

# Decapod crustaceans of the Lower Miocene Montpelier Formation, White Limestone Group of Jamaica

Roger W. Portell<sup>1</sup> & Joe S.H. Collins<sup>2</sup>

<sup>1</sup>Florida Museum of Natural History, PO Box 117800, University of Florida, Gainesville, Florida 32611-7800, USA; e-mail: portell@flmnh.ufl.edu

<sup>2</sup>Department of Palaeontology, The Natural History Museum, Cromwell Road, London, SW7 5BD, and 8, Shaw's Cottages, Perry Rise, Forest Hill, London, SE23 2QN, England

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Hitherto, only *Callianassa* sp. has been documented from the White Limestone Group of Jamaica. To this meagre record we here add a well-preserved, coral-associated crab fauna of sixteen new species in fourteen genera. The fauna was discovered in the Lower Miocene of the Montpelier Formation, in exposures near the north-central coast of Jamaica. This assemblage is a Miocene decapod fauna unique to the Caribbean. Three genera, belonging to the families Leucosiidae, Portunidae and Xanthidae, are new. Of the remainder, *Lophopanopeus* is known from both older and younger North American deposits, *Kromtitis* is known only as fossil, and *Dynomene*, *Teleophrys*, *Daira*, *Trapezia* and *Chlorodiella* are extant genera. All are recorded for the first time as fossils in the Caribbean. With the exception of *Teleophrys*, all are represented in the Upper Miocene coral-associated deposits of Europe and similar deposits of Middle Miocene age from Japan, from whence *Leptodius*, also present in the new collection, has been described. Three extant genera, *Mithrax*, *Micropanope* and *Panopeus*, have previously been recorded in younger deposits from Jamaica. The only other coral-associated assemblage described from the Caribbean, from the Pleistocene terraces of Barbados, consists of twelve species in seven genera, all but one of which are extant forms.

KEY WORDS: Decapoda, Jamaica, Montpelier Formation, White Limestone Group.

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## Introduction

Early knowledge of crabs from Jamaica, summarised by Morris (1993), are of those described from the Upper Cretaceous (Maastrichtian) of the parish of St James (Rathbun, 1919; Withers, 1922, 1924, 1927), those from the Middle Eocene Chapelton Formation of the parishes of Hanover and Trelawny, and other, unnamed species from the Oligocene and Pleistocene. Additionally, Morris (1993) reported a number of species from the Upper Pleistocene Falmouth Formation, and Collins *et al.* (1996, 2001), Collins & Donovan (1997) and Collins & Portell (1998) considerably enlarged the knowledge of Pliocene and Pleistocene species. However, hitherto only a single specimen from the whole of the Middle Eocene to Middle Miocene White Limestone Group of Jamaica was recorded (Morris, 1993). This, a propodus? of *Callianassa* sp., was collected at New Ground, St Ann's Bay, parish of St Ann and, according to Morris (1993), of Middle Eocene to early Middle Oligocene age. To this single record we here add the discovery of a coral-associated crab assemblage in the parish of Trelawny which provides an opportunity to describe a Miocene

crab fauna unique to the Caribbean. The only other coral-associated assemblage described from the Caribbean (Collins & Morris, 1976) is comprised of a small fauna from the Pleistocene terraces of Barbados, consisting of twelve species in seven genera, all but one of which are extant forms.

The Early Miocene fauna of the Montpelier Formation documented herein consists of sixteen new species in fourteen genera (see Table 1). Three of the genera, *Actaeops*, *Pseudoachelous* and *Duncania*, are new, the last-named being a leucosiid whose closest related forms are among *Ebalia* spp. Of the remainder, *Lophopanopeus* is known from both older and younger deposits in North American, and six genera, *Daira*, *Kromtitis*, *Dynomene*, *Teleophrys*, *Chlorodiella* and *Trapezia*, are recorded for the first time as fossils in the Caribbean. With the exception of *Teleophrys*, all are present in the Upper Miocene coral-associated deposits of Europe and, with the exception of *Kromtitis*, similar deposits of Middle Miocene age from Japan, from whence *Leptodius*, also present in the new material, has been described (Müller, 1984; Karasawa, 1993).

Genus	New Genera	1 <sup>st</sup> Caribbean Fossil Record	Fossil Coral-Associated Genera	Japanese Miocene Coral Associates	Tethyan Associates	Recent Pacific-Caribbean Genera
<i>Kromtitis</i>		X	X			
<i>Dynomene</i>		X	X	X	X	P
<i>Duncania</i>	X	X				
<i>Teleophrys</i>		X				C
<i>Mithrax</i>			X			C/P
<i>Daira</i>		X	X	X	X	P
<i>Pseudoachelous</i>	X	X				
<i>Lophopanopeus</i>						C/P
<i>Micropanope</i>						C/P
<i>Panopeus</i>						C/P
<i>Trapezia</i>		X	X	X	X	P
<i>Actaeops</i>	X	X				
<i>Chlorodiella</i>		X	X		X	C
<i>Leptodius</i>			X	X		C/P

**Table 1.** List of genera of Early Miocene crabs from the Montpelier Formation, White Limestone Group, Jamaica, and their attributes. Genera still living in the Pacific are denoted by P; those still living in the Caribbean are denoted by C.

Only three extant genera, *Micropanope*, *Panopeus* and *Mithrax*, have previously been recorded in younger deposits from Jamaica; *Mithrax* is also known from the Pleistocene terraces of Barbados (Collins & Morris, 1976).

The dominant decapod species found in the Montpelier Formation is undoubtedly the parthenopid *Daira vulgaris* sp. nov., which is well represented by thirty-two carapaces of various growth sizes. Furthermore, isolated chelae elements that correspond well to those of Recent species of *Daira* and can confidently be attributed to the new fossil species, were found in the deposit. Today, the genus contains two Recent species, one of which, *Daira americana* Stimpson, 1860, ranges from southern California to Ecuador.

The family Portunidae is represented by a single, fragmentary carapace, *Pseudoachelous schindleri* gen. et sp. nov. The anterolateral spines of this species follow the alternate wide and narrow arrangement common to the North American species of *Achelous*.

Oxyrhynchs comprise a reasonably high percentage (18.75%) of the fossil coral-associated assemblage of Jamaica. Two species of *Mithrax* have been determined from our samples; *Mithrax donovani* sp. nov. exhibits characters in common with the more pyriform members of the genus such as *Mithrax acuticornis* Stimpson, 1870, and *Mithrax spinipes* (Bell, 1836), the former widespread in the Caribbean, the latter a Pacific coast species. *Mithrax unguis* sp. nov., on the other hand, has characters in common with extant *Mithrax hispidus* (Herbst, 1790), a species known also from the Pleistocene of Barbados. *Teleophrys acornis* sp. nov. has related characters with *Teleophrys ornatus* Rathbun, 1901, presently recorded from Yucatán, the West Indies to

Brazil (Rathbun, 1925).

The nearest living comparable dynomenid, *Hirsutodynomene ursula* (Stimpson, 1860), is confined from the west coast of Mexico to Ecuador and offshore to the Galapagos Islands (McLay, 1999). Its highly sculptured surface immediately distinguishes it from *Dynomene variabilis* sp. nov. The dromiid, *Kromtitis spinulata* sp. nov., has much in common with the type species *Kromtitis koberi* (Bachmayer & Tollmann, 1953) from the Miocene ('Badenian') of Europe.

There is a closer resemblance of *Trapezia prisca* sp. nov. to the Late Miocene *T. glaessneri* Müller, 1984, than to the Japanese Middle Miocene *T. breviformis* Karasawa, 1993. The three Recent North America species of *Trapezia* are found off the Pacific coast (although two extend their range far beyond); the new species is closest to *T. cymodoce feruginea* Latreille, 1825. It also shares characters with *Quadrella nitida* Smith, 1869 (Hickman & Zimmerman, 2000, p. 23), and could possibly have given rise to the genus *Quadrella*. Unlike *T. cymodoce feruginea*, *Q. nitida* is presently confined from southern California to Panama. As pointed out by Müller (1984), species of *Trapezia* are commensal only with seriatopodid (= pocilloporid) corals (i.e., *Stylophora*, *Pocillopora*, *Madracis* and *Seriatopora*). Except for *Madracis*, these corals are no longer present in the Caribbean, which may explain the absence of *Trapezia* in that region today.

The earliest appearance in North America of *Lophopanopeus* is from the Oligocene of Alaska (Rathbun, 1926), in which work three species were also recorded from the Pleistocene of California. However, both of the Oligocene species described from Alaska, *L. olearis* Rathbun, 1926, and *L. baldwini* Kooser & Orr, 1973,

have recently been reassigned to *Panopeus* by Schweitzer (2000). The genus has also been tentatively recorded from the Miocene Cercado Formation of the Dominican Republic and Upper Pliocene Moin Formation of Costa Rica (Collins and co-workers, research in progress).

In North America, the genus *Chlorodiella* is restricted to a single species, *C. longimana* (H. Milne Edwards, 1834), which differs from *C. occidentalis* sp. nov. in having more continuous transverse ridges; those of *C. occidentalis* are shorter and confined closely to the lateral margins, thereby more closely allied to the diminutive *C. juglans* Müller, 1984, from the Upper Miocene of Hungary. Whereas four genera occur in the Middle Miocene of Japan, there is an equal affinity of the Jamaican species to late Tethyan forms. Additionally, it seems remarkable that galatheids, abundant in the Danish, Tethyan, and Japanese coral-associated crab faunas, have yet to be found in the Montpellier Formation.

### Material and methods

RWP and associates collected the fossil crabs described herein between 1990 and 2001 from the informally named Duncans Quarry (University of Florida locality XJ015). The small, seldom used, quarry is located near the centre of the north coast in the parish of Trelawny, approximately 5 km west of the Duncans police station on the south side of Highway A1 (GPS reading 18° 28.05'N, 77° 34.77'W). Here, a sequence approximately 25 m thick, consisting of bedded and folded white carbonates and chert layers of the Montpellier Formation (White Limestone Group) is exposed. The uppermost unit (3-6 m thick) consists of large slump blocks of indurated bioclastic limestone composed primarily of coral rubble with interstitial echinoid tests and spines, mouldic molluscs and crabs. Many of the corals and echinoids are recrystallized or coated by calcite crystals (Donovan & Portell, 2000). The bioclastic limestones of the uppermost unit are presumed to have been derived from shallow water and deposited in a deeper-water setting by submarine mass flow processes (Donovan & Portell, 1995, 2000). For a detailed discussion of the stratigraphy at the Duncans Quarry, the Montpellier Formation or White Limestone Group, see Mitchell (2004).

Crabs were located by breaking off large pieces of indurated limestone boulders with heavy hammers and chisels. Back in the laboratory the crabs were prepared using an air scribe to remove coarse-grained matrix and then an engraver with a fine tipped chisel for detailed cleaning. Crab carapaces are preserved as internal and external moulds; no original shell material was recovered. All the fossil specimens described in this paper are repositied in the Invertebrate Paleontology Division of the Florida Museum of Natural History (FLMNH), University of Florida (UF), Gainesville, Florida. Additional specimens will be repositied in the Geology Museum, University of the West Indies, Mona, Kingston, Jamaica (UWIGM). Systematic arrangement follows Martin &

Davis (2001). All carapace measurements were taken under a binocular microscope using Mitutoyo dial calipers.

### Systematic palaeontology

Infraorder Brachyura Latreille, 1802

Section Dromiacea de Haan, 1833

Superfamily Dromioidea de Haan, 1833

Family Dromiidae de Haan, 1833

Genus *Kromtitis* Müller, 1984 (*non* Papp *et al.*, 1978, *nomen nudum*)

*Type species* — *Dromilites koberi* Bachmeyer & Tollmann, 1953, by monotypy.

*Range* — Upper Eocene to Upper Miocene.

*Kromtitis spinulata* sp. nov.

Figure 1/1

*Material* — Holotype, carapace UF 68421; paratypes, carapaces UF 38959, UF 68429, UF 68430, UF 73096 and UF 106689.

*Diagnosis* — Carapace subcircular, subglobose, margins spinulated, postcervical furrow well developed, dividing epi- and mesobranchial lobes; dorsal surface bilaterally tuberculate.

*Derivation of name* — Refers to spinulated marginal spines.

*Description* — Carapace subcircular in outline, wider than long (holotype L/W = 0.79); moderately arched transversely, longitudinally more down-turned in anterior third. Orbitofrontal margin takes up half of the carapace width; small, circular, forwardly directed orbits occupy the outer fourths. The front is slightly produced; the downturned (damaged) rostrum is broadly? triangular and weakly sulcate. The upper orbital margins are entire; lower orbital margin and outer angle are spinose, a continuation of about 13 spines, alternately broad and narrow, line the antero- and posterolateral margins. The larger spines have spinulated margins. The dorsal lobes are well-defined; all, except hepatic region, are composed of tubercles of varying size. Cervical furrow, broadly V-shaped across the midline, curves forwards and outwards before turning sharply towards the margin which it reaches at about the 7th/8th spines. A pair of granules, representing gastric pits, occurs behind a flask-shaped mesogastric lobe. A short urogastric lobe is well separated from a narrow, rounded-triangular cardiac region. Longitudinally divided epi- and mesobranchial lobes are transversely divided by a distinct postcervical furrow.

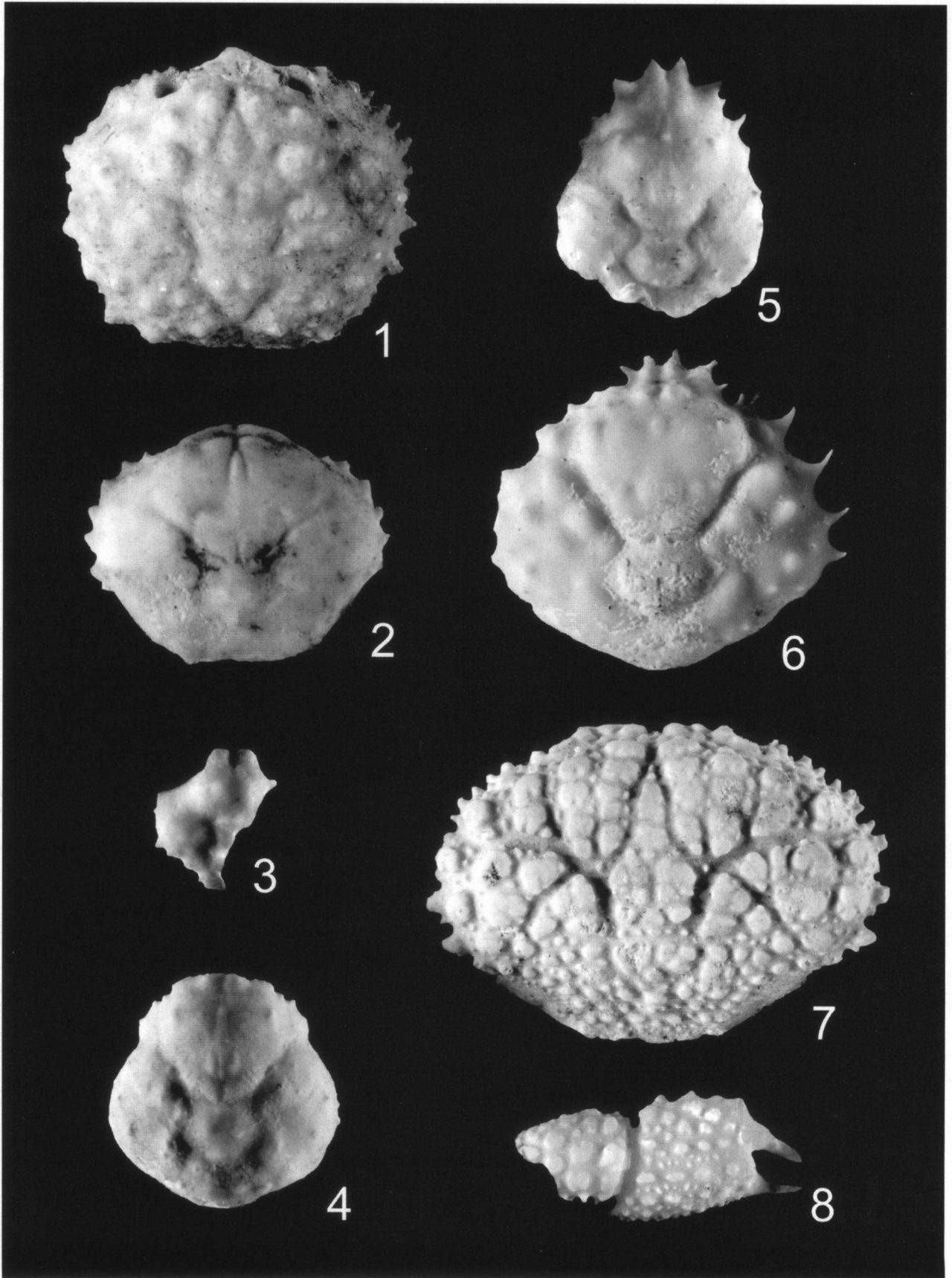


Figure 1. Early Miocene crabs from the Montpelier Formation (White Limestone Group), Jamaica.

- 1 - *Kromtitis spinulata* sp. nov., dorsal view of carapace, holotype, UF 68421, x 4.
- 2 - *Dynomene variabilis* sp. nov., dorsal view of carapace, holotype, UF 106705, x 5.
- 3 - *Duncania jamaicensis* gen. et sp. nov., dorsal view of carapace, holotype, UF 103950, x 5.
- 4 - *Teleophrys acornis* sp. nov., dorsal view of carapace, holotype, UF 106756, x 5.
- 5 - *Mithrax donovani* sp. nov., dorsal view of carapace, holotype, UF 103958, x 5.
- 6 - *Mithrax unguis* sp. nov., dorsal view of carapace, holotype, UF 106697, x 5.
- 7, 8 - *Daira vulgaris* sp. nov., dorsal view of carapace (7), holotype, UF 68349, x 4; outer view of right cheliped (8), paratype, UF 68356, x 4.

**Discussion** — The new taxon conforms in all basic characters with the type species, marginal spines of which are better preserved in a specimen figured by Müller (1984, pl. 31, fig. 2). The rounded carapace outline immediately distinguishes the new species from the Late Eocene ('Priabonian') *Kromtitis pentagonalis* Müller & Collins, 1991. However, *K. spinulata* has much in common with *Dromiopsis rugosa* (von Schlotheim, 1820) from the Middle Danian coral/bryozoan banks of Denmark and Sweden. Essentially similar characters are conformity of furrows, particularly the postcervical furrow, and effect on the lobation. Moreover, well-preserved, decorticated carapaces of *D. rugosa* have lateral margins lined with a similar number of spines, though not so strongly developed or spinulated as in *K. spinulata*. While coarser tubercles crown the lobes of *D. rugosa* they are less noticeable among the densely crowded surface granules of *K. spinulata*.

**Measurements** — Carapace measurements (mm). Key: maximum length (L), maximum width (W), width of front (W1), fronto-orbital width (W2) and posterior width (W3). An asterisk (\*) indicates that the measurement was an approximation due to incomplete specimen. A blank (—) indicates a measurement could not be taken.

Specimen	L	W	W1	W2	W3
Holotype (UF 68421)	12.3	15.6	3.7	7.2	3.4
Paratype (UF 38959)	11.3	12.0*	—	6.4*	3.0*
Paratype (UF 68429)	6.4	7.7	1.1	3.9	3.0

Family Dynomenidae Ortmann, 1892  
Genus *Dynomene* Desmarest, 1823

**Type species** — *Dynomene hispida* Guérin-Méneville, 1832, by monotypy.

**Range** — Lower Middle Miocene to Recent.

*Dynomene variabilis* sp. nov.  
Figure 1/2

**Material** — Holotype, carapace UF 106705; paratypes, carapaces UF 38961, UF 72810, UF 73086, UF 73156,

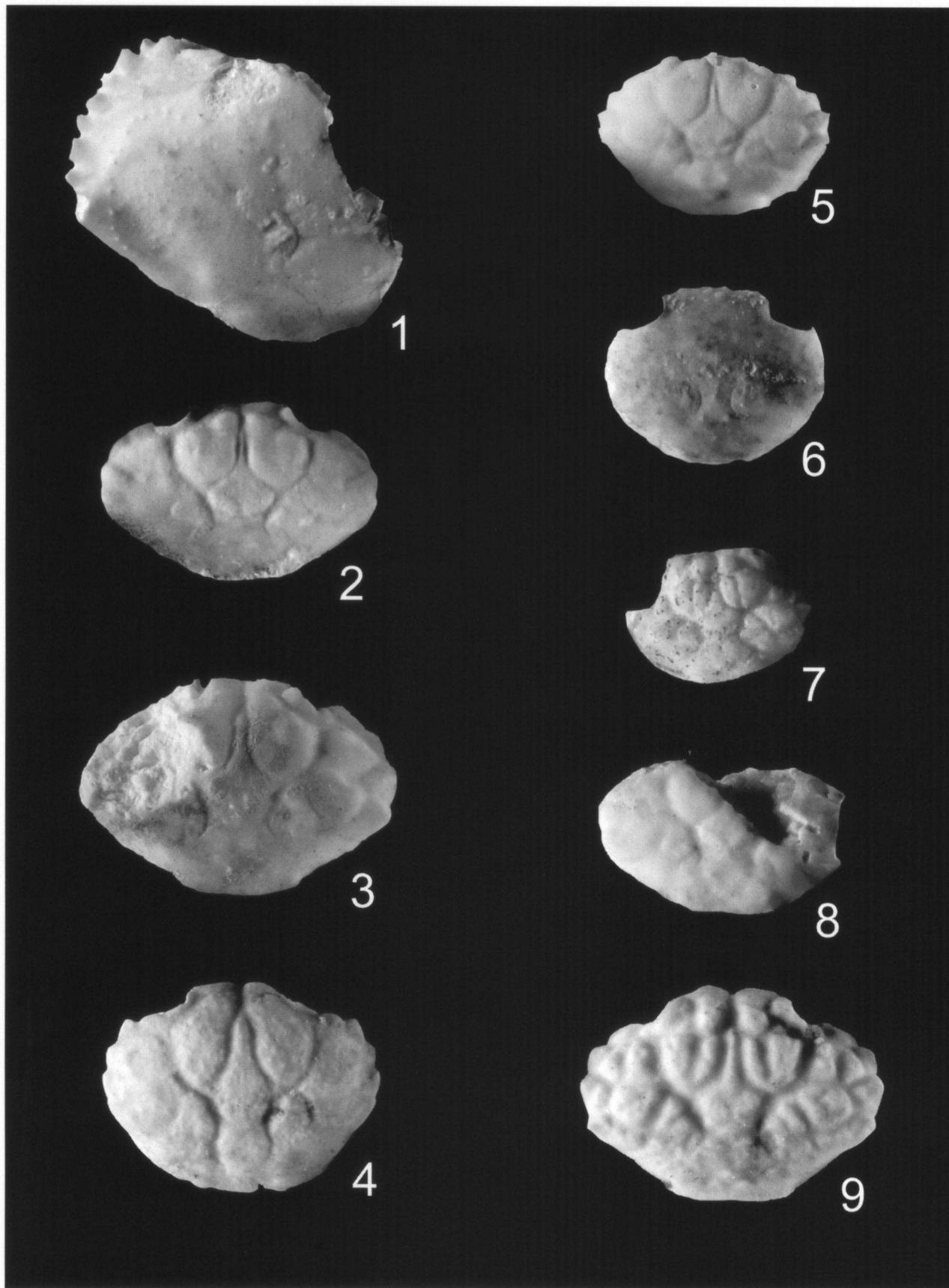
UF 73169, UF 80448, UF 80462, UF 104435, UF 106698, UF 106703, UF 106841 and UF 106844.

**Diagnosis** — Carapace wider than long, convex, subcircular, sparsely granulate to smooth. Lateral carapace margin with small spines or nodes. Front broadly triangular to rounded, spines absent; orbits well defined. Frontal groove shallow, bifurcated posteriorly; cervical, postcervical and branchial areas typically defined.

**Derivation of name** — Alluding to the ontological development of the carapace.

**Description** — Carapace wider than long (holotype L/W = 0.81); displays a degree of ontological development ranging from a subcircular carapace with vaulted longitudinal section to a transversely subhexagonal outline, weakly arched. The lateral ornament progresses from little more than nodes, the fourth and fifth barely developed, to forwardly directed spines diminishing in size posteriorly and a weak 'ridge' extending onto the dorsal surface from the fifth spine outlines the branchiocardiac furrow. The depressed orbitofrontal margin, following the general carapace curvature, occupies about two-thirds of the carapace width. An incipient frontal margin notch is more obvious as a weak sulcus in the upper edge, leading back between prominent, steep fronted epigastric lobes that, with the fragile front invariably not preserved, present a misleading appearance. The upper orbital margin, without notches, terminates in a sharp angle; the lower margin extends beyond the upper margin. Curving across the midline, opposite the fourth spine the cervical furrow turns forwards and outwards, and becomes obsolete before reaching the margin; a short spur defines the hepatic groove. Only the tip of the anteromesogastric process is preserved between the epigastric lobes. Larger individuals have three granules in an inverted triangle on the pentagonal cardiac region.

**Discussion** — There is considerable agreement in carapace outline, marginal spines and dorsal areolation of *D. variabilis* sp. nov. to those of *Dynomene emiliae* Müller, 1984, from the Upper 'Badenian' (Miocene) of Austria, which differs little more than having a more continuous hepatic furrow and less prominent branchiocardiac furrow and epigastric lobes.



**Figure 2.** Early Miocene crabs from the Montpelier Formation (White Limestone Group), Jamaica

- 1 - *Pseudoachelous schindleri* gen. et sp. nov., dorsal view of carapace, holotype, UF 80478, x 4.
- 2 - *Lophopanopeus corallinus* sp. nov., dorsal view of carapace, holotype, UF 106702, x 5.
- 3 - *Lophopanopeus toomeyorum* sp. nov., dorsal view of carapace, holotype, UF 68432, x 5.
- 4 - *Micropanope pulcherrima* sp. nov., dorsal view of carapace, holotype, UF 73087, x 5.
- 5 - *Panopeus nanus* sp. nov., dorsal view of carapace, holotype, UF 106687, x 6.
- 6 - *Trapezia prisca* sp. nov., dorsal view of carapace, holotype, UF 73097, x 5.
- 7 - *Actaeops frontalis* gen. et sp. nov., dorsal view of carapace, holotype, UF 106750, x 9.
- 8 - *Chlorodiella occidentalis* sp. nov., dorsal view of carapace, holotype, UF 80472, x 5.
- 9 - *Leptodius granulatus* sp. nov., dorsal view of carapace, holotype, UF 103968, x 5.

The front, where preserved, in *Dynomene shinobui* Karasawa, 1993 (Middle Miocene, Japan), would appear to be somewhat more advanced; the subdued marginal spines of the small specimen (Karasawa, 1993, pl. 6, fig. 12) are reminiscent of young forms of *D. variabilis* sp. nov. Both *D. emiliae* and *D. shinobui* are coral-associated species. *Hirsutodynomene ursula* is confined to the west coast of Mexico and the Galapagos Islands. Its highly sculptured surface immediately distinguishes it from the new species.

**Measurements** — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 106705)	8.5	10.5	3.8	6.5	3.7
Paratype (UF 80462)	5.5	6.5	2.3	4.4	2.4
Paratype (UF 106698)	5.8	6.5	2.8	4.7	2.4

Section Eubrachyura de Saint Laurent, 1980  
 Superfamily Leucosioidea Samouelle, 1819  
 Family Leucosiidae Samouelle, 1819  
 Genus *Duncania* gen. nov.

**Type species** — *Duncania jamaicensis* gen. et sp. nov.

**Diagnosis** — Carapace subcircular, subglobose with produced, bilobed front, lateral margins spinulate.

**Derivation of name** — Genus named for the type locality, near the town of Duncans, parish of Trelawny, Jamaica.

**Range** — Lower Miocene.

*Duncania jamaicensis* sp. nov.  
 Figure 1/3

**Material** — Holotype, and sole specimen known, is UF 103950.

**Diagnosis** — As for genus.

**Derivation of name** — For Jamaica.

**Description** — Carapace subcircular and subglobose,

wider than long (holotype L/W = 0.81). The bilobed front occupies about half of the orbitofrontal margin and is produced a little beyond the general curvature; a median notch forms a narrowly rounded V, and the rounded lateral angle leads to an oblique orbital margin with a notch close to the outer orbital spine. There are two minuscule granules on the very short, depressed anterolateral margin which terminates in a sharp angle. Convex posterolateral margins are finely beaded, beads interrupted by two spinules before a spine at the lateral angle, followed by two larger, triangular spines before and another at the posterior angle. The cervical furrow forms a shallow curve across the midline. From the lateral angle a crest extends to the frontal lobe leaving the hepatic region depressed; a second crest leading onto the metabranchial lobe rises to a low elevation. Mesogastric, protogastric and cardiac lobes are tumid. The lateral margins of the depressed urogastric and anterior part of the cardiac region are concave.

**Discussion** — The present new genus is most similar to *Ebalia* Leach, 1817. However, the bilobed front and spinulose lateral margins distinguish *D. jamaicensis* from all known members of *Ebalia*.

**Measurements** — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 103950)	5.2	6.4	1.8	3.0	—

Superfamily Majoidea Samouelle, 1819  
 Family Mithracidae Balss, 1929  
 Genus *Teleophrys* Stimpson, 1860

**Type species** — *Teleophrys cristulipes* Stimpson, 1860, by monotypy.

**Range** — Lower Miocene to Recent.

*Teleophrys acornis* sp. nov.  
 Figure 1/4

**Material** — Holotype, and only specimen known, is UF 106756.

*Diagnosis* — Carapace subpyriform, almost as wide as long; frontal margin with minute rostrum vertically inclined from weak marginal notch; no rostral horns.

*Derivation of name* — Indicating absence of rostral horns.

*Description* — Carapace subpyriform, as wide as long (holotype L/W = 1.0), weakly arched in both longitudinal and transverse sections. The orbitofrontal margin occupies about a half of the carapace width, the beaded, slightly produced front, weakly convex overall, has a pair of nodes either side of a weak median notch, the spaces between the nodes concave. A minute rostrum extends vertically from the median notch. The inner orbital angle is bluntly rounded; the short, oblique subcircular upper orbital margin has a blunt spine at midlength; the outer orbital spine is bluntly rounded. Anterolateral margin very short, convex with a median tubercle. Eleven evenly spaced granular spines line the boldly curved posterolateral margins, conjoining posteriorly to isolate the base of a circular intestinal margin from the true posterior margin, which has a slightly wider curve. A faint V-shaped cervical furrow, crossing the midline posterior to carapace midlength, becomes bolder at union with the cardiac furrow. The weaker hepatic furrow extends to the orbital margin. Hepatic and protogastric lobes are weakly tumid. The parallel-sided anteromesogastric process tapers to the frontal sulcus and a small trapezoidal mesogastric lobe is weakly defined. The V-shaped urogastric lobe is entirely hatchured by the respective muscle scars. There is a median tubercle on the shield-shaped cardiac region. Large epimesobranchial lobes, vaguely delimited from tumid branchial regions, are divided by a weak depression extending posterolaterally from the cardiac furrow.

*Discussion* — *Teleophrys acornis* sp. nov. has much in common with the small, extant *T. ornatus* Rathbun, 1901, presently recorded from Yucatán. The upper orbital margin of *T. acornis* sp. nov. is more distinctly divided than in Recent forms, but absence of prominent rostral horns, a prominent feature among *Mithrax* spp., more closely allies the new species with *Teleophrys*. Surface areolation of the new species has much in common with that of *Mithrax bahamensis* Rathbun, 1892, a rare Caribbean species, which is otherwise distinguished by its widely-spaced rostral horns and conspicuous sub-orbital spines.

*Measurements* — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 106756)	7.8	7.8	1.7	4.8	1.5

Genus *Mithrax* Desmarest, 1832

*Type species* — *Cancer aculeatus* Herbst, 1790 (= *Mithrax pilosus* Rathbun, 1892), by subsequent designation of H. Milne Edwards (1837).

*Range* — Lower Miocene to Recent.

*Mithrax donovani* sp. nov.  
Figure 1/5

*Material* — Holotype, and only specimen known, is UF 103958.

*Diagnosis* — Carapace pyriform with short, bifurcate rostral horns and a straight frontal edge before broad, triangular inner orbital spines; upper orbital margin with a deep notch and closed fissure; outer orbital spine long; lobes, except mesobranchial with spiniform tubercles or granules.

*Derivation of name* — The species is named in honour of Stephen K. Donovan for his many contributions to our knowledge of Caribbean palaeontology and geology.

*Description* — Carapace longer than wide (holotype L/W = 1.29), pyriform in outline, longitudinal section gently curved posteriorly, more so anteriorly, weakly arched transversely. Short, rounded-triangular rostral horns separated by a V-shaped notch leading to a sinus extending a short way onto the dorsal surface; laterally, they turn sharply into an almost transverse frontal margin terminating in a broad, triangular, outwardly directed inner orbital spine. A deep U-shaped notch in the upper orbital margin is closely followed by a closed fissure before a long, curving, outer orbital spine. The anterolateral margin curves to a spine on the hepatic margin and slants into the cervical notch. The posterolateral margin curves broadly to a (damaged) narrow posterior margin. A deep cervical furrow curving back from the margin turns abruptly round the base of the mesogastric lobe, where it is very shallow and has a pair of gastric pits close to the mid-line. The much shallower branchiocardiac furrow, bounded part way by a metabranchial ridge, terminates at deep grooves bounding the uro-cardiac region. The tip of the slender anteromesogastric process barely extends into the frontal sinus. There is a weak median tubercle flanked by two in line on each protogastric lobe. The larger, hinder tubercle on the mesogastric lobe is bifurcated. The epibranchial lobes have a tubercle close to the margin and three, the median the largest, on the metabranchial lobes follow the curve of the branchiocardiac furrow. A shallow groove separates the median-tuberculated urogastric lobe from an almost circular cardiac region, which has two tubercles in line. There is a transverse pair of tubercles on the intestinal lobe. Granules scattered over the dorsal surface are denser on the meso-epibranchial areas.

*Discussion* — *Mithrax donovani* sp. nov. has much in common with the proportionately narrower, more pyri-

form members of the genus, such as *M. acuticornis* and *M. spinipes*. The absence of prominent suborbital spines on *M. donovani* sp. nov. considerably effects 'first-sight' comparison. From the above-mentioned species, *M. donovani* sp. nov. differs in having a wider front, a longer outer orbital spine; additionally, from the former, in the reduced number of dorsal tubercles. Distribution of the tubercles, particularly the transverse row across the protogastric lobes, more closely approximates that of *M. spinipes* from which *M. donovani* sp. nov. differs in having the hepatic spine reduced to a node and a rather more obvious branchiocardiac furrow.

*Measurements* — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 103958)	8.8	6.8	3.2	4.6	2.2*

***Mithrax unguis* sp. nov.**

Figure 1/6

*Material* — Holotype, carapace UF 106697; paratypes, carapaces UF 68417, UF 73089, UF 73165, UF 103955, UF 106768, UF 106772 and UF 111483.

*Diagnosis* — Carapace pyriform with six spines on lateral margin; rostral spines delicate distally to broad triangular base projecting not much beyond inner orbital spines; protogastric and metabranchial lobes tuberculated.

*Derivation of name* — Referring to the hooked appearance of the lateral spines.

*Description* — Carapace slightly wider than long (holotype L/W = 0.91), outline pyriform, gently arched in both longitudinal and transverse sections. Width between spines slightly exceeds length to base of rostrum. Rostral horns short and delicate distally, becoming broad-triangularly based and extending shortly as 'ridges' onto the protogastric lobes. Horns not projecting much beyond triangular, obliquely directed inner orbital spines. There are two delicate spines on the oblique, sinuous upper orbital margin to a weak notch and blunt outer spine. There is a spine on the hepatic margin and five fine, forward curving spines line the posterolateral margins which curve broadly to a narrow posterior margin. A deep cervical furrow forms a flat-bottomed V across the midline. A granule occupies the hepatic region; there is one median granule between the bases of the protogastric 'ridges' and a cluster on each protogastric lobe; three granules, in an inverted triangle, occupy the ovate cardiac region and a line of three on each metabranchial lobe runs parallel with one on narrow, oblique epibranchial lobes, which are vaguely separated from somewhat longer mesobranchial lobes. The posterior parts of meta-

branchial lobes have a group of tubercles and there is a pair on the intestinal lobe.

*Discussion* — The new species has much in common with extant *Mithrax hispidus* (Delaware Bay to Rio de Janeiro). It differs little more than in the arrangement of the anterolateral spines, the first and second of which in *M. hispidus* have wide bases giving rise to trifid spinules. A similar arrangement occurs in the closely related *M. brasiliensis* Rathbun, 1892, a rare species apparently confined between the Bay of Bahia and Rio de Janeiro (Rathbun, 1925). The wide bases of the first and second lateral spines of *M. hispidus* figured by Collins & Morris (1976) from the Coral Rock of Barbados indicates division of the spines to have been well advanced by the Pleistocene.

*Measurements* — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 106697)	11.8	13.0	3.7	6.8	2.0*
Paratype (UF 68417)	-	14.0	-	-	2.7
Paratype (UF 73089)	11.3	12.8	4.0*	7.0*	2.8

Superfamily Parthenopoidea MacLeay, 1838

Family Dairidae Ng & Rodriguez, 1986

Genus *Daira* de Haan, 1833

*Type species* — *Cancer perlatus* Herbst, 1790, by monotypy.

*Range* — Eocene to Recent.

***Daira vulgaris* sp. nov.**

Figure 1/7, 8

*Material* — Holotype, carapace UF 68349; paratypes, carapaces UF 68357, UF 68363, UF 68364, UF 68365, UF 68367, UF 68442, UF 68446, UF 68474, UF 73093, UF 73153, UF 73162, UF 73168, UF 73174, UF 80461, UF 80449, UF 103948, UF 103949, UF 103954, UF 103964, UF 103965, UF 103966, UF 103967, UF 104433, UF 106693, UF 106695, UF 106704, UF 106706, UF 106707, UF 106711, UF 106769 and UF 106843; paratypes, attributed claws UF 68356, UF 104440 and UF 106773.

*Diagnosis* — Carapace transversely ovate with flattened tubercles of varying size forming longitudinal and transverse rows anteriorly; tubercles on metabranchial region contrastingly smaller; anterolateral margins lined with tridentate spinules.

*Derivation of name* — Indicating a very common species.

*Description of carapace* — Transversely ovate, gently arched longitudinally, flattened transversely with rounded marginal sides, nearly two-thirds broader than long (holotype L/W = 0.70). The orbitofrontal margin takes up rather more than a half of the carapace width and the orbits occupy the outer fourths. Front weakly bilobed with nearly straight sides. Upper orbital margins thickened and lined with flattened tubercles. Antero- and posterolateral margins broadly rounded, the crenulations normal to the genus produced to spinules arranged in groups of three, the median the largest. One or two single spines occur immediately behind the lateral angle. Dorsal lobes are moderately well-defined, but crowded with flattened tubercles of varying diameters. The cervical furrow runs straight across the midline, turns forwards besides an ovate mesogastric angle, then curves smoothly to the margin. The anteromesogastric process is embraced by a dividing sulcus extending from frontal notch. The largest tubercles occur on the epi- and mesobranchial lobes. More or less even sized tubercles on the protogastric lobes are arranged in transverse and longitudinal rows with granules scattered between the longitudinal rows. Three relatively large tubercles on the urogastric lobe are bounded by four smaller ones; there is a fused cluster of tubercles anteriorly on the lingulate cardiac region and a fused row lining its margins encloses a group of various sized granules. Two or three rows of tubercles on the metabranchial lobes are contrastingly smaller.

*Description of limb fragments* — Distal height of right merus (UF 104440), preserved with associated carpus, is about 5/8th of the length, slightly tapering proximally; lower margin gently convex, upper margin nearly straight with three tubercles and a slim distal hook overhanging carpus; tubercles arranged in rows on outer surface, decreasing in size as they continue to the lower inner margin, becoming granulated proximally. Carpus length equals distal height of merus, a little longer than high; tubercles generally larger than on merus.

Propodus (UF 68356) one and a half times length and height of carpus; upper margin curved with a small carpal and four large, blunt spines reducing in height distally. The interdigital margin is convex with three to four spines. Fixed finger a little less than half the length of manus, smooth. Upper margin of dactylus is concave with a median spine, tip rounded; occludent margin concave, producing a slight gape.

*Discussion* — The Recent *Daira americana*, ranging from southern California to Ecuador (Rathbun, 1930), differs considerably in the arrangement of surface ornament. Anterior tubercles are generally smaller, less linearly arranged and the size of the metabranchial tubercles is more coincident with others on the carapace. A greater conformity in size and distribution of granules occurs in *D. perlata* (Herbst, 1790; q.v. Karasawa, 2000), a Recent Indo-West Pacific species. The Pacific species and *D. vulgaris* sp. nov. are further distinguished

in having a more obvious linear arrangement that more clearly defines hepatic furrows. *Daira vulgaris* sp. nov. differs from the European Miocene *D. speciosa* (Reuss, 1871) in having a denser alignment of gastric tubercles, larger epi- and mesobranchial tubercles and a sharper delineation of these from smaller metabranchial tubercles. The ornament of *D. eocenica* (Lorenthey, 1897) (Müller & Collins, 1991, pl. 4) consists of irregularly rounded tubercles, the size of which differs considerably from the figure in Lorenthey & Beurlen (1929, pl. 12) which, however, depicts sharp, well-spaced marginal spines. Disassociated limb fragments in the collection can safely be attributed to *Daira*.

*Measurements* — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 68349)	14.3	20.4	5.8	11.4	6.0
Paratype (UF 104433)	11.8	17.5	5.4	10.0	4.7
Paratype (UF 106706)	11.0	15.5	4.4	10.3	4.0

Superfamily Portunoidea Rafinesque, 1815

Family Portunidae Rafinesque, 1815

Genus *Pseudoachelous* gen. nov.

*Type species* — *Pseudoachelous schindleri* gen. et sp. nov.

*Diagnosis* — Carapace with eight anterolateral spines increasing in size posteriorly, a linear ornament of granules on branchial region and behind orbits.

*Derivation of name* — Indicating a (probably misleading) likeness to *Achelous*.

*Range* — Lower Miocene.

*Pseudoachelous schindleri* sp. nov.

Figure 2/1

*Material* — Holotype, a partial left longitudinal carapace UF 80478; paratype, carapace UF 111487.

*Diagnosis* — As for genus.

*Derivation of name* — This species is named after Kevin S. Schindler for his years of dedicated service to the Invertebrate Paleontology Division at the FLMNH. He was instrumental in assisting RWP with collecting many of the crabs described herein.

*Description* — Orbitofrontal margin largely missing; orbit small, circular with a notch in the upper margin close to a (stout) outer orbital spine. The anterolateral margin is gently convex. U-shaped notches separate eight peg-like? spines increasing in size posteriorly; as

indicated by their bases, these are alternately wide and narrow. Straight posterolateral margins converge to broadly rounded posterior angles, the mid-arc point seemingly occurring in line with the orbit. The posterior margin is broadly concave and bounded with a fine ridge. On the dorsal surface a row of even-sized granules extends from near the lateral edge level with the lateral angle forwards and gradually inwards to about level with the fifth spine. A ridge of close set granules from the second spine encircles the orbit. A posterior row of five or six granules curves more or less parallel to the posterolateral margin. A vague cardiac furrow, or outline of an attenuated portion of the cardiac region, occurs opposite midlength of the posterolateral margin.

*Discussion* — An arrangement of eight anterolateral spines of alternating width is apparently common to several Caribbean species of *Achelous* de Haan, 1833 (Rathbun, 1930). This feature and carapace proportions place the present carapace fragment near to *Achelous*, but its virtually smooth surface allows no comparison of dorsal characters well developed in members of that genus.

*Measurements* — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 80478)	15.5*	10.0*	-	-	5.1

Superfamily Xanthoidea MacLeay, 1838  
 Family Panopeidae Ortmann, 1893  
 Genus *Lophopanopeus* Rathbun, 1898

*Type species* — *Xantho bella* Stimpson, 1860, by original designation.

*Range* — Eocene to Recent.

*Lophopanopeus corallinus* sp. nov.  
 Figure 2/2

*Material* — Holotype, carapace UF 106702.

*Diagnosis* — Carapace hexagonal, wider than long, convex, front bilobed, regions distinct.

*Derivation of name* — Refers to its occurrence among fossil corals at the type locality.

*Description* — Carapace rounded hexagonal, length over half carapace width (holotype L/W = 0.67), weakly arched in longitudinal and transverse sections. Front occupies the median half of the wide orbitofrontal margin which takes up 69% (6.7 mm) of carapace width, weakly sinuous to sharp corners of notch before a thin, upturned upper orbital margin; there are no obvious fissures, but a

weak deviation of curvature occurs coincident with hepatic furrow; outer orbital angle blunt. A shallow depression bounds front and orbits. The anterolateral margin is divided into three lobes, median longest. Posterolateral margins converge to sharp posterior angles. The weakly concave posterior margin is a little narrower than the front. The lobes are clearly defined. The cervical furrow, shallow and convex across the midline to outer angles of the mesogastric lobe, deepens and turns straight outwards and forwards to union with the hepatic furrow, then runs concave to the margin. Large, trapezoidal hepatic and protogastric lobes are weakly bilobed anteriorly. The subpentagonal mesogastric lobe is weakly bilobed basally and the slender anterior process tapers to base of curved, steep-fronted epigastric lobes. A narrow urogastric lobe is clearly separated from the heart-shaped cardiac region that has three low granules in an inverted triangle and there is a granule on each protogastric lobe. The third marginal lobe forms the epibranchial lobe and large metabranchial lobes are weakly subdivided by a posterior extension of the hepatic furrow.

*Discussion* — The anterolateral margins of the species presently assigned to *Lophopanopeus* are more globose than normally accepted for the genus, but the loss of a sharp, triangular-spine appearance may be accounted for by loss of shell thickness. The lobation and frontal region of *L. corallinus* sp. nov. can be compared with *L. maculatus* Rathbun, 1898 (vide Hickman & Zimmerman, 2000), a Pacific coast species.

*Measurements* — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 106702)	6.5	9.7	3.4	6.7	2.5*

*Lophopanopeus toomeyorum* sp. nov.  
 Figure 2/3

*Material* — Holotype, and sole specimen known, is carapace UF 68432.

*Diagnosis* — Carapace subhexagonal, anterolateral spines lobate to bluntly triangular, epigastric lobes triangular.

*Derivation of name* — Named in honour of Barbara and Reed Toomey, along with their son James, for contributions aiding in the study of Jamaican palaeontology.

*Description* — Carapace subhexagonal, longitudinally and transversely weakly arched, wider than long (holotype L/W = 0.72). The orbitofrontal margin occupies about 59% of the carapace width, with the front, in line with the curvature, taking up the median half. The front has a narrow median notch and weakly convex sides terminating in rounded angles to a thickened, oblique

upper orbital margin, pierced by two notches, the median opposite hepatic furrow. Of the five anterolateral spines illustrated by Rathbun (1930, p. 319), the first and second (D and E) are coalesced; third and fourth are about the same length, the third is lobate and fourth at lateral angle, rather more triangular; the fifth is smaller and bluntly triangular. Lobes well demarcated. The cervical groove curves across the midline 3/5th distance from the front, turns sharply outward at anterior 'angle' of ovate mesogastric lobe, curves gently round the ovate mesobranchial lobe, then runs sharply forward to the margin. The slightly tapering anteromesogastric process extends midway between triangular epigastric lobes. Ovate protogastric lobes are slightly smaller than triangular hepatic region. The epibrachial lobe is diamond-shaped and there is a small node inserted between the mesobranchial and urocardiac junctures; the cardiac region is rounded triangle with rounded, tumid posterior angles.

*Discussion* — There is considerable difference in carapace proportions and surface detail from *Lophopanopeus corallinus* sp. nov. Surface differences from *L. corallinus* sp. nov. include thickening of the upper orbital margin, with a larger median notch, a more distinct first anterolateral spine, triangular epigastric lobes and a more distinct mesogastric lobe. There is some similarity to *L. lockingtoni* Rathbun, 1901, from which *L. toomeyorum* sp. nov. is differentiated in having well-developed anterolateral spines and a small ovate mesogastric lobe.

*Measurements* — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 68432)	8.0	11.1	4.0	6.6*	2.5

Genus *Micropanope* Stimpson, 1871

*Type species* — *Micropanope sculptipes* Stimpson, 1871, by original designation.

*Range* — Lower Miocene to Recent.

*Micropanope pulcherrima* sp. nov.  
Figure 2/4

*Material* — Holotype, and only specimen known, is UF 73087.

*Diagnosis* — Frontal margin with prominent U-shaped notch; third anterolateral spine diminutive.

*Derivation of name* — Refers to its delicate beauty.

*Description* — Carapace rounded hexagonal, wider than long (holotype L/W = 0.77), transversely and longitudinally weakly arched. Orbitofrontal margin wide, occu-

pying 8/10th of carapace width of which the front takes up the median third; there is a deep U-shaped median notch with a sulcus leading onto a wide postfrontal depression. The inner orbital angle is smoothly rounded; the first of two notches in the slightly receding upper margin is coincident with the conspicuous hepatic furrow; the second notch occurs at base of a triangular outer orbital spine. The first and second anterolateral spines are more or less even-sized, the third is reduced and bluntly rounded. Posterolateral margins are longer than anterolateral, weakly concave medially and converging to rounded posterior angles. Posterior margin damaged. Dorsal lobes well-defined and steep-fronted. Cervical furrow shallow and narrowly curved round the base of flask-shaped mesogastric lobe; after a basal constriction, the anterior process tapers to the front of the protogastric lobes. The urogastric lobe follows almost U-shaped basal curve of the mesogastric lobe and the cardiac region is lingulate. Flattened, even-sized granules cover the dorsal surface.

*Discussion* — *Micropanope pulcherrima* sp. nov. shares characters with Recent *Micropanope* spp. throughout the Caribbean and, particularly, with *M. granulimanus* (Stimpson, 1871). The front of *M. granulimanus* is not so produced; the median notch is shallower and internal orbital angle rounded.

*Measurements* — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 73087)	7.2	9.4	3.5	7.6	3.3*

Genus *Panopeus* H. Milne Edwards, 1834

*Type species* — *Panopeus herbstii* H. Milne Edwards, 1834, by subsequent designation.

*Range* — Paleocene to Recent.

*Panopeus nanus* sp. nov.  
Figure 2/5

*Material* — Holotype, carapace UF 106687; paratypes, carapaces UF 73090 and UF 106696.

*Diagnosis* — Carapace subhexagonal, moderately wide, anterolateral margins with five teeth.

*Derivation of name* — Denotes diminutive size of this species.

*Description* — Carapace subhexagonal, wider than long (holotype L/W = 0.72), front in line with carapace curvature. The front, taking up the median half of the orbitofrontal margin, has a U-shaped median notch, weakly

sinuous sides terminate in a sharp angle before a preorbital notch; there are two fissures in the thin, raised upper orbital margin; no spine is present at outer orbital angle. Four spines on the anterolateral margin develop from obscure to triangular, the fourth narrower than the third; a thin 'ridge' continuing from the fifth spine partially embraces the epibranchial lobe. The posterolateral margins curve gently to weak coxigeal embayments. The cervical furrow curves broadly across the midline, turns sharply out and is sinuous to the margin. Epigastric, protogastric, hepatic and epibranchial lobes all steep-fronted. The protogastric lobes are partially divided anteriorly. The mesogastric lobe is flask-shaped; its tapering tip does not reach the epigastric lobes. A urogastric lobe follows the basal curve of the mesogastric lobe and the rounded-pentagonal cardiac region is a little wider than the mesogastric region.

*Discussion* — The steep fronts and general disposition of the lobes have all the aspects of some Recent Caribbean *Panopeus* spp. A similar arrangement of lateral spines is seen on *P. occidentalis* de Saussure, 1857 (presently ranging from Florida to Brazil), but that species lacks the median frontal notch. An internal cast of *Panopeus wronai* Müller, 1984 (pl. 83, fig. 2), from the Middle Miocene ('Badenian') of Austria, differs markedly in the apparent absence of transverse ridges typical of *Panopeus* which are prominent on a cast of an external mould figured in the same paper (Müller, 1984, pl. 82, figs 3, 4). In this respect, together with general appearance of lobes, the internal cast has much in common with *P. nanus* sp. nov.

*Measurements* — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 106687)5.0	6.9	2.3*	4.3	2.0	
Paratype (UF 73090) 4.4*	6.0	-	4.1	1.8	
Paratype (UF 106696) 4.2	5.3	2.1	3.7	1.3	

Family Trapeziidae Miers, 1886  
Genus *Trapezia* Latreille, 1825

*Type species* — *Trapezia dentifrons* Latreille, 1825 (= *Trapezia cymodoce* (Herbst, 1801)).

*Range* — Lower Miocene to Recent.

*Trapezia prisca* sp. nov.  
Figure 2/6

*Material* — Holotype, carapace UF 73097; paratypes, carapaces UF 73088, UF 73091, UF 106701, UF 106767, UF 106774, UF 111484, UF 111485 and UF 111486.

*Diagnosis* — Carapace wider than long, orbitofrontal margin a little less than greatest carapace width, frontal margin produced with two pairs of small lobes, the inner pair slightly in advance; upper orbital margin subovate; lateral margins boldly curved, interrupted only by minute spine at widest part of carapace; posterior margin narrow, weakly concave.

*Derivation of name* — The species name means ancient.

*Description* — Carapace rounded pentagonal, wider than long (holotype L/W = 0.82), longitudinally and transversely flatly arched. The orbitofrontal margin a little less than greatest width of carapace; the projected front has two pairs of rounded lobes, the spaces between are weakly concave and the median pair is slightly in advance. Anterolateral margins weakly convex to a minute spine at the lateral angle. Lateral angle and posterolateral margin broadly rounded, particularly in maturer forms, into a narrow, almost straight posterior margin. The dorsal surface is smooth with a vague outline of the cardiac region probably absorbed by shell thickness.

*Discussion* — There is a marked resemblance of *T. prisca* sp. nov. to the Late Miocene *T. glaessneri* Müller, 1976, from which the Duncans *Trapezia* may be distinguished in having a comparatively straighter, distinctly four lobed frontal margin, rather than the six lobed margin of the younger species. The orbitofrontal margin of the early Middle Miocene *T. brevispinosa* Karasawa, 1993, from Japan, is smoother and relatively narrower than that of *T. prisca* sp. nov. and the anterolateral margins are convex rather than subparallel. In carapace outline, *T. prisca* sp. nov. also closely resembles *T. maculata* (MacLeay, 1838) (vide Rathbun, 1930, pl. 228), whose range includes the Red Sea and Indo-Pacific Ocean. However, *T. maculata* differs from *T. prisca* sp. nov. in having less boldly curved posterolateral margins and angles, and in details of the front which in the latter species more nearly resembles *T. cymodoce feruginea*. There is also a remarkable resemblance of the carapace outline of *T. prisca* sp. nov. to that of *Quadrella nitida*, particularly as illustrated in Hickman & Zimmerman (2000, p. 123), in which the rounded outline is sharply in contrast with Rathbun's figures (1930, pl. 229). While quadrilobate, the frontal margin of *Q. nitida* is comparatively spinose.

The fossil range of *Trapezia* is now extended from the lower Middle Miocene, while the present range of North American species is confined to the central Pacific region. Müller (1984) stated that modern *Trapezia* spp. are commensal with seriatopod (= pocilloporid) corals (Garth, 1974), which (with the exception of *Madracis*) no longer occur in the Caribbean. This may explain the absence of *Trapezia* from the region today.

*Measurements* — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 73097)	6.5	7.9	3.9	7.0	3.3
Paratype (UF 73088)	4.4	5.4	2.4	4.7	1.9
Paratype (UF 73091)	4.4	5.3	2.6	4.7	1.6

Family Xanthidae MacLeay, 1838  
Genus *Actaeops* gen. nov.

*Type species* — *Actaeops frontalis* gen. et sp. nov.

*Diagnosis* — Carapace subhexagonal with broad, orbito-frontal margin, produced frontal margin and oblique orbits. Dorsal surface strongly areolated.

*Derivation of name* — Indicating characters in common with *Actaea* and *Medaeops*.

*Range* — Lower Miocene.

*Actaeops frontalis* sp. nov.  
Figure 2/7

*Material* — Holotype, and sole specimen known, is carapace UF 106750.

*Diagnosis* — As for genus.

*Derivation of name* — Indicating a wide front.

*Description* — Carapace subhexagonal in outline; moderately arched in longitudinal and transverse sections; wider than long (holotype L/W = 0.81), widest about midlength. The orbitofrontal margin occupies almost 65% of the carapace width, of which the produced front, occupying nearly two-thirds, is almost straight with a minute median notch and a notch leading to a groove bounding a thick, oblique upper orbital margin. Outer orbital angle rounded into a concave anterolateral margin with a blunt node. The posterolateral margins curve broadly into a narrow, concave posterior margin. The cervical furrow crosses the midline in its posterior third, turns sharply forwards to the mesogastric angle, then obliquely out to junction with deep hepatic furrows and curves smoothly to the margin. The lobes are well-defined and subdivided lobation (after Dana, 1852, *vide* Rathbun, 1930, p. 6) indicates a narrow 1F, 2F and 1M increase in length; 2M (of protogastric) is further divided longitudinally. The mesogastric lobe (3M) is broadly ovate and its anterior process tapers to the base of 1M. The hepatic region (L) has two lobes, the median clefted anteriorly. Two narrow, depressed urogastric lobes (4M) are attenuated laterally and the heart-shaped cardiac region (1P) is longitudinally divided. Paired intestinal lobes (2P) lay close to the posterior margin. There is a rectangular lobule next to 2F and 1M, and the area occupied by 1L and 3L is depressed. Just anterior to the lateral angle more-or-less equal sized 4L and 5L are

bounded by a ridge formed by 1R and 2R on the meta-branchial lobe.

*Discussion* — Both *Actaea* de Haan, 1833, and *Medaeops* Guinot, 1967, are established genera in the Miocene of Japan and/or Tethys, but only *Actaea* is represented in the extant fauna of Jamaica (Rathbun, 1930). The subhexagonal carapace outline of this new genus, *Actaeops*, more closely approaches that of *Medaeops*, from which it is immediately distinguished by the greater width of the orbitofrontal margin and elongated orbital margin. The frontal lobation of the new genus complies more or less with that of both *Medaeops* and *Actaea*, but the latter differs in having a more circular carapace and narrower orbitofrontal margin.

*Measurements* — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 106750)	3.0	3.7	1.7	2.4	1.0

Genus *Chlorodiella* Rathbun, 1894

*Type species* — *Cancer niger* Forskål, 1775, by original designation.

*Range* — Lower Miocene to Recent.

*Chlorodiella occidentalis* sp. nov.  
Figure 2/8

*Material* — Holotype, left half of carapace UF 80472; paratypes, carapaces UF 80460, UF 68340 and UF 68423.

*Diagnosis* — Carapace rounded ovate, four subdued marginal lobes; steep-fronted ridges running parallel to anterolateral margin.

*Derivation of name* — Denoting the first known western fossil species of the genus.

*Description* — Carapace transversely ovate, length less than two-thirds of width (holotype L/W = 0.63), widest about mid-carapace length; weakly arched longitudinally, transversely nearly flat. The front (not well-preserved) takes up the median third? of the orbitofrontal margin which occupies slightly more than 75% of the carapace width. A median sulcus divides round tip of a long, narrow anteromesogastric process. Elongate, ovate orbits set slightly obliquely to the front; upper orbital margin thin, raised, without notches and bounded by a narrow depression. No spine at outer orbital angle; short anterolateral margins have two suppressed spines, the second the more conspicuous. From a blunt spine at the lateral angle, a steep-fronted ridge bounding the margin

thickens opposite the marginal spines; following a gap caused by the hepatic furrow, the ridge is continued by steep-fronted epigastric lobes. Anterior to the 'gap' is a steep-fronted angular 'ridge'. From a basal scar of a (possibly) similar spine behind that at the lateral angle, a lower, short ridge runs parallel to the lateral one. Weakly sinuous posterolateral margins lead to rounded posterior angle and a narrow concave posterior margin.

*Discussion* — Among fossil species ascribed to *Chlorodiella*, *C. occidentalis* sp. nov. compares favourably with the relatively small *C. juglans* Müller, 1984 (Upper Miocene, Hungary). However, the 'ridge' bounding the margin is more tumid, interrupted also by the cervical furrow, and approaching the transverse appearance of the contemporary *C. mediterranea* (Lorenthey in Lorenthey & Beurlen, 1929), but there remains the typical distinct depression before the margin. *Chlorodiella occidentalis* sp. nov. differs from the Recent *C. longimana* (H. Milne Edwards, 1834), presently ranging from Florida and the West Indies to Curaçao and across to West Africa (Rathbun, 1930), in having a less angular carapace outline and ridges extending more or less in line with anterolateral margin curvature, rather than transverse as in *C. longimana*.

*Measurements* — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 80472)	5.5*	8.8*	-	7.0*	2.3
Paratype (UF 68340)	-	11.0	-	-	2.6

Genus *Leptodius* A. Milne Edwards, 1863

*Type species* — *Chlorodius exaractus* H. Milne Edwards, 1834, by original designation.

*Range* — Lower Miocene to Recent.

*Leptodius granulatus* sp. nov.

Figure 2/9

*Material* — Holotype, carapace UF 103968; paratype, carapace UF68434.

*Diagnosis* — Front slightly advanced, protogastric lobes deeply divided; lobes granulate.

*Derivation of name* — With reference to its granulated lobes.

*Description* — Carapace weakly arched in longitudinal and transverse sections, wider than long (holotype L/W = 0.71). The orbitofrontal margin is slightly produced beyond curvature of anterolateral margins; the front has a narrow U-shaped median notch, slightly concave sides

lead to a weak notch terminating in a groove round thickened, oblique upper orbital margins. There is a fissure before the sharp outer orbital angle and another shortly median to it; orbits ovate. Anterolateral margins are well-rounded with three blunt, triangular spines; a weak ridge from the third spine bounds the epibranchial lobe. The posterolateral margins converge almost straight to narrowly rounded posterior angles, posterior margin is slightly concave. Dorsal lobes are well-defined. The cervical furrow, almost straight across the midline, turns sharply forward, then outwards to the margin. Equally strong hepatic furrows reach the orbital margin. Tip of the anteromesogastric process tapers to base of steep-fronted epigastric lobes; the protogastric lobes are deeply divided, front of inner lobe weakly tumid, front of outer lobe not quite so steep as epigastric lobes. A large, triangular hepatic lobe is bilobed anteriorly, and the flask-shaped mesogastric lobe is divided medially and from its anterior process. A narrow urogastric lobe is distinctly defined from the heart-shaped cardiac region that has three tubercles in an inverted triangle. Large mesobranchial lobes, deeply divided medially, have a small extension between the urogastric and cardiac regions. The depressed base of the metabranchial lobes is bounded by a narrow intestinal ridge. Minute, even-sized granules crown the lobes.

*Discussion* — The general characters of *L. granulatus* sp. nov. are consistent with other species of this relatively common Caribbean genus. However, a distinguishing feature is the granulated surface that could well be obscured by shell thickness. *Leptodius morrisoni* Karasawa, 1993, from the lower Middle Miocene of Japan, is readily distinguished by five anterolateral spines and a trilobed protogastric lobe. *Leptodius crosnieri* Karasawa, 1993, from the same horizon and location in Japan, differs in having a long, but weakly clefted protogastric lobe and a smooth dorsal surface. Both Japanese species are coral-associated forms.

*Measurements* — Carapace measurements (mm). Abbreviations as above.

Specimen	L	W	W1	W2	W3
Holotype (UF 103968)	7.7	10.8	3.9	6.6	3.9
Paratype (UF 68434)	11.9*	18.0*	-	9.9	-

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