Additions to the fossil decapod crustacean fauna of New Zealand

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Abstract Five new species of decapod crustaceans are described from New Zealand: *Glyphea stilwelli*, from the Paleocene of Otago, *Homolodromia novaezelandica* and *Torynomma planata*, from the Late Cretaceous near Hawke's Bay, *Calappilia maxwelli*, from the Miocene of Kaipara Harbour, and *Actinotocarcinus maclauchlani*, from the Miocene of Motunau Beach. The sternum of *Hemioon novozelandicus* Glaessner and the ventral surface of a male specimen of *Miograpsus papaka* Fleming are illustrated for the first time. *Torynomma flemingi* Glaessner is noted from a new locality in Northland. The occurrence of *Glyphea stilwelli* represents the first record of a Paleocene decapod in New Zealand and the first record of that genus in the Paleocene.

Keywords Decapoda; Macrura; Brachyura; Glypheidae; Homolodromiidae; Raninidae; Torynommidae; Calappidae; Majidae; Grapsidae; Cretaceous; Paleocene; Miocene; New Zealand; systematic paleontology

INTRODUCTION

Fossil decapod crustaceans in New Zealand are rather well known. Although they could not be considered common fossils, a recent compilation (Feldmann & Keyes 1992) has identified over 230 localities from which crustacean remains have been collected. At these localities, 81 species-level taxa have been identified, of which 39 species have been named. They are arrayed within 40 genera and 21 families.

During the course of that compilation, several taxa were examined, and referred to genera, without species identification. In some instances, the quality and completeness of the material was such that it was not felt possible to make an accurate species identification. In other cases, it was judged that description and notification of new species should be made in another, more appropriate publication. In addition to the material recognised within the compilation, additional material has been collected subsequent to that publication that also contains new species. Therefore, it is the purpose of this work to identify and describe several new species of decapod crustaceans from New Zealand as well as to comment on the species-level placement of several specimens into previously named taxa. In addition, extensions of geologic and geographic ranges as well as emendations to descriptions of named species are provided.

The fossils described herein range in age from Late Cretaceous through Miocene, and do not necessarily bear any relationship to one another, except for the fact that they are all decapod crustaceans. Three occurrences are notable, however.

Two new species of crabs are described from Cretaceous rocks, from inland Hawke's Bay. This fauna contains six species, represented by well-preserved material, making it the most diverse Cretaceous fauna known from New Zealand. The quality of the preservation and the diversity of the fauna suggest that additional collecting of this locality might be warranted.

A single species of glypheid lobster is described from Paleocene rocks in Otago. This represents the first record of Paleocene decapod crustaceans from New Zealand and extends the geologic range of the genus *Glyphea* into the Cenozoic. Neither the locality from which this specimen was collected, nor the lobster, had been noted in Feldmann & Keyes (1992).

Finally, new specimens of crabs collected from Kaipara Harbour, Northland, are referred to the family Calappidae. This occurrence represents the only published occurrence of a member of this family from New Zealand and documents a Tethyan species in New Zealand during the Miocene. There are no published occurrences of calappids living in New Zealand today; however, Feldmann & McLay (1993) refer to an unpublished record of a living species.

SYSTEMATIC PALEONTOLOGY

Infraorder **PALINURA** Latreille, 1803
Superfamily **GLYPHEOIDEA** Winckler, 1883
Family **GLYPHEIDAE** Winckler, 1883
Genus *Glyphea* von Meyer, 1835

Glyphea stilwelli n. sp.   Fig. 1–2

DIAGNOSIS: Glypheid with weakly developed postcervical groove, and cephalic carinae with larger, more coarsely set spines ventrally. Forward directed spines along ventral margin of branchial region; remainder of carapace generally smooth and punctate.

DESCRIPTION: Cephalothorax average size for genus, height about 0.5 length, excluding rostrum. Dorsal margin straight; posterior margin concave dorsally, strongly convex ventrally; posteroventral margin smoothly curved, greatest depth at midlength; anteroventral margin straight, inclined posteroventrally, strongly downturned at base of cervical groove; anterior margin broken; rostrum not known.

Cervical groove slightly convex forward, steeply inclined, intercepting dorsal midline at 70° angle at distance of 39% length measured along dorsum. Branchiocardiac groove oblique, approaching midline at 25° angle and curving abruptly to cross midline nearly at right angle. Postcervical groove weak, defined at either extremity by depressed area, convergent with branchiocardiac groove posteriorly, and curving abruptly posteroventrally to meet branchiocardiac groove anteriorly. Inferior and hepatic grooves not well preserved. Antennar groove parallels ventral border of cephalic region. All grooves deep, narrow, and well defined.
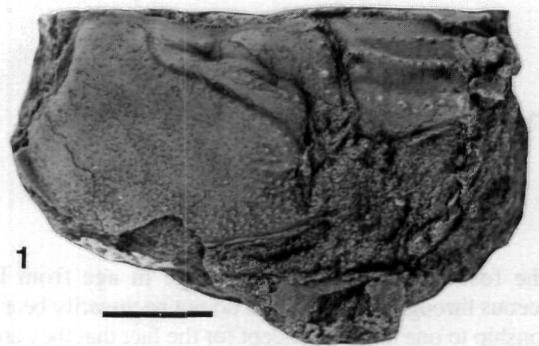
Fig. 1 Right lateral view of the carapace of the holotype of *Glyphea stilwelli* n. sp., OU39532. Scale bar equals 1 cm.
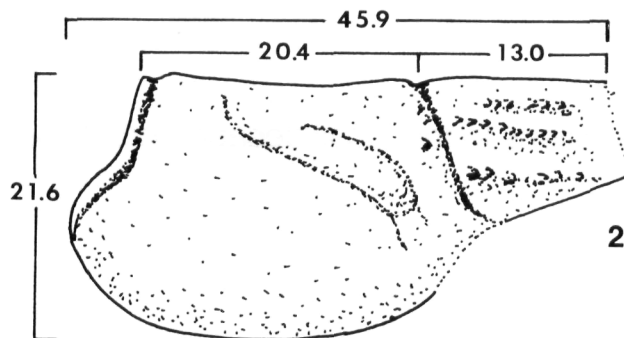

Fig. 2 Line drawing of the carapace of *Glyphea stilwelli* showing the measurements taken.

Cephalic region with 3 strong, well-defined, spinose carinae on flanks. Supraorbital carina weakest, nearly parallel dorsal surface, with about 6 small spines. Suborbital carina stronger, inclined anteroventrally, with about 10 spines of size equal those on supraorbital ridge. Antennal ridge broader, more elevated, with about 6 coarser spines. Cephalic region between grooves generally smooth and coarsely punctate.

Branchiostegite finely granulose anteroventrally becoming smooth and punctate posteriorly and dorsally. About 4 moderately strong spines parallel posterior margin of cervical groove. Marginal furrow well developed posteriorly, moderately strong ventrally.

Abdomen and pereiopods unknown.

MEASUREMENTS: Measurements, in millimetres, are given on Fig. 2.

TYPES: The holotype and sole specimen is deposited in the collections of the Geology Department, University of Otago, Dunedin, New Zealand, OU39532.

LOCALITY AND STRATIGRAPHIC POSITION: The specimen was collected from fossil locality I43/f059, from glauconitic fine sandstone, probably referable to the lowermost Abbotsford Formation (J. Stilwell, University of Otago, pers. comm.), c. 50 m uphill from Mt Watkin Road, directly east from Trig. F, Mt Watkin, Otago (N.Z. metric grid ref. I43/208130). Collected by J. Stilwell and A. Grebneff, 15 October 1989. According to Stilwell (pers. comm.), associated molluscs *Spineilo elongata* (Marshall), ?*Miltha agilis* Finlay and Marwick, *Bittiscala simplex* (Marshall), and *Tudiclana simulator* Finlay and Marwick, support an age assignment for *Glyphea stilwelli* of "Wangaloan" (Teurian Stage, early Paleocene).

ETYMOLOGY: The trivial name honors Jeffrey Stilwell, Department of Geology, University of Otago, who is studying the paleontology of Paleocene rocks in New Zealand.

REMARKS: The genus *Glyphea* is distinguished from other genera in the family by the presence of a relatively thick cephalothorax bearing branchiocardiac and postcervical grooves that converge posteriorly. The two genera which are most like *Glyphea* are *Litogaster* von Meyer and *Trachysoma* Bell; however, the two grooves are parallel to one another in both of them. *Glyphea stilwelli* has a weakly developed postcervical groove which converges strongly with the branchiocardiac groove and, therefore, placement within the genus can be made with confidence. The generic identification is important because this represents the youngest occurrence

of *Glyphea* known to me. Species of *Glyphea* range in age from ?Late Triassic to Late Cretaceous (Glaessner 1969). In the high southern latitudes, *Glyphea arborinsularis* Etheridge Jr. is known from the Aptian of Queensland, Australia (Woods 1957), *G. oculata* Woods from the upper Albian of Queensland (Woods 1957), *G. alexandri* Taylor and *G. georgiensis* Taylor from the Lower Cretaceous of Alexander Island, Antarctic Peninsula (Taylor 1979), and *G. australensis* Feldmann, Tshudy and Thomson from the Campanian and ?lowermost Maastrichtian of James Ross Island, Antarctic Peninsula (Feldmann et al. 1993). This new species is the first record of *Glyphea* in Paleocene-aged sediments.

Within the genus, species are distinguished on the position and relative development of carapace grooves, on the degree of development of cephalic ridges, and on ornamentation. Amongst other species in the genus, particularly with those from the Southern Hemisphere, *Glyphea stilwelli* has extremely fine ornamentation, which increases in strength ventrally. The cephalic ridges are also diagnostic on this species. The dorsal two ridges converge posteriorly and have similarly strong spines on the new species, whereas the ventral ridge is markedly more coarsely spined and is slightly concave upward. The ornamentation on *Glyphea stilwelli* is as delicate as that on any species of *Glyphea*, and can be taken to be diagnostic of it.

Only one other representative of the Glypheidae has been recognised from New Zealand. Glaessner (1960) named *Glypheopsis antipodum* from Jurassic rocks cropping out about 3 km south from Glenomaru, South Island. The species was subsequently referred to the genus *Trachysoma* Bell. *Trachysoma antipodum* (Glaessner) is coarsely pustulose between the cervical and branchiocardiac grooves, and coarsely pitted behind the branchiocardiac groove, so that, although only the dorsal part of the carapace of this species is available for study, there can be no possibility for confusion.

Section PODOTREMATA Guinot, 1977
Subsection DROMIACEA de Haan, 1833
Superfamily **HOMOLODROMIOIDEA** Alcock, 1899
Family **HOMOLODROMIIDAE** Alcock, 1899
Genus *Homolodromia* A. Milne Edwards, 1880

Homolodromia novaezelandica n. sp.   Fig. 3–6

Homolodromia sp. Feldmann & Keyes, 1992, p. 61.
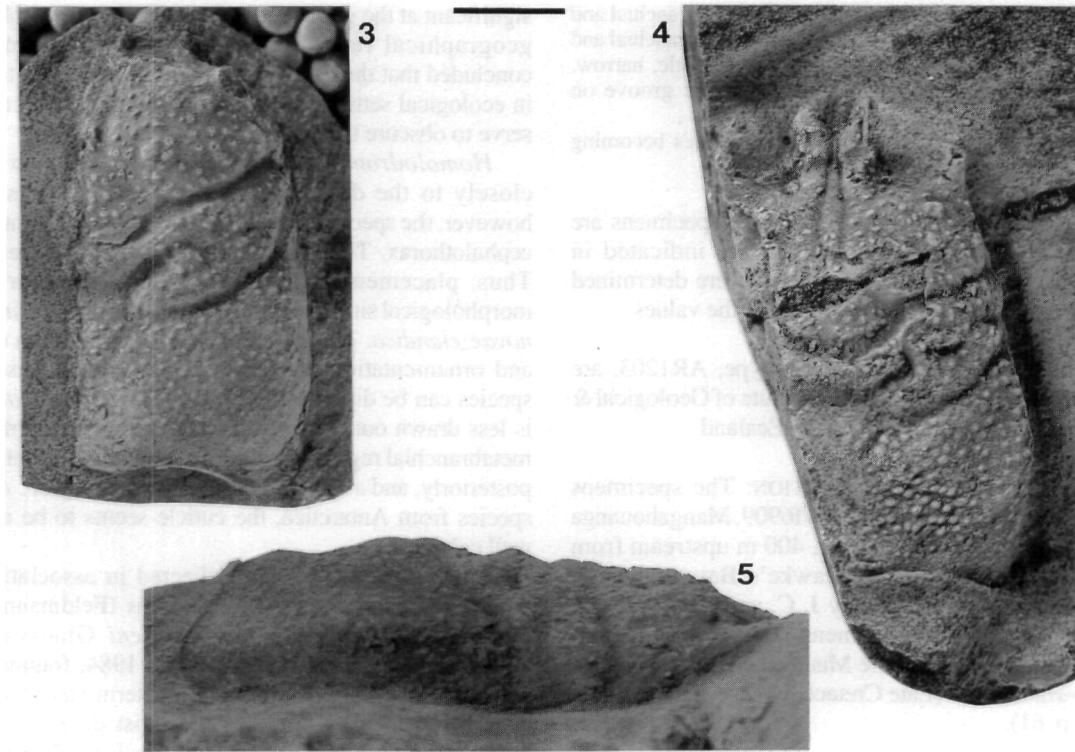Erymid Feldmann & Keyes, 1992, p. 61.

Fig. 3–5 *Homolodromia novaezelandica* n. sp.   3, Dorsal view of right half of carapace of paratype, AR1203.   4–5, Dorsal and right lateral views of holotype, AR1836. Scale bar equals 1 cm.
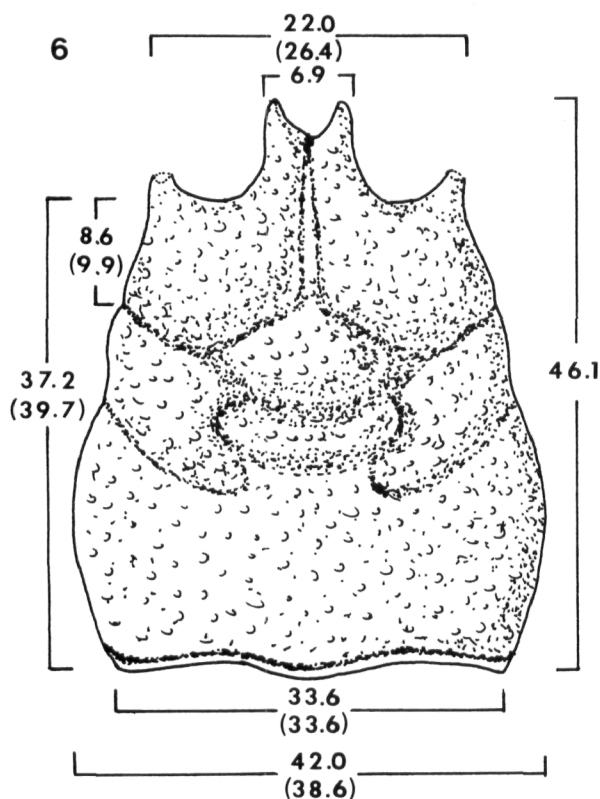

Fig. 6 Line drawing showing the measurements taken on the holotype and paratype (in parentheses) of *Homolodromia novaezelandica*.

DIAGNOSIS: Carapace quadrate, widening slightly posteriorly, rostrum with 2 stout horns separated by sulcate axis, with well-developed postorbital spines, generally inflated regions ornamented by coarse pustules, and bearing well-defined cervical and branchiocardiac grooves, lacking lineae.

DESCRIPTION: Carapace large for genus, generally quadrate outline; widest in metabranchial region; gently arched longitudinally; more distinctly arched transversely; lateral margins nearly vertical, undefined in cephalic, protobranchial, and mesobranchial regions and weakly indicated by abrupt increase in curvature in meta-branchial region.

Front narrow, about 13% maximum width and about 20% total fronto-orbital width, produced as bicornuate rostrum, sulcate axially; orbital regions smooth and deeply concave, directed forward, bounded laterally by prominent postorbital spine directed anteriorly and slightly laterally, and slightly upward. Anterolateral and lateral margins of 2 nearly straight elements meeting at midlength of metabranchial region, the widest part of carapace; posterolateral margin tightly curved; posterior margin wide, about 125% fronto-orbital width, sinuous.

Mesogastric region distinctly defined by smooth, broad sulci impressed below general level of carapace, widest, about 30% maximum width, along cervical groove, tapering abruptly toward anterior to about 5% maximum width and extending anteriorly to terminate in sulcate region of front. Gastric and hepatic regions not differentiated, generally a smoothly inflated area. Cervical groove broadly and deeply impressed and concave forward along posterior margin of mesogastric region becoming narrower, but well defined, as 2 arcuate elements laterally. Metagastric region about 35% maximum width, reniform, concave forward, well defined by cervical groove and broad, deeply impressed, smooth branchiocardiac groove. Cardiac and intestinal regions not clearly distinguishable in dorsal aspect and weakly defined as broad axial swellings when viewed laterally; cardiac region defined laterally by branchiocardiac groove which is concave axially and then curves

laterally to parallel cervical groove and to separate epibranchial and mesobranchial regions from metabranchial region. Epibranchial and mesobranchial regions may be distinguished by a subtle, narrow, sinuous groove which merges with branchiocardiac groove on lateral margins.

Carapace surface with moderately coarse pustules becoming more densely spaced laterally and posteriorly.

MEASUREMENTS: Measurements taken on the specimens are given in Fig. 6. Those of the paratype are indicated in parentheses. In all cases, width dimensions were determined by measuring from the midline and doubling the values.

TYPES: The holotype, AR1836, and paratype, AR1203, are deposited in the type collection of the Institute of Geological & Nuclear Sciences Ltd, Lower Hutt, New Zealand.

LOCALITY AND STRATIGRAPHIC POSITION: The specimens were collected from fossil locality V19/f6909, Mangahouanga Stream, a tributary of Te Hoe River, 400 m upstream from the forestry road bridge, inland Hawke's Bay, collection GS11359, grid ref. V19/420469, by J. C. and M. A. Wiffen and others, 1973–82. The specimens were collected from stream boulders derived from the Maungataniwha Sandstone of Piripauan–Haumurian (Late Cretaceous) age (Feldmann & Keyes 1992, p. 61).

ETYMOLOGY: Geographical (= New Zealand).

REMARKS: The Homolodromiidae is a small family of primitive crabs which, until recently, has included only two genera known solely from Holocene, deep-water habitats. The family is thought to be descended from the Prosopidae (Guinot 1978). Both families are characterised by having generally cylindrical carapaces with well-developed cervical and branchiocardiac grooves, without indication of dorsal lineae, and with the fourth and fifth, or at least the fifth, pereiopod carried in a dorsal position (Glaessner 1969). In gross aspect, they resemble some genera of Homolidae; however, the latter are characterised by the development of distinctive lineae homolica. There is also some similarity between *Homolodromia novaezelandica* and some species of *Dioratiopus* Woods (= *Glaessneria* Wright and Collins, 1972; *non Glaessneria* Takeda and Miyake, 1969; = *Glaessnerella* Wright and Collins, 1975); however, species of the latter genus exhibit a "line of least calcification" (Woods 1953, p. 53; Wright & Collins 1972, p. 33) which is not present on *H. novaezelandica*, a more produced frontal region yielding a pentagonal outline, and typically a downturned rostrum. With the exception of these differences, the late Albian *Dioratiopus salebrosus* Woods, from central Queensland, Australia, may have been ancestral to the Homolodromiidae.

In 1988, Feldmann and Wilson described the first fossil species referable to this family and placed it in the genus *Homolodromia*. *Homolodromia chaneyi* Feldmann and Wilson, 1988 was collected from the Eocene La Meseta Formation on Seymour Island, Antarctica, extending the range of the genus and the family into the Paleogene. The morphological similarities between the living *Homolodromia paradoxa* A. Milne Edwards and the sole fossil species were striking, and the arguments for placement of the fossils in the same genus as the modern congeners seemed compelling. The primary differences that could be observed included the presence of a much more heavily calcified, pustulose carapace. Although these differences perhaps could have been

significant at the generic level, considering the geological and geographical range extensions, Feldmann and Wilson concluded that the differences could be attributed to a change in ecological setting, and that creation of a new genus might serve to obscure the relationships.

Homolodromia novaezelandica n. sp. also conforms closely to the definition of the genus. In this instance, however, the specimens each preserve only the right half of the cephalothorax. The abdomen and appendages are unknown. Thus, placement in the family is based upon the close morphological similarity of the carapaces of *H. chaneyi* and *H. novaezelandica*. The general shape, conformation of regions, and ornamentation are quite similar; nonetheless, the two species can be distinguished. *Homolodromia novaezelandica* is less drawn out in the front, widens somewhat more in the metabranchial region, has a gastric region that is better defined posteriorly, and a less well defined cardiac region. As with the species from Antarctica, the cuticle seems to be moderately well calcified.

These specimens were collected in association with a number of other decapod crustaceans (Feldmann & Keyes 1992) including *Eodorippe spedeni* Glaessner, 1980, *Haumuriaegla glaessneri* Feldmann, 1984, fragments of the abdomen of *Linuparus* sp., and indeterminate thalassinoids. This fossil locality contains the most diverse Cretaceous decapod fauna known from New Zealand. The occurrence represents the only Cretaceous record of the Homolodromiidae and, therefore, represents an extension of the range of the family, and the genus *Homolodromia*, into the Late Cretaceous.

Superfamily **RANINOIDEA** de Haan, 1841
Family **RANINIDAE** de Haan, 1841
Genus *Hemioon* Bell, 1863

Hemioon novozelandicum Glaessner, 1980   Fig. 7–9

LOCALITIES AND STRATIGRAPHIC POSITIONS: Fossil locality P30/f265, collection GS14032, east bank of Nidd Stream, opposite Sawpit Gully junction, Coverham, Marlborough, grid reference P30/828181, collected by I. G. Speden and M. G. Laird, 21 March 1985, deposited in the Institute of Geological & Nuclear Sciences Ltd, Lower Hutt; fossil locality P30/-, collection V1206 (Specimen VA139), boulder in Sawpit Gully, a tributary of Nidd Stream, Coverham, Marlborough, collected by H. W. Wellman, W. Prebble, and R. A. Henderson, February 1964, deposited in the Geology Department, Victoria University of Wellington; and fossil locality P30/f6692, collection V1780 (Specimen VA140), Sawpit Gully, a tributary of Nidd Stream, Coverham, Marlborough, grid ref. P30/824198, collected by H. W. Wellman and A. J. Wright, 1966, deposited in the Geology Department, Victoria University of Wellington.

All the specimens were derived from the Swale Siltstone Formation and were preserved within concretions. Collection GS14032 (AR1302) was from an unspecified stratigraphic position; V1206 (VA139) was collected in a boulder interpreted to be from a concretionary mudstone 90–180 m below a flint horizon, and associated with *Scaphites* sp. and *Inoceramus* sp.; V1780 (VA140) was collected in place from a concretionary mudstone 30–60 m below limestone. The age of the Swale Formation in this area of Coverham, Marlborough, is Ngaterian (early Late Cretaceous).
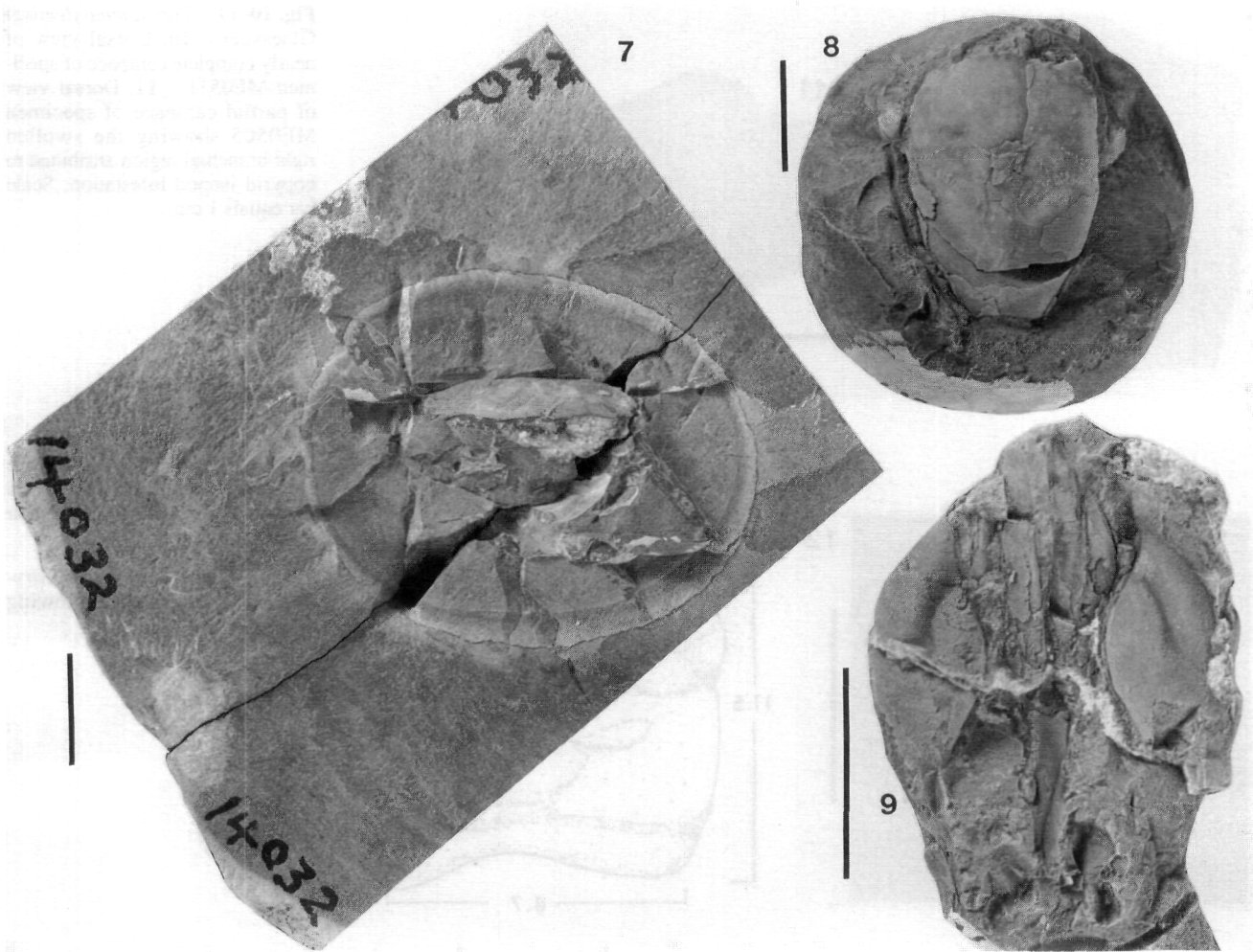
Fig. 7–9 *Hemioon novozelandicum* Glaessner. **7**, View of portion of the concretion from which one carapace (AR1302) was collected showing the aureole, within the concretion, surrounding the specimen. The specimen is unwhitened. **8**, Dorsal view of specimen VA139. **9**, Ventral view of specimen VA140 showing the sternum. Scale bars equal 1 cm.

REMARKS: Glaessner's original description of this species (1980, p. 177) was based upon a single specimen on which the dorsal carapace was exposed, collected from the Swale Siltstone, in Swale Stream, Marlborough (Glaessner 1980). As is often the case with raninids, the morphology of the frontal and anterolateral margins is useful in identification. The holotype preserved these areas quite well, whereas the specimens collected subsequently are incompletely preserved in the anterior regions. Assignment of the specimen to *Hemioon novozelandicum* is based upon the development of subtle elevations and depressions on the carapace, development of the branchiocardiac groove, and relative proportions of length to width. The specimens match the holotype closely.

The anatomy of the sternum also is important in the identification of raninids. Aspects of the anatomy of the ventral portion of the carapace, sternum, and maxillipeds are preserved on two specimens, AR1302 and VA140 (Fig. 9). Wright & Collins (1972, p. 87) noted that the sternum of *Hemioon* was, "moderately broad between chelipeds and very narrow between second pereiopods." The portion of the sternum preserved on VA140 appears to be similar to that illustrated by Wright & Collins (1972, pl. 19, fig. 2a) for *H. elongatum* (A. Milne Edwards) but neither conform strictly to

the written description. The sternal plate between the first pereiopods in most raninids tends to be broader than that seen on *Hemioon novozelandicum* (see, e.g., Glaessner 1969). The sternum typically narrows between the second and subsequent pereiopods; the narrowing is gradual in forms such as *Lyreidus* de Haan and abrupt in taxa such as *Ranina* Lamarck. The sternum of *H. novozelandicum* appears to be elongate and linear, elements 1–3 form a nearly circular plate and elements 4, corresponding to the first pereiopod, and 5, corresponding to the second pereiopod, are equally narrow, and only slightly broader than elements 1–3. The alate process separating the first two pereiopods is only weakly developed. This sternal architecture, although typically raninid in form, sets the genus off from other members of the family for which the sternum is known.

All of the specimens have been collected from concretions. One, AR1302, is unusual in that the enclosing concretion appears to be formed of two concentric shells, a concretion within a concretion. The specimen is enclosed within a well-defined aureole with a diameter of twice the carapace length (Fig. 7). This concretionary structure is, in turn, enclosed within another concretionary aureole at least four and one-half times the carapace length. It was this larger concretionary structure that was collected.
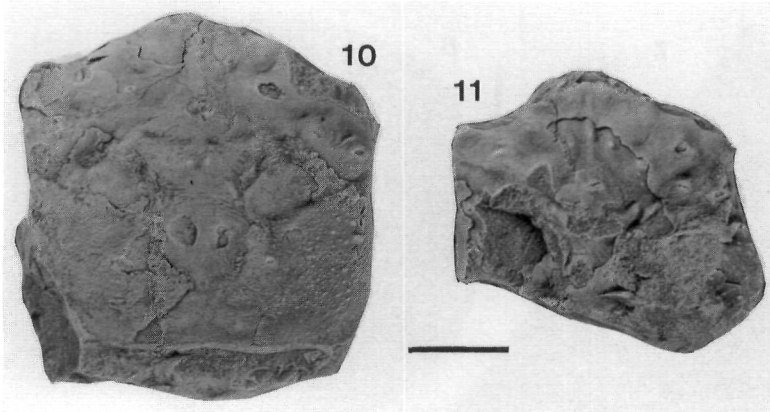
Fig. 10–11 *Torynomma flemingi* Glaessner. **10**, Dorsal view of nearly complete carapace of specimen ME0511. **11**, Dorsal view of partial carapace of specimen ME0505 showing the swollen right branchial region attributed to bopyrid isopod infestation. Scale bar equals 1 cm.
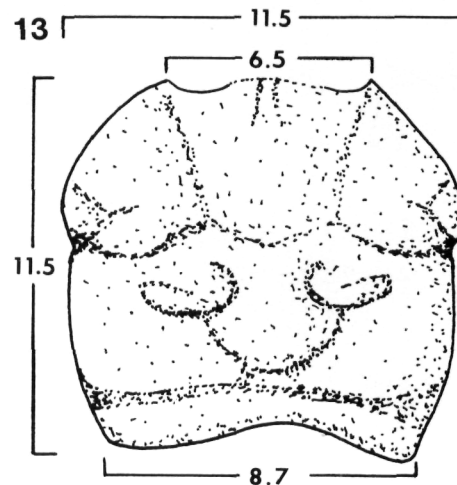

Fig. 12 Dorsal view of carapace of the holotype of *Torynomma planata* n. sp., AR1873. Scale bar equals 1 cm.

Fig. 13 Line drawing of *Torynomma planata* showing measurements taken.

Superfamily **CYCLODORIPPOIDEA** Ortmann, 1892
Family **TORYNOMMIDAE** Glaessner, 1980
Genus *Torynomma* Woods, 1953

Torynomma flemingi Glaessner, 1980   Fig. 10–11

LOCALITY AND STRATIGRAPHIC POSITION: ME0505A/B/C, Whakapirau, Apapoa River foreshore, Northland, grid ref. Q08/592218; ME0511, Whakapirau, Apapoa River foreshore, Northland, grid ref. Q08/603216. Both specimens were collected by Michael Eagle, 16 April 1991, and are housed in his private collection. ME0505 was collected from a concretionary structure determined, by the collector, to be Haumurian, Late Cretaceous, in age. ME0511 was collected from a site at which Bortonian, mid-Eocene, rock was exposed. However, the similarity of the concretions, as well as the similarity of the fossils, strongly suggested to Eagle that the concretion was Cretaceous "float material."

The specimens will be deposited permanently in the collection of the Auckland Institute and Museum as No. 77823, Institute of Geological & Nuclear Sciences fossil record no. Q08/560, grid ref. Q08/603216 (ME0511) and No. 77824, Institute of Geological & Nuclear Sciences fossil record no. Q08/561, grid ref. Q08/592218 (ME0505A/B/C).

REMARKS: Glaessner (1980) originally based this species on a single specimen collected from the upper Senonian – Maastrichtian Mata Series at Koutu Point, Hokianga Harbour,

Northland, fossil locality O6/f7739, grid ref. O6/502351 (Feldmann & Keyes 1992, p. 35). This report of specimens from Whakapirau thus constitutes the second occurrence of this taxon.

Glaessner (1980) originally referred the Torynommidae to the superfamily Tymoloidea Alcock, 1896. Tavares (1990 (1991)) has recently demonstrated that the superfamily name is synonymous with Cyclodorippoidea Ortmann, 1892. Thus, the latter name has precedence.

Both specimens are well preserved and conform closely to the type description and illustrations. No new morphological observations can be added. However, one of the specimens, ME0505, exhibits a large swelling on the right branchial chamber (Fig. 11). The swelling is nearly circular, with a diameter of 10.3 mm. Swellings similar to this have been observed in several other fossil decapods, including a new species of *Torynomma* from Cretaceous rocks on James Ross Island, Antarctica (Feldmann et al. 1993), and are usually attributed to parasitism by bopyrid isopods.

Torynomma planata n. sp.   Fig. 12, 13

Indet., Feldmann & Keyes 1992, p. 61.

DIAGNOSIS: Quadrate carapace with flattened dorsal surface and prominent, swollen posterior rim.

DESCRIPTION: Carapace moderate to small for genus, quadrate, widest at anterolateral corner, tapering slightly posteriorly, transversely and longitudinally flattened, regions well defined by
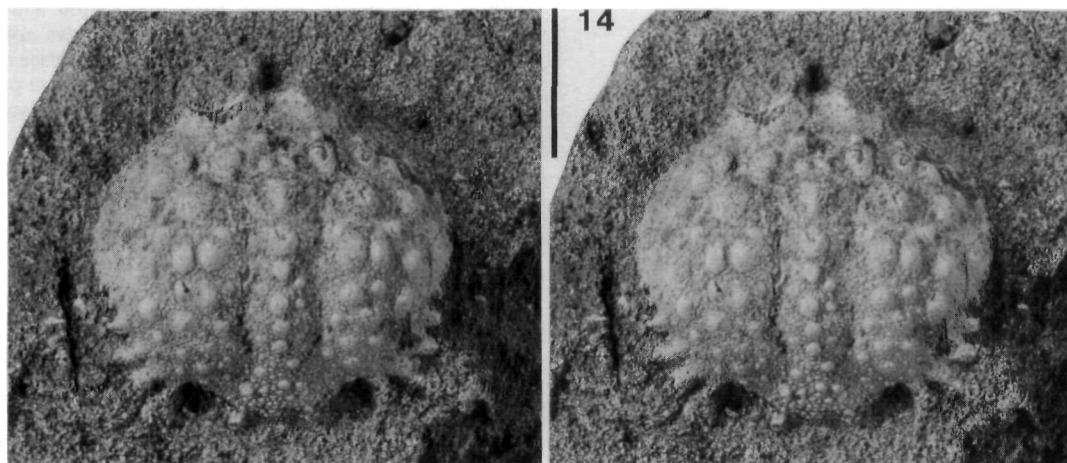
Fig. 14 Stereoscopic photographs of the holotype of *Calappilia maxwelli* n. sp., ÅR927. Scale bar equals 1 cm.

shallow, but well-defined grooves. Front wide, 56% maximum width; orbits shallow, vertical, directed forward, rostrum not preserved; anterolateral margin convex terminating posteriorly in prominent boss formed as swollen termination of well-defined angulation between dorsal surface and lateral walls. Posterolateral margins weakly convex, converging posteriorly; posterolateral corner sharply rounded; posterior margin broad, 76% maximum width, consisting of 2 convex posterior elements meeting axially in deep reentrant, forming angle of about 155°; posterior margin with prominent, raised border and deep, broad sulcus.

Cervical groove well defined, concave forward laterally surrounding posterior margin of hepatic regions and shallow and weakly defined concave forward in axial region at posterior of poorly defined gastric regions; frontal area very narrow, poorly defined by closely set shallow sulci. Hepatic regions smoothly inflated above level of gastric region. Branchiocardiac groove well defined as arcuate, broad groove defining posterolateral margins of mesogastric region and anterolateral margin of prominent, swollen cardiac region. Branchiocardiac groove diminishes in strength of development as it extends laterally to define arcuate epibranchial regions. Remainder of branchial regions smoothly convex, undifferentiated.

Pterygostomial regions broadly and smoothly inflated, appear to define broad, quadrate buccal cavity. Line of least calcification appears to extend just ventral to border posterior to cervical groove.

Carapace integument exfoliated but surface appears to have been covered by fine, uniform granulations.

Ventral surface, abdomen, and appendages unknown.

MEASUREMENTS: Measurements taken on the sole specimen are recorded on Fig. 13.

HOLOTYPE: The holotype, and sole specimen, AR1873, is deposited in the type collection of the Institute of Geological & Nuclear Sciences Ltd, Lower Hutt, New Zealand.

LOCALITY AND STRATIGRAPHIC POSITION: The specimen was collected from fossil locality V19/f6909, from stream boulders of the Maungataniwha Sandstone, Piripauan–Haumurian (Late Cretaceous) age, c. 400 m upstream from the forestry road bridge on Mangahouanga Stream, a tributary of Te Hoe River, inland Hawke's Bay. Collection GS11359, grid ref. V19/420469. Collected by J. C. and M. A. Wiffen, and others, May 1986 (Feldmann & Keyes 1992, p. 61).

ETYMOLOGY: The trivial name refers to the flat transverse and longitudinal profile of this species in contrast to other described species of *Torynomma*.

REMARKS: This specimen closely corresponds to Wood's original description of the genus (1953, p. 54), to the extent that the features are preserved. The only points of divergence may lie in the convexity of the carapace and the development of the pronounced border on the posterior margin. The convexity does vary considerably in species referred to the genus and served as one of the characters used by Glaessner (1980, p. 181) to erect the subgenus *Paratorynomma*. The flattened aspect of the carapace of *Torynomma planata* simply lies at one end of the range of carapace convexities in the genus. In other regards, the species does not conform closely to the description of that subgenus. *Torynomma planata* lacks coarse granulations and prominent extraorbital teeth. In most regards, this new species most closely resembles the type species, *T. quadrata* Woods, 1953, but differs from it in having a slightly narrower front, being less convex, exhibiting bosses on the posterolateral corners of the hepatic regions, and having a well-developed posterior border.

The Torynommidae are now represented in New Zealand by at least three species, *Torynomma flemingi* Glaessner, *Eodorippe spedeni* Glaessner, placed provisionally in the family by Glaessner (1980, p. 181), and this new species. The latter two were collected from the same exposure. The family, as defined by Glaessner, is restricted to Cretaceous crabs and, subsequent to his work, no representatives of the family have been indentified from younger rocks. Glaessner did suggest (1980, p. 181) that the Tymolidae (= Cyclodorippidae) were possibly descendents of this family. Because that family is represented in the modern New Zealand fauna, there is some reason to suspect that additional collecting may clarify this lineage.

Superfamily **CALAPPOIDEA** de Haan, 1833
Family **CALAPPIDAE** de Haan, 1833
Subfamily **CALAPPINAE** de Haan, 1833
Genus *Calappilia* A. Milne Edwards, 1873

Calappilia maxwelli n. sp.   Fig. 14–15

Calappila [sic] sp. Feldmann & Keyes, 1992, p. 40.

DIAGNOSIS: *Calappilia* with distinct, well-differentiated orbital regions, broad axial regions, well-developed posterolateral flange
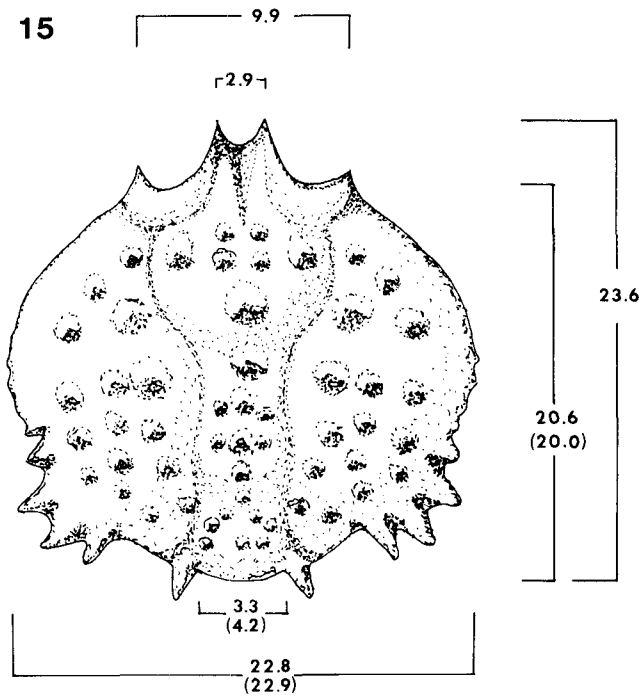
15

Fig. 15 Line drawing of *Calappilia maxwelli* showing the measurements taken.

with 5 teeth, fourth of which is largest, a pair of spines on posterior margin flanking intestinal region, and no axial spine on posterior margin.

DESCRIPTION: Moderate sized calappid; nearly circular outline; steeply arched transversely and longitudinally; posterior of carapace draped below lateral margin; regions moderately well delineated.

Front narrow, about 1/7 maximum width which is developed at about midlength; without rostrum; deeply sulcate; outer margins of frontal region defined by sharp protuberances marking inner edges of orbits. Orbits large, about 1/6 maximum width, broadly arcuate, directed forward and slightly laterally; orbital regions project forward from general carapace field as flanges sloping antero-laterally; lateral margins of orbits protuberant but not spined.

Anterolateral margin and lateral margin smooth and uniformly curved to point of maximum width; no marginal rim or furrow; margin sharply folded as carapace merges into epistomal region. Posterolateral margin with 5 or 6 spines increasing in length and breadth posteriorly; projecting beyond general carapace outline as serrate flanges. Posterior margin narrow, about 1/6 maximum width, convex, with a prominent narrow spine at each corner. Posterior 1/3 of carapace steeply sloping when viewed in lateral aspect; posterolateral margin projects obliquely downward below antero-lateral margin.

Axial carapace regions separated from lateral regions by distinct, broad sulci representing cervical and branchiocardiac grooves; frontal, gastric, cardiac, and intestinal regions distinguishable on basis of relative proportions and ornamentation. Gastric region subcircular, truncated anteriorly by narrow, weakly ornamented, triangular frontal region and by orbital flanges; ornamented by 4 moderately large nodes set in rectilinear pattern in anteromesial position flanked laterally and posteriorly by 3 large nodes. Width of gastric region about 2/5 maximum width. Cardiac region about 1/2 as wide, nearly straight sided; dominantly ornamented by row of axial nodes. Anterior constriction of cardiac region may represent urogastric region. Intestinal region triangular, broadening posteriorly; ornamented by much smaller nodes than on other areas. Lateral regions only weakly defined, primarily by degree of development of nodes. Hepatic region dominated by relatively few, very large nodes, the largest of which are adjacent the posterolateral

corners of the gastric region. Branchial region with somewhat smaller, more numerous nodes arranged in rows approximately paralleling the branchiocardiac groove; nodes decrease in number in each row adaxially and decrease progressively in size posteriorly.

Entire surface of carapace ornamented by miniscule, closely spaced pustules resulting in granular texture.

Abdomen and appendages unknown.

MEASUREMENTS: Measurements taken on the two specimens referred to this species are recorded on Fig. 15. Those of the paratype are indicated in parentheses.

TYPES: The holotype, AR927, and paratype, AR928, are deposited in the type collection of the Institute of Geological & Nuclear Sciences Ltd, Lower Hutt, New Zealand.

LOCALITY AND STRATIGRAPHIC POSITION: The specimens were collected from fossil locality Q8/f9828, on the east side of Hollands Point, c. 1.7 km northwest from Pakaurangi Point, Kaipara Harbour, Northland. Collection GS9730, grid ref. Q8/262513. The specimens were collected by P. A. Maxwell and A. G. Beu, from medium grey tuffaceous siltstone at the top of the Waiteroa Member of the Pakaurangi Formation, November 1966. The unit has been assigned a late Otaian, early Miocene, age (Feldmann & Keyes 1992, p. 40).

ETYMOLOGY: The trivial name honors Dr P. A. Maxwell, Waimate, New Zealand, who has contributed so much to the understanding of the bivalve history of the Cenozoic in New Zealand and who was one of the collectors of these specimens.

REMARKS: Placement of these specimens within *Calappilia* can be done with certainty. The generally circular outline of the carapace with a spinose flange along the posterolateral margin, the coarsely nodose ornamentation on a generally granulose carapace surface, and the clear definition of the axial regions and indistinct development of lateral regions on the cephalothorax are diagnostic of the genus. Other calappids with a generally circular outline, for example, *Campylostoma* Bell, *Cenomanocarcinus* van Straelen, and *Necrocarcinus* Bell, tend to lack the posterolateral flange and, instead, have spines in that position. *Calappa* Weber has a well-developed flange which typically results in a triangular outline.

In general, species within this genus can be distinguished by the shape and degree of development of spines on the posterolateral flange, the relative breadth of axial regions, and the strength and uniformity of development of carapace nodes. *Calappilia maxwelli* most closely resembles *C. dacica* Bittner, 1893 from the late Eocene of Hungary. The similarity is based upon the number, size, and relative development of nodes on the carapace. However, the latter species has narrower axial regions, perhaps a less well developed posterolateral flange, and may bear an axial spine on the posterior margin (Lörenthey & Beurlen 1929, pl. 6, fig. 5a). Furthermore, neither this species nor any other species within the genus has orbital regions that are as well defined as those on *Calappilia maxwelli*. Thus, the species is clearly unique.

Species of *Calappilia* have been described from Eocene and Oligocene rocks in Europe, North America, and the East Indies (Glaessner 1929, 1969) and from the Holocene in Australia, the Pacific, and the West Indies (Glaessner 1969). This New Zealand occurrence is the first formal notice of the genus in the Miocene and the first record of the genus, and the family Calappidae, in New Zealand. It represents one of the few authentic "tropical" taxa among the decapods in the fossil
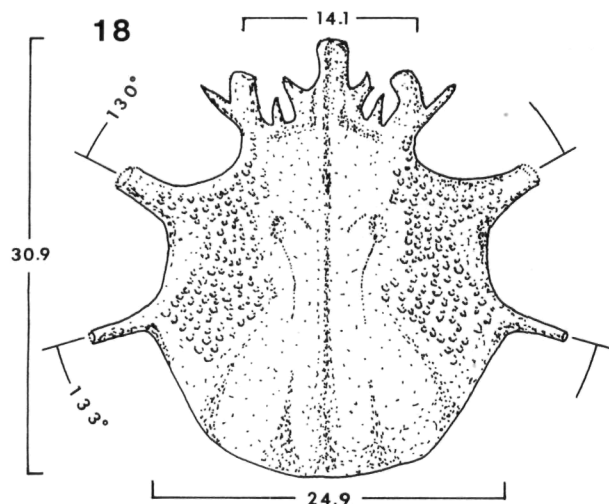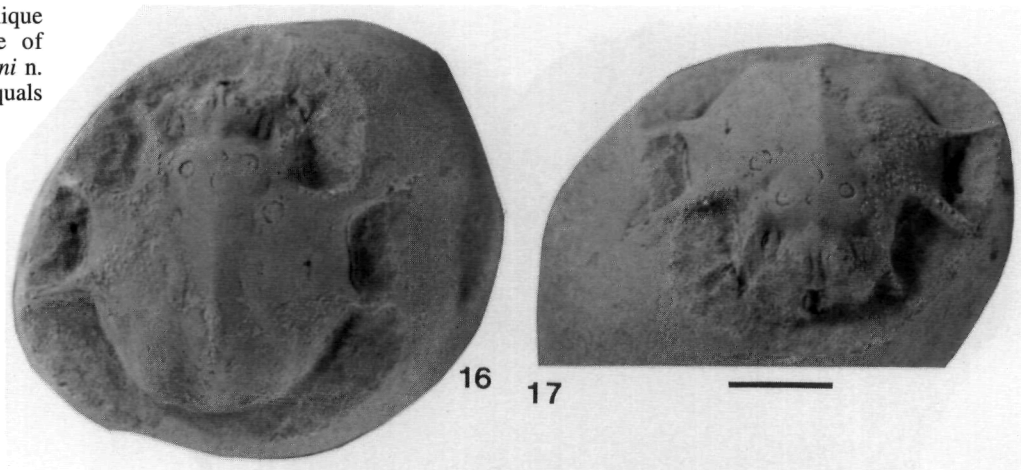
Fig. 18 Line drawing of *Actinotocarcinus maclauchlani* showing the measurements taken.

record of New Zealand. Most other fossils seem to have had high latitude, temperate water origins (Feldmann & McLay 1993).

Family **MAJIDAE** Samouelle, 1819
Subfamily **ACTINOTOCARCININAE** Jenkins, 1974
Genus *Actinotocarcinus* Jenkins, 1974

Actinotocarcinus maclauchlani n. sp.   Fig. 16–18

DIAGNOSIS: Actinotocarcinid with strongly downturned, lobose rostrum, lateral-orbital spine shorter than other spines, and without spines at posterolateral corners.

DESCRIPTION: Moderate size for genus; ovoid outline, slightly longer than wide; moderately convex longitudinally and somewhat more vaulted transversely; regions weakly defined, particularly in anterior.

Front narrow, with axial ridge extending onto rostrum which broadens distally to lobose termination and is strongly downturned to be nearly vertical. Rostrum projects just slightly in advance of orbital spines. Frontal and orbital regions slightly depressed below broadly inflated gastric regions. Antorbital spine broad based, slightly longer than wide at base, curved slightly toward anterior.

Intercalated spine short, stout, curved toward anterior, terminating nearly in contact with antorbital spine. Base of lateral-orbital process broad; process quadrate, steeply inclined to horizontal, situated at outer and lateral margin of orbit. Lateral-orbital spine shorter than other lateral spines, steeply inclined ventrally. Anterolateral margin relatively short, convex; carapace widens nearly to maximum width in this region. Anterolateral spines long, broad at base, apparently tapering to slender spines, directed anterolaterally; angle subtended by anterolateral spines about 130°. Lateral margins weakly concave and nearly parallel long axis in advance of lateral spines and nearly straight and converging posteriorly behind lateral spines; lateral spines long, slender, directed posterolaterally; angle subtended by lateral spines about 135°. Greatest width of carapace developed at base of lateral spines. Posterolateral corner smoothly convex, not spined. Posterior margin weakly convex.

Axis of carapace defined by narrow, smooth crest, arising in metagastric region, becoming more prominent in mesogastric, urogastric, and cardiac regions, broadening and merging into swollen, intestinal region. Cardiac region only slightly broader than urogastric. Metagastric, protogastric, and hepatic regions not distinguishable from one another, uniformly and smoothly swollen. Epibranchial and mesobranchial regions form continuous smoothly inflated region separated from metabranchial region by subtle, arcuate sulcus extending posteriorly then posterolaterally to define pear-shaped metabranchial region.

Surface of carapace ornamented by fine granules on hepatic, epibranchial, and mesobranchial regions; other areas apparently only finely punctate.

MEASUREMENTS: Measurements taken on the sole specimen representing this species are given in Fig. 18.

TYPE: The holotype, and sole specimen, CMzfc346, is deposited in the Canterbury Museum, Christchurch, New Zealand.

LOCALITY AND STRATIGRAPHIC POSITION: The specimen was collected as a loose concretion from between the high and low tide levels at the southern end of "Sandy Bay", Motunau Beach, North Canterbury. Grid ref. N34/144957 (approx). These concretions are assumed to have been derived from the Greta Siltstone. The age of the rock unit is not clearly defined (Lewis 1976); however, Feldmann & Keyes (1992, p. 32) suggested that a probable age for the concretions is Waiauan–Tongaporutuan, that is, mid–late Miocene.

ETYMOLOGY: The trivial name honors Mr Don McLauchlan, Christchurch, who collected and prepared the specimen and made it available for study.
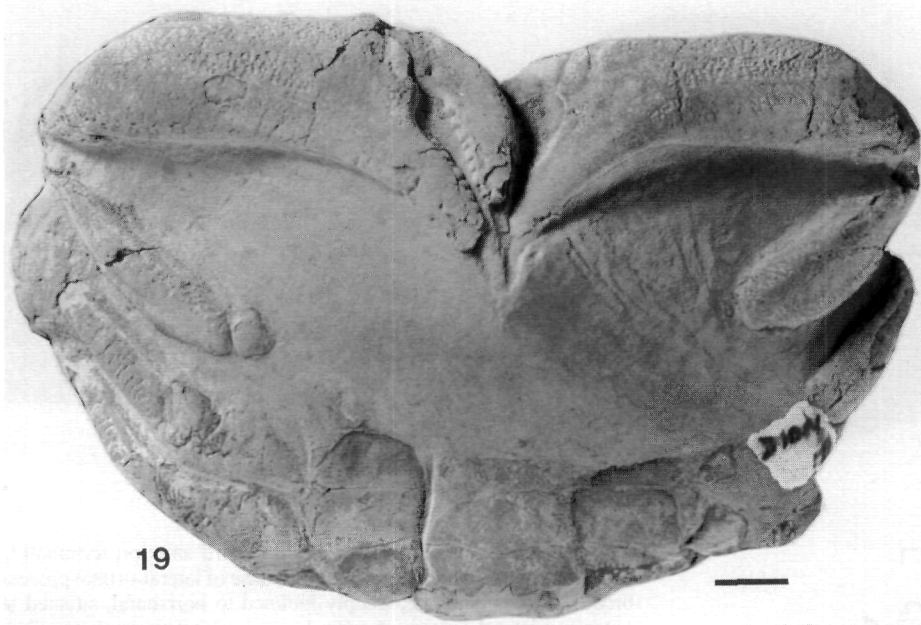
Fig. 19 Ventral view of a male specimen of *Miograpsus papaka* Fleming. Scale bar equals 1 cm.

REMARKS: *Actinotocarcinus* was first described by Jenkins (1974), from specimens collected along Glenafric Beach, North Canterbury, New Zealand. The morphology of the type species readily distinguished it from other spider crabs and was distinctive enough to warrant the naming of a new subfamily of Majidae. *Actinotocarcinus maclauchlani* shares many morphological characters with the type species and can be placed in the same genus with no hesitation. The array of lateral-orbital, anterolateral, and lateral spines are distinctive features of the genus. In addition, the generally weakly inflated carapace regions, granular or pustulose ornamentation, and subtle boundaries between branchial regions are characteristic of both species and, therefore, may serve as generic descriptors. Finally, the architecture of the dorsal portion of the orbits, consisting of an antorbital and intercalated spine, coupled with a flared base on the lateral-orbital spine and reduced supra-orbital surface is also distinctive.

The two species can be readily distinguished from each other. The rostrum of *Actinotocarcinus maclauchlani* broadens distally to form a blunt termination and is very strongly curved downward. The anterolateral margins of *Actinotocarcinus chidgeyi* Jenkins, 1974 tend to be long and parallel to the long axis so that the frontal regions are somewhat elongate. The anterolateral margins on *Actinotocarcinus maclauchlani* are directed posterolaterally and are shorter so that the frontal regions are proportionately shorter and broader. The angle of divergence of the anterolateral spines is about 130° in *A. maclauchlani* whereas that of *A. chidgeyi* is about 155°. The angle of divergence of the lateral spines is approximately the same in both species, about 135°. *Actinotocarcinus maclauchlani* lacks any indication of the spines at the anterolateral corner that characterise the type species. In fact, the metabranchial regions on *A. maclauchlani* tend to be rounded posteriorly, whereas those regions on *A. chidgeyi* taper posteriorly in the direction of the posterolateral spines. The ornamentation on the anterolateral regions of the type species tends to be coarser, consisting of pustules, whereas the same areas on *Actinotocarcinus maclauchlani* are granulose. Finally, the axial regions on the latter species are apparently smooth as opposed to the granular nature of the

axis on *Actinotocarcinus chidgeyi*. Thus, although the two species occur together and bear recognisable similarities at the generic level, there are numerous details of morphology of the dorsal carapace that serve to readily distinguish them.

Three circular impressions, one situated on each of the protogastric regions and one on the right epibranchial region of the specimen of *Actinotocarcinus maclauchlani*, may represent scars from epibionts, possibly barnacles. The diameter of the impressions varies from c. 2.0 to 3.1 mm. Each is defined by a rim etched into the carapace. Because the marks do not seem to correspond to any anticipated morphological feature of spider crabs, have not been observed on specimens of *Actinotocarcinus chidgeyi*, and are asymmetrically arrayed on the carapace, they probably are not part of the morphology of the organism.

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Section HETEROTREMATA Guinot, 1977
Superfamily **GRAPSOIDEA** MacLeay, 1838
Family **GRAPSIDAE** MacLeay, 1838
Genus *Miograpsus* Fleming, 1981

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Miograpsus papaka Fleming, 1981, p. 103   Fig. 19

LOCALITY AND STRATIGRAPHIC POSITION: D10A/12, S28/-, loose block, near end of the carpark where Putangirua Stream has cut into mudstone, Palliser Bay, grid ref. S28/957706, collected by L. Higginson, 1991, and in the private collection of Yvonne Summers, Masterton. The specimen was collected from the Tongaporutuan, late Miocene, Hurupi Formation.

REMARKS: The original description of *Miograpsus papaka* was based on two female specimens (Fleming 1981). A single other specimen, of undetermined gender, subsequently was collected at the type locality (Feldmann & Keyes 1992, p. 54). This recently collected specimen represents the first male specimen of the species known and, for that reason, warrants illustration (Fig. 19). In other respects, the morphology of the specimen conforms closely to the original description, and the identity is certain.

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