trachyleberis medwayensis</u> n.sp.

(Plate 25, figs. 11-14)

<u>Derivation of name</u>: After the Medway valley on the north side of which is the Blue Bell Hill quarry.

<u>Diagnosis</u>: A species of the genus <u>Trachyleberis</u> without a distinct muscle node. Lateral surface smooth with spines restricted to the margins.

<u>Holotype</u>: A left valve, OS 9881. Sample BB4, 25.5m. below the base of the Plenus Marls, Blue Bell Hill, Kent.

<u>Paratypes</u>: A right valve, OS 9882 from the same horizon and locality.

<u>Hypotypes</u>: a carapace, OS 9883 from sample S21, Middle Cenamanian, Southerham, Sussex.

<u>Other Material</u>: 12 valves.

<u>Measurements</u> (mm)		Length	Height	Width
Holotype, left valve	OS 9881	0.681	0.330	0.130
Paratype, right valve,	OS 9882	0.670	0.319	0.130

<u>Description</u>: Valves thinly calcified, elongate, triangular in outline. Dorsal and ventral margins straight and strongly converging posteriorly. The posterior is triangular and acutely pointed with a weak marginal rib. This rib bears three spines on its lower margin and three posteriorly directed spines at the posterior extremity. In the left valve only there is a large spine over the posterior cardinal angle. The anterior margin is broadly rounded with a weak marginal rib which bears 6-7 indistinct nodes on its lateral edge, the upper one of these forms a long spine. There is a row of 12 stout spines around the anterior margin, and some of these bifurcate at their distal ends. The eye tubercle is small but distinct. In the left valve only, two spines project from

the dorsal margin one in front and one behind the eye tubercle, a thin high ridge connects the anterior spine with the anterior rib. There are two stout spines at 2/5 length near the dorsal margin and a further large spine near the dorsal margin at 3/5 length with a pore cone beneath and behind it. Along the ventral margin there are two groups of spines. In the anterior group there are 4 stout spines, an anterior one and a vertical row of 3 behind this with the lower two being joined at their bases. The posterior group consists of a broad base from which arise two stout spines, one beneath and behind the other. These spines may bifurcate distally but they are often broken. There is a further small spine on the ventral surface beneath this group. The lateral surface of the valves is completely smooth without a muscle node or middle rib.

The hinge of the right valve consists of a rather short, broad crenulate anterior tooth, with a lower anterior portion, small rounded antero-median socket, weakly crenulate median groove and a small triangular, weakly crenulate posterior tooth.

The inner lamella is very broad, particularly antero-ventrally, and is without vestibules.

Other internal details could not be seen.

Remarks: This species has fewer spines than most other species of *Trachyleberis*, but the long, sometimes bifid, spines around the margins, the overall shape and the hinge suggest that it belongs in this genus. The absence of spines over most of the lateral surface and the absence of a muscle node make this species quite distinct from other species of the genus. *T. medwayensis* is most closely comparable to *T. pennyi* Neale 1975, from the Santonian of Gingin, W.Australia, but that species has a muscle node with a large spine on it and more spines on the lateral surface.

Occurrence: This species is very rare in the British

Cenomanian. All the specimens that have been found have come from the Middle Cenomanian above the mid-Cenomanian non-sequence.

Family CYTHERURIDAE G.W. Müller, 1894.

Subfamily CYTHERURINAE G.W. Müller, 1894

Genus CYTHERURA Sars, 1866.

Type species: Cythere gibba O.F. Müller.

Cytherura striatoides Bonnema, 1941.

(Plate 34, figs. 5, 6)

1941 Cytherura striatoides Bonnema: 10, pl.5, figs. 24-28.

1966 Cytherura striatoides Bonnema; Herrig: 864, pl.28, figs.18-21.

Diagnosis: An elongate species of Cytherura with straight dorsal and ventral margins which converge towards the posterior. Lateral surface bears about nine longitudinal ribs.

Material: 44 valves

Measurements (mm)		Length	Height	Width
Left valve,	OS 9883	0.363	0.165	0.066
Right valve,	OS 9884	0.341	0.155	0.066

Description: Valves elongate, thinly calcified. The dorsal margin is long and straight and converges posteriorly with the ventral margin which is straight to weakly convex. The posterior margin is weakly rounded to almost triangular. The anterior margin is obliquely rounded. There are about 9 low longitudinal ribs which are equally spaced across the valve surface, these converge somewhat at the posterior and anterior ends of the carapace. The valves are moderately well inflated and in dorsal view the outline is gently convex with the greatest width just in front of mid-length.

Internally the marginal zone is broad with a large crescentic vestibule at the anterior and a narrow posterior vestibule. The hinge consists of small elongate terminal teeth in the left valve, separated by a straight, smooth groove. The right valve is complementary. Other internal details could not be seen.

Remarks: This species appears to be quite well defined and its shape and ornamentation make it unlikely to be confused with other species of Cytherura.

Occurrence: This species can be found throughout the Cenomanian but it is never common.

Genus EUCYTHERURA G.W. Müller, 1894

Subgenus EUCYTHERURA G.W. Müller, 1894

Type species: Cythere complexa Brady, 1867.

Eucytherura (Eucytherura?) chathamensis n. sp.

(Plate 27, figs. 5; Plate 34, figs. 1,2)

Derivation of name: After the town of Chatham, Kent, which is 10km. from the Blue Bell Hill quarry.

Diagnosis: A species of Eucytherura with long straight dorsal and ventral margins, an inflated carapace with distinct swellings and a reticulate surface.

Holotype: A right valve, OS 9885. Sample BB8. 13.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: A left valve, OS 9886 and a carapace OS 9887 from the same horizon and locality.

Other material: 61 valves

Measurements (mm)		Length	Height	Width
Holotype, right valve,	OS 9885	0.395	0.187	0.105
Paratype, left valve,	OS 9886	0.384	0.200	0.110

Description: Valves elongate, sub-rectangular. Ventral margin straight, sub-parallel to the long, straight dorsal margin, the two converging slightly posteriorly. Anterior margin broadly rounded, posterior margin rounded but straight postero-dorsally. Cardinal angles are quite well developed. The valves are inflated and bear a series of rounded swellings. There is a pronounced elongate ventral swelling running from just in front of mid-length to ¾ length, this swelling rises gently but ends rather abruptly at the posterior. At 1/3 length there is a rounded swelling over the muscle scar area. A series of lower swellings occur along the dorsal margin, the most prominent of which is the antero-dorsal, but low swellings also occur at ½ and ¾ length. Around the anterior end runs a narrow flattened area and there is a wider flattened area at the posterior. The surface is covered by a series of low ridges forming a reticulate meshwork. This mesh crosses the swellings but is less prominent behind the muscle node and is absent on the flattened posterior end. In dorsal view the ventral swelling and muscle node form the outline with tapered anterior and posterior ends. The valves are almost equal in size with the left valve overlapping the right at the anterior and posterior ends of the hinge. The greatest height lies anteriorly, the greatest width lies across the ventral swelling.

Interiorly the marginal zone is moderately wide with a vestibule situated postero-ventrally adjacent to the depression caused by the postero-ventral swelling. There are no other vestibules. The hinge consists of terminal squarish teeth in the right valve separated by a straight smooth groove. The left valve has terminal sockets, open beneath, separated by a long smooth bar. Other internal details could not be seen.

Remarks: E. (E?) chathamensis is similar to E. nuda Kaye, 1964a but it can be distinguished by its long, straight ventral margin, the presence of a muscle node and weak swellings along the dorsal margin. The pattern of reticulation is also stronger in E. nuda.

Whilst E. nuda was described from the Barremian of Speeton, Kaye also described some specimens as E. aff. nuda from the Albian of Kent. E. (E?) chathamensis is closely related to these forms and is almost certainly descended from them. E. (E?) chathamensis can be distinguished from E. aff. nuda by its more pronounced muscle node and antero-dorsal node and also by its smaller ventro-lateral swelling. A further development along this lineage appears to be in the specimens figured by Bonnema (1941; pl.5, figs. 56,57). Bonnema grouped his specimens into E. tuberculata Bonnema 1941, but if his first figures of this species are taken as typical (pl.5, figs. 52-55) then the specimens of pl.5, figs. 56 and 57 are seen to be quite different. These figures differ from E. (E?) chathamensis by having much more pronounced dorsal nodes and muscle node.

The subgenus Eucytherura (Vesticytherura) is defined by Gründel (1964) as differing from E. (Eucytherura) by the development of broad vestibules at the anterior and posterior ends of the valves. E. (E?) chathamensis appears to be somewhat transitional in having a postero-ventral vestibule only and it is therefore referred to the type sub-genus.

Occurrence: Cenomanian but never common.

Eucytherura (Eucytherura) gründeli n. sp.
(Plate 26, figs. 5-7; Plate 33, figs. 3,4)

Derivation of name: After J. Gründel who first recognised this species.

1966 Eucytherura (Vesticytherura)? tumida? Bonnema; Gründel: 43, pl.7, figs. 37,38.

Diagnosis: A strongly reticulate species of Eucytherura with two nodes in the region of the muscle scars and a series of ventral riblets.

Holotype: A left valve, OS 9888. Sample PBH3 12, 2m. below the Totternhoe Stone, Middle Cenomanian, Pitstone, Herts.

Paratypes: 9 valves, OS 9889 to OS 9897 from the same horizon and locality.

Other material: 473 valves.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9888	0.300	0.176	0.115
Paratype, right valve,	OS 9892	0.290	0.176	0.110

Description: Valves small, sub-quadrate, inflated and strongly reticulate. Dorsal margin straight, ventral margin sub-parallel, being weakly convex. The anterior margin is gently rounded and in well preserved specimens there are 5 short marginal projections which project back as short raised ribs. The lowest of these ribs is joined to a rib running along the ventral margin. The posterior is triangular with the posterior extremity at 2/3 height. The eye tubercle is prominent and has a short vertical rib beneath it. The muscle node consists of a small rounded anterior node with a crescent-shaped node behind this. The ventral surface bears two longitudinal ridges at the anterior, the outermost of these is longer and joins the lowest anterior marginal projection. These two ridges end at about ½ length and behind them is an oblique ridge which runs up onto the lateral surface. There are also raised areas at the posterior ends of the dorso-lateral and ventro-lateral margins- In dorsal view the sides of the valves are almost straight and converge slightly towards the anterior end. At the anterior and posterior ends the valve margins are strongly convergent.

The surface of the valves is strongly reticulate. The reticulation takes the form of a "trefoil celation" with the fossae being constricted by ingrowths from the muri. Several perforate spines are also present.

The hinge of the right valve consists of very small, smooth terminal teeth separated by a long straight groove. In the left valve the terminal sockets are small and open beneath, the median bar is very finely crenulate.

The marginal zone is moderately broad and vestibules have not been seen. Marginal pore canals and muscle scars could not be seen.

Remarks: This species was first recognised by Gründel (1966) but was referred by him to *E. tumida* Bonnema 1941. *E. tumida* as interpretted by Herrig 1966 is larger, lacks the muscle nodes, has a smaller eye tubercle and weaker ventral ribs. The fossae of the reticulation are also larger and less celate. Gründel placed the species in the sub-genus *E. (Vesticytherura)*, whilst recording that he could not see any vestibules. This species is therefore placed in the sub-genus *E. (Eucytherura)*.

E. (E.) gründeli is rather similar to *E. (E.) antipodum* Neale 1975 but this species has a postero-dorsal rib and is rather different in dorsal view.

Occurrence: This species is present throughout the Cenomanian of Southern England.

Eucytherura (Eucytherura) kayei n. sp.
(Plate 27, fig. 6,7; Plate 34, figs. 3, 4)

Derivation of name: In honour of Dr. P. Kaye who first recognised this species.

Diagnosis: A species of the genus *Eucytherura* with four bulbous nodes along the dorsal margin, two bulbous nodes situated postero-ventrally and a bulbous muscle node. Surface covered with tiny pustules.

Holotype: A left valve, OS 9898. Sample GB 44, 4.5m. above the base of the Cenomanian, Lower Cenomanian, Glyndebourne, Sussex.

Paratypes: Two valves, OS 9901 and OS 9902 from the same horizon and locality.

Other material: 23 valves.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9898	0.319	0.165	0.088
Paratype, right valve,	OS 9901	0.320	0.155	0.088

Description: Valves elongate, sub-rectangular with straight dorsal and ventral margins which converge towards the posterior end The anterior margin is broadly rounded and the posterior margin is narrowly rounded with a weakly concave upper margin. The greatest height lies at the anterior end of the dorsal margin. The valves are quite strongly inflated with the greatest width lying across the postero-ventral region where there are two bulbous nodes, one in front of the other. Just in front, and slightly above, the anterior of these nodes is the bulbous muscle node. Along the dorsal margin is a row of four bulbous nodes with the posterior one being less inflated and much broader. The anterior node lies beneath the anterior cardinal angle and beneath this is a further low node. In dorsal view the valves are strongly inflated with laterally compressed anterior and posterior ends. The compressed posterior continues ventrally as a thin ridge along the postero-ventral part of the valve junction. The surface of the valves is covered with a dense series of pustules. These pustules are absent on the posterior and ventral areas where they are replaced by a weak reticulation.

Internally the swellings on the lateral surface are represented by deep depressions. The marginal zone is relatively broad, without vestibules. The hinge consists of small, square terminal teeth in the right valve separated by a smooth, straight groove. In the left valve there are small terminal sockets, open beneath and connected by a smooth bar. Other internal details could not be seen.

Remarks: This species was first noted by Kaye (1965c) in his remarks about E. aff nuda. He described it as having two rows of low surface nodes, one row dorsally and a more prominent one ventrally. E. (E.) kayei can be distinguished from other related species such as E. nuda Kaye, E. aff. nuda Kaye and E. (E?) chathamensis n.sp. by its two postero-ventral nodes and bulbous dorsal nodes. It also has much of the reticulation of the other species replaced by a dense series of pustules.

Occurrence: Cenomanian, but usually rare.

Eucytherura (Eucytherura) longisculpta n. sp.
(Plate 26, fig.13; Plate 35, figs. 3,4)

Derivation of name: Long - sculpta - Latin - referring to the longitudinal ridges on the lateral surface.

Diagnosis: A species of Eucytherura with a flattened anterior margin and a reticulate surface which is dominated by longitudinal ridges.

Holotype: A right valve, OS 9903. Sample BB12, 5.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: 4 valves and a carapace, OS 9904 to OS 9908 from the same horizon and locality.

Other material: 93 valves.

Measurements (mm)		Length	Height	Width
Holotype, right valve,	OS 9903	0.253	0.155	0.080
Paratype, left valve,	OS 9904	0.264	0.150	0.088

Description: Valves small and sub-quadrate. Dorsal margin long and straight. Ventral margin straight and parallel to the dorsal margin but often obscured by a slight tumidity of the valve. The anterior margin is broadly rounded and the posterior margin is obliquely rounded with the posterior extremity at 2/3 height. The anterior and posterior margins are marked by broad flattened rims, distally these are smooth but the reticulation of the lateral surface crosses onto them proximally. A small eye tubercle is present. The lateral surface bears a series of longitudinal riblets, between which are numerous cross-ribs, forming a reticulate pattern. There is a weak median sulcus which extends from the dorsal margin to about ½ height. In dorsal view the greatest width lies across the postero-ventral region where there is a slight swelling.

The hinge of the right valve consists of a very small squarish anterior tooth, a shallow (smooth?) median groove and an elongate posterior tooth.

The marginal zone is moderately wide, without vestibules. Other internal details could not be seen.

Remarks: This species can be distinguished from most other species of Eucytherura by its ornament of longitudinal ribs with short cross ribs. It differs from E. cf. tuberculata Bonnema 1941, from the Upper Cretaceous of Holland and E.grundeli n.sp. in lacking a muscle node and having flattened anterior and posterior rims.

Occurrence: This species is found in Middle and Upper Cenomanian samples from Southern England.

Eucytherura (Eucytherura) cf. E.(E.)tuberculata Bonnema, 1941

(Plate 26, figs. 1-4; Plate 33, figs. 1,2)

? 1941 Eucytherura tuberculata Bonnema: 21, pl.5, figs.52-55 (non figs. 56,57)

non 1966 Eucytherura tuberculata Bonnema; Herrig: 878, pl.29, figs.13a-d.

Diagnosis: A species of Eucytherura with a large complex muscle node and a ridge along the anterior half of the ventral margin. Eye tubercle set on a raised area of the reticulation.

Material: 384 valves and carapaces

Measurements (mm)		Length	Height	Width
Left valve,	OS 9909	0.280	0.155	0.088
Right valve,	OS 9910	0.286	0.165	0.088

Description: Valves small, sub-quadrate, strongly reticulate. Dorsal margin straight, parallel to the ventral margin which is weakly convex. Anterior margin gently rounded to almost straight in the upper part, with 5 small spines along the lower ½ of the margin. Posterior area fairly small with the posterior extremity at ¾ height. The eye tubercle is fairly large and is set in a raised area of the reticulation such that it is encircled by a murus. In the right valve there is a short rib on the dorsal edge behind the eye tubercle. A dorsal rib begins at a perforate spine at ½ length and is formed by a row of raised muri. A raised ridge-like rib begins at ½ height near the anterior margin and curves round antero-ventrally to run along the ventral margin to just behind ½ length where it terminates. At the postero-ventral angle there is a large raised area which does not form a true rib. The muscle node is large and complex and is best studied by reference to Pl. 33, fig.1 . In dorsal view the carapace is equally as wide across the muscle node and postero-ventral process, there is a distinct notch between the two. The whole of the surface of the valves is strongly reticulate. The muri are rather strong and bear small conical spines which project into the fossae. Perforate spines are numerous.

The hinge of the right valve consists of a small, squarish anterior tooth, weakly crenulate median groove and a low, slightly elongate posterior tooth. The left valve has a complementary arrangement.

The marginal zone is moderately wide, without vestibules. Other internal details could not be seen.

Remarks: These forms are very similar to Eucytherura tuberculata as figured by Bonnema (1941, pl.5, figs. 52-55) from the Upper Cretaceous of Holland. However Bonnema's figures are rather poor and the Cenomanian specimens are quite different to E. tuberculata as figured by Herrig (1966), from the Campanian of Rugen.

Occurrence: This species can be found throughout the Cenomanian of Southern England.

Subgenus VESTICYTHERURA Gründel, 1964.

Type species: Eucytherura neocomiana Kaye, 1964a

Eucytherura (Vesticytherura) multituberculata
Gründel, 1964
(Plate 26, figs. 14-17)

1964a Eucytherura ansata Weingeist; Kaye: 97, pl.4, figs.1-4

1964 Eucytherura (Vesticytherura) multituberculata Gründel: 748, pl.2, figs. 12,13.

1966 Eucytherura (Vesticytherura) multituberculata Gründel; Gründel: 42, pl.7, figs. 28,29.

Diagnosis: A species of the subgenus Eucytherura (Vesticytherura) with a laterally compressed carapace with a smooth surface and three large nodes along the dorsal margin.

Material: 298 valves and carapaces.

Measurements (mm)		Length	Height	Width
Left valve,	OS 9913	0.319	0.170	0.060
Right valve,	OS 9914	0.308	0.155	0.060

Description: Carapace small, sub-rectangular and strongly laterally compressed. Dorsal and ventral margins straight and weakly converging towards the posterior. Posterior area triangular with a steep upper margin and a vertical row of 3 very small spines on its lateral surface. Anterior margin broadly rounded with a marginal rib which is most prominent from the anterior cardinal angle to 2/3 height. There are 4 - 5 small spines along the lower ½ of the anterior margin. The anterior rib joins the large eye tubercle at the top. Behind the eye tubercle, equally spaced along the dorsal margin are 3 large nodes. The anterior rib joins the ventral rib which is most prominent at ½ length and at the posterior where it ends in a fairly large process. Small pore cones may be seen beneath and behind the eye tubercle and another two may be present just above the ventral rib at and just behind mid-length respectively.

In dorsal view the carapace has almost parallel sides with the greatest width at mid-length across the ventral rib.

The hinge of the right valve consists of two terminal small teeth separated by a smooth groove. The left valve is complementary.

The marginal zone is broad with a small anterior vestibule. Marginal pore canals cannot be seen.

The central muscle scars consist of a vertical row of 4 oval scars with an indistinct anterior scar or scars.

Remarks: This species is very similar to E. ansata Weingeist but Gründel has shown that E. ansata has a double postero-ventral node and lacks the lateral, raised pore cones. E. (V.) multituberculata differs from E. dorsotuberculata Veen, from the Maastrichtian of Limburg, by having equally spaced dorsal nodes. In E. dorsotuberculata the posterior node is further removed from the other nodes.

Occurrence: This species can be found throughout the Cenomanian of Southern England.

Genus HEMICYTHERURA Elofson, 1941.

Type species: Cythere cellulosa Norman, 1865.

Hemicytherura euglyphea Kaye, 1965

(Plate 27, figs. 1-3)

1965c Hemicytherura euglyphea Kaye: 231, pl.8, figs. 1-4.

1966 Metacytheropteron ? euglyphea Kaye ?; Gründel: 47, pl.8, figs. 9-12.

Diagnosis: A species of Hemicytherura with an ornament of longitudinal ridges with short cross ridges between them.

Material: 600 valves and carapaces.

Measurements (mm)		Length	Height	Width
Left valve,	OS 9917	0.341	0.176	0.066
Right valve,	OS 9918	0.308	0.165	0.066

Description: Valves elongate, laterally compressed. Dorsal margin arched, particularly in the right valve. Posterior drawn out into a caudal process just above mid-height, below this the posterior margin is concave, becoming almost vertical. The ventral margin is straight and the anterior margin rounded. The lateral surface is ventrally tumid and almost forms an ala in some specimens, thus producing a near flat ventral surface. There is an indistinct tubercle near the dorsal margin. The rest of the valve surface is strongly ornamented with a series of longitudinal ridges joined by weaker cross ridges. In dorsal view the outline is oval with pointed ends and greatest width at mid-length.

The marginal zone is broad, without vestibules. The hinge of the right valve consists of two elongate terminal bar-like teeth. Above the teeth and extending the length of the hinge line is a smooth groove above which is a strong bar. In the left valve there is a curved bar which fits into the groove of the right valve.

Other internal details could not be seen.

Remarks: This species was included in the genus *Hemicytherura* by Kaye (1965c) but Gründel (1966) tentatively referred it to *Metacytheropteron* Oertli, 1957. The shape however more closely resembles *Hemicytherura* since it has a caudal process. Species of *Metacytheropteron* have rounded posterior margins. This species is therefore retained in *Hemicytherura*.

Occurrence: This species is common throughout the Cenomanian of Southern England.

Genus PARANOTACYTHERE Bassiouni, 1974

Subgenus PARANOTACYTHERE Bassiouni, 1974

Type species: Orthonotacythere diglypta Triebel, 1941.

Paranotacythere (Paranotacythere) bassiouni n.sp.

(Plate 27, figs. 12,13; Plate 35, fig. 5)

Derivation of name: After M. el A.A. Bassiouni in honour of his work on this group of Ostracoda.

Diagnosis: A strongly reticulate species of the subgenus P. (Paranotacythere) with a vertical ridge in front of the eye tubercle, a frill-like rib along the posterior half of the dorsal margin and a ventro-lateral spine.

Holotype: A right valve, OS 9920. Sample BB8, 13.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: 5 valves, OS 9921 to OS 9925 from the same horizon and locality.

Other material: 140 valves.

Measurements (mm)		Length	Height	Width
Holotype, right valve,	OS 9920	0.374	0.200	0.100
Paratype, left valve,	OS 9921	0.341	0.200	0.088

Description: Valves small, ornate with a straight dorsal margin. Ventral margin gently convex, anterior margin obliquely rounded with a flattened margin. Posterior small and laterally compressed with the posterior extremity at ¼ height. The lateral surface is inflated, but divided by a broad vertical median sulcus just in front of half length. The whole of the surface is strongly reticulate.Where ridges are developed they are produced by exaggeration of the muri of the reticulation. There is a raised ridge along the posterior half of the dorsal margin and a high, vertical ridge in front of the low eye tubercle. This rib has horizontal extensions at both ends, the upper one forming the dorsal margin in front of the sulcus. The boundary between the ventral and lateral areas is marked by a ridge which extends nearly the whole length of the valves and obscures the ventral margin in lateral view. Above this rib at the anterior end is a short rib above which is a further parallel rib which extends back to the ventral termination of the sulcus. Behind the sulcus is a short ridge and behind this is a strong ventro-lateral spine which is often broken. There is usually a low vertical ridge on the posterior half of the valves. In ventral view there is a single longitudinal rib on each valve.

The hinge in the right valve consists of terminal, crenulate, elongate teeth separated by a crenulate groove. The left valve has a complementary arrangement.

The marginal zone is rather narrow without vestibules. Other internal details cannot be seen.

Remarks: This species is similar to several of the species described by Bassiouni (1974). The combination of a small eye tubercle, completely reticulate surface and a ventro-lateral spine distinguishes this species from P.(P.) fordensis (Kaye), from the Albian of England. P.(P.) luettigi Bassiouni from the Aptian of W. Europe has a very large eye tubercle and a postero-dorsal node. P.(P.) damottae Bassiouni, from the Barremian of France has a somewhat different shape with a less reticulate surface. P.(P.) oertlii Bassiouni from the Aptian of France has a similar shape to P.(P.) bassiouni but the reticulation is not so pronounced, the eye tubercle is larger and the vertical rib in front of the eye tubercle is absent.

Occurrence: This species is rare in the Cenomanian of Southern England but specimens have been found throughout the stage.

Genus PSEUDOBYTHOCYTHERE Mertens, 1956

Type species: Pseudobythocythere goerlichi Mertens, 1956.

Pseudobythocythere colini n. sp.

(Plate 28, figs. 1-4)

Derivation of name: After Dr. J.P. Colin who first recognised this species.

1973 Annosacythere sp.2 Colin: 22, pl.4, fig.12.

Diagnosis: A species of the genus Pseudobythocythere with a reduced median sulcus and muscle node and a strong median rib.

Holotype: A female left valve, OS 9925. Sample BB11, 7.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: 6 valves OS 9926 to OS 9931 from the same horizon and locality.

Other material: 168 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, female left valve,	OS 9925	0.351	0.200	0.100
Paratype, female right valve	OS 9926	0.341	0.209	0.100
Paratype, male left valve,	OS 9928	0.407	0.203	0.100

Description: Valves small, sub-rectangular with straight and parallel dorsal and ventral margins. The dorsal and ventral margins curve together at the posterior end to form a rounded posterior extremity just above ½ height. The anterior end is broadly rounded and is strengthened by a marginal rib. There is a distinct eye spot in the region of the anterior cardinal angle. There is a vertical rib beneath the eye tubercle which runs to the region of the muscle area where it meets a strong, sinuous median rib which runs to the posterior end. Behind the vertical rib is a weak sulcus and behind this is a further short vertical rib. There is a prominent, slightly arched ventro-lateral rib which begins near the anterior margin and ends near the posterior margin. A further rib runs parallel to and beneath this rib from the anterior to just after ½ length. In dorsal view the ends of the carapace have triangular outlines and are separated by the straight parallel middle portions of the valves.

The hinge of the right valve consists of two small crenulate terminal teeth separated by a finely crenulate median groove. The left valve hinge is complementary.

The marginal zone is moderately wide. Other internal details could not be seen.

Males are longer than females.

Remarks: This species appears to be identical with Annosacythere sp.2 Colin, 1973. It appears however to have more characteristics of the genus Pseudobythocythere Mertens. Annosacythere has in fact been taken to be synonomous with Pleurocythere by Howe (in Moore and Pitrat 1961). Species of Pleurocythere are usually much larger and more heavily calcified.

P. colini is similar to P. ornata Kaye 1965, from the Lower Barremian of Speeton, but P. ornata has a more complex pattern of ribs and is larger. P. goerlerchi Mertens 1956, from the Albian of Germany has a strongly develloped ventro-lateral rib and a deeper median sulcus, but lacks the strong median rib of P.colini.

Occurrence: Usually restricted to the Upper Cenomanian but specimens may also be found in the Middle Cenomanian.

Subfamily CYTHEROPTERINAE Hanai, 1957.

Genus CYTHEROPTERON Sars, 1866

Type species: Cythere latissima Norman, 1865.

Cytheropteron (Cytheropteron) nanissimum

Damotte and Grosdidier, 1963.

(Plate 27, figs. 8, 11; Plate 36, figs. 1,2)

1963 Cytheropteron nanissimum Damotte and Grosdidier: 56, pl.1. figs. 2a-f.

1965c Cytheropteron (Cytheropteron) nanissimum nanissimum Damotte and Grosdidier; Kaye: 234, pl.7, figs.13,15.

1966 Cytheropteron (Cytheropteron) nanissimum Damotte and Grosdidier; Gründel: 46, pl.8, figs.27,28.

1971b Cytheropteron nanissimum Damotte and Grosdidier; Damotte: 117, pl.8, fig.17.

Diagnosis: A species of the subgenus Cytheropteron (Cytheropteron) with a short rib just beneath the dorsal margin from which a vertical rib extends downwards to the ventro-lateral ala.

Material: 619 valves

Measurements (mm)		Length	Height	Width
Left valve,	OS 9932	0.308	0.200	0.100
Right valve,	OS 9933	0.308	0.165	0.100

Description: Valves small, thinly calcified. Dorsal margin convex in the left valves, but straight with weak cardinal angles in the right valve. Posterior margin rounded in the left valves to pointed in the right. Anterior margin rounded with an oblique, straight antero-dorsal margin in the left valve. Ventral margin straight but obscured by the ventro-lateral ala in lateral view. A narrow laterally compressed rim runs around the anterior margin and also along the dorsal border in the left valve. There is a strong ventro-lateral ala which begins indistinctly behind the anterior rim and curves down to obscure the ventral margin in lateral view. Near the dorsal margin above the ala is a short rib or node. Between this rib and the ala is a broad depressed area, down the middle of which runs a vertical rib. The rest of the valve surface is smooth, but there may be one or two faint ridges on the ventral margin.

The hinge of the right valve consists of a very small anterior tooth, finely crenulate median groove and a small, squarish posterior tooth. The left valve is complementary with a broad marginal shelf.

The marginal zone is moderately broad with a narrow anterior vestibule. Other internal details could not be seen.

Remarks: This species has been well described in the past. The British Cenomanian specimens often have a lesser relief to the dorsal and vertical ribs but otherwise they are identical to the type material.

Occurrence: This species is common throughout the Cenomanian.

Cytheropteron (Cytheropteron) pitstonensis n. sp.
(Plate 27, figs. 9,10; Plate 36, figs. 3, 4)

Derivation of name: After the village of Pitstone (Herts.) the type locality for this species.

Diagnosis: A species of the subgenus Cytheropteron (Cytheropteron) with a very short vertical rib above the ventro-lateral ala and a pitted lateral surface.

Holotype: A left valve, OS 9936. Sample PBH3 12, 2m. below the Totternhoe Stone, Middle Cenomanian, Pitstone, Herts.

Paratypes: 9 valves OS 9937 to OS 9945 from the same horizon and locality.

Other material: 565 valves.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 9936	0.300	0.176	0.088
Paratype, right valve,	OS 9937	0.300	0.165	0.088

Description: Valves small, elongate, fairly thin shelled. Dorsal margin arched in the right valve but straight with weak cardinal angles in the left valve. Posterior triangular in the right valve but more rounded in the left valve. Ventral margin straight, curving up at the posterior but partly obscured in lateral view by the ventro-lateral ala. Anterior margin rounded but with a straight oblique antero-dorsal margin in the right valve. Above the ventro-lateral ala is a short vertical rib with a deep vertical sulcus on each side of it. The lateral surface above this bears numerous large pits but the rest of the lateral surface is smooth. In ventral view there are two weak longitudinal ridges on the ala.

The hinge of the right valve consists of a small anterior tooth, finely crenulate median groove and a squarish posterior tooth. The left valve is complementary with a narrow marginal shelf.

The marginal zone is moderately broad with a small anterior vestibule. Other internal details could not be seen.

Remarks: This species is similar to C. (C.) nanissimum Damotte and Grosdidier, 1963 in shape and size but lacks the dorsal rib and has a much shorter vertical rib. It also has a pitted lateral surface. C. (C.) milbourni Kaye 1965, from the Albian of England has a similar ornament but lacks the short vertical rib and has a much stronger ventro-lateral ala.

Occurrence: This species can be found throughout the Cenomanian of Southern England.

Genus HEMIPARACYTHERIDEA Herrig, 1963

Type species: Paracytheridea (Hemiparacytheridea) occulta Herrig, 1963.

Hemiparacytheridea cf. H. longicauda (Bonnema, 1941)

(Plate 26, figs. 8, 9; Plate 33, figs. 5, 6)

? 1941 Eucytherura longicauda Bonnema: 24, pl.5, figs.95-103.

Diagnosis: A species of Hemiparacytheridea with a weak dorsal rib and a weak muscle node. Valves inflated, especially postero-ventrally. Surface strongly reticulate.

Material: 94 valves.

Measurements (mm)		Length	Height	Width
Left valve,	OS 9946	0.286	0.160	0.100
Right valve,	OS 9947	0.286	0.160	0.110

Description: Valves small, fairly strongly built. The dorsal margin is long and straight and converges slightly with the straight ventral margin towards the posterior. The posterior is somewhat drawn out, with the posterior extremity at the end of the hinge margin. The lower margin of the posterior area is straight. The anterior margin is obliquely rounded with the anterior extremity at 1/3 height. The valves are strongly inflated, especially ventrally, and particularly postero-ventrally. A broad shallow median sulcus is present in the central part of the valves. There is a large eye tubercle behind which runs a weak dorsal rib. At the posterior end this rib forms a node. The valves are strongly reticulate and many of the muri bear ingrowing spines. Over the muscle scar area there is a vertical row of elongate fossae. This area is slightly thickened. In dorsal view the position of greatest width lies at 2/3 length across the postero-ventral inflation. The anterior and posterior ends are laterally compressed. In ventral view there are three weak longitudinal ridges on each valve.

The marginal zone is broad and without vestibules. The internal eye pit is prominent. The hinge of the left valve consists of a small anterior socket, above this begins a long straight bar. This bar is smooth but becomes crenulate at the posterior end. Above the bar is a narrow shelf. In the right valve there is a small anterior tooth above which begins a long straight smooth groove which becomes crenulate at the posterior. This groove is open beneath but is bounded above by a thin bar. Above this bar is a narrow shelf. Other internal details could not be seen.

Remarks: This species appears to be similar to H. longicauda (Bonnema 1941). However, Bonnema's figures are rather poor and his specimens are not available for study. As interpreted by Herrig (1966), Bonnema's species is very similar to forms from the British

Cenomanian. Some of Herrig's specimens, however, show a well developed muscle node which is not so well defined in the Cenomanian specimens. The hinge described by Herrig is also different to that in the Cenomanian forms.

H. longicauda was placed in the genus Paracytheridea (Paracytheridea) by Herrig, 1966 but Neale, 1975 has shown that it belongs in Hemiparacytheridea.

Occurrence: Middle and Upper Cenomanian.

Hemiparacytheridea minutissima (Kaye, 1965)

(Plate 26, figs. 10-12; Plate 35, figs. 1,2)

1965c Orthonotacythere minutissima Kaye: 239, pl.8, figs.5-11.

1973 Paracytheridea aff. gr. occulta Herrig; Colin: 29, pl.6, fig.8.

Diagnosis: A species of Hemiparacytheridea with a ventro-lateral rib which becomes alate at the posterior, small hinge ears in the left and right valves and a dorso-lateral node at 2/3 length.

Material: 138 valves

Measurements (mm)		Length	Height	Width
Left valve,	OS 9950	0.300	0.155	0.091
Right valve,	OS 9951	0.286	0.155	0.093

Description: Valves small, strongly built. The dorsal margin is long and straight but there is a small triangular hinge ear in each valve. The ventral margin is straight and converges with the dorsal margin towards the posterior but it is obscured by the ventro-lateral inflation in lateral view. The posterior is strongly drawn out with the posterior extremity at the end of the dorsal margin. The lower margin of the posterior area is weakly concave. The anterior margin is broadly rounded. The valves are strongly inflated, particularly postero-ventrally where there is a broad ala-like extension. This is prolonged forwards by a rib which reaches almost to the anterior margin. A broad, vertical, median sulcus extends down from the dorsal margin and notches the ventro-lateral rib. There is a large, prominent eye tubercle which has a short, vertical ridge extending above it, to form the hinge ear in each valve. A large node is present dorso-laterally at 2/3 length. The lateral surface of the valves is reticulate but the muri are rather thick and the fossae appear more as pits. The posterior and ventral areas are smooth but there is a thin longitudinal ridge on the ventral surface of each ala. In dorsal view the anterior and posterior areas are laterally compressed and the greatest width lies across the ventro-lateral ala near the posterior. There is a flat dorsal surface.

The marginal zone is moderately broad without vestibules. The hinge of the right valve consists of a small squarish anterior tooth behind which is a long crenulate median groove. Towards the posterior this median groove becomes shallower and the posterior part may in fact become a denticulate bar. The left valve has a corresponding arrangement. Other internal details could not be seen.

Remarks: This species was placed in the genus Orthonotacythere Alexander by Kaye but he did remark that it was not typical of the genus. The shape, ornament and hinge all place this species into the genus Hemiparacytheridea as interpretted by Neale (1975).

The specimens figured as P. aff gr. occulta by Colin 1973 from the Upper Cenomanian of the Dordogne appear to belong to this species.

Occurrence: This species is fairly common in the Lower Cenomanian of Southern England.

Genus PEDICYTHERE Eager, 1965.

Type species: Pedicythere tessae Eagar, 1965.

Pedicythere pitstonensis n.sp.

(Plate 27, fig. 4; Plate 36, figs. 5, 6)

Derivation of name: After the village of Pitstone (Herts.) the type locality.

Diagnosis: A species of *Pedicythere* with a long, upturned caudal process and a convex dorsal margin in the left valve.

Holotype: A right valve, OS 9954. Sample PBH3 12, 2m. below the Totternhoe Stone, Middle Cenomanian, Pitstone, Herts.

Paratypes: 2 valves, OS 9955 and OS 9956 from the same horizon and locality.

Other material: 339 valves.

Measurements (mm)		Length	Height	Width
Holotype, right valve,	OS 9954	0.330	0.143	0.165
Paratype, left valve,	OS 9955	0.330	0.165	0.155

Description: A small, rather fragile species with a strong ventro-lateral ala. Dorsal margin of the right valve straight with a strongly upturned caudal process. In the left valve the dorsal margin is convex but the part of the valve above the hinge line is often broken giving the appearance of a straight dorsal margin. The caudal process in both valves is strongly developed with the posterior extremity lying above the hinge margin. The anterior margin is asymmetrically rounded. There is a very strong ventro-lateral ala which in lateral view extends below the ventral margin at its distal end. This ala has a fairly broad base and tapers almost to a point, along its leading and trailing edges are sharp frills which may be broken. From the ventral margin behind the ala extend two more frill-like extensions. The surface of the valves is smooth.

The hinge of the right valve consists of a small, squarish anterior tooth, rounded antero-median socket, crenulate median groove and poorly developed elongate posterior tooth.

The marginal zone is moderately wide without vestibules. Other internal details cannot be seen.

Remarks: Most species in this genus appear to be rather similar to each other. *P. pitstonensis* differs from *P. trigonda*

(Grundel, 1966), from the Albian of E. Germany by lacking the dorsal rib of that species. P.trigonda also has a straight dorsal margin in both valves. P. flutians (Bonnema), from the Upper Cretaceous of Holland, as refigured by Herrig (1966) also has a straight dorsal margin in both valves and has a much less upturned caudal process. P.australis Neale 1975, from the Santonian of W. Australia again has straight dorsal margins and it also has a less upturned and less drawn out caudal process.

Occurrence: This species appears to be present throughout the British Cenomanian. It is sometimes quite common but is rarely found in samples which are difficult to process.

Family LOXOCONCHIDAE Sars, 1925.

Genus LOXOCONCHA Sars, 1866.

Type species: Cythere impressa Baird, 1850

Loxoconcha ? bluebellensis n.sp.

(Plate 30, figs. 1-16; Plate 31, figs. 1, 2)

Derivation of name: After Blue Bell Hill, near Chatham, Kent, - the type locality.

Diagnosis: A species referred to the genus Loxoconcha with numerous pits on the surface. These are arranged in concentric rows towards the margins of the valves. Hinge lophodont.

Holotype: A female left valve, OS 9957. Sample BB8, 13.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: 10 valves and carapaces OS 9956 to OS 9967 from the same horizon and locality.

Other material: Several hundred valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, female left valve,	OS 9957	0.440	0.286	0.155
Paratype, female right valve,	OS 9958	0.448	0.275	0.155
Paratype, male right valve,	OS 9959	0.516	0.264	0.132

Description: Valves oval in outline, strongly inflated. The dorsal margin in both valves is convex but in the right valves it is only weakly so. The ventral margin is short and weakly concave but it is obscured by the inflation of the valves in lateral view. At the posterior it curves up to the posterior extremity which lies at 3/5 height. The posterior margin is rounded with its upper margin rising above the dorsal margin in the left valves. The anterior margin is obliquely rounded with the anterior extremity at 2/5 height. There are narrow smooth flattened areas around the anterior and posterior margins. Over the rest of the surface of the valves are a series of pits. These pits are arranged in concentric rows, but towards the centre of the valves this arrangement is lost. The left valve overlaps the right around the entire free margin. In dorsal view the carapace is rounded with flattened anterior and posterior ends.

The inner lamella is moderately broad, without vestibules. The hinge of the right valve consists of very small, elongate, smooth anterior and posterior teeth separated by a smooth groove. In the left valve there is a smooth median bar with a small open socket at each end.

Other internal details could not be seen.

Males are much longer than females and have straight dorsal margins in both valves.

Remarks: Externally this species is very similar to species of *Loxoconcha* but internally it lacks vestibules and has a simple lophodont hinge. The genus *Camptocythere* Triebel 1950 has a similar hinge to *L. ? bluebellensis* but in this genus the right valve strongly overlaps the left. It seems likely that this species is a primitive member of the genus *Loxoconcha*.

Occurrence: Middle and Upper Cenomanian.

<u>Loxoconcha ? icknieldensis</u> n.sp.

(Plate 31, figs. 3-12)

<u>Derivation of name</u>: After the Icknield Way which runs close to Pitstone quarry (Herts.) - the type locality.

<u>Diagnosis</u>: A species referred to the genus <u>Loxoconcha</u> with straight sub-parallel sides in dorsal view. Surface ornamented with a series of large pits which form roughly concentric rows towards the margins but have no regular arrangement in the centre of the valves. Hinge lophodont.

<u>Holotype</u>: A female left valve, OS 9980. Sample PBH1 28, 8m. above the base of the Cenomanian, Lower Cenomanian, Pitstone, Herts.

<u>Paratypes</u>: 11 valves and carapaces, OS 9981 to OS 9991 from the same horizon and locality.

<u>Other material</u>: 370 valves and carapaces.

<u>Measurements</u> (mm)		Length	Height	Width
Holotype, female left valve,	OS 9980	0.436	0.275	0.130
Paratype, female right valve,	OS 9981	0.450	0.265	0.137
Paratype, male left valve,	OS 9982	0.478	0.253	0.132

<u>Description</u>: Valves rather small and heavily calcified, sub-rectangular in outline. Ventral margin gently convex curving upwards at the posterior to the broadly rounded posterior extremity which lies at 2/3 height. The anterior is obliquely rounded with the anterior extremity at 1/3 height. The dorsal margin is straight but slightly upturned at the posterior end in the left valve. There is a very narrow, flattened area around the anterior margin. The valves are strongly inflated, with the maximum inflation postero-ventrally. The ventral inflation partially obscures the ventral margin. In dorsal view the sides of the valves are straight and they converge slightly towards the anterior. The greatest height lies in the centre of the valves whilst the greatest width lies postero-ventrally at ¾ length.

The surface of the valves is strongly ornamented. There are a series of large deep pits, between which run broad, strong riblets. Around the anterior, ventral and posterior margins the pits are arranged in concentric rows but towards the centre of the valves there is no regular arrangement. The margins of the valves are smooth.

The inner lamella is moderately wide with narrow anterior and postero-ventral vestibules. There are about 10 straight marginal pore canals at the anterior end, these are widely spaced. At the posterior end there are about 4 marginal pore canals grouped at about mid-height. A few marginal pore canals can also be seen along the ventral margin. The hinge of the right valve consists of small, elongate terminal teeth separated by a straight smooth groove. In the left valve there are small, terminal, open sockets separated by a smooth bar. Other internal details could not be seen.

Males are longer and less high than females.

Remarks: This species, and L. ? bluebellensis n.sp., closely resemble species of the genus Loxoconcha. However these two species have very simple hinges, and so their assignment to this genus remains tentative. L. ? icknieldensis can be distinguished from L. ? bluebellensis by its straight dorsal margin, straight sides in dorsal view and much larger pits on the lateral surface. The lophodont hinge serves to distinguish these two species from other species of Loxoconcha.

Occurrence: Lower Cenomanian.

Family XESTOLEBERIDIDAE Sars, 1928.

Genus XESTOLEBERIS Sars, 1866

Type species: Cythere aurantia Brady and Norman, 1889

Xestoleberis burnetti n.sp.

(Plate 28, figs. 10, 11)

Derivation of name: After Dr. A.D. Burnett, Co-Director of

'Engineering Geology Ltd' who supplied samples from Pitstone quarry.

Diagnosis: A species of *Xestoleberis* with a rounded shape, weakly crenulate hinge teeth, 15 anterior marginal pore canals and 7 posterior ones.

Holotype: A carapace, OS 9998. Sample PBH1 26, 11m. above the base of the Cenomanian, Lower Cenomanian, Pitstone, Herts.

Paratypes: 6 valves and carapaces, OS 9999 to OS 10004 from the same horizon and locality.

Other material: 84 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, carapaces,	OS 9998	0.407	0.242	0.238
Paratype, carapace,	OS 9999	0.418	0.242	0.242

Description: Valves rather small, fairly thinly calcified. Anterior margin narrowly rounded, with the anterior extremity at 1/3 height. There is a long inclined antero-dorsal margin which meets the hinge margin in a rounded cardinal angle. The hinge margin is slightly convex and is inclined down towards the posterior. The posterior margin is broadly rounded. The ventral margin is weakly concave but in lateral view it is obscured by the inflation of the valves. The greatest height lies at ½ length. The valves are strongly inflated and in dorsal view the outline is oval with a rounded posterior end and the greatest width just in front of 2/3 length. From the position of greatest width to ¼ length the valve sides are straight, converging slightly towards the anterior. In front of this the valve sides converge strongly.

The marginal zone is rather narrow with a small crescendic vestibule at the anterior end. Anteriorly there are about 15 straight marginal pore canals, and at the posterior there are about 7. The hinge of the right valve consists of thin, elongate, terminal teeth which are very weakly crenulate. The teeth are separated by a short smooth groove. In the left valve there are elongate terminal sockets which are separated by a smooth bar. The central muscle scars consist of a vertical row of 4 elongate-oval scars with an indistinct frontal scar.

Remarks: The shape and internal details of this species place it in the genus *Xestoleberis* though a true '*Xestoleberis* spot' has not been seen. The crenulations of the terminal teeth in the right valve are also poorly developed. *X. planus* can be distinguished from *X. burnetti* by its flat ventral surface and ventro-lateral rib. *X. burnetti* is similar to *X. northensis* Deroo, 1966, but is relatively longer and has more marginal pore canals at the anterior end.

Occurrence: Lower Cenomanian with occasional specimens from the Middle Cenomanian,

Xestoleberis planus n.sp.

(Plate 28, figs. 5-9)

Derivation of name: Planus - Latin - referring to the flat ventral surface of the valves.

Diagnosis: A species of *Xestoleberis* with a ridge along the part of the junction between the flat ventral surface and the lateral surface of each valve.

Holotype: A left valve, OS 10005. Sample BB2, 29.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: 6 valves and carapaces OS 10007 to OS 10012 from the same horizon and locality.

Other material: 116 valves and carapaces.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 10005	0.429	0.253	0.132
Paratype, right valve,	OS 10007	0.418	0.230	0.132

Description: Valves rather small, strongly inflated. Dorsal margin almost symmetrically arched from the anterior to posterior ends.

Ventral margin straight. Anterior margin sharply rounded with the anterior extremity at 1/3 height. At the posterior, the dorsal margin curves down sharply and may become almost vertical in the left valve. The posterior extremity lies just above the ventral margin. The valves are strongly inflated with an oval outline in dorsal view. In dorsal view the valve sides converge towards the anterior end but the posterior end is truncate. The ventral surface is broad and flattened, it bears about 4 very weak ridges which may be seen in lateral view near the anterior end where they just cross onto the lateral surface. The uppermost of these ridges becomes more pronounced behind ½ length and forms a ridge-like flange along the junction between the ventral and lateral surfaces.

The marginal zone is narrow with a crescendic vestibule at the anterior end. The hinge of the right valve consists of a low crenulate posterior tooth with a gently curved smooth groove in front but there is no visible anterior tooth. In the left valve there is a gently curved smooth bar with a groove above it and beneath the dorsal margin. At the ends this groove is deepened to accept the selvage of the right valve. A crescendic scar can be seen antero-dorsally on the inside of the valves.

Remarks: This species has all the characteristics of the genus *Xestoleberis* except that its hinge is somewhat different. The hinge in fact is much more similar to that in *Uroleberis* Triebel, in that it has a groove above the hinge bar in the left valve and the hinge bar is not crenulate. It does however have very poorly developed terminal teeth in the right valve. The absence of a caudal process however suggests that it does not belong in *Uroleberis*.

The distinctive hinge and ventro-lateral ridge distinguish this species from other representatives of *Xestoleberis*.

Occurrence: This species is present throughout the Cenomanian of Southern England but it is never common.

Family SCHIZOCYTHERIDAE Mandelstam, 1960

Genus AMPHICYTHERURA Butler and Jones, 1957

Type species: Cytherura ? dubia Israelsky, 1929.

Amphicytherura cf. A. falloti Donze, 1972

(Plate 28, figs. 12,13; Plate 29, fig.1)

cf. 1972 Amphicytherura falloti Donze; in Donze and Thomel: 384, pl.2, figs. 13 - 20.

Diagnosis: A species of Amphicytherura with sharp median and ventral ribs which converge towards the anterior. The eye tubercle has a sharp, oblique ridge beneath it, and parallel to the anterior margin.

Material: 157 valves and carapaces.

Measurements (mm)		Length	Height	Width
Left valve,	OS 10013	0.384	0.230	0.132
Right valve,	OS 10014	0.384	0.220	0.110

Description: Valves sub-quadrate, heavily calcified. The dorsal margin is straight with a small hinge ear in the left valve. The ventral margin is straight to weakly convex and is parallel to the dorsal margin. The anterior margin is obliquely rounded with the anterior extremity at 2/5 height and an almost straight, inclined upper margin. Along the lower half of the anterior margin are 4 short spines. The posterior margin is triangular with a straight lower margin and a distinctly concave upper margin. The posterior extremity is pointed and lies at 3/5 height. There is a straight dorsal rib which extends nearly to the posterior end of the hinge line and obscures the dorsal margin in lateral view. At the anterior end the dorsal rib joins the eye tubercle. There is a short oblique rib extending down from the eye tubercle parallel to the dorsal margin. A strong median rib is present. In the middle part of the valve this is broad and inclined up towards the posterior. At the anterior this rib is ridge-like and meets the anterior margin at

2/5 height. Towards the posterior the middle rib is weak but runs to meet the upper part of the posterior margin. The ventral rib is also well developed, at the anterior end it curves up onto the lateral surface and runs to meet the anterior margin just below the middle rib. On the ventral surface of each valve there are three weak longitudinal ribs. The anterior end of the outer one of these is visible in lateral view. Along the sides of the lateral ribs are weak cross-ribs. The rest of the valve surfaces are weakly reticulate. In dorsal view the sides of the valves are straight and parallel with the greatest breadth across the middle rib. The anterior and posterior ends are laterally compressed.

The inner lamella is moderately wide, without vestibules. The hinge of the right valve consists of an anterior tooth which has a low anterior portion and a high, bifid posterior portion. The median bar is finely crenulate and is deepened into a rounded socket at the anterior end. The posterior tooth is large and squarish with three strong crenulations. The hinge of the left valve consists of a deep anterior socket, rounded antero-median tooth, finely denticulate median bar and a crenulate posterior socket. Other internal details could not be seen.

Remarks: These specimens are very similar to A. falloti Donze from the Upper Cenomanian of S. France, but the lateral longitudinal ribs are more rounded in A. falloti and the rib beneath the eye tubercle is less pronounced. A. falloti also has a more convex ventral margin. These differences are, however all relative and a separation is not thought possible at present.

Occurrence: This species occurs in the upper part of the Upper Cenomanian.

Family UNCERTAIN

Genus KRAUSELLA Ulrich, 1894

Type species: Krausella inequalis Ulrich, 1894.

Krausella ? minuta Van Veen, 1936

(Plate 29, figs. 7-11)

1936 Krausella minuta Van Veen: 176, pl.10, figs. 7-15.

1940 Krausella minuta Triebel; Bonnema: 115, pl.3, figs. 32-34.

1958 Krausella ? sp. 301 Oertli: 1563, pl.2, figs. 39-41.

1966 Sigillium ? minuta Van Veen; Gründel: 49, pl.8, figs. 40-41

Diagnosis: A species referred to the genus Krausella showing marked sexual dimorphism, an irregular sagittal plane and a flattened posterior dorso-lateral area.

Material: 479 valves and carapaces.

Measurements (mm)		Length	Height	Width
Female, left valve,	OS 10016	0.434	0.264	0.165
Male, left valve,	OS 10019	0.472	0.253	0.165

Description: Valves small, strongly calcified, sub-oval in lateral view. The dorsal margin has a convex anterior half with a straighter posterior half. The position of greatest height lies at about mid-length in the left valve but just behind 1/3 length in the right valve. The ventral margin is gently convex in the left valve, but straight to weakly concave in the right valve with a short oblique postero-ventral margin. The posterior margin forms a right angled point at ¼ height in the right valve, but has a rounded margin with the posterior extremity at ½ height in the left valve. The anterior margin is rounded. The left valve overlaps the right around the entire margin except at the posterior end of the right valve where there is no overlap. The lateral surface is smooth and strongly inflated with the greatest width at mid-length. The lateral surface beneath the straight part of the dorsal margin is somewhat flattened particularly in males. The sagittal plane is not flat since the left valve extends postero-dorsally and in the mid-ventral region. The right valve is incised along the dorsal margin.

The hinge of the right valve consists of a low, elongate, crenulate anterior tooth, a smooth median groove and a posterior crenulate tooth which continues as a ridge around the posterior end of the valve. This ridge fits into a corresponding shelf in the left valve.

The marginal zone is rather narrow, without vestibules. Other internal details could not be seen.

Males are more elongate and less high than females and have a more drawn out posterior part of the valves.

Remarks: This species appears to have been erected by Van Veen (1936) but it has frequently been credited to Triebel 1936. Gründel (1966) referred it to the genus *Sigillium* Kusnetsova but this is such an imperfectly known genus that it seems better to retain it in *Krausella* for the present.

Occurrence: This species can be found throughout the Cenomanian.

Genus *SAIDA* Hornibrook, 1952

Type species: *Saida truncata* Hornibrook, 1952

Saida cf. *S. nettgauensis* Gründel, 1967

(Plate 29, figs. 5,6; Plate 35, fig. 6)

? 1966 *Saida nettgauensis* Gründel: 49, pl.8, figs. 36,37.

Diagnosis: A species of the genus *Saida* with a short dorsal rib, concave ventral margin and a pointed ventro-lateral ala.

Material: 255 valves

Measurements (mm)		Length	Height	Width
Left valve,	OS 10021	0.330	0.200	0.100
Right valve,	OS 10022	0.319	0.187	0.100

Description: Valves small, rectangular, with a compressed outline in dorsal view. Dorsal margin straight, ventral margin concave in the middle but otherwise parallel to the dorsal margin. Posterior margin obliquely rounded with the posterior extremity at 2/3 height. Anterior margin semicircular in the left valve but obliquely rounded in the right valve. There is a very weak anterior marginal rib which is set just in from the anterior margin and joined to the latter by a series of small cross ribs. A short dorsal rib is developed just beneath the posterior end of the dorsal margin. Vertically beneath this is the ventro-lateral process which does not obscure the ventral margin in lateral view. There is a narrow flattened marginal rim around the valves, this is smooth, but the rest of the valve surface bears large rounded pits. In dorsal view the carapace is triangular with the greatest width across the ventro-lateral process at 2/3 length, the posterior is laterally compressed.

The hinge of the right valve consists of two very small terminal teeth separated by a smooth median groove. The hinge of the left valve is complementary.

The marginal zone is moderately wide, without vestibules. Other internal details could not be seen.

Remarks: This species strongly resembles *S. nettgauensis* Gründel 1966, from the Albian of Germany, but differs by being smaller, relatively more elongate and having a concave ventral margin. Several transitional forms can be found, however, in the British Albian and until further material has been studied it is unwise to erect a new species.

Occurrence: This species can be found throughout the Cenomanian of Southern England.

Order MYODOCOPIDA Sars, 1866

Suborder CLADOCOPINA Sars, 1866

Family POLYCOPIDAE Sars, 1866

Genus POLYCOPE Sars, 1866

Type species: Polycope orbicularis Sars, 1866

Polycope bluebellensis n.sp.

(Plate 29, fig. 2; Plate 37, fig. 2)

Derivation of name: After Blue Bell Hill (Kent) - the type locality.

Diagnosis: A species of Polycope with two anterior marginal spines, one posterior marginal spine, and a row of four spines on the dorso-lateral surface. There is also a weak anterior marginal rib.

Holotype: A right valve, OS 10024. Sample BB8, 13.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: 2 valves, OS 10025 and OS 10026 from the same horizon and locality.

Other material: 12 valves.

Measurements (mm)		Length	Height	Width
Holotype, right valve,	OS 10024	0.450	0.340	0.135
Paratype, left valve,	OS 10025	0.400	0.340	0.135

Description: Valves almost round in lateral view with a short straight hinge margin. The lateral surface is inflated, particularly dorsally. The greatest width lies above the middle of the valves. The anterior and posterior extremities of the valves bear triangular spines, and a further marginal spine is found antero-dorsally. On the lateral surface just beneath the hinge margin are two conical spines, another spine occurs posterior to these and a further spine is found on the lateral surface just above the posterior spine. A very weak rib begins beneath the antero-dorsal spine and runs parallel to the margin. It becomes stronger beneath the anterior spine and its sides become fluted. This rib ends antero-ventrally. The rest of the valve surface is smooth.

The hinge consists of a short bar in the right valve and an indistinct groove in the left valve. Other internal details could not be sēen.

Remarks: The presence and distribution of the spines in this species make it easily recognisable. P. luxuriosa Herrig 1964 has several spines but has an ornamented lateral surface. The presence of two anterior and one posterior marginal spines suggests that the species might belong to the genus Thaumatocypris Müeller, but in that genus the spines are much longer. The central muscle scars might place the species with certainty but unfortunately they cannot be seen and so the species is placed in the genus Polycope on the basis of its small size and general form.

Occurrence: This species has been found in Middle and Upper Cenomanian samples of soft easily processable chalk. As with other Polycope species it is easily broken and is therefore not found in harder samples.

Polycope delicata n.sp.

(Plate 29, fig. 3; Plate 37, fig. 1)

Derivation of name: Referring to the delicate nature of the ornament in this species.

Diagnosis: A species of Polycope with a marginal frill extending all around the valves except for a short distance along the dorsal margin. Surface strongly reticulate with some of the intervening riblets raised into high ridges.

Holotype: A left valve, OS 10027. Sample BB8, 13.5m. below the base of the Plenus Marls, Upper Cenomanian, Blue Bell Hill, Kent.

Paratypes: 9 valves OS 10028 to OS 10036 from the same horizon and locality.

Other material: 83 valves.

Measurements (mm)		Length	Height	Width
Holotype, left valve,	OS 10027	0.308	0.253	0.105
Paratype, right valve,	OS 10028	0.330	0.280	0.105

Description: Valves almost round in lateral view with slightly flattened dorsal margin. At 1/3 length along the dorsal margin a thin marginal frill begins. This continues around the anterior, ventral and posterior margins and ends after turning in onto the lateral surface, just below the dorsal margin at the posterior. The surface of the valves is strongly reticulate, adjoining the marginal frill are two concentric rows of fossae. In the central area the muri of some of the fossae are raised into high ridges. Four or five such ridges usually run parallel to, and beneath, the posterior termination of the marginal frill. Towards the dorsal margin the muri form spines rather than ridges.

The hinge is simple. The dorsal margin of both valves is straight and flattened to form a bar. There appears to be a very weak groove along the lower edge of the bar in the left valve which suggests that the bar in the right valve fits beneath it.

The marginal zone is very narrow. Marginal pores cannot be seen. There is a shallow pit on the internal surface which presumably houses the muscle scars, but no scars could be seen.

Remarks: P. oweni Kaye, 1965 is larger than P. delicata and lacks the marginal frill and the raised ridges in the reticulation, but it does have the same type of hinge. P. luxuriosa Herrig, 1964 from the Maastrichtian of Rugen. has a marginal rib but this is not raised into a frill. Its surface is dominated by ridges and it has a reduced reticulation when compared to P.delicata. P. luxuriosa also has long marginal spines.

Occurrence: P. delicata occurs in the Middle and Upper Cenomanian. It appears to be fairly common, but its appearance in samples is governed by the hardness of the chalk. It is most common in residues from soft easily processed chalk, any difficulty in processing results in its destruction.

Polycope nuda Kaye, 1965

(Plate 37, fig. 3)

1965c Polycope nuda Kaye: 221, 222, pl.4, figs. 1-3.

Diagnosis: A species of Polycope with a sub-round outline, and a smooth, to weakly ornamented surface.

Material: 18 valves.

Measurements (mm)		Length	Height	Width
Right valve,	OS 10037	0.395	0.341	0.143

Description: Outline sub-round, with a flattening along the hinge margin. Some specimens diverge from the rounded outline by being less convex along the postero-ventral margin. Valves moderately inflated. The lateral surface may be smooth but in most specimens there are weak, concentric ribs around the margins of the valves. These ribs are usually more obvious around the anterior margin.

The hinge consists of a bar in the left valve which fits into a groove in the right valve.

Remarks: This species was first described by Kaye 1965c. The Cenomanian specimens are similar to Kaye's material but they are considerably smaller.

Occurrence: Rare, but can be found throughout the Cenomanian.

Polycope oweni Kaye, 1965

(Plate 29, fig. 4; Plate 37, fig. 4)

1965c Polycope oweni Kaye: 222, 223; pl.4, figs. 11-15.

Diagnosis: A species of Polycope with weak concentric ribs on the lateral surface and numerous small spines which are more strongly developed along the ventral margin.

Material: 23 valves.

Measurements (mm)		Length	Height	Width
Left valve,	OS 10039	0.352	0.209	0.083
Right valve,	OS 10038	0.363	0.313	0.086

Description: Outline sub-round, with a slight flattening along the hinge margin. Valves moderately inflated. The lateral surface bears a series of weak concentric ribs which enclose a weakly reticulate area in the centre. Spines may be present along the ribs but between the ribs there are numerous very small protuberances. Small spines are present around most of the margin but they become larger and thicker along the ventral margin.

The hinge consists of short bars in each valve which overlap each other. In the right valve there is a groove beneath the hinge bar. The right valve possesses a contact groove around its entire inner margin which accepts the edge of the left valve. Other internal details cannot be seen.

Remarks: Kaye (1965c) describes this species as having a rather variable ornament with some specimens being reticulate and some being spinose. The Cenomanian representatives appear more like the spinose variants (pl.4, fig.11) of Kaye, but they also have small marginal spines.

Occurrence: Cenomanian, but only from easily processed samples.

CHAPTER 6

STATIGRAPHY

Marked changes in the ostracod fauna occurred during the Cenomanian period in Southern England. Changes were not only at the species level but many genera also disappeared, eg. Dolocytheridea, Homocythere, Platycythereis, Protocythere and Schuleridea. It must be noted that some of these genera e.g. Platycythereis can be found in post-Cenomanian deposits from other areas but in Southern England their disappearance is abrupt and occurs at the same level in all the areas studied. Several new genera appear during the Cenomanian e.g. Amphicytherura, Curfsina?, Idiocythere, Imhotepia, Limburgina?, Loxoconcha?, Oertliella, Trachyleberis and Xestoleberis. These genera have all been recorded from Upper Cretaceous deposits. Oertliella, Trachyleberis and Xestoleberis also have recent representatives. The main changes in the Ostracoda occurred near the base of the Stage, at the level of the mid-Cenomanian non-sequence and in the middle of the Plenus Marls (junction between beds 3 and 4). However, other changes occur between these three levels, and a useful stratigraphy based on Ostracoda can be drawn up (Fig. 6 : 10). As in most Cretaceous sequences the Trachyleberididae are the most important group since they are common, they evolved rapidly and are strong enough to be preserved, and to withstand processing. The following account is restricted to those species which are regarded as being stratigraphically useful, and the zones referred to are those defined by Carter and Hart (1977) as benthonic foraminiferal zones (Figs. 2 : 1 and 6 : 1).

Comparatively few changes occur at the Albian/Cenomanian boundary. A few metres below the top of the Albian Isocythereis

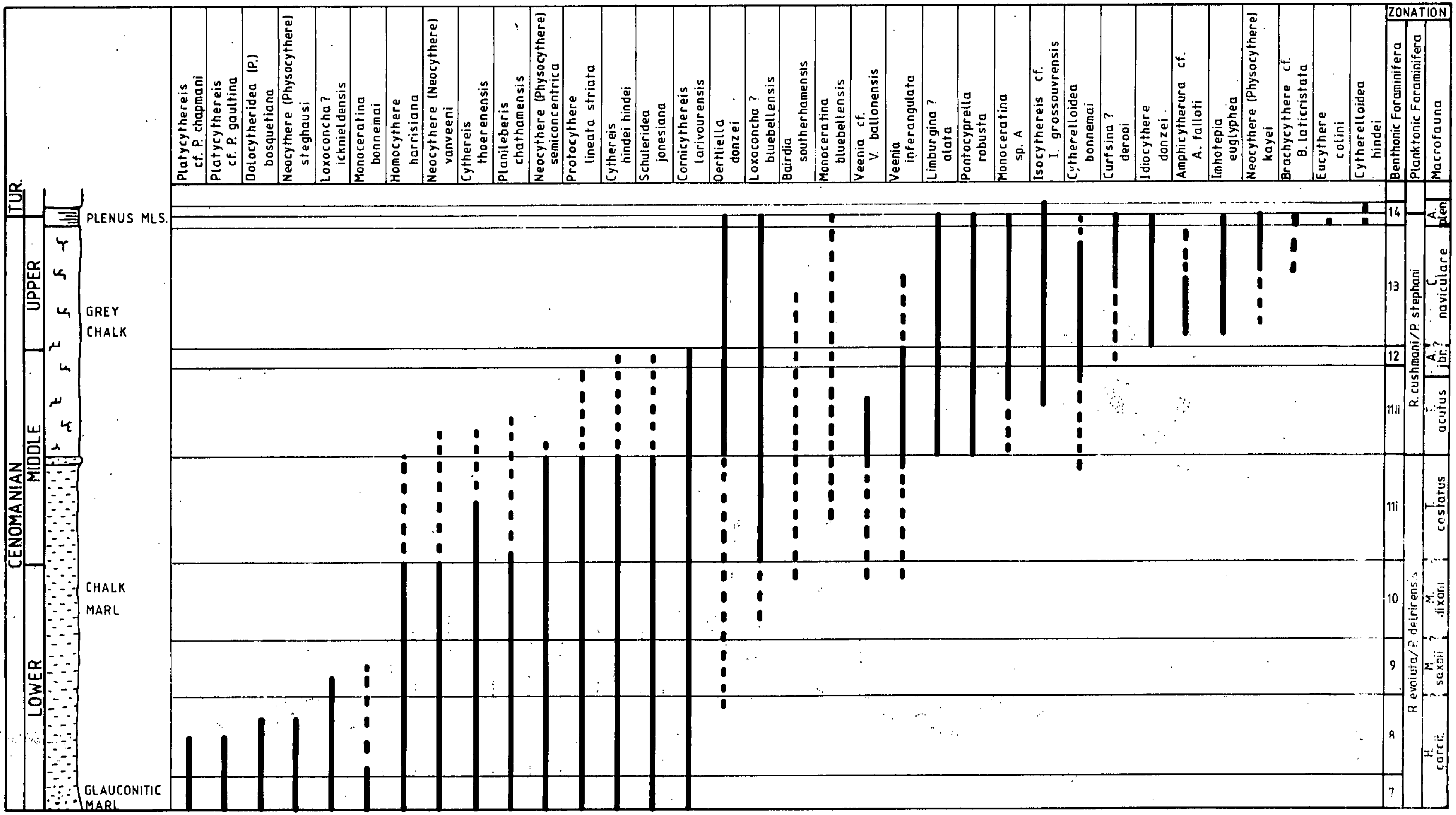


Fig.6:1 Stratigraphic distribution of selected species of Ostracoda from the Cenomanian of Southern England

fissicostis Triebel, I. fortinodis Triebel, Eucythere solitaria Triebel and E. trigonalis (Jones and Hinde) disappear, (Mertens, 1956), whilst at the boundary itself Cytherelloidea knaptonensis Kaye, Neocythere (P.) tenuis, N. (P.) lingenensis Mertens and Homocythere lapparenti (Damotte and Grosdidier) disappear from the British succession. Species such as Cytherelloidea stricta, Schuleridea jonesiana, Dolocytheridea (P.) bosquetiana, Platycythereis cf.P.gaultina, P. cf.chapmani, Cythereis thoerenensis, C. hirsuta, C. larivourensis, C. hindei hindei, C. luermannae s.l., Homocythere h. harrisiana, Neocythere (N.) vanveeni, N. (P.) semiconcentrica and N. (P.) steghausi are present in both the Albian and Cenomanian of Southern England. Of these species, D. (P.) bosquetiana, P.cf.P.gaultina, P.cf.P.chapmani and N. (P.) steghausi are only present in the lowest few metres of the Cenomanian but at this level they are usually very common and are therefore useful stratigraphically.

There are several new appearances at the base of the Cenomanian although further work may reveal that some of the species extend into the Albian. Some of the more important appearances are of Cytherella medwayi, Cytherelloidea globosa, Loxoconcha ? icknieldensis, Monoceratina bonnemai and M. herrigi. Of these, C. globosa and M. bonnemai have very limited stratigraphic ranges, being found only in the Glauconitic Marl and succeeding few metres of the Cenomanian. L. ? icknieldensis is a very useful species because it occurs in large numbers throughout the lower part of the Lower Cenomanian (it disappears just above the base of Zone 9). Oertliella donzei appears near the base of the Cenomanian at Culver Cliff (top of Zone 8) but further north, towards Pitstone and Barrington, its first appearance becomes progressively later so that at Barrington it first appears above the mid-Cenomanian non-sequence. Loxoconcha ? bluebellensis important species because it is common throughout the Middle and

Upper Cenomanian. It generally makes its first appearance at the base of the Middle Cenomanian but at Glyndebourne and Blue Bell Hill, it can be found lower than this, in Zone 10.

Important changes occur near the level of the mid-Cenomanian non-sequence. Many species disappear at this level, or become much less abundant and disappear a few metres above the non-sequence, e.g. Cythereis hindei hindei, C.luermannae s.l., C.thoerenensis, Homocythere harrisiana, Neocythere (N.) vanveeni, N.(P.) semiconcentrica, Planileberis chathamensis, P. sandersi, Protocythere lineata striata and Schuleridea jonesiana. In the southern sections, namely Culver Cliff, Southerham and Blue Bell Hill H.hharrisiana disappears somewhat earlier (at the top of Zone 10), whilst N. (N.) vanveeni also disappears at this level in the Southerham and Culver Cliff sections. It is interesting to note that Veenia inferangulata always appears at the same level at which H.hharrisiana dies out. V. inferangulata is often very abundant, but its range in Southern England is rather short. It extends up to the base of the Upper Cenomanian, or occasionally just into the Upper Cenomanian. V. inferangulata is usually found in association with V. cf. ballonensis, but this latter species is not so abundant and is not always present. Monoceratina bluebellensis and Bairdia southerhamensis may also be found throughout the Middle Cenomanian and M. bluebellensis extends up to the top of the Cenomanian. However, these two species are not always present in samples from these levels and hence their value is limited. Two species, Limburgina ? alata and Pontocyprella robusta, make their first appearance just above the mid-Cenomanian non-sequence. P. robusta is often common and is a useful indicator of post mid-Cenomanian non-sequence strata. Monoceratina sp.A. may also appear at this level but its distribution is rather sporadic. Cornicythereis larivourensis is a very useful species because it is common throughout the Lower and Middle Cenomanian and it dies out at the base of the Upper Cenomanian.

Several species make their first appearance during the Upper Cenomanian. Isocythereis cf I.grossouvrensis appears towards the top of the Middle Cenomanian but in the Culver Cliff succession a few specimens have also been found at the base of the Middle Cenomanian. Idiocythere donzei and Curfsina ? derooi both appear at the base of the Upper Cenomanian whilst Amphicytherura cf. falloti, Imhotepia euglyphea and Neocythere (P.) kayei first appear somewhat above the base of this sub-stage. Pseudobythocythere colini often becomes quite common through the Upper Cenomanian but this species can be found as low as the top of the Lower Cenomanian. Similarly Cytherelloidea bonnemai is often common in the Upper Cenomanian but occasional specimens can be found from the lower Middle Cenomanian.

Most of the species which are present in Zone 13 can also be found in the lower part of the Plenus Marls (Beds 1 - 3). Brachycythere cf.B.laticristata also occurs at this level and may also be found at the top of Zone 13. Eucythere colini appears to be restricted to Bed 1 of the Plenus Marls and here it is often extremely common. It has not been found beneath or above this horizon in Southern England. At the top of Bed 3 (= the sub Bed 4 erosion surface) a marked change occurs in the ostracod fauna. Most species disappear at this level and only species of the Cytherellidae, Isocythereis cf. I.grossouvrensis and Monoceratina herrigi can be found above this level in the Plenus Marls. Cytherelloidea hindei becomes common above Bed 3 but specimens of this species may also be found in Beds 1 - 3 of the Plenus Marls and occasionally in the Middle Cenomanian. Occasional specimens of Cythereis sp.A. also occur above Bed 3 of the Plenus Marls.

Samples from above the Plenus Marls are generally too hard to be processed. However, one sample from Buckland Newton revealed a similar reduced fauna to that from the top of the Plenus Marls. It contained species of Cytherella, Monoceratina cf. M. umbonata, M. herrigi and numerous specimens of Cytherelloidea hindei.

Species of Cytherella are not very useful stratigraphically since most of them can be found throughout the Cenomanian. Some variation in relative abundance may be observed, however, with C. cf. C. truncata and C. medwayensis being more abundant below the mid-Cenomanian non-sequence, whilst C. cantabrigensis and C. aff. C. contracta become more common above the mid-Cenomanian non-sequence. C. cf. C. truncata, in fact, has not been found in the upper part of Zone 13 nor in the Plenus Marls. Cytherelloidea stricta and Cytherelloidea kayei are both present throughout the Cenomanian but C. stricta is more common beneath the mid-Cenomanian non-sequence whilst C. kayei is more common above the non-sequence.

Species of the Cytheruridae are generally long ranging and hence their stratigraphic value is limited. However, Hemiparacytheridea minutissima is only common in the Lower Cenomanian and has not been found above the base of the Upper Cenomanian. Conversely Eucytherura (E.) longisculpta has only been found in the Middle and Upper Cenomanian.

The above stratigraphic distributions are summarised in Fig. 6 : 1. With reference to this diagram the stratigraphy of each section studied may now be analysed.

Buckland Newton

The base of this section is known to lie some way above the mid-Cenomanian non-sequence (Kennedy 1970, Carter and Hart, 1977). The Ostracoda agree completely with this observation, but species

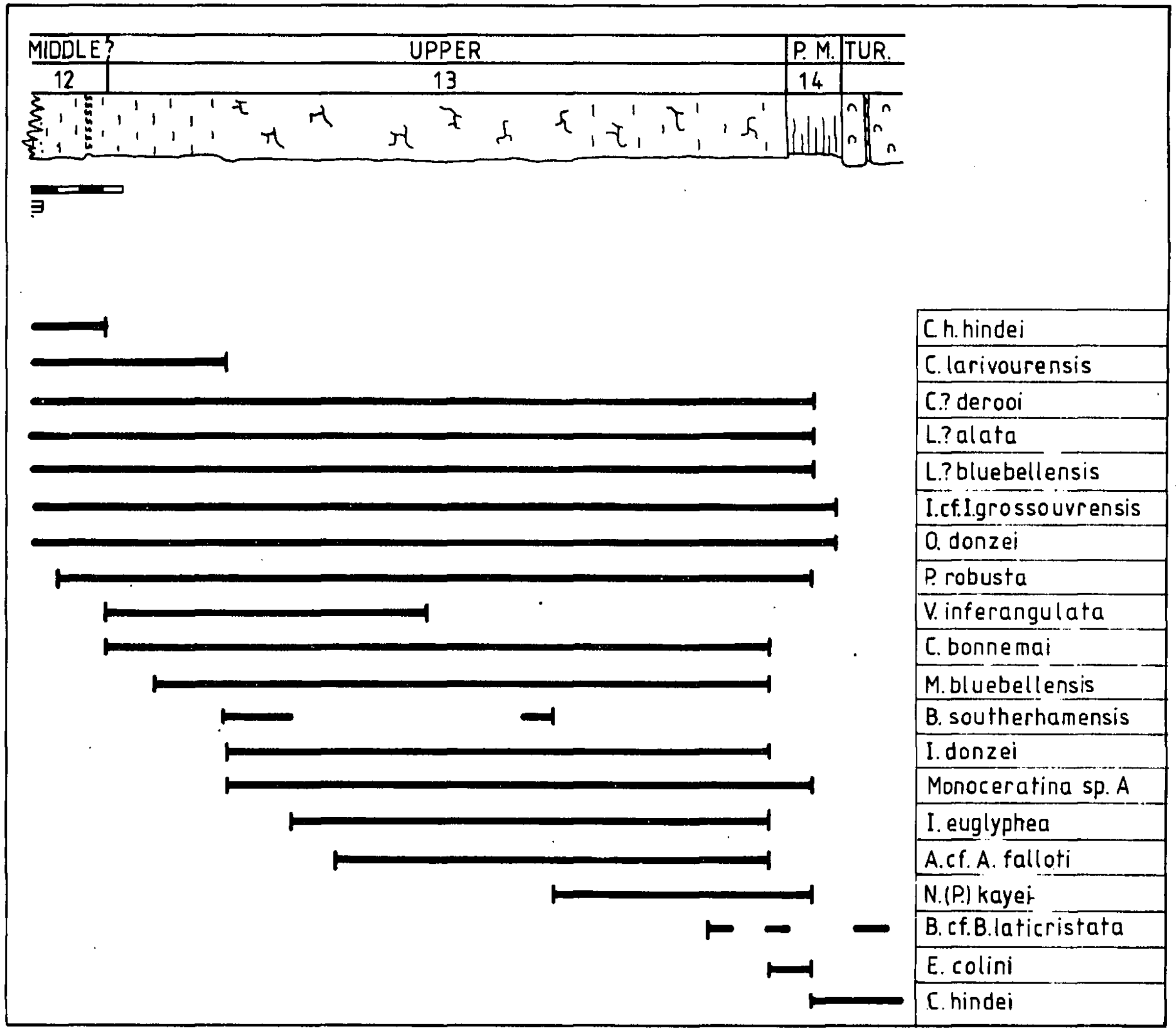
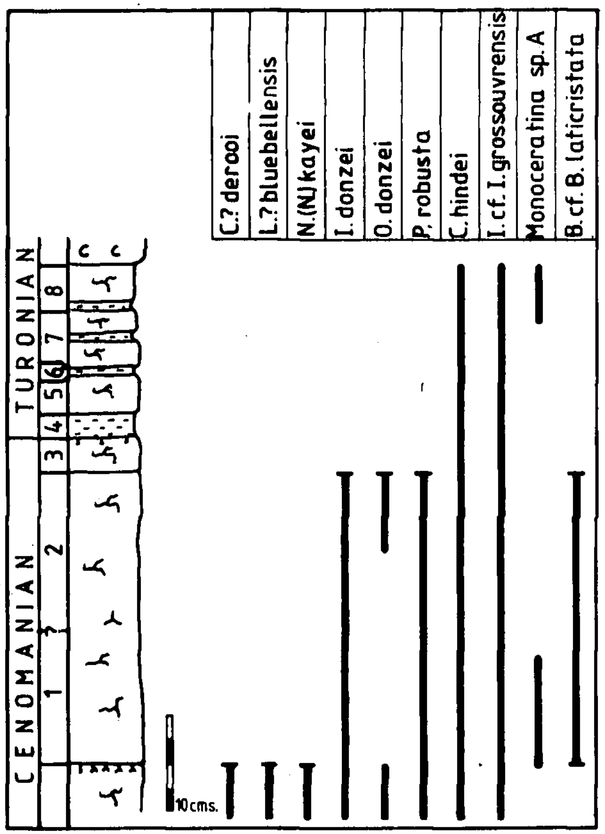


Fig. 6:2 Ostracod stratigraphy of the Buckland Newton section, Dorset.

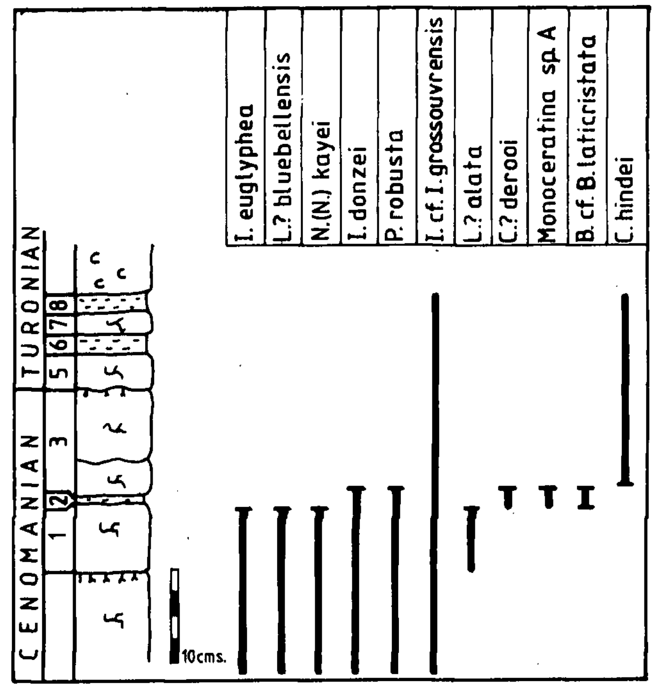
such as Cythereis hindei hindei, Cornicythereis larivourensis and Veenia inferangulata can be found in the lower part of the section, thus indicating a Middle Cenomanian age for the lowest few metres. I.cf.I.grossouvrensis and C. ? derooi can be found throughout the section but I. donzei and C. bonnemai first appear about 8 m. above the base. Thus, this section consists mainly of Upper Cenomanian chalk. Towards the top of the section the Plenus Marls can be seen. Bed 1 was sampled and contained numerous specimens of Eucythere colini. Above the sub Bed 4 erosion surface Ostracoda are rare. Apart from species of Cytherella the only species found were O. donzei, I.cf.I.grossouvrensis, M. umbonatoides and C. hindei. A single sample from a marl seam in the succeeding Turonian chalk revealed a similar reduced fauna with numerous specimens of Cytherella spp.& Monoceratina spp.& also several specimens of C. hindei. The distribution of the total Ostracoda fauna from this section is shown in Enclosure 1. Fig.6 : 2 shows a comparison of the stratigraphy based on Ostracoda and Foraminiferida.

Shillingstone

Samples were obtained from individual beds of the Plenus Marls and from the top of the Grey Chalk just beneath the Plenus Marls. From just beneath the Plenus Marls specimens of Neocythere (P.) kayei and Cytherelloidea hindei indicate a position near the top of the Upper Cenomanian. Beds 1 and 2 show similar faunas with numerous specimens of Brachycythere cf.B.laticristata. No specimens of Eucythere colini have been found from this locality. Several species disappear at the top of bed 2, most noteable being the disappearance of Idiocythere donzei, Pontocyprella robusta and Brachycythere cf.B. laticristata. Above bed 2 the fauna is very reduced and is made up of Cytherellas, Isocythereis cf.I.grossouvrensis and Cytherelloidea hindei. A few specimens of Cythereis sp. A. have also been found



SHILLINGSTONE



PITSTONE

Fig. 6:3 Ostracod stratigraphy of the Plenus Marls - Shillingstone, Dorset and Pitstone, Herts. (Bed nos. after Jefferies 1962).

from Bed 6. Thus the Plenus Marls from Shillingstone display a typical ostracod fauna for this level (Fig.6:3) with a distinct division between the lower and upper beds.

Culver Cliff

Samples collected from Culver Cliff proved to be very difficult to process and hence only 7 samples from above the mid-Cenomanian non-sequence could be examined. The lower levels however were more marly and Ostracoda were obtained from most of these samples.

Cytherelloidea globosa, Monoceratina bonnemai, Neocythere (P.) steghausi and Loxoconcha? icknieldensis are all confined to the lowest 3 metres of the section which is represented by the Glauconitic Marl, whilst Platycythereis cf. P.gaultina, P.cf.P.chapmani and D. (P.)bosquetiana have not been recorded at all. This suggests that the basal beds of the Cenomanian are either condensed or, more likely, absent from this section (Fig. 6:4). This agrees with the foraminiferal zonation of this section given in Carter and Hart (1977). Oertliella donzei can be found all the way through this section and hence its first appearance is somewhat earlier than in other areas. Homocythere harrisiana and Neocythere (N.) vanveeni die out rather early in this sequence (at the top of Zone 10) and they are replaced at this level by Veenia cf.V.ballonensis and V. inferangulata.

At the top of the O. mantelliana band, Cythereis hindei hindei dies out, whilst Limburgina ? alata and Pontocyprella robusta make their first appearance. This level is correlated with the mid-Cenomanian non-sequence (Carter and Hart, 1977). Schuleridea jonesiana, Cythereis thorenensis and Planileberis sandersi however, can be found a few metres above this level. The distribution of Ostracoda in the few samples from above the mid-Cenomanian non-sequence compare well with the other sections (Figs.6:2-6:9). Only two samples from the

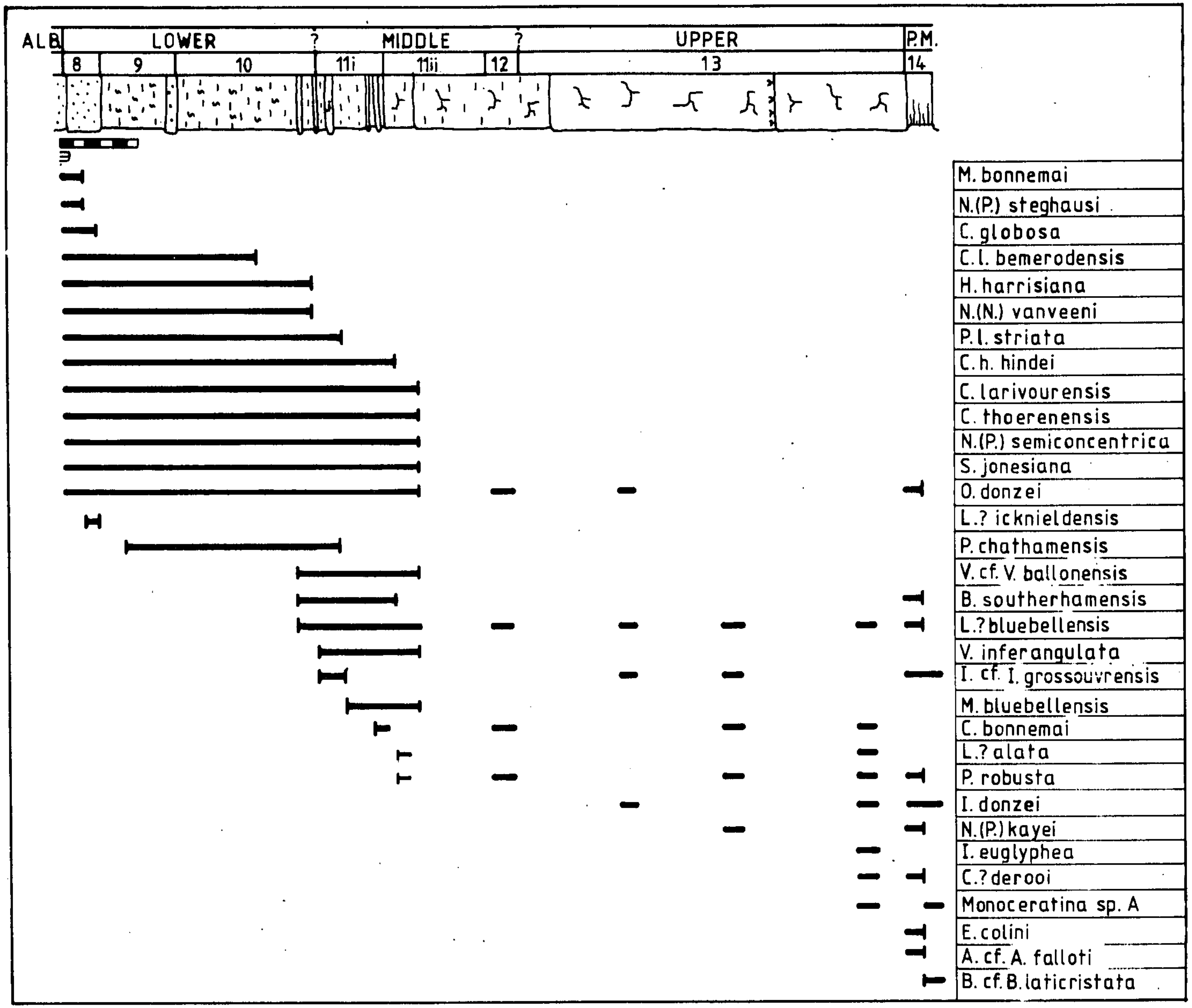


Fig.6:4 Ostracod stratigraphy of Culver Cliff, Isle of Wight.

Plenus Marls could be processed. The sample from Bed 1 contained a normal Upper Cenomanian fauna with Idiocythere donzei, Neocythere (P) kayei and numerous specimens of Eucythere colini. The following sample from Bed 2 revealed a similar fauna but with numerous specimens of Brachycythere cf. B. laticristata and no specimens of E. colini.

Pitstone

This section gives a complete sequence through the Cenomanian with the Plenus Marls and the Melbourn Rock at the top. Unfortunately the Upper Cenomanian samples were difficult to process and consequently they show reduced faunas. Foraminiferal zones were drawn up by M.B. Hart using the same samples used in this study.

At the base of the section quite long ranges are shown by Dolocytheridea bosquetiana, Neocythere (P.) steghausi, Platycythereis cf. P. gaultina and P. cf. P. chapmani (Fig. 6:5). This suggests that the lower part of this sequence is quite a lot thicker than at Culver Cliff. Loxoconcha ? icknieldensis also has a considerably longer range in the Pitstone section. Thus Zone 8 is rather thick in this section and this is corroborated by the foraminiferal evidence (Hart, pers. comm.). Oertliella donzei first appears in Pitstone at the top of Zone 9 whilst Loxoconcha ? bluebellensis appears just above the base of the Middle Cenomanian. At the base of the Totternhoe Stone Cythereis thoerenensis, C. hindei hindei, C. hirsuta and Homocythere h. harrisiana die out, whilst Veenia inferangulata and V. cf. V. ballonensis make their first appearance. Just above the Totternhoe Stone Neocythere (N.) vanveeni, N. (P.) semiconcentrica, Protocythere lineata striata, Planileberis sandersi and Schuleridea jonesiana die out whilst Pontocyprella robusta and Limburgina ? alata make their first appearances. The top of the Totternhoe Stone is marked by the mid-Cenomanian non-sequence and thus this level is extremely important in this section.

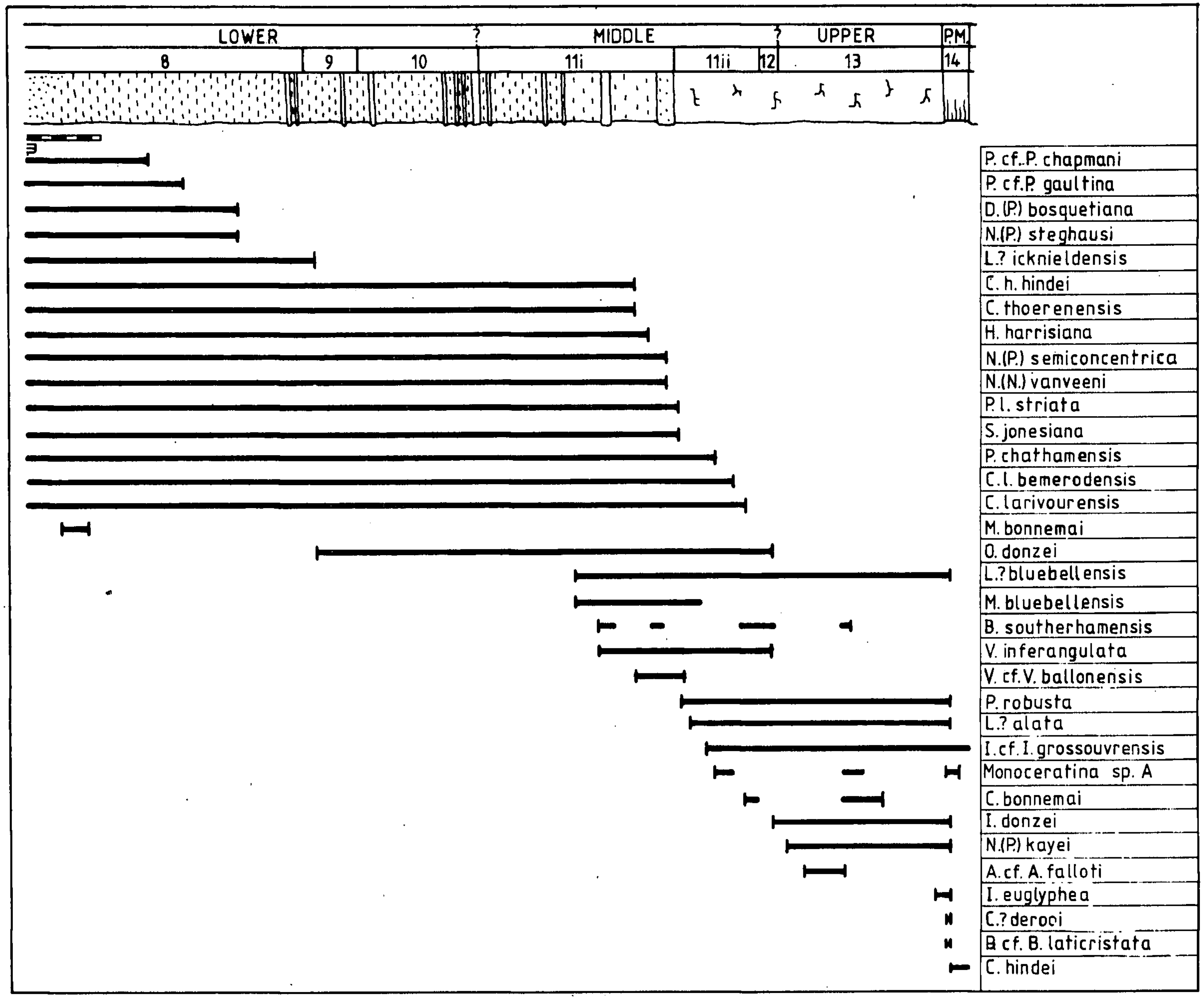


Fig. 6:5 Ostracod stratigraphy of Pitstone quarry, Herts.

About 8 m. above the mid-Cenomanian non-sequence Cornicythereis larivourensis and Veenia inferangulata die out. This level may be correlated with the top of the Middle Cenomanian or this may be a few metres higher (Hart pers. comm.). The ostracod fauna through the Upper Cenomanian is rather poor, but Isocythereis cf.I.grossouvrensis may be found from the top of the Middle Cenomanian onwards. Cytherelloidea bonnemai, Idiocythere donzei, Neocythere (P.) kayei and Amphicytherura cf.A falloti may also be found towards the top of the section.

The Plenus Marls were collected bed by bed except for Bed 4 which was absent. Bed 1 contained a fauna similar to that in the preceeding chalk. Bed 2 produced a large fauna with the noteable exceptions of Imhotepia euglyphea, Loxoconcha ? bluebellensis and Neocythere (P.) kayei which were present beneath this level. Bed 2 also contained several specimens of Brachycythere cf. B.laticristata The fauna from Beds 3 - 8 was much reduced but Cytherelloidea hindei and Cythereis sp.A. were present in these beds.

Attempts were made to process the overlying Melbourn Rock but this proved to be too hard and only specimens of Cytherella spp. were obtained.

Barrington

This section consists of Lower and Middle Cenomanian chalk and good ostracod faunas were obtained throughout (see Enclosure 4, and Fig. 6:6).

At the base of the section Dolocytheridea (P.) bosquetiana, Platycythereis cf.P. gaultina, P.cf.P.chapmani and Neocythere (P.) steghausi were only found in the lowest one or two samples whilst Loxoconcha ? icknieldensis was only found in the lowest 4 m. As in the Culver Cliff section this indicates a reduced or absent lower part

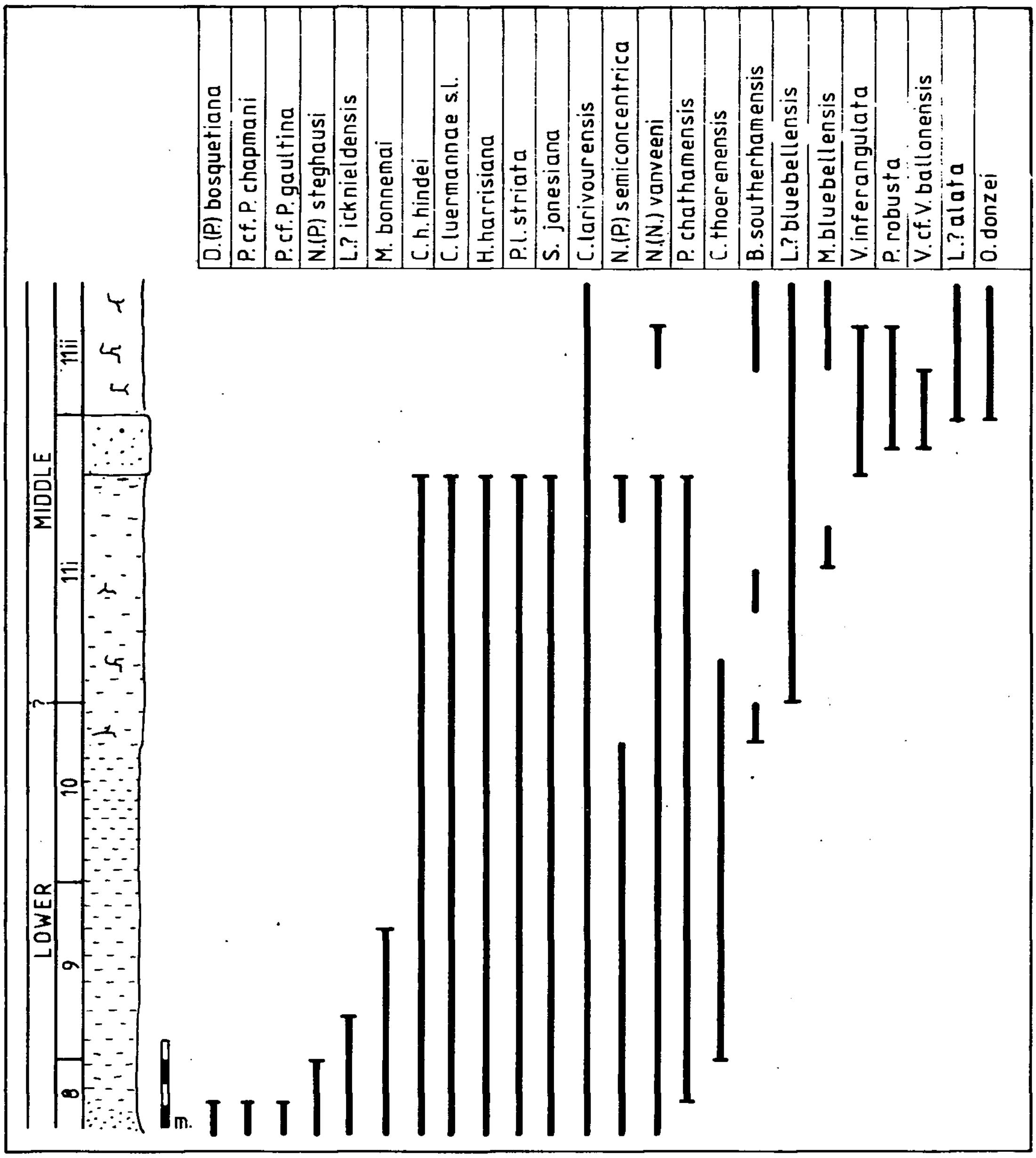


Fig. 6:6 Ostracod stratigraphy of the Barrington section, Cambridgeshire.

of the Cenomanian. This agrees with the foraminiferal data of Hart (1973). Loxoconcha ? bluebellensis first appears in this section at the base of the Middle Cenomanian but Oertliella donzei does not appear until above the mid-Cenomanian non-sequence.

Just below the mid-Cenomanian non-sequence Cythereis hindei hindei, C. luermannae s.l., Homocythere h. harrisiana, Planileberis chathamensis, Protocythere lineata striata and Schuleridea jonesiana all die out, whilst Veenia inferangulata, V. cf. V. ballonensis and Pontocyprella robusta make their first appearance. Limburgina ? alata also appears a few metres above the mid-Cenomanian non-sequence, but the section does not extend high enough for Isocythereis cf. I. grossouvrensis to be found, nor for Cornicythereis larivourensis to die out. Upper Cenomanian chalk is therefore not quite reached.

Blue Bell Hill

The main section from this quarry consists of Middle and Upper Cenomanian chalk, but 3 samples from the Lower Cenomanian were also collected from a nearby quarry.

The samples from the lower section have been dated as Zone 10 by Hart (pers. comm.), but they do contain Loxoconcha ? bluebellensis Bairdia southerhamensis and Monoceratina bluebellensis which indicates that they come from near the top of this zone (Fig. 6:7).

The base of the main section displays the O. mantelliana band. The ostracod fauna from this level reveals that Homocythere h. harrisiana is absent but Veenia inferangulata and V. cf. V. ballonensis are both present. At the mid-Cenomanian non-sequence Neocythere (N.) vanveeni and N. (P.) semiconcentrica both disappear whilst Limburgina ? alata and Monoceratina sp. A. make their first appearance. Cythereis thoerenensis, C. hindei hindei, Planileberis chathamensis, P. sandersi, Protocythere lineata striata and

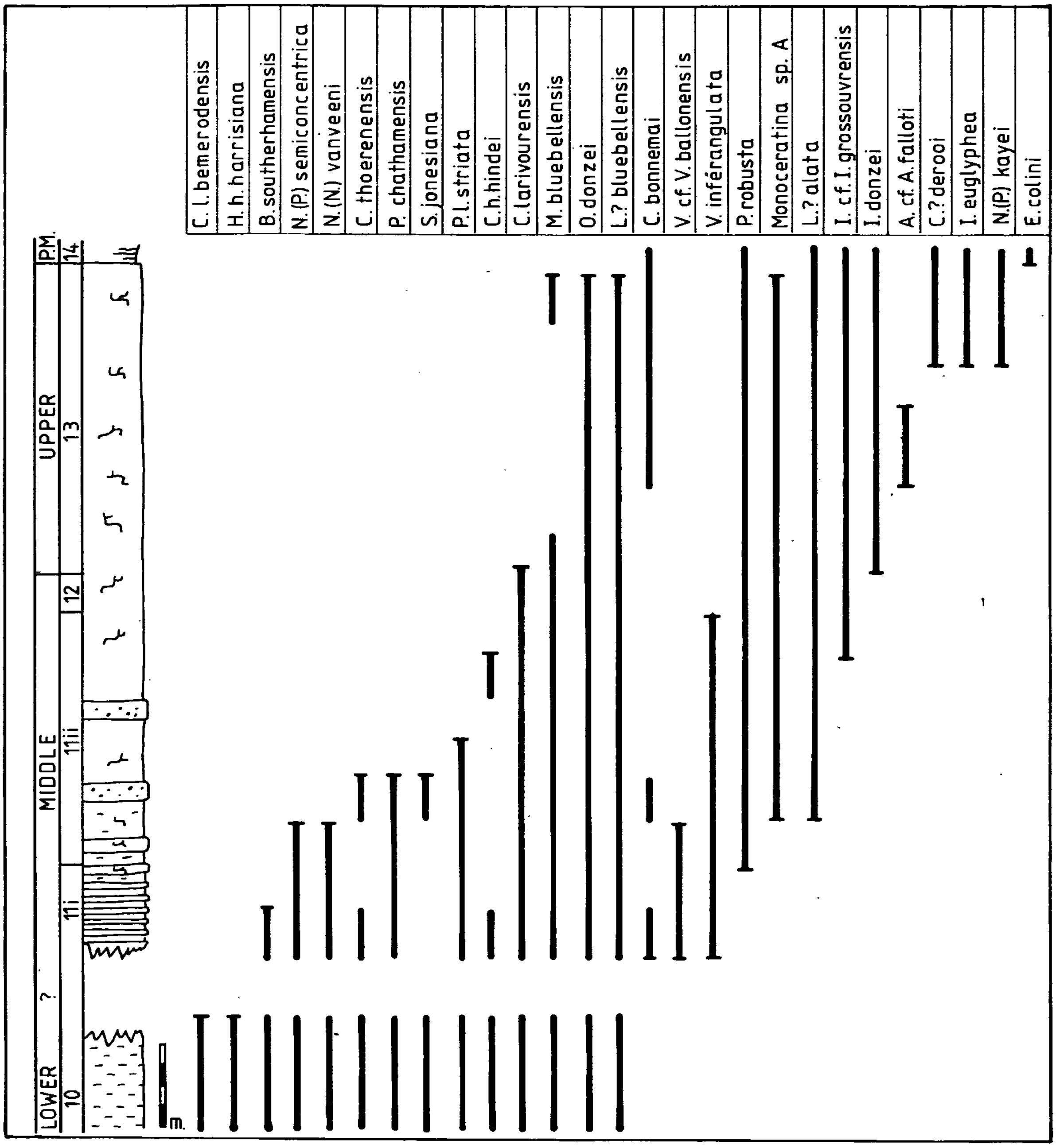


Fig.6:7 Ostracod stratigraphy of the Blue Bell Hill section, Kent.

Schuleridea jonesiana all die out just above the mid-Cenomanian non-sequence. A little higher up the sequence Cornicythereis larivourensis dies out at the point where Idiocythere donzei makes its first appearance. This point is regarded as the top of the Middle Cenomanian and this level is confirmed by the Foraminiferida (Hart, pers. comm.), (Fig.6:7). Just below this level Isocythereis cf.I.grossouvrensis makes its first appearance. In this section Curfsina ? derooi first appears 3 m. below the Plenus Marls at the point where Imhotepia euglyphea and Neocythere (P.) kayei also make their first appearances. Bed 1 of the Plenus Marls was sampled and produced numerous specimens of Eucythere colini amongst a fauna which was otherwise similar to that from preceeding samples.

Glyndebourne

This is a borehole section through the Lower Cenomanian. The samples were easy to process and good faunas were therefore obtained throughout (Enclosure 6).

Two samples from the underlying Albian were examined, and apart from species which can be found in the Cenomanian these samples also contained Homocythere Lapparenti and Eucythere trigonalis. At the base of the Cenomanian Platycythereis cf.P.gaultina and P.cf.P.chapmani were only present in the lowest 2 m. whilst Dolocytheridea (P.) bosquetiana, Monoceratina bonnemai and Neocythere (P.) steghausi only occur in the lowest 4 m. Similarly Loxoconcha? icknieldensis dies out only 8 m. into the Cenomanian. In Glyndebourne, as in Barrington and Culver Cliff, therefore, the lowest beds of the Cenomanian appear to be absent when compared to the Pitstone section. Again this is confirmed by the Foraminiferal evidence (Hart pers. comm.). Oertliella donzei appears at the base

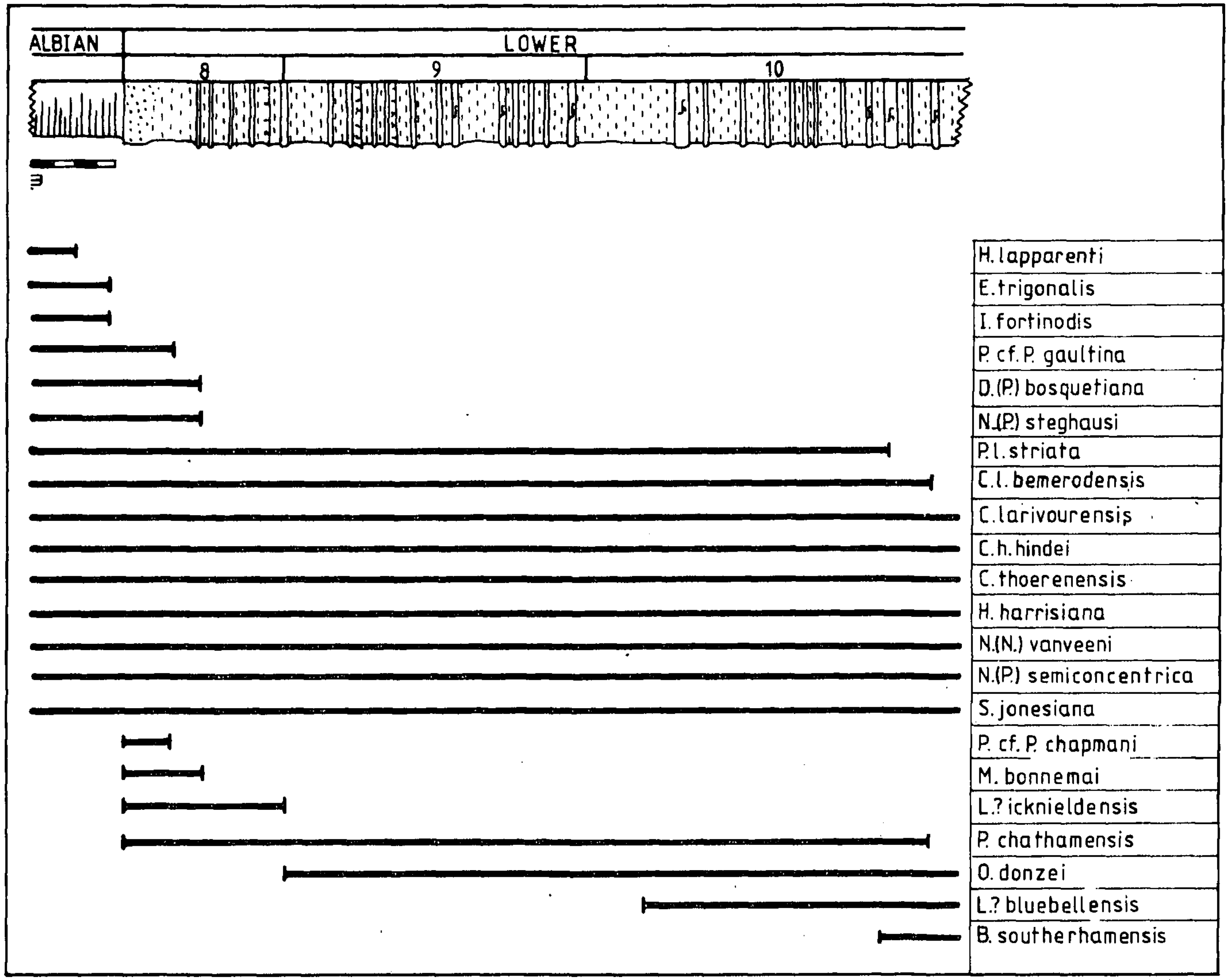


Fig. 6:8 Ostracod stratigraphy of the Glyndebourne borehole, Sussex.

of Zone 9 in this section which is earlier than in Pitstone or Barrington but it does appear at this level in Culver Cliff. The foraminiferal evidence (Hart pers. comm), shows that the top of this section is of lower Cenomanian age, but Loxoconcha ? bluebellensis which is normally restricted to the Middle and Upper Cenomanian can be found in the top 16 m. here (Fig. 6:8).

Southerham

This section extends from the top of the Lower Cenomanian to the base of the Plenus Marls. Unfortunately samples from the lower part of the Upper Cenomanian were difficult to process and consequently show reduced ostracod faunas. The lower part of this section contains an unusual ostracod fauna. The lowest sample in particular contains several species which have not been recorded from elsewhere, e.g. Homocythere ornata, Protocythere siddiquii. This sample also contains the last occurrence of Planileberis chathamensis, Homocythere h. harrisiana and Neocythere (N.) vanveeni, even though there is at least a further 8 m. of chalk beneath the mid-Cenomanian non-sequence. Veenia inferangulata, V. cf. V. ballonensis Oertliella donzei and Loxoconcha ? bluebellensis are all present from the base of this section. The only change which occurs in the Ostracoda at the mid-Cenomanian non-sequence is the appearance of Pontocyprella robusta. Just above the non-sequence Cythereis hindei hindei, C. thoerenensis, Planileberis sandersi, Neocythere (P.) semiconcentrica and Veenia cf. V. ballonensis disappear whilst Limburgina ? alata and Monoceratina sp.A. make their first appearance. Higher up the succession Cornicythereis larivourensis disappears at the point where Isocythereis cf. I. grossouvrensis and Curfsina ? derooi first appear. This level is taken to be the top of the Middle Cenomanian and this agrees with the foraminiferal zonation (Hart pers. comm.)

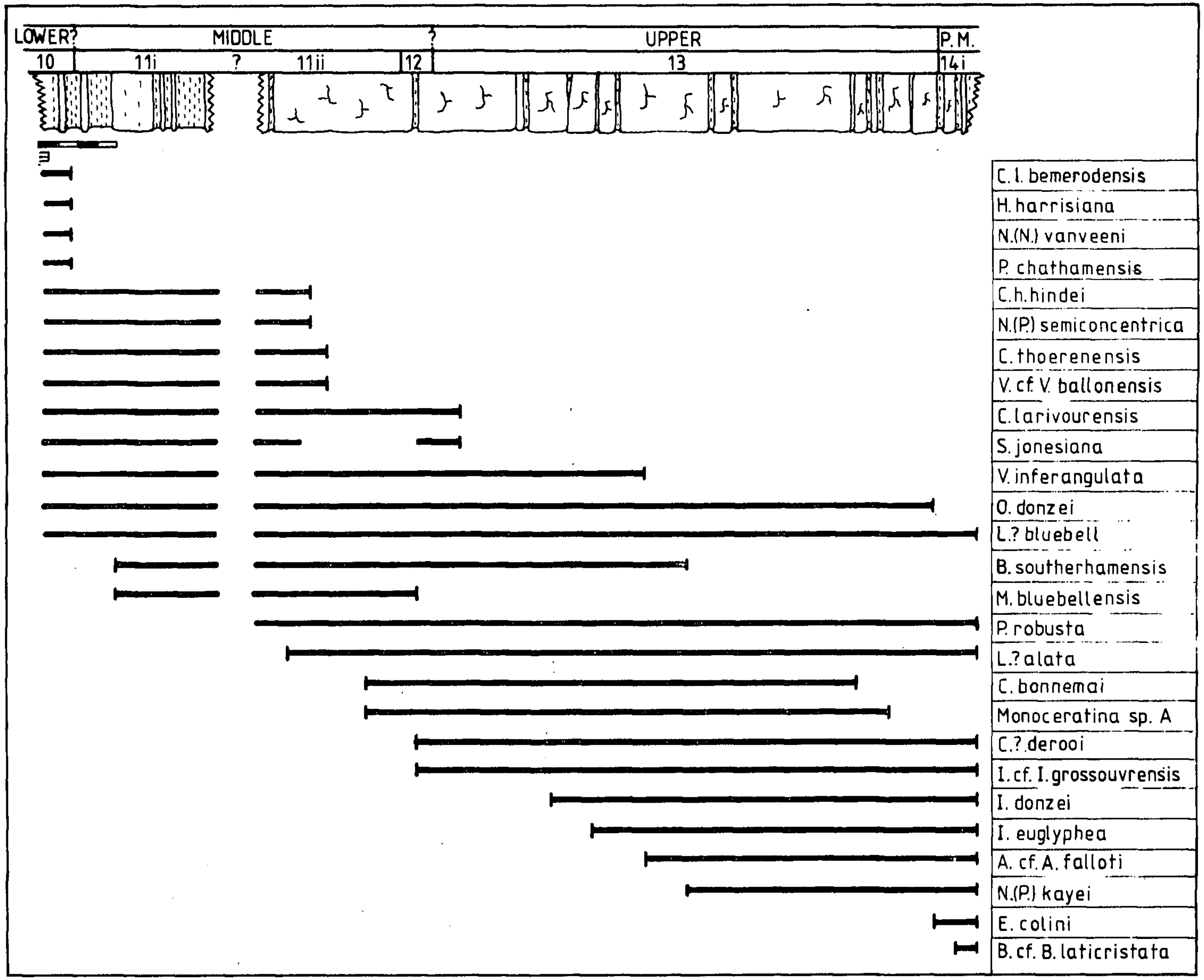


Fig.6:9 Ostracod stratigraphy of the Southerham section, Kent.

Above this level Idiocythere donzei, Imhotepia euglyphea, Amphicytherura cf. A. falloti and Neocythere (P.) kayei appear in successive samples (Fig. 6:9). Two samples were obtained from Bed 1 of the Plenus Marls. As usual the fauna from this level is similar to that from lower horizons but Eucythere colini was very common in both samples. Brachycythere cf. B. laticristata was also found in the higher of these two samples.

Conclusion

It can be seen therefore that the distribution of the Ostracoda outlined at the beginning of this chapter (Fig. 6:1) can be used to correlate Cenomanian sections across Southern England. Some of the species occur at slightly different levels in different localities but if several species are used to define each level, a meaningful stratigraphy can be established (Fig.6 :1). When used in conjunction with the foraminiferal zonation the Ostracoda can be used to sub-divide some of the Zones. Platycythereis cf. P. gaultina, P. cf. P. chapmani, Neocythere (P.) steghausi and Dolocytheridea (P.) bosquetiana occur only in the lower part of Zone 8, whilst Amphicytherura cf. A. falloti, Imhotepia euglyphea and Neocythere (P.) kayei make their first appearance towards the top of Zone 13. Eucythere colini is a particularly useful species since it has only been found in Bed 1 of the Plenus Marls.

Some of the species mentioned above may also be useful for international correlation. Babinot et. al. (in press) show that Homocythere harrisiana has an identical range in the Alpes Maritimes of Southern France to that in Southern England. Neocythere (N.) vanveeni has an identical range in the Paris Basin and southern England, whilst Cornicythereis gr. bonnemai (= C. larivourensis?) has an identical range in Southern England and the Alpes maritimes

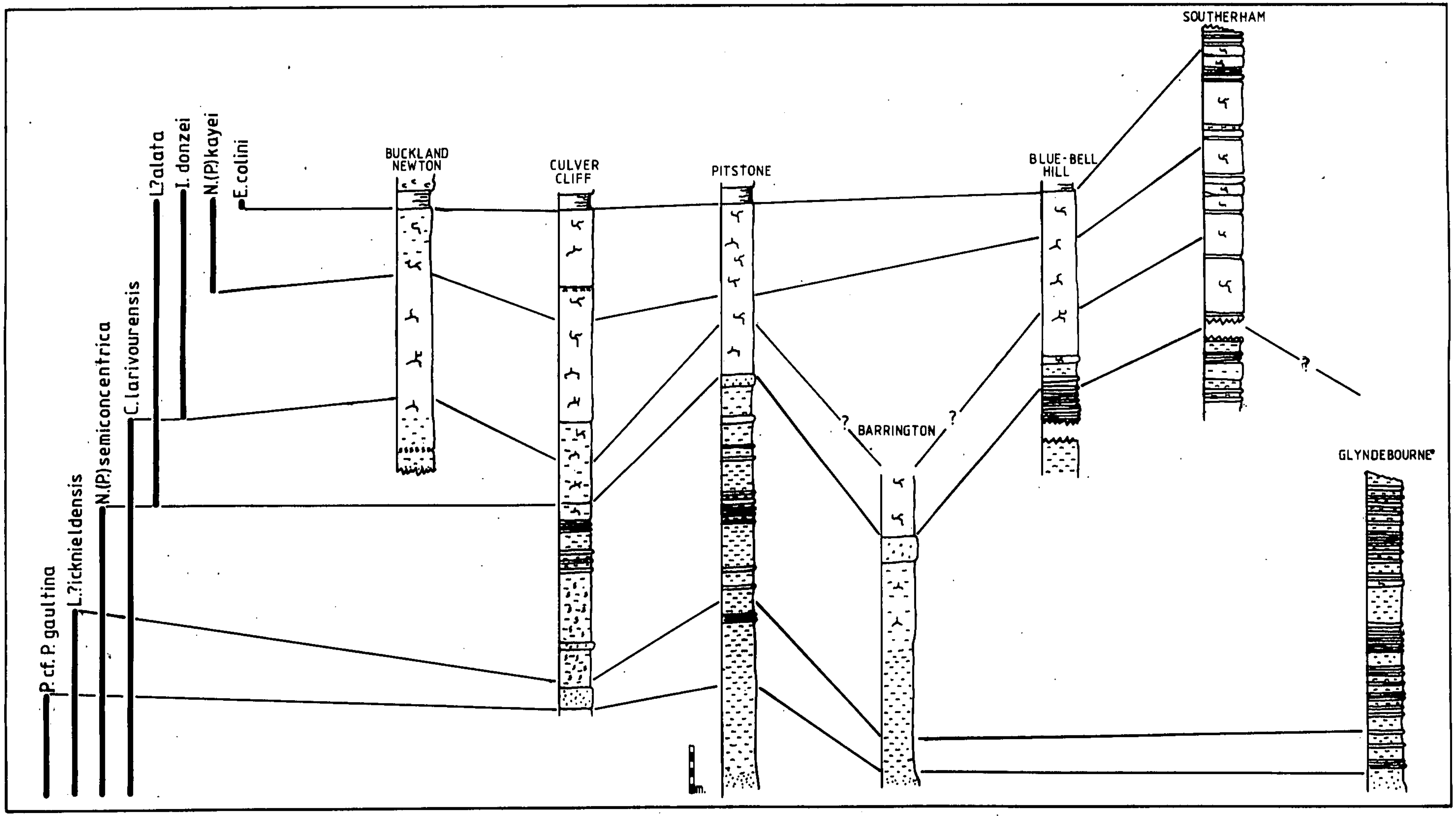


Fig. 6:10 Correlation of Cenomanian sections using selected species of Ostracoda.

with only a slightly shorter range in the Paris Basin. Amphicytherura cf. A. falloti from Southern England has a corresponding range to A. falloti from the Alpes maritimes. Unfortunately there is very little recent literature on Cenomanian Ostracoda from Germany but Grundel (1966) has shown that N. (P.) steghausi extends just into the Cenomanian in the Camin borehole from East Germany and its range is therefore the same in Germany and Southern England.

Although no formal ostracod zonation has been set up Fig.6:10 shows that it is quite possible to correlate Cenomanian sections across Southern England by means of selected species. The variable age of the base of the Cenomanian can be seen as clearly as with Foraminifera (see Carter and Hart 1977), and many other levels can also be identified and correlated.

CHAPTER 7

PALAEOECOLOGY

Even though a vast amount of literature has been published on the ecology and palaeoecology of Ostracoda, the study of palaeoecology is still rather imprecise. Kilenyi (1971) has listed some of the problems encountered in palaeoecological studies of Ostracoda. Perhaps the most fundamental problem is the recognition of a biocenosis, or part of a biocenosis, in a fossil population. The extent of post-mortem transport, both laterally due to currents and vertically due to burrowing, can rarely be ascertained. In the Cenomanian fauna from Southern England there are numerous fragile species, such as species of Polycope, Pedicythere and Trachyleberis, which might be expected to break during any lengthy transport. There are also numerous juvenile forms which are frequently very fragile. It has been suggested by Kilenyi (1971) that the presence of a large number of juveniles indicates that the species was living in the area where the fossil adults are found. However, it must be pointed out that juveniles of several species have not been found at all e.g. Dolocytheridea bosquetiana, Paracypris cf. P. wrothamensis. It is possible that these species have been transported, but since the shells of the adults show no signs of abrasion it is possible that the juveniles were too weakly calcified to be preserved. This selective preservation of adults has been reported by Pokorny (1971) in his studies of Upper Cretaceous Ostracoda from Bohemia. It is suggested, therefore, that the majority of the species found during the present study were, in fact, living in or near the locality where they were found. There is in fact very little evidence of strong bottom current activity during the Cenomanian. Assuming that the present distribution of species compares reasonably well with the distribution of the species when they were alive various aspects of their palaeoecology may now be discussed.

Salinity

The widespread occurrence of brachiopods, echinoderms and planktonic Foraminiferida in the Cenomanian chalk suggests that normal marine salinities (about 35 parts per thousand) prevailed throughout (Hancock, 1975). This is also substantiated by the large ammonite fauna from the Cenomanian (Kennedy and Cobban, 1975). In the Ostracoda the common occurrence of the Cytherellidae, and the total absence of any non marine forms support this contention.

Temperature

Temperature has been regarded as one of the most important factors which influence the distribution of recent marine Ostracoda (Neale, 1964), and it seems likely to have been equally important in the past. Sohn (1964) has shown that the distribution of the genus *Cytherelloidea* in the Cretaceous could be limited by temperature since recent species are limited by a $10^{o}C$ minimum temperature. The presence of this genus in the Cenomanian of Southern England may therefore indicate minimum temperatures in excess of $10^{o}C$. However as Kennedy and Garrison (1975) have pointed out, Britain lay in the sub-tropical belt during the Upper Cretaceous and thus temperatures were probably well in excess of $10^{o}C$.

Carter and Hart (1977) have suggested that during the lower Cenomanian in Southern England temperatures may have been below $17^{o}C$ but associated with the mid-Cenomanian non-sequence there was a warming of the seas so that temperatures exceeded $17^{o}C$ throughout the Upper Cenomanian. These suggestions are based on the occurrence of keeled planktonic foraminifera in the Upper Cenomanian but not in the Lower Cenomanian. In the present day oceans the keeled forms are restricted to waters warmer than 17°C. This warming at the level of the mid-Cenomanian non-sequence is associated with a distinct change in the ostracod fauna but this faunal change could be associated with other factors such as the deepening of the seas which also occurred at this time.

It is interesting to note that in the Paris Basin *Veenia ballonensis* can be found in the Lower, and lower part of the Middle Cenomanian. In Britain *V.cf.V.ballonensis* (a very closely related form), first appears towards the top of the Lower Cenomanian (top of Zone 10) in the two most southerly localities of Culver Cliff and Southerham, whilst further north in Pitstone and Barrington it makes its first appearance at the top of Zone 11i and the base of Zone 11ii respectively. This species therefore spread progressively further northwards during the Middle Cenomanian. During this period it also entered the Touraine-Poitou area of France (Babinot et. al. in press). It has also been recorded from Northern Ireland in a sample reported to be of Lower Cenomanian age (= top of Zone 10?).

A similar example can be seen with *Oertliella donzei*. Although this species has so far not been recorded from the Paris Basin, in the Sub-Alpine Chain of Southern France it can be found in the Lower and Middle Cenomanian. In Southern England it first appears at the top of Zone 8 in Culver Cliff and only slightly later in Glyndebourne. Further north in Pitstone it first appears at the top of Zone 9 whilst in Barrington it is not found until the base of Zone 11ii in the Middle Cenomanian. In Southern France this species is not found in the Upper Cenomanian but in Southern

England it is common at this level.

If the distributions of the two species above were governed by temperature then it is possible that, at least during the Lower and Middle Cenomanian, there was a temperature gradient from south to north in Western Europe. During the Middle Cenomanian temperatures in Southern England increased and allowed species to migrate northwards.

Depth

There has been considerable speculation about the depth of the chalk sea. However, recent estimates by Kennedy and Garrison (1975) suggest a range between 50 - 300 m., whilst Hancock (1975), suggests a range between 100 and 600 m. Kennedy and Garrison have suggested that the Glauconitic Marl was deposited in shallow water, possibly even in the photic zone, whilst the Chalk Marl also represents fairly shallow water. Carter and Hart (1977), have suggested that there was a considerable deepening of the sea at the level of the mid-Cenomanian non-sequence. This allowed a greater connection with the opening Atlantic by drowning a series of barriers in Western England and Brittany. This deeper water continued through the Upper Cenomanian.

Omhert (1970) suggested that the genus Platycythereis was restricted to shallow water. Its disappearance just after deposition of the Glauconitic Marl in Southern England is therefore very interesting, and may correlate with the depth increase at this level suggested by Kennedy and Garrison. In the south and west of France several species of Platycythereis have been recorded from the Middle and Upper Cenomanian (Babinot et. al., in press). The disappearance of Cytherelloidea globosa, Monoceratina bonnemai and Neocythere (P.) steghausi at this level may also be related to the increasing depth, but other factors such as the changing sediment type could also be important.

The increasing water depth at the mid-Cenomanian non-sequence coincides with considerable changes in the ostracod fauna e.g. the disappearance of species such as S. jonesiana, C. hirsuta, C. thoerenensis, N.(N.) vanveeni and H.h.harrisiana, whilst species such as Pontocyprella robusta, Limburgina?alata and C. barringtonensis make their first appearance in Southern England at this level. There are other changes too, with O. donzei and in particular C. larivourensis becoming more abundant above the mid-Cenomanian non-sequence. The exact cause of these changes in the fauna is not clear. Apart from the increase in sea depth there was the increasing temperature and an increase in the carbonate content at this level, (Destombes and Shepard-Thorn, 1971; Sanders and Burnett pers. comm. 1975).

Bottom Conditions

Two thorough reviews of bottom conditions in the Chalk seas have recently been published by Kennedy and Garrison (1975) and Hancock (1975). The general conclusions are that most of the sediment accumulated as a soft, thixotropic mud which had a very high water content. The fact that coccoliths and mica flakes were able to settle suggests very quiet conditions, but there may have been periods when bottom currents were active. The occurrence of hard grounds suggests periods of reduced sedimentation which enabled a hard substrate to form. During these periods new groups of organisms could move in, since the habitat would favour attached and boring species.

Whatley (1976) has shown that in present day seas live Ostracoda are generally associated with animal or plant substrates, but he has also indicated that exceptions may occur in stable areas of fine sediment. In the Cenomanian it cannot be ascertained whether the Ostracoda lived on the epifauna or on, and in, the chalk ooze. In the chalk seas there were probably large numbers of epifaunal soft bodied animals although animals with hard skeletons were not always common since they were liable to sink into the soft ooze.

Conditions during the deposition of the Glauconitic Marl must have been somewhat different. The coarser grain size and the presence of re-worked and derived fossils and pebbles suggests much stronger current activity. This deposit would not have been soft and thixotropic, and it probably allowed a somewhat different bottom fauna to prevail. Kennedy (1969) has suggested that certain brachiopods and sponges were limited to this facies. In the Ostracoda Cytherelloidea globosa and Monoceratina bonnemai both appear to be limited to this horizon and the succeeding few metres of Chalk Marl. However, it is very difficult to establish whether facies was the chief controlling factor affecting these two species.

As mentioned earlier the change from Chalk Marl with about 50 - 85% carbonate (Enclosures 3 and 4) to the Grey Chalk with over 90% carbonate, at about the level of the mid-Cenomanian non-sequence, coincides with significant changes in the ostracod fauna (Fig. 6 : 1). It is, however, very difficult to correlate these faunal changes directly with the changing carbonate content, (and possibly thereby with a modified substrate), since there were other factors, such as increasing temperature and water depth, which may have been more important. With the return to marl deposition at the beginning of the Plenus Marls there are some changes in the ostracod fauna. At this level most of the species found in the Upper Cenomanian are still present but their relative proportions may be different e.g. *Isocythereis* cf. *I. grossouvrensis*, *Idiocythere donzei* and *Curfsina? derooi*, may become relatively more abundant. Also, in Bed 1 of the Plenus Marls, *Eucythere colini* is very abundant but is not found beneath or above this horizon. Again it is impossible to ascertain the true cause of these changes.

Beds 4 - 8 in the Plenus Marls contain a very reduced ostracod fauna, and also a reduced benthonic foraminiferal fauna (Carter and Hart, 1977). The reasons for this are not clear, but in Yorkshire at this level (or slightly higher) is the 'Black Band' which has been described as a deposit formed in an oxygen-poor environment by Schlanger and Jenkyns (1976). If this was the case then areas to the south could also have suffered reduced oxygen concentrations during this period which could have caused reductions in the benthos.

Size

The size of individual species and specimens of Ostracoda in the Cenomanian of Southern England poses certain problems. In the Lower Cenomanian the fauna is very similar to that from the preceeding Albian where there are quite a number of relatively large species e.g. *C. thorenensis*, *C. hirsuta*, *C. lurmannae* s.l., *H.h.harrisiana*, *S. jonesiana*, *P. lineata striata*. However, these large species all die out around the level of the mid-Cenomanian non-sequence and the new species of the Cytheracea which evolve at or above this level are all comparatively small. Species such as *Isocythereis* cf. *I. grossouvrensis*, *Idiocythere donzei*, *Imhotepia euglyphea* and *Curfsina? derooi* are all less than 0.6 mm. long and all except *I. donzei* are less than 0.55 mm. long. No large species of *Cythereis* are found through the Upper Cenomanian, but rather interestingly in the Plenus Marls a few specimens of Cythereis sp.A. and Cythereis sp.B. with respective lengths of 0.846 and 0.880 mm. have been found. In the Upper Cenomanian of France numerous large species such as Dolocytheridea (P.) crassa Damotte, Cythereis parareticulata Colin, Platycythereis crassa Colin, etc. can be found. This suggests that the Upper Cenomanian environment in Southern England did not favour large species of the Cytheracea. Other groups of Ostracoda such as the Cytherellidae, Bairdudae and Pontocyprididae however, were not affected.

An interesting corollary to this is seen in some species which occur in both France and Southern England. C. hirsuta, C. larivourensis and V.cf.V.ballonensis have all been described by Damotte and Grosdidier from the Paris Basin. However, the specimens of these species from England are all considerably smaller (Fig. 7 : 1). In the case of V.cf.V. ballonensis the specimens could possibly be ascribed to a new sub-species, but the two forms are nevertheless very closely related and the specimens from England are considerably smaller than the French material. In Isocythereis cf. I. grossouvrensis, which appears to be closely related to the specimens described by Donze from the south of France, the British specimens are again considerably smaller (0.54 mm. long as opposed to 0.74 mm. in the French specimens). No cases have been observed where the British specimens are larger than the French forms.

This problem of populations of a species being of different size in different geographical areas was discussed during the Naples Symposium (1964 pp. 77-81; ed. Califano et al.). Pokorny described a small sized population of Cythereis longaeva from Bohemia and several other fossil and Recent examples were also quoted. Several reasons were proposed for these differences. Salinity was thought to affect some populations but as Pokorny pointed out, this was

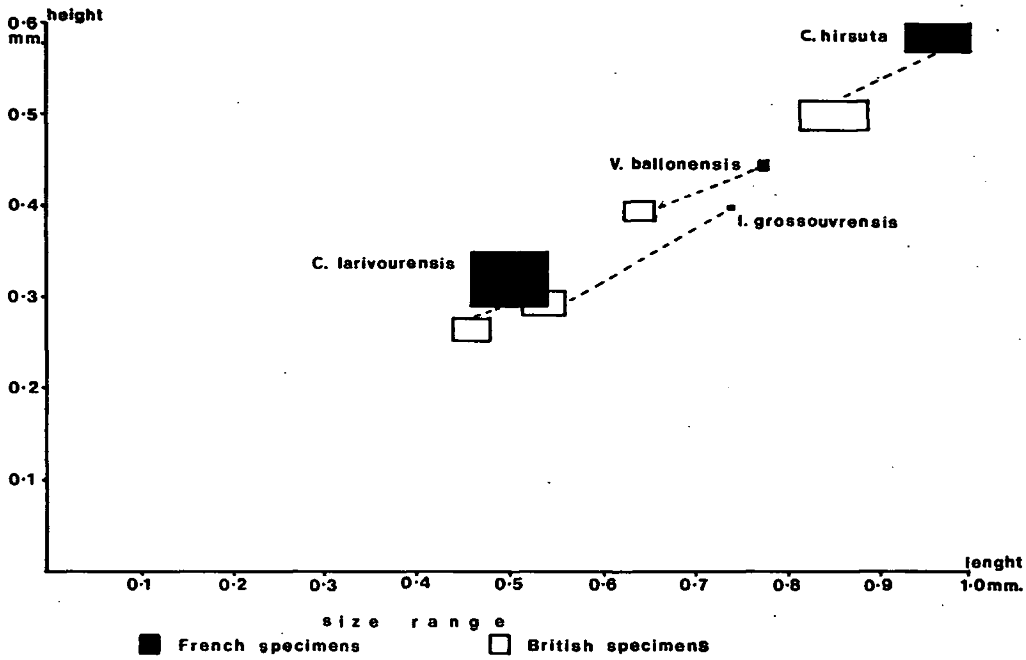


Fig 7:1 Comparison of size between species from France and related forms from Southern England

hardly the case during the Cretaceous examples, since the sea was obviously euhaline in the areas concerned. Decreased temperatures were also considered as possible causes of larger sized individuals, but in the Cenomanian the larger specimens occur in the more southerly areas which were presumably warmer. Pokorny suggested that the small individuals could be caused by a low oxygen content of the water which could be related to very quiet sedimentation. However, there is little evidence to suggest more turbulent conditions in the middle of the Paris Basin at this time. More study on recent faunas may reveal the true cause(s) of different sized populations but at the present time no firm conclusions can be drawn.

Palaeogeographic Distributions

Britain

Over most of Southern England the Cenomanian ostracod fauna is very similar, small changes do occur in the relative abundance of given species e.g. Cythereis lurmannae lurmannae has only been found to occur commonly in the Barrington section, but on the whole the sections show very similar faunas. There are two noteable exceptions to this general rule. One is the fauna from the basal sample of the Southerham section. In this sample there are large numbers of Homocythere ornata and Protocythere siddiquii. These two species have not been found elsewhere in the Cenomanian and Cythereis coronata which is also common in this sample is very rare elsewhere. The reasons for this peculiar fauna are not known but this sample did contain several specimens of the planktonic Foraminifera Rotalipora reicheli (MONOD 1949). This species has not previously been found in Britain, but at Cap Blanc Nez in Northern France there is a short lived influx at the top of the Lower Cenomanian

(F. Robaszynski, pers. comm. to M.B. Hart). These British specimens appear to be transported, since no juveniles have been found and the direction of transport therefore seems to be from the south-east (R. reicheli is very common in Denmark, the Polish trough and S.E. France). It is possible that the Ostracoda from this sample were also transported but so far they have not been recorded from any other area in Western Europe.

Secondly, the Ostracoda from the lower part of the Cenomanian of Culver Cliff show certain differences to other areas. Cornicythereis sp.A. is common in a sample from just above the Glauconitic Marl but it has not been recorded from elsewhere. Further, specimens of Imhotepia euglyphea and Isocythereis cf. I. grossouvrensis have been found in a sample from the Lower Cenomanian of Culver Cliff. In all other areas I.cf.I.grossouvrensis first appears near the top of the Middle Cenomanian whilst I. euglyphea appears in the Upper Cenomanian.

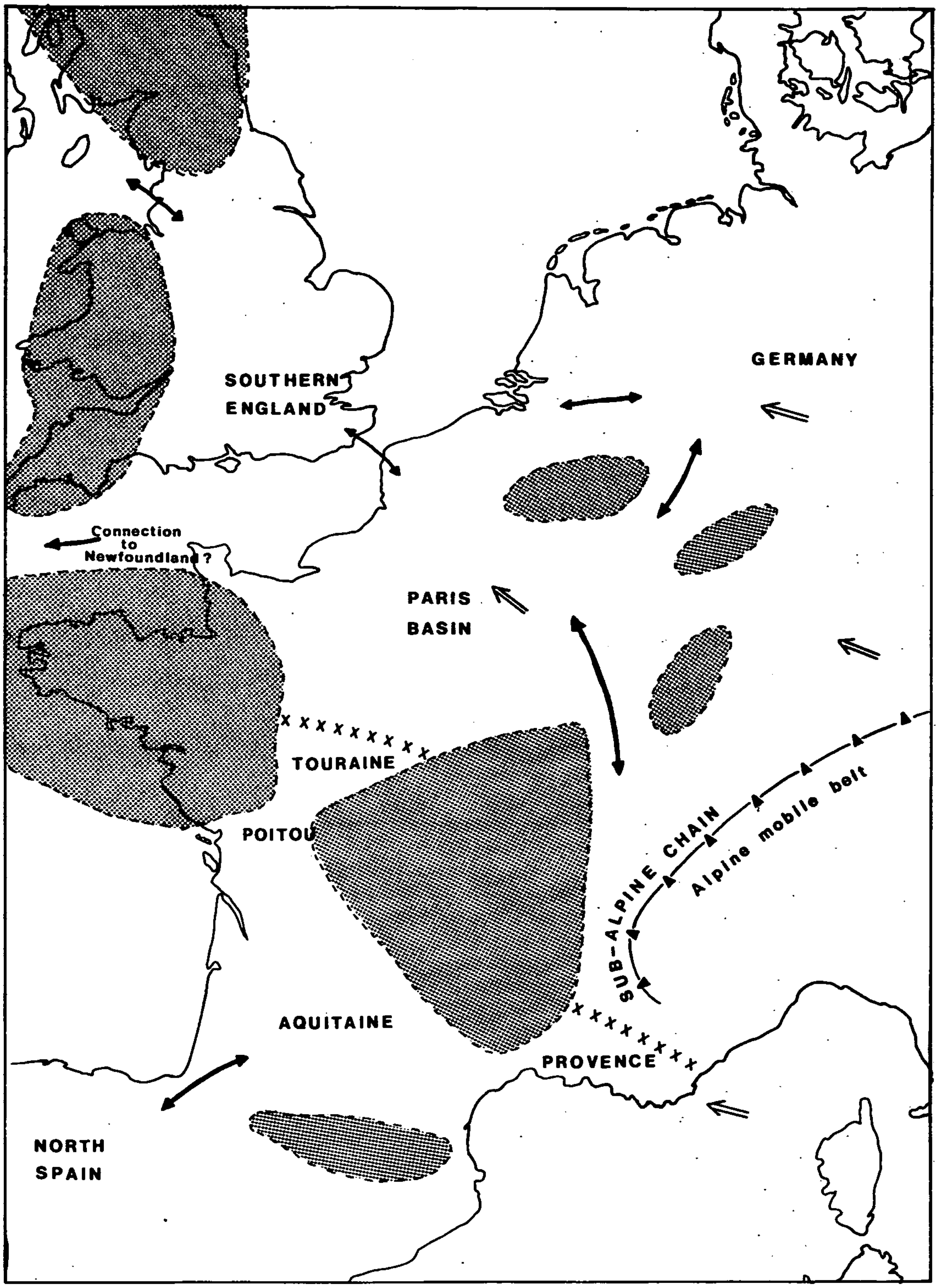
Of the 9 species recorded from the Lower Cenomanian of Belfast by Keen and Siddiqui (1971) only two cannot be found in the Lower Cenomanian of Southern England. These two are Cythereis carrensis Keen and Siddiqui and Neocythere (N?) antrimensis Keen and Siddiqui. Of these N. (N?) antrimensis is very similar to some specimens from the Cenomanian of Bornholm, Denmark. It is interesting to note that the Danish specimens come from a clayey Greensand of Lower Middle Cenomanian age, whilst the Irish specimens come from a shell bed.

France

The study of Cenomanian Ostracoda in France has revealed some interesting conclusions regarding the geographic distribution of species. A paper synthesising most of the published work on French

Cenomanian Ostracoda has recently been produced by Babinot et al. (in press). This work reveals the existence of three distinct ostracod provinces during the Cenomanian, namely - Paris Basin (Touraine excluded), Touraine - Poitou - Aquitaine - Provence area and the southern sub-Alpine chain (Fig. 7 :2). A large number of species are limited to one particular province, but there are also numerous species in common between the provinces. The species from Southern England appear to fall into a separate province but unfortunately there is very little information on the Upper Cenomanian Ostracoda from the Paris Basin. In the Lower Cenomanian, whilst there are quite a few species in common between Southern England and the Paris Basin there are distinct differences. On the evidence given in the distribution charts by Babinot et al. it can be seen that Homocythere harrisiana, Cythereis luermannae and the genera Oertliella and Saida have not been recorded from the Paris Basin whilst these were all present in Southern England at this time. Similarly Homocythere lapparenti, Spinoleberis petrocorica and Cythereis dorsispinata are present in the Paris Basin but not in Southern England, whilst Veenia cf. V. ballonensis has a much shorter range in Southern England than in France. The Cenomanian fauna from Southern England appears to be much more diverse than from France, but it is not certain how much of the Paris Basin fauna remains to be described. Unfortunately there is no published information on the Upper Cenomanian Ostracoda from the Paris Basin.

There are very few similarities between Southern England and the Touraine - Poitou - Aquitaine - Provence province. Differences exist even at the generic level with genera such as Hazelina, Mauritsina, Dumontina, Spinoleberis, Dordoniella and Echinocythereis? all occurring in the French province but being entirely absent from Southern England.



Presumed land areas

Direction of water movement

Migration routes of Ostracoda

X X X Ostracod province boundaries

Fig. 7:2 Ostracod provinces during the Cenomanian

There are some rather surprising similarities between Southern England and the southern, sub-Alpine chain province. In the Lower Cenomanian Homocythere harrisiana, Cythereis lurmannae, C.aff.C. reticulata, Oertliella donzei and species of Saida are present in both areas but, as previously mentioned, these species have, so far, not been recorded from the Paris Basin. In the Middle Cenomanian Veenia inferangulata can be found in both areas whilst in the Upper Cenomanian Amphicytherura cf.A.falloti from Southern England is very similar to the type material from S.E. France. Furthermore, Idiocythere donzei which is found in the Upper Cenomanian of Southern England is recorded from the topmost Cenomanian (M. geslinianum Zone) of S.E. France and Isocythereis cf.I.grossouvrensis from the Upper Cenomanian of Southern England is very similar to the type material also from the topmost Cenomanian of S.E. France.

The fact that most of the above mentioned species have not been recorded from the Paris Basin is rather puzzling. However, very little has been published on the Upper Cenomanian from the Paris Basin and nearly all of the published faunas from the Lower and Middle Cenomanian are from the western and southern parts of the basin (see the maps of localities given in Damotte, 1971b). It certainly appears that there was a north-south connection between Southern England and the southern sub-alpine chain during the Cenomanian and at present the most likely route seems to be up the eastern side of the Paris Basin. Deroo (1956) described part of the ostracod fauna from the east of the Paris Basin and all of the species which he lists for the Lower and Middle Cenomanian can be found in Southern England. He also lists Veenia ballonensis, (as Cythereis semiplicata Reuss), as occurring only in the Middle Cenomanian. This coincides more closely with its range in Southern England than in the rest of the Paris Basin.

Other Areas

Apart from the French work comparatively little has been written on Cenomanian Ostracoda. Grekoff and Deroo (1956) and Bremen (1976) have described Cenomanian Ostracoda from Spain. As might be expected there are some correlations between Spain and Southern France but there is very little correlation with the British fauna.

The ostracod fauna from the lowest Cenomanian of East Germany has been described by Gründel (1966). Unfortunately he found very few specimens from the Cenomanian but the fauna which he does describe appears to be similar to that from Britain. The fauna described by Mertens (1956) from the top of the Albian in West Germany is also similar to the Lower Cenomanian fauna from Britain. Many of the species described by Mertens have slightly longer ranges in Britain e.g. Neocythere (P.) semiconcentrica is recorded with a range ending in the Upper Albian whereas in Britain its range extends well into the Cenomanian. The Cenomanian Ostracoda listed by Dupper (1952) are also similar to the British fauna.

In comparison with the fauna described from Eastern Europe and Asia by Ljubimova (1955 and 1965) there are few similarities to the British fauna.

Ascoli (1976) described species of Ostracoda from the Cretaceous of the Scotian shelf, off Canada. The species recorded from the Cenomanian show some affinities to the species from Southern England, Schuleridea jonesiana, "Cythereis" gr. bonnemai (= ? Cornicythereis larivourensis) and Neocythere vanveeni are present in both areas, but the rest of the species have more affinity to the North American fauna. The Cenomanian Ostracoda from North Texas were described by Alexander (1929) but at the species level there is no comparison with the British fauna.

CHAPTER 8

CONCLUSIONS

The Cenomanian of southern England has therefore yielded 111 species of Ostracoda. Of these, 38 species have been previously described, 47 species are new and 26 species are left under open nomenclature. One previously recorded sub-species and two new sub-species have also been found. These species fall into 47 genera and subgenera. In the Lower Cenomanian the fauna is very similar to that in the preceeding Albian but new genera such as Loxoconcha ? and Oertliella can be found. During the Middle and Upper Cenomanian new genera such as Amphicytherura, Curfsina ?, Idiocythere, Imhotepia, Limburgina ? and Trachyleberis make their first appearance and give the fauna a more Upper Cretaceous aspect.

With a few exceptions the fauna is similar throughout southern England but there are significant differences when this fauna is compared with that described from the Paris Basin. There appears to be more correlation with the eastern side of the Paris Basin down to the southern sub-Alpine chain region of France, than with the western and southern parts of the Paris Basin. Correlation between southern England and other areas of France and Northern Spain is rather poor at the species level but many of the genera are common to all these areas. Very little has been published on German Cenomanian Ostracoda, but at least in the Lower Cenomanian several species can be found which are also known from Southern England. There is also some correlation between Southern England and the Scottian Shelf off eastern Canada. In the Lower Cenomanian there are 3 species common to both these areas, but after this the faunas become dissimilar. At the species level no other comparisons can be made with

Cenomanian Ostracoda from Southern England. Many of the genera however were cosmopolitan at this time.

There are comparatively few changes in the fauna at the Albian/Cenomanian boundary but a few metres above the base of the Cenomanian several species die out. Many of the species characteristic of the Upper Albian can be found up to the level of the mid-Cenomanian non-sequence in the Middle Cenomanian. At about this level marked changes occur in the ostracod fauna. Not only do many of the species inherited from the Albian Stage die out but above this level many new species and genera make their first appearance. Thus the ostracod fauna from the Lower Cenomanian is quite different to that from the Upper Cenomanian.

This changing fauna has enabled the Ostracoda to be used stratigraphically in the Cenomanian. The most important species have been selected and their stratigraphic ranges have been compared to the macrofaunal zonation produced by Kennedy (1969) and the Foraminiferal zonation produced by Hart and Carter (1975). Several of the ostracod species are very useful stratigraphically and the 7 Cenomanian sections used in this work could be correlated by Ostracoda alone. However, since the examination of 8 sections is not thought to be sufficient to fully test a zonal scheme based on Ostracoda, no formal zonation is set up here. Instead, the Ostracoda are related to the Foraminiferal zonation to produce a more detailed sub-division of the Cenomanian. The following additions to the Zonal scheme described in detail by Carter and Hart (1977) can be made:-

1. Zone 8 can be sub-divided on the basis of the disappearance of several species of Ostracoda.
2. The Zone 11i/11ii boundary (mid-Cenomanian non-sequence) is emphasised by major changes in the Ostracoda.

3. The base of Zone 13 (= base of the Upper Cenomanian) can be recognised by the disappearance of one species and the first appearance of other species of Ostracoda.
4. The rather long Zone 13 can be sub-divided on the basis of the first appearances of several species of Ostracoda.
5. Bed 1 of the Plenus Marls can be recognised by the appearance, (and in large numbers) of Eucythere colini.
6. Beds 4 - 8 of the Plenus Marls can be recognised by a very reduced ostracod fauna but with the noteable occurrence of Cytherelloidea hindei.
7. The base of the Middle Chalk also appears to have a very reduced ostracod fauna.

This stratigraphic distribution appears to be useable across Southern England but it is not certain how far it can be followed into France. Some of the species appear to have different ranges in the Paris Basin whilst others have identical ranges.

The Ostracoda indicate that normal marine salinities (about 35 parts per thousand), and a temperature in excess of 10°C prevailed throughout the Cenomanian period in Southern England. Certain species which appear to have migrated into Britain from France appear much earlier in the south of the area of study than they do in the north. This could indicate a temperature gradient from south to north during the Lower and Middle Cenomanian with the northern areas becoming gradually warmer.

As well as an increasing temperature, other physical changes occurred during the Cenomanian period. The sediment became more carbonate rich and the sea became deeper. The mid-Cenomanian non-sequence appears to be associated with these changes and at this level significant changes occur in the ostracod fauna. At this time it is not possible to decide which of the environmental factors was most important in affecting the Ostracoda. Present day Ostracoda are more influenced by changing temperature than depth with sediment type playing a minor role (at least as far as carbonate content is concerned). The sediment type may have been more important in the Glauconitic Marl since two species appear to be restricted to this facies. The environment during the deposition of beds 4 - 8 of the Plenus Marls appears to have been inhospitable to all ostracods except the Cytherellidae. The reasons for this are not known but a reduced oxygen concentration may have been a contributing factor.

A factor (or factors) which influenced the size of specimens appears to have been important during the Cenomanian in Southern England. The large species of the Cytheracea died out during the Middle Cenomanian and the newly evolving species during the Middle and Upper Cenomanian were mostly of small size. Species which can be found in France and Southern England are often smaller (and never larger) in Southern England. The reasons for this are not known but similar geographical variations in size have been reported from the Turonian of Poland. It has been suggested that small specimens may be caused by low oxygen concentrations related to very quiet areas of deposition. This may be the cause of small specimens in the Cenomanian of Southern England.

The study of Cenomanian Ostracoda from Southern England has therefore been immensely rewarding. Not only have a large amount of new species been found but several known species have been recorded from Britain for the first time. It has been possible to use Ostracoda in stratigraphical correlation across Southern England and their study has enabled certain suggestions to be made about the palaeoecology of the Cenomanian environment in Southern England. This research leads to the formulation of several questions to be answered in the future - What Ostracoda are present in the Middle and Upper Chalk of Southern England and can Ostracoda be used in the stratigraphy of the whole of the Upper Cretaceous? What is the occurrence and distribution of Ostracoda in the Cenomanian sections throughout Western Europe which have not yet been studied?

REFERENCES

Alexander, C.I. 1927. The stratigraphic range of the Cretaceous ostracod Bairdia subdeltoidea and its allies. J. Paleont., Tulsa, 5(1): 29-33, pl.6.

—— 1929. Ostracoda of the Cretaceous of North Texas. Bull. Univ. Texas, Bur. Econ. Geol.,2907: 1-137, pls 1-10, 2 text-figs.

—— 1932. Sexual dimorphism in fossil Ostracoda. Amer. Midl. Naturalist, Notre Dame (Ind.), 13: 302-311, pl.28.

—— 1933. Shell structure of the ostracod genus Cytheropteron and fossil species from the Cretaceous of Texas. J. Paleont. Tulsa, 7(2): 181-214.

—— 1934. Ostracoda of the genera Monoceratina and Orthonotacythere from the Cretaceous of Texas. Ibid., 8(1): 57-67.

—— 1936. Ostracoda of the genera Eucythere, Cytherura, Eucytherura and Loxoconcha from the Cretaceous of Texas. Ibid., 10(8): 689-694.

Andreev, Yu N. & Mandelstam, M.I. 1971. Biogeographical associations of Cretaceous ostracods in the U.S.S.R. In Oertli, H.J. (ed.) Paleoecologie Ostracodes Pau 1970. Bull. Centre Rech. Pau - SNPA 5 suppl. 615-629.

Ascoli, P. 1976. Foraminiferal and Ostracod biostratigraphy of the Mesozoic - Cenozoic, Scotian Shelf, Atlantic Canada. Inst. Int. Symp. on Benthonic Foraminifera of Continental margins Part B. Paleoecology and Biostratigraphy. Maritime Sediments Spec. Pub. 1: 653-771.

Babinot, J.F. 1970. Nouvelles espèces d'Ostracodes du Cénomanien supérieur de l'auréole septentrionale du bassin du Beausset (Bouches-du-Rhône-Var) (part 1) Revue Micropaléont., Paris, 13(2): 95-106.

—— 1971. Nouvelles espèces d'Ostracodes du Cénomanien supérieur de l'auréole septentrionale du bassin du Beausset (Bouches-du-Rhône-Var) (part 2). Ibid. 13(4): 237-248.

—— 1973. Ostracodes Turoniens de la région de Cassis la Bédoule (Bouches-Du-Rhône, France), associations et affinitiés paléogéographiques. Geobios, Lyon, 6(1): 27-48, pls. 1-5, 2 text-figs.

Babinot, J.F., Colin, J.P., Damotte, R., Donze, P. (in press) Les Ostracodes du Cenomanien Francais: Mise au point Biostratigraphique et paleogeographique. Geologie Medit. Marseilles.

Barrois, C. 1876. Recherches sur le Terrain Crétace, supérieur de l'Angleterre et de l'Ireland. Mém. Soc. géol. N., Lille. 234 pp.

Bassiouni, M. el A.A. 1974. 'Paranotacythere' n.g. (Ostracoda) aus dem Zeitram Oberjura bis Unterkreide (Kimmeridgium bis Albium) von Westeuropa. Geol.Jb. A., Hannover, 17: 3-111, plates 1-13, 5 text-figs, 1 table.

Bassoullet, J.P., et Damotte, R. 1969. Quelques Ostracodes nouveaux du Cénomano-Turonien de l'Atlas saharien occidental (Algérie). Revue Micropaléont. Paris. 12(3), 130-144, pls. 1-2, 1 text-fig.

Bate, R.H. 1972. Upper Cretaceous Ostracoda from the Carnarvon Basin, Western Australia. Spec. Pap. Palaeont. 10: 1-85, pls. 1-27, 42 text-figs.

Bate, R.H. Bayliss, D.D. 1969. An outline account of the Cretaceous and Tertiary Foraminifera and Ostracoda. Proc. 3rd. African Micropal. Coll. Cairo. 113-164, 8 pls.

Baynova, E.K. 1965. Ostracodes d'albien de la Partie d'ouest et central de Bulgarie du Nord. Rev. Bulgarian Geol. Soc. Sofia, 24 (3): 287-315, pls. 1-5.

Baynova, E.K. & Talev, B. 1964. Ostracoden aus dem Hauterive des zentralen und ostlichen Teiles Nordbulgariens. Trav. geol. Bulg. Ser. Paleont., Sofia, 6: 17-53.

Benson, R.H. 1972. The Bradleya problem, with descriptions of two new psychrospheric Ostracode genera Agrenocythere and Poseidonamicus (Ostracoda : Crustacea). Smithsonian Contr. Paleobiol. 12. 138 pp. 38 pls. 67 text-figs. 4 tables.

—— 1975. Morphologic stability in Ostracoda. Bull. Am. Paleont., 65, 282 : 13-46.

Benson, R.H. & Tatro, J.O. 1964. Faunal description of Ostracoda of the Marlbrook Marl (Campanian), Arkansas. Paleont. Contr. Univ. Kansas. Arthropoda Art., Topeka, 7: 1-32, pls. 1-6, 15 text-figs.

Berry, E.W. 1926. Upper Cretaceous Ostracoda from Maryland. Am. J. Sci. ser 5, New Haven, 209: 481-487.

Bertels, A. 1968. Micropaleontologia y estratigrafia del limite Cretacico-Terciario en Huantrai-co (Provincia de Neuquen). Ameghiniana, Buenos Aires, 5(8) 279-295, pls. 1-3, 2 text-figs.

Bertram, H. & Kemper, E. 1971. Das Alb von Hannover. Beih. Ber. Naturh. Ges., Hannover, 7: 27-47, 3 pls.

Bischoff, G. 1963. Ostracoden - studien im Libanon 3: Die gattung *Cytherelloidea* in Oberen Jura und in der Unterkreide. Senck. Leth., Frankfurt a.M., 45(1): 1-28, pls. 1-3, 6 text-figs.

Blezard, R.G. 1972. Field meeting on the Chalk of Pitstone, Central Chilterns. Proc. Geol. Ass. London, 83: 349-353, pl.18.

Bold, W.A. van den, 1946. Contribution to the study of Ostracoda, with special reference to the Tertiary and Cretaceous microfauna of the Caribbean Region. Diss. Univ. Utrecht. Amsterdam. 167 pp., 18 pls.

Bonnema, J.H. 1940 - 1941. Ostracoden aus der Kreide des Untergrundes der Nordostlichen Niederlande. Natuur. Maandbl., Maastricht, 29 (9-12): 91-95, 104-108, 115-118, 129-132, pls. 1-4 ; 30 : 8-10, 21-24, 26-29, 40-43, 56-60, 70-72, pls. 5-7.

Bosquet, J. 1847. Description des Entomostracés fossiles de la craie de Maestricht. Mém. Soc. r. Sci., Liège. 4: 353-378, 4 pls.

—— 1852. Description des Entomostracés fossiles des terraine Tertiares de la France et de la Belgique. Mém. Akad. R. Belg., Brussels. 24: 142 pp., 6 pls.

—— 1854. Monographie des Crustacés fossiles du terraine crétacé du duché de Limbourg. Verhand. Geol. beschr. Kaar. Nederland. Haarlem. 2: 1-139, 10 pls.

Bremen, E. 1976. Paleoecology and Systematics of Cenomanian and Turonian Ostracoda from Guadalajara and Soria (Central Spain). Rev. Esp. Micropal., Madrid, 8(1): 71-122.

Brown, P.M. 1957. Upper Cretaceous Ostracoda from North Carolina. N. Carolina Dept. Cons. Devel. Div. Min. Res. Bull no. 70: 1-28, pls. 1-7, 1 text-fig.

Burnaby, T.P. 1961. The palaeoecology of the Chalk Marl. Palaeontology, London, 4(4): 599-608, 1 text-fig., 2 tables.

Butler, E.A. & Jones, D.E. 1957. Cretaceous Ostracoda of Prothro and Reyburns Salt Domes, Bienville Parish, Louisiana. Bull. Geol. Surv. La. Baton Rouge. 32: 1-65, pls. 1-6, 5 text figs.

Califano, L., Dohrn, P., Montalenti, G., Puri, H.S. 1964. Ostracods as Ecological and Palaeoecological indicators. Pubbl. staz. zool. Napoli 33 suppl., 612 pp.

Carter, D.J. and Hart, M.B., 1977. Aspects of mid-Cretaceous stratigraphical micropalaeontology. Bull. Br. Mus. Nat. Hist. (Geol.) London. 29(1): 1-135, text figs. 1-53, pls. 1-4.

Chapman, F. 1898. On Ostracoda from the 'Cambridge Greensand'. Ann. Mag. Nat. Hist. London. 7(2): 331-346.

Chapman, F. & Sherborn, C.D. 1893. On the Ostracoda of the Gault at Folkestone. Geol. Mag., London, 10 : 345-349, pl.14.

Charollais, J., Moullade, M., Oertli, J., Rapin, F. 1977. Découverte de microfaunes de l'Albien moyen et supérieur dans la vallée de joux (Jura vaudois, suisse). Geobios, Lyon, 10(5): 683-695, 2 pls.

Colin, J.P. 1973. Nouvelle contribution a l'étude des ostracodes du Crétacé superieur de Dordogne (S.O. France). Palaeontographica A. Stuttgart, 145 (1-3): 1-38, 2 text-figs., 6 pls., 1 table.

—— 1974a. Contribution a l'étude des Ostracodes du crétacé supérieur de Dordogne (France). Geobios, Lyon, 7(1): 19-42, pls. 8-10, 1 text-fig.

—— 1974 b. Nouvelles espèces des genres 'Metacypris' et 'Theriosynoecum' (Ostracodes Lacustres) dans le Cénomanien de Dordogne (S.O. France). Rev. Esp. Micropal., Madrid, 6(2): 183-189.

Colin, J.P. 1974 c. Nouvelles espèces d'Ostracodes dans le Cénomanien supérieur de l'Ile Madame (Charente-Maritime, sud-ouest de la France). Eclog. geol. Helv., Basel, 67(2): 445-455, 1 pl., 3 text-figs.

Colin, J.P., & Lauverjat, J. 1974. Ostracodes nouveaux du Cénomanien de Mamarrosa (Province du Beira Littoral, Portugal). Revue Micropaléont, Paris, 17(1): 3-14, 3 pls.

Cornuel, J. 1846. Description des Entomostracées fossiles du terrain crétacé inférieur de Haute-Marne. Mém. Soc. géol. France, series 2, Paris, 2(1): 193-205, 1 pl.

—— 1848. Description de nouveaux fossiles microscopiques du terrain crétacé inférieur du département de Haute-Marne. Ibid. 2(3): 241-263, 2 pls.

Crane, M.J. 1965. Upper Cretaceous ostracodes of the Gulf Coast area. Micropaleontology, New York, 11(2): 191-254, pls. 1-9, 2 text-figs.

Damotte, R. 1962. Quelques Ostracodes du Turonien Inférieur de la Touraine. Revue Micropaléont. Paris, 5(3): 191-204, pls. 1,2.

—— 1964a. Contribution a l'étude des Ostracodes du Sénonien de Sens (Yonne): les Trachyleberidae. Ibid. 7(2): 100-110, pls. 1,2.

—— 1964 b. Contribution a l'étude des Ostracodes du Sénonien de Sens (Yonne): les Schizocytheridae, les Cytheridae et les Cytherellidae. Ibid., 7(4): 232-241, 2 pls.

—— 1968. Protocythere Triebel 1938, Mandocythere Gruendel 1964 et Costacythere Gruendel 1966 (Ostracodes) dans le Crétacé du bassin de Paris. Bull. Soc. géol. Fr. Paris, 10(7): 384-392, 1 pl., figs. 1-3, 2 tables.

Damotte, R. 1971 a. Quelques Ostracodes du Cénomanien de Dordogne et de Touraine. Revue Micropaléont. Paris, 14(1): 3-20, pls. 1-3.

—— 1971 b. Contribution à l'étude des Ostracodes marins dans le Crétacé du Bassin de Paris. Soc. Géol. France. nouvelle serie, t.1. mem. No.113, 152 pp. 8pls.

—— 1974. Un nouveau genre d'Ostracode de l'Albien du Bassin de Paris. Matronella n.g. Palaeontographica A. Stuttgart, 146 s.181-189.

—— 1975. Ostracodes Cenomaniens du Bassin de Paris; Quelques resultats d'ordre paleoecologique et paleogeographique. Bull. Am. Paleont. 65 (282): 263-269.

—— 1976. Sur le problème de l'évolution des empreintes musculaires chez le Trachyleberidinae albiennes et Cénomaniennes du Bassin de Paris. Abh. Verh. Naturwiss. Ver. Hamburg (N.F.) Hamburg, 18/19 (suppl.): 295-303.

—— 1977. Sur les genres crétacés : Rehacythereis, Veeniacythereis, Cornicythereis, Parvacythereis, et Chapmanicythereis (Trachyleberididae, Ostracoda) créés par J. Gruendel en 1973. Revue Micropaléont. Paris, 19(4): 200-210, 2 pls.

Damotte, R., & Grosdidier, E. 1963. Quelques ostracodes du crétacé de la Champagne Humide. 1 Albien - Cénomanien. Ibid., 6(1): 51-66, pls. 1-3, 1 text-fig.

Damotte, R., & Freytet, P. 1974. Contribution a la connaissance du Cenomanien du Massif de Fontfroide (Aude-France): Etude des Ostracodes. Rev. Esp. Micropal., Madrid, 6(2): 201-207.

Damotte, R. & Saint-Marc, P. 1972. Contribution a la connaisance des Ostracodes Crétacés du Liban. Ibid. 4(3): 273-296.

Deroo, G. 1956. Études critiques au sujet des ostracodes marins du Crétacé inférieur et moyen de la Champagne humide et du Bas Boulonnais. Rev. Inst. Franç. Pétrole, Paris, 11(12): 1499-1535.

—— 1966. Cytheracea (Ostracodes) du Maastrichtien de Maastricht (Pays-Bas) et des régions voisines; résultats stratigraphiques et paléontologiques de leur étude. Meded. geol. Sticht. Series C. Maastricht, 2(2): 1-197, 27 pls. 22 text-figs. 9 tables.

Destombes, J.P. & Shepard-Thorn, E.R. 1971. Geological results of the channel tunnel site investigation, 1964 - 1965. Rep. Inst. geol. Sci., London, 71/11. 12 pp.

Dingle, R.V. 1969. Upper Senonian ostracods from the coast of Pondoland, South Africa. Trans. roy. Soc. S. Afr. 38(2): 139-163, 9 pls.

—— 1971. Some Cretaceous ostracodal assemblages from the Agulhas Bank (South African Continental Margin). Ibid. 39(4), 393-418, 1 pl.

Donze, P. 1970. Influence de milieu sur la mode de reproduction de *Cythereis* ? *castellanensis*, ostracode nouveau du Cénomanien-Turonien de la Foux (Basses-Alpes). Bull. Soc. Géol. de France. Paris. 12(7): 302-303.

Donze, P. & Porthault, B. 1972. Les Ostracodes de la sous-famille des Trachyleberidinae dans quelques coupes de reference du Cénomanien du Sud-Est de la France. Rev. Esp. Micropal., Madrid, 4(3): 355-376.

Donze, P. & Thomel, G. 1972. Le Cénomanien de la Foux (Alpes de Haute Provence). Biostratigraphie et faunes nouvelles d'Ostracodes. Eclog. geol. Helv. Basel, 65(2): 369-389, pls. 1-3, 3 text-figs.

Drummond, P.V.O. 1970. The mid-Dorset Swell. Evidence of Albian-Cenomanian movements in Wessex. Proc. Geol. Ass. London 81(4): 679-714, figs. 1-10.

Dupper, A. 1952. Uber das Cenoman in Niedersachsischen Bergland. Palaeont. Z. Stuttgart, 26: 49-111, pls. 3-5.

Eager, S.H. 1965. Ostracoda of the London Clay (Ypresian) in the London Basin : 1 Reading District. Revue Micropaleont. Paris, 8(1): 15-32, pls. 1,2.

Egger, J.G. 1910. Ostracoden and Foraminiferen des Eybrunner Kreidemergels in der Umgegend von Regensburg. Regensburg naturwiss. Ber. Regensburg, 12: 86-133, 6 pls.

Ellermann, C. 1962. Neue Alb-Vorkommen in der Munsterschen Kreidebucht und ihr Microfauna. N. Jb. Geol. Palaont. Mh. Stuttgart, 8: 385-408, 2 pls.

Forbes, C.L. 1960. Field meeting in the Cambridge District. Proc. Geol. Ass., London, 71: 233-241.

Gerry, E. & Rosenfeld, A. 1973. Amphicytherura distincta and Neocyprideis vandenboldi (Ostracoda), new species from the Cenomanian-Turonian of Israel. Rev. Esp. Micropal., Madrid, 5(1): 99-105.

Gray, D.A. et. al. 1965. The stratigraphic significance of electrical resistivity marker bands in the Cretaceous strata of the Leatherhead (Fetcham Mill) borehole, Surrey. Bull. Geol. Surv. Gt. Br. London, 23: 65-116.

Grekoff, N. & Deroo, G. 1956. Algunos Ostracodos del Cretacico medio del norte de España. Estudios Geologicas, Madrid, 31-32: 215-235, 2 pls.

Gründel, J. 1964 a. Neue ostracoden aus der deutschen Unterkreide 1. Mber. dt. Akad, Wiss. Berl. Berlin, 6: 743-749, pl.1.

—— 1964 b. Neue ostracoden aus der deutschen Unterkreide 2. Ibid. 6: 849-858, pls. 1,2.

Gründel, J. 1966. Taxionomische, biostratigraphische und variationstatistische Untersuchungen an den Ostracoden der Unterkreide in Deutschland. Freib. Forsch. Leipzig,C200 Palaontologie, 1-105, pls. 1-10, 29 text-figs.

—— 1967. Neue Ostracoden aus dem Hauterive und Alb Deutschlands. Jb. Geol., Berlin, 1: 629-650, pls.1,2, 2 tables.

—— 1969 a. Ostracoden aus der Plenus-Zone (Oberkreide) Sachsens. Freib. Forsch. C.245: 83-89, 1 pl.

—— 1969 b. Neue taxionomische Einheiten derunterklasse Ostracoda (Crustacea). N. Jb. Geol. Palaont. Min. Stuttgart, 6: 353-361.

—— 1971. Zur taxionomie und Entwicklung der Gattung Dolocytheridea Triebel, 1938 (Crustacea, Ostracoda) in der Unterkreide Mittel und Westeuropas. Ber. deutsch. Ges. Geol. Wiss. A. Geol. Palaont., Berlin, 16(1): 19-43.

—— 1973. Zur Entwicklung der Trachyleberididae (Ostracoda) in der unterkreide und in der tieferen Oberkreide. Teil 1: Taxonomie. Z. Geol. Wiss. Berlin, 1(11): 1463-1474.

—— 1974a. Zur Entwicklung der Trachyleberididae (Ostracoda) in der Unterkreide und in der tieferen Oberkreide. Teil 2: Phylogenie. Ibid. 2(1): 61-71.

—— 1974 b. Einige Bemerkungen zu den bei Ostrakoden (Crustacea) auftretenden schlosstypen. Biol. Rundschau. 12(1): 60-62, 1 text-fig.

—— 1974 c. Zur taxonomie und phylogenie der Cytherettidae Triebel, 1952 (Ostracoda, Crustacea). Freib. Forsch. C298: 81-99.

—— 1974 d. Zur kenntnis des Tribus 'Phacorhabdotina' Grundel, 1969 (Cytherocopina, Ostracoda). Ibid. C298: 101-107.

Gründel, J. 1974 e. Der schlossbau in der unterklasse Ostracoda (Crustacea): Seine ausbildung in abhangigkeit von funktionellen strukturellen und okologischen faktoren. Geoscience and Man 6: 127-136, 12 text-figs.

—— 1976 a. Neue Taxonomische Einheiten der Cytherocopina Grundel, 1967 (Ostracoda). Z. Geol. Wiss. Berlin, 4(9): 1295-1304.

—— 1976 b. Zur Taxonomie und Phylogenie der Cytherurinae G.W. Muller, 1894 (Cytherocopina, Ostracoda) in Zeitram hohere Trias bis Unterkreide. Ibid. 4(11): 1531-1541.

Gründel, J., & Kozur, H. 1971. Zur taxionomie der Bythocytheridae und Tricorninidae (Podocopida, Ostracoda). Montasber. Deutsch. Akad. Wiss. Berlin, 907-937.

—— 1973. Zur phylogenie der Tricorninidae und Bythocytheridae (Podocopida, Ostracoda). Freib. Forsch. C 282: 99-111, 1 text-fig.

Hamblin, R.J.O., & Wood, C.J. 1976. The Cretaceous (Albian-Cenomanian) stratigraphy of the Haldon Hills, South Devon, England. Newsl. Stratigr. Berlin, Stuttgart, 4(3): 135-149, 2 figs, 1 table.

Hancock, J.M. 1959. Les Ammonites du Cénomanien de la Sarthe. C. r. Cong. Socs. sav. Paris Sect. Sci., Colloque sur la Crétacé Superieur Français (Dijon, 1959): 249-252.

—— 1967. In "The London Region (South of the Thames)" by Pitcher, W.S., Peake, N.B., Carreck, J.N., Kircaldy, J.F., and Hancock, J.M. Geol. Ass. Guide no. 30B : 9-14 Colchester.

—— 1969. The transgression of the Cretaceous sea in the south-west of England. Proc. Ussher Soc., Camborne 2: 61 - 83.

—— 1975. The petrology of the Chalk. Proc. Geol. Ass., London, 86(4): 499-535, pls. 1-4, 2 text-figs., 4 tables.

Hart, M.B. 1973 a. Foraminiferal evidence for the age of the Cambridge Greensand. Proc. Geol. Ass. London, 84: 65-82, figs. 1-5.

—— 1973 b. Some observations on the Chert Beds (Upper Greensand) of south-west England. Proc. Ussher Soc., Cambourne, 2: 599-608, figs. 1-4.

—— 1975. Microfaunal analysis of the Membury Chalk succession. Proc. Ussher Soc., Leeds, 3(2): 271-279, text-figs. 1-3.

Hart, M.B. & Carter, D.J., 1975. Some observations on the Cretaceous Foraminiferida of south-east England. J. foramin. Res., Washington, 5: 114-126, figs. 1-10.

Hart, M.B. & Tarling, D.H. 1974. Cenomanian palaeogeography in the North Atlantic and possible mid-Cenomanian eustatic movements and their implications. Palaeogeogr. palaeoclimat. Palaeoecol. Amsterdam, 15: 95-108, text-figs. 1-5.

Hartmann, G. 1964. Neontological and paleontological classification of Ostracoda. Publ. staz. zool. Napoli. 33 suppl: 550-587.

Hartmann, G., & Puri, H.S. 1974. Summary of neontological and paleontological Classification of Ostracoda. Mitt. Hamburg Zool. Mus. Inst., Hamburg, 70: 7-73.

Hazel, J.E. & Poulson, O.L. 1964. Some new Ostracod species from the Austinian and Taylorian of E. Texas. J. Paleont., Tulsa, 38: 1047-1064.

Herrig, E. 1965. Zwei neue Idiocythere-Arten aus dem Campan, Insel Rugen (Ostsee). Geologie, Berlin, 14(10): 1224-1235, pl.1, text-figs. 1-5.

—— 1966. Ostracoden aus der Weissen Schreibkreide (Unter Maastricht) der Insel Rugen. Palaont. Abh. A. Palaozool, Berlin, 11: 693-1024, pls. 1-45.

—— 1967. Zur phylomorphogenese van Bythoceratina umbonatoides

(Kaye, 1964), Ostracoda, Crustacea aus der nordostdeutschen Oberkreide. Geologie, Berlin, 16(5): 598-614.

Hill, B.L. 1954. Reclassification of winged *Cythereis* and winged Brachycythere. J. Paleont., Tulsa, 28(b): 804-826, pls. 97-100.

Hinte, J.E. van, 1976. A Cretaceous time scale. Bull. Am. Ass. Petrol. Geol., Chicago, 60: 498-516.

Holden, J.C. 1964. Upper Cretaceous ostracods from California. Palaeontology, London, 7(3): 393-429, 28 figs.

Hornibrook, N. de B. 1952. Tertiary and Recent marine Ostracoda of New Zealand. Their origin, Affinities and Distribution. Palaeont. Bull. N.Z. geol. surv. 18: 1-82, pls. 1-18, 4 text-figs.

Howe, V.H. & Laurencich, L. 1958. Introduction to the study of Cretaceous Ostracods. Louisiana state Univ. Press, Baton Rouge, 536 pp. illus.

Jeans, C.V. 1968. The origin of the Montmorillonite of the European chalk with special reference to the Lower Chalk of England. Clay Miner., Oxford, -: 311-330.

Jefferies, R.P.S. 1962. The palaeoecology of the *Actinocamax plenus* subzone (lowest Turonian) in the Anglo-Paris Basin. Palaeontology, London, 4(4): 609-647, text-figs. 1-13, pls. 77-79.

—— 1963. The stratigraphy of the *Actinocamax plenus* subzone (Turonian) in the Anglo-Paris Basin. Proc. Geol. Ass., London, 74: 1-33, figs. 1-9.

Jones, T.R. 1849. A monograph of the Entomostraca of the Cretaceous Formation of England. Palaeontogr. Soc. (Monogr.). London, 1-40, pls. 1-7.

—— 1870. Notes on Cretaceous Entomostraca. Geol. Mag., London, 7: 74-77.

Jones, T.R., & Hinde, G.J., 1890. A supplementary monograph of the Cretaceous Entomostraca of England and Ireland. Palaeontogr. Soc., (Monogr.), London, i-viii, 1-70, pls. 1-4.

Juignet, P., Kennedy, W.J. & Wright, C.W. 1973. La limite Cénomanien - Turonien dans la région du Mans (Sarthe): Stratigraphie et paléontologie. Annls. Paléont. (Invert.), 59: 207-242, pls. 1-3.

Jukes-Browne, A.J. & Hill, W. 1896. A delimitation of the Cenomanian Q. Jl. geol. Soc. Lond. 52: 99-177, pl.5, tables.

—— 1903. The Lower and Middle Chalk of England. Mem. geol. Surv. U.K. London, 558 pp., 8 pls. 87 figs.

Kaye, P. 1963 a. The Ostracod genus Neocythere in the Speeton Clay. Palaeontology, London, 6(2) 274-281, pl.41.

—— 1963b. Species of the Ostracod family Cytherellidae from the British Lower Cretaceous. Senckenbergiana, Frankfurt, a.M., 44(2): 109-125, 3 pls.

—— 1963c. The interpretation of the mesozoic Ostracod genera of the family Cytherideidae Sars, 1925. Revue Micropaléont., Paris, 6(1), 23-40, 3 pls.

—— 1963d. Ostracoda of the subfamilies Protocytherinae and Trachyleberidinae from the British Lower Cretaceous. Palaont. Z. Stuttgart, 37: 225-238, pls. 18, 19.

—— 1964a. Ostracoda of the genera Eucytherura and Cytheropteron from the Speeton Clay. Geol. Mag., London, 101(2): 97-10-, pls. 4, 5.

—— 1964b. Revision of the Ostracoda from the Bargate Beds in Surrey. Palaeontology, London, 7(2): 317-330, pls. 54, 55.

Kaye, P. 1964 c. Revision of British Marine Cretaceous Ostracoda with notes on additional forms. Bull. Br. Mus. Nat. Hist. (geolcgy), 10(2): 37-79, pls. 1-9.

—— 1965 a. Further Ostracoda from the British Lower Cretaceous. Senckenberg. leth. Frankfurt a.M., 46: 83-87, 1 pl.

—— 1965 b. Ostracoda from the Aptian of the Isle of Wight, England. Palaont. Zeitschr., Stuttgart, 39(1-2): 33-50, 2 pls.

—— 1965 c. Some new British Albian Ostracoda. Bull. Br. Mus. Nat. Hist. (geology). 11(5): 215-253, 11 pls. 5 figs.

Kaye, P., & Barker, D. 1965. Ostracoda from the Sutterby Marl (U. Aptian) of south Lincolnshire. Palaeontology, London, 8(3): 375-390, pls. 48-50, 1 text-fig.

Keen, M.C., & Siddiqui, Q.A. 1971. Cenomanian Ostracoda from the Carrs Glen Shell bed, Belfast. Revue Micropaléont., Paris, 14(1): 62-68, 2 pls.

Kemper, E. 1971. 'Batavocythere' und Saxocythere, zwei neue Protocytherinae - Gattungen (Ostracoda) der Unterkreide. Senckenberg. leth., Frankfurt a.M., 52 (5/6): 385-431, 8 pls.

Kemper, E., Bertram, H. & Deiters, H. 1975. Zur Biostratigraphie und Palakologie der Schichtenfolge Ober-Apt/Unter Alb.im Beckenzentrum nordlich und ostlich von Hannover. Ber. naturhist. Ges., Hannover, 119: 49-85.

Kennedy, W.J. 1967. Burrows and surface traces from the Lower Chalk of southern England. Bull. Br. Mus. Nat. Hist. (geology), 15(3): 125-167, 9 pls.

—— 1969. The correlation of the Lower Chalk of south-east England. Proc. Geol. Ass., London, 80: 459-560, pls. 15-22, 16 figs.

Kennedy, W.J. 1970. A correlation of the Uppermost Albian and the Cenomanian of south-west England. Ibid., 81: 613-677, figs. 1-20.

Kennedy, W.J., & Cobban, W.A. 1976. Aspects of Ammonite Biology, Biogeography, and Biostratigraphy. Spec. Pap. Palaeont. no. 17: 94 pp., 11 pls.

Kennedy, W.J., & Garrison, R.E. 1975. Morphology and genesis of nodular chalks and Hardgrounds in the Upper Cretaceous of southern England. Sedimentology, Oxford, 22(3): 311-386.

Kilenyi, T. 1971. Some basic questions in the palaeoecology of Ostracods. In Oertli, H.J. (Ed.). Paleoecologie Ostracodes Pau 1970. Bull. Centre Rech. Pau - SNPA 5 (suppl.): 31-44, 3 figs.

King, C.B. 1968. Ostracoda from the Upper Chalk of the British Isles. University of London Thesis (Ph.D.). unpubl.

Lecointre, G. 1959. Le Turonien dans sa région type, la Touraine. C. r. Cong. Socs Sav. Paris Sect. Sci., Colloque sur la Crêtacé Supérieur Français (Dijon 1959): 415-423.

Liebau, A. 1969. Homologisierende Korrelationen von Trachyleberiden Ornamenten (Ostracoda, Cytheracea). N.Jb. Geol. Palaont. Mh., Stuttgart, 7: 390-402, 4 figs.

—— 1971. Homologe Skulpturmuster bei Trachyleberididen und verwandten Ostrakoden. Diss. Techn. Univ. Berlin, 118 pp. 32 figs.

—— 1975. Comment on suprageneric taxa of the Trachyleberididae s.n. (Ostracoda, Cytheracea). N.Jb. Geol. Palaont., Stuttgart, 148: 353-379.

Ljubimova, P.S. 1955. Ostracoda of the Middle Mezosoic formations of the central Volga area and the Obshehego Sirta (drainage area to east). In Ljubimova, P.S. & Khabarova, T.H. Ostracoda of the Mezosoic sediments of the Volga-Ural Region. All-Union

Petrol. Sci-Res. Geol. Expl. Inst. (VNIGRI), Trans. N.S. 84: 1-189, pls. 1-13.

—— 1965. Ostracods of the Lower Cretaceous deposits of the Prekaspian depression. All. Union Petrol. Sci. - Res. Geol. Expl. Inst. Trans. 244 : 1 - 199, 16 pls.

Malecki, J. 1960. Ostracodes du Crétacé inférieur de la localite Wawal pres de Tomaszow Mazowiecki. Ann. Soc. geol. Pologne 30: 99-120.

Malz, H. 1974. 'Homocythere howei' n. sp.: A contribution toward retaining a juvenile genus. Geoscience and Man, 6: 41-45, 1 pl.

Mandelstam, M.I. 1956. Ostracoda. In Contributions to palaeontology New families and Genera. All. Union Geol. Res. Inst. (VSEGEI) 12: 87-144, pls. 19-27.

Marks, P. 1967. Rotalipora et Globotruncana dans la craie de Théligny (Cenomanien : Dépt. de la Sarthe). Proc. K. ned. Akad. Wet., Amsterdam, B70(3): 264-275, pls. 1-3, text-figs. 1-4.

Marsson, T. 1880. Die Cirrepedien und Ostracoden der Weissen Schreibkreide der Insel Rugen. Mitt Naturw. Verein. Neu Vorpommern und Rugen in Greifswald : 1880: 1-50.

Mertens, E. 1956. Zur Grenzziehung Alb/Cenoman in Nordwestdeutschland mit Hilfe von Ostracoden. Geol. Jb., Hannover, 72: 173-230, pls. 8-14, 1 table.

Moore, R.C. & Pitrat, C.W. eds. 1961. Treatise on Invertebrate Paleontology, part Q: Arthropoda, 3 Crustacea, Ostracoda: xxii + 442 pp., 334 figs. Kansas.

Morkhoven, F.P.C.M. van. 1962. Post-Palaeozoic Ostracoda. Their Morphology, Taxonomy and Economic Use. 1 general: 204 pp. Elsevier, Amsterdam.

—— 1963. Post Palaeozoic Ostracoda. Their Morphology, Taxonomy and Economic Use. 2 generic Descriptions: 478 pp. Elsevier, Amsterdam.

Neale, J.W. 1960. Marine Lower Cretaceous Ostracoda from Yorkshire, England. Micropaleontology, New York, 6(2): 203 - 224, pls. 1-4.

—— 1961. The Senonian (Upper Cretaceous) ostracod Paracypris siliqua Jones and Hinde 1890. Ann. Mag. Nat. Hist. London, 13(4): 193-197, pl.7.

—— 1962. Ostracoda from the type Speeton Clay (Lower Cretaceous) of Yorkshire, Micropaleontology, New York, 8(4): 425-484, pls. 1-13.

—— 1964. Some factors influencing the distribution of Recent British Ostracoda. Pubbl. staz. zool. Napoli 33 suppl.: 247-307.

—— 1973. Ostracoda as a means of correlation is the Boreal Lower Cretaceous, with special reference to the British marine Ostracoda. In 'The Boreal Lower Cretaceous' ed. Casey, R. & Rawson, P.F. Geol. Journ. special issue, Liverpool, 5: 169;184, 2 text-figs.

—— 1975. The Ostracod fauna from the Santonian chalk (Upper Cretaceous) of Gingin, Western Australia. Spec. pap. Palaeont., no. 16: 1-81, pls. 1-22, 17 text-figs.

Oertli,H.J.1958. Les ostracodes de l'Aptian-Albian d'Apt. Rev. Inst. Franc. Pétrole, Paris, 13: 1499-1537, pls. 1-9.

—— 1963. Faunes d'ostracodes du Mézozoïque de France. Leyde. E.J. Brill éd. 57 pp. XC pls.

Omhert, W. 1970. Ecology of some Trachyleberididae (Ostracoda) from the Bavarian Upper Cretaceous. In Oertli, H.J. (ed.). Paleoecologie Ostracodes Pau 1970. Bull. Centre Rech. Pau - SNPA, 5 (suppl.): 601-614, 7 figs.

Orbigny, A.D.d' 1842-47. Pteropoda, Gasteropoda. Paléontologie française, Terrains crétacés, 2. 456 pp., Atlas 236 pls. table (1842) Brachiopoda (includes Bivalvia. loc. cit.4. 390 pp., Atlas pl. 490-599. (1847) Paris.

Owen, H.G. 1975. The stratigraphy of the Gault and Upper Greensand of the Weald. Proc. Geol. Ass. London, 86(4) 475-498, text-figs. 1-10, 1 table.

Pokorny, V. 1955. The phylomorphology of the hinge in Podocopida (Ostracoda, Crustacea) and its bearing on the taxonomy. Acta. Univ. Carolinae Geol., Prague, 5: 3-22, 4 text-figs.

—— 1963. The revision of Cythereis ornatissima (Reuss, 1846), (Ostracoda, Crustacea). Ropr. Ceske. Akad., Prague, 73(6); 1-59, pls. 1-7.

—— 1964. Oertliella and Spinicythereis, new ostracod genera from the Upper Cretaceous. Vest. Ustred. Ust. geol. 39: 283-284, 1 pl., 1 text-fig.

—— 1965. New species of Cythereis (Ostracoda, Crustacea) from the Turonian of Bohemia. Acta. Univ. Carolinae geol., Prague, 1: 75-89, 2 pls. 4 text-figs.

—— 1967. The genus Curfsina (Ostracoda, Crustacea) from the Upper Cretaceous of Bohemia, Czechoslovakia. Ibid. 4: 345-364.

—— 1968. The diversity of fossil ostracode communities as an indicator of palaeogeographic conditions. In Oertli, H.J.(ed.) Paleoecology Ostracodes Pau 1970. Bull. Centre Rech. Pau-SNPA, 5(suppl.): 46-61, 4 figs., 2 tables.

Reuss, A.E. 1845/1846. Die Versteinerungen der Bohmischen Kreideformation. E. Schweizerbart, Stuttgart. Abt. 2, 59-148, pls. 14-51.

—— 1851. Die Foraminiferen und Entomostraceen des Kreidmergels von Lemberg. Haidingers naturw. Abh., Vienna, 4, 17-57, pls. 2-6.

—— 1854. Beitrage zur Charakteristik der Kreideschichten in der Ostalpen. Denkschr. Akad. Wiss. Wien, 7: 139-142, pls. 26-28.

—— 1855. Ein Beitrag sur generaveran Kenntniss der Kreidegebilde Meklenburgs. Z. dtsch. geol. Ges., Berlin, 7: 261-292, pls. 8-11.

—— 1874. Die Foraminiferen, Bryozoen und Ostracoden des Planers. In Geinitz, Das Elbthalsgebirge in Sachsen. Paleontographica, 20(2): 138-157, pls. 26-28.

Reyment, R.A. 1960. Studies on Nigerian Upper Cretaceous and Lower Tertiary Ostracoda. Part 1: Senonian and Maastrichtian Ostracoda. Stockolm. Contr. Geol., Stockholm, 7: 1-238, 13 pls.

—— 1966. Studies on Nigerian Upper Cretaceous and Lower Tertiary Ostracoda. Part 3: Stratigraphical, palaeoecological and biometrical conclusions. Ibid. 14: 1-151.

Roemer, F.A. 1840. Die Versteinerungen des Norddeutschen Kreidegebirges. Hannover. 145 pp., 16 pls.

Schlanger, S.O. & Jenkyns, H.C. 1976. Cretaceous oceanic anoxic events : causes and consequences. Geol. Mijnb., Den Haag, 55 (3-4): 179-184.

Schmidt, R.A.M. 1948. Ostracoda from the Upper Cretaceous and Lower Eocene of Maryland, Delaware and Virginia J. Paleont., Tulsa. 22(4): 389-431.

Sexton, J.V. 1951. The Ostracoda Cytherelloidea in North America. J. Paleont. Tulsa 25: 808-816.

Smith, W.E. 1957. The Cenomanian limestone of the Bear district, south Devon. Proc. Geol. Ass., London, 68: 115-133, pls. 4, 5, figs. 1-5.

Smith, W.E. 1961. The Cenomanian Deposits of south-east Devonshire; the Cenomanian limestones and contiguous deposits west of Beer. Ibid. 72: 91-133, pls. 4-6, figs. 1-8.

Sohn, I.G. 1964. The ostracoda genus Cytherelloidea, a possible indicator of paleotemperature. Pubbl. staz. zool. Napoli, 33 suppl., 529-534.

Sornay, J. (ed.) 1957. France, Belgique, Pays-Bas, Luxembourg. Crétacé. Lexique Strat. Int., Paris, 1 (Europe), fasc. 4a, VI. 403 pp., figs.

Spath, L.F. 1926. On the zones of the Cenomanian and uppermost Albian. Proc. Geol. Ass., London, 37 : 420-432.

Stchépinsky, A. 1954. Etude des Ostracodes du Cretace inferieur de la Haute-Marne. Bull. Soc. geol. Fr., Paris 6(4): 485-500.

Swain, F.M. 1973. Upper Cretaceous Ostracoda from the N.W. Pacific ocean. J. Paleont., Tulsa, 47(4): 711-714, pl.1.

Sylvester-Bradley, P.C. 1948. The Ostracod genus Cythereis. J. Paleont., Tulsa, 22(6): 792-797, pl.122, 1 text-fig.

Sylvester-Bradley, P.C., & Benson, R.H. 1971. Terminology for surface features in ornate Ostracodes. Leth. Oslo, 4: 249-286.

Szczechura, J. 1964. Monoceratina Roth (Ostracoda) from the upper Cretaceous and Lower Paleocene of North and central Poland. Acta Palaeont, pol. Warsaw, 9(3): 357-418, 11 pls.

—— 1965. Cytheracea (Ostracoda) from the uppermost Cretaceous and lowermost Tertiary of Poland. Ibid. 11(4): 451-464, 19 pls.

Triebel, E. 1938a. Ostracoden Untersuchungen 1: Protocythere und Exphthalmocythere, zwei neue Ostracoden-Gattungen aus der deutschen Kreide. Senckenberg. Leth. Frankfurt a.M. 20: 178-200, pls. 1-3.

Triebel, E. 1938 b. Die Ostracoden der deutschen Kreide: 2 Die Cytheridae Arten. Ibid. 20(6): 471-501, 6 pls.

—— 1940. Die Ostracoden der deutschen Kreide 3 Cytherideinae und Cytherinae aus der Unteren Kreide. Ibid. 22: 160-227. pls. 1-10, 2 text-figs. 1 table.

—— 1950. Camptocythere eine neue Ostracoden - Gattung aus dem Dogger Norddeutschlands. Ibid., 31 (3-4): 197-208.

Upson, M.E. 1933. The Ostracoda of the Big Blue Series in Nebraska Nebraska Geol. Surv. Bull. Ser. 2(8): 54pp.

Veen, J.E. van. 1932. Die Cytherellidae der Maastricher Tuffkreide und der Kunrader Korallenkalkes von Sud Limburg. Verh. geol. Mijnb. Genoots Nederl. Kol., The Hague, geol. ser., D 9: 317-354, 15 pls.

—— 1936. Die Cytheridae der Maastrichter Tuffkreide und der Kunrader Korallenkalkes von sud Limburg. 3. Die Gattungen Loxoconcha, Monoceratina, Paracytheridea, Xestoleberis, Cytheropteron und Cytherura. Natuurhist. Maandbl. Maastricht, 25 : 21-24, 32-36, pl.1; 42-45, 62-64, pl.2; 69-71, 82-86, pl.3; 98-101, 108-113, pl.4.

—— 1938. Die Ostracoden in der Tuffkreide ohne gelbe Limonitische Farbung unter dem Koprolithenschichten zu Slavante. Ibid. 27: 10-12, pl.1; 15-20.

Weingeist, L. 1949. The Ostracod genus Eucytherura and its species from the Cretaceous and Tertiary of the Gulf Coast. J. Paleont. Tulsa, 23(4): 364-379, pl.73.

Whatley, R.C. 1976. Association between podocopid Ostracoda and some Animal substrates. Abh. Verh. naturwiss. Ver. Hamburg (N.F.), Hamburg, 18/19 (suppl.): 191-200.

White, H.J.O. 1926. The Geology of the Country near Lewes. Mem. Geol. Surv. U.K.

Williamson, W.C. 1848. On some of the microscopical objects found in the mud of the Levant, and other deposits; with remarks on the mode of formation of calcareous and infusorial siliceous rocks. Mem. Manchr. Lit. Phil. Soc. series 2, 8 : 1-128, 4 pls.

—— 1872. Corrections of the nomanclature of the objects figured in a Memoir "on some of the minute objects found in the mud of the Levant"; Ibid ser. 3, 5 : 131-139.

Wright, C.W. & Wright, E.V. 1951. A survey of the Fossil Cephalopoda of the Chalk of Great Britain. Palaeontogr. Soc. (Monogr.): 1-41.

PLATE 1.

(x 68)

Cytherella ex. gr. C. ovata (Roemer)

Fig. 1. Female right valve, OS 9325, sample BN 1, Middle Cenomanian, Buckland Newton, Dorset.

Fig. 2. Female left valve, OS 9324, sample Bar 18, Lower Cenomanian, Barrington, Cambs.

Fig. 3. Female carapace, OS 9327, dorsal view, sample Bar 18, Lower Cenomanian, Barrington, Cambs.

Fig. 4. Male carapace, OS 9328, dorsal view, sample Bar 18, Lower Cenomanian, Barrington, Cambs.

Fig. 5. Male right valve, OS 9326, sample GB 32, Lower Cenomanian, Glyndebourne, Sussex.

Cytherella cf. C. truncata (Bosquet)

Fig. 6. Female right valve, OS 9429, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 7. Female carapace, OS 9431, dorsal view, sample Bar 16, Lower Cenomanian, Barrington, Cambs.

Fig. 8. Male carapace, OS 9432, dorsal view, sample GB 34, Lower Cenomanian, Glyndebourne, Sussex.

Fig. 9. Female left valve, sample GB 32, Lower Cenomanian, Glyndebourne, Sussex. Specimen lost.

Fig. 10. Female carapace, OS 9431, left view, sample Bar 16, Lower Cenomanian, Barrington, Cambs.

Fig. 11. Male right valve, OS 9430, sample Bar 18, Lower Cenomanian, Barrington, Cambs.

Fig. 12. Male left valve, OS 9433, sample Bar 18, Lower Cenomanian, Barrington, Cambs.

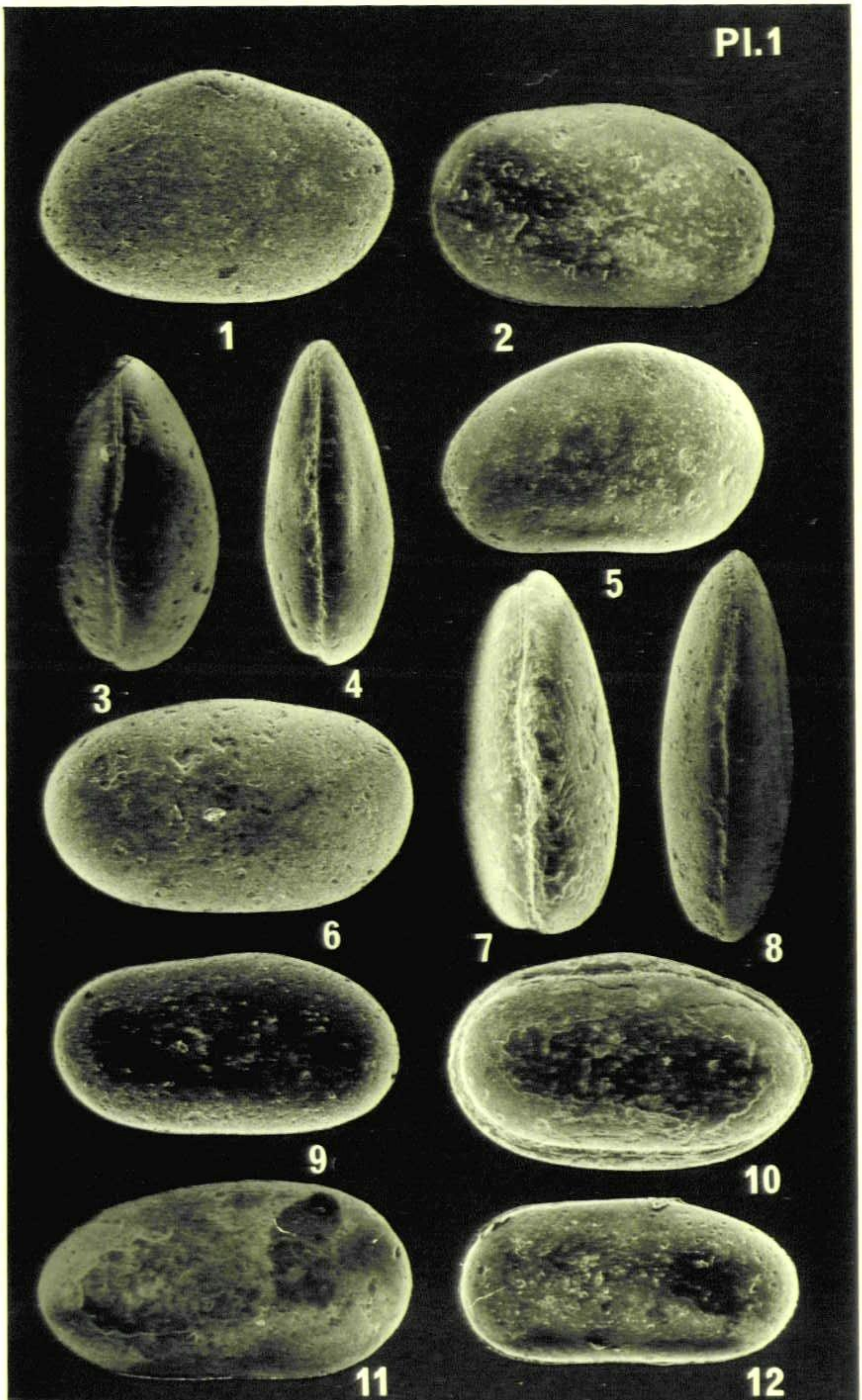

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PLATE 2

(x 68)

Cytherella cantabrigensis n.sp.

Fig. 1. Female left valve, paratype, OS 9352, sample BB8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 2. Female right valve, holotype, OS 9351, sample BB8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 3. Male right valve, paratype, OS 9353, sample BB8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 4. Male carapace, paratype, OS 9354, sample BB8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 5. Female carapace, paratype, OS 9355, dorsal view, sample BB8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 12. Juvenile right valve, paratype, OS 9356, sample BB8, Upper Cenomanian, Blue Bell Hill, Kent.

Cytherella medwayensis n.sp.

Fig. 6. Female carapace, Hypotype, OS 9409, dorsal view, sample BN7, Uppen Cenomanian, Buckland Newton, Dorset.

Fig. 7. Female right valve, holotype, OS 9408, sample BB20, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 8. Female left valve, paratype, OS 9411, sample BB20, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 9. Female carapace, paratype, OS 9409, left view, sample BN7, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 13. Juvenile right valve, OS 9410, sample PBH1 26 Lower Cenomanian, Pitstone, Herts.

Cytherella ex. gr. C. ovata (Roemer)

Fig. 10. Juvenile right valve, OS 9329, sample PBH1 12, Lower Cenomanian, Pitstone, Herts.

Cytherella cf. C. truncata (Bosquet)

Fig. 11. Juvenile right valve, OS 9434, sample GB 32, Lower Cenomanian, Glyndebourne, Sussex.

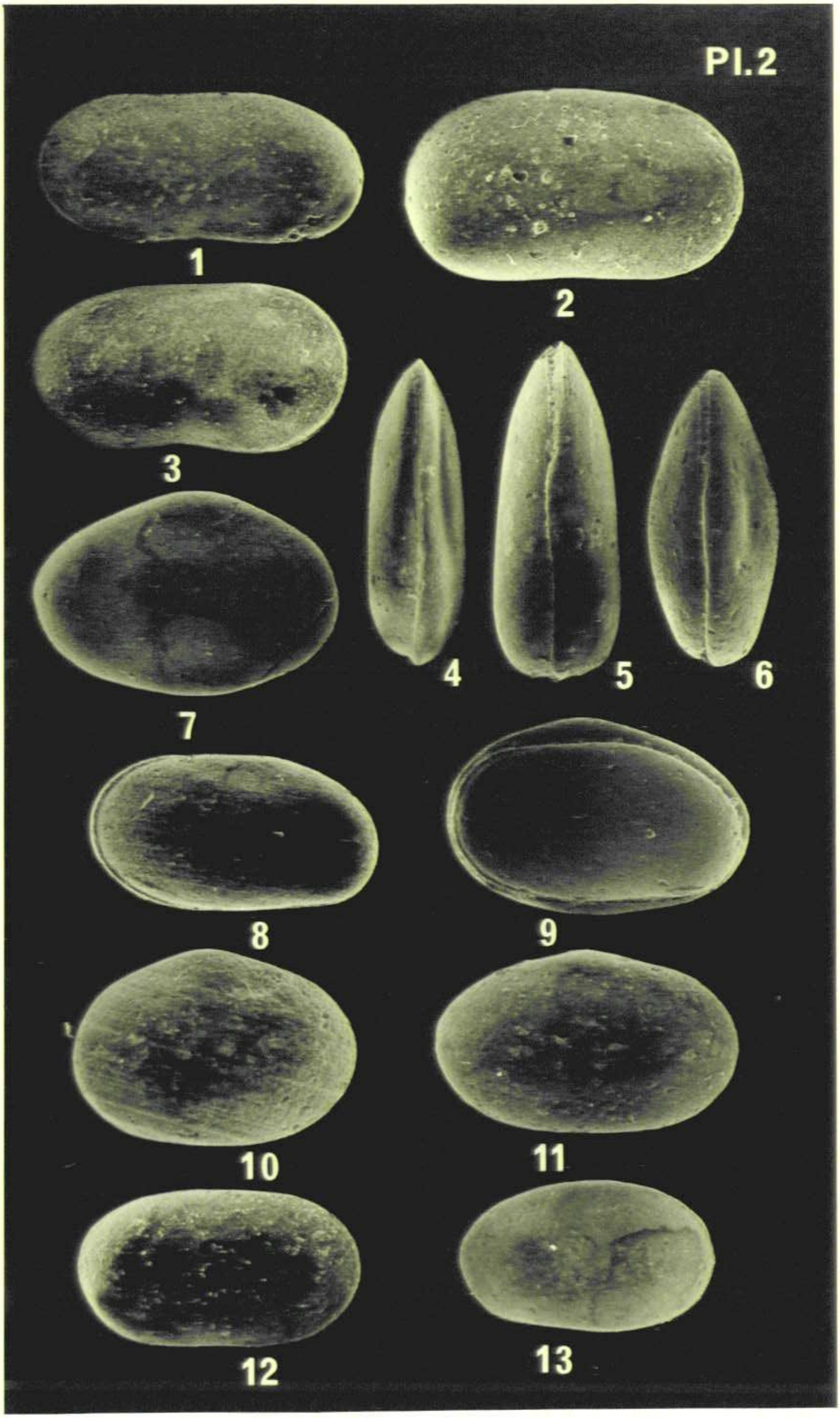
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PLATE 3

(x 90)

Cytherella grundeli n.sp.

Fig. 1. Left valve, OS 9401, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 2. Right valve, OS 9399, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 3. Carapace, OS 9400, left view, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 4. Carapace, OS9400, dorsal view, sample Bar 10, Middle Cenomànian, Barrington, Cambs.

Fig. 5. Right valve, holotype, OS 9396, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 6. Left valve, paratype, OS 9397, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 7. Carapace, paratype, OS 9398, dorsal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Cytherella aff. C. contracta contracta (Veen)

Fig. 8. Female right valve, OS 9374, sample BB 11, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 9. Female left valve, OS 9373, sample BB 11, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 10. Male right valve, OS 9375, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 11. Juvenile right valve, OS 9376, sample BB 11, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 12. Male carapace, OS 9377, dorsal view, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 13. Female carapace, OS 9378, dorsal view, sample BB 11, Upper Cenomanian, Blue Bell Hill, Kent.

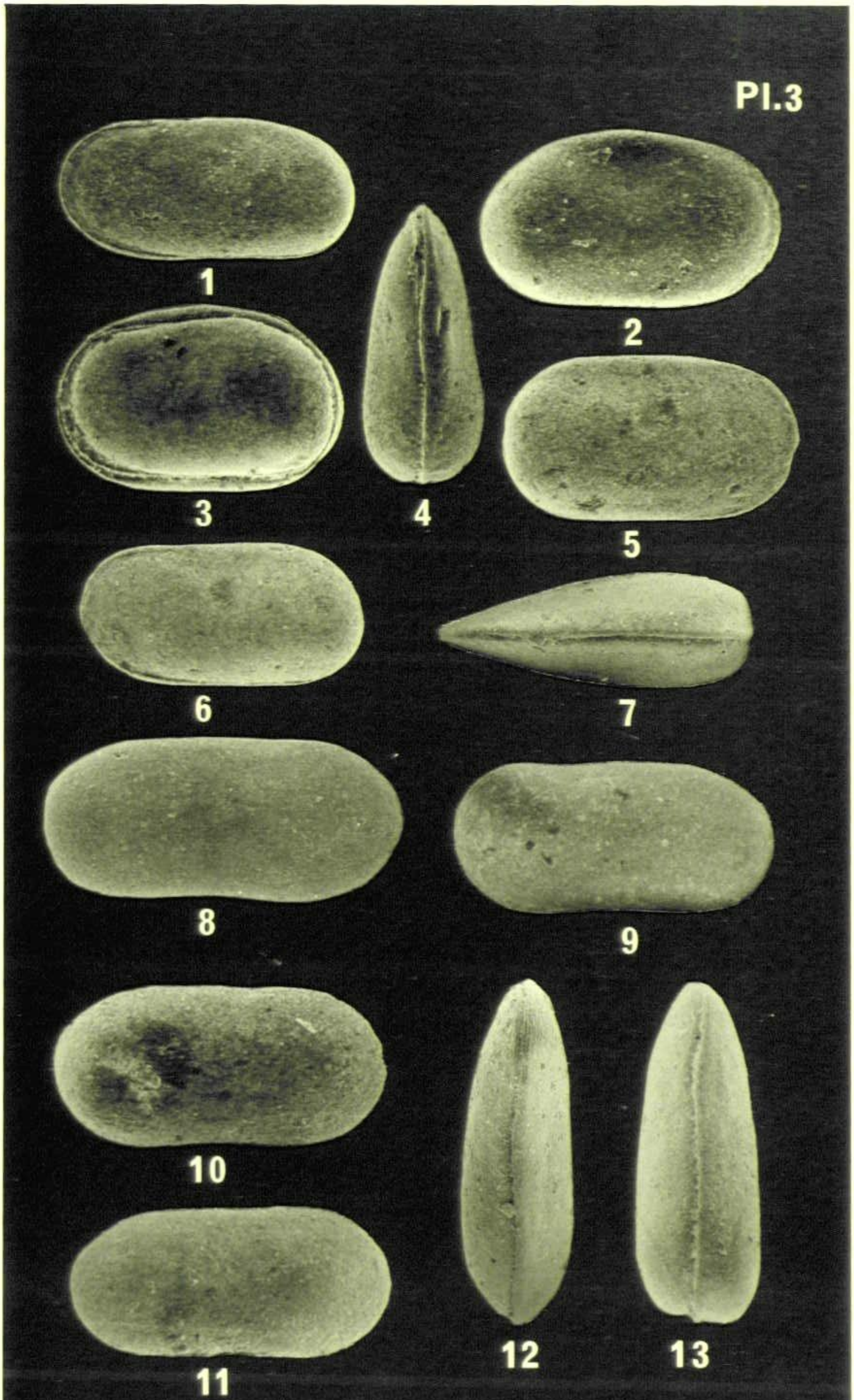
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PLATE 4

(x 90)

Cytherella damottae n.sp.

Fig. 1. Female right valve, holotype, OS 9386, sample BB 14, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 2. Female left valve, Hypotype, OS 9387, sample S 19, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 3. Female right valve, OS 9388, interior view, sample Bar 11, Middle Cenomanian, Barrington, Cambs.

Fig. 4. Male ? carapace, OS 9389, left view, sample GB 14, Lower Cenomanian, Glyndebourne, Sussex.

Fig. 5. Female carapace, OS 9390, dorsal view, sample PBH3 9, Middle Cenomanian, Pitstone, Herts.

Cytherelloidea stricta (Jones and Hinde)

Fig. 6. Female right valve, OS 9478, sample GB 40, Lower Cenomanian, Glyndebourne, Sussex.

Fig. 7. Male carapace, OS 9479, dorsal view, sample GB 40, Lower Cenomanian, Glyndebourne, Sussex.

Fig. 8. Female carapace, OS 9477, dorsal view, sample GB 40, Lower Cenomanian, Glyndebourne, Sussex.

Fig. 9. Female right valve, OS 9478, oblique ventral view, sample GB 40, Lower Cenomanian, Glyndebourne, Sussex.

Cytherelloidea kayei n.sp.

Fig. 10. Female right valve, holotype, OS 9464, oblique ventral view, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 11. Male carapace, holotype, OS 9465, dorsal view, sample BB 6, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 12. Female carapace, paratype, OS 9466, dorsal view, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 13. Female carapace, paratype, OS 9467, left view, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 14. Female right valve, holotype, OS 9464, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

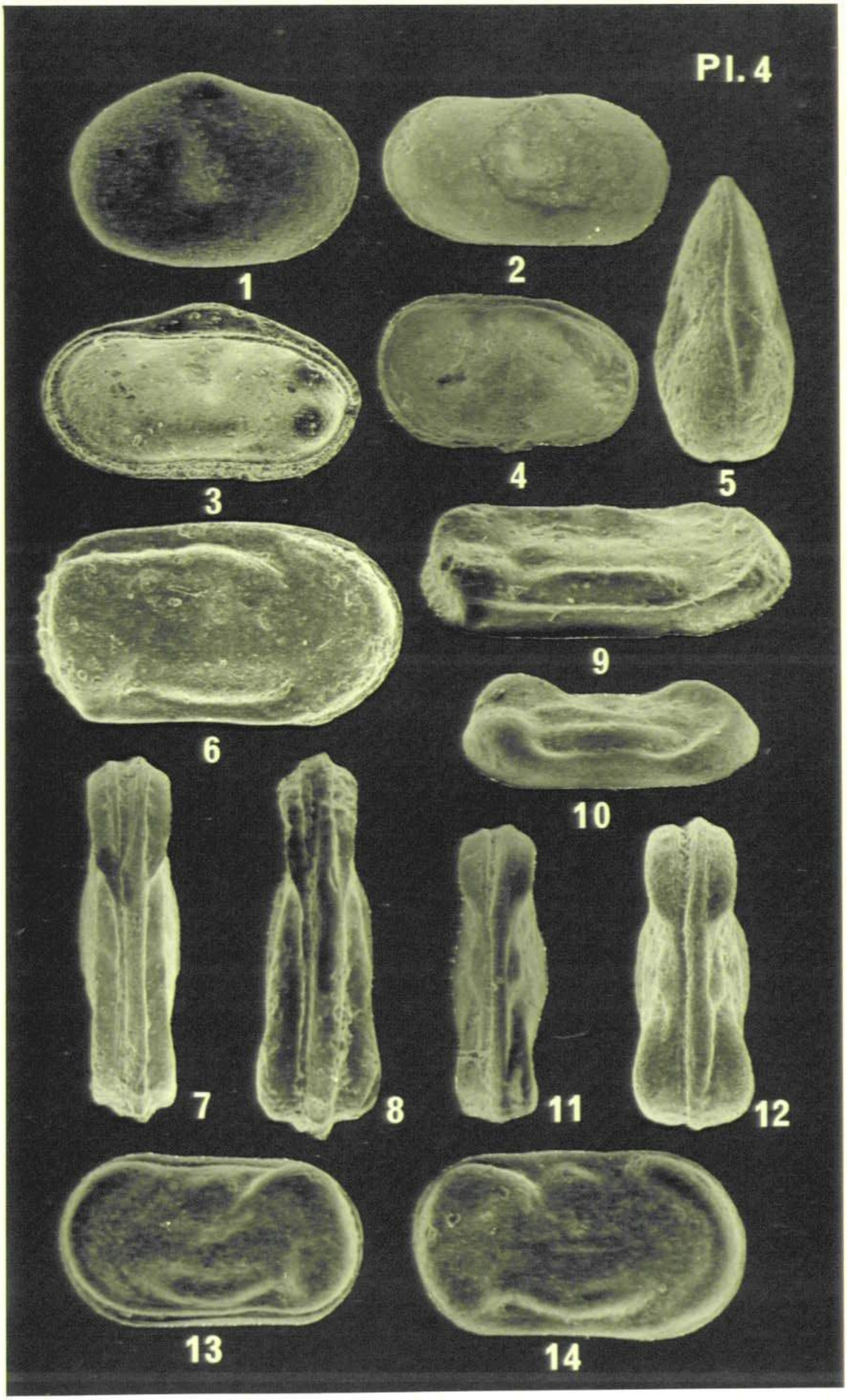
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PLATE 5

(x 93)

Cytherelloidea hindei Kaye

Fig. 1. Female left valve, OS 9461, sample SH 1, Upper Cenomanian, Shillingstone, Dorset.

Fig. 2. Female right valve, OS 9460, sample SH 1, Upper Cenomanian, Shillingstone, Dorset.

Fig. 3. Male right valve, OS 9463, sample SH 7, Lower Turonian, Shillingstone, Dorset.

Fig. 4. Female right valve, OS 9460, oblique ventral view, sample SH 1, Upper Cenomanian, Shillingstone, Dorset.

Fig. 5. Male right valve, OS 9463, sample SH 7, Lower Turonian, Shillingstone, Dorset.

Fig. 8. Female right valve, OS 9462, sample SH 1, Upper Cenomanian, Shillingstone, Dorset.

Cytherelloidea bonnemai n.sp.

Fig. 6. Female carapace, holotype, OS 9445, sample BB 12, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 7. Female left valve, paratype, OS 9446, oblique ventral view, sample BB 12, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 9. Female left valve, paratype, OS 9446, sample BB 12, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 10. Female carapace, holotype, OS 9445, dorsal view, sample BB 12, Upper Cenomanian, Blue Bell Hill, Kent.

Platella sp.A.

Fig. 11. Male left valve, OS 9482, sample PBH 3 23, Middle Cenomanian, Pitstone, Herts.

Fig. 12. Female carapace, OS 9481, dorsal view, sample PBH3 23, Middle Cenomanian, Pitstone, Herts.

Fig. 13. Female left valve, OS 9480, sample PBH3 22, Middle Cenomanian, Pitstone, Herts.

Cytherelloidea globosa Kaye

Fig. 14. Female left valve, OS 9458, sample CC 3, Lower Cenomanian, Culver Cliff, I.O.W.

Fig. 15. Female right valve, OS 9459, sample CC 3, Lower Cenomanian, Culver Cliff, I.O.W.

Fig. 16. Female right valve, OS 9459, sample CC 3, Lower Cenomanian, Culver Cliff, I.O.W.

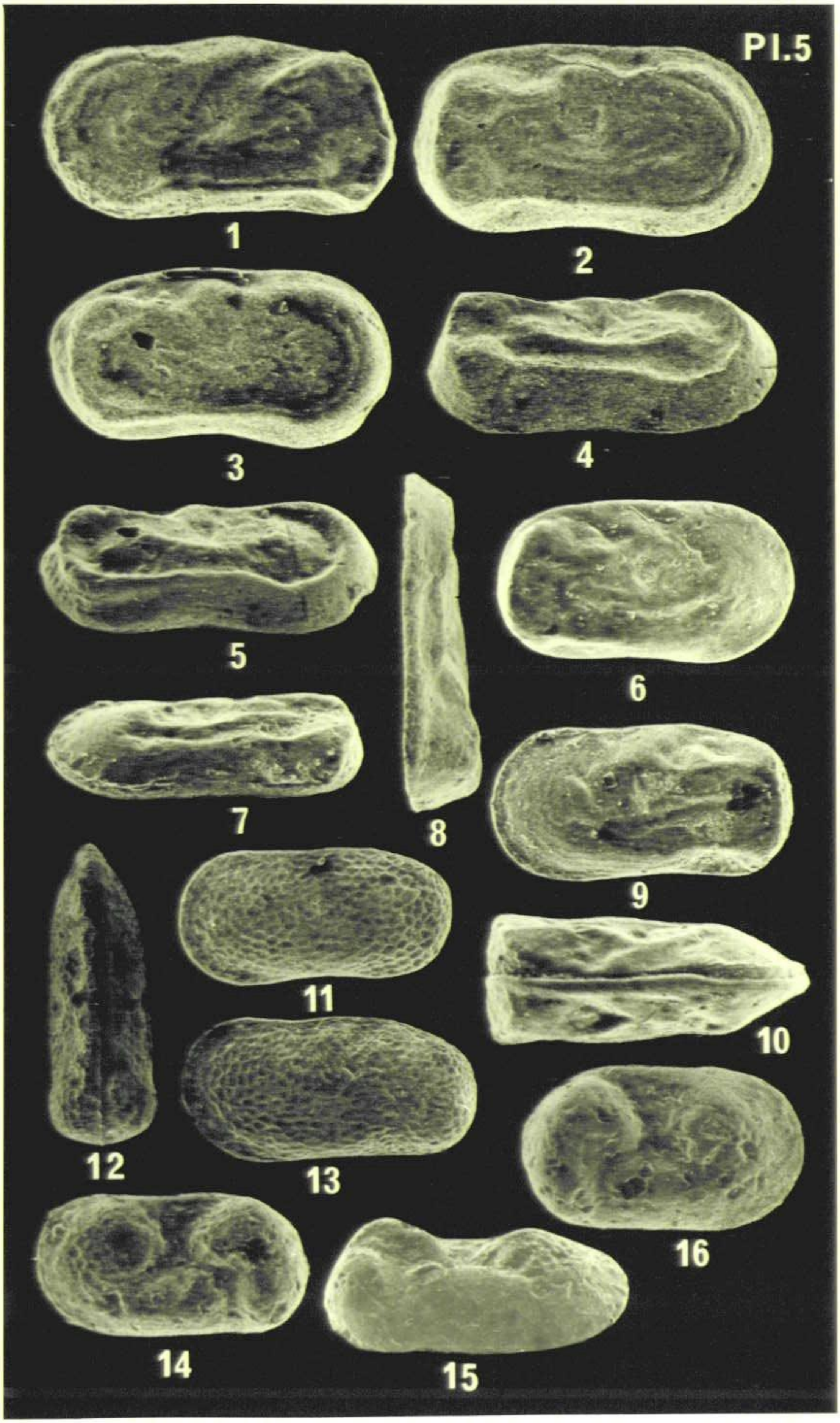
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PLATE 6

(Fig. 1-7 x 54 : Fig. 8-10 x 65 : Fig. 11-13 x 42)

Bairdia pseudoseptentrionalis (Mertens)

Fig. 1. Left valve, OS 9483, sample PBH1 4, Lower Cenomanian, Pitstone, Herts.

Fig. 2. Right valve, OS 9484, sample BN 12, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 5. Carapace, OS 9485, dorsal view, sample PBH1 13, Lower Cenomanian, Pitstone, Herts.

Bairdia southerhamensis n.sp.

Fig. 3. Left valve, hypotype, OS 9486, sample PBH3 13, Middle Cenomanian, Pitstone, Herts.

Fig. 4. Carapace, holotype, OS 9485, sample S 19, Middle Cenomanian, Southerham, Sussex.

Fig. 6. Carapace, paratype, OS 9487, dorsal view, sample S 19, Middle Cenomanian, Southerham, Sussex.

Fig. 7. Left valve, hypotype, OS 9486, internal view, sample PBH3 13, Middle Cenomanian, Pitstone, Herts.

Bythocypris sp.A.

Fig. 8. Left valve, OS 9491, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 9. Right valve, OS 9492, sample BN 13, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 10. Left valve, OS 9493, internal view, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Macrocypris siliqua (Jones)

Fig. 11. Right valve, OS 9498, internal view, sample BB 9, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 12. Carapace, OS 9497, dorsal view, sample BN 17, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 13. Carapace, OS 9496, left view, sample BN 17, Upper Cenomanian, Buckland Newton, Dorset.

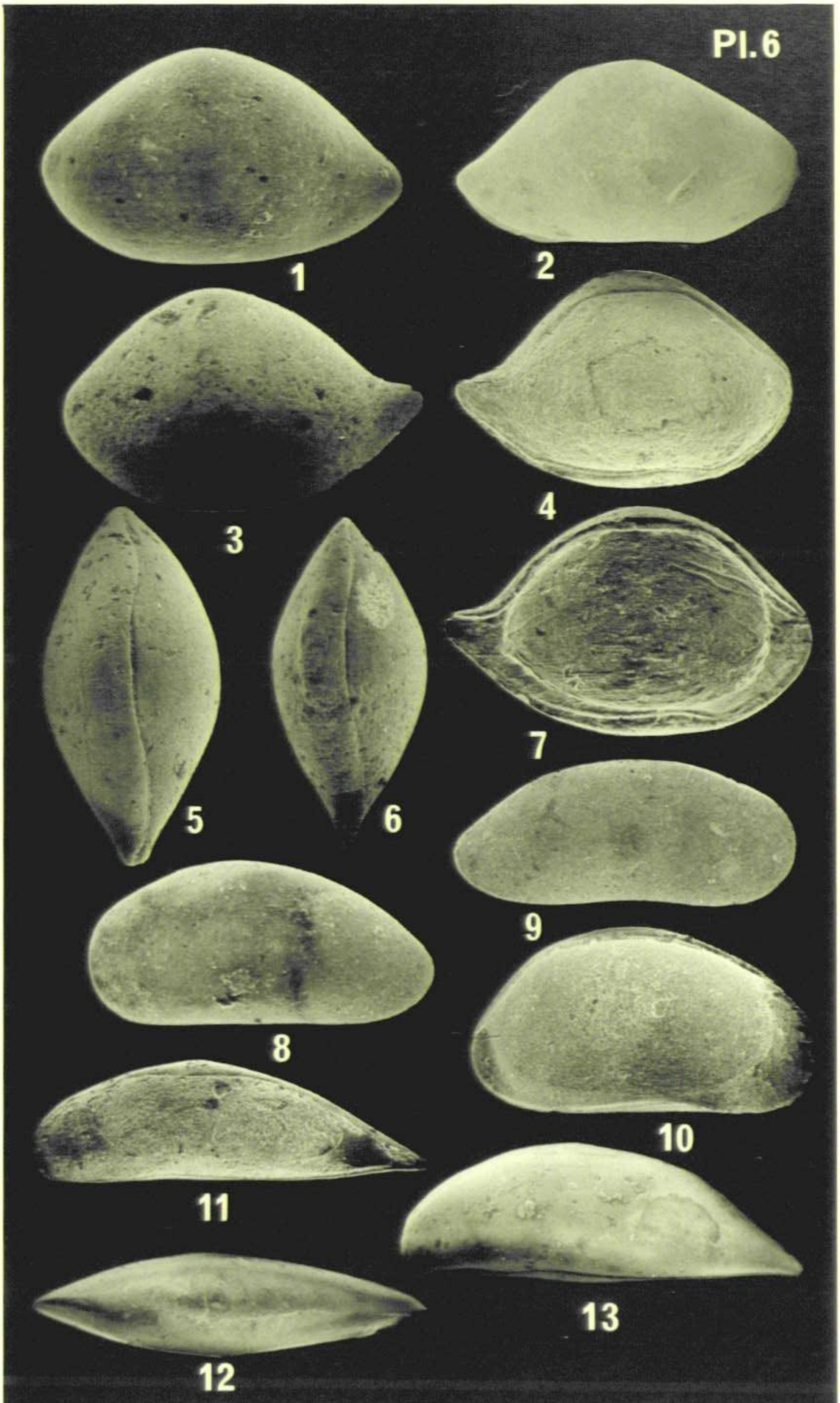
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PLATE 7

Macrocypris muensteriana Jones & Hinde (x 50)

Fig. 1. Carapace, OS 9494, left view, sample BB 4, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 2. Carapace, OS 9495, right view, sample BB 11, Upper Cenomanian, Blue Bell Hill, Kent.

Macrocypris siliqua (Jones) (x 42)

Fig. 3. Right valve, OS 9498, sample BB 9, Upper Cenomanian, Blue Bell Hill, Kent.

Paracypris cf.P. wrothamensis Kaye (x 100)

Fig. 4. Right valve, OS 9500, sample Bar 16, Lower Cenomanian, Barrington, Cambs.

Fig. 5. Left valve, OS 9499, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 6. Right valve, OS 9500, internal view, sample Bar 16, Lower Cenomanian, Barrington, Cambs.

Fig. 7. Carapace, OS 9501, dorsal view, sample BB 3, Middle Cenomanian, Blue Bell Hill, Kent.

Pontocyprella robusta n. sp. (x 75)

Fig. 8. Left valve, holotype, OS 9515, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 9. Carapace, paratype, OS 9517, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 10. Right valve, paratype, OS 9516, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 12. Carapace, paratype, OS 9518, dorsal view, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

Pontocyprella hindei n.sp. (x 75)

Fig. 11. Left valve, holotype, OS 9504, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 13. Male ? left valve, OS 9505, sample BB 16, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 14. Right valve, paratype, OS 9506, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

<u>Pontocyprella harrisiana</u> (Jones) (x 70)

Fig. 15. Left valve, OS 9502, sample BB 11, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 16. Right valve, OS 9503, sample BB 9, Upper Cenomanian, Blue Bell Hill, Kent.

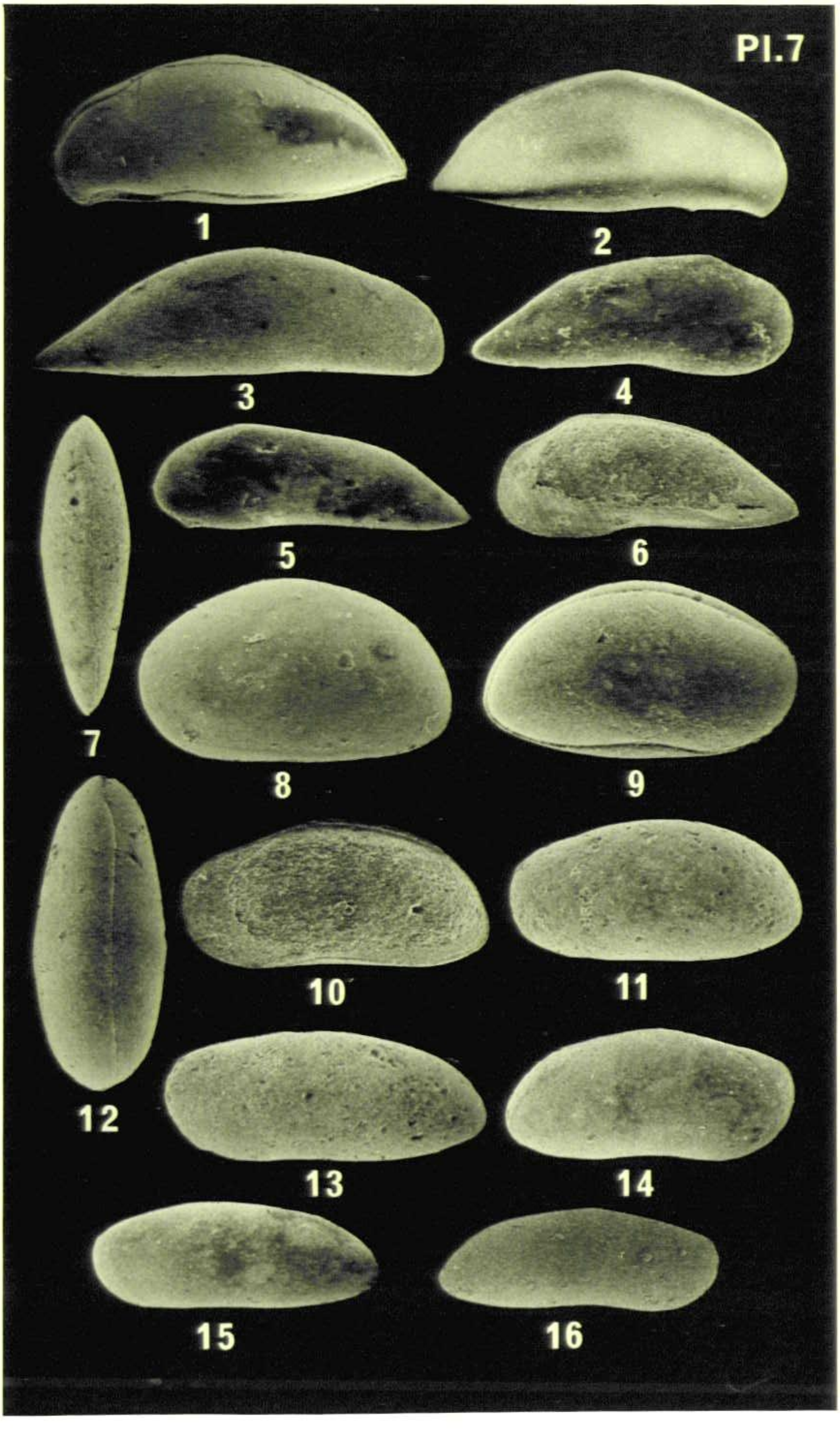
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PLATE 8

(Figs. 1,2 x 60 : Fig. 3-6 x 140 : Figs 7-13 x 78)

Pontocyprella ? bosquetiana (Jones)

Fig. 1. Right valve, OS 9532, sample Bar 5, Middle Cenomanian, Barrington, Cambs.

Fig. 2. Left valve, OS 9531, sample Bar 5, Middle Cenomanian, Barrington, Cambs.

Clithrocytheridea aff. *Haplocytheridea nana* Triebel

Fig. 3. Female left valve, OS 9541, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 4. Female carapace, OS 9542, right view, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 5. Male left valve, OS 9543, Sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 6. Female carapace, OS 9544, dorsal view, sample S 23, Lower Cenomanian, Southerham, Sussex.

Dolocytheridea (Puracytheridea) bosquetiana (Jones & Hinde)

Fig. 7. Female left valve, OS 9533, sample PBH1 32, Lower Cenomanian, Pitstone, Herts.

Fig. 8. Male right valve, OS 9535, sample PBH1 32, Lower Cenomanian, Pitstone, Herts.

Fig. 9. Female right valve, OS 9534, sample PBH1 30, Lower Cenomanian, Pitstone, Herts.

Fig. 10. Female carapace, OS 9536, dorsal view, sample PBH1 27, Lower Cenomanian, Pitstone, Herts.

Dolocytheridea (Puracytheridea) cf. *D. (P.) crassa* Damotte

Fig. 11. Female left valve, OS 9540, dorsal view, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 12. Female left valve, OS 9537, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 13. Male right valve, OS 9539, sample S 23, Lower Cenomanian, Southerham, Sussex.

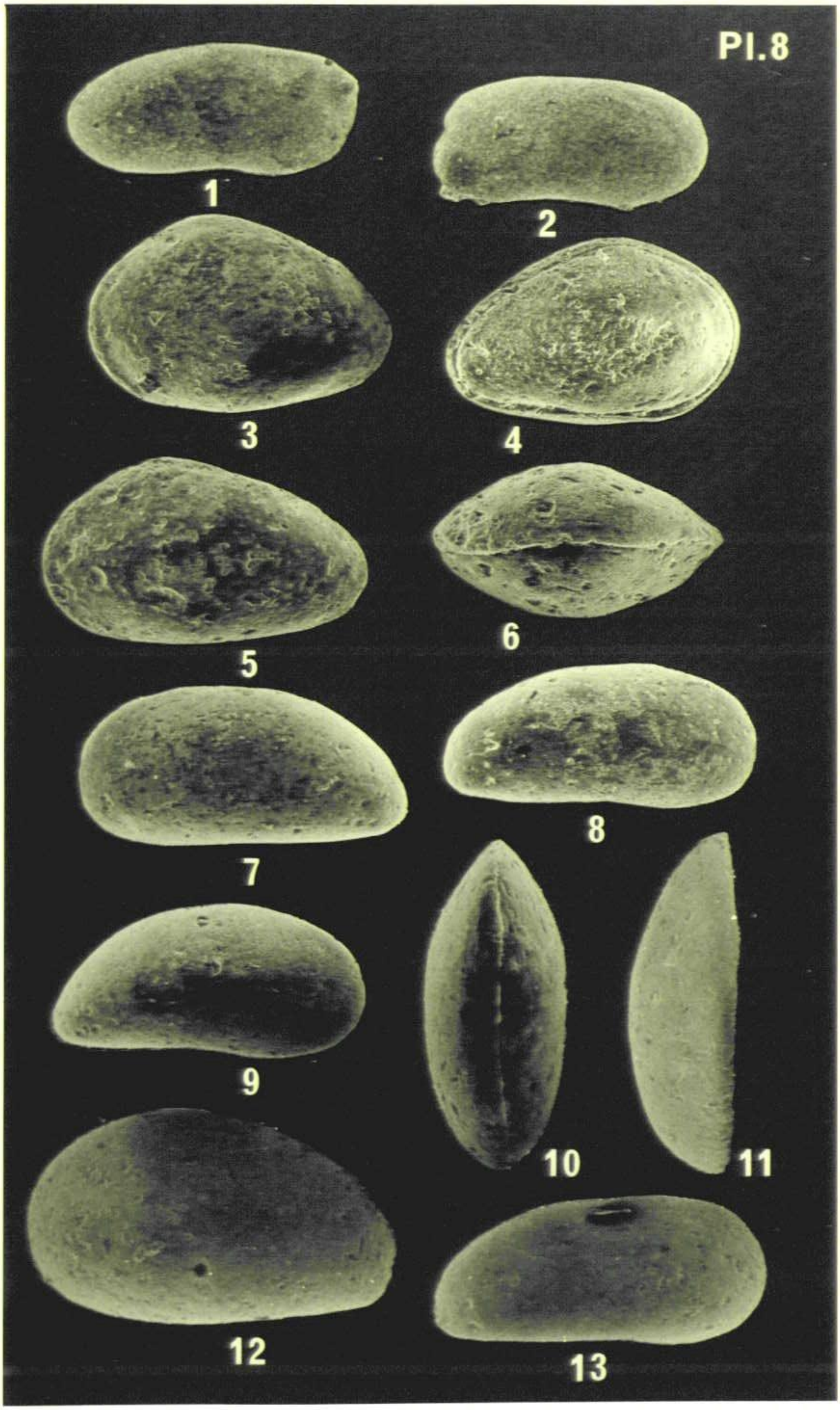
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PLATE 9

Dolocytheridea (Puracytheridea)

cf. D. (P.) crassa Damotte (x 78)

Fig. 1. Female right valve, OS 9538, sample S 23, Lower Cenomanian, Southerham, Sussex.

Schuleridea jonesiana (Bosquet)

(Fig. 2 x 75 : Fig. 3 x 66)

Fig. 2. Female right valve, Lower Cenomanian, Pitstone, Herts, specimen lost.

Fig. 3. Male left valve, OS 9545, sample PBH3 18, Middle Cenomanian, Pitstone, Herts.

Schuleridea medwayensis n.sp (x 100)

Fig. 4. Female left valve, holotype, OS 9547, sample Bar 4, Middle Cenomanian, Barrington, Cambs.

Fig. 5. Female left valve, paratype, OS 9549, dorsal view, sample Bar 4, Middle Cenomanian, Barrington, Cambs.

Fig. 6. Female right valve, paratype, OS 9548, sample Bar 4, Middle Cenomanian, Barrington, Cambs.

Habrocythere fragilis Triebel (x 136)

Fig. 7. Left valve, OS 9566, sample BB 9, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 8. Left valve, OS 9568, internal view, sample BB 9, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 9. Right valve, OS 9567, sample BB 11, Upper Cenomanian, Blue Bell Hill, Kent.

Eucythere colini n. sp. (x 110)

Fig. 10. Left valve, hypotype, OS 9570, sample BN 12, Plenus Marls Bed 1, Buckland Newton, Dorset.

Fig. 11. Left valve, hypotype, OS 9572, internal view, sample BN 12, Plenus Marls Bed 1, Buckland Newton, Dorset.

Fig. 12. Carapace, holotype, OS 9569, right view, sample S 1, Plenus Marls Bed 1, Southerham, Sussex.

Fig. 13. Carapace, OS 9571, dorsal view, sample BB 15, Plenus Marls Bed 1, Blue Bell Hill, Kent.

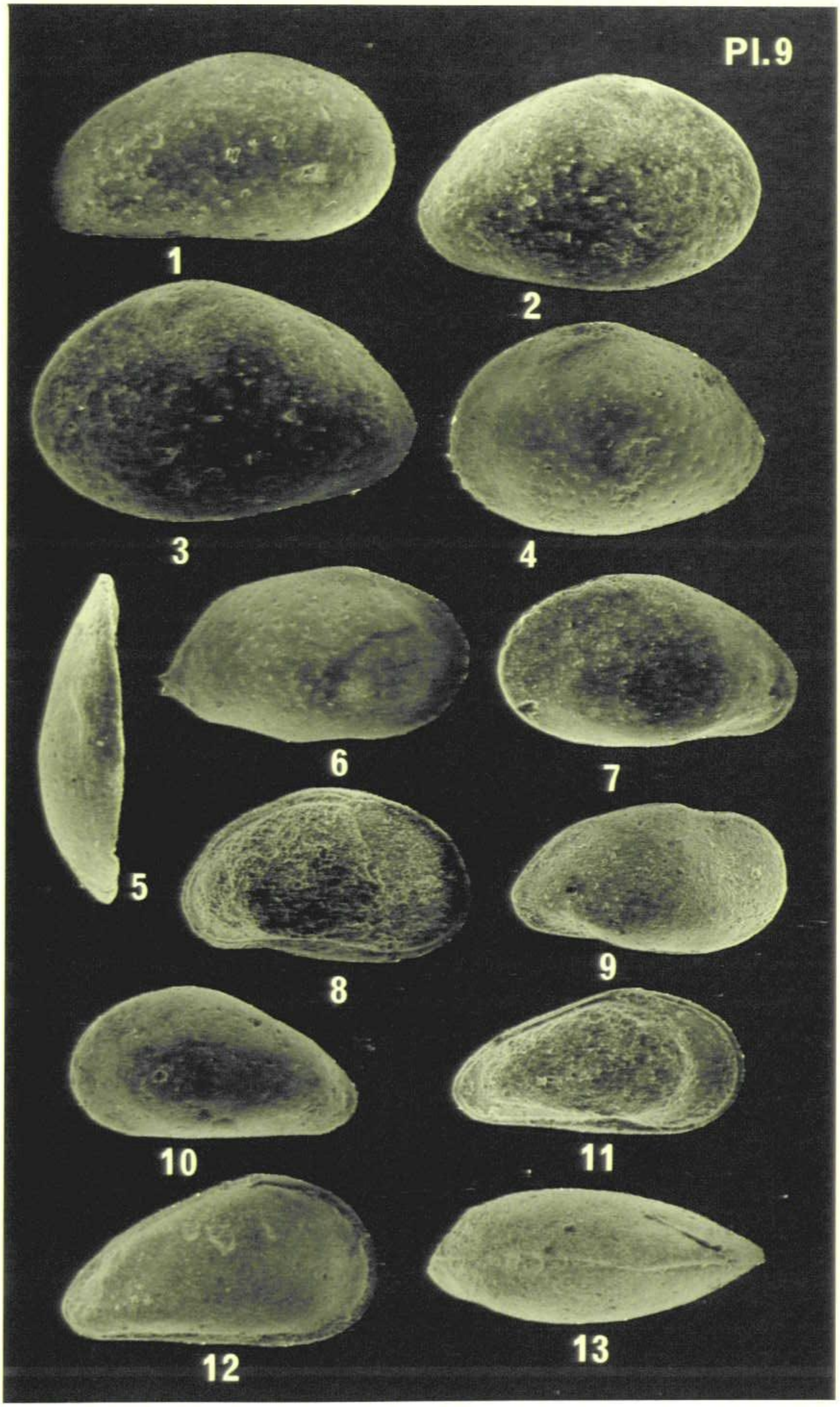
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PLATE 10
(x 100)

Monoceratina umbonata (Williamson)

Fig. 1. Left valve, OS 9615, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 2. Right valve, OS 9616, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 3. Left valve, OS 9618, internal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 4. Left valve (smooth type), OS 9619, sample PBH1 28, Lower Cenomanian, Pitstone, Herts.

Fig. 5. Left valve, OS 9617, dorsal view, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 6. Juvenile left valve, OS 9620, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Bythoceratina umbonatoides
umbonatoides Kaye

Fig. 7. Left valve, OS 9627, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 8. Right valve, OS 9628, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 9. Right valve, OS 9630, dorsal view, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 10. Juvenile right valve, OS 9629, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Monoceratina bonnemai Kaye

Fig. 11. left valve, OS 9590, sample PBH1 33, Lower Cenomanian, Pitstone, Herts.

Monoceratina herrigi n.sp

Fig. 12. Left valve, paratype, OS 9592, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 13. Right valve, holotype, OS 9591, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 14. Juvenile left valve, paratype, OS 9593, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 15. Left valve, paratype, dorsal view, Upper Cenomanian, Blue Bell Hill, Kent, specimen lost.

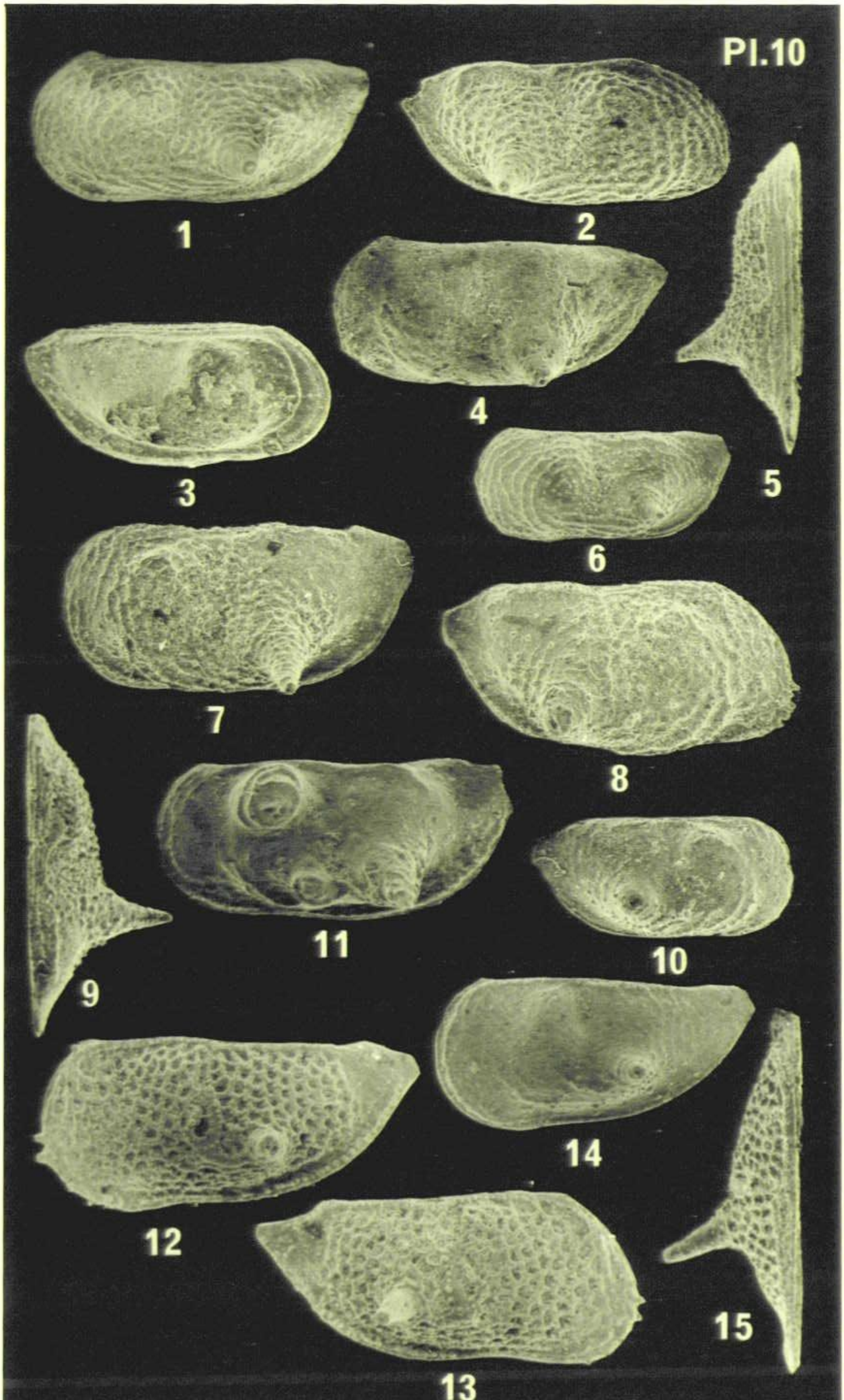
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PLATE 11

(x 100)

Monoceratina marginata n.sp.

Fig. 1. Left valve, holotype, OS 9607, sample BB 4, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 2. Right valve, paratype, OS 9608, sample BB 4, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 3. Left valve, hypotype, OS 9610, dorsal view, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Monoceratina longispina (Bosquet)

Fig. 4. Left valve, OS 9605, sample BB 14, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 5. Right valve, OS 9606, sample BB 14, Upper Cenomanian, Blue Bell Hill, Kent.

Monoceratina bluebellensis n.sp.

Fig. 6. Left valve, holotype, OS 9585, sample BB 16, Lower Cenomanian, Blue Bell Hill, Kent.

Fig. 7. Right valve, paratype, OS 9586, dorsal view, sample BB 16, Lower Cenomanian, Blue Bell Hill, Kent.

Fig. 8. Right valve, paratype, OS 9586, sample BB 16, Lower Cenomanian, Blue Bell Hill, Kent.

Monoceratina sp. B

Fig. 9. Right valve (Broken), OS 9622, sample BB 20, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 10. Left valve (broken), OS 9621, dorsal view, sample BB 20, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 11. Left valve (broken), OS 9623, sample BB 20, Middle Cenomanian, Blue Bell Hill, Kent.

Monoceratina sp. A

Fig. 12. Right valve, OS 9625, sample BB 12, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 13. Right valve, OS 9626, dorsal view, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 14. Left valve, OS 9624, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Monoceratina pseudoutilazea n.sp.

Fig. 15. Right valve, hypotype, OS 9612, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 16. Left valve, holotype, OS 0611, sample BB 19, Middle Cenomanian, Blue Bell Hill, Kent.

Nemoceratina tricuspidata (Jones and Hinde)

Fig. 17. Right valve, OS 9632, oblique dorsal view, sample PBH1 22, Lower Cenomanian, Pitstone, Herts.

Fig. 18. Left valve, OS 9631, sample PBH1 20, Lower Cenomanian, Pitstone, Herts.

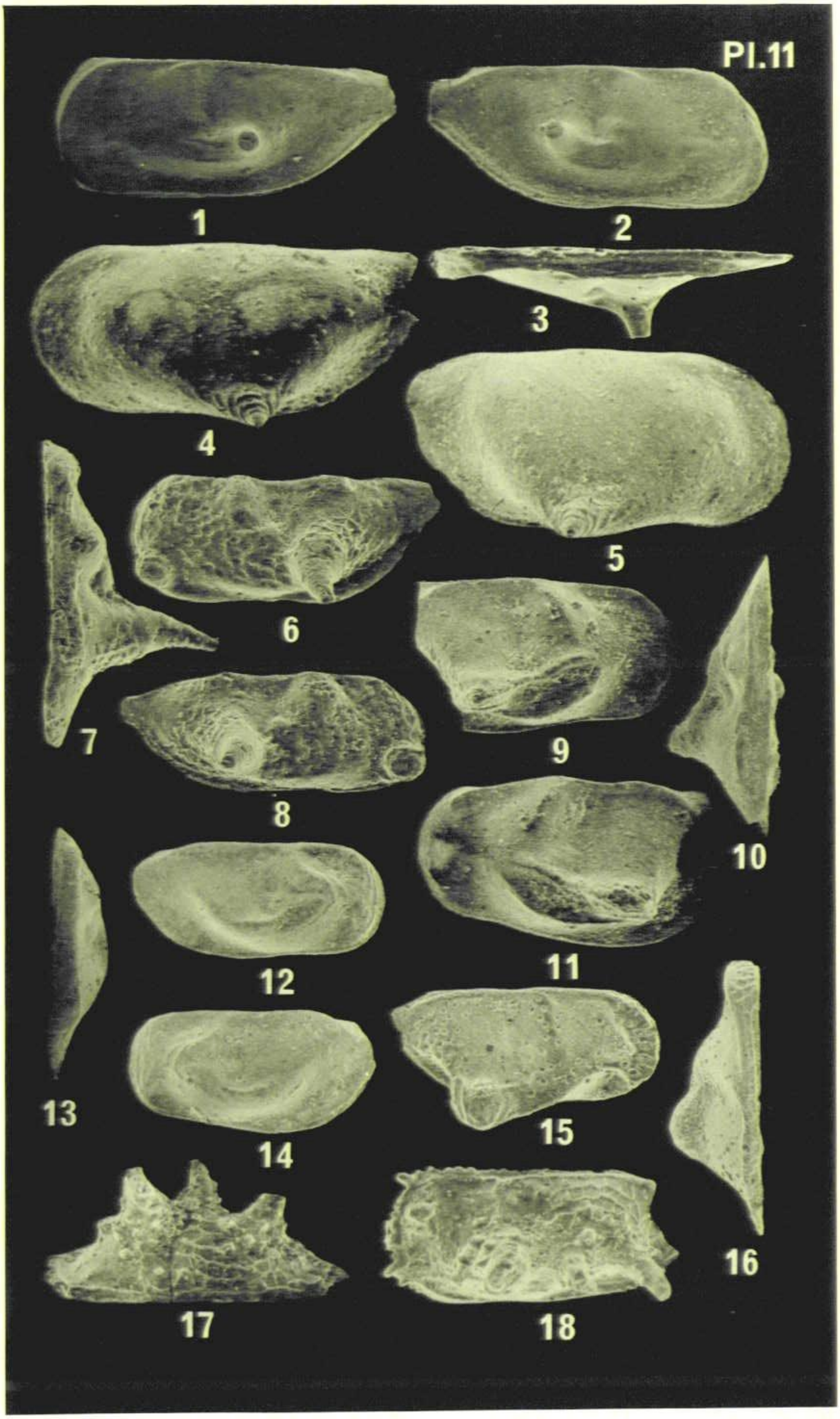
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PLATE 12

(x 110 except Fig. 7 x 175)

<u>Neocythere (Neocythere) vanveeni</u> Mertens

Fig. 1. Female left valve, OS 9633, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 2. Female right valve, OS 9634, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 3. Female carapace, OS 9365, dorsal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 7. Female right valve hinge, sample PBH3 12, Middle Cenomanian, Pitstone, Herts, specimen lost.

<u>Neocythere (centrocythere)</u>

<u>posterospinosa</u> n.sp.

Fig. 4. Female carapace, holotype, OS 9647, dorsal view, sample GB 42, Lower Cenomanian, Glyndebourne, Sussex.

Fig. 5. Female left valve, hypotype, OS 9649, sample PBH1 14, Lower Cenomanian, Pitstone, Herts.

Fig. 6. Female right valve, paratype, OS 9648, sample GB 42, Lower Cenomanian, Glyndebourne, Sussex.

Fig. 8. Female left valve, hypotype, OS 9650, sample PBH1 14, Lower Cenomanian, Pitstone, Herts.

<u>Neocythere (Physocythere) kayei</u> n.sp.

Fig. 9. Female left valve, holotype, OS 9636, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 10. Female right valve, paratype, OS 9637, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 11. Female left valve, holotype, OS 9636, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 12. Female right valve, paratype, OS 9637, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

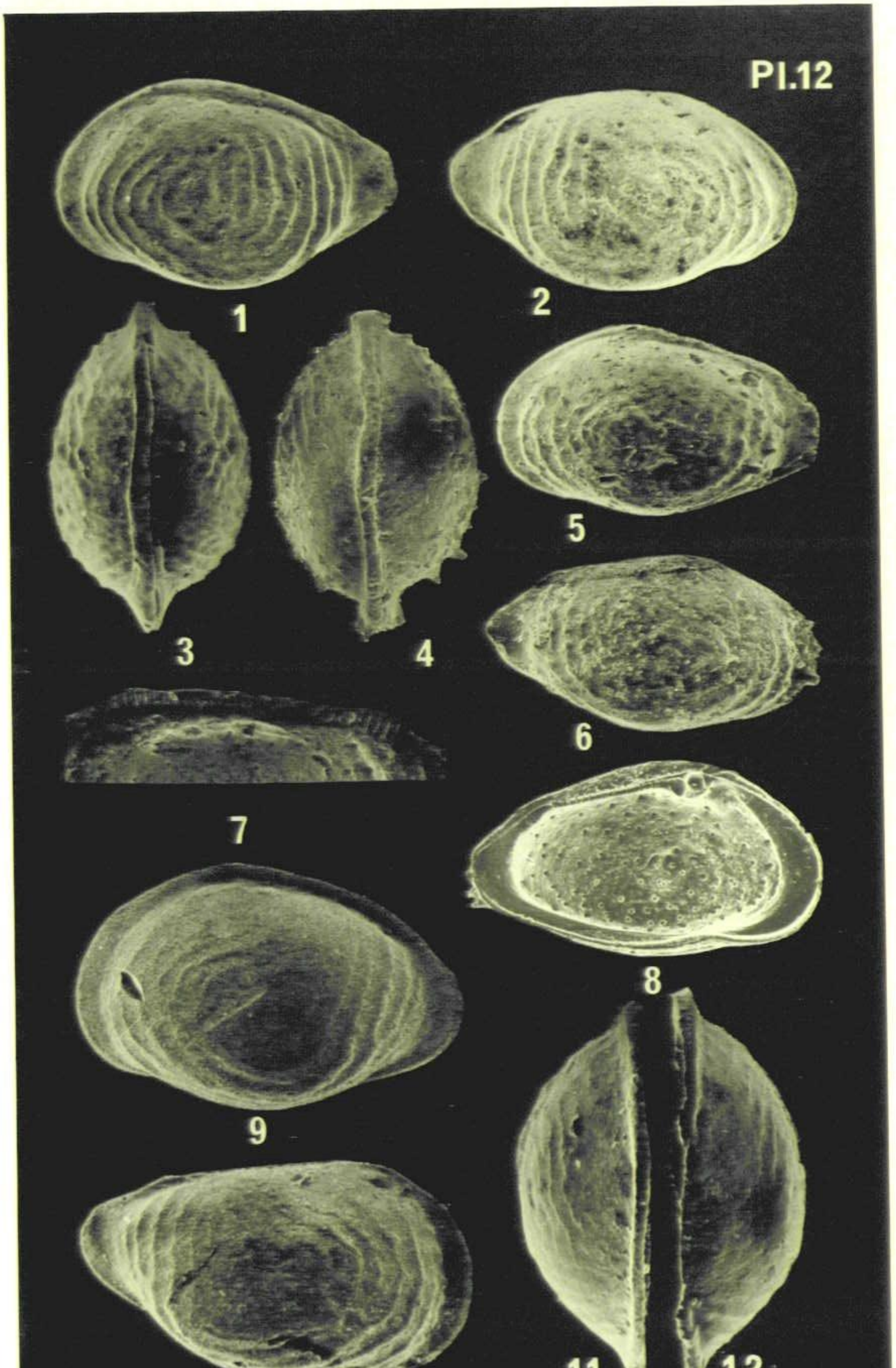
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PLATE 13

(x 100 except Fig. 9 x 115)

Neocythere (Physocythere ?) sp.A

Fig. 1. Left valve, OS 9645, sample PBH1 26, Lower Cenomanian, Pitstone, Herts.

Fig. 2. Carapace, OS 9647, dorsal view, sample PBH1 26, Lower Cenomanian, Pitstone, Herts.

Fig. 3. Carapace, OS 9646, right view, sample PBH1 26, Lower Cenomanian, Pitstone, Herts.

Neocythere (Physocythere) steghausi Mertens

Fig. 4. Female left valve, OS 9643, sample PBH1 28, Lower Cenomanian, Pitstone, Herts.

Fig. 5. Female carapace, OS 9645, dorsal view, sample PBH1 28, Lower Cenomanian, Pitstone, Herts.

Fig. 6. Female right valve, OS 9644, sample PBH1 26, Lower Cenomanian, Pitstone, Herts.

Neocythere (Physocythere) semiconcentrica Mertens

Fig. 7. Carapace, OS 9642, dorsal view, sample S 19, Middle Cenomanian, Southerham, Sussex.

Fig. 8. Left valve, OS 9641, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Protocythere speetonensis Kaye

Fig. 9. Left valve, OS 9667, sample GB 40, Lower Cenomanian, Glyndebourne, Sussex.

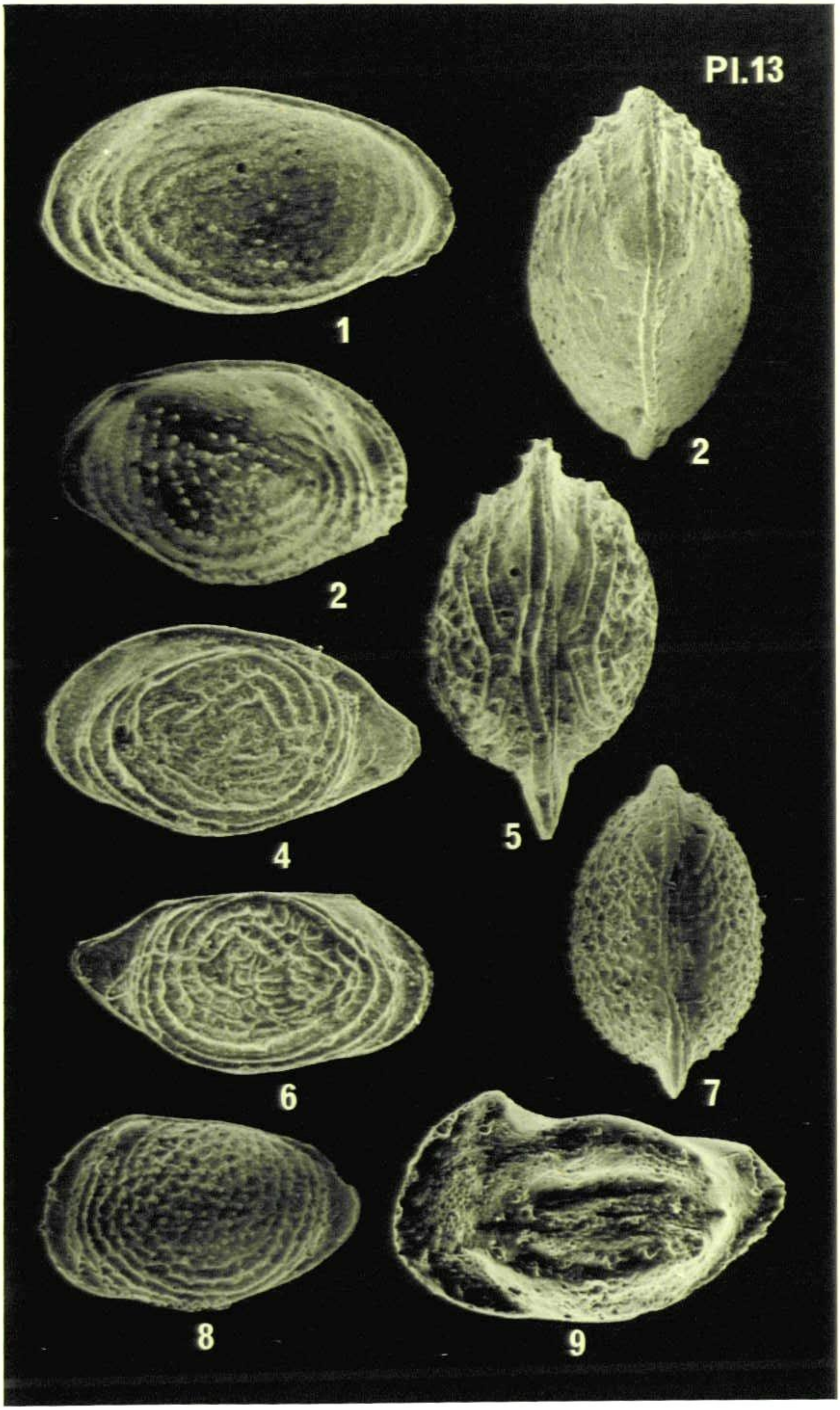
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PLATE 14

(Figs. 1,2 x 90 : Fig. 3-12 x 70)

Protocythere speetonensis Kaye

Fig. 1. Right valve, OS 9668, sample GB 40, Lower Cenomanian, Glyndebourne, Sussex.

Fig. 2. Carapace, OS 9669, dorsal view, sample GB 40, Lower Cenomanian, Glyndebourne, Sussex.

Protocythere lineata striata Gründel

Fig. 3. Carapace, OS 9651, left view, sample Bar 16, Lower Cenomanian, Barrington, Cambs.

Fig. 4. Right valve, OS 9652, sample Bar 28, Lower Cenomanian, Barrington, Cambs.

Fig. 7. Carapace, OS 9651, dorsal view, sample Bar 16, Lower Cenomanian, Barrington, Cambs.

Protocythere siddiquii n.sp.

Fig. 5. Female left valve, holotype, OS 9653, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 6. Female carapace, paratype, OS 9656, dorsal view, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 8. Male left valve, paratype, OS 9655, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 9. Female carapace, paratype, OS 9654, sample S 23, Lower Cenomanian, Southerham, Sussex.

Veenia pseudostriata n.sp.

Fig. 10. Male left valve, holotype, OS 9695, sample PBH1 22, Lower Cenomanian, Pitstone, Herts.

Fig. 11. Female left valve, paratype, OS 9697, dorsal view, sample PBH1 22, Lower Cenomanian, Pitstone, Herts.

Fig. 12. Female right valve, paratype, OS 9696, sample PBH1 22, Lower Cenomanian, Pitstone, Herts.

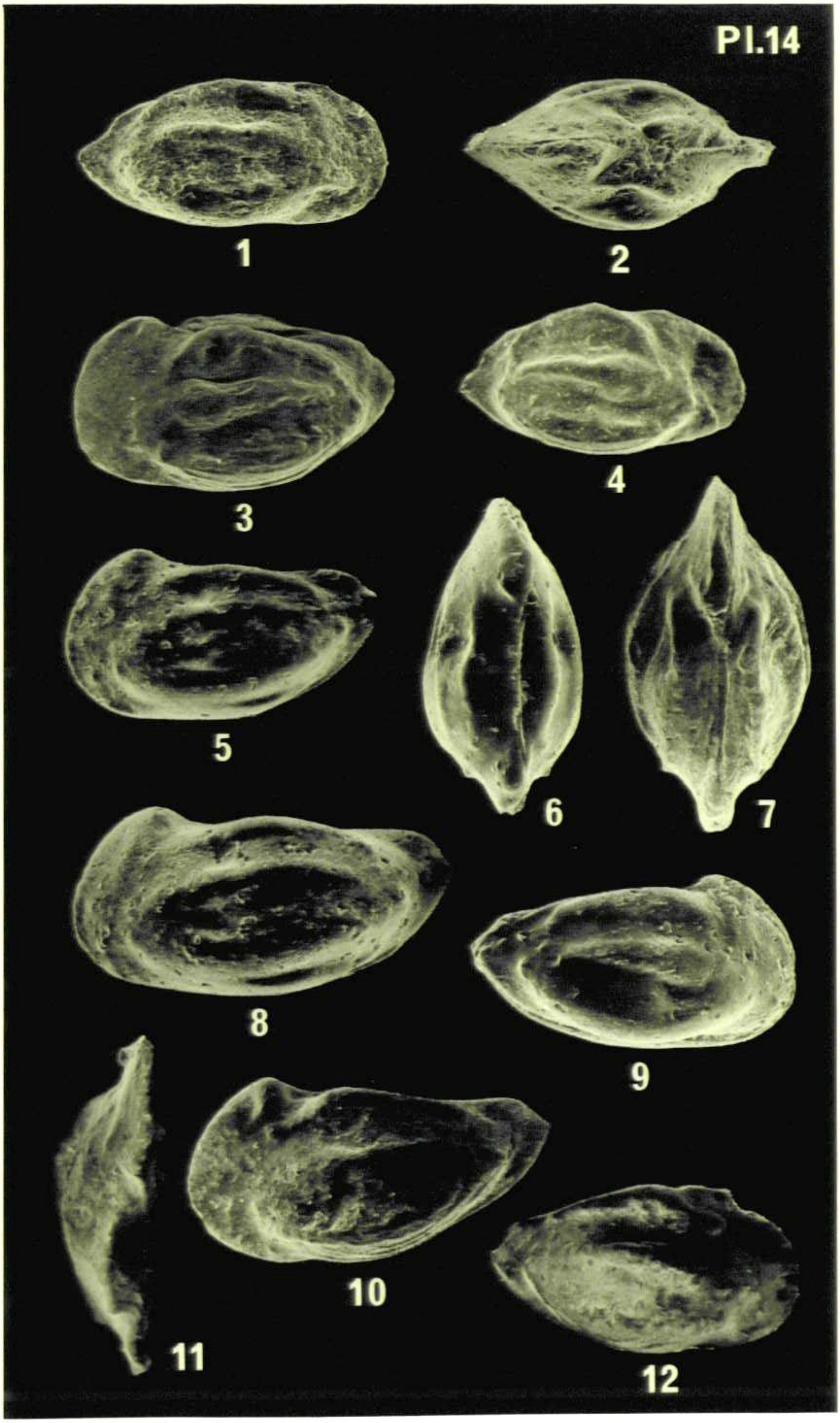
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PLATE 15

(x 90)

Veenia inferangulata Donze

Fig. 1. Female left valve, OS 9693, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 2. Male left valve, OS 9692, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 3. Female right valve, OS 9691, internal view, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 4. Female carapace, OS 9690, right view, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 5. Juvenile left valve, OS 9694, Sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 6. Female carapace, OS 9690, dorsal view, sample S 23, Lower Cenomanian, Southerham, Sussex.

Veenia cf. V. ballonensis Damotte & Grosdidier

Fig. 7. Carapace, OS 9688, dorsal view, sample Bar 9, Middle Cenomanian, Barrington, Cambs.

Fig. 8. Carapace, OS 9688, left view, sample Bar 9, Middle Cenomanian, Barrington, Cambs.

Fig. 9. Right valve, OS 9689, sample Bar 9, Middle Cenomanian, Barrington, Cambs.

Veenia pseudostriata n.sp.

Fig. 10. Female right valve, paratype, OS 9698, sample PBH1 22, Lower Cenomanian, Pitstone, Herts.

Fig. 11. Male right valve, OS 9699, sample S 23, Lower Cenomanian, Southerham, Sussex.

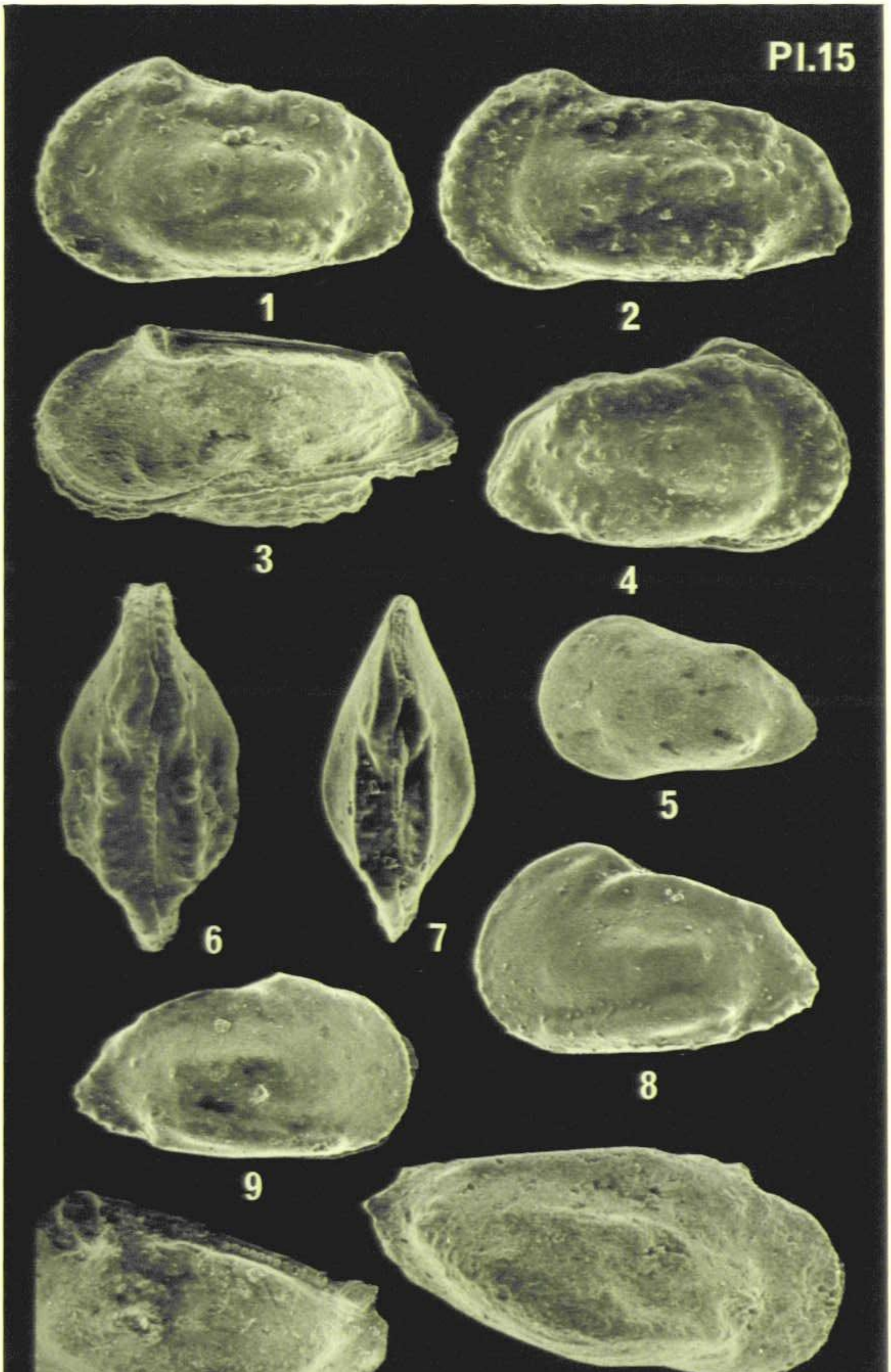
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PLATE 16

(x 70 except where stated)

Homocythere harrisiana harrisiana Jones

Fig. 1. Female left valve, OS 9670, sample PBH1 21, Lower Cenomanian, Pitstone, Herts.

Fig. 2. Male left valve, OS 9671, sample PBH1 24, Lower Cenomanian, Pitstone, Herts.

Fig. 3. Juvenile left valve (smooth type), OS 9672, sample PBH1 36, Lower Cenomanian, Pitstone, Herts.

Fig. 4. Juvenile left valve, (reticulate type), OS 9763, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 5. Female carapace, OS 9674, dorsal view, sample PBH1 35, Lower Cenomanian, Pitstone, Herts.

Homocythere sp.A.

Fig. 6. Left valve, OS 9685, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 7. Right valve, OS 9687, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 8. Left valve, OS 9686, dorsal view, sample Bar 11, Middle Cenomanian, Barrington, Cambs.

Homocythere ornata n.sp.

Fig. 9. Female carapace, paratype, OS 9678, dorsal view, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 10. Female left valve, holotype, OS 9675, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 11. Female carapace, paratype, OS 9679, right view, sample S 23, Southerham, Sussex.

Fig. 12. Female left valve, holotype, OS 9675, detail of ornamentation, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 13. Right valve, paratype, OS 9676, internal view, sample S 23, Lower Cenomanian, Southerham, Sussex.

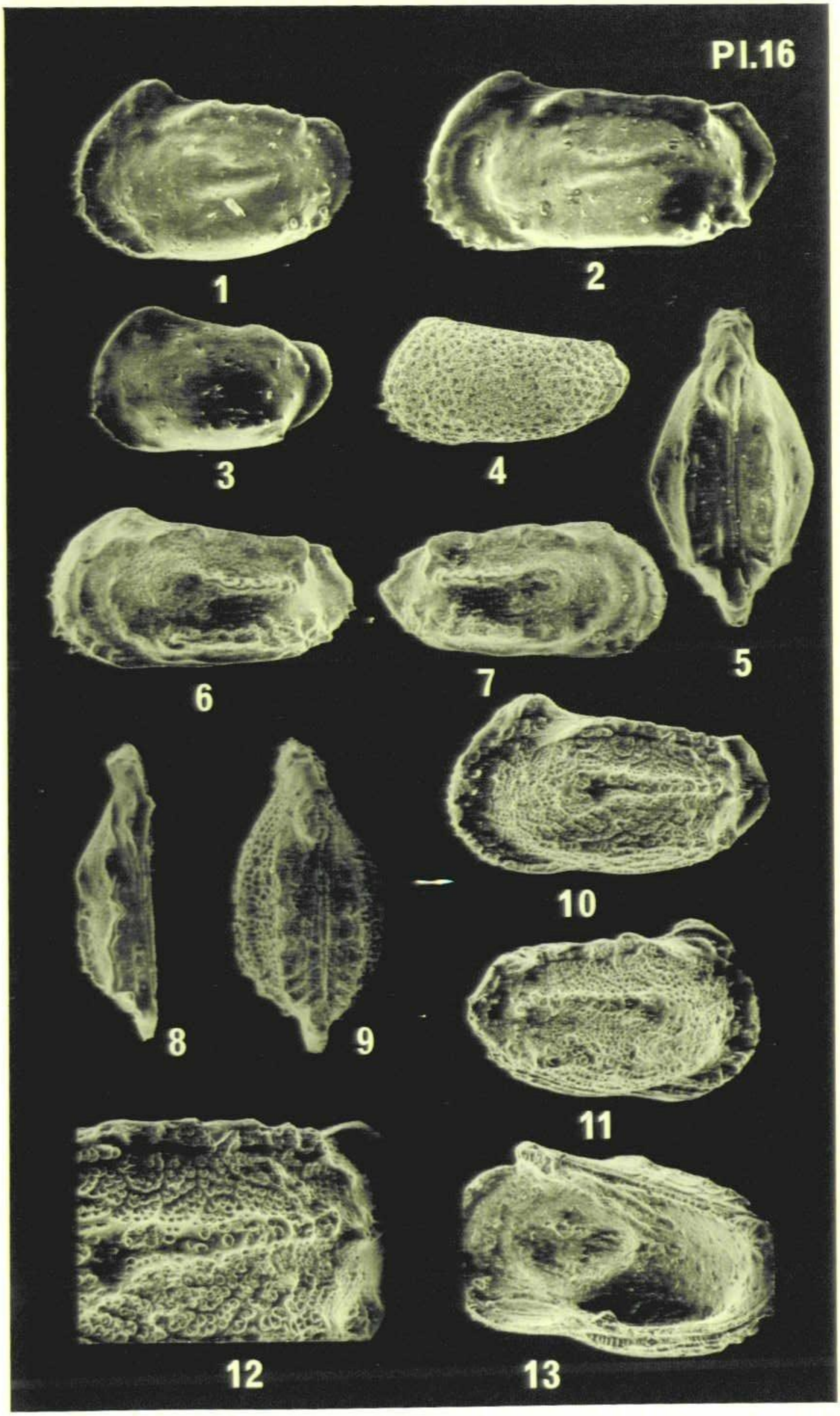
Pl.16
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PLATE 17

(x 70)

Brachycythere cf. B. laticristata (Bosquet)

Fig. 1. Left valve, OS 9705, sample BN 12, Plenus Marls Bed 1, Buckland Newton, Dorset.

Fig. 2. Right valve, OS 9706, sample BN 12, Plenus Marls Bed 1, Buckland Newton, Dorset.

Fig. 3. Carapace, OS 9707, oblique anterior view, sample BN 12, Plenus Marls Bed 1, Buckland Newton, Dorset.

Fig. 5. Carapace, OS 9707, dorsal view, sample BN 12, Plenus Marls Bed 1, Buckland Newton, Dorset.

Pterygocythereis (Pterygocythere)

cf. P.(P) robusta (Jones & Hinde)

Fig. 4. Carapace, OS 9722, anterior oblique view, sample PBH1 19, Lower Cenomanian, Pitstone, Herts.

Fig. 6. Right valve, OS 9721, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 7. Carapace, OS 9722, dorsal view, sample PBH1 19, Lower Cenomanian, Pitstone, Herts.

Fig. 8. Left valve, OS 9720, sample PBH1 19, Lower Cenomanian, Pitstone, Herts.

Pterygocythereis (Pterygocythere)

diminuta n.sp.

Fig. 9. Carapace, holotype, OS 9713, anterior oblique view, sample BN 6, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 10. Left valve, paratype, OS 9715, sample BN 6, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 11. Carapace, holotype, OS 9713, dorsal view, sample BN 6, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 12. Right valve, paratype, OS 9714, sample BN 6, Upper Cenomanian, Buckland Newton, Dorset.

Pterygocythereis (Pterygocythereis)

phylloptera reducta n.ssp.

Fig. 13. Carapace, holotype, OS 9708, anterior oblique view, sample PBH1 36, Lower Cenomanian, Pitstone, Herts.

Fig. 14. Left valve, sample Bar 9, Middle Cenomanian, Barrington, Cambs. Specimen lost.

Fig. 15. Right valve, hypotype, OS 9709, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 16. Carapace, holotype, OS 9708, dorsal view, sample BH1 36, Lower Cenomanian, Pitstone, Herts.

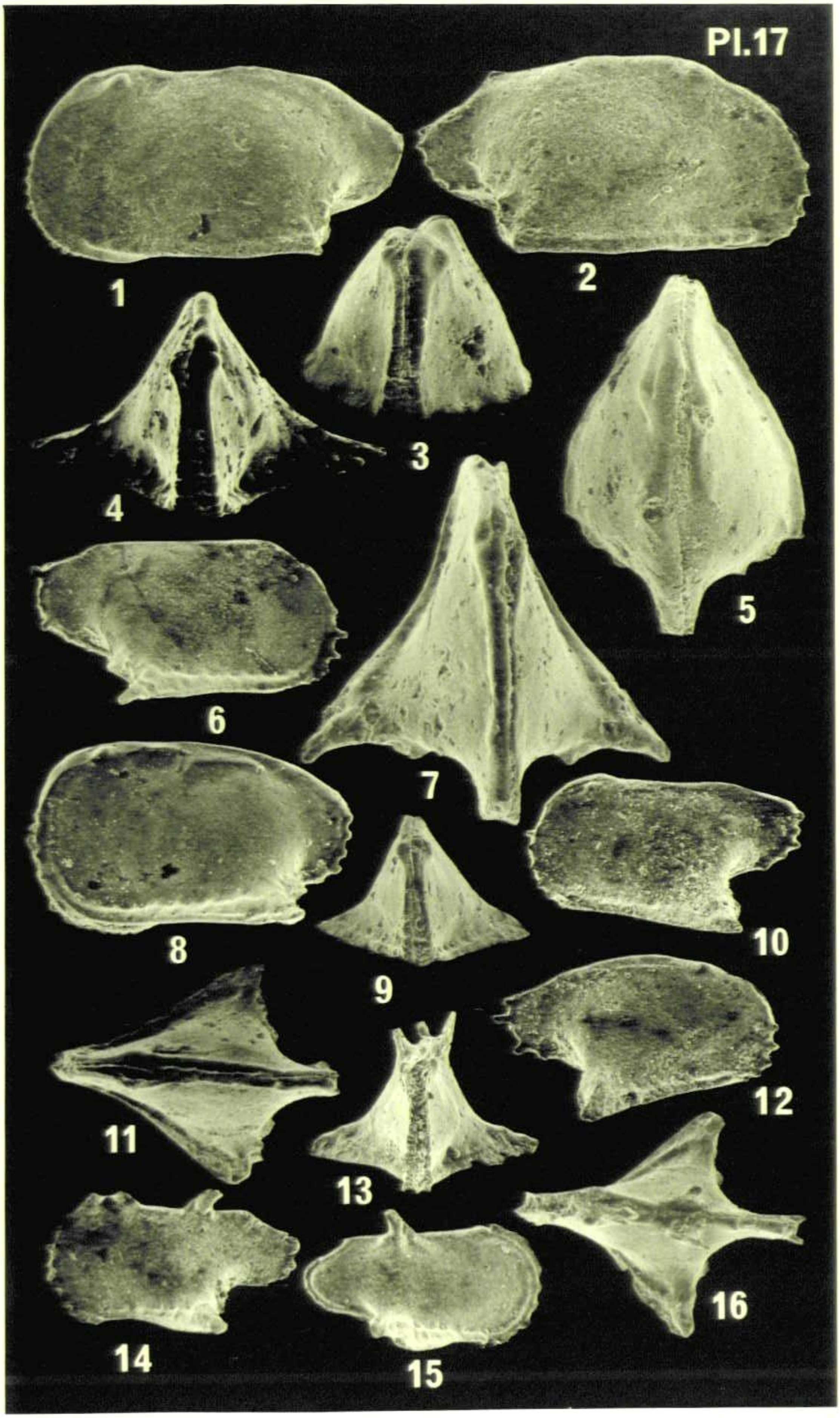
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PLATE 18

(x 65)

Cythereis hirsuta Damotte & Grosdidier

Fig. 1. Male left valve, OS 9785, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 2. Female left valve, OS 9784, sample BB 16, Lower Cenomanian, Blue Bell Hill, Kent.

Fig. 3. Male right valve, OS 9786, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 4. Female carapace, OS 9787, dorsal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Cythereis thoerenensis Triebel

Fig. 5. Female carapace, OS 9810, dorsal view, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 6. Female left valve, OS 9808, sample PBH1 36, Lower Cenomanian, Pitstone, Herts.

Fig. 7. Male right valve, OS 9809, sample S 23, Lower Cenomanian, Southerham, Sussex.

Cythereis coronata n.sp.

Fig. 8. Female left valve, holotype, OS 9755, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 9. Female right valve, paratype, OS 9756, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 10. Female left valve dorsal view, same specimen as Fig. 8.

Fig. 11. Female valve dorsal view, same specimen as Fig. 9.

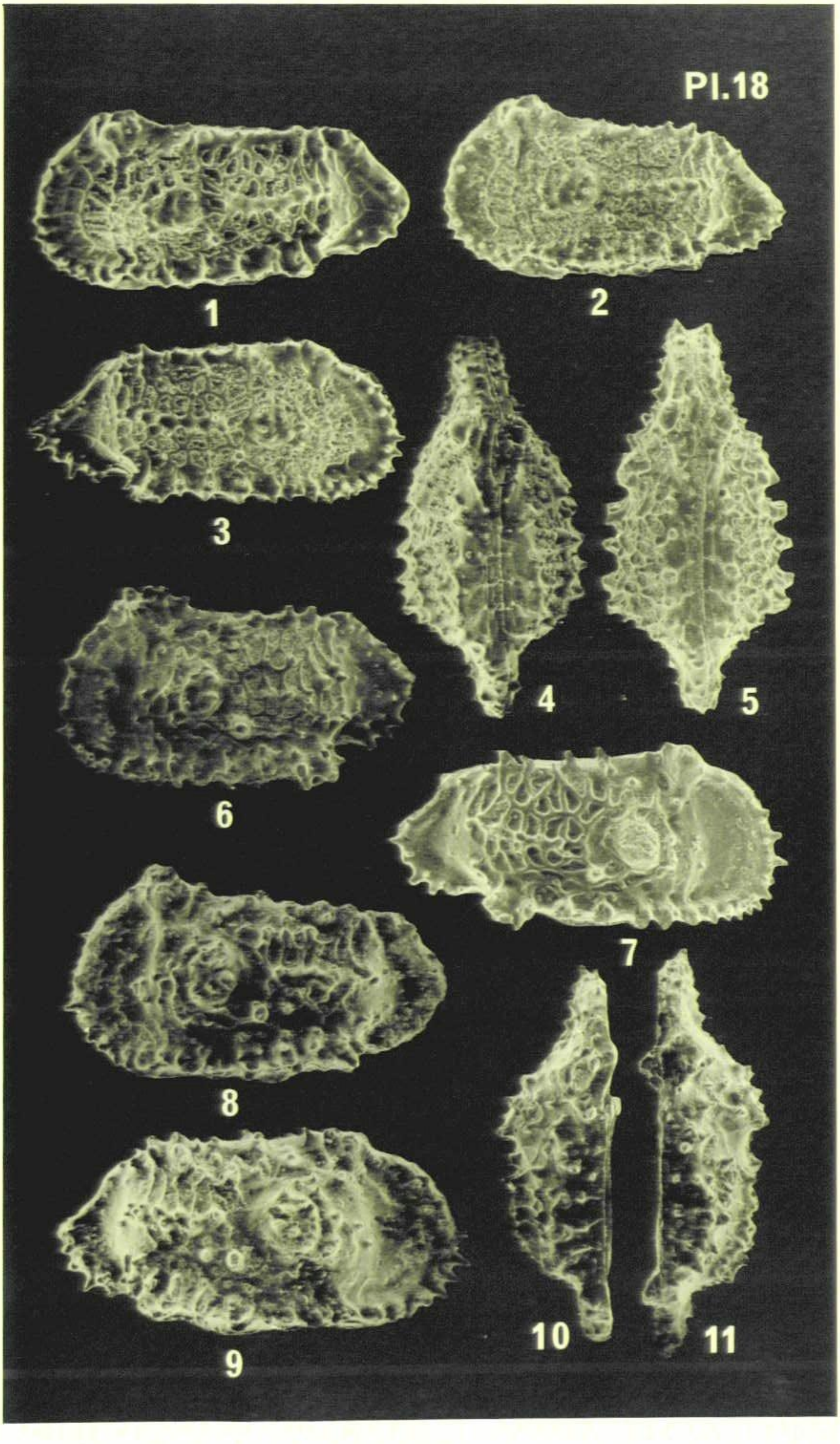
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PLATE 19

(x 70 except Fig. 11 x 140)

Cythereis aff. C. reticulata Jones & Hinde

Fig. 1. Left valve, OS 9805, sample BB 16, Lower Cenomanian, Blue Bell Hill, Kent.

Fig. 2. Juvenile right valve, OS 9807, sample BB 17, Lower Cenomanian, Blue Bell Hill, Kent.

Fig. 4. Right valve, OS 9806, sample BB 16, Lower Cenomanian, Blue Bell Hill, Kent.

Cythereis coronata n.sp.

Fig. 3. Juvenile left valve, OS 9757, sample S 23, Lower Cenomanian, Southerham, Sussex.

Cythereis hirsuta Damotte & Grosdidier

Fig. 5. Juvenile left valve, OS 9788, sample BB 16, Lower Cenomanian, Blue Bell Hill, Kent.

Cythereis paranuda n.sp.

Fig. 6. Female left valve, holotype, OS 9795, sample PBH1 36, Lower Cenomanian, Pitstone, Herts.

Fig. 7. Female carapace, paratype, OS 9798, dorsal view, sample PBH1 36, Lower Cenomanian, Pitstone, Herts.

Fig. 8. Female carapace, OS 9796, ventral view, sample BN 2, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 9. Female carapace, paratype, OS 9798, right view, sample PBH1 36, Lower Cenomanian, Pitstone, Herts.

Fig. 10. Male carapace, OS 9797, left view, sample PBH3 18, Middle Cenomanian, Pitstone, Herts.

Cythereis luermannae luermannae Triebel

Fig. 11. Female left valve, OS 9789, detail of ornament, sample Bar 12, Lower Cenomanian, Pitstone, Herts.

Fig. 12. Female, left valve, OS 9789, sample Bar 12, Lower Cenomanian, Barrington, Cambs.

Fig. 13. Female carapace, OS 9790, dorsal view, sample PBH1 27, Lower Cenomanian, Pitstone, Herts.

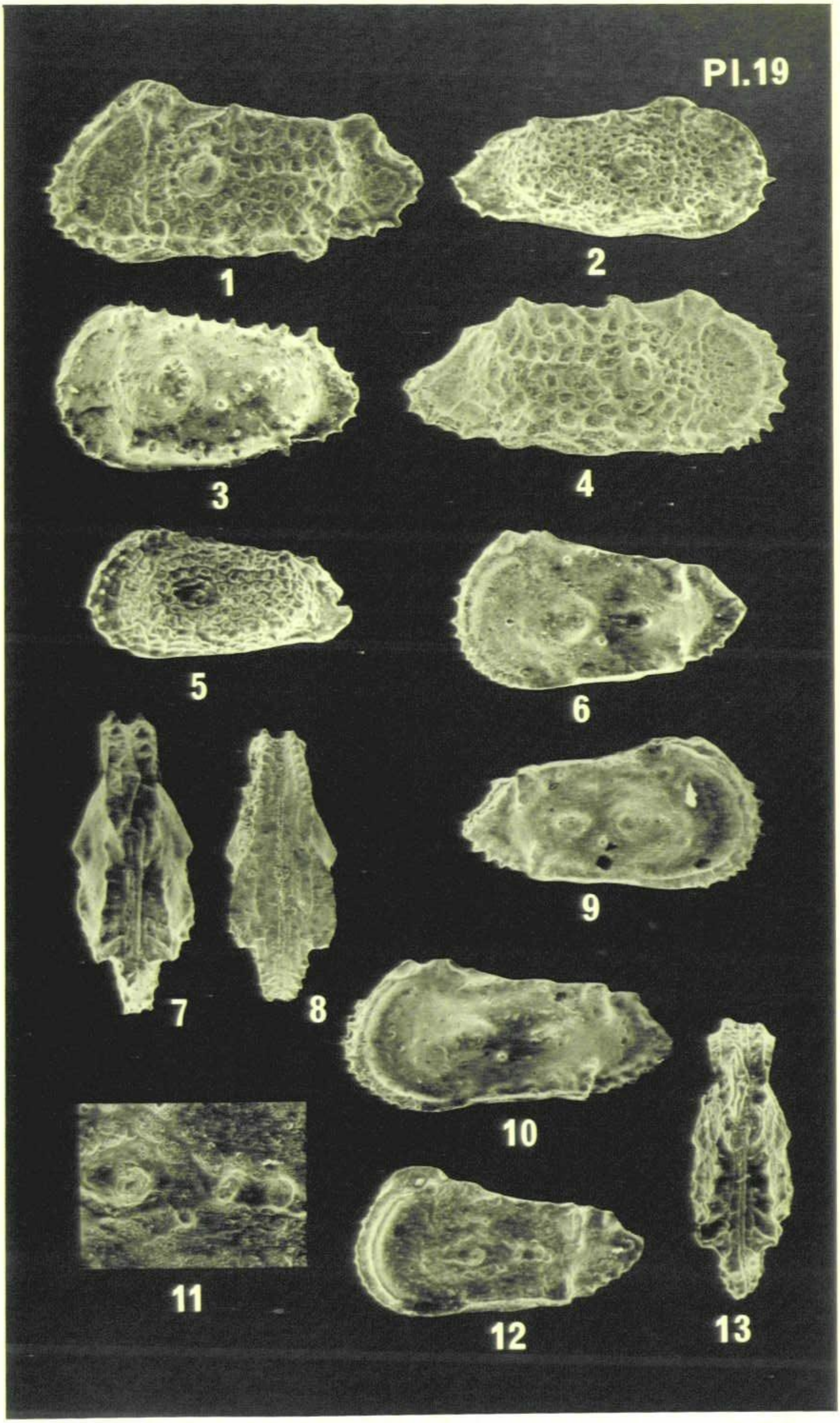
Pl.19
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PLATE 20

Cythereis luermannae bemerodensis Kemper

(x 90)

Fig. 1. Female left valve, OS 9791, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 2. Female carapace, OS 9792, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 3. Male carapace, OS 9793, dorsal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Cythereis barringtonensis n.sp.

(Figs. 4-6 x 90 : Fig. 7 x 220)

Fig. 4. Carapace, paratype, OS 9742, dorsal view, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 5. Left valve, holotype, OS 9740, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 6. Right valve, paratype, OS 9741, sample Bar 10, Middle Cenomanian, Barrington, Cambs.

Fig. 7. Left valve, detail of ornament. Same specimen as Fig. 5.

Cythereis cantabrigensis n.sp.

(x 115)

Fig. 8. Female left valve, holotype, OS 9748, sample Bar 9, Middle Cenomanian, Barrington, Cambs.

Fig. 9. Female right valve, paratype, OS 9751, sample Bar 9, Middle Cenomanian, Barrington, Cambs.

Fig. 10. Male carapace, paratype, OS 9750, dorsal view, sample Bar 9, Middle Cenomanian, Barrington, Cambs.

Fig. 11. Female carapace, OS 9749, dorsal view, sample Bar 20, Lower Cenomanian, Barrington, Cambs.

Cythereis hindei hindei n.sp.

(x 115)

Fig. 12. Female left valve, holotype, OS 9765, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

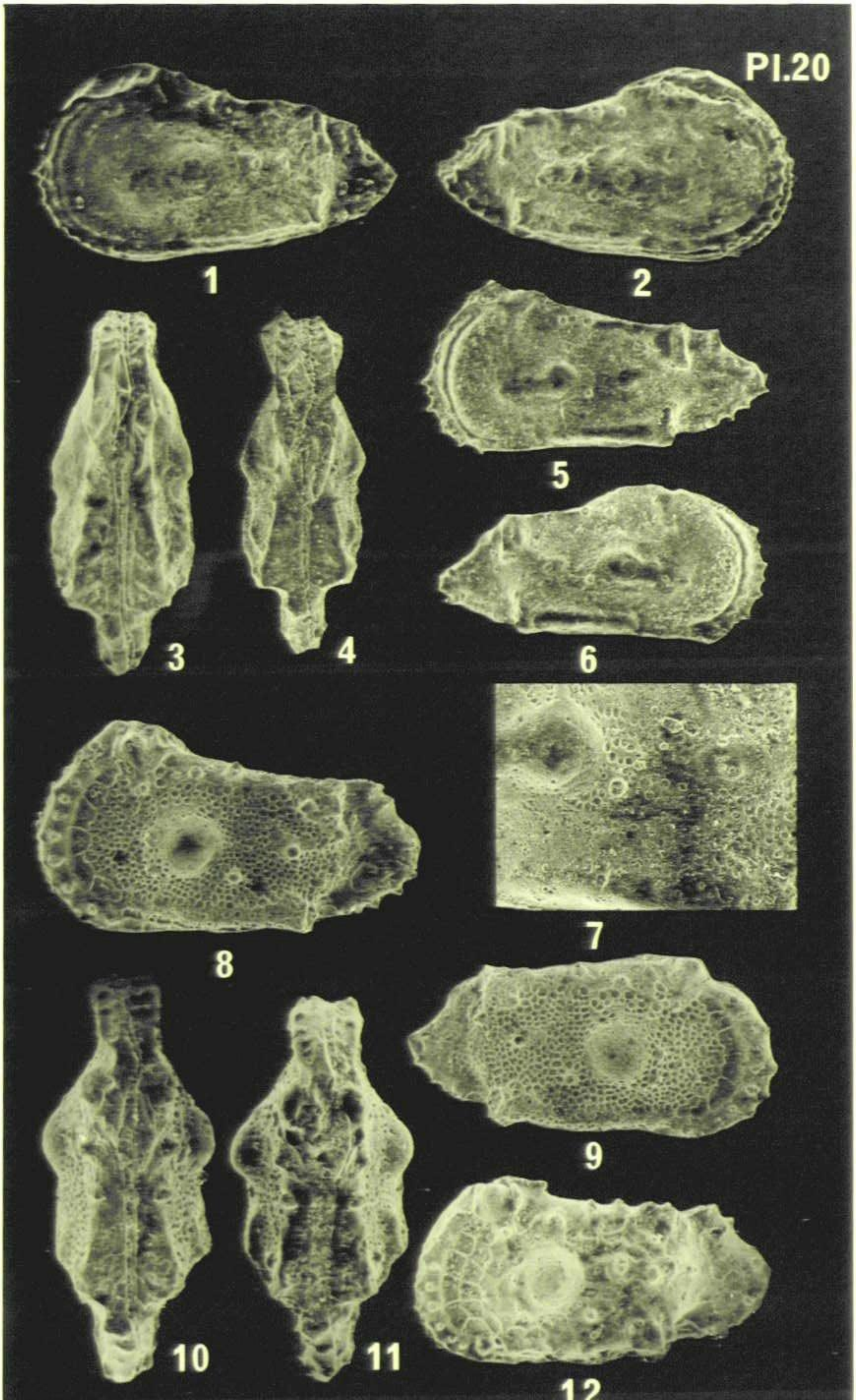
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PLATE 21

(x 20 except Fig. 9 x 4,400)

Cythereis hindei hindei n.ssp.

Fig. 1. Female right valve, paratype, OS 9766, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 2. Female left valve, paratype, OS 9767, internal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 3. Juvenile left valve, paratype, OS 9770, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 4. Male left valve, paratype, OS 9768, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 5. Female carapace, paratype, OS 9769, dorsal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Cythereis hindei diminuta n.ssp.

Fig. 6. Carapace, paratype, OS 9781, dorsal view, sample S 19, Middle Cenomanian, Southerham, Sussex.

Fig. 7. Carapace, holotype, OS 9780, left view, sample S 19, Middle Cenomanian, Southerham, Sussex.

Fig. 8. Right valve, paratype, OS 9782, sample S 19, Middle Cenomanian, Southerham, Sussex.

Fig. 9. Detail of sieve plate. Same specimen as Fig. 7.

Curfsina ? derooi n.sp.

Fig. 10. Left valve, holotype, OS 9730, sample BN 12, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 11. Right valve, paratype, OS 9731, sample BN 12, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 12. Carapace, paratype, OS 9732, dorsal view, sample BN 12, Upper Cenomanian, Buckland Newton, Dorset.

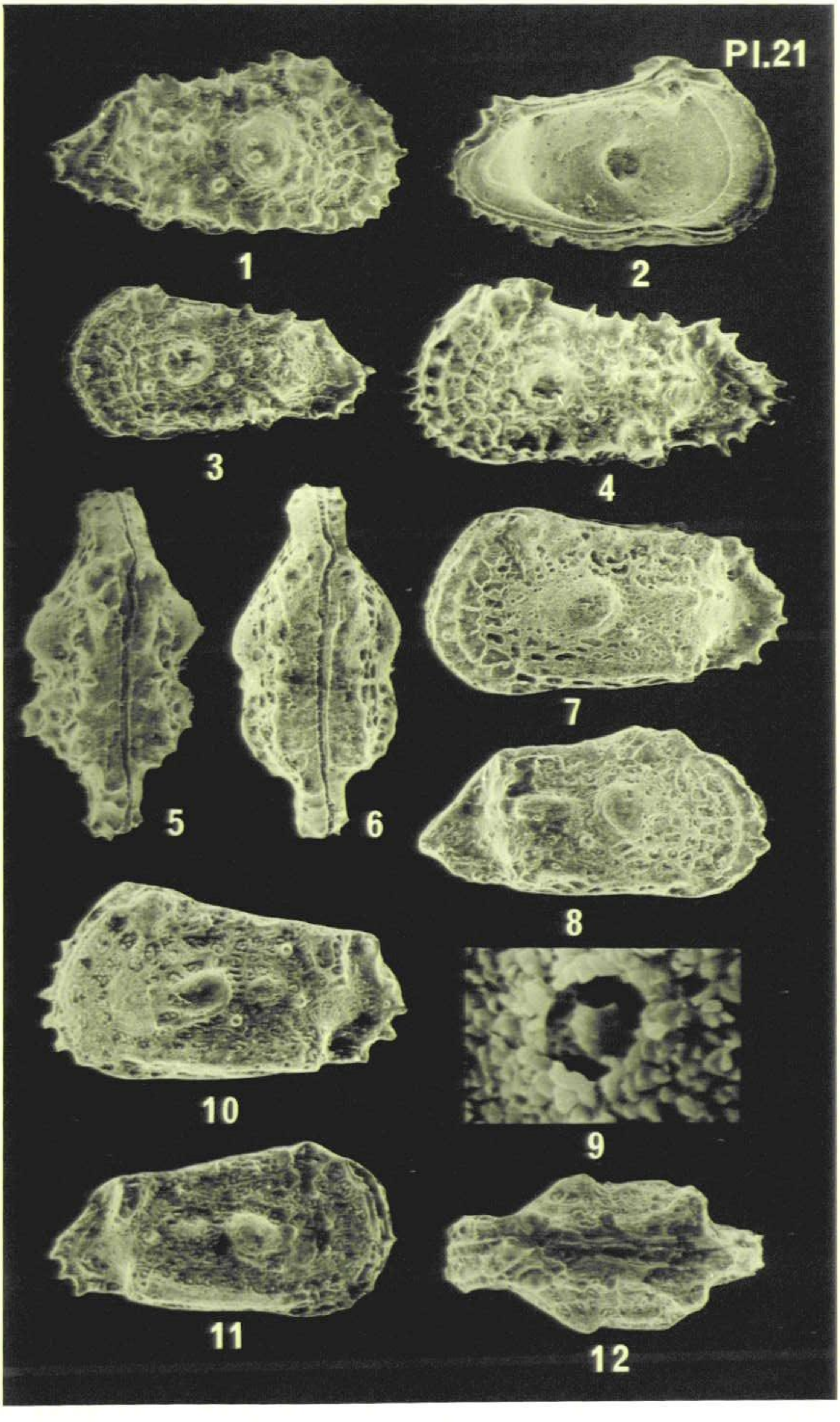
Pl.21
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PLATE 22

Curfsina ? derooi n.sp.

(x 750)

Fig. 1. Left valve, holotype, OS 9730, detail of ornament, sample BN 12, Upper Cenomanian, Buckland Newton, Dorset.

Cornicythereis larivourensis (Damotte and Grosdidier)

(x 110)

Fig. 2. Male left valve, OS 9725, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 3. Female right valve, OS 9724, internal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 4. Female left valve, OS 9723, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 5. Female carapace, OS 9726, dorsal view, sample Bar 22, Lower Cenomanian, Barrington, Cambs.

Fig. 6. Female carapace, OS 9727, right view, sample Bar 22, Lower Cenomanian, Barrington, Cambs.

Cornicythereis sp.A.

(x 110)

Fig. 7. Left valve, OS 9729, sample CC 2, Lower Cenomanian, Culver Cliff, I.O.W.

Fig. 8. Carapace, OS 9728, dorsal view, sample CC 2, Lower Cenomanian, Culver Cliff, I.O.W.

Idiocythere donzei n.sp.

(x 110)

Fig. 9. Female left valve, holotype, OS 9813, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 10. Female right valve, paratype, OS 9815, internal view, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 11. Female carapace, OS9814, right view, sample BN 12, Upper Cenomanian, Buckland Newton, Dorset.

Imhotepia euglyphea n.sp.

(x 110)

Fig. 12 Left valve, holotype, OS 9828, sample S 1, Upper Cenomanian, Southerham, Sussex.

Fig. 13. Right valve, paratype, OS 9829, sample S 1, Upper Cenomanian, Southerham, Sussex.

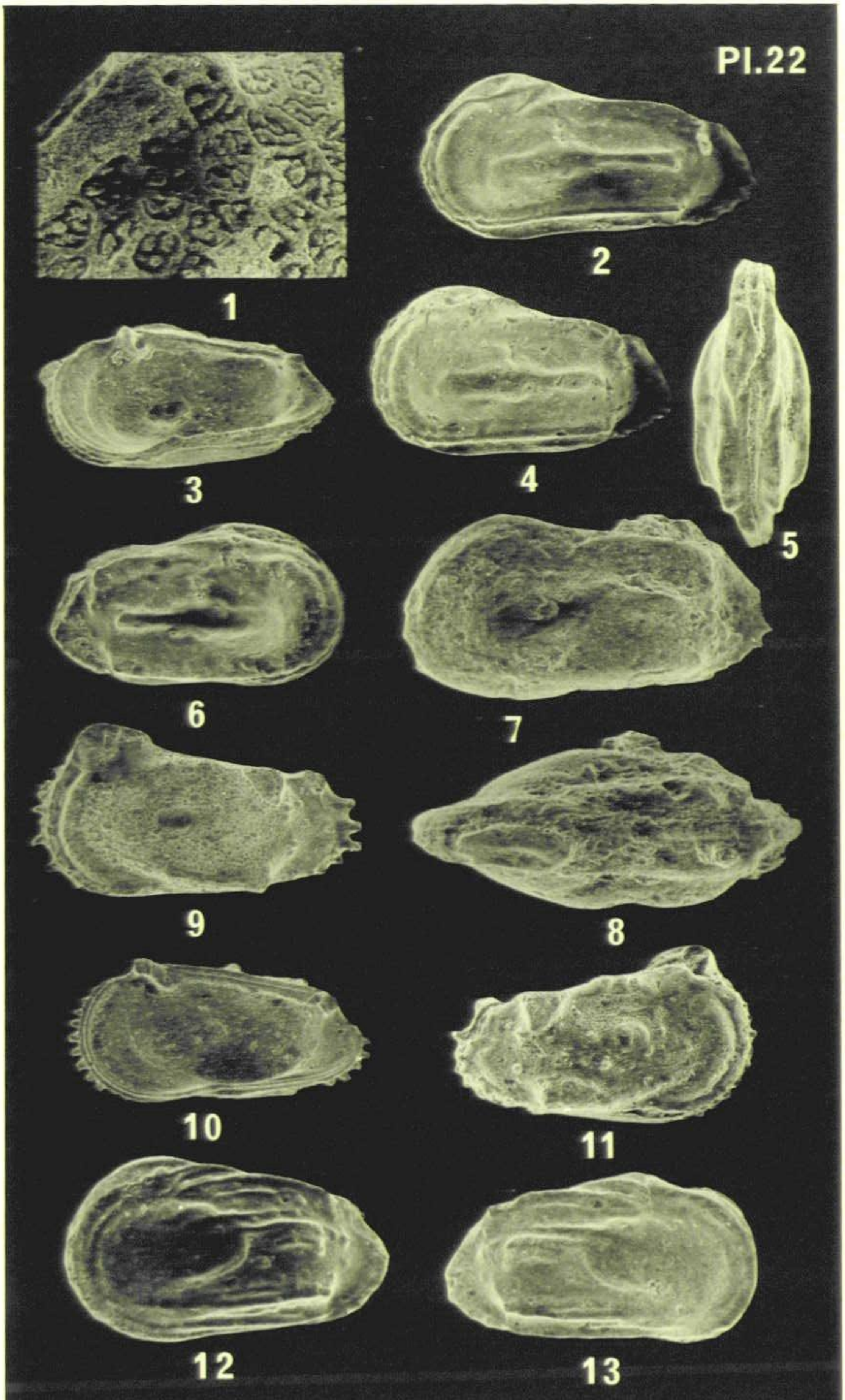
Pl.22
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PLATE 23

Imhotepia euglyphea n.sp.

(x 110)

Fig. 1. Left valve, paratype, OS 9830, interior view, sample S 1, Upper Cenomanian, Southerham, Sussex.

Fig. 2. Carapace, paratype, OS 9831, dorsal view, sample S 1, Upper Cenomanian, Southerham, Sussex.

Isocythereis cf. I. grossouvrensis Donze

(x 110)

Fig. 3. Carapace, hypotype, OS 9837, dorsal view, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 4. Left valve, hypotype, OS 9838, sample BN 12, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 5. Right valve, hypotype, OS 9839, sample BN 12, Upper Cenomanian, Buckland Newton, Dorset.

Planileberis sandersi n.sp.

(Figs. 6-8 x 95 : Fig. 12 x 400)

Fig. 6. Left valve, holotype, OS 9869, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 7. Right valve, paratype, OS 9870, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 8. Carapace, paratype, OS 9871, dorsal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 12. Right valve, paratype, OS 9872, anterior tooth, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Planileberis chathamensis n.sp.

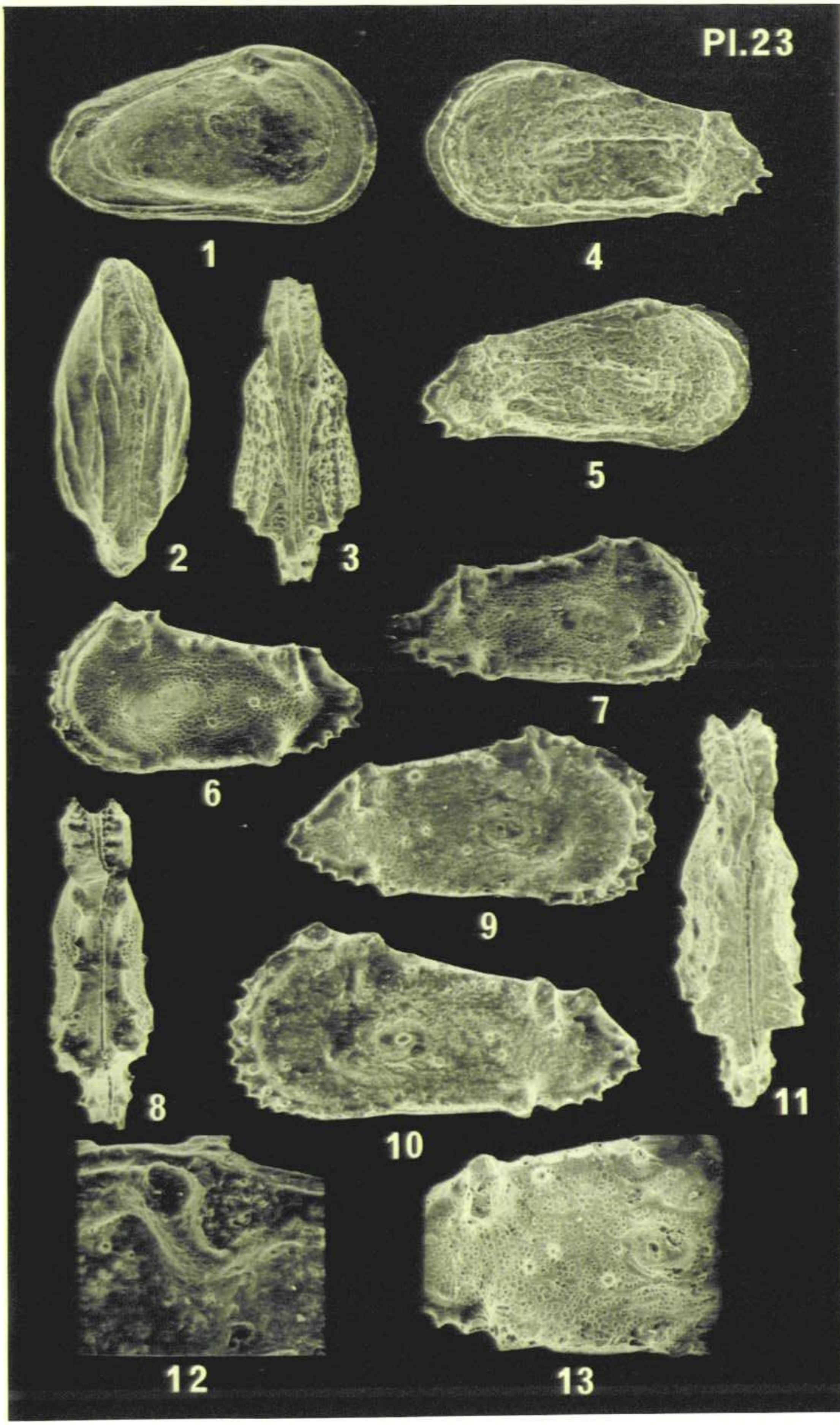
(Figs. 9-11 x 100 : Fig. 13 x 130)

Fig. 9. Female right valve, holotype, OS 9865, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 10. Male left valve, paratype, OS 9866, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 11. Female carapace, paratype, OS 9867, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 13. Female right valve, detail of ornament. Same specimen as Fig. 9.



Pl.23
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PLATE 24

(Figs. 1-8 x 110 : Figs. 9-12 x 300)

Limburgina ? alata n.sp.

Fig. 1. Left valve, holotype, OS 9848, sample BN 9, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 2. Right valve, paratype, OS 9849, sample BN 9, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 3. Carapace, paratype, OS 9850, dorsal view, sample BN 9, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 8. Carapace, paratype, OS 9852, ventral view, sample BN 9, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 11. Right valve, paratype, OS 9851, anterior tooth, sample BN 9, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 12. Posterior tooth. Same specimen as Fig. 11.

Oertliella donzei n.sp.

Fig. 4. Left valve, holotype, OS 9855, sample BN 1, Middle Cenomanian, Buckland Newton, Dorset.

Fig. 5. Right valve, OS 9856, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 6. Carapace, paratype, OS 9859, ventral view, sample BN 1, Middle Cenomanian, Buckland Newton, Dorset.

Fig. 7. Carapace, paratype, OS 9857, dorsal view, sample BN 1, Middle Cenomanian, Buckland Newton, Dorset.

Fig. 9. Right valve, paratype, OS 9858, anterior tooth, sample BN 1, Middle Cenomanian, Buckland Newton, Dorset.

Fig. 10. Posterior tooth, Same specimen as Fig. 9.

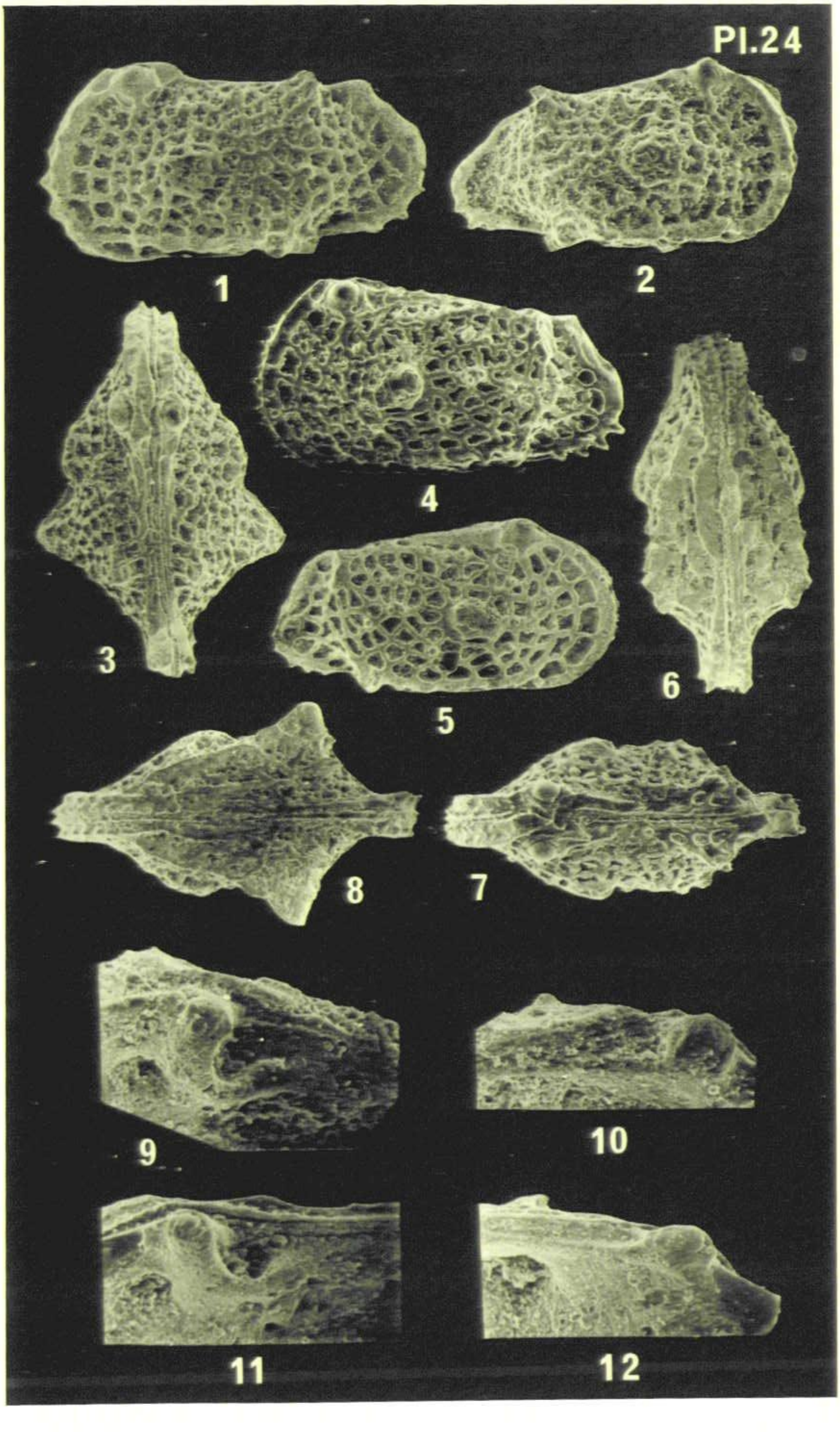
Pl.24
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PLATE 25

(Figs. 1,2 x 100 : Fig. 3-10 x 90 : Figs. 11-14 x 82)

Matronella matronae matronae

(Damotte & Grosdidier)

Fig. 1. Left valve, OS 9854, sample S 23, Lower Cenomanian, Southerham, Sussex.

Fig. 2. Right valve, OS 9853, sample S 23, Lower Cenomanian, Southerham, Sussex.

Platycythereis cf. P. chapmani Kaye

Fig. 3. Left valve, OS 9873, sample PBH1 30, Lower Cenomanian, Pitstone, Herts.

Fig. 4. Right valve, OS 9874, sample PBH1 30, Lower Cenomanian, Pitstone, Herts.

Fig. 5. Carapace, OS 9875, dorsal view, sample PBH1 30, Lower Cenomanian, Pitstone, Herts.

Fig. 6. Juvenile left valve, OS 9876, sample PBH1 30, Lower Cenomanian, Pitstone, Herts.

Platycythereis cf. P. gaultina Jones

Fig. 7. Left valve, OS 9877, sample PBH1 32, Lower Cenomanian, Pitstone, Herts.

Fig. 8. Right valve, OS 9878, sample PBH1 32, Lower Cenomanian, Pitstone, Herts.

Fig. 9. Carapace, OS 9879, dorsal view, sample PBH1 32, Lower Cenomanian, Pitstone, Herts.

Fig. 10. Juvenile left valve, OS 9880, sample PBH1 28, Lower Cenomanian, Pitstone, Herts.

Trachyleberis medwayensis n.sp.

Fig. 11. Right valve, paratype, OS 9882, sample BB 4, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 12. Carapace, hypotype, OS 9883, anterior oblique view, sample S 21, Middle Cenomanian, Southerham, Sussex.

Fig. 13. Left valve, holotype, OS 9881, sample BB 4, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 14. Carapace dorsal view. Same specimen as Fig. 12.

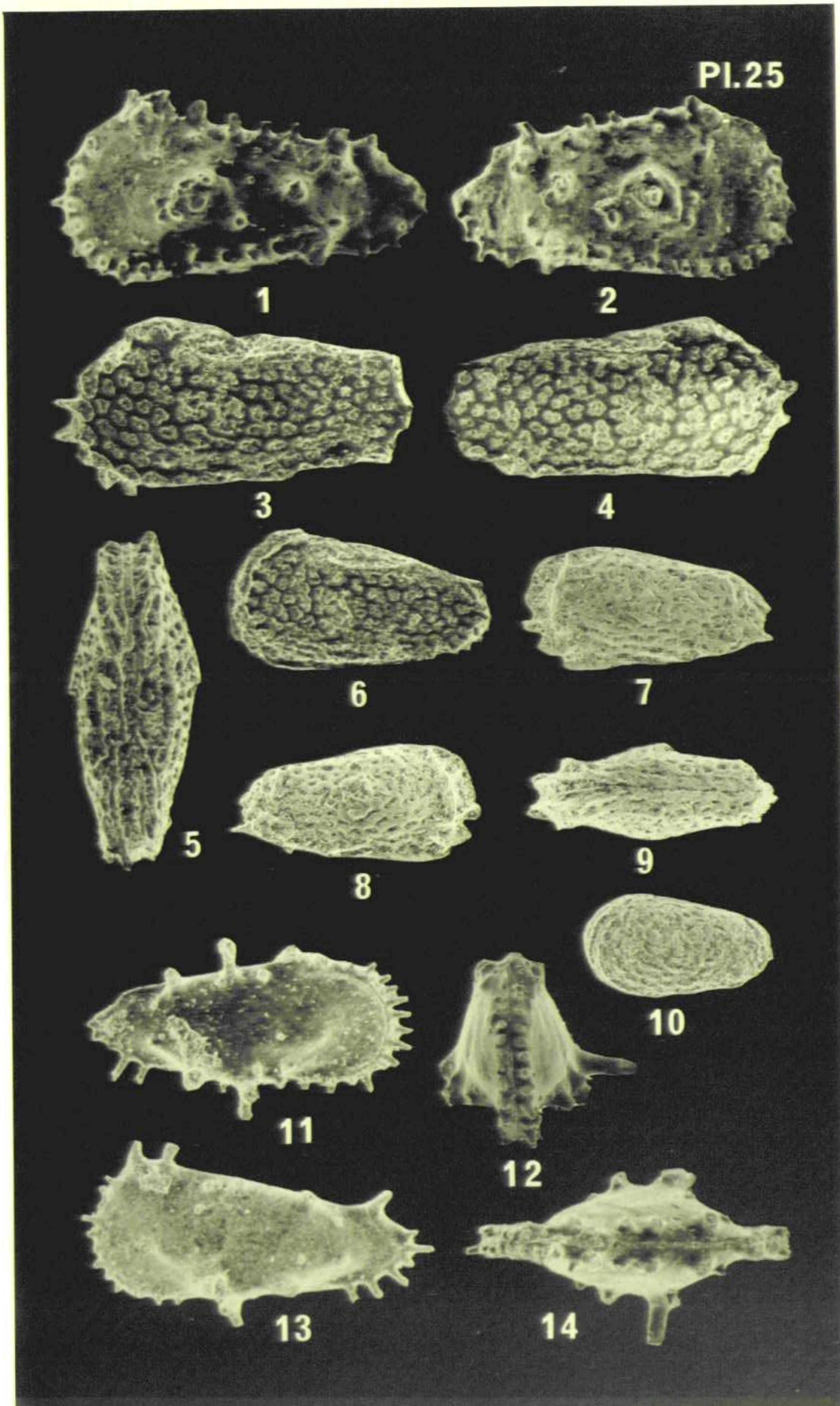
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PLATE 26

(x 170)

Eucytherura (Eucytherura)

cf. E.(E.) tuberculata

Fig. 1. Left valve, OS 9909, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 2. Right valve, OS 9910, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 3. Right valve, OS 9912, interior view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 4. Carapace, OS 9911, dorsal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Eucytherura (Eucytherura) grundeli n.sp.

Fig. 5. Left valve, paratype, OS 9889, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 6. Left valve, paratype, OS 9890, internal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 7. Right valve, paratype, OS 9892, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Hemiparacytheridea cf. H. longicauda (Bonnema)

Fig. 8. Right valve, OS 9947, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 9. Left valve, OS 9949, interior view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Hemiparacytheridea minutissima (Kaye)

Fig. 10. Right valve, OS 9951, sample PBH1 34, Lower Cenomanian, Pitstone, Herts.

Fig. 11. Left valve, OS 9950, sample PBH1 34, Lower Cenomanian, Pitstone, Herts.

Fig. 12. Right valve, OS 9953, interior view, sample PBH1 34, Lower Cenomanian, Pitstone, Herts.

Eucytherura (Eucytherura) longisculpta n.sp.

Fig. 13. Right valve, holotype, OS 9903, sample BB 12, Upper Cenomanian, Blue Bell Hill, Kent.

Eucytherura (Vesticytherura)

multituberculata Gründel

Fig. 14. Left valve, OS 9913, sample PBH3, 12, Middle Cenomanian, Pitstone, Herts.

Fig. 15. Carapace, OS 9915, dorsal view, sample PBH1 32, Lower Cenomanian, Pitstone, Herts.

Fig. 16. Left valve male?, OS 9916, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 17. Right valve, OS 9914, sample BN 12, Upper Cenomanian, Buckland Newton, Dorset.

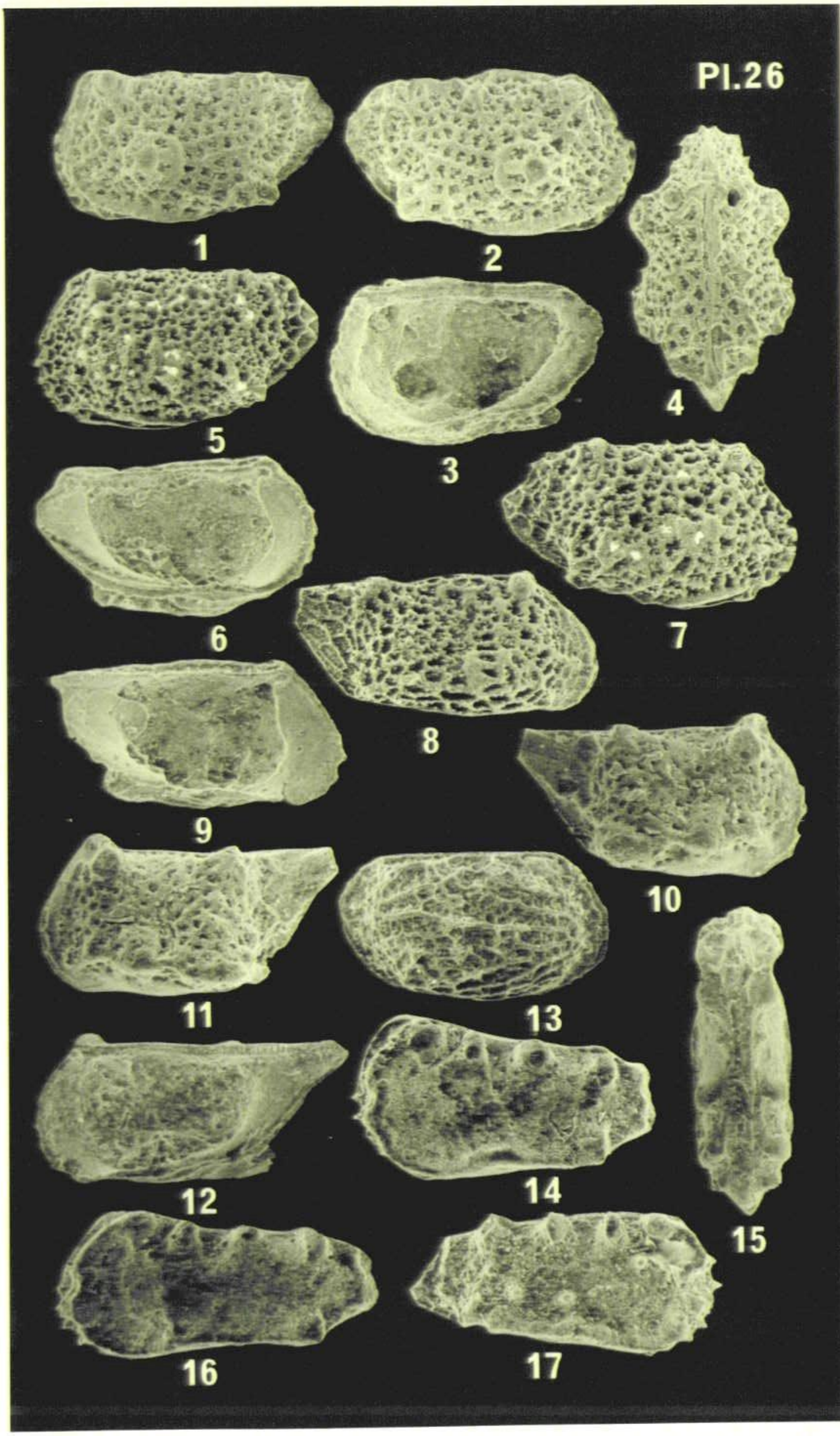
Pl.26
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PLATE 27

(Figs. 1-9 x 175 : Figs. 10,11 x 290 : Figs. 12,13 x 140)

Hemicytherura euglyphea Kaye

Fig. 1. Left valve, OS 9917, sample PBH1 30, Lower Cenomanian, Pitstone, Herts.

Fig. 2. Right valve, OS 9918, sample PBH1 30, Lower Cenomanian, Pitstone, Herts.

Fig. 3. Carapace, OS 9919, dorsal view, sample PBH1 30, Lower Cenomanian, Pitstone, Herts.

Pedicythere pitstonensis n.sp.

Fig. 4. Left valve, paratype, OS 9955, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Eucytherura (Eucytherura?) chathamensis n.sp.

Fig. 5. Left valve, paratype, OS 9886, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Eucytherura (Eucytherura) kayei n.sp.

Fig. 6. Right valve, OS 9900, internal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 7. Right valve, paratype, OS 9902, sample GB 44, Lower Cenomanian, Glyndebourne, Sussex.

Cytheropteron (Cytheropteron) nanissimum Damotte & Grosdidier

Fig. 8. Right valve, OS 9933, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 11. Left valve hinge, OS 9935, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Cytheropteron (Cytheropteron) pitstonensis n.sp.

Fig. 9. Right valve, paratype, OS 9937, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 10. Left valve hinge, paratype, OS 9939, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Paranotacythere bassiouni n.sp.

Fig. 12. Left valve, paratype, OS 9922, dorsal view, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 13. Left valve, paratype, OS 9921, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

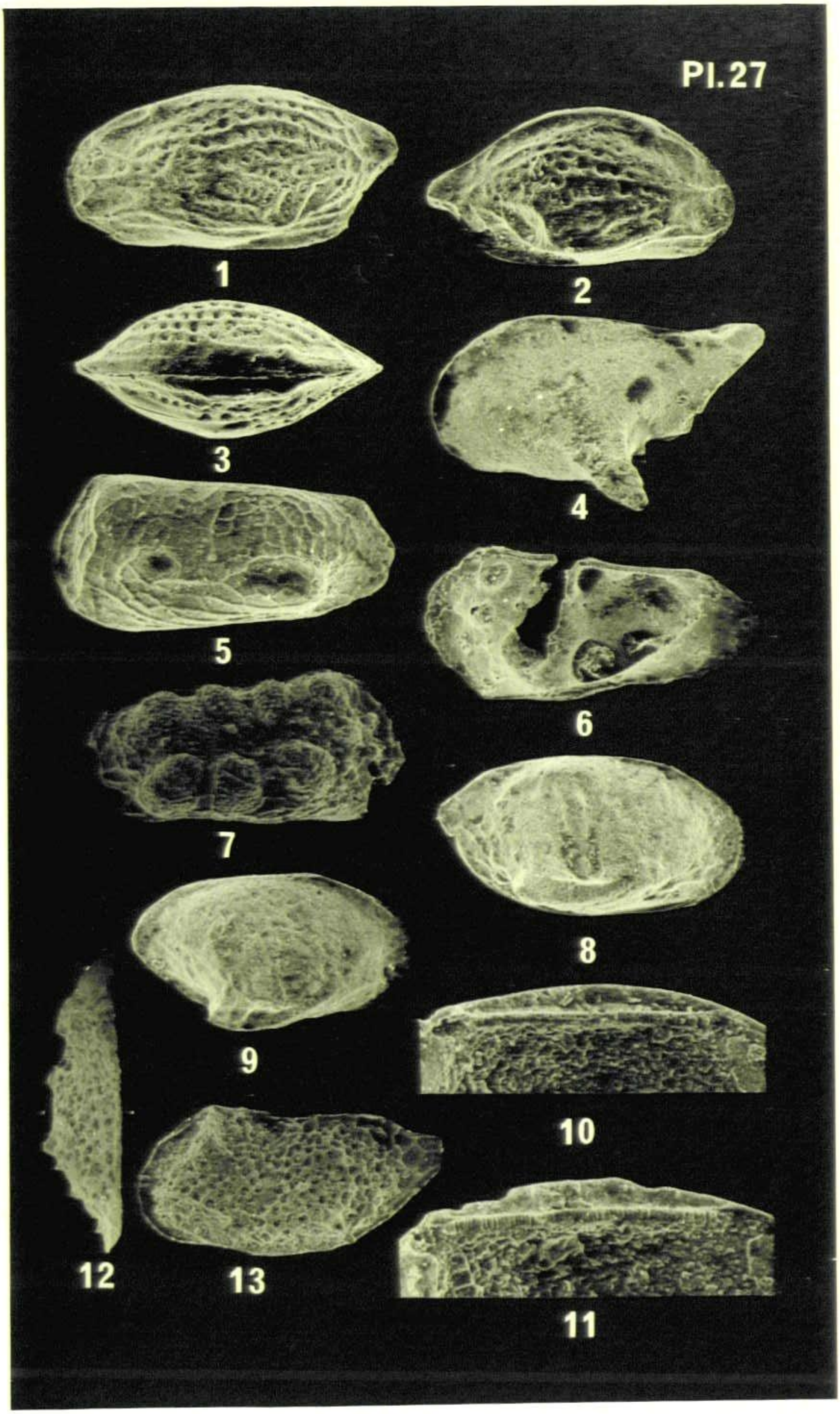
Pl. 27
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PLATE 28

(Figs. 1-4 x 165 : Figs. 5,8,10,11 x 125 : Figs. 9,12,13 x 150)

Pseudobythocythere colini n.sp.

Fig. 1. Female left valve, holotype, OS 9925, sample BB 11, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 2. Female right valve, paratype, OS 9926, sample BB 11, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 3. Male left valve, paratype, OS 9928, sample BB 11, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 4. Female carapace, paratype, OS 9927, dorsal view, sample BB 11, Upper Cenomanian, Blue Bell Hill, Kent.

Xestoleberis planus n.sp.

Fig. 5. Left valve, holotype, OS 10005, sample BB 2, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 6. Right valve, paratype, OS 10007, sample BB 2, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 7. Carapace, paratype, OS 10008, dorsal view, sample BB 2, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 8. Left valve, OS 10006, interior view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts.

Fig. 9. Left valve, interior oblique view. Same specimen as Fig. 8.

Xestoleberis burnetti n.sp.

Fig. 10. Carapace, paratype, OS 9999, right view, sample PBH1 26, Lower Cenomanian, Pitstone, Herts.

Fig. 11. Carapace, holotype, OS 9998, dorsal view, sample PBH1 26, Lower Cenomanian, Pitstone, Herts.

Amphicytherura cf. A. falloti Donze

Fig. 12. Left valve, OS 10013, sample BN 10, Upper Cenomanian, Buckland Newton, Dorset.

Fig. 13. Carapace, OS 10015, dorsal view, sample BN 10, Upper Cenomanian, Buckland Newton, Dorset.

Pl. 28

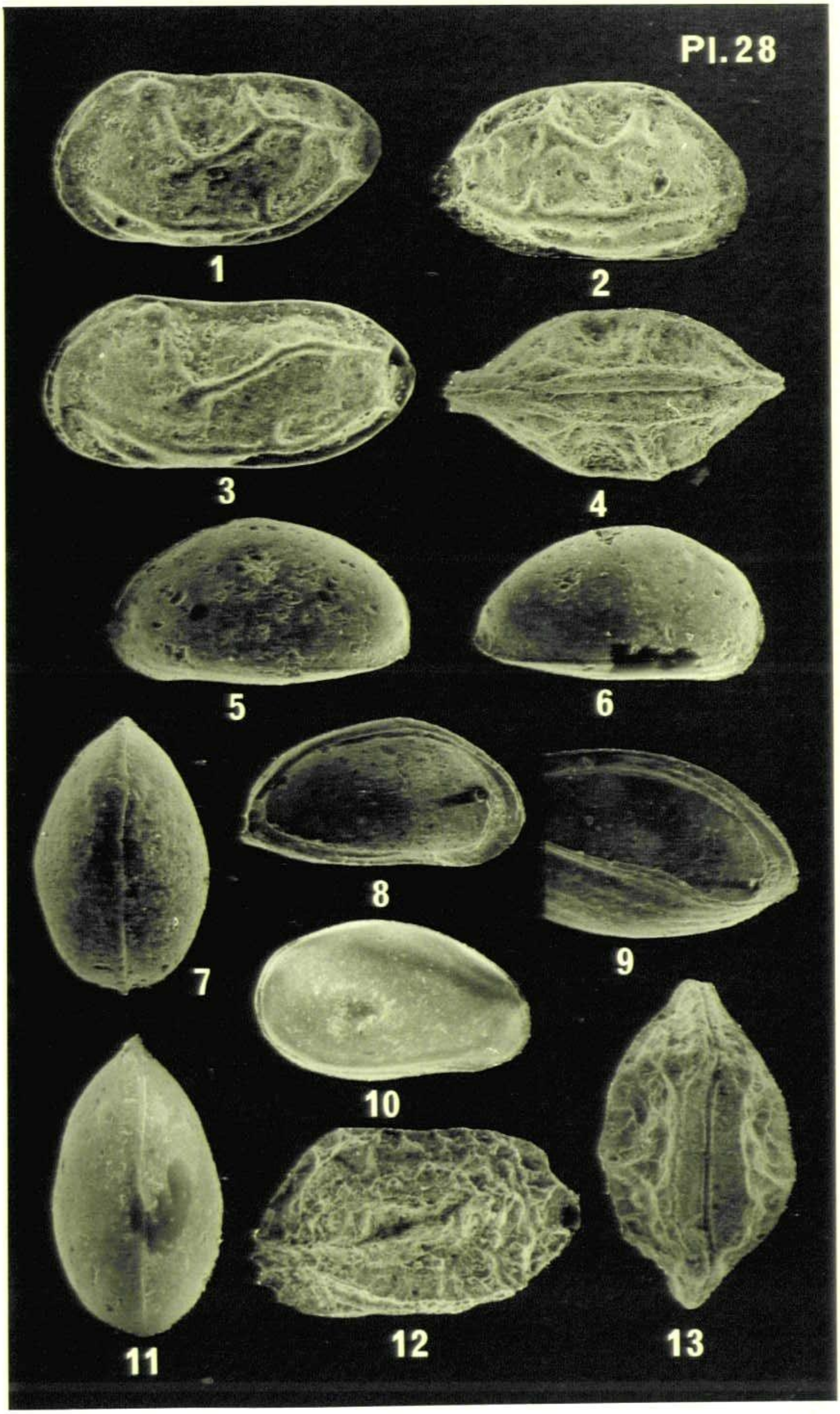

PLATE 29

Amphicytherura cf. A. falloti Donze (x 150)

Fig. 1. Right valve, OS 10014, sample BN 10, Upper Cenomanian, Buckland Newton, Dorset.

Polycope bluebellensis n.sp. (x 125)

Fig. 2. Left valve, paratype, OS 10025, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Polycope delicata n.sp. (x 150)

Fig. 3. Right valve, paratype, OS 10028, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Polycope oweni Kaye (x 132)

Fig. 4. Left valve, OS 10039, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Saida cf. S. nettgauensis Gründel (x 180)

Fig. 5. Left valve, OS 10021, sample Bar 11, Middle Cenomanian, Barrington, Cambs.

Fig. 6. Carapace, OS 10023, dorsal view, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

Krausella minuta Veen (x 112)

Fig. 7. Female left valve, OS 10016, sample BB 12, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 8. Male left valve, OS 10019, sample BB 12, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 9. Female carapace, OS 10018, right view, sample BB 19, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 10. Female carapace, OS 10017, dorsal view, sample BB 19, Middle Cenomanian, Blue Bell Hill, Kent.

Fig. 11. Female left valve, OS 10020, interior view, sample BB 13, Upper Cenomanian, Blue Bell Hill, Kent.

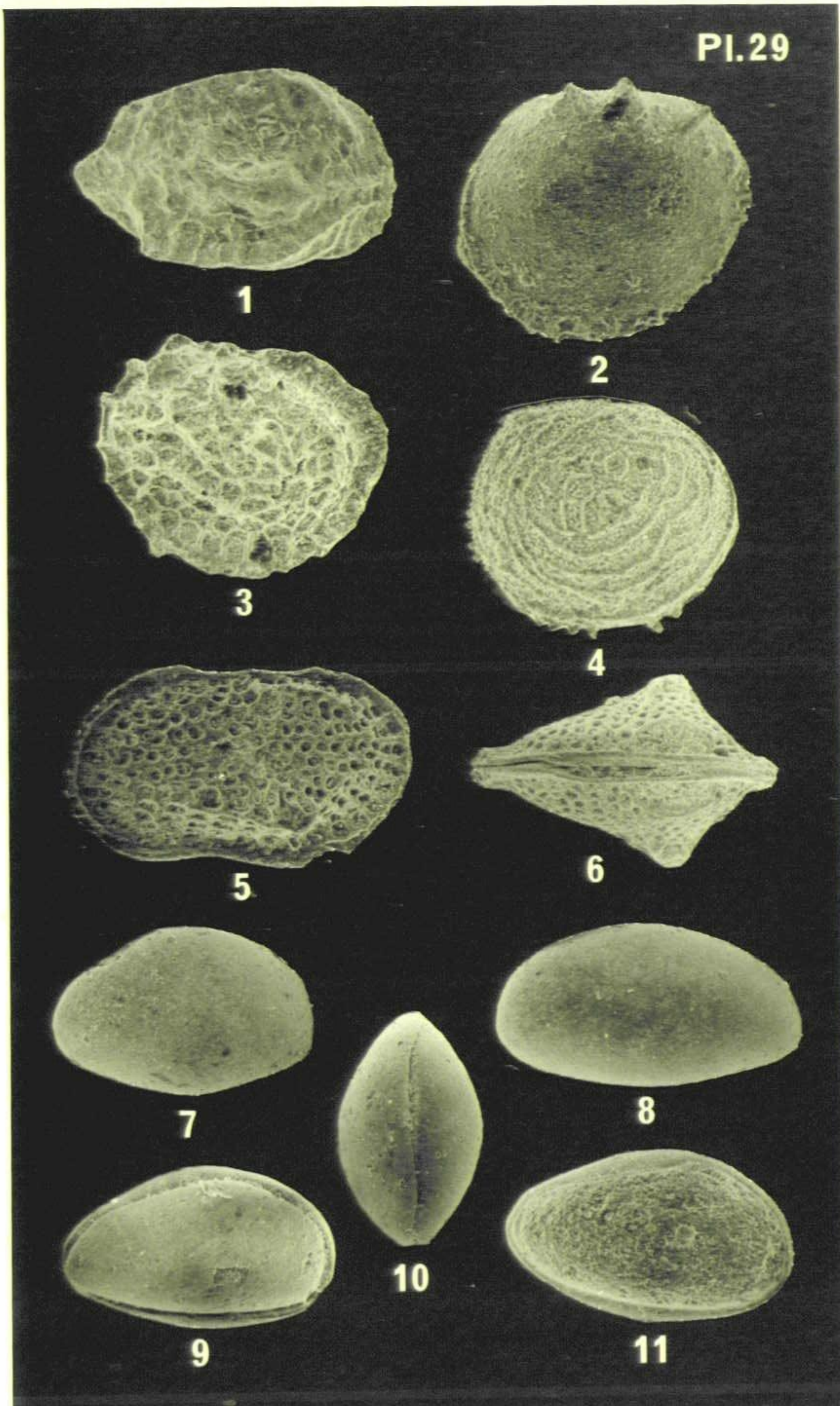
Pl. 29
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PLATE 30

(x 125)

<u>Loxoconcha ? bluebellensis</u> n.sp.

All specimens from sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 1. Female left valve, holotype, OS 9957

Fig. 2. Female right valve, paratype, OS 9958

Fig. 3. Male right valve, paratype, OS 9959

Fig. 4. Female carapace, dorsal view, paratype, OS 9960

Fig. 5. Juvenile A-1 left valve, OS 9968

Fig. 6. Juvenile A-1 right valve, OS 9969

Fig. 7. Juvenile A-2 left valve, OS 9970

Fig. 8. Juvenile A-2 right valve, OS 9971

Fig. 9. Juvenile A-3 left valve, OS 9972

Fig. 10. Juvenile A-3 right valve, OS 9973

Fig. 11. Juvenile A-4 left valve, OS 9974

Fig. 12. Juvenile A-4 right valve, OS 9975

Fig. 13. Juvenile A-5 left valve, OS 9976

Fig. 14. Juvenile A-5 right valve, OS 9977

Fig. 15. Juvenile A-6 left valve, OS 9978

Fig. 16. Juvenile A-6 right valve, OS 9979

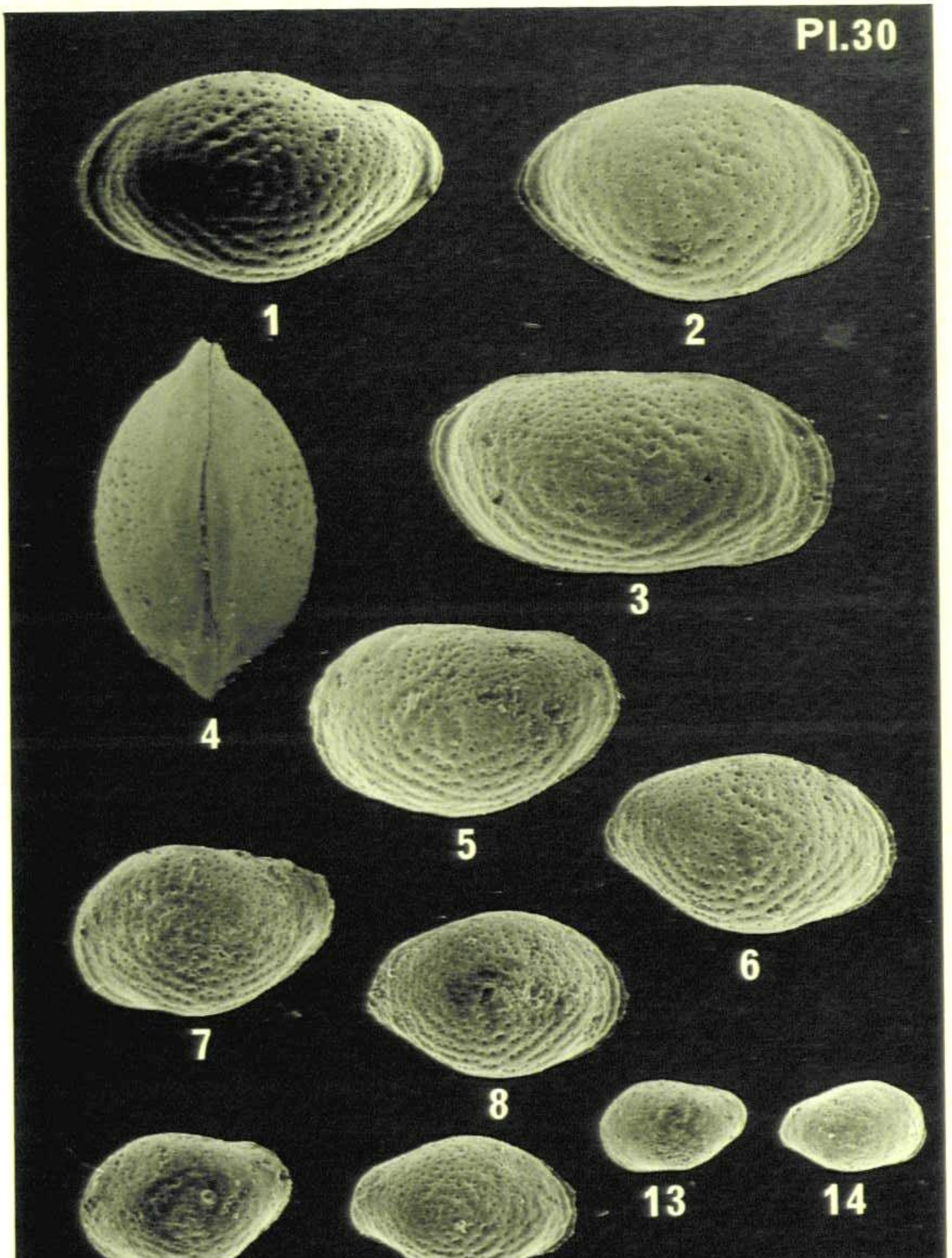
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PLATE 31

(x 125)

Loxoconcha ? bluebellensis n.sp.

Fig. 1. Female left valve, holotype, OS 9957, interior view, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Fig. 2. Female right valve, paratype, OS 9958, interior view, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent.

Loxoconcha ? icknieldensis n.sp.

All specimens from sample PBH1 28, Lower Cenomanian, Pitstone, Herts.

Fig. 3. Female left valve, holotype, OS 9980

Fig. 4. Female right valve, paratype, OS 9981

Fig. 5. Male left valve, paratype, OS 9982

Fig. 6. Female carapace, paratype, OS 9983, dorsal view

Fig. 7. Juvenile A-1 left valve, OS 9992

Fig. 8. Juvenile A-1 right valve, OS 9993

Fig. 9. Juvenile A-2 left valve, OS 9994

Fig. 10. Juvenile A-2 right valve, OS 9995

Fig. 11. Juvenile A-3 left valve, OS 9996

Fig. 12. Juvenile A-3 right valve, OS 9997

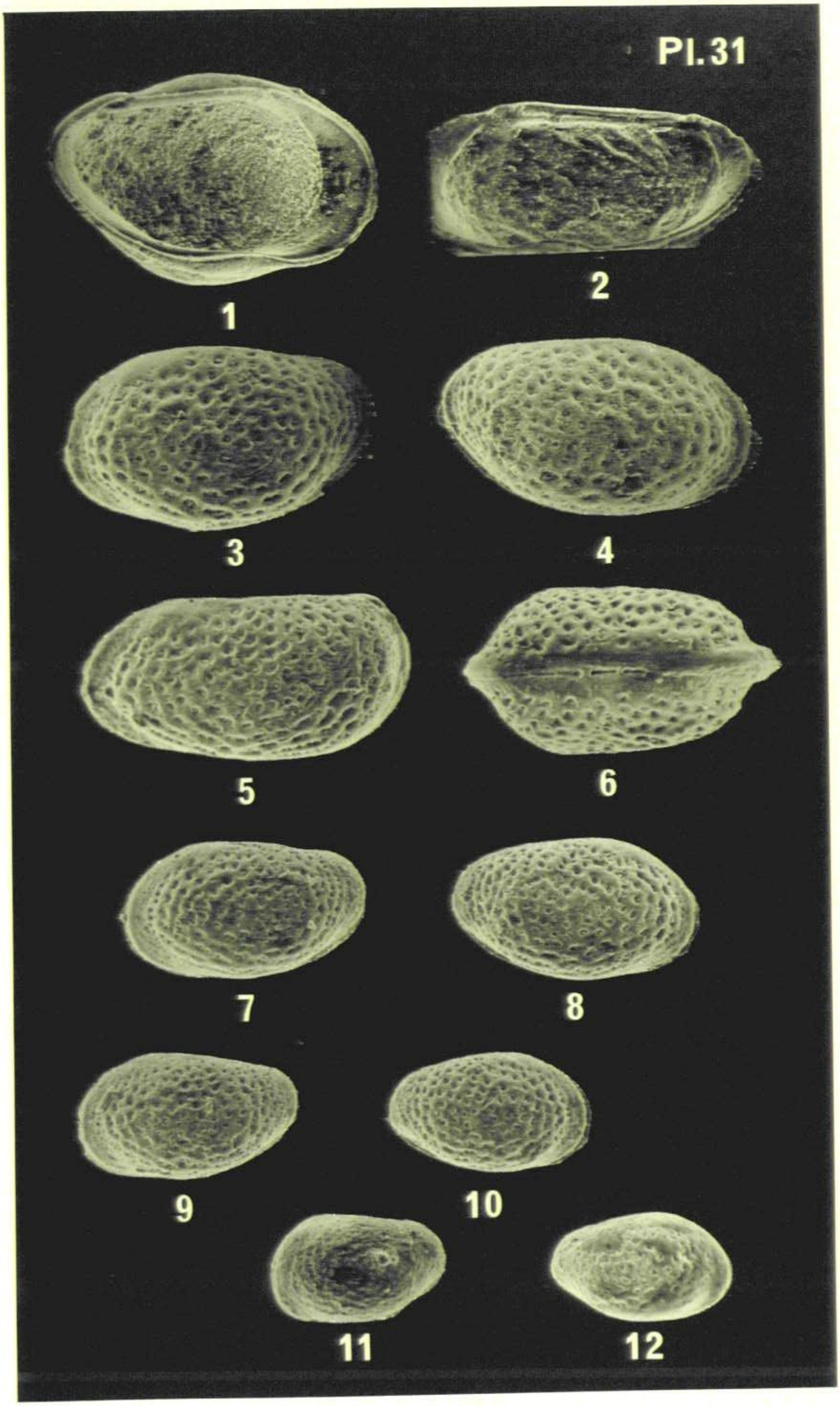


PLATE 32

Stereoscopically paired photographs

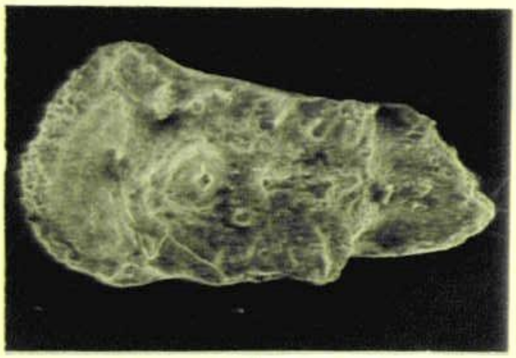
Fig. 1. Cythereis sp. B left valve, OS 9812, sample BN 12, Plenus Marls Bed 1, Buckland Newton, Dorset, (x 70)

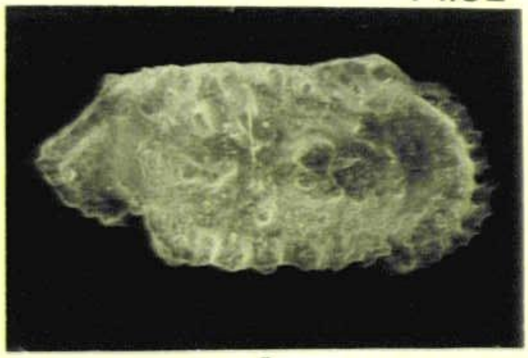
Fig. 2. Cythereis sp. A right valve, OS 9811, sample P 2, Upper Cenomanian, Pitstone, Herts.

Fig. 3. Isocythereis cf. I. grossouvrensis Donze, right valve, OS 9840, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent. (x 110).

Fig. 4. Idiocythere donzei n.sp. carapace, OS 9816, dorsal view, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent. (x 110)

Pl.32





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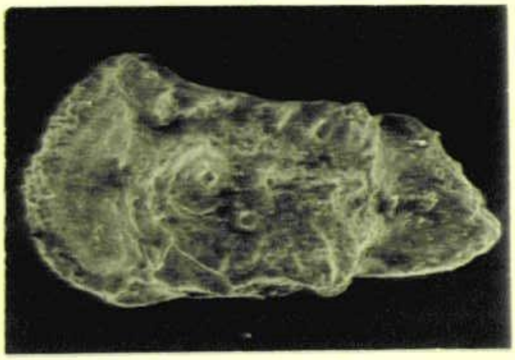

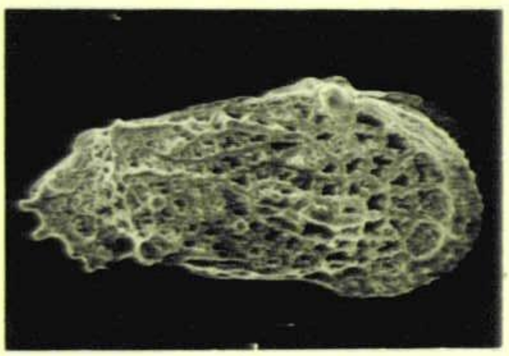

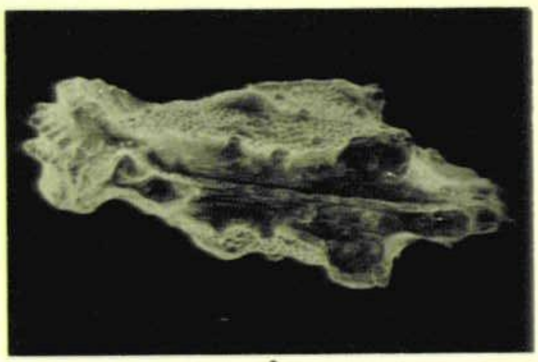

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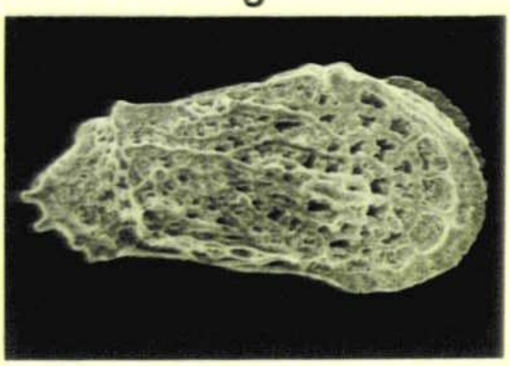

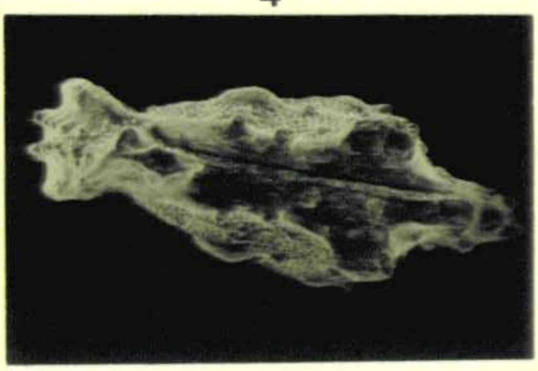

PLATE 33

Stereoscopically paired photographs

Fig. 1. Eucytherura (Eucytherura) cf. E.(E.) tuberculata Bonnema, left valve, OS 9909, sample PBH3 12, Middle Cenomanian, Pitstone, Herts. (x 170)

Fig. 2. Eucytherura (Eucytherura) cf. E.(E.) tuberculata Bonnema, carapace, OS 9911, dorsal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts. (x 170)

Fig. 3. Eucytherura (Eucytherura) grundeli n.sp. left valve, holotype, OS 9888, sample PBH3 12, Middle Cenomanian, Pitstone, Herts. (x 170)

Fig. 4. Eucytherura (Eucytherura) grundeli n.sp. right valve, paratype, OS 9891, dorsal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts. (x 170)

Fig. 5. Hemiparacytheridea cf. H. longicauda Bonnema, left valve, OS 9946, sample PBH3 12, Middle Cenomanian, Pitstone, Herts. (x 170)

Fig. 6. Hemiparacytheridea cf. H. longicauda Bonnema, right valve, OS 9948, dorsal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts. (x 170)

Pl. 33

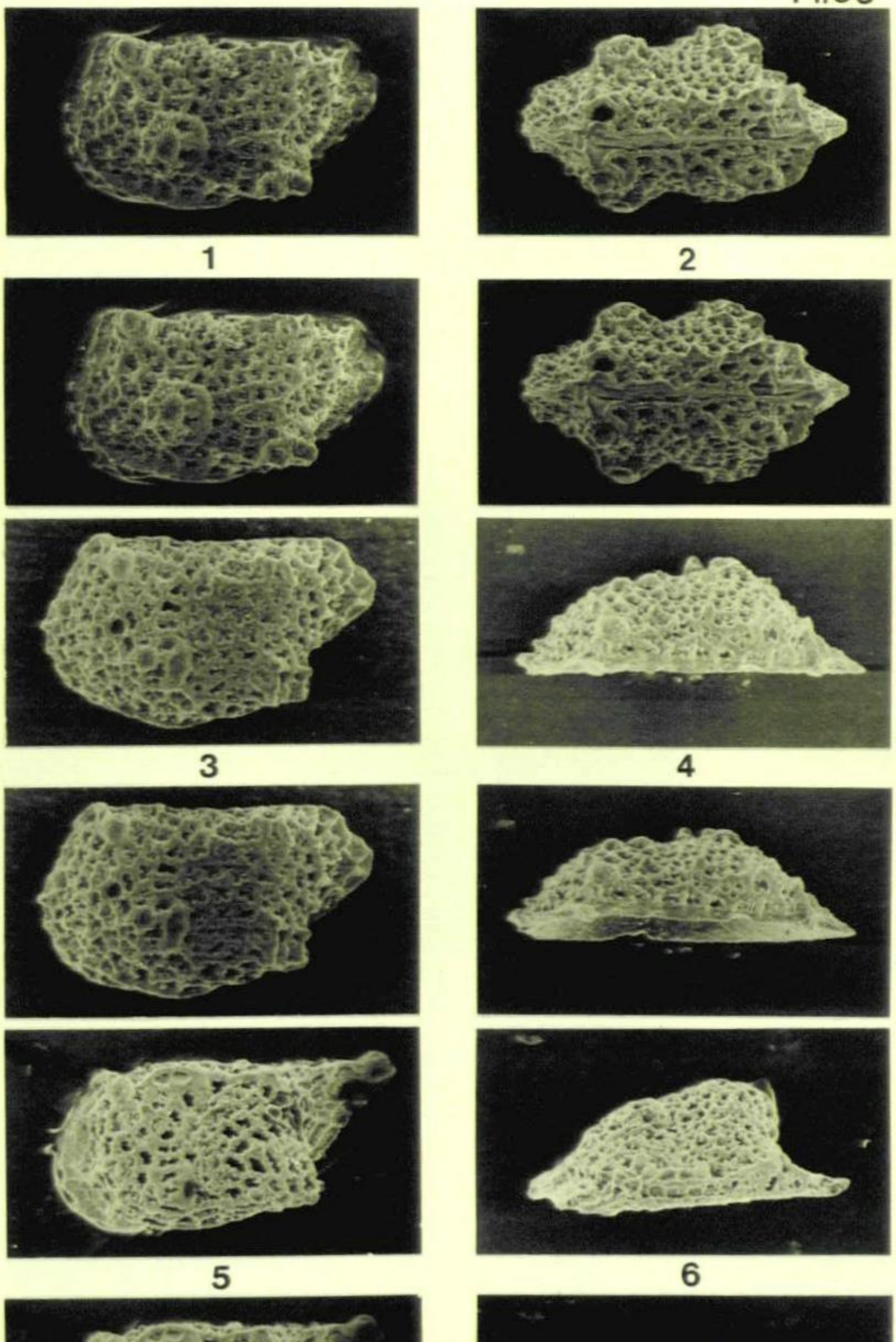

PLATE 34

Stereoscopically paired photographs.

Fig. 1. Eucytherura (Eucytherura?) chathamensis n.sp. right valve, OS 9885, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent (x 160).

Fig. 2. Eucytherura (Eucytherura?) chathamensis n.sp., carapace, OS 9887, dorsal view, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent, (x 160).

Fig. 3. Eucytherura (Eucytherura) kayei n.sp. left valve, OS 9898, holotype, sample GB 44, Lower Cenomanian, Glyndebourne, Sussex. (x 180)

Fig. 4. Eucytherura (Eucytherura) kayei n.sp. carapace, OS 9899, dorsal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts (x 180)

Fig. 5. Cytherura striatoides Bonnema, right valve, OS 9884, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent. (x 180)

Fig. 6. Cytherura striatoides Bonnema, left valve, OS 9883, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent. (x 180).

Pl.34

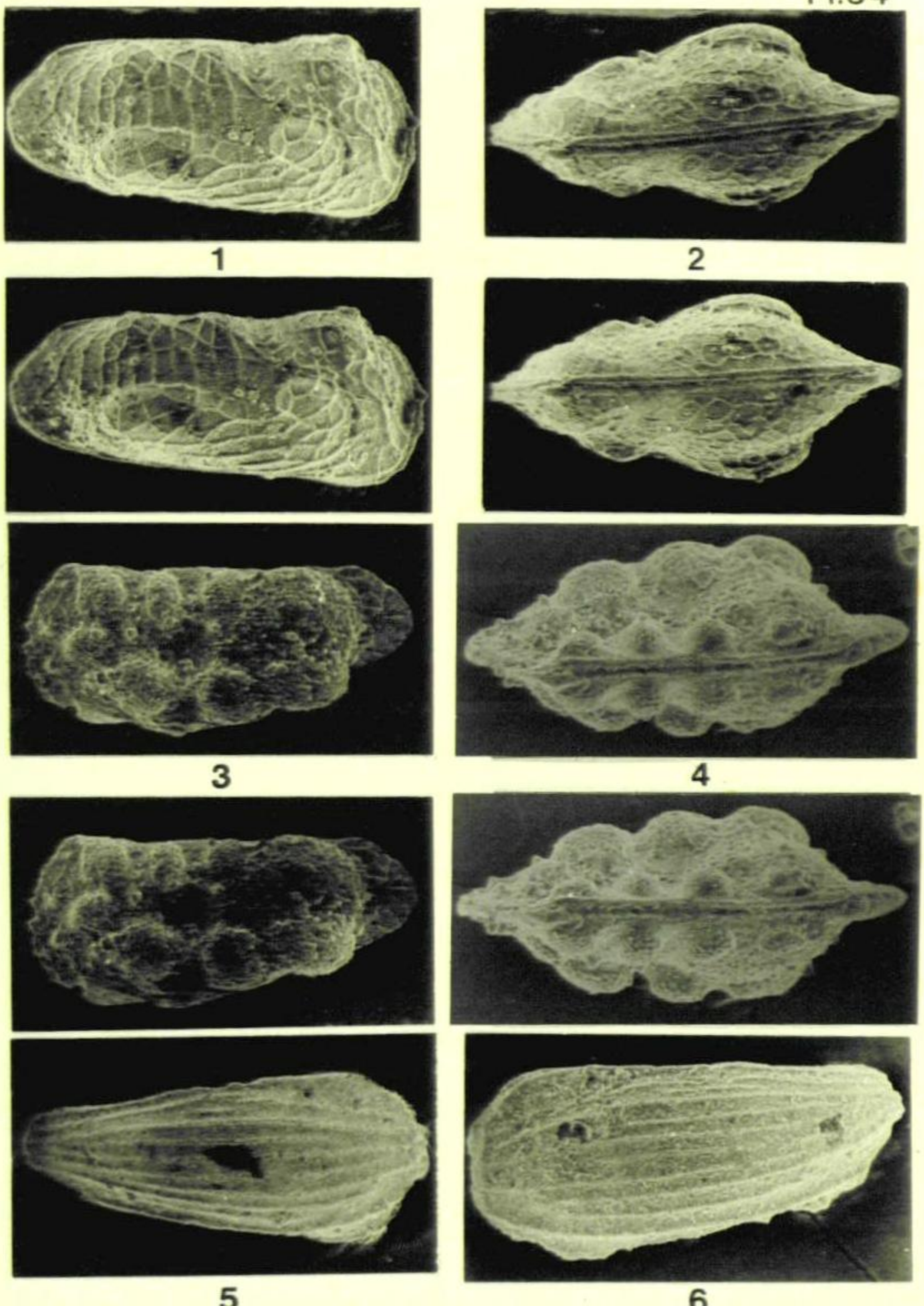

PLATE 35

Stereoscopically paired photographs

Fig. 1. Hemiparacytheridea minutissima (Kaye), left valve OS 9950, sample PBH1 34, Lower Cenomanian, Pitstone, Herts. (x 170)

Fig. 2. Hemiparacytheridea minutissima (Kaye), left valve, OS 9952, dorsal view, sample PBH1 32, Lower Cenomanian, Pitstone, Herts. (x 170).

Fig. 3. Eucytherura (Eucytherura) longisculpta n.sp., left valve, paratype, OS 9904, sample BB 12, Upper Cenomanian, Blue Bell Hill, Kent, (x 185)

Fig. 4. Eucytherura (Eucytherura) longisculpta n.sp., right valve, paratype, OS 9905, dorsal view, sample BB 12, Upper Cenomanian, Blue Bell Hill, Kent (x 185).

Fig. 5. Paranotacythere bassiouni n.sp. right valve, holotype, OS 9920, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent. (x 185)

Fig. 6. Saida cf. S. nettgauenensis Gründel, right valve, OS 10022, sample PBH3 18, Middle Cenomanian, Pitstone, Herts. (x 172).

Pl.35

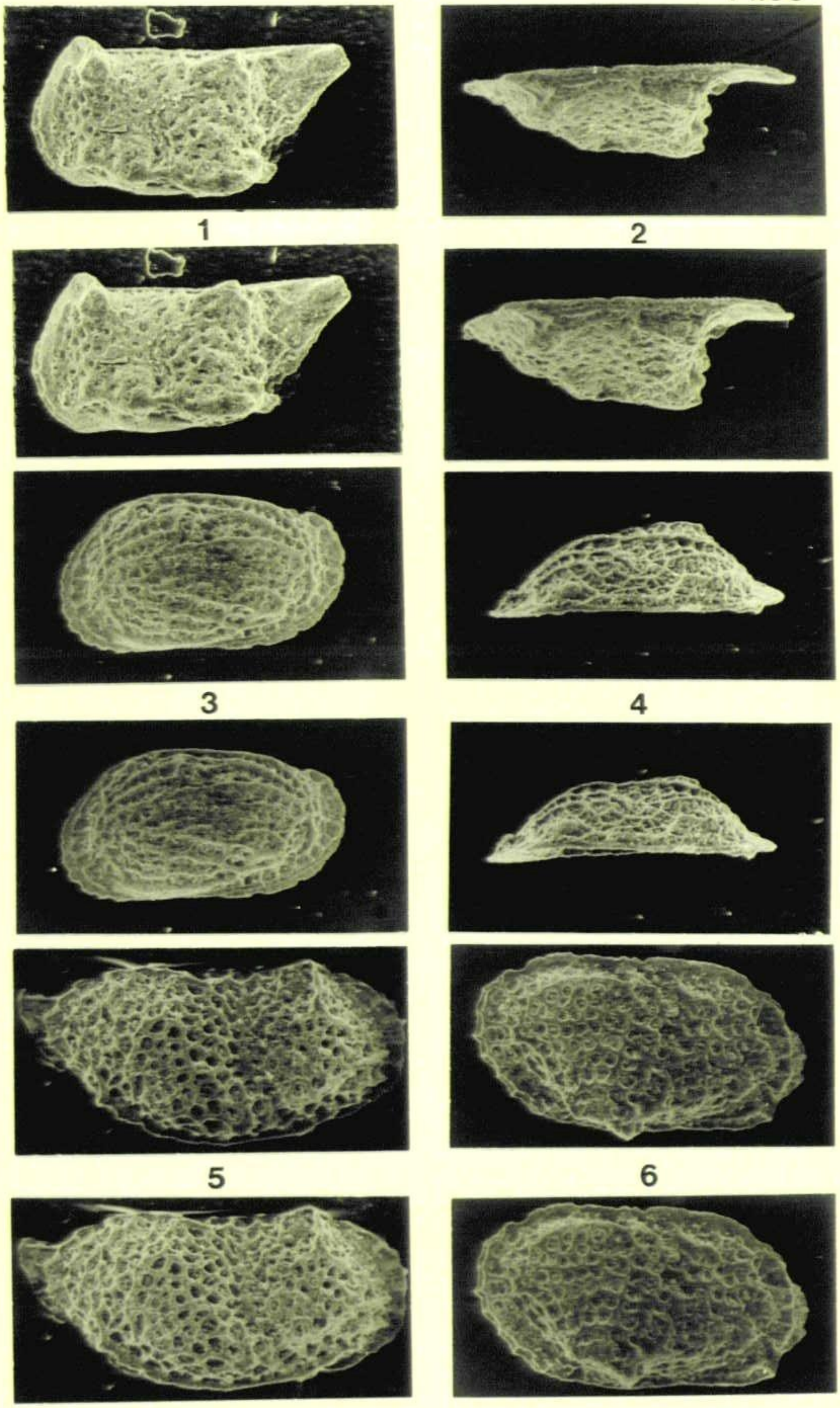

PLATE 36

Stereoscopically paired photographs.

Fig. 1. Cytheropteron (Cytheropteron) nanissimum Damotte & Grosdidier, left valve, OS 9932, sample PBH3 12, Middle Cenomanian, Pitstone, Herts, (x 175).

Fig. 2. Cytheropteron (Cytheropteron) nanissimum Damotte & Grosdidier, right valve, OS 9934, dorsal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts, (x 175).

Fig. 3. Cytheropteron (Cytheropteron) pitstonensis n.sp., left valve, holotype, OS 9936, sample PBH3 12, Middle Cenomanian, Pitstone, Herts, (x 170).

Fig. 4. Cytheropteron (Cytheropteron) pitstonensis n.sp., left valve, paratype, OS 9938, dorsal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts, (x 170).

Fig. 5. Pedicythere pitstonensis n.sp., right valve, holotype, OS 9954, dorsal view, sample PBH3 12, Middle Cenomanian, Pitstone, Herts, (x 170).

Fig. 6. Pedicythere pitstonensis n.sp., right valve, paratype, OS 9956, sample PBH3 12, Middle Cenomanian, Pitstone, Herts, (x 170).

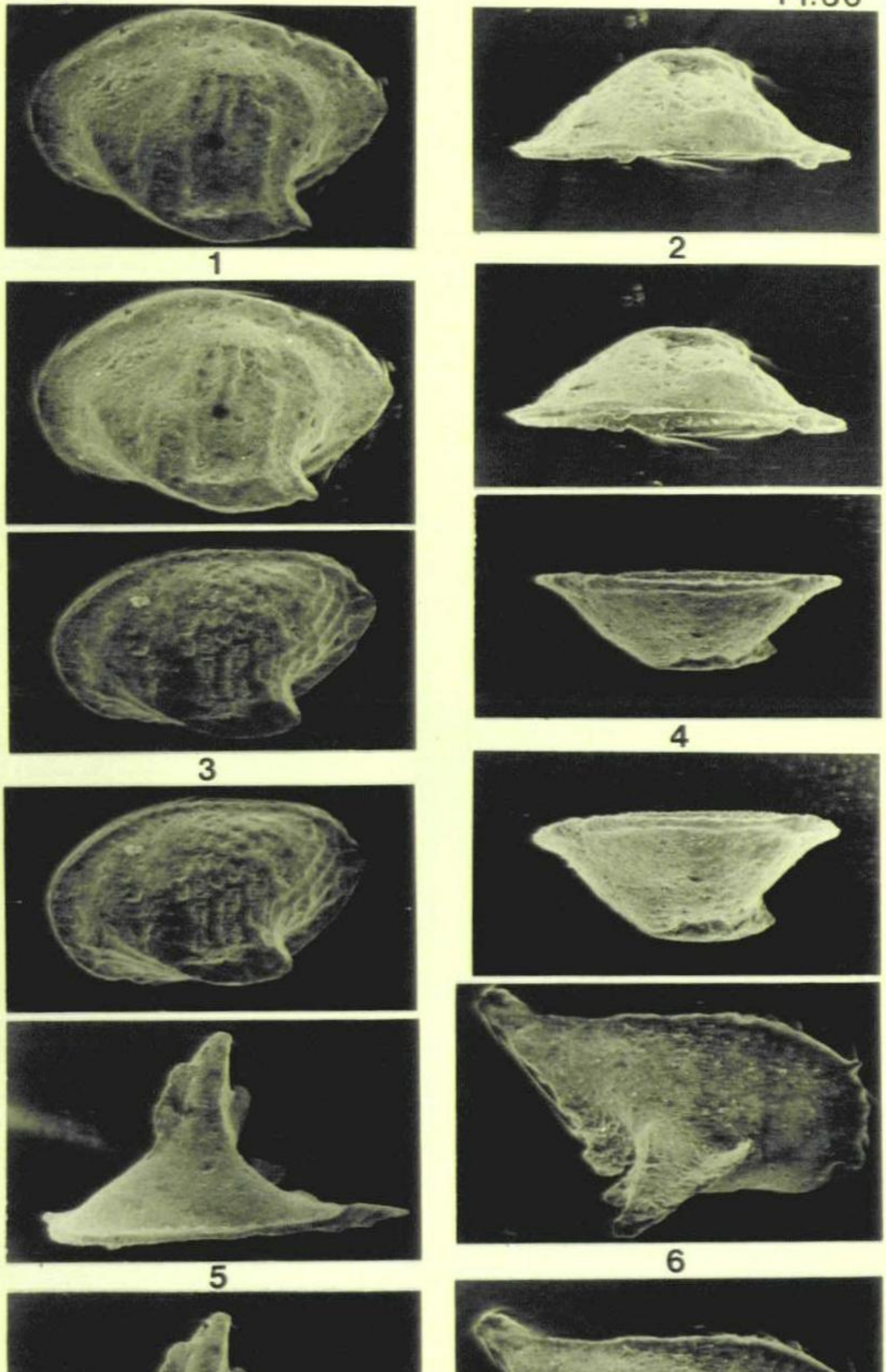
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PLATE 37

Stereoscopically paired photographs

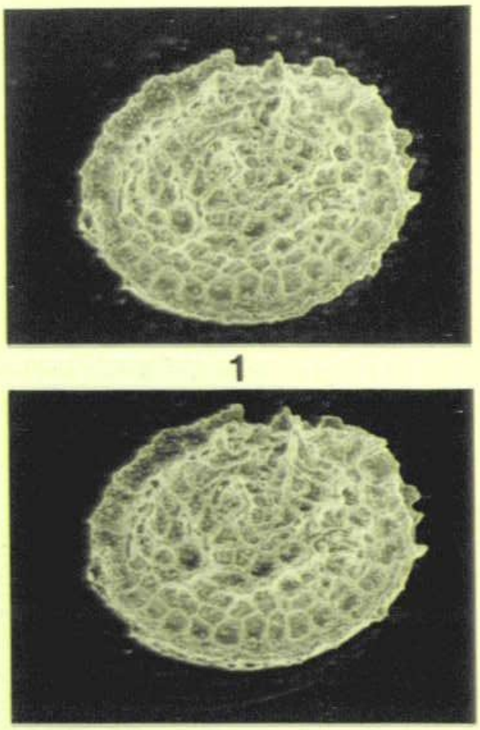
Fig. 1. Polycope delicata n.sp. left valve, holotype, OS 10027, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent. (x 142).

Fig. 2. Polycope bluebellensis n.sp. right valve, holotype, OS 10024, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent. (x 122).

Fig. 3. Polycope nuda Kaye, right valve, OS 10037, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent, (x 115).

Fig. 4. Polycope oweni Kaye, right valve, OS 10038, sample BB 8, Upper Cenomanian, Blue Bell Hill, Kent (x 130)

Pl.37



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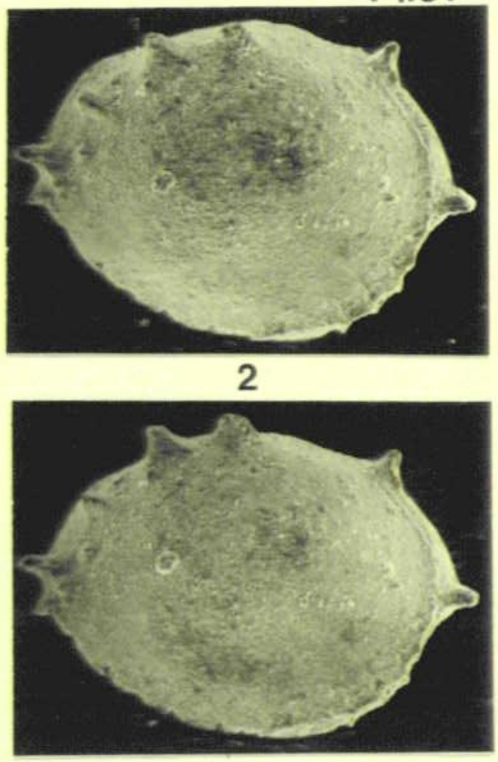

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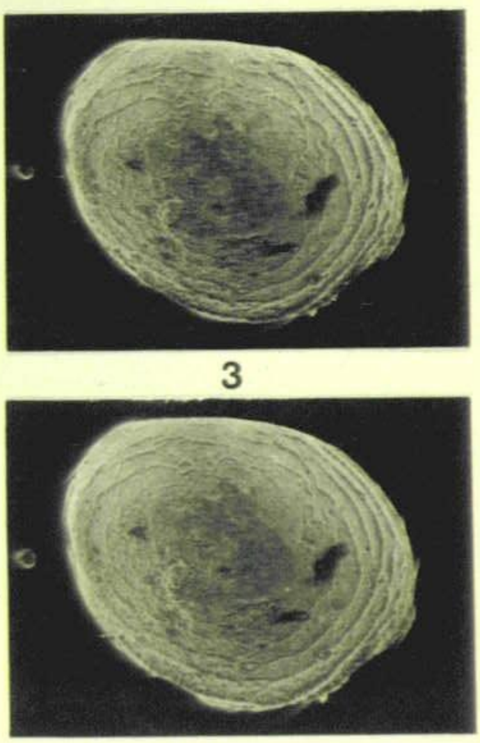

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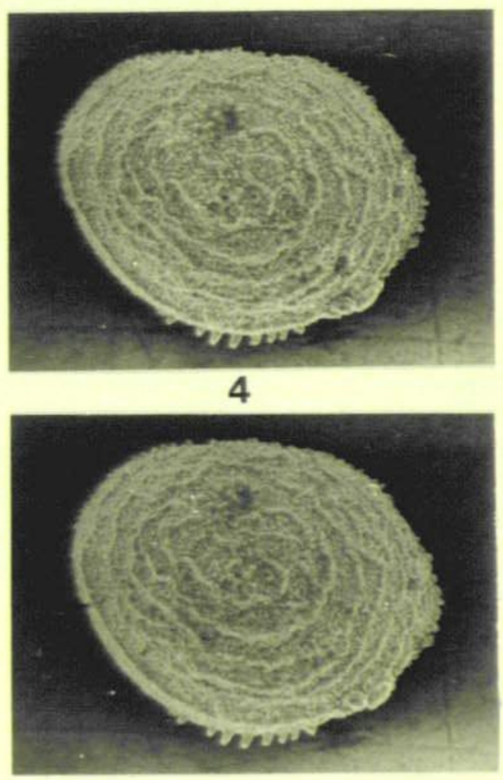

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