HETTANGIAN TO SINEMURIAN OSTRACOD FAUNAS FROM EAST QUANTOXHEAD, WEST SOMERSET.

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The Hettangian to Sinemurian (Lower Jurassic) succession has been investigated for its ostracod fauna. The marine assemblages from this part of the Lower Jurassic succession are of low diversity, dominated by the genus *Ogmoconcha* Triebel, 1941. The stratigraphical distribution of the known taxa, although distinctive, do not appear to provide a diagnostic tool for recognition of the base of the Sinemurian Stage. The data generated by this work do, however, provide additional evidence that the East Quantoxhead succession is a suitable GSSP for the base of the Sinemurian Stage.

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INTRODUCTION

The Sinemurian Stage was initially defined (d'Orbigny, 1942) as the lowest stage of the Lower Jurassic and was named after Semur-en-Auxois in Burgundy. Subsequently Renevier (1864) redefined the Sinemurian by separating the lower part of d'Orbigny's original unit as the Hettangian. By tradition (Arkell, 1933) the Sinemurian is now the 2nd stage of the Jurassic. Recent work (Page, 1992, 1995) on the distribution of the ammonites in the succession has indicated (Page *et al., in press)* that the succession at Semur-en-Auxois, and elsewhere in South-east France, may be significantly thinner than the succession near the village of East Quantoxhead, Somerset. The Somerset succession has recently (August, 1998) been proposed (Page *et al. in press)* as a candidate "Global Stratotype Section and Point" (GSSP) for the base of the Sinemurian Stage. In order to fully assess the utility of the East Quantoxhead succession as a GSSP data are being gathered on all macrofossil, microfossil and microfloral groups as well as geochemical, sedimentological and magnetostratigraphical information. Work by Hylton (1998) on the foraminifera is here supported by work on the ostracod faunas using the same samples.

THE SUCCESSION

The coastal succession of the Hettangian - Sinemurian transition is exposed on the foreshore immediately to the east of Quantock's Head (Figure 1) on the West Somerset coast. The nearest access point is by means of a minor road which runs northwards from the village of Kilve to a car park near the beach. Access to the sampled succession is best obtained by following the coastal path westwards for 0.5 km and then descending to the foreshore by some metal stairs which are actually built across the boundary section. The succession of the Lias Group can then be followed both east and west along the sea cliffs as well as the foreshore. There are numerous small faults in the succession, but it is possible to identify the lithological succession of Palmer (1972) and Whittaker and Green (1983) with little difficulty. The sampled succession is shown in Figure 2, although it must be pointed out that only samples yielding ostracods are marked. The whole succession has been sampled but many of the samples, especially in the upper part of the section, are barren of both ostracods and foraminifera (see Hylton, 1998). Samples collected for this work weighed approximately 200 gm and were prepared as described by Hylton (1998). In most clay successions this method should yield reliable ostracod assemblages, especially as most of the material is preserved as distinct carapaces, rather than separated valves. The latter can often be broken, especially in the case of delicate taxa such as *Polycope.*

MATERIALS AND METHODS

A number of samples have been collected from the succession (see Hylton, 1998, fig.3 for locations) but, unfortunately, a number of these proved to be barren of ostracods. The samples yielding faunas are indicated in Figure 2. As indicated by Hylton (1998), around 200 grams of sediment was processed for each sample using standard preparation techniques. The raw sample was broken into small fragments (5 - 10 mm diameter) and then dried in an oven at 60° for approximately 12 hours. The sample was then soaked in white spirit for several hours under a fume hood and the excess poured off. The sample was then soaked in distilled water for around eight hours. If the sample had not completely broken down it was bolied gently in a solution of washing soda prior to sieving through a 74 µm sieve under a gentle jet of water. The process was repeated if unsuccessful at a first attempt. The sieve residue was gently dried and stored in plastic phials. All specimens from the full range of size fractions were picked from the residue and inspected. All specimens remain in the collections of the University of Plymouth.

TAXONOMY

The fauna described in this investigation has not been subjected to a thorough taxonomic analysis and only key texts are cited in the reference and synonymy lists. There is little published work on Lower Jurassic Ostracoda of the UK. In the last century the works of Jones (1872, 1894) and Blake (in Tate and Blake, 1876) contain a number of original descriptions of taxa. Aside from brief mentions in papers on other aspects of the succession the next major works on the Lower Jurassic of the UK are those of Field (1966), Bate and Coleman (1968) and Lord (1971, 1972, 1974 and 1978). A number of unpublished theses (Field, 1968; Clark, 1969; Park, 1985) have been generated and while a number of authors (e.g., Lord, 1978) have made use of these data in their publications, much of this valuable information remains unavailable. While Field (1968) produced a valuable documentation of the ostracod succession of the Dorset coast (sampled bed-by-bed) there has been no previous attempt to compare his data with the succession in West Somerset. In general we have found faunas from the West Somerset succession much less diverse and this is probably due to differences in depositional environment between the two areas; the Somerset succession contains more, very dark, organic-rich mudstones.

Although the following data are presented as a taxonomic account the justification of the taxa reported is simply to enable the use of the identified species in the range chart (Figure 2). The classification followed is that of the Treatise (Benson *et a1.,* 1961).

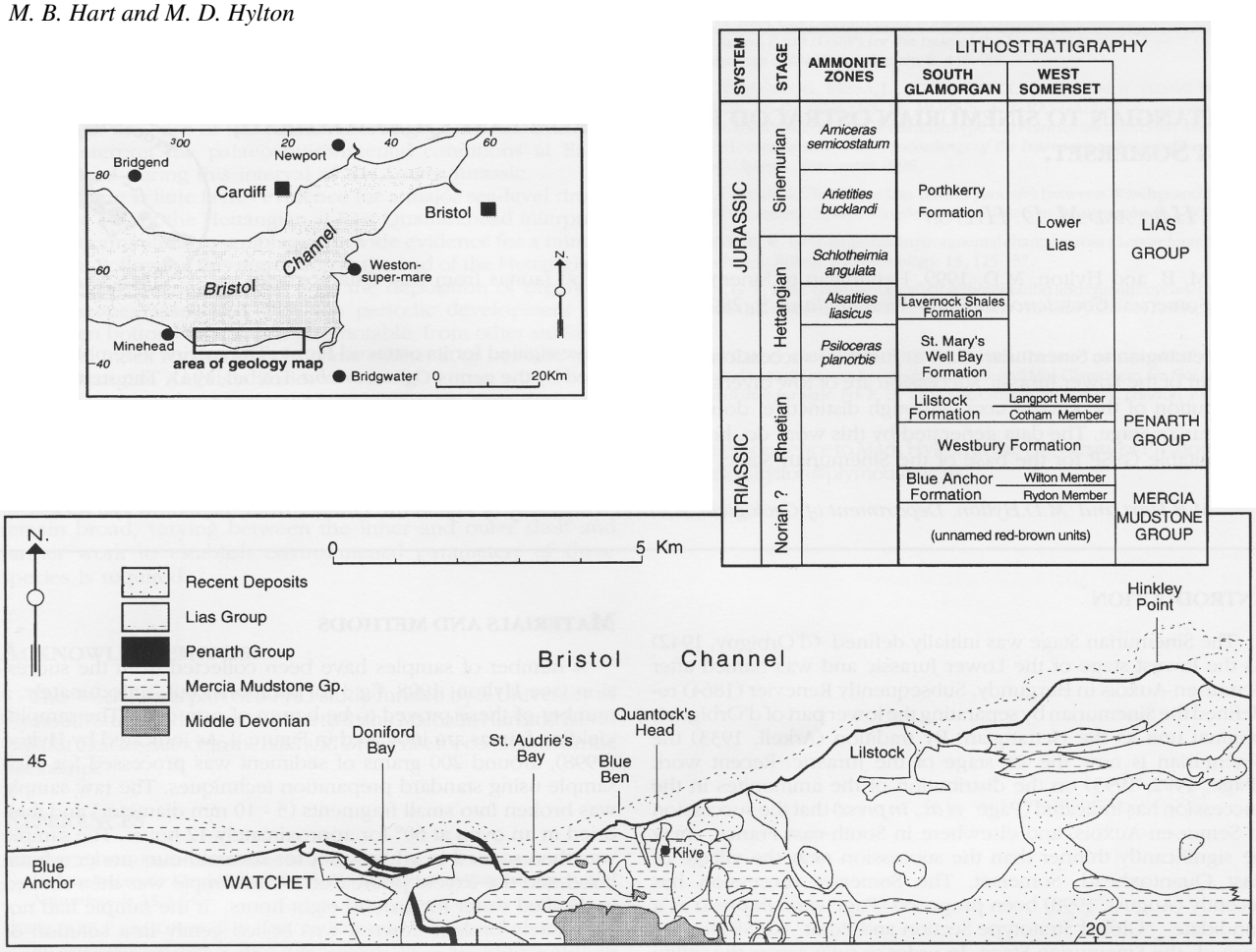

***Figure 1**. Location of the West Somerset succession and the position of Quantock's Head (lower map) within the Watchet to Lilstock SSSI. The position of the Hettangian/Sinemurian boundary is also located within the Lower has succession (top right). N.B. The village near the section is known as East Quantoxhead but the cliff on the coast is known as Quantock's Head.*

SUBCLASS OSTRACODA Latreille, 1806
ORDER PODOCOPIDA Muller, 1894
Suborder Podocopina Sars, 1866
Superfamily Bairdiacea Sars, 1888
Family Bairdiidae Sars, 1888
Genus *Bythocypris* Brady, 1880
Type species: *Bythocypris reniformis* Brady, 1880

Bythocypris **sp.**
[not illustrated; see figures of Field, 1968]
cf. 1968 *Bythocypris sevenrockensis* Field, pp. 126-129, pl. 13, figs 1-15.
Diagnosis: A tumid species of *Bythocypris* with slightly angular posterior extremity occurring immediately below mid-height.
Material: Total 16 specimens.
Size: Average size of specimens:-

	Length	Height	Width
Right valve	0.68 mm	0.38 mm	
Left valve	0.68 mm	0.40 mm	0.30 mm (carapace)

Remarks: The specimens recorded here are very close to those described by Field (1968) as *Bythocypris sevenrockensis.* Unfortunately this species is only introduced in an unpublished thesis it can only be regarded as a manuscript name. The number, and quality, of the specimens found in this investigation preclude a formal determination of the new species. Initially described from the Angulata Zone of the Upper Hettangian on the Dorset Coast west of Lyme Regis this species has not been formally defined in the literature. A few specimens have been found in the uppermost Hettangian that may be referrable to this taxon, but without formal definition it is difficult to make direct comparisons. With a range from mid-Hettangian to Lower Sinemurian it may prove to be stratigraphically useful, although Field (1968) also reports it from the Lower Toarcian.

Stratigraphical Range: Field (1968) gives the 'normal' range as mid-Hettangian to Lower Sinemurian.

Superfamily Cypridacea Baird, 1845
Family Paracyprididae Sars, 1923
Genus *Paracypris* Sars, 1866
Type species: *Paracypris polita* Sars, 1866

Paracypris **sp. A.**
Figure 3.6
cf. 1968 *Paracypris? oertlii* Field, pp. 138-143, pl. 15, figs 6-10
Diagnosis: A relatively small species of *Paracypris* with a narrow rounded posterior extremity.
Material: Total 8 specimens.
Size: Average size of specimens:-

	Length	Height	Width
Left valve	0.40 mm	0.23 mm	0.18 mm

Remarks: This rare form is only tentatively compared to the species described by Field (1968). Unfortunately Field never published a full definition of the species, although material is reportedly held at University College, University of London.

Stratigraphical Range: Field (1968) gives the range of the species as mid-Hettangian to Upper Sinemurian.

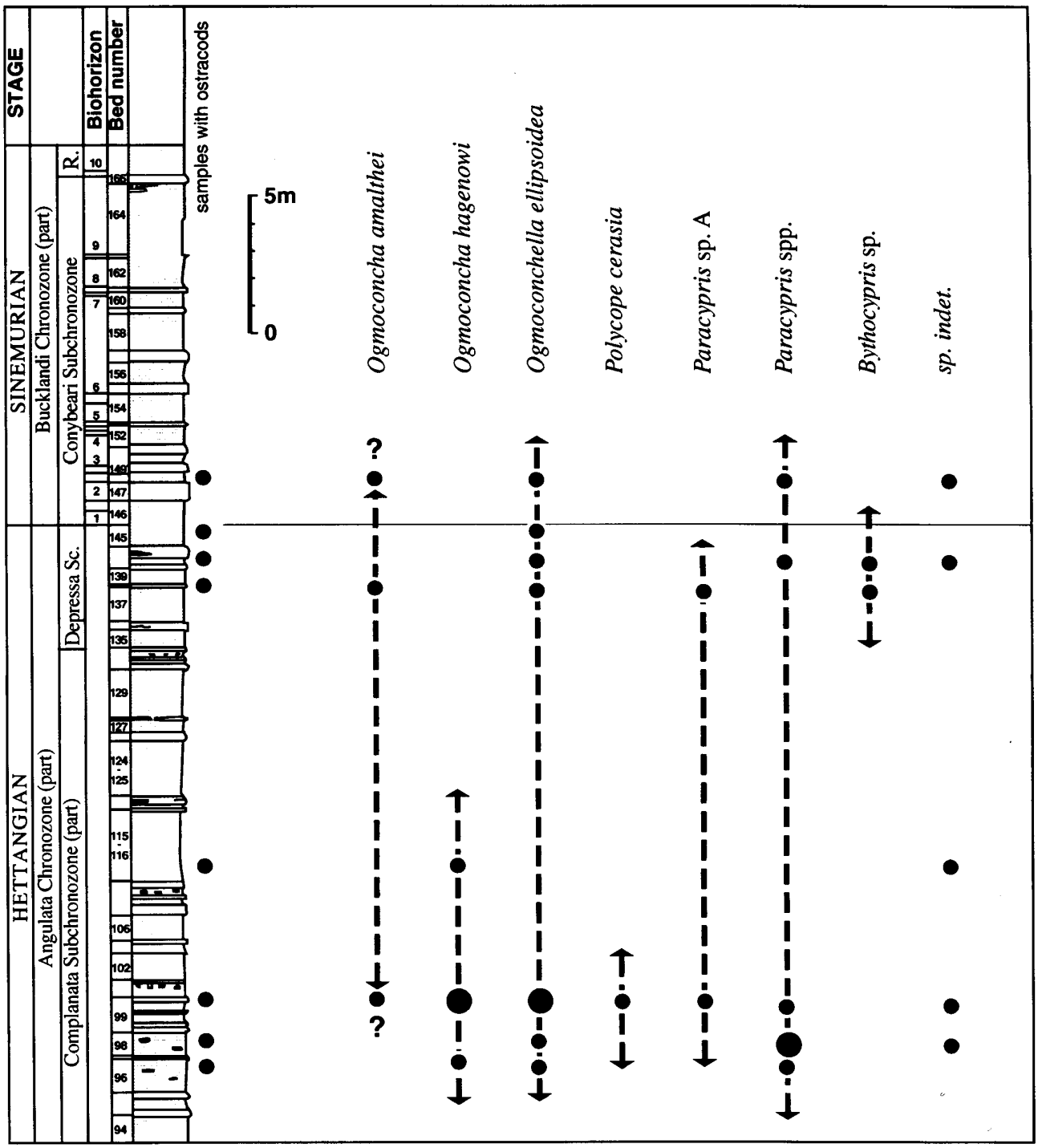

Figure 2. *The Hettangian/Sinemurian succession of the East Quantoxhead succession (after Page et al., in* press). *Also indicated are the samples used in this investigation and the ranges of the ostracods reported in the text. Known extensions of ranges elsewhere in southern England are indicated hy vertical (hoth upward and downward pointing) arrows. Large circles indicate >10 specimens; small circles indicate <10 specimens. Abbreviations on Figure: R = Rotiforme Suhchronozone; Depressa Sc. = Depressa Suhchronozone (not recognised by Field on the Dorset Coast).*

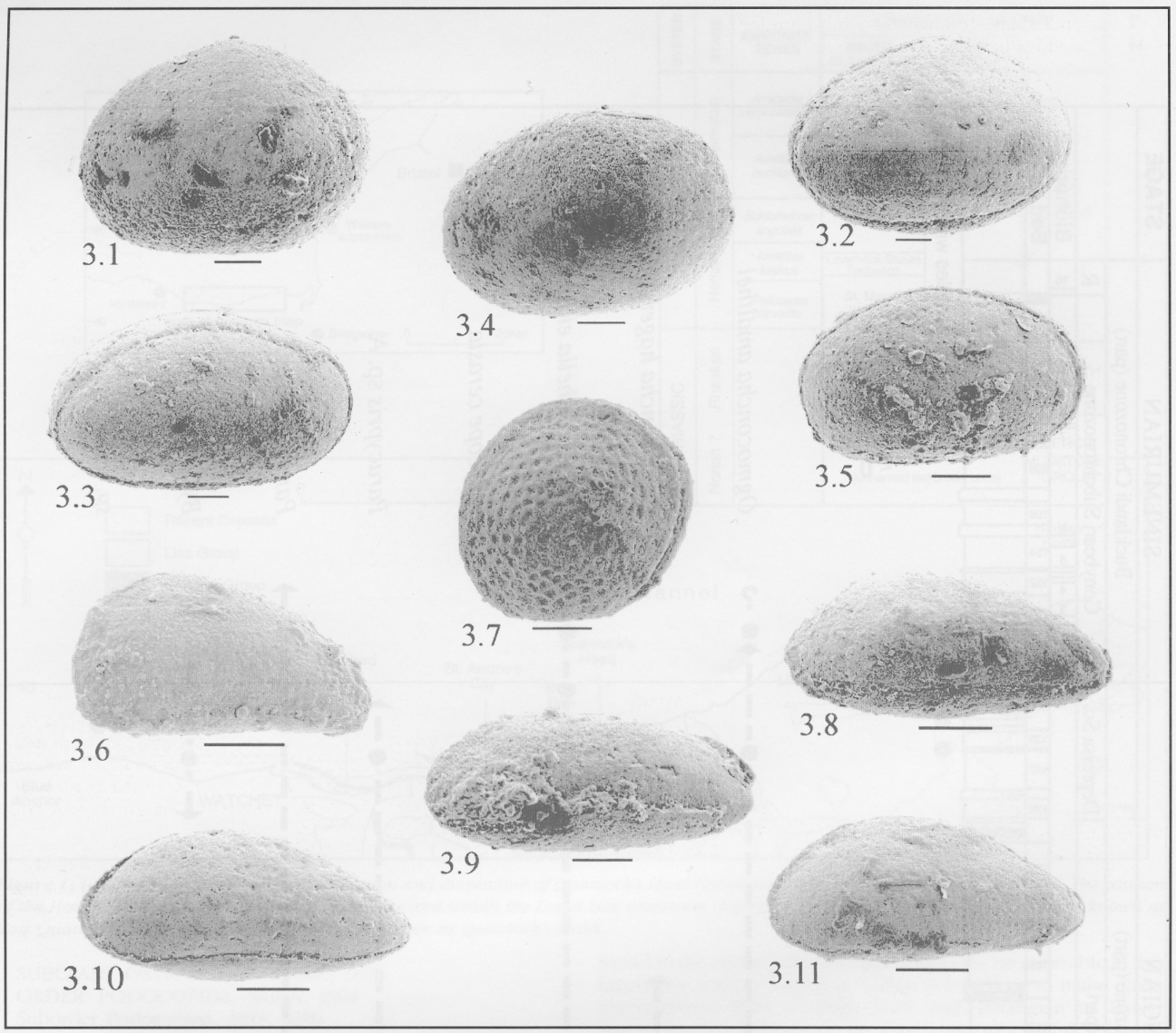

Figure 3. *Representative illustrations of some of the ostracod taxa (in all cases the scale har is 100µm). Fig.3.1. Ogmoconcha* hagenowi, *left valve; Fig.3.2.* Ogmoconcha amalthei, *right valve of a complete carapace; Fig.3.3 - 3.5.* Ogmoconchella ellipsoidea, *Fig. 3.4 is a left valve, Figs 3.3 and 3.5 are complete carapaces; Fig.3.6.* Paracypris *sp. A, left valve; Fig.3.* 7. Polycope cerasia; *Figs 3.8 - 3.11.* Paracypris *spp., in all cases a complete carapace.*

Paracypris spp.
Figures 3.8 - 3.11
Material: Total 32 specimens
Size: As a range of taxa may be involved average measurements are meaningless. See Figure 3 for the sizes of the figured material.

Remarks: A number of paracyprid-like ostracods have been recorded in the samples from West Somerset, some of which may belong in *P.redcarensis* (Blake, 1876). Donze (1985) records only one species of *Paracypris* (again in open nomenclature) from the Pliensbachian of France. That species is unlike any of the indivduals recorded from the Somerset succession.

Suborder Metacopina Sylvester-Bradley, 1961
Superfamily Healdiacea Harlton, 1933
Family Healdiiidae Harlton, 1933

This long-ranging (Devonian to Lower Cretaceous) group of ostracods contains a number of relatively simple taxa in which the left valve is larger than the right valve and usually overlaps it around much of the margin. In the Treatise (Benson *et al.,* 1961) *Hungarella* Mehes, 1911 was given priority over *Ogmoconcha* Triebel, 1941 and *Ogmoconchella* Grundel, 1964, although it is clear that the authors were in some disagreement over the decisions (see comments on pp. Q361-Q362 in Benson *et al.,* 1961). In most UK (Lord, 1978) and European (e.g., Drexler, 1958) literature *Ogmoconcha* and *Ogmoconchella* are used. Field (1968), in his thesis, did adhere to the ruling of the Treatise and used *Hungarella* for these Liassic taxa. The differences are based, largely, on the muscle scar patterns but as these are rarely visible in Liassic material (including the samples from West Somerset) we cannot make any contribution to this debate.

Within this group of taxa there is considerable variation both within and between samples. There is also progressive morphological variation throughout the stratigraphical range of some of the defined taxa and, as a result, there is considerable difficulty involved in a consistent definition of the taxa. A fuller taxonomic investigation of the group is probably required using more material than we have at our disposal. Field (1968) has provided the most detailed analysis to date, but this remains unpublished.

In the absence of data on muscle scars we have attempted to distill the range of morphological variation into a consideration of:-

- the location of maximum height;
- overall shape (triangular to sub-rounded);
- the width/height proportions; and
- other distinctive features (e.g., distinct point in margin of left valve in *O. sinuosa* Drexler).

Figure 4 illustrates this range of features and identifies the species that we have recognised in the East Quantoxhead succession. *O. sinuosa* is also included for comparison.

Genus ***Ogmoconcha*** Triebel, 1941
Type Species: *Ogmoconcha amalthei* (Quenstedt, 1858)
Ogmoconcha amalthei (Quenstedt, 1858)
Figure 3.2.
1858 *Cypris amalthei* Quenstedt, pp. 164, 200, pl. 24, fig. 37a.
1950 *Ogmoconcha amalthei* (Quentstedt): Triebel, p. 118, pl. 1, figs 1-5, pl. 2, figs 13-17.
1968 *Hungarella amalthei* (Quenstedt): Field, pp. 83-84, pl. 6, figs 1-5.
1969 *Hungarella amalthei(Quenstedt):* Clark, pp. 100-102, pl. 2, figs 1-9.
Diagnosis: A moderately large species of *Ogmoconcha* with slightly inflated valves that have their greatest height approximately two-fifths valve length from the anterior.
Material: Total 20 specimens.
Size: Average size of specimens:-

	Length	Height	Width
Left valve	0.75 mm	0.52 mm	0.40 min (carapace)
Right valve	0.70 mm	0.45 mm	

Remarks: *O. amalthei* is similar to *O. hagenowi* but the latter species is less elongate and more clearly inflated when viewed from the dorsal or ventral side. Field (1968) observed that these two species rarely occur together despite *0 .hagenowi* being abundant in samples both above, and below, the range of *0 .amalthei.*

Stratigraphical Range: This species has a restricted range (Field, 1968) in the lowest part of the Sinemurian. In our samples the species is also restricted to the uppermost Hettangian and the lowermost Sinemurian.

Ogmoconcha hagenowi Drexler, 1958
Figure 3.1.
1958 *Ogmoconcha hagenowi* Drexler, p. 58, pl. 21, figs 8a-f, pl. 26, figs 1-2.
1968 *Hungarella hagenowi* (Drexler): Field, pp. 93-95, pl. 6, figs 6-10, pl. 7, figs 1-7.
1969 *Hungarella hagenowi* (Drexler): Clark, pp. 102-105, pl. 3, figs 1-6, pl. 6, figs 3-4.
1978 *Ogmoconcha hagenowi* Drexler: Lord, p. 198, pl. 1, fig. 4, table 1.
1985 *Ogmoconcha hagenowi* Drexler: Donze, pl. 21, figs 14,15.
Diagnosis: A large species of *Ogmoconcha* that is sub-ovate in lateral view and with a valve apex at approximately mid-length. In some forms the left valve becomes almost triangular in appearance.
Material: Total 36 specimens.
Size: Average size of specimens:-

	Length	Height	Width
Right valve	0.68 mm	0.48 mm	
Left valve	0.70 mm	0.52 mm	0.40 mm (carapace)

Remarks: When Drexler erected this species in 1958 he also identified the sub-species *Ogmoconcha hagenowi sinuosa.* Field (1968) elevated this form to species level, recording it from the lower part of the Sinemurian on the Dorset Coast; horizons which in the Somerset successions are barren of ostracods. *Hungarella sinuosa* (Drexler) is characterised (Field, 1968, pp. 102-104) by a pointed posterior extremity at two-thirds valve height from the ventral margin (see Figure 4). This distinctive species has not been found in the Somerset material even though Field (1968) records a (usefully) limited range in part of the Lower Sinemurian.

Stratigraphical Range: The full range of this species (Field, 1968)

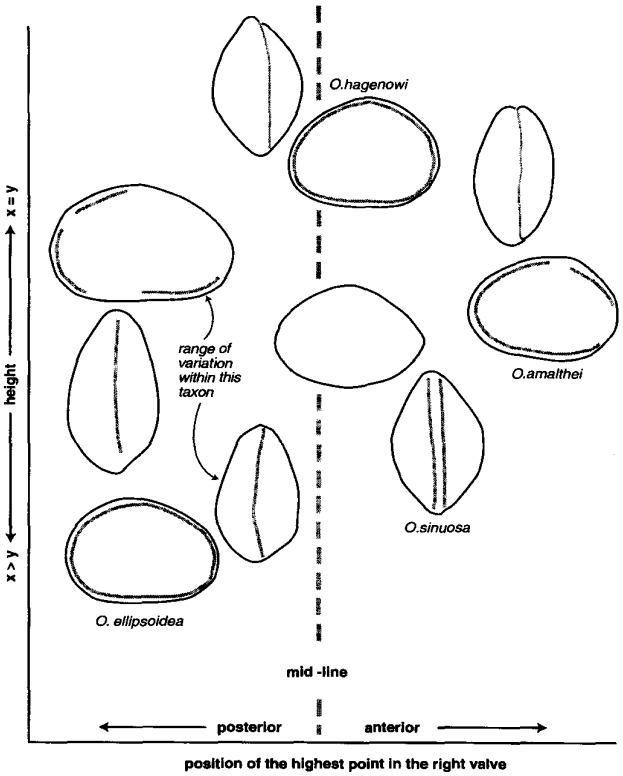

Figure 4. *Identification guide to species of the genus* Ogmoconcha *and* Ogmoconchella *recorded in the investigation. In each case the carapace is illustrated looking at the right valve or from the dorsal side. Taxa are located in approximate positions on a grid that shows the length:height ratio and the location of the maximum height in relation to the mid-point.* O. sinuosa *is included for reference.*

is Lower Hettangian to mid-Sinemurian. In the West Somerset material it is common in the Upper Hettangian but was not found above the base of the Sinemurian. Donze (1985) gives an overall range for the taxon of mid-Hettangian to the Sinemurian/ Pliensbachian boundary.

Genus ***Ogmoconchella*** Grundel, 1964
Type Species: *Healdia aspinata* Drexler, 1958

Ogmoconchella ellipsoidea (Jones, 1872)
Figures 3.3 to 3.5
1872 *Bairdia (?) ellipsoidea* G.S. Brady MS, Jones, p.146. 1876 *Bairdia liassica* Blake, in Tate and Blake, p. 430, pl. 12, fig. 1,1a.
?1958 *Healdia aspinata* Drexler, pp. 505,506, pl. 21, fig. 5a-e, pl. 25, figs 1-4.
?1964 *Hungarella owthorpensis* Anderson, pp. 147,148, pl. 14, figs 96-101.
?1964 *Ogmoconchella aspinata(Drexler):* Gründel, pp. 470,477, figs 5-7.
1968 *Hungarella liassica* (Blake): Field, pp. 95-102, pl. 10, figs 1-17, t.figs 15b, 16, 17.
1971 *Ogmoconcha ellipsoidea* (Jones): Lord, pp. 658-661, pl. 123, figs 9-13.
1978 *Ogmoconchella ellipsoidea* (Jones): Lord, p. 198, p1.1, figs 1-3, table 1.
1985 *Ogmoconchella aspinata* (Drexler): Donze, pl. 21, fig. 10.
Diagnosis: A species of *Ogmoconchella* with an oval, inflated, carapace with greatest height posterior of mid-length.
Material: Total 62 specimens.
Size: Average size of specimens:-

	Length	Height	Width
Right valve	0.60 mm	0.37 mm	
Left valve	0.62 mm	0.40 mm	0.32 mm (carapace)

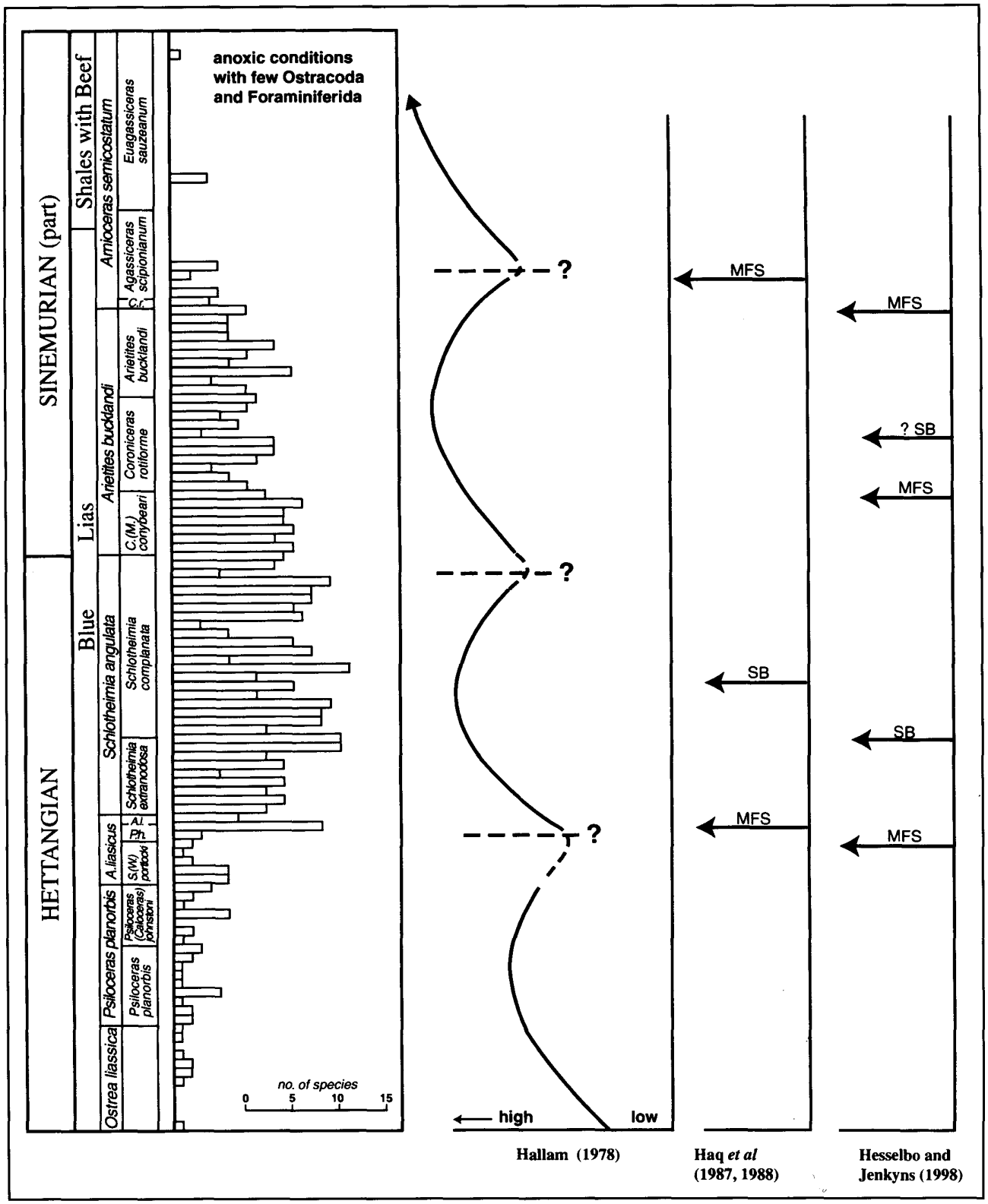

Figure 5. *Species diversity of the Lower Lias ostracods (after Field, 1968) plotted against the sea-level curve of Hallam (1978) and the sequence stratigraphy of Haq et al. (1987, 1988) and Hesselbo and Jenkyns (1998). Abbreviations: SB = Sequence Boundary; MFS = Maximum Flooding Surface. The Blue Lias and the Shales-with-Beef are the lowest lithological units of the Lias Group.*

Remarks: Lord (1971) has presented a full discussion of the taxonomic problems posed by the early definition of this taxon and *Bairdia liassica* Blake (1876). The name *Bairdia liassica* actually owes its origins to Brodie (1845, p. 80) who used it first as *Cypris liassica',* but as there was never any proper definition or illustraion of the species given it should be regarded as invalid (Anderson, 1964, p. 133; Lord, 1971, pp. 659-660). Subsequently Blake (1876, p. 430) suppressed *Bairdia ellipsoidea* Jones (1872) in favour of *B. liassica.* This taxonomic problem is even more complicated, and Lord (1971) has attempted to provide a solution. Prior to his publication both Field (1968) and Clark (1969) used *liassica,* with the latter (Clark, 1969, fig. 27) illustrating a range of morphotypes that should be included within the definition of the species. In Figure 4 we have illustrated two extremes; one which accords with Blake's view (supported by Field and Clark) of the *liassica* `morphotype', the other following Lord's (1971, 1978) view of *O. ellipsoidea.* There are slight differences, but as Clark (1969, fig. 27) has shown, the two forms in the Liassic material of the UK can be taken as a complete morphological spectrum. The full taxonomy of this taxon has not been investigated although most authors now regard *0. aspinata* as synonymous.

Stratigraphical Range: The range given by Lord (1978) is Hettangian to Lower Sinemurian while Donze (1985) gives *0. aspinata* an identical range.

ORDER MYODOCOPIDA Sars, 1866
Suborder Cladocopina Sars, 1866
Family Polycopidae Sars, 1866.
Genus ***Polycope*** Sars, 1866
Type species *Polycope orbicularis* Sars 1866

Polycope cerasia Blake, 1876
Figure 3.7
1876 *Polycope cerasia* Blake, p. 434, pl. 17, fig. 16.
1958 *Polycope cerasia* Blake: Drexler, p. 501, pl. 21, fig. 1. 1968 *Polycope cerasia* Blake: Field, pp. 47-49, pl. 1, figs 1-4. 1969 *Polycope cerasia* Blake: Clark, p. 83, pl. 1, figs 1-2. 1971 *Polycope cerasia* Blake: Lord, p. 645, pl. 122, figs 1,2. 1978 *Polycope cerasia* Blake: Lord, p. 204, pl. 4, figs 11-12, table 2.

Diagnosis: A small species of *Polycope* that is characterised by the presence of a valve margin that is accentuated by a smooth raised rib and a valve wall ornamented by shallow pitting.
Material: Total 3 specimens.
Size: Maximum dimension (average) 0.38 mm.

Remarks: Only a few specimens of this delicate taxon have been recovered in our samples. As delicate foraminifera (see Hylton, 1998) have been recorded from the same samples its low abundance is not thought to have been primarily caused by a too destructive processing technique.

Stratigraphical Range: Field (1968) records a range of mid-Hettangian to mid-Pleinsbachian, although Lord (1978) records a European range that extends to the mid-Toarcian.

SUMMARY

The ranges of the identified taxa are shown in Figure 2. In many cases the species recorded here are in the middle of their known ranges and, as such, their distribution in this succession does not assist in the definition of the base of the Sinemurian. It is, however, important that the fauna is described as a part of the work towards the proposal of the succession as the base Sinemurian GSSP. Two species, *O. amalthei* and *O. sinuosa,* have restricted ranges at, or about, the Hettangian/Sinemurian boundary. Before either can be proposed as distinctive enough for the micropalaeontological recognition of the boundary there would have to be further work on their distribution in both the East Quantoxhead succession and that on the Dorset Coast near Lyme Regis (the section described by Field, 1968). It is clear from this limited study that further work needs to be done on the distribution of the Ostracoda in the Liassic.

O. sinuosa is not recorded in our material but Field (1968) records it in samples from the lowest Sinemurian on the Dorset Coast. As our samples above the boundary are generally barren of ostracods we have been unable to confirm this distribution. *O. amalthei* is recorded by Field (1968) in the very uppermost Hettangian and the lowermost Sinemurian and this distribution is also reported from the Somerset Coast.

This absence of ostracods in the higher levels of the Sinemurian succession on the Dorset Coast is clearly shown by Field (1968) who plotted the species diversity throughout the succession. From low diversity faunas in the Lower Hettangian the fauna increases (see Figure 5) to a maximum of ca. 19 in the uppermost Hettangian (Complanata Sub-zone). Above that level the diversity decreases progressively until the fauna all but disappears in the uppermost part of the Blue Lias. In the West Somerset material (Figure 2) we record a diversity of ca. 7 - 9 (depending how many species of *Paracypris* are present), which is significantly less than in Dorset. The succession is more complete in Somerset and this may indicate deeper water conditions in that area. The loss of the ostracod and foraminiferal fauna up the succession above the boundary is also different to that recorded on the Dorset Coast (Lord *et al.,* 1987) and, again, this may be due to differences in depositional environment between the two areas. Figure 5 also shows how the distribution of the ostracod faunas relate to the changes in sea-level proposed by Hallam (1978) and the sequence boundaries and maximum flooding surfaces suggested by Haq *et al.* (1987, 1988). In a recently published review of Lower Jurassic sequence stratigraphy, Hesselbo and Jenkyns (1998) have indicated - on a general scale - the sequence boundaries and maximum flooding events, together with a generalised sea-level curve. There is considerable variation in the placing of these 'events', and few (if any) appear to equate with the ostracod diversity changes. The basinwide flooding event (key surface) of Hesselbo and Jenkyns (1998, fig.11) at the Bucklandi - Semicostatum Sub-zone boundary is close to the disappearance of the fauna shown in Figure 5 and this might imply that the deeper, anoxic, water is the cause of the restriction on the ostracod assemblage. The marked diversification of the ostracod fauna in the upper part of the Liasicus Sub-Zone might be close to the tentative flooding event of Hesselbo and Jenkyns but that is by no means clear.

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