

A review of the decapod crustaceans from the Tertiary of the Isle of Wight, Hampshire, U. K, with description of three new species

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Abstract

To the known decapod crustaceans of the Tertiary deposits of the Isle of Wight, Hampshire, the Early Eocene species, *Basinotopus lamarkii* (Desmarest) and *Dromilites bucklandi* Bell are introduced from the mainland, as are *Glyphithyreus wetherelli* (Bell), *Rhachiosoma bispinosum* Woodward, *Coeloma (Litoricola) dentate* (Woodward), *Xanthilites bowerbanki* Bell, and *Xanthopsis unispinosa* (M'Coy), the stratigraphic range of which has been extended to the London Clay on the Island. The development of an anomaly concerning *Zanthopsis unispinosa*, also present, if not peculiar to the island, is well established. A carapace of *Harpactocarcinus* sp. from this horizon is the first British record for the genus. Late Eocene species new to the island are *Goniocypoda quaylei* Crane, *Orthakrolophus depressus?* (Quayle and Collins) and *Typilobus belli* Quayle and Collins. Three new genera and species are described from the Late Eocene Headon Hill Formation; a callianassid, *Vecticallichirus abditus*; a goneplacid, *Gonioplacoides minuta*, and a hexapodid, *Headonipus tuberculosus*. New, superior material of the Late Eocene species, *Typilobus obscurus* Quayle and Collins, from the type locality, Colwell Bay necessitates a new description. A table of all known Tertiary species of decapod crustaceans from the Isle of Wight is appended.

Key words: Tertiary decapods, Isle of Wight, revision, new species

Introduction

The diversity of the decapod fauna of the Isle of Wight was realised during preparation for the essentially brachyuran work concerning the

decapods of the Hampshire Basin (Quayle and Collins, 1981), followed by an appraisal of macruran species (Quayle, 1987). Subsequent residence on the island allowed WJQ ready access to all of the available Paleogene exposures. The extensive suite of specimens, ranging from

Table 1. Showing all recorded Tertiary species from the Isle of Wight. NB. Numbers refer to map-localities.

	EOCENE				OLIGOCENE
	LONDON CLAY FORMATION	WITTERING FORMATION	BARTON CLAY FORMATION	HEADON HILL FORMATION	
<i>Branchioplox concinna</i> Quayle & Collins				6c	
<i>Basinotopus lamarkii</i> (Desmarest)	6b				
<i>Calappilia dacica</i> Bittner			1b		
' <i>Callianassa</i> ' <i>batei</i> Woodward					4
<i>Coeloma dentate</i> (Woodward)	1a & 6b				
<i>Dromilites bucklandi</i> Milne-Edwards	6a				
<i>Glyphithyreus wetherelli</i> Bell		6b			
<i>Goniocypoda quaylei?</i> Crane			1b	6c	
<i>Gonioplacoides minuta</i> gen. et sp. nov.				6c	
<i>Harpactocarcinus</i> sp.	6b				
<i>Headonipus tuberculatus</i> gen. et sp. nov.				6c	
<i>Homarus morrisi</i> Quayle	6b				
<i>Homarus</i> sp.	!a & 6b				
<i>Limuparus eocenica</i> Woods	1a & 6b				
<i>Lobonotus vulgatus</i> Quayle & Collins			1b		
<i>Orthakrolophus depressus</i> Quayle & Collins			1b		
<i>Portunus vectensis</i> (Carter)					
<i>Propalaeon osborniensis</i> Woodward				5	
<i>Rhachiosoma bispinosum</i> Woodward	6b				
<i>Typilobus belli</i> Quayle & Collins				6c	
<i>Typilobus obscurus</i> Quayle & Collins				2	
<i>Vecticallichirus abditus</i> gen. et sp. nov.				6c	
<i>Xanthilites bowerbanki</i> Bell	6a				
<i>Zanthopsis dufourii</i> (Milne Edwards)	1a				
<i>Zanthopsis leachii</i> (Desmarest)	1a				
<i>Zanthopsis nodosa</i> (M'Coy)	1a				
<i>Zanthopsis unispinosa</i> (M'Coy)	6b				
<i>Zanthopsis</i> sp.	1a				

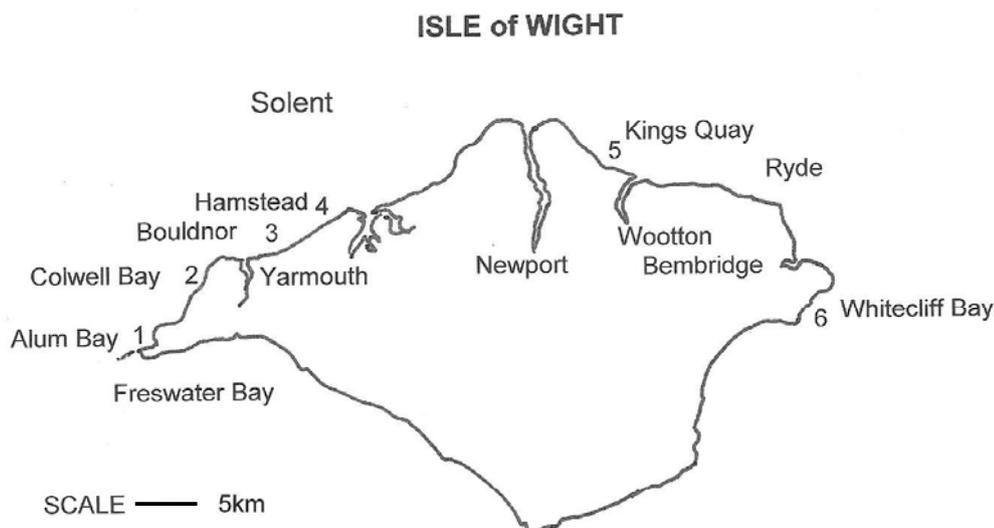


Fig. 1. Site Location map of the Isle of Wight.

the Early Eocene London Clay Formation (Ypresian) to the Early Oligocene Bouldnor Formation (Rupelian, see below) that he amassed, provides an important contribution to our knowledge of decapods from the island. The collection includes eleven species from the London Clay Formation; a carapace of *Harpactocarcinus* sp. from that horizon is the first British record for that genus. Although the Middle Eocene Barton Clay yielded a much sparser fauna compared with mainland exposures, a specimen of one previously described species, *Typilobus obscurus* Quayle and Collins, 1981, allows a more complete description to be given. The number of recorded taxa from the Headon Hill Formation is doubled with the description of three new genera and species (see Table 1). Although much disjointed, numerous remains containing a remarkable range of anatomical detail, of a new callianassid have been collected from the Headon Hill Formation of Whitecliff Bay. It falls within the Callichirinae Manning and Felder, 1991, and is named *Vecticallichirus abditus* gen. et sp. nov. (Pl. 1, figs. 1–16).

Tertiary Stratigraphy of the Isle of Wight

The Eocene of the Isle of Wight can be divided into the Ypresian, Lutetian, and the Priabonian. In the Isle of Wight the Early Eocene is represented by the London Clay Formation (Ypresian) which consists of up to five main cycles which are identified by the letters A to E (King, 1981, 1991). They all start with coarser grained material, that is, a pebble band and continue into clays which become increasingly sandy as the cycles progress. The main groups are subdivided, such as, D1 and D2, (King, 1991). The Middle Eocene consists of the Wittering Formation (formerly Bracklesham Beds) and Barton Clay (Lutetian and Bartonian). The Late Eocene (Priabonian) consists of the Bembridge Limestone and the Headon Hill Formation. These deposits are followed by the Early Oligocene Bouldnor Formation which

belongs to the Solent Group.

Localities and Horizons (Fig. 1)

Locality 1. (1a). The cliff and foreshore exposures at Alum Bay (1a) comprise sandstone and mudrock of the London Clay Formation, Divisions A to E, (King, 1981, 1991), the latter divisions outcropping towards the southern end of the bay. All the known fossil decapods except one, obtained from these horizons are preserved in nodules. Between the London Clay Formation and the Barton Clay Formation, the famous ‘coloured sands’ and ‘Leaf Beds’ outcrop; these form part of the Wittering Formation (1b).

By the chair lift, which is in a northerly direction, are clays and sands, with some horizons containing a rich molluscan fauna. A few specimens of decapods have been obtained from the Barton Clay Formation; these are preserved in the clay as casts, or moulds with some original shell material.

Locality 2. At Colwell Bay, Bramble Chine, the Late Eocene Headon Hill Formation forms a low cliff section where the Colwell Bay Member is at beach level. This member consists of various coloured, sandy claystones, one of which is the ‘Venus Bed’, containing an abundant molluscan fauna. A well preserved carapace of *Typilobus obscurus* Quayle and Collins, 1981, allows details of the front and other characters absent from the type to be described.

Locality 3. At Bouldnor the “Reed bed” (the reeds are growing and should not be confused with the geological term ‘Bed’), has a foreshore of mud and stones. The Dinosaur Isle Museum, Sandown, Isle of Wight, has a specimen of *Portunus vectensis?* (Carter), MIWG 6284, which was found loose on the beach here. The original specimens came from the Cranmore Member (formally ‘Upper Hamstead Beds’) which is several 100 m to the east.

Locality 4. The Cranmore Member of the Bouldnor Formation (Rupelian, from whence came *Callianassa batei* Woodward and *Portunus vectensis?* (Carter), consists of a series of coloured clays, sands and shales. It can be divided into the upper, which is fully marine (*Corbula* Bed), whilst the lower part, the *Cerithium* Bed, is mainly brackish.

Locality 5. The Chapel Corner Fish Bed, in which the prawns *Propalaeon* sp. were found, is a grey-blue, shaly claystone belonging to the Fishbourne Member, Headon Hill Formation, Late Eocene (Priabonian) which underlie the freshwater Bembridge Limestone to form a low cliff and beach exposure.

Locality 6a. Whitecliff Bay, Reading Formation (Sparnasian) and

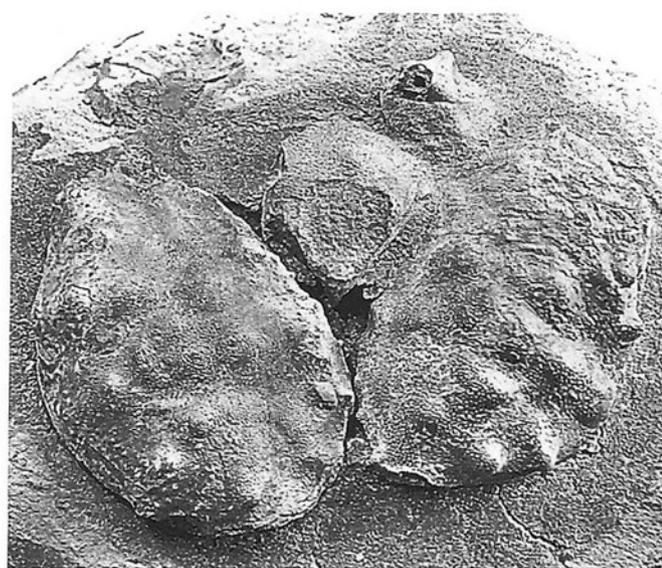
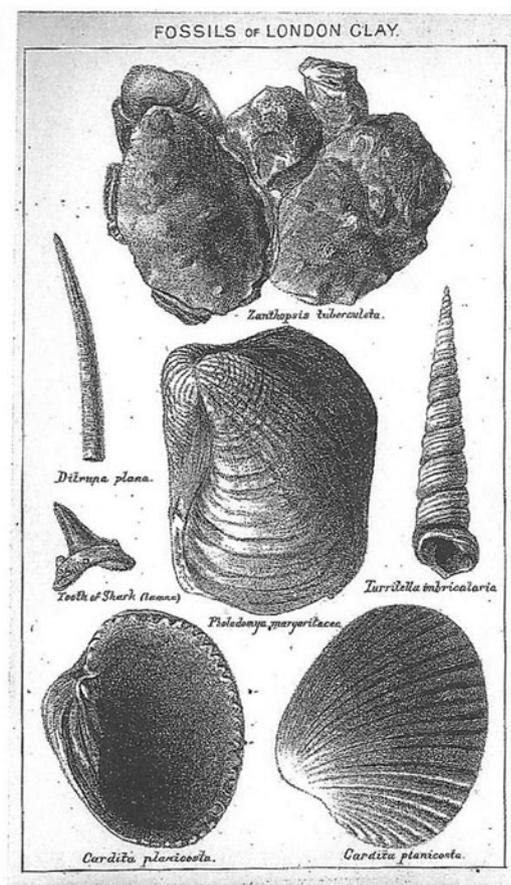
London Clay Formation (Ypresian) are exposed at the western end of the bay. The London Clay Formation consists of clays/sands which, together, form Divisions A to E (King, 1981, 1991). Among the fossils recorded are, *Panopea*, *Ostrea*, *Artica* and *Pholadomya*. Where decapods are rarely found in Horizons A, B, C and E at this locality and then only in nodules; a rich nodule layer in Division D2, c. 8.7 m above the base, has produced six species of decapods and is possibly on a par with some of the mainland horizons i.e. Isle of Sheppey, Kent, for abundance, though it lacks in the fine preservation of the latter (Table 1).

Locality 6b. The Wittering Formation at this locality comprises silts/clays containing well preserved *Cardita* and *Turritella*, etc. The stratigraphic range of *Glyphithyreus wetherelli* (Bell, 1858) is extended by a specimen recorded (by WJQ) from just below the Whitecliff Bay Bed. The Barton Clay Formation which follows is poorly exposed in the cliff section and records of decapods from these beds are unknown.

Locality 6c. The Headon Hill Formation (formerly 'Headon Beds') is made up of sandstones and claystones, with the "Venus Bed" standing out in the cliff section. A callianassid, *Vecticallichirus abditus* gen. et sp. nov., a goneplacid, *Gonioplacoides minuta* gen. et sp. nov., and a hexapodid, *Headonipus tuberculatus* gen. et sp. nov., are described herein from the Headon Hill Formation.

History of Research

The earliest record of a Tertiary crab from the Isle of Wight was made by Bell (1858) who recorded *Zanthopsis leachii* (Desmarest, 1822) (as *Xanthopsis*) from the London Clay of Alum Bay. The specimen, then in Bowerbank's collection, was regarded by Bell (1858, p. 17, pl. 1, fig. 10) as no more than a possible variety with "the marginal spines obsolete." Confusingly, the locality cited as Alum Bay on p. 16, that accompanied the figure, is given as Sheppey (i.e. Isle of Sheppey, Kent). However, the original label corroborates Alum Bay. Drawing attention to this specimen (NHM 46377), Carter (1898, p. 40) said he had similar specimens from the London Clay of that locality, as well as from Sydenham (London) and also Bognor Regis (Sussex). Carter considered (1898, p. 40) that, "this form nearly resembles a variety of *X. Dufourii*, Milne-Edw., but Milne-Edw. regards it as a nodulated variety of *X. hispidiformis* Schloth, the occurrence of which at Sheppey is quoted by M'Coy. *X. hispidiformis* and its varieties are fully described and profusely figured by Reuss and by Milne-Edwards. I am, however, unable positively to determine the precise form to which Schlotheim originally applied the name". Morris (1980, p. 18) listed the specimen,



1b = Scale — 5mm

1a

Fig. 2. a. Crabs on a plate from 'A Popular Guide to the Geology of the Isle of Wight.' b. The original specimen MIWG 840237 in the Dinosaur Isle Museum, Sandown, with the depicted limbs accompanying the left – and carapace long since detached. However, the 'scars' and apparent undisturbed surface, suggests every possibility of artistic embellishment.

NHM 46377, as *Zanthopsis dufourii* Milne Edwards, 1850.

Callianassa batei was named and figured by Woodward (1868, p. 75, pl. 2, fig. 4), from the “Eocene Beds of Hemstead, Isle of Wight”. His intentions for the plate to be included in part 2 of his monograph on the Merostomata (1866–1878) were not fulfilled. Unfortunately, no description accompanied this otherwise valid taxon, the original material of which has not been traced. Woodward’s figures are generally true to form, so, although sketchy, there is no reason to doubt the artistry of ‘C’. *batei*, which bears little resemblance to the new material described below.

The year 1887 saw the publication of, A Popular guide to the Geology of the Isle of Wight, by M. W. Norman. Therein he mentions and figures (p. 126, plate to face p. 132) ‘a small crab, *Zanthopsis tuberculatus*’, that he found in the London Clay at Alum Bay. This specimen deposited in The Dinosaur Isle Museum, Sandown, Isle of Wight, is actually of two adjoined crabs preserved in a nodule, labelled *Zanthopsis tuberculata*, although they more closely resemble *Zanthopsis leachii*. *Zanthopsis tuberculatus* Morris, 1857, is a junior synonym of *Scyllarides tuberculatus* (König, 1825).

Zanthopsis leachii and *Callianassa batei* were the only two Tertiary species listed by Bristow in his Geological Survey Memoir (1889) of the island. In 1903, Woodward described two prawns, *Propalaemon osbornensis* and *Propalaemon minor*, from Colenutt’s bed 3, ‘fish clay’ (Colenutt, 1888, p. 101), now better known as the ‘Fish Bed’, collected from two foreshore sites near Wooton Creek. A more complete description of these species, based on better preserved specimens, appeared in Gaudant and Quayle (1988). The authors reiterated Woodward’s opinion that *P. minor* was probably a juvenile form of *P. osbornensis*. In his posthumous paper, Carter (1898) added a description of *Neptunus vectensis* to the fauna list of the ‘Hamstead Beds’; the species is presently recognised as *Portunus vectensis* by Karasawa *et al.* (2008, p. 133).

There followed a hiatus of 78 years before new Tertiary crabs were described from the Hampshire Basin by Quayle and Collins (1981), when the first Bartonian species, *Calappilia dacica* Bittner, 1893, was recorded from Alum Bay and the range of *Lobonotus vulgatus* Quayle and Collins, 1981, was extended from the type locality at Christchurch Bay, Dorset/Hampshire. In the same work *Typilobus obscurus* was described from the ‘Headon Beds’ of Colwell Bay, while *Branchioplax concinna* Quayle and Collins, 1981 (type from the Bartonian of Christchurch Bay), was recorded from the Late Eocene, Headon Hill Formation of Whitecliff Bay. Cooper (2004) recorded a specimen (JSHC Coll.) of *Zanthopsis dufourii* from the London Clay of Alum Bay.

In the past, the London Clay Formation (Ypresian) of Alum Bay was not recognised for its decapods and only a few crabs in nodules have been recorded from its horizons; specimens presently recorded from these horizons are included in Table 2. The majority of the nodules were collected from the beach although several were found *in situ*. Among specimens in the Natural History Museum, London, are four zanthopsids from this locality. Their preservation is typical of forms from Division A. Of these, NHM IC 620, is a juvenile *Zanthopsis dufourii*, the others are, NHM I.227a and b *Zanthopsis nodosus*, and NHM I.227c, *Zanthopsis*

Table 2. Showing all recorded London Clay species from the Isle of Wight and their Horizons.

	LONDON CLAY FORMATION DIVISIONS				
	A	B	C	D	E
<i>Basinotopus lamarckii</i> (Desmarest)				6b	
<i>Coeloma dentate</i> (Woodward)	1a		1a	6b	
<i>Dromilites bucklandi</i> Milne-Edwards				6b	
<i>Harpactocarcinus</i> sp.				6b	
<i>Homarus morrissi</i> Quayle		6b		6b	
<i>Homarus</i> sp.			1a	6b	
<i>Linuparus eocenicus</i> Woods			1a	6b	
<i>Rhachisoma bispinosum</i> Woodward				6b	
<i>Xanthilites bowerbanki</i> Bell				6b	
<i>Zanthopsis dufourii</i> (Milne-Edwards)	1a				
<i>Zanthopsis leachii</i> (Desmarest)	1a				
<i>Zanthopsis nodosa</i> (M’Coy)	1a				
<i>Zanthopsis unispinosa</i> (M’Coy)				6b	
<i>Zanthopsis</i> sp.		6b		6b	

leachii. Two other species, *Coeloma (Litoricola) dentata* (Woodward, 1873), and *Linuparus eocenicus* Woods, 1925, have been determined (see Table 2); neither of these is common at this locality. A specimen of *C. (Litoricola) dentata* preserved in the clay with original shell material, is in the Hampshire Museum’s Collection, Winchester, HMCMS: 1995.37. This is the only known specimen to have been found preserved in the clay and not in a nodule.

The London Clay Formation of Whitecliff Bay, like Alum Bay has also never been recognised previously for its decapods. They are rarely found in the London Clay Formation and then only in nodules; a nodule band c. 8.7 m above the base of Division D2 has produced six species of decapods (Table 2). Among these, *Zanthopsis* spp. are the commonest brachyurans, while *Linuparus eocenicus* Woods, 1925, predominates among the macrurans. In the Hampshire Museum’s Collection, is a *Dromilites bucklandi*, HMCMS: GOS1983.11 in a nodule from Division B, London Clay Formation.

The Wittering Formation of this locality has produced a specimen of *Glypithyreus wetherelli* (Bell, 1858). It was recorded from just below the Whitecliff Bay Bed (Hugget and Gale, 1997).

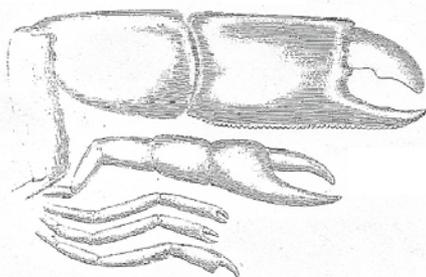
No new material has been obtained from the Chapel Corner Fish Bed, Late Eocene, in which the prawns *Propalaemon* sp. were found, since the publication of Gaudant and Quayle (1988). The Cranmore Member of the Bouldnor Formation, from whence came *Callianassa batei* Woodward and *Portunus vectensis* (Carter), are now largely obscured and no new material was found. An additional carapace of the latter species is in the Dinosaur Isle Museum, Sandown.

Preservation and Preparation

Crabs and callianassids from the Headon Hill Formation are found with their shell surfaces preserved. The smaller specimens found as part and counterpart invariably retain the shell in the mould. In this condition, the mould is filled with Araldite and a pin added for later handling. The quick-setting Araldite is allowed to cure, then the whole is soaked in water to release the specimen. Further cleaning is achieved with a soft brush under running water and the specimen is allowed to dry; no further preparation is required.

The crabs and lobsters from the London Clay Formation, Division B and C at Alum Bay, and D2 at Whitecliff Bay are preserved in hard

***Callianassa batei* Woodward**



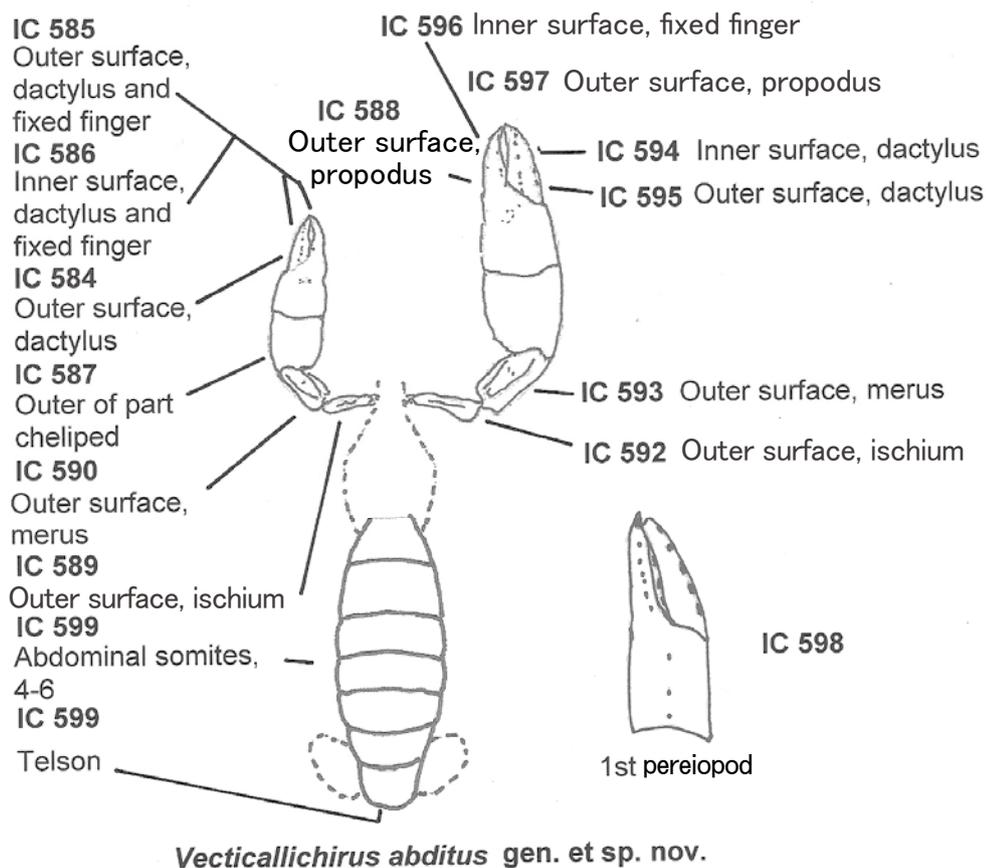
Right cheliped

Left cheliped

Pereopods 2-4

Woodward's 1868 figure

Position of principal material collected



***Vecticallichirus abditus* gen. et sp. nov.**

Fig. 3. Woodward's 1868 figure of *Callianassa batei* and the principal material assigned to *Vecticallichirus abditus* gen. et sp. nov.

ironstone nodules. As well as the nodules being of a softer material, the original shell surface is preserved on crabs from the Division A of the London Clay Formation at Alum Bay. Most of the nodules except those from Division A, are opened using a hammer, careful tapping around the circumference will usually open them and further preparation can be carried out with a fine air chisel.

Fossils preserved in clay are usually cleaned with a fine needle or an air tool. Ideally, this consists of various sized hypodermic needles fitted to a small bore plastic tube and coupled to an aquarium air pump.

All specimens prefixed NHM IC have been deposited in the Department of Palaeontology, The Natural History Museum, London (NHM).

Systematic Descriptions

Order Decapoda Latreille, 1802
 Infraorder Palinura Latreille, 1802
 Superfamily Palinuroidea Latreille, 1802

Family Palinuridae Latreille, 1802
 Genus *Linuparus* White, 1847

Type species: Palinurus trigonus von Siebold, 1824, by original designation.

***Linuparus eocenicus* Woods, 1925**
 (Pl. 4, fig. 4)

1925 *Linuparus eocenicus* Woods, p. 31, pl. 7, figs 4-6, pl. 8, fig. 1.
 1987 *Linuparus eocenicus* Woods; Quayle, p. 600, pl. 66, figs. 1-5.

Remarks: Specimens from the London Clay Formation, Alum Bay, occur less frequently than some of the mainland exposures. A carapace (NHM Cooper Coll.) enclosed in a nodule appears to have been found on the (beach probably from Division C). Specimens from Division D2, Whitecliff Bay are fairly common and reach a large size of 38.0 cm overall length. All are contained in nodules. NHM IC 619 (Pl. 4, fig. 4) is a rare occurrence of a moult with a flipped-over carapace, instead of it being in the commonly found relaxed, near-normal position.

Infraorder Axiidea de Saint Laurent, 1979
 Superfamily Callianassoidea Dana, 1852
 Family Callianassidae Dana, 1852
 Subfamily Callichirinae Manning and Felder, 1991

Genus *Vecticallichirus* gen. nov.

Type species: Vecticallichirus abditus gen. et sp. nov. The only species known.

Diagnosis: Left part-cheliped: merus, distal height about half length, increasing to two thirds at midlength, upper margin almost straight; basal margin more strongly curved and spinose, incised at carpal articulation, outer surface divided by two broad ridges. Carpus, about as long as merus, upper margin less convex than lower, spiny-granulate margin. Propodus, about one third longer than carpus, upper margin weakly convex, lower margin almost straight, spinose on inner edge and a weak depression before fixed finger, carpal margin straight, interdigital margin biconvex, spinulate, fixed finger about four fifths length of and in line with manus, setae pores on ridge lining cusped occludent margin. Dactylus robust, as long as manus, upper margin spinose, occludent margin smooth.

Derivation of name: From *Vectis insula*, Latin for the Isle of Wight + the generic root.

***Vecticallichirus abditus* sp. nov.**

(Pl. 1, figs. 1–16; Pl. 2, figs. 1a, b; Fig. 3)

Diagnosis: As for genus.

Material: Holotype. NHM IC 587, a left cheliped. Paratypes, NHM IC 584; left dactylus; NHM IC 585, associated left fixed finger and dactylus; NHM IC 586, associated left fixed finger and dactylus; NHM IC 588, left propodus; NHM IC 589, left ischium; NHM IC 590, left merus; NHM IC 591, left merus; NHM IC 592, right ischium and merus; NHM IC 593 right merus; NHM IC 594, right dactylus; NHM IC 595, a right dactylus; NHM IC 596, right fixed finger; NHM IC 597, right right propodus; NHM IC 598, right chela of pereopod 1; NHM IC 599, Abdominal somites 4–6, telson, uropod and pereopods. All from the late Eocene, Upper Headon Beds of Whitecliff Bay, Isle of Wight. (Locality 6c).

Derivation of name: From the Latin, hidden, alluding to spinose ornament largely confined to the inner surface.

Description: Ischuim. Left and right are of similar proportions. The length is about three times the distal height, tapering proximally to narrowest part about one fourth distant from expanded proximal end. A right-hand upper margin has a bifurcated granulated ridge (IC 592, Pl. 1, fig. 9).

Merus. Left-hand (IC 590, Pl. 1, fig. 7), about as long as the ischium; the distal height is about one third the length, increasing rapidly to two thirds about midlength. The upper margin is almost straight for four fifths the length, being deeply incised at the carpal articulation which takes up about half the height. The basal margin, more strongly curved towards the carpus, is lined with about ten large spines. From the carpal end two broad ridges divide the outer surface into three more or less equal parts; the upper ridge inclines slightly towards the upper margin, the lower runs parallel to, but terminates before the end, of the basal margin. Between the ridges the surface is indented medially and weakly ornamented with round ridges, some bifurcated, others becoming transverse towards the upper margin. On a right hand merus (IC 593, Pl. 1, fig. 10) the median ridges are coarser, some bifurcated, others

becoming transverse towards the upper margin. A short spur extends below the distal end.

Carpus. (IC 587, Pl. 1, fig. 4). About as long as manus. The weakly rounded upper margin is in sharp contrast to the boldly rounded lower margin which is lined with spiny granules towards the meral articulation and the margin is bordered by a line of evenly spaced setal pores. The propodal margin is weakly concave.

Left-hand propodus. (IC 587), about one third longer than the carpus; the subquadrae manus is highest proximally; the outer surface weakly tumid and smooth. The upper margin is weakly convex, the basal margin almost straight to a weak depression before the fixed finger. The interdigital margin is biconvex, the larger, granule lined lower part has a few surface granules. Fixed finger is about four-fifths the length of and in line with the manus, and about two fifths its distal height. There is a depression proximally and a ridge bordering the occludent margin has a line of eight or nine, setae pores of varying sizes, followed by a group of three at the tip. On the occludent margin a group of granules before a large proximal cusp is followed by a line of evenly sized granules.

On the reticulated inner surface, the upper margin, is bordered by a thin ridge, granulated above the articulating facet, and a row of setae-punctured granules (IC 588, Pl. 1, fig. 5). Coarse, triangular spines, with setae pores wedged in between, line the lower margin of the manus and extend half the length of the fixed finger. The occludent margin has nine small, more or less even sized proximal ‘cusps’, then is ridged to the tip.

Dactylus. Form 1: (IC 585, pl. 1, fig. 2). Left (outer surface) robust, a little more than twice greatest height, the upper margin is lined with seven or eight low, long-based spines; the occludent margin is smooth, sinuous, gently concave distally to a rounded tip in which is a seta pore; other pores bound the occludent margin and there are four, proximal close to the upper margin.

Form 2: (IC 586, Pl. 1, fig. 3) left (inner surface). the upper margin is lined with similar, but fewer spines; the occludent margin has five unequal sized ‘cusps’ followed by a concave row decreasing in size to a pointed tip.

Form 3: (IC 594, Pl. 1, fig. 11). Right (inner) surface, the occludent margin is similar to that of IC 586, but only three ‘cusps’ in the proximal row are followed by a gap before the distal row.

Subtle as these differences are, they could well indicate sexual dimorphism as yet undetermined.

In all instances, the closed position of the fingers leaves only a narrow gape, in sharp contrast to that of *C. batei* (Fig. 3 herein).

First (right) pereopod (IC 598, Pl. 1, fig. 15). The outer surface, in close proximity to its associated merus, is about three fourths the length of that section. The distal height of the manus is about three fourths the length, tapering slightly proximally; the upper and lower margins are gently convex, the lower margin being almost in line with the fixed finger. The vertical carpal margin is weakly convex. The robust fixed finger is as long as the manus and about half its height; a rounded ridge developing below the occludent margin, sharpens distally. Denticles, reducing in size, line the length of the occludent margin. As preserved, the tip of the dactylus overlaps the outer surface of the fixed finger; at least seven large setae pits line the rounded upper margin and four or

more, line the occludent margin.

Discussion: For the most part, the attention paid to the claws of Recent callianassids in published descriptions is barely adequate from the palaeontological point of view. Nevertheless, the range of chelae in the present collection have characters in common with Recent genera within the Callichirinae. The spinulose interdigital margin resembles that of *Podocallichirus gilchristi* (Barnard, 1946) (Sakai, 1999, p. 57), and dorsal spines are common to *Glypturus* sp. The interdigital 'spur', seen on IC 596 (Pl. 1, fig. 13), is represented on *Neocallichirus indicus* (De Man, 1905) (Sakai, 1999, p. 100), as a protruding triangle, more strongly developed in *Neocallichirus kempfi* Sakai, 1999 (Sakai, 1999, p. 102), which also has a spinulate lower margin. *Sergio mericeae* Manning and Lemaitre, 1994, is depicted (Manning and Felder, 1995, p. 270) with a serrate interdigital margin, serrations line the manus of *Neocallichirus nickellae* (Manning, 1993, p. 100, 110), and continue the whole length of the manus. It would appear that a spinulose upper dactyl margin is peculiar to *Vecticallichirus*. As illustrated, the chelipeds of '*C. batei*' Woodward differ from *Vecticallichirus* in the marked difference in size of the left and right claws; the rounded basal margin of the minor claw; the relative length of the fingers to manus, producing a wide gape; and in the absence of spinose/granular ornament.

Section Eubrachyura de Saint Laurent, 1980

Subsection Heterotremata Guinot, 1977

Superfamily Goneplacoidea MacLeay, 1838

Family Mathildellidae Karasawa and Kato, 2003

Genus *Coeloma* A. Milne-Edwards, 1865

Type species: *Coeloma vigil* A. Milne-Edwards, 1865, by monotypy.

***Coeloma (Litoricola) dentate* Woodward, 1873**

(Pl. 4, figs. 1a, b)

1873 *Litoricola dentate* Woodward, p. 30, pl. 2, figs. 2–5.

1969 *Coeloma (Litoricola) dentate*; Glaessner, p. R524.

Additional material: A carapace, NHM IC 616, from the Early Eocene London Clay Formation, Division C.

Remarks: Previously recorded from the London Clay of Hampshire, this species is noted herein from the London Clay Divisions A and C, at Alum Bay and Division D2 of Whitecliff Bay (localities 1a and 6). Although of rare occurrence, two specimens were obtained *in situ* from Divisions A and C, Alum Bay. Four others have been found on the beach. Only one specimen has been found at Whitecliff Bay and it is thought to have come from the nodule band 8.7 m above the base of Division D2. All WJQ Coll.

Family Goneplacidae MacLeay, 1838

Subfamily Gonioplacoidinae subfam. nov.

Type genus: *Gonioplacoides* gen. nov., by monotypy.

Diagnosis: Carapace subquadrate, wider than long (W/L c. 79 %), widest a little before midlength; flattened in both longitudinal and transverse sections; orbitofrontal margin almost as wide as carapace length, slightly produced front about one third width of orbitofrontal margin; upper orbital margins entire, sinuous, outer

orbital spine triangular; anterolateral margins entire, in shallower arc than posterolateral margins, together curving smoothly to rounded posterior angles overlapping granule-rimmed posterior margin which is a little wider than the front. Regions well developed, weakly tumid; cervical furrow crosses midline about mid-carapace length; hepatic, metabranchial and intestinal regions depressed; cardiac region with lateral lobes.

Remarks: As far as preserved, the new genus meets the requirements for the family as envisaged by Karasawa and Kato (2003), but it differs primarily from included genera in that the widest part of the carapace is further from the front.

Derivation of name: Referring to the similarity to *Goneplax* spp.

Genus *Gonioplacoides* gen. nov.

Type species: *Gonioplacoides minuta* sp. nov., by monotypy.

Diagnosis: As for subfamily.

***Gonioplacoides minuta* sp. nov.**

(Pl. 3, figs. 6, 7)

pars 1981 *Palaeograpsus depressus* Quayle and Collins, pl. 105, fig. 13.

Diagnosis: As for subfamily.

Material: Holotype. NHM IC 607. Paratypes. NHM IC 606, IC 608, NHM IC 621, from the late Eocene Headon Hill Formation, Whitecliff Bay.

Derivation of name: With reference to the small size of the species.

Description: The carapace is subquadrate in outline, wider than long, widest just before midlength; flattened in both longitudinal and transverse sections; the arc of the short anterolateral margins is less than that of the posterolateral margins; together they curve smoothly to boldly rounded posterior angles slightly overlapping the posterior margin. The posterior margin is wider than the front and weakly concave. Taking up the median third of the orbitofrontal margin which is almost as wide as the carapace, the front is produced, weakly depressed, shallow-sulcate with rounded corners. Sinuous, elongate, upper orbital margins are entire and terminate in sharp, forwardly directed, triangular spines. The regions are well delineated, and apart from depressed, subrectangular, hepatic regions, and metabranchial lobes, are tumid. The deep cervical furrow passes straight across the midline about mid-carapace length, turns sharply forwards at the outer angles of the mesogastric lobe, it unites with the post cervical furrow, then becomes shallower and broader as it curves forwards and outwards to the margin close to the outer orbital spine. There is a medially divided thickening at the base of the rounded-triangular mesogastric lobe and its parallel-sided anterior process extends between circular protogastric lobes to ovate epigastric lobes, filling the base of the front. The epibranchial lobes are ovate and separated from larger reniform metabranchial lobes by the postcervical furrows. The branchiocardiac furrows are inclined towards the united shield-shaped uro/cardiac region. Rounded lobes lateral to the cardiac region may be isolated or fused to it.

Remarks: Formerly considered by Quayle and Collins (1981, pl. 105, fig. 13), to be a paratype (NHM In. 61734) of *Palaeograpsus depressus* Quayle and Collins, from the Bracklesham Group, Elmore Formation

of Lee-on-the-Solent, Hampshire, the difference in carapace outline, a broader orbitofrontal margin with elongate orbits, and distinctive dorsal characters became obvious with additional, better preserved material.

Subfamily Chasmocarcinae Serène, 1964

Genus *Orthakrolophus* Schweitzer and Feldmann, 2001

Type species: Orthakrolophus bartonensis Quayle and Collins, 1981, by original designation.

***Orthakrolophus* sp. cf. *Orthakrolophus bartonensis*
(Quayle and Collins, 1981)**

(Pl. 3, fig. 11)

1981 *Palaeograpsus bartonensis* Quayle and Collins, p. 756, pl. 105, fig. 10.

2001 *Orthakrolophus bartonensis* (Quayle and Collins, 1981); Schweitzer and Feldmann, p. 339.

Material: Internal cast of a carapace, NHM IC 612, from the Barton Clay Formation, Alum Bay (Locality 1b).

Remarks: The rounded outline of the present specimen, together with a slightly produced, thickened front and, albeit vague, lobation, immediately distinguishes it from the earlier *Orthakrolophus depressus* (Quayle and Collins, 1981), from the Elmore Member, Bracklesham Group, Lee-on-the-Solent, Hampshire, which has straighter sides and the front in line with the curvature of the anterolateral margins.

Superfamily Hexapodoidea Miers, 1886

Family Hexapodidae Miers, 1886

Genus *Goniocypoda* Woodward, 1867

Type species: Goniocypoda edwardsi Woodward, 1867, by monotypy.

***Goniocypoda quaylei?* Crane, 1981**

(Pl. 3, fig. 12)

1981 *Goniocypoda quaylei* Crane, p. 11, figs. 7–9.

Material: A carapace NHM IC 613 from the Headon Hill Formation of Whitecliff Bay (Locality 6c).

Remarks: As preserved the carapace outline and length/width ratio (c. 57%) closely approaches those of *Goniocypoda quaylei* (c. 55 %) the length estimated from Crane (1981, fig. 10) to coincide with that of the holotype in the Bristol Museum, BRSMG CD 161, from the Barton Clay Formation of Chewton Bunny, Highcliffe, Christchurch Bay, Dorset/Hampshire. Although the lateral margins of the two carapaces are minutely beaded, the dorsal surface may be finely granulated or pitted and the ‘two pairs of pits close to the midline’, noted in the original description (Crane, 1981, p. 16), are barely discernable. However, these differences are no doubt due to the difference in growth size; Crane’s specimen has a breadth of 9.5 mm, whereas that of NHM IC 613 is 5 mm, so Crane’s opinion (1981, p. 17), concerning the proximity of *quaylei?* from the Barton Clay Formation, to the nominate species is plausible.

Genus *Headonipus* gen. nov.

Type species: Headonipus tuberculatus sp. nov., by monotypy.

Derivation of name: From the type formation + the generic root.

Diagnosis: Carapace transversely sub-rectangular narrowing towards the front, wider than long (W/L 60 %), widest about midlength; gastric regions ill-defined, branchial and cardiac regions tumid; orbitofrontal margin c.48 % of carapace width; front about half width of orbitofrontal margin, slightly produced, weakly sulcate; coxigeal incisions deep, beaded; posterior margin straight, wider than orbitofrontal margin; intestinal lobes clearly demarked; dorsal surface densely and coarsely granulated.

Remarks: In carapace outline and arrangement of dorsal lobes, *Headonipus* has a superficial resemblance to a number of genera within the Hexapodidae, of which De Angeli *et al.* (2010, p. 54) recognise 18 fossil or Recent forms, but it differs from all of them principally in relative carapace proportion; where some agree, others radically differ and none coincide *in toto*. Also, the sternites, abdomen and limbs essential to generic placement are, as yet, unknown. It is, therefore, considered prudent to erect a new genus.

***Headonipus tuberculatus* sp. nov.**

(Pl. 3, figs. 9, 10)

Diagnosis: As for genus.

Material: Holotype, a carapace NHM IC 610. Paratypes, NHM IC611. NHM IC 622, all from the Late Eocene Headon Beds of Whitecliff Bay.

Derivation of name: Referring to the tuberculated dorsal ornament.

Description: The carapace outline is transversely sub-rectangular, about three fifths wider than long (c. 60 %), widest about midlength, gently arched in longitudinal section, laterally tumid in transverse section. The weakly rimmed orbitofrontal margin takes up about half (c. 48 %) of the carapace width; of this the slightly produced, weakly concave front occupies a little less than half and its outer angles are rounded into a weak constriction. The upper orbital margins are sinuous and slightly raised. The lateral margins may be somewhat straight, or boldly rounded into the beaded anterolateral and posterolateral margins. The sides, slightly splayed posteriorly, terminate in a beaded coxigeal incision curving sharply into the posterior margin which is straight and wider (69 %) than the orbitofrontal margin. From a pair of gastric pits set close to the midline about mid-carapace length, the cervical furrow is deep and curves broadly to the anterior angles of the mesogastric lobe, becoming weaker as it turns sharply forwards, joins the insipient hepatic furrows and becomes obsolete as it curves towards the margin. The hepatic furrows become obsolete towards the middle of the orbital margin. A line between the surface granules defines a sub-triangular mesogastric lobe and base of the anterior process. Outer angles of a narrow urogastric lobe lay in a deep pit marking the attractor epimeralis muscles attachment; from them a pit develops into a groove outlining a large, transversely subovate cardiac region, although abraded surfaces present a shield-shaped median area. Grooves curving from the base of the cardiac region to the middle of the coxigeal incisions isolate elongated intestinal lobes.

The dorsal surface is densely covered by even-sized tubercles, proportionately larger on the branchial region and a tendency to become linear on the mesogastric lobe. On internal casts (i.e. NHM IC 611) the lobes are subdued, the deep pits are coalesced and there is a scattering

of shallow pits of several diameters over the dorsal surface.

Discussion: The relatively wider front and coarse granulation readily distinguishes *Headonipus* from other known hexapodids.

Superfamily Leucosioidea Samouelle, 1819

Family Leucosiidae Samouelle, 1819

Genus *Typilobus* Stoliczka, 1871

Type species: *Typilobus granulosus* Stoliczka, 1871, by monotypy.

***Typilobus obscurus* Quayle and Collins, 1981**

(Pl. 3, figs. 8a, b)

1981 *Typilobus obscurus* Quayle and Collins, p. 743, pl. 104, fig. 13.

Additional material: A carapace, NHM IC 609, from the Middle Headon Beds of Colwell Bay

New diagnosis: Carapace pyriform, widest just posterior to midlength, orbitofrontal margin, slightly produced, less than half carapace width, front narrow, divided by a median groove. Cervical furrow inconspicuous across midline about mid-carapace length, uro-cardiac grooves prominent, hepatic furrows vestigial; urogastric lobe, with a node at outer angles, extends beyond cardiac region; a short lateral spine is situated opposite the cardiac region.

New description: Carapace pyriform in outline, slightly longer than wide, widest just posterior to midlength. In longitudinal section it is flat behind the front, then steeply domed to the slightly higher cardiac region; transversely, it is evenly rounded. The slightly produced orbitofrontal margin, bounded by a prominent depression is a little under half the carapace width (44 %). Of this the front occupies about the median 17 %; its straight sides incline to a weak median notch and narrowly rounded outer angles lead to shallow, sinuous upper orbital margins terminating in a rounded outer angle. There is a shallow constriction of the short, convex anterolateral margins at the cervical notch and the posterolateral margins are interrupted by a conical tubercle opposite the widest part of the cardiac region, then recurve sharply to nodose posterior angles. The almost straight posterior margin is narrower than the orbitofrontal margin.

The cervical furrow is feebly developed across the midline about mid-carapace length, becoming deeper and turning straight forwards it embraces the sides of the pentagonal mesogastric lobe before curving to the margins. Only the basal portion of the hepatic lobe is present, represented by little more than a line between the surface granules. The grooves separating the rectangular urogastric and wider, rounded-pentagonal cardiac lobes from one another are more clearly defined. Anteriorly, the mesogastric lobe is discernable rather by the grouping of granules than by a clear cut groove. The cardiac region and branchial regions are tumid. The intestinal lobe is isolated from the branchial region and depressed.

The dorsal surface is densely covered in granules which tend to become less coarse medially and towards the lateral margins.

Discussion: Contrary to the original description, the carapace is pyriform rather than ‘almost circular and the cardiac region is more clearly isolated from the intestinal lobe. The lateral spines on the type carapace are little more than enlarged lateral granules and the nodes

at the posterior margin are not preserved. The pyriform outline, weak lateral development of the cervical furrow, virtual absence of hepatic furrows and shorter anterolateral margin immediately distinguishes *T. obscurus* from the more or less contemporary *Typilobus belli*.

***Typilobus belli* Quayle and Collins, 1981**

(Pl. 3, figs. 4, 5)

1981 *Typilobus belli* Quayle and Collins, p. 742, pl. 104, fig. 12.

Additional material: A carapace NHM IC 604; an Araldite re-enforced front of carapace; NHM IC 605, both from the Middle Headon Beds of Whitecliff Bay

Remarks: Previously known from the Barton Beds of Christchurch Bay, Dorset, Hampshire, the apparent disparity in length/width ratios results from a slight tilt in the elevation of the type-figure. Thus in direct dorsal view, the carapace outline is rather more ovate than indicated in the type-figure (Quayle and Collins, 1981, pl. 104, fig. 12). A sharp conical spine, abraded in the type series, overhangs the posterolateral margin opposite the widest part of the cardiac region.

Superfamily Portunoidea Rafinesque, 1815

Family Macropipidae Stephenson and Campbell, 1960

Genus *Rhachiosoma* Woodward, 1871

Type species: *Rhachiosoma bispinosum* Woodward 1871, by subsequent designation.

***Rhachiosoma bispinosum* Woodward, 1871**

(Pl. 4, fig. 2)

1871 *Rhachiosoma bispinosum* Woodward, p. 91, pl. 4, fig. 3.

Remarks: Previously recorded from the London Clay of Portsmouth and Fareham, Hampshire, carapaces have now been recorded from the London Clay Formation Division D2 of Whitecliff Bay (locality 6a). Although rare, they were recorded from the nodule band c. 8.7 mm above the base of Division D2, associated with *Z. unispinosa*, and *L. eocenicus*. The species has also been recorded from the London Clay of ‘London’, NHM 3100.

Family Portunidae Rafinesque, 1815

Genus *Portunus* Weber, 1795

Type species: *Cancer pelagicus* Linnaeus, 1758, by selection by Rathbun (1926: see Opinion 394, International Commission of Zoological Nomenclature, 1956, name 986 on Official List).

***Portunus vectensis* (Carter, 1898)**

(Pl. 3, figs. 13a–15)

1898 *Neptunus vectensis* Carter, p. 33, fig. 2.

2008 *Portunus vectensis* (Carter); Karasawa *et al.*, p. 133.

Remarks: The species was described from the Hamstead Beds of Hamstead, Isle of Wight. Apparently, several specimens were available to Carter, although only the underside of one male individual (the Holotype) was figured. The species was said to “closely resemble those of *N. larteti* Milne Edwards” (Carter, 1898, p. 34). Unfortunately, the figured specimen cannot be traced (pers comm., M. Riley, Sedgwick

Museum), nor is there any evidence of the others. However, a specimen (NHM IC 614, Pl. 3, fig. 13), from the Early Oligocene, Bouldnor Formation of Hamstead, with a partially preserved underside, corresponds well with Carter's figure; the prominent 4/5 sternal suture of Carter's figure is 153° to the midline, whereas that of IC 614 is 149°. The Dinosaur Isle Museum, Sandown, Isle of Wight, has a specimen of *P. vectensis* (MIWG 6284), which was found loose on the beach.

Superfamily Carpioidea Ortmann, 1893

Family Zanthopsidae Via, 1959

Genus *Zanthopsis* M'Coy, 1849

Type species: Cancer leachii Desmarest, 1822, by original designation.

***Zanthopsis unispinosa* M'Coy, 1849**

(Pl. 3, fig. 3)

1849 *Zanthopsis unispinosa* M'Coy, p. 164.

1858 *Zanthopsis unispinosa* M'Coy; Bell, pp. 16–17, pl. 2, fig. 1.

1863 *Zanthopsis unispinosa* M'Coy; A. Milne-Edwards, p. 319, pl. 5, fig. 1.

1929 *Zanthopsis unispinosa* M'Coy; Glaessner, p. 400, see also for intermediate entries.

1980 *Zanthopsis unispinosa* M'Coy; Morris, p. 18.

Additional material: A carapace, NHM IC 603.

Remarks: When considering the lateral spines in his discussion of *Zanthopsis unispinosa* M'Coy, 1849, Bell (1858, p. 17), categorically stated that the name was, "a very incorrect one", a statement fully exemplified by comparing the lateral spines figured by Milne-Edwards (1863, pl. 5, fig. 1), with Bell's figure (1858, pl. 2, fig. 1). Of the latter Bell said (*op. cit.*, p. 16), "... the posterior lateral process short flattened triangular, and sharp pointed, the penultimate one smaller and the two anterior obsolete". In sharp contrast, the specimen figured by Milne-Edwards depicted spines 2–4 flattened, broad based triangular, increasing rapidly in size posteriorly. Being of much the same size, the identical overall surface characters of the two carapaces are readily apparent.

No precise locality of the figured specimen (1863, pl. 5, fig. 1) was recorded by Milne-Edwards, and we are unaware of carapaces similar to that figured by Milne-Edwards from localities other than from the Isle of Wight which are from Division A.

Albeit scarce in this horizon, conditions prevailing in the London Clay Formation, Division D2 of Whitecliff Bay were particularly favourable in the development of the triangular spined forms which attained a size comparable with that found among the largest *Zanthopsis* species. In all instances the nodule-encased carapaces are internal casts and surface detail is somewhat suppressed. However the development and preservation is more or less constant. There is the occasional indication of the (normal) 1st spine, the second remains small, while the 3rd spine approaches or equals the size of the 4th. In every instance the margin between the spines is convex and increases the carapace width. This is an important factor in distinguishing the similar, contemporary species, *Zanthopsis dufourii*, in which the margins are straighter and more or less parallel.

Genus *Harpactocarcinus* A. Milne-Edwards, 1862

Type species: Cancer punctulatus A. Milne-Edwards, 1862, by subsequent designation of Rathbun, 1928.

***Harpactocarcinus* sp.**

(Pl. 4, fig. 3)

Remarks: A poorly preserved carapace, NMH IC 618, from the London Clay Formation, Division D2 (c. 8. 7 m above the base) of Whitecliff Bay retains traces of a tuberculate lateral margin typical of the genus and sufficient to distinguish it from *Harpactoxanthopsis* spp. It marks the first record of the genus from the British Tertiary.

Family Tumidocarcinidae Schweitzer, 2005

Genus *Xanthilites* Bell, 1858

Type species: Xanthilites bowerbanki Bell, 1858, by monotypy.

***Xanthilites bowerbanki* Bell, 1858**

(Pl. 3, fig. 2)

1858 *Xanthilites bowerbankii* Bell, p. 17, pl. 2, figs. 2–5.

Remarks: As far as comparison allows, an internal cast of a juvenile (NHM IC 602), agrees in all respects with specimens of more or less similar growth stage in the NHM, London. Not too common in the London Clay of the mainland, this is the first specimen to be recorded from the London Clay Formation, Division D2 of Whitecliff Bay.

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Plate 1

Vecticallichirus abditus gen. et sp. nov. Early Eocene Headon Beds, Whitecliff Bay.

Figs. 1–8. Form a left hand series:

- Fig. 1. Outer surface of dactylus, NHM IC 584.
 Fig. 2. Outer surface of associated dactylus and fixed finger, NHM IC 585.
 Fig. 3. Inner surface of associated dactylus and fixed finger, NHM IC 586.
 Fig. 4. Outer of part cheliped, Holotype, NHM IC 587.
 Fig. 5. Inner surface of propodus, NHM IC 588.
 Fig. 6. Outer surface of ischium, NHM IC 589.
 Fig. 7. Outer surface of merus, NHM IC 590.
 Fig. 8. Inner surface of merus, NHM IC 591.

Figs. 9–15. Form a right hand series:

- Fig. 9. Outer surface of associated ischium and merus, NHM IC 592.
 Fig. 10. Outer surface of merus, NHM IC 593.
 Fig. 11. Inner surface of dactylus, NHM IC 594.
 Fig. 12. Outer surface of dactylus, NHM IC 595.
 Fig. 13. Inner surface of fixed finger, NHM IC 596.
 Fig. 14. Outer surface of propodus, NHM IC 597.
 Fig. 15. Outer surface of chela of pereopod 1, NHM IC. 598.
 Fig. 16. a, abdominal somites 4–6 and telson; b, uropod; c, pereopod, NHM IC 599.

Scale bars equal 5.0 mm.

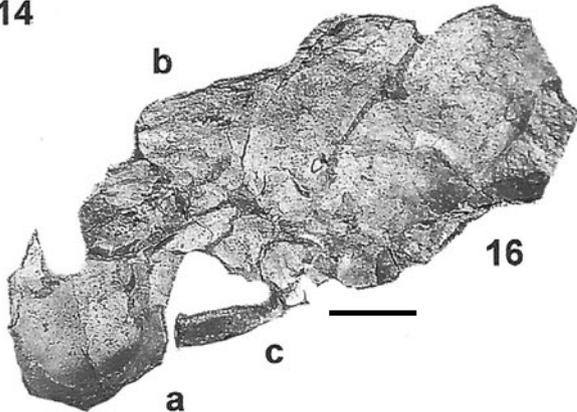
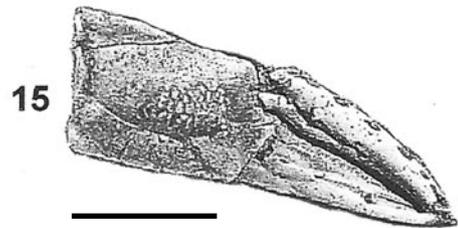
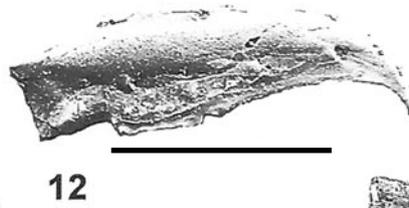
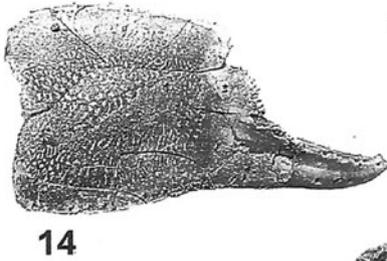
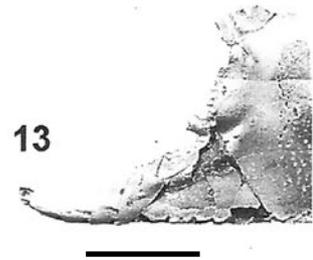
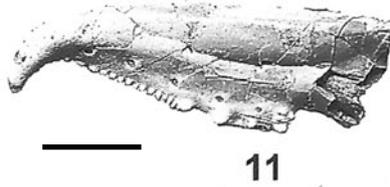
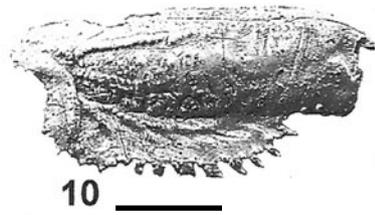
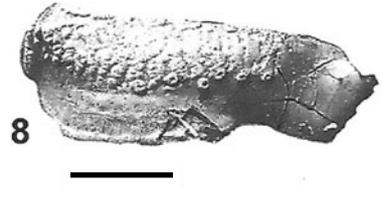
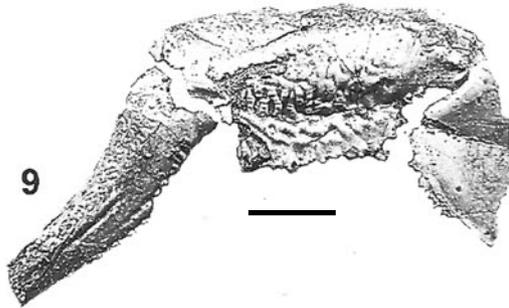
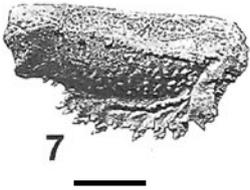
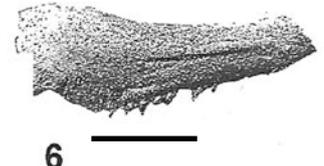
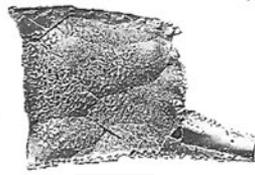
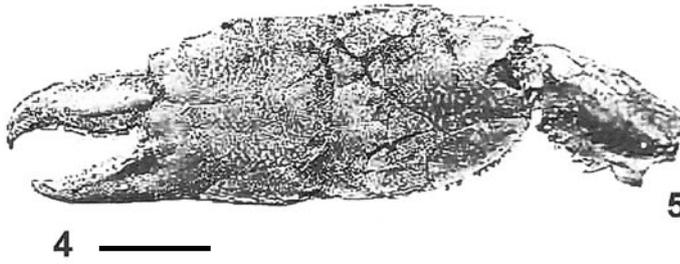
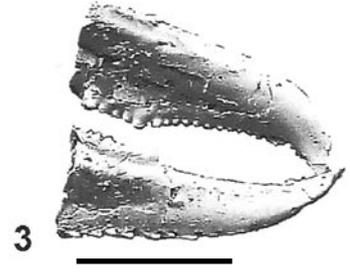
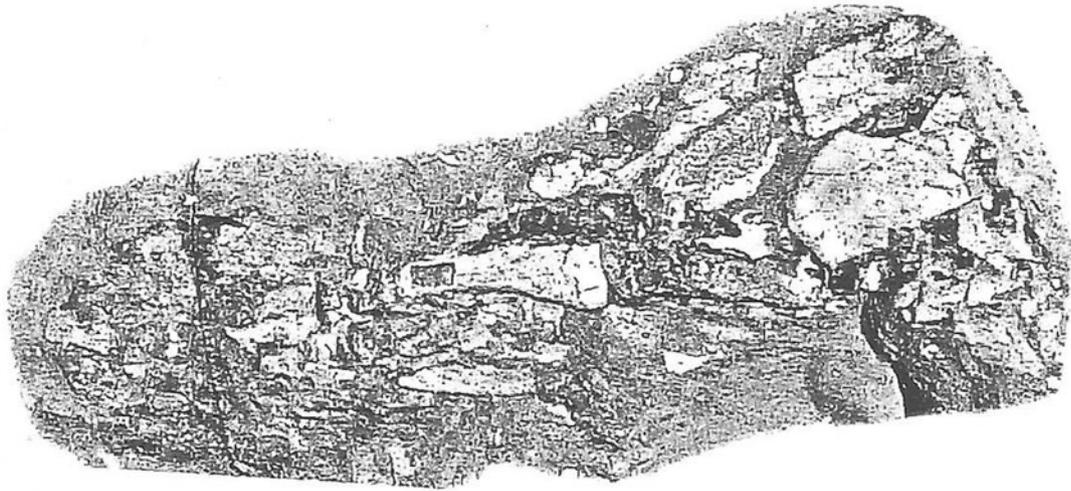


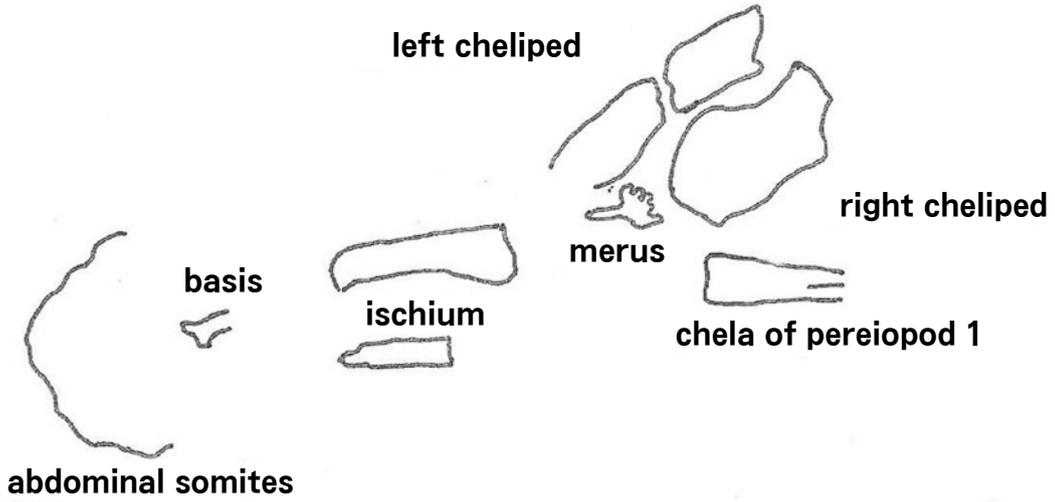
Plate 2

Figs. 1a, b. *Vecticallichirus abditus* gen. et sp. nov., NHM IC 600, from the Late Eocene, Headon Hill Formation, Whitecliff Bay; an almost complete specimen, a, outer surface; b, internal mould.

Scale bar equals 5.0 mm.



1a



1b

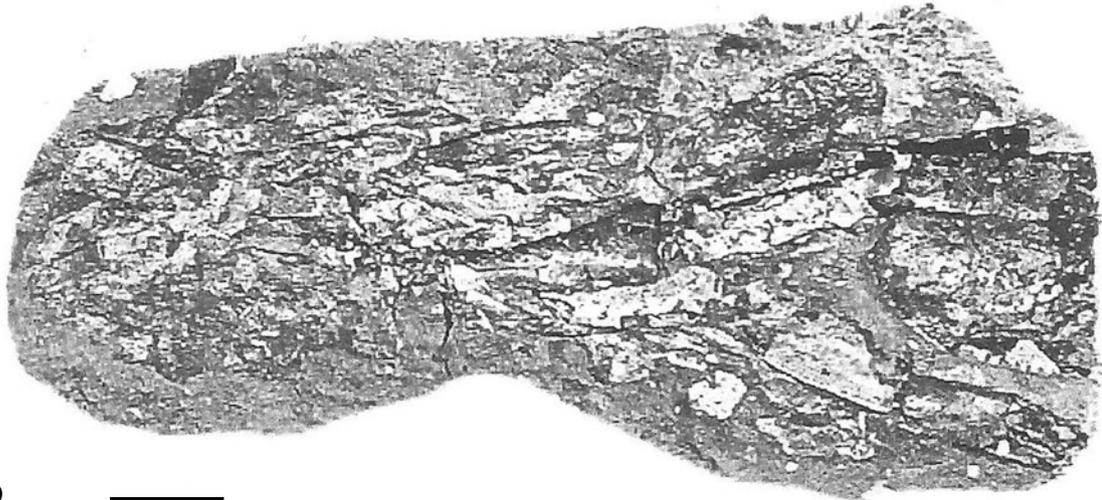


Plate 3

- Figs. 1a, b. *Zanthopsis dufourii* (Milne-Edwards). NHM IC 601; a, dorsal, b. ventral surface; Lower Eocene, Alum Bay.
- Fig. 2. *Xanthilites bowerbankii* (M'Coy). NHM IC 602; Early Eocene, London Clay Formation, Whitecliff Bay. A juvenal carapace.
- Fig. 3. *Zanthopsis unispinosa* (M'Coy). NHM IC 603; Early Eocene, London Clay Formation, Whitecliff Bay.
- Fig. 4. *Typilobus belli* Quayle and Collins, NHM. IC 604; Late Eocene, Headon Hill Formation, Whitecliff Bay, dorsal surface.
- Fig. 5. *Typilobus belli* Quayle and Collins, NHM. IC 605; Late Eocene, Headon Hill Formation, White close up of cliff Bay. Araldite re-enforced front of carapace.
- Fig. 6. *Gonioplacoides minuta* gen. et sp. nov. Holotype, NHM IC 607; Late Eocene, Headon Hill Formation, Whitecliff Bay, dorsal surface.
- Fig. 7. *Gonioplacoides minuta* gen. et sp. nov. Paratype, NHM IC 606; Late Eocene, Headon Hill Formation, Whitecliff Bay, Araldite re-enforced dorsal surface.
- Figs. 8a, b. *Typilobus obscurus* Quayle and Collins. NHM IC 609; a, dorsal; b, right lateral views; Late Eocene, Headon Hill Formation, Colwell Bay.
- Fig. 9. *Headonipus tuberculatus* gen. et sp. nov. Holotype. Carapace, NHM IC 610; Late Eocene, Headon Hill Formation, Whitecliff Bay.
- Fig. 10. *Headonipus tuberculatus* gen. et sp. nov. Paratype, NHM IC 611; Araldite re-enforced front of carapace, showing orbits, Late Eocene, Headon Hill Formation, Whitecliff Bay.
- Fig. 11. *Orthrakrolophus depressus* (Quayle and Collins). NHM IC 612; internal cast of carapace; Middle Eocene Barton Beds, Alum Bay.
- Fig. 12. *Goniocypoda ?quaylei* Crane. NHM IC 613; Late Eocene, Headon Hill Formation, Whitecliff Bay.
- Figs. 13a, b. *Portunus vectensis* (Carter). NHM IC 614; Early Oligocene, Bouldnor Formation, Hamstead, a, dorsal, b, ventral views.
- Fig. 14. *Portunus vectensis* (Carter). MIWG 6284; Dinosaur Isles Museum Sandown; found loose on beach, Bouldnor.
- Fig. 15. *Portunus vectensis* (Carter). NHM IC 615; Early Oligocene, Bouldnor Formation, Hamstead

Scale bar equals 5.0 mm.

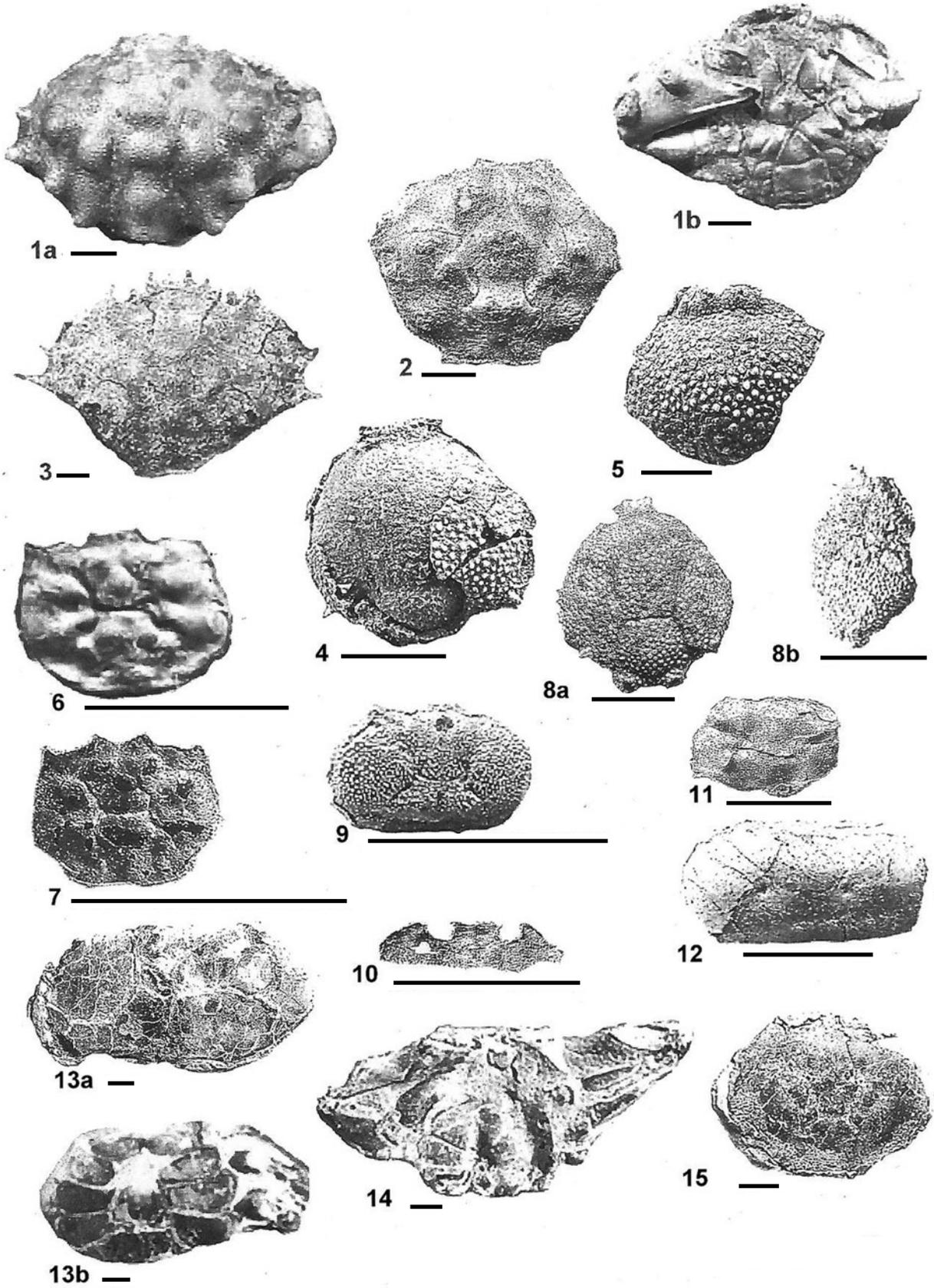


Plate 4

Figs. 1a, b. *Coeloma (Litoricola) dentate* (Woodward). NHM IC 616; a, carapace, b. counterpart. Early Eocene, London Clay Formation, Division C, Alum Bay.

Figs. 2–4. From the Early Eocene London Clay, Division D, Whitecliff Bay.

Fig. 2. *Rhachiosoma bispinosum* Woodward. NHM IC 617.

Fig. 3. *Harpactocarcinus* sp. NHM IC 618.

Fig. 4. *Linuparus eocenicus* Woods. NHM IC 619; a moult with flipped over carapace.

Scale bar equals 5.0 mm.

