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John Garth, with many thanks &  
also apologies for not coming

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## A new grapsid crab from the Upper Miocene of New Zealand

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*Miograpsus papaka* n. gen., n. sp. is based on two female specimens from the Hurupi Formation of Putangirua Stream, Palliser Bay (Tongaporutuan Stage, Upper Miocene). *Miograpsus*, provisionally classed in the subfamily Varuninae, is distinguished from related genera by its narrow deflexed front with a median sulcus and median marginal notch, by two prominent postfrontal tubercles, apparently by six abdominal segments, by four anterolateral carapace teeth and by its weak, elongate, ridged and subequal chelae (at least in females).

### INTRODUCTION

Although diverse and abundant in modern seas, crabs of the family Grapsidae are not well represented as fossils. The oldest records are middle Eocene. Only six living genera (in three subfamilies) have been identified as fossils, while two extinct genera from the Eocene and ?Oligocene of Europe and Egypt are of uncertain subfamily (Glaessner, 1969). Their rarity as fossils may in large part be due to their shallow, mostly intertidal, habitat, seldom represented in the geological record (Glaessner, 1960: 46). On the other hand, Grapsidae, now so diverse in shallow seas, may have undergone adaptive radiation in relatively late geological time. This hypothesis gains some support from the fact that the New Zealand Upper Miocene crab described below cannot be accommodated in a genus still living in the southwest Pacific. Although nine species of Grapsidae are recorded on New Zealand coasts (Bennett, 1964; Dell, 1968), no fossil grapsids have hitherto been identified among the 30 or more species of Cenozoic Brachyura recorded from New Zealand by Glaessner (1960) and later authors.

### Family GRAPSIDAE: Subfamily VARUNINAE

As the material is limited to two females, in which the surface of maxillipeds and other details are poorly exposed, the genus described below is only provisionally allocated to a subfamily. It lacks the oblique ridging or striation of the branchial regions of Grapsinae and has nothing in common with the genera of Plagusinae. *Miograpsus* is larger than the majority of Sesarminae, and its carapace has greater relief, being raised into a series of low mamillae; moreover, what is visible of the third maxillipeds (ischium and part of merus) gives no suggestion of the oblique ridge (hairy in life) characteristic of Sesarminae, which is developed on the merus alone in most genera.

### *Miograpsus* n. gen.

*Type-species:* *Miograpsus papaka* n. sp., Upper Miocene, New Zealand.

*Name:* from "Miocene" and "Grapsus"; gender masculine.

*Diagnosis:* Medium-sized grapsid with rounded quadrangular carapace, widest at posterior third, moderately vaulted longitudinally and transversely, mamillate, deflected frontally and also posterolaterally at well-defined oblique moniliform ridges (Figs. 1, 5). Anterolateral margins dentate. Cervical groove a distinct semicircular sulcus medially (marked internally by a radial pattern of wrinkles in the urogastric region), ill-defined on either side, connected to second postorbital notch by a low transverse ridge (Figs. 1, 5).

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Frontal width less than half fronto-orbital width. Orbits shallow, open, each with a conspicuous narrow orbital hiatus. Postfrontal lobes conspicuous, separated by a shallow mesogastric sulcus that extends forward to divide front into two lobes; frontal border moniliform, with a distinct medial notch. Front irregularly deflected, with margin sloping downwards medially, almost to epistome, which it overhangs (Figs. 3, 7).

Abdomen (in females) broad, rounded, extending to bases of pereopods and forwards almost to maxillipeds, with six segments, apparently due to suppression of an abdominal segment, probably the second (Fig. 6). Terminal segment three times as broad as long, shallowly impacted in penultimate segment.

Chelipeds elongate, ridged, sub-equal in size. Walking legs obtusely triangular in section (merus), lacking any armature of spines, tubercular.

***Miograpsus papaka* n. sp.** (Figs. 1-7)

*Holotype*: AR 674, mature female, in the N.Z. Geological Survey, Lower Hutt. *Paratype*: immature female, in the collection of Mrs G. G. Thornton, Lyall Bay, Wellington.

*Preservation*: The carapace of the holotype is represented by a well-preserved internal mould carrying exoskeletal shell over about half its area but with the external surface (dark brown in colour, with granular ornament) even more restricted. The chelipeds and ambulatory legs are all to some degree incomplete (Figs. 1, 2), the latter, in particular, lacking all segments distal to the merus, which is represented by proximal portions of varying length. Parts of the carapace (especially its outer surface and moniliform border) that were initially present were lost in attempts to expose more detail by leaching the calcareous concretionary matrix in dilute acetic acid. The ventral surface is well preserved, but the external layer of the exoskeleton is in places abraded, with loss of surface ornament. The left chela, firmly attached by a layer of refractory matrix, covers the left maxilliped in front of the ischium, but by careful excavation the outer proximal part of the merus has been exposed. The carapace has been slightly compressed and fractured, but the hinge line between it and the abdomen shows no evidence of deformation that might have telescoped the first two abdominal segments leaving only one visible.

The paratype (Fig. 4), represents an individual about two-thirds the size of the holotype. The dorsal and anterior surfaces are obscured by hard concretionary siltstone, from which the abdomen, chelae, and parts of the ambulatory legs protrude. What is exposed (including the abdomen) closely resembles the holotype.

*Description*: Carapace (Figs. 1, 5) broader than long (1.18 times); breadth between external orbital angles somewhat less than length. Surface finely granular, margin finely moniliform. Posterolateral regions gently deflexed, cardiac and branchial regions irregularly swollen. Urogastric region depressed towards semicircular cervical groove, thus clearly delimiting anterior border of cardiac region, but lateral borders of cardiac and intestinal regions and branchiohepatic borders ill-defined, merely broad shallow depressions. Mesogastric lobe convex behind, extending forwards as a mesogastric sulcus. Epigastric lobes strongly developed as two well-defined raised postfrontal tubercles, separated by the mesogastric sulcus, which continues across the deflexed front. Lateral borders weakly convex, converging forwards, with four notches, defining four distinct (but apparently rather obtuse) anterolateral teeth behind the external orbital angle on each side, decreasing in strength posteriorly.

Frontal width about two-fifths of orbital width. Front deflexed, divided into two broad lobes, when viewed from above, by the median sulcus, but most deflexed in the region of the sulcus, so that the lobes are not visible in frontal view. A narrow well-defined notch in the moniliform frontal border occupying centre of sulcus (Fig. 7n).

Orbits shallow, wide, open, each with a distinct orbital hiatus; external orbital angles obtuse. Epistome horizontal, overhung and closely approached mesially by deflexed front. Pterygostome poorly exposed, weakly granular with no evidence of reticulation.

Chelipeds subequal. Female chelae elongate, the palm with a longitudinal ridge extending to base of fixed finger; surface granular; fingers with about 16 low teeth of subequal strength (Figs. 2, 6). Merus of walking legs (none complete) triangular in section, finely granular.

Female abdomen broadly oval, almost completely obscuring thorax, of six segments in both holotype and paratype, with first segment short, rounded longitudinally, second apparently suppressed (Figs. 2, 4, 6).

*Dimensions:* Carapace, maximum length 55 mm, width 66.5 mm; orbital width 53 mm, frontal width 21.5 mm; left chela 31 mm long, 12 mm wide; abdomen 39 mm long, 49 mm wide (holotype). Abdomen 31 mm long, 35 mm wide (paratype).

*Locality:* Putangirua Creek, Palliser Bay, below the Pinnacles; concretionary fine-grained silty sandstone pebble, not in place.

*Horizon and Palaeoecology:* Lower part of Hurupi Formation, above the Putangirua Conglomerate. Although, as Dell remarked (1952), the Hurupi beds east of Palliser Bay yield a particularly uniform fauna, deposited in depths equivalent to comparatively shallow off-shore waters today, there are thin beds in Putangirua Creek near the base of the formation containing abundant shells of *Zeacumantus* cf. *tirangiensis* (Marwick), indicating deposition between high and low tide marks, which is a likely habitat for grapsid crabs.

*Age:* Lower part of Tongaporutuan Stage, Upper Miocene.

*Name:* The trivial name is the Maori word for a crab, treated as a first-declension Latin nominative in apposition.

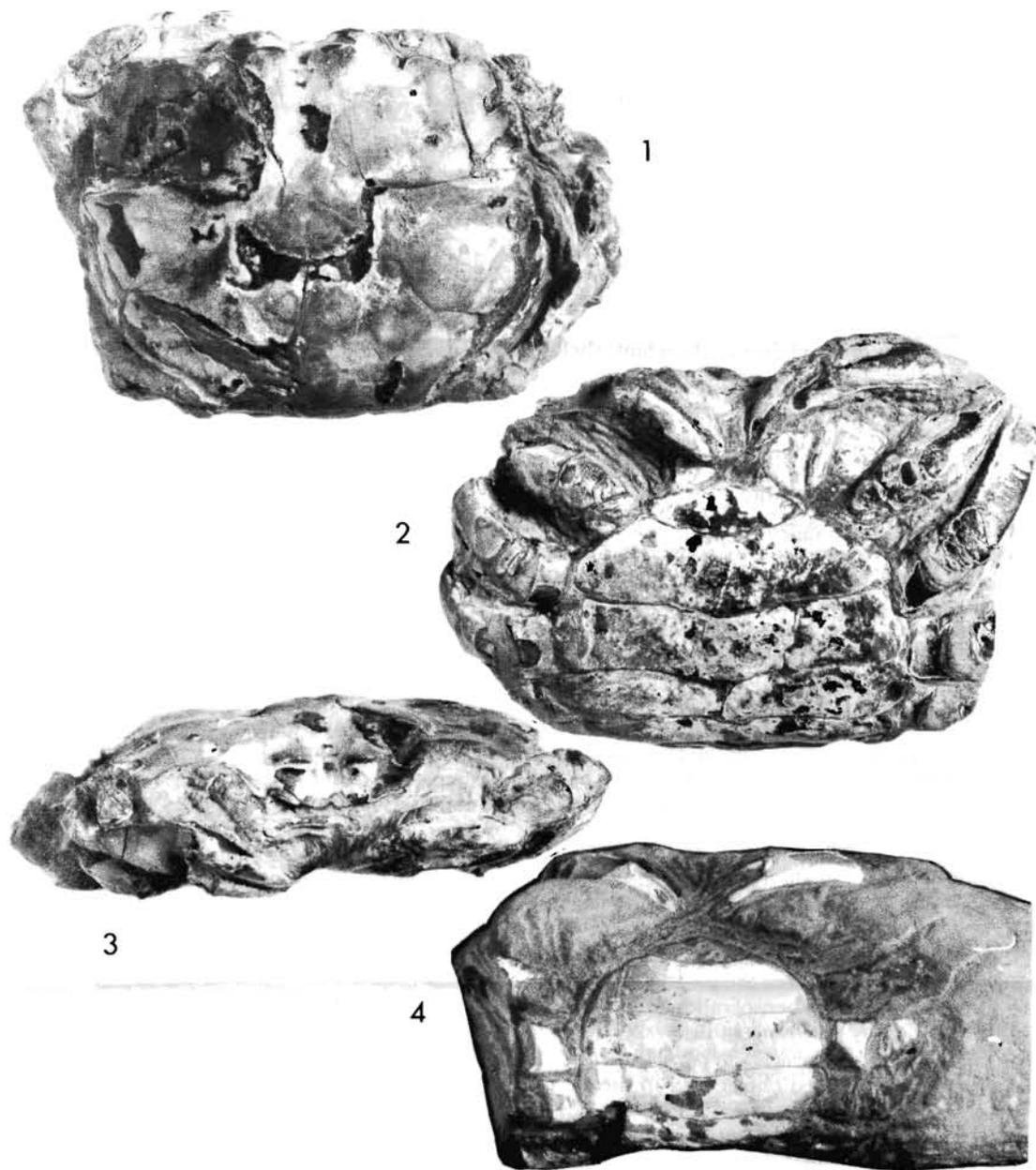
*Relationships:* Among the Sesarminae, *Miograpsus* has been compared with living species of *Sesarma* and its subgenus *Chiromantes*, with *Metasesarma*, *Cyclograpsus*, *Aratus*, *Helice* and *Paragrapsus*. Most Sesarminae differ from *Miograpsus* in their smaller size, smooth and inflated chelae, and generally smoother carapace, with little relief, strongly but evenly deflected in front. Many Sesarminae (but not all) lack any lateral teeth on the carapace and the oblique moniliform ridges defining the posterolateral parts of the branchial areas, and most lack a distinct orbital hiatus. *Miograpsus* is not unlike the Australian genus *Paragrapsus* in some features (see Campbell and Griffin, 1966), but the latter is smoother, without a distinct orbital hiatus, and if the structure of the maxillipeds in *Miograpsus* is correctly interpreted, it is unlikely to be a sesarminae.

Among the Varuninae, *Miograpsus* has been compared with *Eriochair*, *Cyrtograpsus*, *Hemigrapsus*, *Glyptograpsus* and *Tetragrapsus*. These comparisons have been supplemented by comparisons with figures and descriptions of other genera in the systematic works cited in the references, especially Rathbun (1918). From all these, *Miograpsus* appears to differ in having only six abdominal segments, apparently by suppression of the second (or perhaps the first) segment, but (as pointed out to me by Dr D. J. G. Griffin) such a condition is unusual and raises the possibility that the first segment has been telescoped below the posterior margin of the carapace. From examination of the holotype and from the close agreement of the paratype this does not appear to be the case, but the validity of the reduced number of abdominal segments as a generic character remains to be confirmed by discovery of more specimens.

The type of *Cyrtograpsus* (*C. angulatus* Dana, South America) resembles *Miograpsus* in its elongate, ridged chelae and in the strong relief of its carapace, with two prominent epifrontal tubercles, separated by a sulcus that runs forward to embay the front, and its distinct orbital hiatus, but *Cyrtograpsus* differs in its much stronger lateral teeth, in the absence of diagonal moniliform ridges bordering the posterolateral parts of the branchial region, and in lacking the median frontal notch of *Miograpsus*. *C. altimanus* Rathbun differs even more, in chelae and frontal outline. *Eriochair* de Haan has a toothed front and does not appear at all related.

*Tetragrapsus* Rathbun (Mexico) lacks diagonal posterolateral moniliform ridges to its parallel-sided carapace, which bears only weak postfrontal tubercles, separated by a very shallow sulcus that scarcely embays the front.

*Glyptograpsus* Smith (tropical America) agrees with *Miograpsus* in the strong relief of its carapace, its strong epifrontal tubercles, and its mesially sulcate front which is bilobed when viewed from above, but its carapace is more coarsely granular, its orbital hiatus does not gape so widely, and it lacks the median frontal notch and posterolateral beaded ridges; moreover it has very unequal granulose chelepedes.



*Miograpsus papaka* n.sp. (all figures  $\times 1$ ).

Fig. 1 — Holotype, dorsal view, showing bilobed front, postfrontal tubercles, cervical groove, orbit, and dentate lateral margin.

Fig. 2 — Holotype, ventral view, showing abdomen, chelipeds, and exposed portions of maxillipeds and pterygostome.

Fig. 3 — Holotype, frontal view, showing deflexed front, with median notch in its anterior border and postfrontal tubercles.

Fig. 4 — Paratype, ventral view.

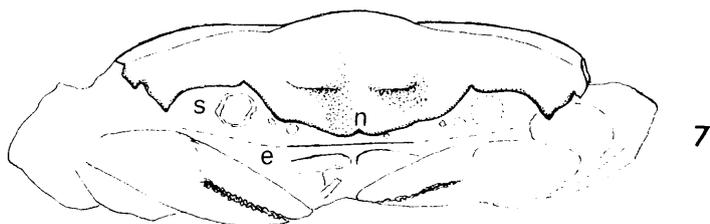
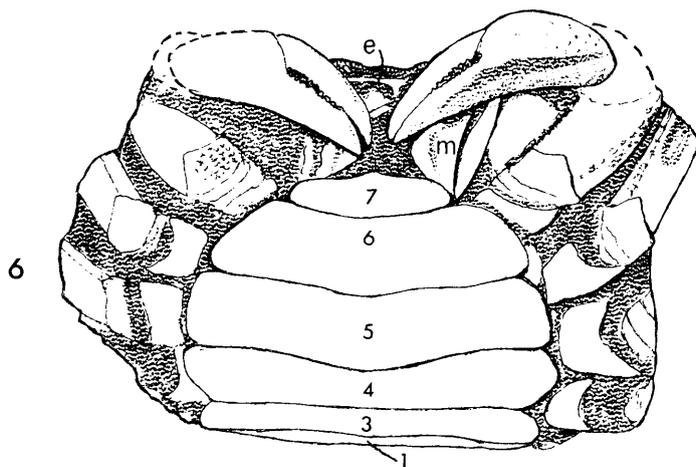
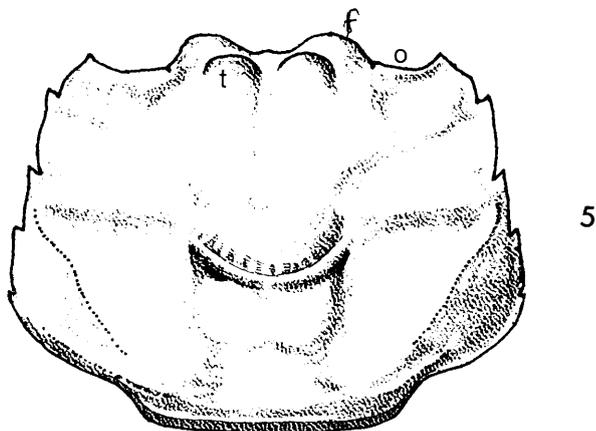


Fig. 5 — Dorsal view of carapace, restored, showing orbits (o), frontal lobes (f), postfrontal tubercles (t) and dentate margins.

Fig. 6 — Ventral view, somewhat restored, showing six abdominal segments (second assumed suppressed), epistome (e) and left maxilliped (m).

Fig. 7 — Frontal view, with margin of carapace restored on right (true left) side, showing median notch of front (n), cross-sections of eye-stalk (s), antennae and attenules, and epistome (e).

*Hemigrapsus* Dana is a widely-distributed (mainly Pacific) genus including two New Zealand species, neither of which has a strongly embayed sulcate front nor prominent epifrontal tubercles. On the other hand, *Hemigrapsus oregonensis* (Dana), which ranges from Alaska to the Gulf of California (Rathbun, 1918), while much smaller and having only two postorbital lateral teeth, has an embayed front (viewed from above), a median sulcus (albeit shallow) and low epifrontal tubercles intermediate in strength between those of *H. crenulatus* (Milne-Edwards) and those of *Miograpsus*. Viewed from the front, the moniliform frontal border in *Hemigrapsus* is almost horizontal and certainly not notched as it is in *Miograpsus*. The chelae are shorter than in *Miograpsus* and are but weakly ridged if at all. The maxillipeds of *Hemigrapsus* are quite similar to what can be seen of them in *Miograpsus*.

In the grapsid genus *Daranyia* Lorenthey, 1901, from the Eocene of Sicily and Hungary (see Glaessner 1969: R 529) the carapace is widest anteriorly, with seven or more lateral teeth, decreasing in size posteriorly. It resembles *Miograpsus* in having a median sulcus in the fronto-orbital margin, but is obviously not closely related.

I conclude that *Miograpsus* is a member of the subfamily Varuninae, related to *Hemigrapsus*, but differing in the high relief of its carapace, its embayed front with a median notch, its elongate chelae and, perhaps, in its six abdominal segments.

#### ACKNOWLEDGEMENTS

The holotype of the species described above was collected by Dr Margaret Blanshard, now of London, in the nineteen-sixties and presented to the author, for the New Zealand Geological Survey, by her father, Mr A. K. Brown of Wellington. The paratype was collected by Mrs Jocelyn Thornton, Wellington, who kindly made it available for study.

Mr J. Simes, N.Z. Geological Survey, helped with preparation of the specimens and Mrs E. McGregor kindly typed the draft manuscript. Ms D. S. Russell, N.Z. Geological Survey, took the photographs. The work was done at the New Zealand Geological Survey, by courtesy of the Director, Dr R. P. Suggate.

I am grateful to several carcinologists for their suggestions and tolerant indulgence to a palaeontologist who insisted that it is necessary to attempt classification on the basis of imperfect material. Drs D. J. G. Griffin (Director) and J. K. Lowry (Curator of Crustacea) at the Australian Museum, Sydney and Dr J. C. Yaldwyn (National Museum, Wellington), all made collections available for study and loan. Dr R. W. Ingle, British Museum (Natural History), helped me examine relevant specimens. I am especially grateful to Dr John S. Garth for his wise counsel and hospitality on 28 June 1980 when he gave up a Saturday to allow me to examine Grapsidae in the collection of the Allan Hancock Foundation, Los Angeles, as only one episode in a highly memorable visit.

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