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to Dr Chase
from Richard Jenkins

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³A new spider-crab from the Miocene
of New Zealand

BY

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A NEW SPIDER-CRAB FROM THE MIOCENE OF NEW ZEALAND

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by R. J. F. JENKINS

ABSTRACT. *Actinotocarcinus chidgeyi* gen. et sp. nov. from the Waiauan or Middle Miocene of North Canterbury, New Zealand, is a long-spined, spider-crab belonging to the family Majidae Samouelle, 1819. While it shows a mosaic of individual features present within other subfamilies of the Majidae it differs from all in its total combination of characters, and a new subfamily *Actinotocarcininae* subfam. nov. is erected to contain it.

IN 1967 a loose concretion containing three specimens of an extraordinary, long-spined spider crab was found by Mr. S. A. Chidgey at Glenafric Beach, about 50 km NNE. of Christchurch, South Island of New Zealand, and subsequently sent to Professor M. F. Glaessner, University of Adelaide, South Australia, who suggested the present study. A further dozen or so specimens of the spider-crab, all in loose concretions, have since been collected at the same locality by Mr. S. A. Chidgey and his son Mr. S. J. Chidgey.

The taxonomy of the modern decapod crustacean fauna of Australasia is becoming increasingly complete (Griffin and Yaldwyn 1968; Dell 1968; Yaldwyn 1971). A monographic treatment of the fossil decapods of New Zealand was presented by Glaessner (1960) and latterly I described an interesting new fossil lobster from the Pliocene of North Canterbury (R. J. F. Jenkins 1972a). The Cretaceous fossil decapods of Australia are relatively well known (Woods 1953, 1957, and several later authors) and I have recently studied most of the more common Tertiary forms (R. J. F. Jenkins 1972b). The new spider-crab described here is unlike any form with which I am familiar, and Professor Glaessner is of the same opinion. Thus the new crab is described as a new genus and species. It can be confidently referred to the family Majidae Samouelle, 1819, of the Oxyrhyncha, but shows a combination of features significantly different from all of the subfamilies at present recognized within this family. The present subdivision of the Majidae is unsatisfactory in so far as it is based partly on gradational differences and lacks definitive phylogenetic control from fossils; however, the new crab is so distinctive that a new subfamily is erected to accommodate it.

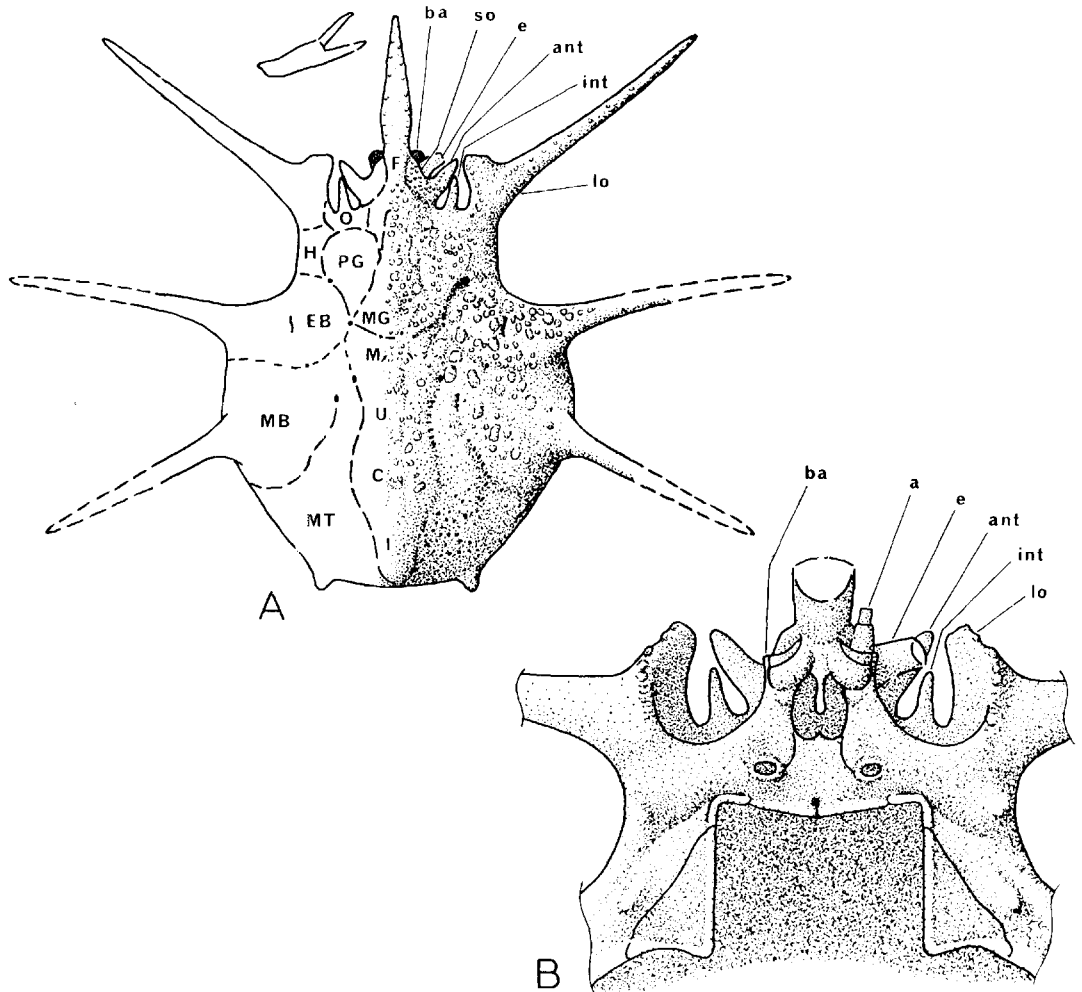
The rocks exposed in the immediate vicinity of Glenafric Beach (the sea coast near the mouth of Dovedale Stream) are shown by Wilson (1963) to be part of the Mount Brown Beds and are dated by Fleming (1963) as of Waiauan age, which, according to D. G. Jenkins (1971) and Berggren (1972) is equivalent to the later part of the Middle Miocene.

The repositories of materials and abbreviations used to indicate them are:

- C.M. Canterbury Museum, Christchurch, New Zealand; specimen numbers pertain to the 'Canterbury Museum register of fossil Arthropoda'.
- S.A.M. South Australian Museum, Adelaide, South Australia; Palaeontological collection.

SYSTEMATIC PALAEONTOLOGY

The present crab shows features which clearly place it in the Oxyrhyncha; notably the narrowed anterior portion of the carapace and inflated brachial regions, the general form of the other regions of the carapace, the wide epistome and nearly square buccal frame, and the longitudinally elongate antennular fossae (text-fig. 1A, B). Its well-calcified carapace with fine hair pores on the dorsal surface, its incomplete spinose orbits and the fusion of the basal antennal articles to the epistome and



TEXT-FIG. 1. Reconstruction of carapace of *Actinotocarcinus chidgeyi* gen. et sp. nov. A, dorsal view of carapace, $\times 1\frac{1}{2}$; carapace regions notated as follows: F, frontal; O, supra-orbital; PG, protogastric; H, hepatic; MG, metagastric; M, mesogastric; U, urogastric; C, cardiac; I, intestinal; EB, epibranchial; MB, mesobranchial; MT, metabranchial; other lettering: ba, basal antennal article; so, supra-orbital spine; e, eye-stalk; ant, antenna; int, intercalated spine; lo, lateral-orbital process. B, ventral view of anterior parts of carapace, $\times 3$; a, antenna; other lettering as above. The endostome is not known and has been omitted.

rostrum, and its apparently small and slender chelae enable it to be confidently identified as belonging to the family Majidae.

Recent reviews of the major subdivisions within the Majidae have been presented by Garth (1958) and Griffin (1966*a*, 1966*b*). These authors recognize seven extant subfamilies belonging to this family, the Oregoniinae Garth, 1958; Inarchinae McLeay, 1838; Ophthalmiinae Balss, 1929; Acanthonychinae Stimpson, 1870; Pisinae Dana, 1852; Majinae Samouelle, 1819; and Mithracinae Balss, 1929. The characteristic features of each of these subfamilies are summarized by Griffin (1966*a*). The new crab described here shows a mosaic of individual characters present within these divisions, but in its total combination of characters differs from all.

The single rostral spine and relatively slender basal antennal articles of the new crab superficially resemble the same features in the single-horned section of the Inarchinae. It is distinguished from the Inarchinae, however, by its more elaborately developed orbits. Its orbits equally well distinguish it from the circum-Arctic Oregoniinae, which are similar to the Inarchinae in most features. The Oregoniinae have a two-horned rostrum.

The slender form of its rostrum is sharply distinct from the huge, broad beak-like or double rostrum of the Acanthonychinae; also its orbits are larger and more complex than in this division.

The remaining subfamilies all have a two-spined or bifid rostrum (sometimes with the rostral spines more or less fused or forming a broad lamella) and are primarily distinguished by the features of their more or less complex orbits. In the present crab the orbits are formed by a supra-orbital hood or eave, an intercalated spine, and a large post- or lateral-orbital process. The orbits are formed in essentially the same way in a section of the Pisinae, the Majinae, and part of the Mithracinae. In general the orbits are not greatly developed or are 'incomplete' in the Pisinae, rather better developed in the Majinae, and strongly developed and tubular or 'complete' in the Mithracinae. The basal antennal articles of the new crab are tapered and rather narrow, somewhat as in the Pisinae, but the supra-orbital and particularly the lateral-orbital structures are much more strongly developed than in this subfamily. The same features more closely approximate the condition in the Majinae, but the orbits face forwards rather than laterally, the basal antennal articles are more slender and lack the usual conspicuous terminal spinules, and the lateral-orbital processes are much more massive basally and also differ in bearing a long, slender spine. The orbital features differ sharply from those of the Mithracinae in not being tubular with the basal antennal articles expanded laterally to form a floor to the orbits. A feature in common with members of the Mithracinae is the general expansion of the orbits and reduction of the hepatic regions to form a narrowed 'neck' to the carapace.

In the Ophthalmiinae the orbits are formed by an expanded supra-orbital eave or an equivalent elongate spine, and a short post-orbital spine, an arrangement distinctly different from that in the present crab.

Reference to Garth (1958) and Glaessner (1969) shows that five of the above-mentioned subfamilies are represented by fossil remains, the Majinae (?Upper Cretaceous, ?Eocene, and from Miocene to Recent), Inarchinae (Upper Eocene to Recent), Oregoniinae (Miocene to Recent), Pisinae (Pliocene to Recent), and Acanthonychinae (Pliocene to Recent). The Upper Cretaceous record of the Majinae

and an Upper Eocene record are based on fragmentary claws of questionable identity (Glaessner 1969). The only other Eocene record of the Majinae is of a highly aberrant genus *Periacanthus* Bittner, 1875; the majinid genus *Leptomithrax* Miers, 1876, occurs as early as the Oligocene in Australia (R. J. F. Jenkins 1972*b*). An additional fossil subfamily of the Majidae is recognized, the Micromaiinae Beurlen, 1930, of Middle Eocene to Lower Oligocene age. This subfamily is primitive in that the second antennal segment (equivalent to the basal antennal article) is free; the orbits are relatively incomplete and the rostrum is bifid.

From the above discussion it is evident that the new crab almost certainly belongs to the Majidae but that it cannot be referred to any of the presently recognized subfamilies of this taxon. A new subfamily is proposed to accommodate it.

Order DECAPODA
Suborder PLEOCYEMATA
Infraorder BRACHYURA
Section OXYRHYNCHA
Family MAJIDAE Samouelle, 1819
Subfamily ACTINOTOCARCININAE subfam. nov.

Type genus. Actinotocarcinus gen. nov.

Diagnosis. Majid with a single, slender rostral spine; forwardly directed orbits formed above by a supra-orbital cave, an intercalated spine, and a massive lateral-orbital process bearing a slender spine; and tapering, relatively narrow, basal antennal articles fused to rostrum and epistome, and lacking conspicuous terminal spinules.

Genus ACTINOTOCARCINUS gen. nov.

Type species. Actinotocarcinus chidgeyi sp. nov.

Plate 117, figs. 1-4*a, b*; text-fig. 1*A, B*

Derivation of name. *Actinoto*, from the Greek adjective *actīnotōs*, rayed, in reference to the rayed pattern of the spines of the carapace; *carcinus*, from the Greek *carcinōs*, crab.

Diagnosis. As for type species.

Actinotocarcinus chidgeyi sp. nov.

Plate 117, figs. 1-4*a, b*; text-fig. 1*A, B*

Derivation of name. Named for Messrs. S. A. Chidgey and S. J. Chidgey.

EXPLANATION OF PLATE 117

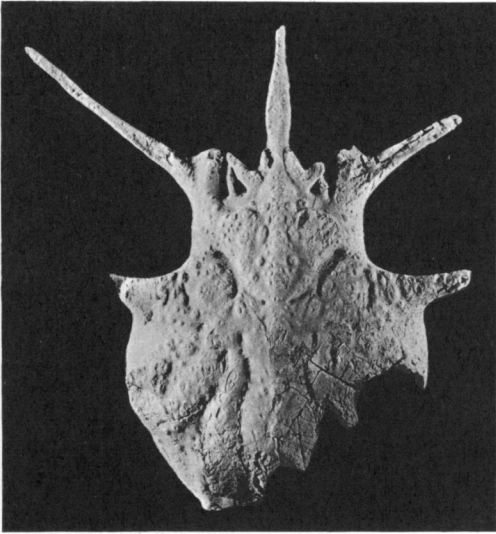
Actinotocarcinus chidgeyi gen. et sp. nov.

Fig. 1, holotype, C.M. zfc 171A, $\times 1\frac{1}{3}$; carapace with branchial spines damaged and central part of posterior margin and right postero-lateral aspect eroded away.

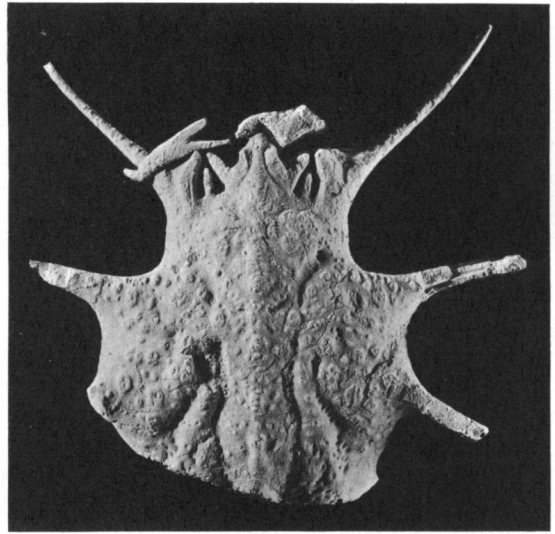
Fig. 2, paratype, C.M. zfc 171B, $\times 1\frac{1}{3}$; carapace with posterior part missing and associated chela.

Fig. 3, holotype (lower right) and two paratypes in concretion after preparation, $\times 1$.

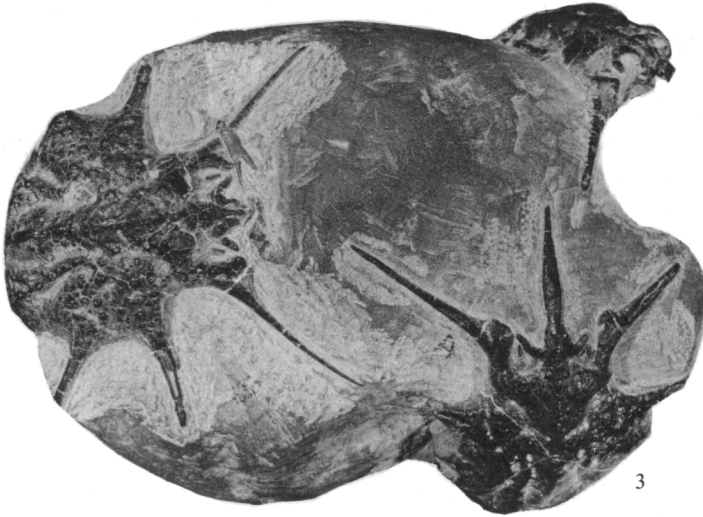
Fig. 4*a, b*, paratype C.M. zfc 171C, $\times 3$; 4*a*, dorsal aspect of anterior part of carapace showing eye-stalk (e), distal tip of basal antennal article (ba), and basal joint of antennal peduncle (bp); 4*b*, ventral aspect of anterior portion of carapace with eye-stalk (e), second joint of antennal peduncle (sp), and mandibular gnathobases (mg) visible.



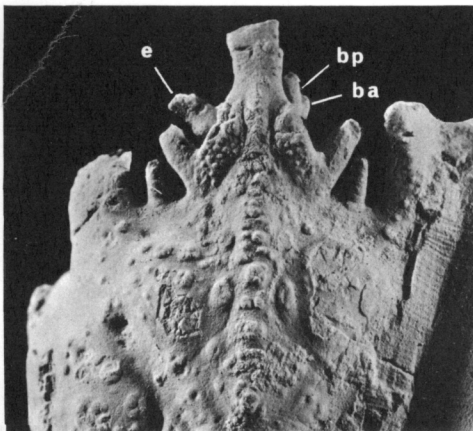
1



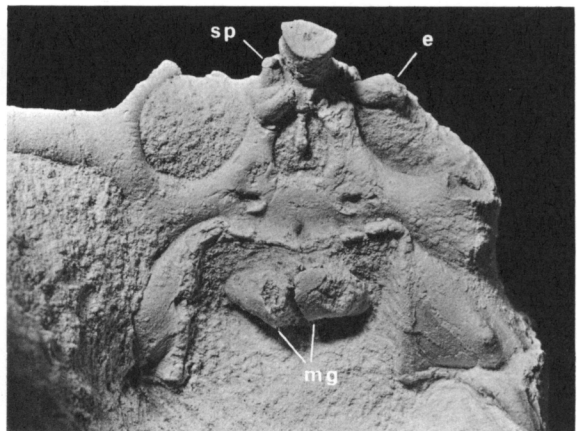
2



3



4a



4b

JENKINS, Miocene spider-crab

Diagnosis. Carapace flask-shaped, constricted at level of hepatic regions, 1.2 times as long as wide (excluding spines); orbits large; rostrum and spine on lateral-orbital process long and slender; branchial margins each with two long spines and a shorter spine behind; surface ornamented by granules and low tubercles between which it is smooth.

Material. Three specimens of the carapace (C.M. zfc 171A, B, C) in a single concretion and another (S.A.M. P.15916) in a similar concretion. The holotype, C.M. zfc 171A, has the more posterior branchial spines eroded or broken and only a small part of the posterior margin remaining. Paratype C.M. zfc 171B has remains of the chelae associated with it. The concretions containing the remains consist of highly indurated grey calcareous siltstone.

Occurrence. The crab occurs in loose concretions found at Glenafric Beach, North Canterbury, New Zealand. The concretions are eroded from a Waiauian (Middle Miocene) interval of the Mount Brown Beds which stand as high cliffs backing a narrow beach zone. Concretions with the crab occur on the wave-cut platform and storm beach between about 300 and 800 m east of the mouth of Dovedale Stream; they are most common at the eastern end of the occurrence. Other concretions containing the fossil crab *Tumidocarcinus giganteus* Glaessner, 1960, occur commonly in association with those containing the spider-crab and are found between 1.4 km south-west and 800 m east of the mouth of Dovedale Stream. Rarely, concretions containing this crab are found *in situ* (cf. Glaessner 1960; Fleming 1963).

Description. Carapace flask-shaped in outline, with large forwardly directed orbits, a single long, slender rostral spine, a similar slender spine arising from a massive lateral-orbital process, and two long spines and a shorter spine behind on each branchial margin. Dorsal aspect of the carapace somewhat flattened, but still moderately convex longitudinally and transversely; a distinct, obtuse, longitudinal ridge in the mid-line; regions moderately distinct, delimited by shallow grooves; surface ornamented by granules and low tubercles between which it is smooth and polished; median ridge with a line of relatively conspicuous low tubercles; much of the surface with exceedingly fine pores which may have borne slender hairs in life.

Rostral spine nearly straight, equal to about two-fifths the length of the carapace, directed forwards and somewhat deflexed, rounded-triangular in section, the two dorso-lateral margins bearing occasional granules.

Orbits consisting above of a supra-orbital eave, an intercalated spine, and a lateral-orbital process, the three separated by deep fissures; supra-orbital eave narrow, granulate, bearing a prominent antorbital spine; intercalated spine small; massive basal part of the lateral-orbital process with its upper margin forming a blunt crest bearing a line of granules and terminating in a rectangular prominence; inner surface of the process shallowly hollowed; outer distal part of the process with a long, tapering, spine; spine narrow in dorsal view, but relatively deep in section, its rather sharply rounded upper margin bearing a line of granules. Proximal portion of the eye-stalks slender.

Protogastric regions relatively small. Mesogastric region limited posteriorly by deep grooves; two slightly more conspicuous low tubercles on its mid-line. A short,

deeply impressed portion of the cervical groove curves forward and outward from the posterior part of the mesogastric region. Hepatic regions small and hardly defined. Metagastric, urogastric, cardiac, and intestinal regions distinguished longitudinally only by slight swellings and the gentle curvature of the lateral cardiac grooves; the latter show the fine crenulation indicative of underlying muscle attachments. A conspicuous tubercle on the median, anterior part of the intestinal region. Cardiac region with its surface relatively smooth, two low tubercles occur on the mid-line of the anterior portion. Epi- and mesobranchial regions with coarse ornament, and each bearing a long, deep, lateral spine. Metabranial regions separated from the epibranchial regions by a deep, pitted groove and with their surface coarsely pitted; a short postero-lateral spine present.

Basal antennal articles fused to the epistome and the rostrum, tapered towards their distal end and mostly rather slender; two rounded lobes on the ventral part of their distal extremity; foramen for the peduncle opening upward and forward. Openings of the antennal glands elongate transversely. Antennular fossae narrow, incompletely separated by a narrow median septum supported by the base of the rostrum.

Epistome wide and smooth, with a high posterior lip. Narrow, oblique subhepatic lobes each with a strong, flattened posterior tubercle. Pterygostomial elements small. Buccal frame a little wider than long, with its lateral margins subparallel. Mandibular gnathobases with their nearly straight inner margin smooth.

Chelae relatively small, the right more robust than the left. Palm narrow; slender tapered fingers equal to about three-fifths the length of the palm; prehensile margins of fingers seemingly smooth.

Dimensions. Measurements of the materials studied are given in Table 1.

TABLE I

	Holotype C.M. zfc 171A	Paratype C.M. zfc 171B
Measurements (mm)		
Rostrum	16	—
Carapace, length	36 (impf.)	—
Carapace, width	30	31
Lateral-orbital process, length basal portion	4.7	4.8
Lateral-orbital process, length outer spine	20	21
Epibranchial spine, length	—	13 (impf.)
Mesobranchial spine, length	—	8 (impf.)
Cheliped palm (left), length	—	6
Movable finger of chela (left), length	—	3.6

Remarks. The long spines of *A. chidgeyi* are presumably an adaptation to prevent it being readily swallowed by fishes. Other majid species such as *Maja arambougi* Van Straelen, 1936, from the Pliocene of Algeria, and the living, Eastern Asiatic *Maja spinigera* de Haan, 1839, have evolved a comparable armament. The predominantly siltstone beds in which *A. chidgeyi* occurs, the Mount Brown Beds, are considered by Fleming (1963) to be 'typical of middle depths on the continental shelf'. In general, modern long-spined crabs seem to be most frequent on the outer part of the continental shelf and bathyal regions.

The distinctive combination of rostral and orbital features in *A. chidgeyi* suggests

that it represents a stock which underwent a lengthy and separate evolutionary history from the other recognized majid divisions. The structure of the orbits most closely resembles that in the section of the family embracing the subfamilies Pisinae, Majinae, and Mithracinae and thus it seems reasonable to infer that its ancestry lies within this section.

A remarkable aspect of the preservation of this crab is the association of several individuals in a single concretion (Pl. 117, fig. 3). This is evidently not unusual for the species as Mr. S. A. Chidgey has several other concretions containing more than one individual in his collection. At least one of the specimens in the association studied (specimen C.M. zfc 171C) is a dead animal, not a moult, as the pterygostomial elements are still in place (Pl. 117, fig. 4b), and it seems likely that the other specimens are also remains of dead individuals. The remains cannot have been moved far after death as parts of delicate appendages still remain and the long carapace spines are unbroken. Chance current transportation thus seems an unlikely explanation for the associations. The associations do not apparently reflect an originally dense population as the crab is a rare fossil, much less common than specimens of *Tumidocarcinus* occurring at the same locality. The explanation for the associations favoured here is that the crabs tended to group together in small numbers during life and died while grouped, perhaps smothered under a sudden influx of sediment. Some small post-mortem transport evidently occurred as the ventral skeleton of at least one specimen is missing. The crab *Trichopaltaron greggi* Dell, 1969, which occurs in similar concretions weathering out of the Pliocene at Motunau Beach, North Canterbury, New Zealand, also occurs in associations of several individuals to a concretion (material in Chidgey collection). Here the ventral skeleton and legs are also present.

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