

## *Eocene decapod crustaceans from Antarctica*

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### ABSTRACT

Two species of anomuran decapods and six species of brachyuran decapods were identified from 14 localities in the Eocene La Meseta Formation on Seymour Island, Antarctica. Of these, six have not previously been identified from Antarctica, and four—*Munidopsis scabrosa*, *Homolodromia chaneyi*, *Calappa zinsmeisteri*, and ?*Micromithrax minisculus*—are new species. All of the records, with the exception of *Protocallianassa* cf. *P. faujasi*, represent the oldest occurrences of the genera in the fossil record. Three extant genera, *Munidopsis*, *Homolodromia*, and *Chasmocarcinus*, are known from the fossil record only in the La Meseta Formation. The fauna was preserved in sediments deposited in a cool temperate, nearshore, shallow-water habitat. Modern descendants of three of the genera—*Munidopsis*, *Homolodromia*, and *Lyreidus*—are known primarily from offshore, deep-water habitats.

### INTRODUCTION

Eight species of decapod crustaceans, arrayed in the Anomura and Brachyura, have been identified (Table 1) from the La Meseta Formation that crops out on Seymour Island, a part of the Antarctic Peninsula, Antarctica (Fig. 1). Two of these species have been described (Feldmann and Zinsmeister, 1984b). The remaining six taxa not previously described are described herein. Additionally, paleoecological interpretations, primarily derived from analysis of the ecological requirements of recent congeners, are presented, which may be useful in explaining the general paleoecological setting of the La Meseta Formation.

Previous studies of the La Meseta Formation have established that the rocks were deposited in a variety of nearshore, shallow-water, wave and tidally dominated habitats interpreted to represent a deltaic complex (Elliot et al., 1982). Sadler (1986, this volume) suggested that the sequence of mappable sedimentary facies was deposited in a northwest-southeast-trending trough, approximately 6 km wide as exposed on Seymour Island, and that the sequence was more complex than had previously been thought. These facies were identified by a numerical sequence, T<sub>elm</sub>1 through 7, along with appropriate modifiers, representing general stratigraphic position. None of the units could be demonstrated to be continuous across the area. Rather, the lowermost unit, T<sub>elm</sub>1, was deposited in isolated sites along the margins of the trough and was superseded by T<sub>elm</sub>2, which seems to have been deposited along the walls of the trough, with beds dipping as much as 15°, generally toward the axis. Overlying

units, typically exhibiting dips to the southeast in the direction of plunge of the trough, have progressively more discontinuous distributions and represent a complex of shallowing-upward deposits in which textures and structures were controlled by local conditions.

Based in part on the paleoceanographic setting resulting from the Eocene configuration of continents, cool temperate water conditions, exhibiting high seasonal temperature fluctuation, were postulated by Zinsmeister and Feldmann (1984). The Eocene, or possibly earliest Oligocene, age was established by Zinsmeister (1982a), primarily on the basis of the abundant molluscan fauna. Subsequent studies have yielded few fossils that serve as good age indices. Wiedman et al. (this volume) have identified the brachiopod *Plicirhynchia* Allan, which is known only from late Eocene deposits in South America. The evidence for an Eocene age, based on study of the decapods, is not conclusive.

Feldmann and Zinsmeister (1984b) described the first two decapod taxa collected from the formation, *Lyreidus antarcticus* and *Chasmocarcinus seymourensis*. Subsequent collecting has yielded a few hundred specimens and has increased the decapod faunal diversity to eight taxa (Table 1). They represent the entire sampling of known Eocene decapods from Antarctica.

The arthropod fauna is significant in several ways. Four of the taxa—*Munidopsis scabrosa* n. sp., *Homolodromia chaneyi* n. sp., *Chasmocarcinus seymourensis* Feldmann and Zinsmeister,

TABLE 1. SYSTEMATIC LIST OF  
ANOMURAN AND BRACHYURAN DECAPOD CRUSTACEANS  
COLLECTED FROM THE  
EOCENE AGE LA MESETA FORMATION, SEYMOUR ISLAND, ANTARCTICA

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	Infraorder <b>ANOMURA</b> H. Milne Edwards, 1832
	Superfamily <b>THALASSINOIDEA</b> Latreille, 1831
	Family <b>CALLIANASSIDAE</b> Dana, 1852
<i>Protocallianassa</i> cf. <i>P. faujasi</i>	
	Superfamily <b>GALATHEOIDEA</b> Samouelle, 1819
	Family <b>GALATHEIDAE</b> Samouelle, 1819
<i>Munidopsis scabrosa</i> n. sp. <sup>1,2</sup>	
	Infraorder <b>BRACHYURA</b> Latreille, 1803
	Section <b>PODOTREMATA</b> Guinot, 1977
	Subsection <b>DROMIACEA</b> de Haan, 1833
	Superfamily <b>HOMOLODROMIOIDEA</b> Alcock, 1899
	Family <b>HOMOLODROMIIDAE</b> Alcock, 1899
<i>Homolodromia chaneyi</i> n. sp. <sup>1,2</sup>	
	Subsection <b>ARCHAEOBRACHYURA</b> Guinot, 1977
	Superfamily <b>RANINOIDEA</b> de Haan, 1839
	Family <b>RANINIDAE</b> de Haan, 1839
<i>Lyreidus antarcticus</i> Feldmann and Zinsmeister, 1984 <sup>3</sup>	
	Section <b>HETEROTREMATA</b> Guinot, 1977
	Superfamily <b>CALAPPOIDEA</b> de Haan, 1833
	Family <b>CALAPPIDEA</b> de Haan, 1833
<i>Calappa zinsmeisteri</i> n. sp. <sup>3</sup>	
	Superfamily <b>PORTUNOIDEA</b> Rafinesque, 1815
	Family <b>PORTUNIDAE</b> Rafinesque, 1815
? <i>Callinectes</i> sp. <sup>3</sup>	
	Superfamily <b>XANTHOIDEA</b> McLeay, 1838
	Family <b>GONEPLACIDAE</b> McLeay, 1838
<i>Chasmocarcinus seymourensis</i> Feldmann and Zinsmeister, 1984 <sup>1,2</sup>	
	Superfamily <b>MAJOIDEA</b> Samouelle, 1819
	Family <b>MAJIDAE</b> Samouelle, 1819
? <i>Micromithrax minisculus</i> n. sp. <sup>1</sup>	

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<sup>1</sup>Absolute oldest occurrence in the fossil record of the genus.

<sup>2</sup>Sole occurrence of the genus in the fossil record.

<sup>3</sup>The first occurrence of the genus is Eocene.

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and ?*Micromithrax minisculus* n. sp.—represent the oldest known occurrence of the respective genera in the fossil record, and an additional three—*Lyreidus antarcticus* Feldmann and Zinsmeister, *Calappa zinsmeisteri* n. sp., and ?*Callinectes* sp.—represent genera that have known geologic ranges of Eocene to Recent. Only one genus, *Protocallianassa*, represents a taxon that ranges back beyond the Eocene. Thus, the sample would seem to more closely represent a pioneer population than a relict one in the sense that several generic-level taxa are first noted in the fossil record of the La Meseta Formation. Furthermore, three of the taxa, *Munidopsis scabrosa*, *Homolodromia chaneyi*, and *Lyreidus antarcticus*, are precursors of modern species characteristic of deeper water. The remaining genera, with the exception of *Protocallianassa*, contain at least some species adapted to deep-water habitats in modern oceans.

Although corroborative work has not been completed, there seems to be some relationship between this Antarctic assemblage and the Eocene decapod fauna of New Zealand. *Lyreidus* spp. are dominant elements in New Zealand decapod faunas (Glaessner, 1960, 1980) as in the La Meseta assemblage, and majids and portunids are also present. The New Zealand Eocene assemblage may also be a pioneer population, strong in components ancestral to quiet, deeper water organisms. These similarities, although neither strong nor conclusive, corroborate the biotic relationship described by Zinsmeister (1982b) for the molluscs. He coined the term Weddellian Province to reflect the unit of this southern circum-Pacific assemblage (Zinsmeister, 1979).

The interpretation of these observations is that the Eocene circum-Antarctic ocean was probably characterized by highly seasonal, cool temperate water conditions which served as a site

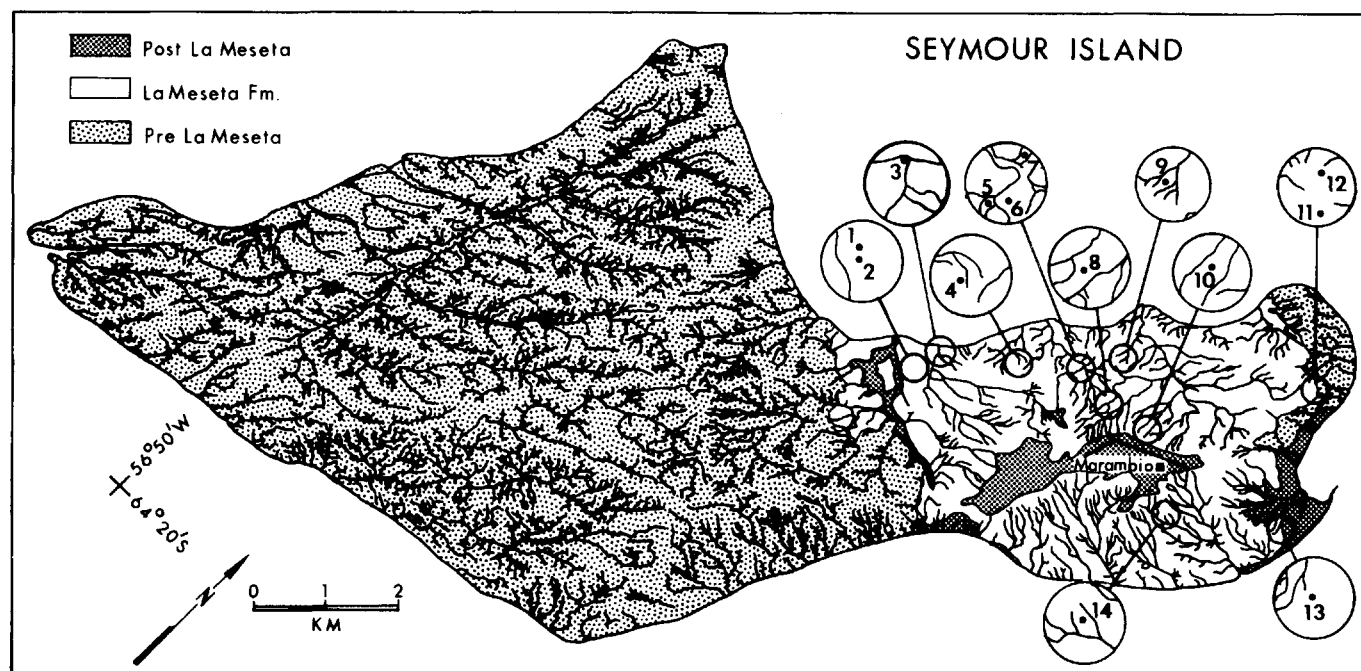


Figure 1. Map of Seymour Island showing the localities from which decapod crustaceans have been collected in the La Meseta Formation.

for the origin of at least some galatheid, homolodromiid, raninid, calappid, portunid, goneplacid, and majid genera that are now more widely dispersed geographically and ecologically.

#### LOCALITIES

Decapod crustaceans have been collected from 14 localities in the La Meseta Formation, which crops out on the eastern end of Seymour Island. Specific descriptions of the localities are given below. The relative position of the locations is illustrated in Figure 1.

**Locality 1.** This locality is a low, rounded knoll, at an elevation of about 15 m, overlooking the main drainage of the Cross Valley. *Lyreidus antarcticus*, barnacles, gastropods, bivalves, brachiopods, shark teeth, vertebrate bones, and trace fossils have been collected from the lower part of the La Meseta Formation, unit I of Elliot et al. (1982) and Telm2 of Sadler (1986, this volume).

**Locality 2.** This site is about 100 m south of Locality 1, and is another domal knob at an elevation of approximately 15 m, overlooking the Cross Valley. The lower part of the La Meseta Formation, unit I of Elliot et al. (1982) and Telm2 of Sadler (1986, this volume), is exposed, allowing collection of *Lyreidus antarcticus*, *Protocallianassa* cf. *P. faujasi*, gastropods, and bivalves.

**Locality 3.** This is a coastal section located on the western side of the mouth of a small valley. The lower part of the La Meseta Formation, unit I of Elliot et al. (1982) and Telm2 of Sadler (1986, this volume), is exposed, and *Protocallianassa* cf. *P. faujasi*, *Munidopsis scabrosa*, ?*Micromithrax minisculus*, and several echinoderms have been collected.

**Locality 4.** A north-south-trending ridge crest, at an elevation of approximately 70 m, exposes the middle part of the La Meseta Formation, unit II of Elliot et al. (1982) and Telm4 of Sadler (1986, this volume). *Homolodromia chaneyi*, crinoids, brachiopods, gastropods, and bivalves have been collected from this locality.

**Locality 5.** *Lyreidus antarcticus*, barnacles, asteroids, brachiopods, gastropods, bivalves, vertebrate bones, teeth of polydolphid marsupials, and numerous trace fossils have been collected from this site, referred to as IPS (Institute of Polar Studies) locality 445 and as the "Rocket Site." This is the type locality for *L. antarcticus* Feldmann and Zinsmeister (1984). It is a rounded hill at the base of the meseta, at an elevation of about 45 m, in the middle part of the La Meseta Formation, unit II of Elliot et al. (1982) and Telm5 of Sadler (1986, 1987).

**Locality 6.** About 100 m northeast of Locality 4, at an elevation of about 50 m, *Lyreidus antarcticus* has been collected from the middle part of the La Meseta Formation, unit II of Elliot

et al. (1982) and Telm5 of Sadler (1986, 1987), on the nose of a northwest-southeast-trending ridge.

Locality 7. This locality is a sloping divide between two small drainages dissecting the middle part of the La Meseta Formation, unit II of Elliot et al. (1982) and Telm5 of Sadler (1986, 1987), at an elevation of approximately 40 m. At this site, *Lyreidus antarcticus* is extremely abundant, and is associated with a fauna including relatively few brittle stars, echinoids, gastropods, bivalves, bryozoans, and trace fossils. Small, unidentifiable plant fragments are common.

Locality 8. This site is a steep, north-facing slope, at an elevation of approximately 150 m, exposing the upper part of the La Meseta Formation, unit III of Elliot et al. (1982) and Telm7 of Sadler (1986, this volume). *Homolodromia chaneyi*, large numbers of brittle stars, echinoids, gastropods, bivalves, brachiopods, bryozoans, teredid bored wood, shark teeth, vertebrate bones, and several trace fossils have been collected from this locality.

Locality 9. This locality is a steep, north-facing slope, at an elevation of approximately 30 m, overlooking the primary drainage on the eastern end of Seymour Island. *Lyreidus antarcticus* has been collected in association with numerous small gastropods and bivalves in the middle part of the La Meseta Formation, unit II of Elliot et al. (1982) and Telm5 of Sadler (1986, 1987).

Locality 10. *Homolodromia chaneyi* has been collected in association with crinoids, brittle stars, gastropods, bivalves and lingulide brachiopods at this site near the crest of the meseta, just below the memorial cross at Marambio. The locality, at an elevation of about 170 m, is in the upper part of the La Meseta Formation, unit III of Elliot et al. and Telm7 of Sadler (1986, this volume).

Locality 11. *Lyreidus antarcticus* was collected in the middle part of the La Meseta Formation, unit Telm3 of Sadler (1986, this volume) near the base of a steep, east-facing slope at an elevation of approximately 20 m.

Locality 12. The type locality of *Chasmocarcinus seymourensis* Feldmann and Zinsmeister (1984) is located at the top of a small hill, at an elevation of approximately 160 m. This is IPS locality 14. The middle part of the La Meseta Formation, unit II of Elliot et al. (1982) and Telm3 of Sadler (1986, this volume), is exposed at this site.

Locality 13. *Lyreidus antarcticus* was collected at this site, at an elevation of approximately 15 m, by Dan Chaney, U.S. National Museum of Natural History. The locality is in the middle part of the La Meseta Formation, unit II of Elliot et al. (1982) and Telm3 of Sadler (1986, this volume).

Locality 14. Specimens were collected on a divide between two small drainages at an elevation of approximately 70 m. *Homolodromia chaneyi*, *Calappa zinsmeisteri*, ?*Callinectes* n. sp., ascothoracican barnacles, ophiuroids, crinoids, gastropods, bivalves, brachiopods, serpulids, wood bored by teredid bivalves, and vertebrate bone fragments have been collected at this locality in the upper part of the La Meseta Formation, unit III of Elliot et al. (1982) and Telm7 of Sadler (1986, this volume).

## SYSTEMATIC PALEONTOLOGY

Superclass CRUSTACEA, Pennant, 1777  
Class MALACOSTRACA Latreille, 1806  
Order DECAPODA Latreille, 1803  
Infraorder ANOMURA H. Milne Edwards, 1832  
Superfamily THALASSINOIDEA Latreille, 1831  
Family CALLIANASSIDAE Dana, 1852  
Subfamily PROTOCOLLIANASSINAE Beurlen, 1930

Genus *Protocallianassa* Beurlen, 1980  
*Protocallianassa* cf. *P. faujasi* (Desmarest)  
Figures 2.1-3, 3

*Description.* Material basis for taxon limited to crushed remains of major and minor claws, arm of major claw, and aureole of decompositional products of cephalothorax of one specimen and interior surfaces of right major cheliped of a second specimen.

Major claw moderate size for genus, quadrate, fingers short, stout; no distinct denticles developed. Hand tapers distally from maximum height near carpus-propodus. Maximum length of manus developed along upper surface. Proximal termination, carpus-propodus joint, intercepts base of manus at angle of about 120°. Fixed finger terminating distally in sharp, upturned point. Occlusal surface broadly undulose with no apparent denticles. Dactylus tapering to downturned, pointed termination crossing over inner surface of fixed finger. Occlusal surface undulose, edentate. Surface ornamentation unknown.

Carpus crushed, fragmented, but appears relatively short. Merus ovoid in lateral aspect, about 5.3 mm long and 3.6 mm high, with greatest height near midlength. Ischium poorly preserved but appears to have flabellate enlargement distally and upwardly curved, narrow proximal termination. Surfaces of these elements appears smooth.

Minor claw smaller, more elongate, more delicate than major claw. Manus subquadrate, slightly higher proximally than distally, upper and lower surfaces smoothly convex. Fixed finger slender, slightly downturned, occlusal surface with single undulation near proximal end. Dactylus nearly circular in cross section, slender, no denticles or undulations evident. Surfaces smooth.

Additional remains consist of numerous small fragments of integument and an ill-defined area of stained, weakly fluorescent material located in the position of the cephalothorax.

*Measurements.* Measurements, in millimeters, are given in Table 2.

*Studied material.* The two specimens, USNM 404849a and b and 404850, are deposited in the U.S. National Museum of Natural History, Washington, D.C.

*Localities and stratigraphic position.* The specimens were collected near the base of the late Eocene La Meseta Formation at localities 2 (USNM 404849) and 3 (USNM 404850) (Fig. 1), Seymour Island, Antarctica.

*Remarks.* Only two specimens, referable to the Callianassidae, have been collected from the La Meseta Formation. This would appear to be anomalous in that burrows referable to the ichnogenus *Ophiomorpha* and attributed to the work of callianassids (Weimer and Hoyt, 1964) are abundant throughout the unit. However, the frequency of *Ophiomorpha* burrows is low in the stratigraphic position of the callianassids but tends to be very high in the position from which another decapod, *Lyreidus*, is found. This suggests that *Lyreidus* might be the producer of *Ophiomorpha* in this instance. The callianassids in the La Meseta were burrowers, but the absence of evidence of their burrowing activity must be attributed to taphonomic processes, rather than to a change in their lifestyle.



Figure 2. *Protocallianassa* cf. *P. faujasi*. 1, USNM 404850, showing portions of right and left pereiopods. 2 and 3, USNM 404849a and b, showing interiors of a major cheliped. Note the geopetal structure preserved as a calcite coated mass of sand in the lower part of the hand. Scale bars = 1 cm.

One of the specimens upon which the above description was based (USNM 404849) consists of the inner surface of a right cheliped preserved in a small ovoid concretion. The chela was apparently separated from the carpus prior to burial. The lower part of the hand is filled with sediment similar to that in the surrounding concretion and constitutes a geopetal structure. In addition to the sediment fill, a thin lining of calcite obscures interior detail of the claw. Thus, the only clues to identity of the organism, based upon this specimen, lie in the general outline and relative proportion of elements of the propodus and dactylus.

The second specimen (USNM 404850), which is proportionally smaller than the first, preserves more elements of the arm of the major cheliped as well as the minor claw. This fortunate circumstance demonstrates differences in size and proportions of the claws, characters important in the classification of the group. In addition to the chelipeds, an aureole of tiny fragments and a dark stain on the rock surface seem to define the position of the cephalothoracic region. Examination of this surface in plain and ultraviolet light, however, does not reveal enough detail to allow adequate description of the structure.

Although confusion surrounds the distinction between *Callianassa* and *Protocallianassa*, these specimens most closely conform to the description of the chelipeds of *Protocallianassa* as discussed by Mertin (1941, p. 199). He outlined criteria useful in distinguishing the two genera, two of which can be applied to the identification of this material. The reentrant, along the distal margin of the manus and just below the base of the dactylus, is relatively shallow. In *Callianassa* this feature is often quite deep. More important, the articulation between the carpus and propodus lies at an angle of about  $120^\circ$  to the long axis of the propodus. By contrast, the axis of rotation of this joint on the overwhelming majority of specimens referred to *Callianassa* is nearly  $90^\circ$ . If this evidence is correctly interpreted, it documents an upward range extension for *Protocallianassa* from the Paleocene (Glaessner, 1969, p. R478) into the Eocene. Most specimens of *Protocallianassa* are Late Cretaceous in age.

Several callianassids have been identified from Antarctica. Ball (1960) described *C. meridionalis* from Upper Cretaceous rocks of James

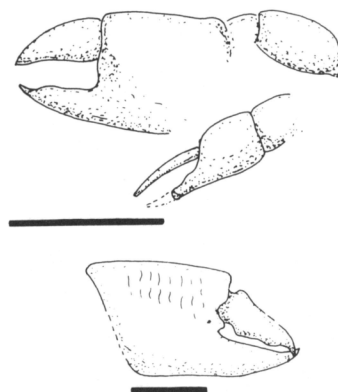


Figure 3. Line drawings of chelipeds of *Protocallianassa* cf. *P. faujasi* based on USNM 404850 (upper) and 404849 (lower). Bar scales = 1 cm.

Ross Island. Those specimens tend to be smaller than ours, and the carpus-propodus joint is clearly at right angles to the base of the hand. That same morphologic condition distinguishes the present specimen from *C. symmetrica* Feldmann and Zinsmeister (1984a). Specimens referable to *Protocallianassa* have been recognized in lower Aptian rocks from Alexander Island by Taylor (1979), but neither of the taxa that he identified closely approximates the specimens from the La Meseta. *Protocallianassa antarctica* Taylor has a relatively slender hand and fingers that greatly exceed the length of the manus, a condition generally not known in other representatives of the genus. *Protocallianassa* sp. (Taylor, 1979, p. 22) is easily distinguished from the specimens from the La

TABLE 2. MEASUREMENTS TAKEN ON TWO SPECIMENS OF  
*PROTOCALLIANASSA* cf. *P. FAUJASI* FROM THE LA MESETA FORMATION

Specimen	L-manus	H-manus	W-manus	L-finger	H-finger	L-dactyl	H-dactylus
404849-major	15.2	12.0	10.5	8.3	3.6	ca. 8	5.2
404850-major	14.1	—	8.2	5.2	3.0	6.1	2.9
404850-minor	ca. 4.4	3.5	2.9	>4.3	1.4	5.8	1.2

Note: All measurements in millimeters.

Meseta in that, in the former, the height of the hand exceeds the length. Additionally, the longest part of the hand on the specimen from Alexander Island lies along the lower surface rather than along the upper surface. No described fossil callianassids from New Zealand bear close comparison with the La Meseta forms.

The species to which the La Meseta specimens can be compared most closely is *Protocallianassa faujasi* (Desmarest). They are similar in relative proportions (Mertin, 1941, p. 201) and in general outline. *Protocallianassa faujasi* has been described from a number of Cretaceous sites in Germany. In the absence of additional bases for comparison, however, it would seem inappropriate to apply that name, with certainty, to this Eocene form. For the same reason it seems unwise to designate a new name.

Superfamily GALATHEOIDEA Samouelle, 1819  
Family GALATHEIDAE Samouelle, 1819  
Subfamily MUNIDOPSISINAE Ortmann, 1898

Genus *Munidopsis* Whiteaves, 1874

**Remarks.** Fossils previously assigned to the Galatheidae possess a carapace that is longer than wide, which bears transverse ornamentation over some or all of the surface, and a well-developed triangular rostrum. As with other members of the Galatheoidea, the epistome is not fused with the carapace. These features are all demonstrable on these specimens of *Munidopsis*, rendering placement in the family a certainty. Genera within the family are distinguished from one another on the basis of details of the rostrum, frontal margin, definition of regions, and development of transverse sculpture.

Ambler (1980) provided a diagnosis of *Munidopsis*, which is represented by over 140 living species, and until this report, no fossil forms. Important points of comparison relative to material from Seymour Island are evident on the carapace. The rostrum tends to be keeled and typically is smooth or only slightly serrated on the lateral margins. The frontal region may lack spines or possess small antennal spines; large supraorbital spines, such as those seen in *Munida*, are not present. The lateral margins may be variously arrayed with spines, or may lack spines. The gastric, cardiac, and branchial regions are well defined. The dorsal surface may be transversely rugose, nodose, squamose, or nearly smooth. On living forms, the eyes are not pigmented and lack facets.

Until recently (Via Boada, 1981, 1982), most fossil galatheids had been referred to the Galatheinae. Yet no described genera within this subfamily can accommodate the Antarctic specimens. The rostrum in all galatheids is serrated or spined, except that of *Munida* Leach and *Protomunida* Beurlen. In both of these genera, however, spines are developed at the base of the rostrum. The transverse ornamentation is not as strongly developed as it is in *Galathea* Fabricius, *Munida*, *Paleomunida*

Lorenthey, and *Protomunida rugafarius* Bishop (1985) was defined on the basis of possession of three transverse grooves, none of which cross the midline. Instead, the midline in this genus is defined by a ridge that is prominent in the thoracic region, termed the "scapular arch" by Bishop (1985, p. 615), and subtle in the cephalic region.

Within the Munidopsinae, transverse sculpture is well developed in *Paragalathea* Patrulius and *Eomunidopsis* Via Boada; both have dentate rostra (Via Boada, 1982). Only *Munidopsis* may have weakly developed transverse ornamentation and a smooth, keeled rostrum. Transverse ornamentation in the *Munidopsis* described herein is limited to rows of nodes and scales best developed on the branchial region, and to a lesser extent, on the axial regions. The rostrum is strongly keeled and devoid of spines or serrations.

As summarized by Via Boada (1981, p. 249), the concept of generic and subgeneric units in the Galatheidae has been variously interpreted by recent workers. Even the attempts to refine the classification of species within the single genus *Munidopsis* (Milne Edwards and Bouvier, 1894) have been proven to be inadequate (Chace, 1942). Clearly, the generic descriptors employing details of spinosity and ornamentation of the rostrum and lateral margins may be viewed as of considerable significance. Perhaps it may be more reasonable to consider the nature of the groove patterns—as they define major regions on the carapace—and gross aspects of the sculpture as being more significant generic descriptors.

The fossils from Seymour Island may be referred to *Munidopsis*, in the Munidopsinae, with confidence and appear to be quite different from taxa in the Galatheinae. Thus, this notice represents the first record of *Munidopsis* in the fossil record.

*Munidopsis scabrosa* n. sp.  
Figure 4.1–3, 5

**Description.** Carapace small size for family; outline quadrate, slightly longer than wide, weakly convex longitudinally, strongly vaulted transversely; rostrum prominent.

Frontal region about one-third the width of carapace, strongly depressed below level of gastric region; defined posteriorly by narrow transverse sulcus interrupted mesially by axial ridge extending from mesogastric region anteriorly onto rostrum. Rostrum elongate triangular, about one-third total length of remainder of carapace, margin with narrow, well-defined smooth rim, prominently keeled axially at least in posterior one-half the length; remainder of surface slightly arched, finely pustulose. Orbits, when viewed from above, expressed as shallow concavities at base of rostrum. Anterolateral corner with two nodose protuberances, which may be spine bases, separated by broad, shallow reentrant. Lateral margins subparallel, slightly convex, greatest width of cephalothorax near midlength of carapace where cervical groove crosses midline. Posterior margin weakly concave with smooth border and narrow, well-defined rim anterior to border.

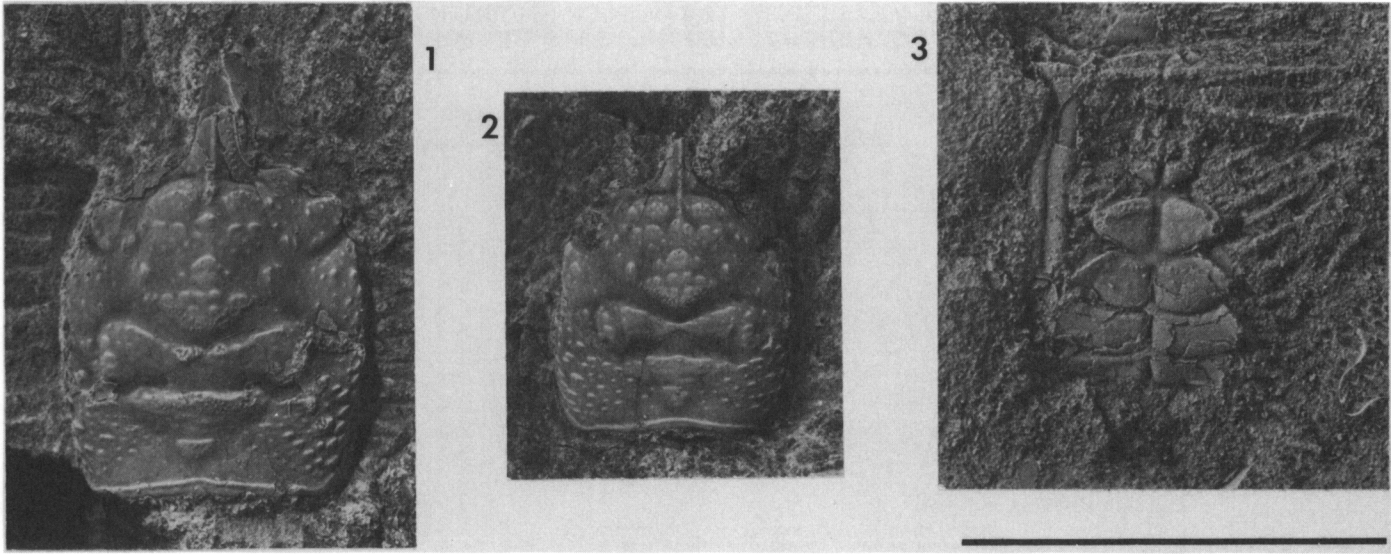


Figure 4. *Munidopsis scabrosa* n. sp. 1, Holotype, USNM 404851, dorsal aspect of cephalothorax. 2, Paratype, USNM 404860, dorsal aspect of cephalothorax. 3, Paratype, USNM 404859, sternum and portions of two pereopods. Scale bar = 1 cm.

Carapace regions and grooves well defined as pustulose or scabrose, domed regions and broad, shallow, smooth depressions, respectively. Gastric region with two pairs of subtle, ovoid elevations identifiable as epigastric and protogastric regions, former smaller than latter; mesogastric region narrow anteriorly and broadening abruptly posteriorly. Gastric regions with transverse rows of scabrous ornamentation, steeply sloping anteriorly and gently sloping posteriorly. Hepatic regions reflected as circular domed areas ornamented by numerous fine nodes. Cervical groove lyrate, deeply and broadly impressed in the axial region, becoming broad and poorly defined in mesolateral areas, and narrow and well defined near lateral terminations. Cardiac region broad, about three-fourths the total width of carapace, well defined by smooth sulci, narrowest axially and widest near adaxial terminations; surface with pair of large nodes adjacent to midline and numerous smaller nodes laterally. Intestinal region large, triangular, irregularly domed; greatest width, at anterior, about one-half the total carapace width; posteriormost expression as an axial triangular swelling. Epibranchial region triangular, ornamented by numerous nodes; separated from remainder of branchial region by subtle depression. Remainder of branchial region smoothly arched, ornamented by rows of nodes and forward-directed scabrose ornamentation.

Sternal region with at least five discrete pairs of elements, each separated from others by narrow, deeply incised depressions; anterior-most elements, fused sternites of MXP1-3, small, forming a triangular unit; subsequent elements widening uniformly from P1-P3, those of P4 apparently slightly narrower than P3; length of somites, measured along midline, decreases posteriorly, P2 only slightly shorter than P1, P3, and P4 much shorter.

Abdomen unknown.

Appendages known only from separate, long, slender, finely spinose articles, largest 13 mm long and 1.5 mm wide.

*Measurements.* Measurements on the specimens referred to this species are given in Table 3. Specimens representing part and counterpart of the

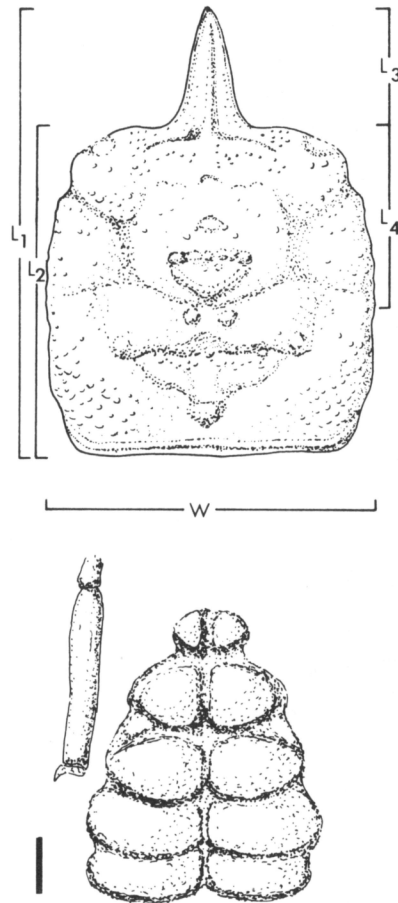


Figure 5. Line drawings of the cephalothorax (upper) and sternum (lower) of *Munidopsis scabrosa*, showing positions and orientations of measurements. Bar scales = 1 mm.

TABLE 3. MEASUREMENTS TAKEN ON SPECIMENS OF  
*MUNIDOPSIS SCABROSA* FROM THE LA MESETA FORMATION

Specimen	L-1	L-2	L-3	L-4	W
404851	11.7	8.6	3.1	4.4	7.7
404852-mold	—	4.0	—	2.1	4.4
404853	—	ca. 7.2	—	3.9	ca. 5.2
404854	9.1	6.9	2.2	3.5	5.9
404855-mold	—	7.2	—	4.9	ca. 6.0
404856	5.2	3.7	1.5	1.8	3.6
404857-mold	14.2	11.5	2.7	5.4	12.4
404858-mold	—	—	1.2	1.8	ca. 3.4
404859	—	8.6	—	4.8	9.0
404860	8.3	6.4	1.9	3.4	6.2
404861-mold	—	5.8	—	ca. 3.0	5.4
404862-mold	11.7	9.2	2.5	5.1	8.7
404863-mold	—	6.2	—	3.5	5.4
404864-mold	5.2	3.9	1.3	2.0	ca. 7.0
404865-mold	—	4.3	—	2.3	—
404866	13.4	10.4	3.0	5.5	9.1
404867	—	7.2	—	3.8	ca. 7.2

Note: All measurements in millimeters.

same individual are measured and recorded as separate specimens because the nature of preservation results in slightly different measurements on each, and part and counterpart are difficult to relate.

*Types.* The holotype USNM 404851, and 18 paratypes, USNM 404852 through 404869, are deposited in the U.S. National Museum of Natural History, Washington, D.C.

*Etymology.* The trivial name was derived from the Latin word *scab(e)r* = rough, reflecting the nature of the ornamentation, considered to be a distinguishing characteristic of this species.

*Locality and stratigraphic position.* All specimens referred to this species were collected from a single exposure near the base of the late Eocene La Meseta Formation at Locality 3 (Fig. 1), Seymour Island, Antarctica.

*Remarks.* Most fossil galatheids have been distinguished mainly on morphology of the cephalothorax. Because of the fine quality of preservation of the La Meseta specimens, comparison has been made with adequate detail to assure the uniqueness of *Munidopsis scabrosa*.

The sternal region (USNM 404869), which is preserved in association with carapace material, may represent only the second such part known from the fossil record; for this reason, it offers little basis for comparison, except with extant forms. Via Boada (1982, Plate 3, Figs. 1, 2) illustrated two sterna he referred to two different, undetermined species. It is not clear that the two specimens differ from one another, and both may be referable to *Galathea*.

Examination of sternal elements of a variety of living representatives of the Galatheaidea suggests that three general forms can be identified, based upon the relationship of the MXP1-3 element and that of P1. In one group, represented *Munidopsis* and *Munida*, MXP1-3 is clearly separated from the posterior elements by a narrow constriction. By contrast, that region in *Galathea*, *Sadayoshia*, and *Eumunida* shows a distinct separation of the two elements, but the constriction is less

pronounced or is reduced to a narrow depression. Finally, in the chirostylid genus *Uroptychus* the anterior elements are almost entirely fused, and their positions are marked only by marginal reentrants. The sternum of *Munidopsis scabrosa* appears to most closely resemble those of living *Munidopsis* and *Munida*, in which the sternal elements supporting attachments for the maxillipeds are discrete, large, and obviously separated from those of the pereopods. This line of evidence tends to confirm the generic placement, but until much more comparative work is conducted on sternal elements in the family, the evidence must be taken as suggestive.

The ecological settings in which living galatheids have been collected are varied. They range through most of the oceanic regions of the world and throughout nearly the entire spectrum of temperatures and depths, except in the Antarctic. Baba (1979), for example, reported 32 species of galatheids from the region of the Moluccas, in the East Indian Archipelago. Seventeen of these species were dominantly deep-water forms, and 14 were confined to shallow-water, reef habitats. Similar variations in ecological requirements have been noted in many other regions. *Munidopsis*, however, is almost exclusively restricted to deep-water, aphotic settings (Austin Williams, personal communication), including at least one species that is adapted to the thermal vents of the Galapagos Rift (Corliss and Ballard, 1977). One of the few records of a shallow-water occurrence of a species of *Munidopsis* is that of *M. polymorpha* Koelbel, which is known only from subterranean habitats in the Canary Islands (Miyake and Baba, 1970).

Although it is tempting to generalize on morphological variations between taxa inhabiting shallow-water realms and those living in deeper water, no such contrasts are apparent in the Galatheaidea. Shallow-water species may have shorter, stouter walking legs and prominent ornamentation, as for example, in *Galathea inflata* Potts, 1915 (fide, Baba, 1979); deep-water forms may have more delicate ornamentation and longer, more slender appendages, as in the various species of the chirolistid genus *Uroptychus*, as described for example, by Baba (1981). On the other hand, *Munidopsis gibbosa* Baba, 1978 was taken from a depth of 520 to 560 fathoms in the South China Sea and has stout appendages and coarse ornamentation. Based solely upon observations



of the morphology of this species, it would probably be considered a shallow-water species. The scabrous ornamentation and general outline of the carapace may lead to the conclusion that the form had burrowing capability, backing into the burrow (Savazzi, 1986).

For the above-stated reason, therefore, little can be said about the ecological requirements of *Munidopsis scabrosa* based on functional morphology. Its preservation in sediments interpreted as having been deposited in shallow-water, nearshore habitats may be taken as the best available interpretation of its living site. Thus, the adaptation of living representatives of *Munidopsis* to bathyal and abyssal regions represents a habitat preference that is significantly different from that of *M. scabrosa*.

**Section PODOTREMATA Guinot, 1977**

**Subsection DROMIACEA de Haan, 1833**

**Superfamily HOMOLODROMIOIDEA Alcock, 1899**

**Family HOMOLODROMIIDAE Alcock, 1899**

**Genus *Homolodromia* A. Milne Edwards, 1880**

*Remarks.* Placement of *Homolodromia* within the Brachyura has been the subject of much controversy. Although it has been generally agreed that the genus represents one of the more generalized brachyurans, suprageneric assignment differs widely. Rathbun (1937) placed the genus in the Homolodromiidae, which was included, along with the Dromiidae and Dynomenidae, in the superfamily Dromioidea. The essential characters, most useful in paleontological studies, uniting these groups were possession of a common orbito-antennular pit, a triangular epistome, and an abdomen with seven segments. This position has been followed, essentially, by numerous subsequent zoologists, including Balss (1957) and Sakai (1976).

Glaessner (1969) placed *Homolodromia* in the subfamily Homolodromiinae within the Prosopidae. This family also embraces two subfamilies of Mesozoic dromiaceans, the Prosopinae and the Pithonotinae (Glaessner, 1969, p. R484-R486). Together with the Eocarcinidae, Dromiidae, and Dynomenidae, the Prosopidae were united in the superfamily Dromioidea. Members of the superfamily were characterized by absence of dorsal lineae and dorsal position of at least the fifth pereopod. The Prosopidae were distinguished from other families in the superfamily by strong development of both cervical and branchiocardiac grooves.

Subsequent to these works, Guinot (1977, 1978) presented a new classification of brachyurans in which sections were defined on the basis of placement of genital openings. She recognized that the homolodromiids were substantially different than the Dromiidae and the Dynomenidae and placed the latter two families in a separate superfamily, the Dromioidea. *Homolodromia* and another genus, *Dicranodromia* A. Milne Edwards, were considered the sole representatives of the Homolodromiidae in the superfamily Homolodromioidea. The essential distinguishing descriptors of the family, of primary use to paleontologists, are possession of a weakly calcified carapace with poorly defined, subvertical lateral margins, an absence of lineae, and reduced, subchelate fourth and fifth pereopods that are carried in a dorsal position. Guinot noted (1978, p. 226) that the terminal pereopods were not utilized, however, as grasping devices to hold camouflaging organisms. Finally, she (1978, p. 228) supported the observations of several paleontologists in considering the Prosopidae as the progenitors of the Homolodromiidae. The Homolodromiidae are deep-water organisms.

Although it is not the expressed intent of this work to comment on suprageneric classification of brachyurans, it is necessary to consider the range of placements of homolodromiids to properly assess the significance of the fossils from Seymour Island. In comparing both Recent and fossil material to the Antarctic fossils, numerous points of comparison can be defined to demonstrate that *Homolodromia*, previously known only from Recent records, has a long ancestry. Further, the generic

descriptors defined (Rathbun, 1937, p. 58; Glaessner, 1969, p. R486) and alluded to (Guinot, 1978, p. 226-229) serve to separate the genus from previously defined fossil, as well as Recent, brachyurans.

*Homolodromia* is characterized by having a quadrate carapace that is longer than wide, with subvertical and poorly sclerotized lateral margins that are not separated from the dorsal surface by a rim. The frontal region is attenuated into two dominant spines separated by a depressed axial region. The dorsal surface of the carapace is crossed by distinct cervical and branchiocardiac grooves and there are no dorsal lineae. The abdominal region is composed of seven segments, of which three are visible in dorsal aspect. Although the pereopods tend to be elongate and slender, the last two are reduced in size, and at least in Recent species, subchelate. The buccal region is quadrate, the epistome distinct.

There is a tendency to consider fossil forms as representative of distinct genera, especially when separated from Recent counterparts by a considerable hiatus. However, the Seymour Island fossils so closely conform to the above description that it would seem more prudent to refer them to *Homolodromia*. Few morphological characters, none of apparent generic significance, distinguish them from their Recent descendants.

***Homolodromia chaneysi* n. sp.**

Figures 6.1-10, 7

*Description.* Carapace moderate size; outline pentagonal, longer than wide, widest near posterolateral corner, weakly convex longitudinally and transversely; sides well defined, vertical or slightly turned.

Front narrow, about one-third the total width; produced anteriorly, sulcate dorsally and apparently terminated by downturned sulcate surface; anteriormost extensions form small, blunt spines. Orbits nearly vertical, slightly concave, extending obliquely from front posterolaterally to well-defined blunt projection on anterolateral corner, with single supraorbital projection at midlength; lateral margins of orbits defined by sharp, pustulose ridges; ventral margin undefined. Lateral margins long, about two-thirds the total length, nearly straight, slightly converging anteriorly, slightly constricted at level of cervical groove. Sides well defined along entire length, bounded dorsally in branchial region by pustulose ridge; height of sides greatest anteriorly, tapering to termination at posterolateral corner. Posterolateral corner slightly produced as posteriorly directed flabellate extension. Posterior margin straight or slightly sinuous, bordered by well-defined marginal ridge and furrow.

Regions and carapace grooves well defined. Mesogastric region about one-third the total width posteriorly, tapering abruptly to narrow termination anteriorly; surface finely pustulose, bordered by shallow, smooth depressions. Gastric and hepatic regions distinguishable only as two broadly domed areas; surfaces pustulose mesially, becoming smooth laterally. Cervical groove well defined, gently arcuate, broad, smooth, extending from midline anteriorly and laterally to side and onto side to terminate at swollen region. Thoracic region with distinguishable gastric, cardiac, and intestinal regions axially and epibranchial, mesobranchial, and metabranchial regions laterally. Gastric region broad, swollen, weakly defined, concave anteriorly; surface pustulose. Cardiac region narrower, less swollen, pustulose, defined laterally by deep, narrow, well-developed branchiocardiac groove which originates near posterolateral corner of gastric region at epimeral muscle scar, extends posteromesially to anterior corner of cardiac region, then posteriorly, and then anterolaterally, paralleling cervical groove and separating epibranchial and mesobranchial regions from metabranchial region; cardiac region tapers posteriorly and terminates at low domed region. Intestinal region triangular, poorly defined, smoother than other axial regions. Epibranchial region relatively small, swollen, with prominent broad node situated posterior to cervical groove; mesobranchial region subtly distinguishable from epibranchial region, surface pustulose mesially, nearly smooth laterally. Metabranchial region broadly arched, pustulose throughout.

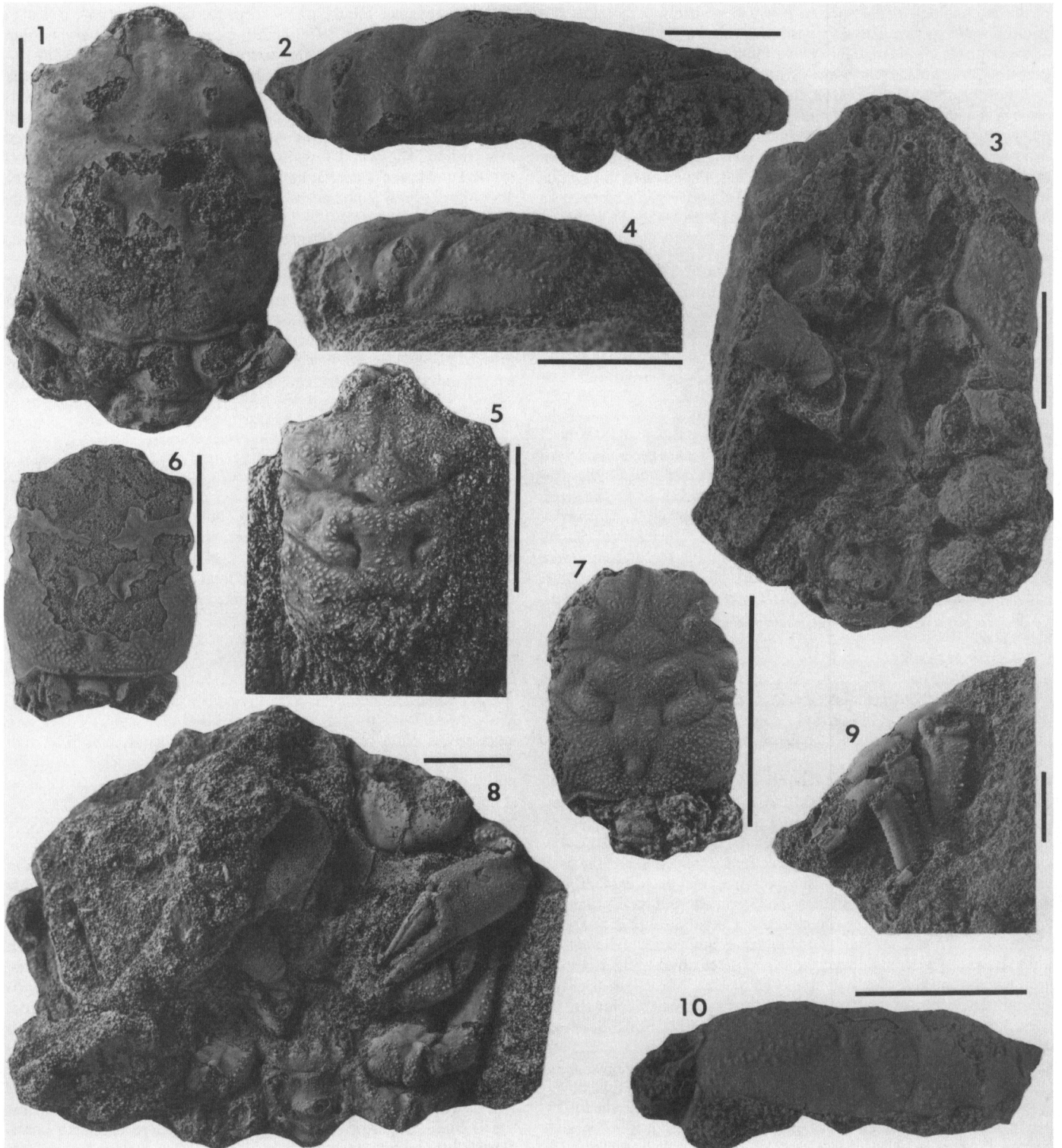


Figure 6. *Homolodromia chaneyi* n. sp. 1-3, Holotype, USNM 404870, dorsal aspect of cephalothorax and proximal segments of abdominal terga, left lateral, and ventral views. 4 and 5, Paratype, USNM 404872, left lateral and dorsal views. 6, 10, Paratype, USNM 404871, dorsal and right lateral views. 7, Paratype, USNM 404873, dorsal aspect of cephalothorax and proximal abdominal terga. 8 and 9, Paratype, USNM 404874, ventral view of abdomen with basal portions of pereopods 1 through 3 and left cheliped, and dorsal view of left meri and carpi of pereopods 1 through 3. Bar scales = 1 cm.

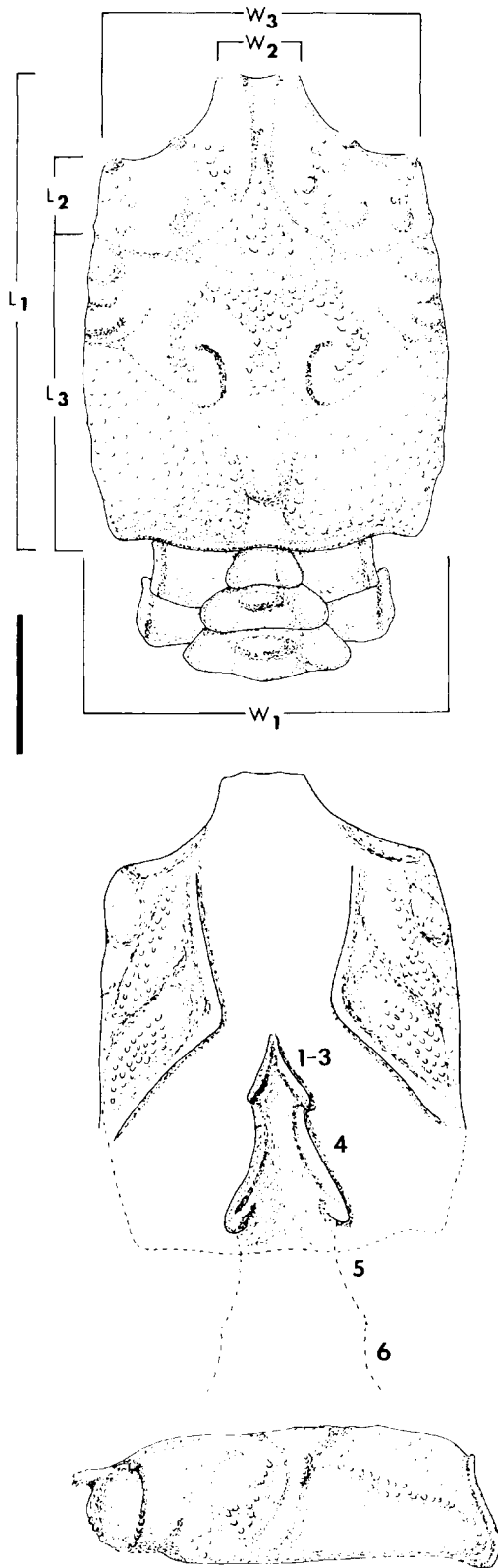


Figure 7. Line drawings of dorsal (upper), ventral (middle), and left lateral (lower) surfaces of the cephalothorax of *Homolodromia chaneyi* showing the positions and orientations of measurements. Bar scale = 1 cm.

First three abdominal somites exposed dorsally, remainder folded ventrally. Width of first three somites increases posteriorly from about one-fifth to nearly one-half the carapace width; width apparently decreases slightly on somites 3 through 6. Length of abdominal somites increases to somite 3 and decreases thereafter. Surfaces of somites pustulose; axial region elevated; pleural regions depressed, margins apparently smoothly rounded; prominent transverse swelling on anterior part of axial regions.

Sternum poorly known; narrow anteriorly, widening posteriorly to approximately maximum width posterior to first pereiopod; depressed axially.

Pterygostomial region large, well defined, triangular surface broadly corrugated, pustulose. Buccal cavity generally quadrate, widens anteriorly.

Thoracic appendages strong. Third maxilliped poorly known, apparently slender. Cheliped wider, thicker, and shorter than second and third pereiopods. Fourth and fifth pereiopods smaller, thinner, dorsal in position. Articles of appendages generally wider than high, ornamented by fine spines, more or less arranged in longitudinal rows, and by a row of somewhat longer spines on leading edges of articles. Meri and carpi with prominent distal ridges and sulci. Cheliped moderately straight, long, slender. Hand apparently ovoid in cross section with nodose ridge on upper surface. Fixed finger with longitudinal sulcus near lower edge. Dactylus with sulcus near upper edge. Denticles unknown. Termination of remaining appendages unknown.

*Types.* The holotype, USNM 404870, and five paratypes, USNM 404871 through 404875, are deposited in the U.S. National Museum of Natural History, Washington, D.C.

*Etymology.* The trivial name honors Dan Chaney, U.S. National Museum of Natural History, who collected one of the key specimens referable to this species.

*Measurements.* Measurements, in millimeters, are given in Table 4.

*Geographical and stratigraphical position.* Specimens referable to this taxon were collected from Localities 4, 8, 10, and 14 (Fig. 1), in the upper part of the La Meseta Formation on Seymour Island, Antarctica.

*Remarks.* Five specimens of *Homolodromia chaneyi* were collected from three separate localities, making this the second most abundant decapod in the La Meseta Formation. The lengths of the carapaces range from a minimum of about 11 mm to a maximum of nearly 38 mm, but the relative proportions and general aspect remain similar. Both dorsal and ventral aspects of the cephalothorax are preserved, along with the proximal elements of the abdomen and parts of several pereiopods. Thus, it is possible to make a detailed comparison of this species with Recent forms.

*Homolodromia chaneyi* seems to be most like *H. paradoxa* A. Milne Edwards, 1880, type species of the genus (Rathbun, 1937, p. 59). The cephalothorax of the Recent species is somewhat more vaulted and less coarsely ornamented than that of *H. chaneyi*. Additionally, the lateral margins on the former tend to be less well calcified and less well defined than on the fossils. A pustulose ridge gives a suggestion of a demarcation between the dorsal and lateral parts of the branchial region.

The pereiopods are smoother and tend to have a more nearly circular cross section on the modern form than on the fossils. The relative proportions of appendages are similar, although those of *H. chaneyi* are somewhat stouter throughout. Unfortunately, dactyli of pereiopods 2 through 5 are not available for comparison.

The form of the abdomen of the two species appears similar, to the

TABLE 4. MEASUREMENTS TAKEN ON SPECIMENS OF  
*HOMOLODROMIA CHANEYI* FROM THE LA MESETA FORMATION\*

Specimen	L1	L2	L3	W1	W2	W3	LA4	WA1	LA2	WA2	LA3	WA3	LA4	WA4	LA5
404870	37.6	6.1	23.9	29.6	7.4	25.8	3.4	6.8	3.8	10.0	6.0	12.9	4.8*	12.8	4.8
404871	20.4*	3.7	13.8	17.4		15.5									
404872	20*	3.6	12.5	16.0	4.9	13.8									
404873	10.9		7.3	8.8											

Specimen†	Merus		Carpus		Propodus		Dactylus	
	L	W	L	W	L	W	L	W
404872-1			5.3	3.6	12.1	3.9		
404874-1	16.3	7.2	11.3	6.3	23.3	7.8	10.7	3.0
404874-2	22.3	5.3	10.7	4.4	10.7*			
404874-3	25.5	4.6	11.0	4.3	6*			
404874-4			6.3	2.6				

Note: All measurements in millimeters. Position and orientation of measurements taken on the cephalothorax are illustrated in Figure 7.  
\*Indicates an approximated measurement.  
†Refers to the USNM catalogue number to which the number of the pereopod has been appended.

extent that comparison can be made. The tergal regions on both species increase to a maximum width at somite 3, and the pleura are smooth or finely pustulose, gently rounded, and reduced. The abdomen is carried in such a fashion that somites 1, 2, and 3 are visible in dorsal aspect and project above the bases of pereopods 4 and 5.

On the ventral surface of the cephalothorax, the general quadrate form of the buccal region on both forms results in similar appearance of the anteroventral area. Additionally, the anterior halves of the sternal regions on the two species are comparable. On *H. chaneyi*, the sternum originates as a small triangular anterior element that widens posteriorly to the approximate position of the insertion of the first pereopod, at which point the sternum narrows and then widens progressively to the point of insertion of the second pereopod. Although not investigated in detail, the position of insertion of pereopods on *H. paradoxa* would suggest a similar sternal outline.

In 1983, Birkenmajer et al. published an illustration of a crab fossil collected from the early Miocene glaciomarine Cape Melville Formation on King George Island, approximately the northernmost island on the Antarctic Peninsula. They referred (p. 58) to the crab as a "crab of the section Dromiacea de Haan, 1833." Subsequently, the material formed the basis for description of a new genus and species, *Antarctidromia inflata* Förster, Gazdzicki and Wrona, 1985, of the Homolodromioidea. The branchial regions on the King George Island material are more inflated transversely, the thoracic region is much broader than the cephalic area, and the frontal region is more attenuated than on *H. chaneyi*. Although there are some differences in the relative proportions of regions, as defined by well-developed grooves, the groove patterns are similar. Therefore, it would appear that the Miocene specimens represent a different, but possibly closely related, species.

The only other family of organisms reported from the fossil record that contains species comparable to *H. chaneyi* is the Torynommiidae Glaessner, 1980. This family was erected to embrace five genera of Cretaceous crabs, two of which—*Torynomma* and *Eodorippe*—are austral forms and a third—*Dioratiopus*—is cosmopolitan. These genera are characterized (Glaessner, 1980, p. 181) by having a square carapace with

a spatulate frontal region, and distinctly defined regions with broad, well-defined grooves, including a branchiocardiac groove. The chelipeds on representatives of the Torynommiidae are subequal, and pereopods 4 and 5, or just pereopod 5, are reduced and dorsal in position. Applying these, and the remainder of the familial descriptors, to *H. chaneyi* would seem to suggest the possibility of its placement in this taxon with as much confidence as offered by placement in the Homolodromiidae.

Examination of species within the Torynommiidae, however, leads to the conclusion that most differ in significant ways from *H. chaneyi*. Most have very broad and deeply impressed carapace grooves or groove patterns that differ significantly from those of the Seymour Island material. The genus with members that most closely resemble *H. chaneyi* is *Dioratiopus* Woods, 1953 (= *Glaessneria* Wright and Collins, 1972; non *Glaessneria* Takeda and Miyake, 1964; = *Glaessnerella* Wright and Collins, 1975). However, careful comparison of trivial characters of the seven species discussed by Wright and Collins (1972) and the two discussed by Glaessner (1980) reveals substantial differences that separate each from *H. chaneyi*. Most representatives of the genus have a more drawn out frontal and anterolateral form, often with a downturned rostrum. In all cases, details of the groove patterns can be considered significant points of distinction. Because most of the species are apparently known only from remains of the cephalothoracic region, no adequate comparison of the abdomen or the walking legs can be made.

Thus, it would appear that the homolodromiid material from Seymour Island may represent the earliest record of the genus *Homolodromia* in the fossil record, extending the range of that genus into the late Eocene. Furthermore, considering *Antarctidromia inflata* as the first fossil record of the Homolodromiidae, *H. chaneyi* represents only the second, and the earliest, occurrence of the family. It is also possible that the Homolodromiidae arose from the Torynommiidae, possibly through *Dioratiopus*. A much more detailed examination of the Torynommiidae must be made before this suggestion can be confirmed.

Records of the sites from which living representatives of the genus *Homolodromia* have been collected (Rathbun, 1937, p. 58) range from 356 to 472 fathoms in the regions of the West Indies and east Africa.

Guinot (1977, p. 229) noted that the entire range of the superfamily Homolodromioidea (comprising a half-dozen species in two genera, *Homolodromia* and *Dicranodromia*) was in deep-water settings. Specimens have been collected at few, widely separated sites in the east and west Atlantic, the Indian Ocean, and Japan. Therefore, the occurrence of *Homolodromia chaneyi* in shallow-water sediments in Eocene rocks of Antarctica documents the first occurrence of a representative of the superfamily in shallow-water habitats and documents the inshore environments as the site of origin of taxa now known to exist only in bathyal environments.

Subsection ARCHEOBACHYURA Guinot, 1978  
 Superfamily RANINOIDEA De Haan, 1839  
 Family RANINIDAE De Haan, 1839  
 Subfamily RANININAE Serene and Umali, 1972

Genus *Lyreidus*, De Haan, 1841  
*Lyreidus antarcticus* Feldmann and Zinsmeister, 1984  
 Figures 8, 9.1–11, 10.1–8

*Lyreidus antarcticus* FELDMANN and ZINSMEISTER, 1984,  
 p. 1048–1056, Figs. 3A–K, 4A–I, 5, 6B, 7.

**Emended Description.** With the recent collection of 190 additional specimens of *Lyreidus antarcticus*, some refinements of the original description of the species may be made. These emendations follow in the order of the original description.

Fronto-orbital margin approximately two-fifths the maximum carapace width; frontal width relatively greater in smaller, presumably younger, individuals and more narrow in larger, or mature, specimens. Rostrum subacute, relatively less acute than that of some other species of *Lyreidus*; rostrum 1.2 times as long as wide, postorbital spines slightly divergent and just longer than rostrum. In addition to setal pits, originally described as only feature of ornamentation, carapace possesses prominent cardiac grooves located in posterior one-third, centered on dorsal surface; as in Recent species, grooves present as longitudinal, paired, curved depressions; gastric apodeme pits not found, although typically extremely small and not readily preserved in fossil material.

Sternal elements 1 through 3 fused, apex sharp; anterolateral portion of element 4 acute and upturned, unlike Recent species of *Lyreidus*; sternum attains greatest width across element 5 and narrows abruptly across element 6, gradually tapering posteriorly. Abdomen articulated with sternum between elements 5 and 6, with female specimens exhibiting a small, raised, outwardly curved projection of sternum.

Thoracic appendages, excluding first pereiopod, not commonly preserved completely, previously undescribed. Second pereiopod, described and measured from two complete specimens, much smaller than first; basis rounded; ischium about 0.80 times as long as wide; merus nearly 2.5 times as long as wide, upper and lower surfaces thin and sharp, sides ornamented with minute spines, nodes, or setal pits; carpus nearly twice as long as wide, widens distally; propodus nearly square, flat; dactylus extremely long, nearly 2.5 times as long as wide, blade shaped. Third pereiopod described and measured from three incomplete specimens, longest walking appendage; merus uniformly about 3.5 times as long as wide, merus proportionally longer than merus of second pereiopod, upper surface sharp, lower surface rounded; carpus much stouter than merus, about twice as long as wide, thinning proximally, upper surface sharp; propodus approximately 1.5 times as long as wide, tapers distally, upper and lower surfaces thin and sharp; dactylus blade shaped, stouter than dactylus of second pereiopod, only slightly more than 1.5 times as long as wide, upper and lower surfaces extremely thin and sharp. Fourth pereiopod described and measured from three specimens. Appendage smaller than third pereiopod; merus about twice as long as wide, slightly

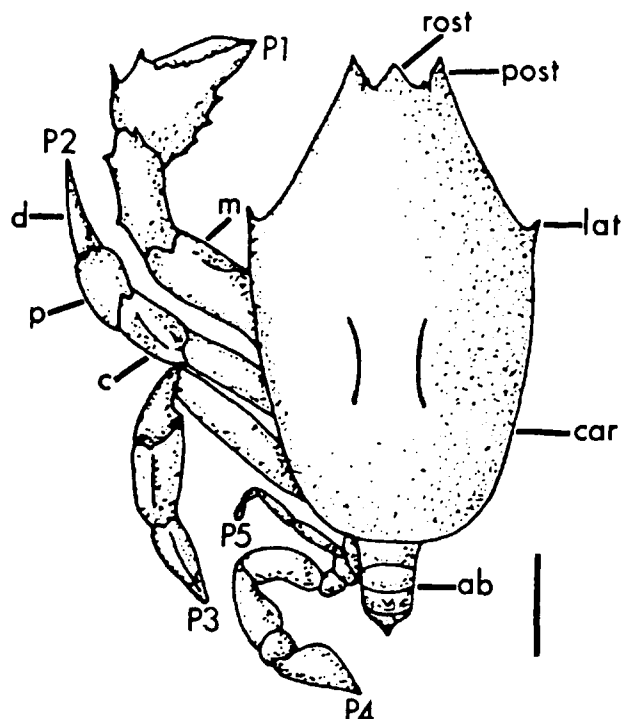


Figure 8. Reconstruction of *Lyreidus antarcticus* with major morphological features labeled. Key: ab = abdomen; car = carapace; c = carpus; d = dactylus; lat = lateral carapace spine; m = merus; P1 = pereiopod 1; P2 = pereiopod 2; P3 = pereiopod 3; P4 = pereiopod 4; P5 = pereiopod 5; post = postorbital spine; p = propodus; rost = rostrum. Bar scale = 1 cm.

wider distally, upper surface rounded, surface thin and sharp; carpus stout, just slightly longer than wide; propodus extremely stout, approximately twice as wide as long; dactylus twice as long as wide, very thin in cross section, and elongate chordate shaped. Fifth pereiopod described and measured from three incomplete specimens. Appendage radically reduced, lies in dorsal plane of body, aligned with first abdominal somite; males exhibit greater proportional length of basis, which extends nearly to posterior portion of second abdominal somite; females exhibit comparatively reduced basis, extending posteriorly only to about one-half the length of second abdominal somite; ischium and merus extremely reduced; carpus, propodus, and dactylus unknown.

**Types.** The holotype, USNM 365441, paratypes, USNM 365442–365450 and 365454, and hypotypes USNM 404881–404922 are deposited in the U.S. National Museum of Natural History, Washington, D.C. Additional specimens KSU 5038–5048 are deposited at Kent State University, Kent, Ohio.

**Measurements.** Measurements, in millimeters, of previously undescribed thoracic appendages (pereiopods 2, 3, 4) are given in Table 5. Measurements were derived from maximum lengths and breadths of the individual appendage segments. Measurements for the fifth pereiopod are not presented, as only incomplete ischia and meri are marginally preserved on two specimens and only approximations could be given.

TABLE 5. MEASUREMENTS TAKEN ON THORACIC APPENDAGES OF SPECIMENS OF *LYREIDUS ANTARCTICUS*

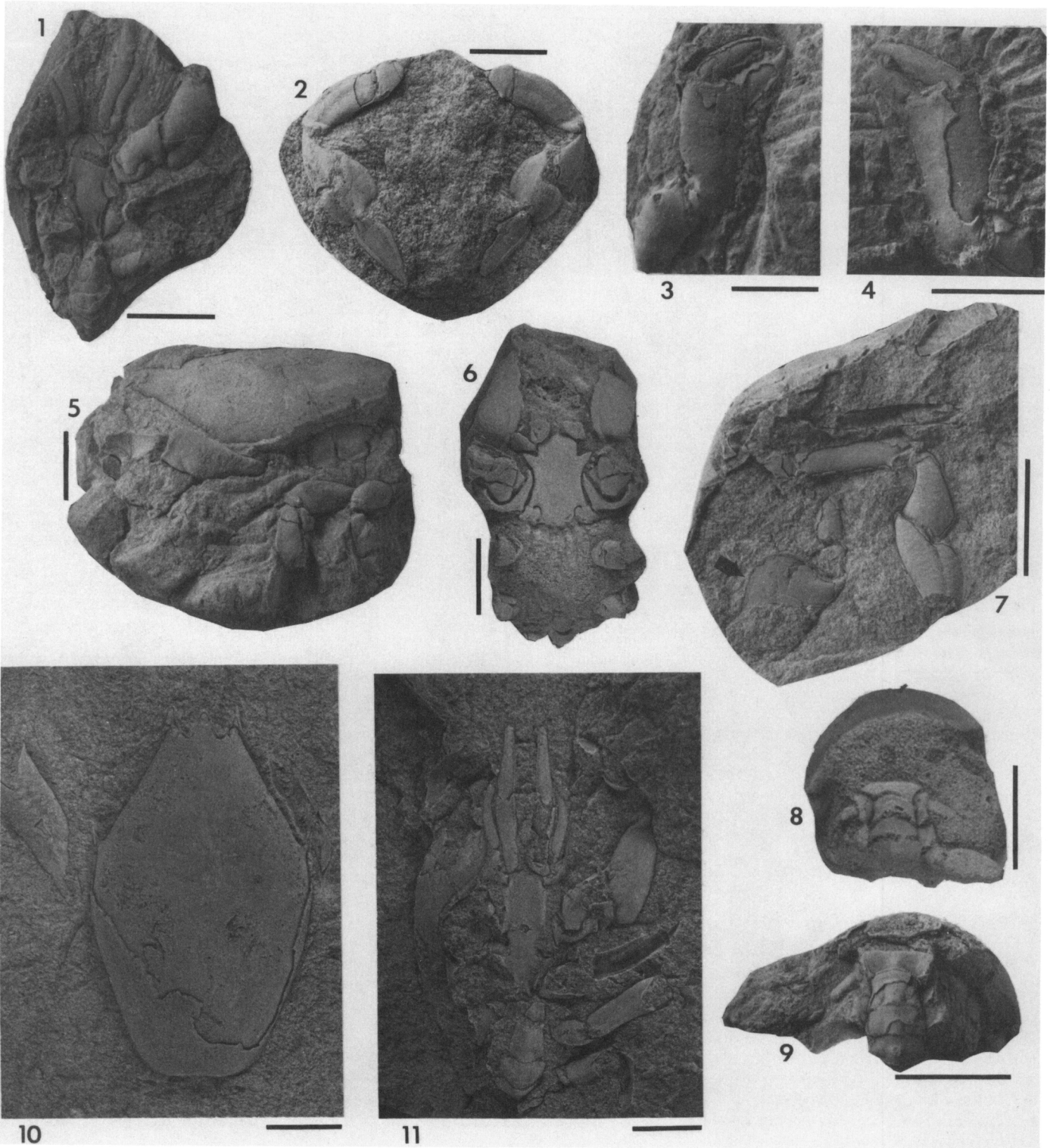
Specimen	Mer-2 L	Mer-2 W	Carp-2 L	Carp-2 W	Prop-2 L	Prop-2 W	Dactyl-2 L	Dactyl-2 W
404882	12.2	5.0	9.5	5.0	9.2	8.1	10.9	5.0
404895	10.0	4.7	8.5	4.5	7.6	—	10.3	4.4
Specimen	Mer-3 L	Mer-3 W	Carp-3 L	Carp-3 W	Prop-3 L	Prop-3 W	Dactyl-3 L	Dactyl-3 W
404883	12.9	4.7	8.8	5.0	—	—	—	—
404886	12.6	3.4	8.5	4.7	11.0	6.8	10.4	6.3
404888	14.9	5.2	—	—	—	—	—	—
Specimen	Mer-4 L	Mer-4 W	Carp-4 L	Carp-4 W	Prop-4 L	Prop-4 W	Dactyl-4 L	Dactyl-4 W
404883	8.8	4.1	7.5	6.5	3.3	6.3	—	—
404886	—	—	—	—	—	—	11.1	5.0
404888	8.9	5.0	8.2	6.4	4.2	7.5	—	—

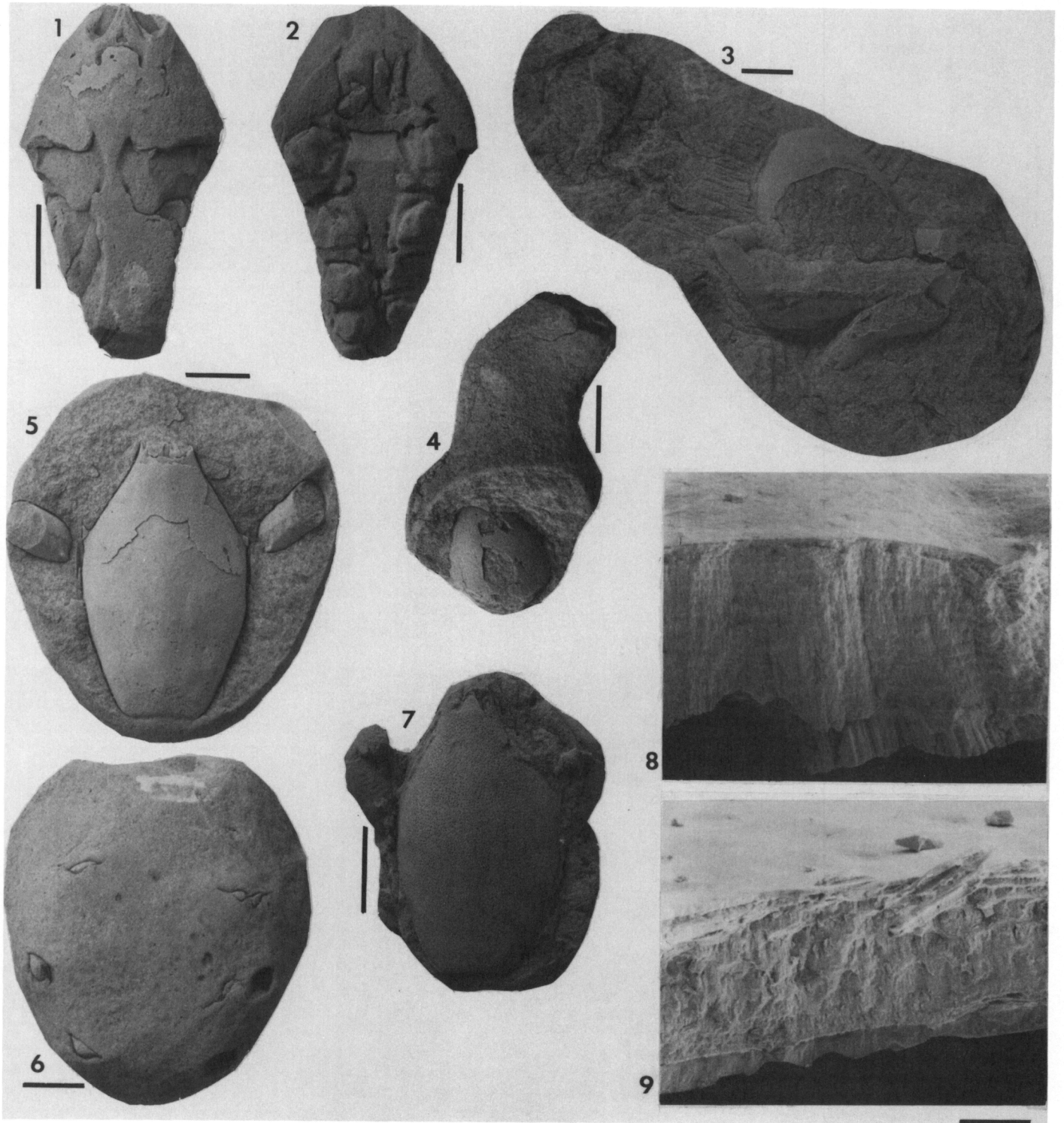
Note: Measurements in millimeters. Length and width measurements represent the maxima for each segment of each measured appendage. Mer = merus, Carp = carpus, Prop = propodus, Dactyl = dactylus. Numbers beside these abbreviations (2-4) represent the corresponding numbers of each pereopod.

*Remarks.* Differentiation of the sexes of *Lyreidus* and some other raninids is very difficult, especially in fossil material. Prior to this study, only Sakai (1937) had described any external feature as part of sexual dimorphism in *Lyreidus*. As there are no obvious external signs of sexual dimorphism, such as claw or carapace size differences, definitive dimorphic characters must be based on analogy with Recent specimens. Sex is easily determined in such specimens by the position and number of pleopods; the male possesses one pair of modified pleopods, the female, two. Sex may also be determined by position of the female genital pore, which is located on the coxa of the third pereopod; the male genital opening is positioned on the coxa of the fifth pereopod. Another subtle, but sexually dimorphic feature, is found on the sternum of both sexes. Bourne (1922) noted that *Lyreidus* has the capability to tightly "lock" its abdomen to its sternum, a feature not found in any other raninid. Bourne (1922) referred to these raised, curved features found on the sternum between the fifth and sixth sternal elements as "pterygoid processes." However, he failed to notice that these raised portions of the sternum are sexually dimorphic. The males, in mature Recent species of *Lyreidus* and *Lysirude*, possess straight, bladed, raised flanges; whereas the female possesses notably reduced, outwardly curved projections. Bliss (1982, p. 109) noted that "male crabs have a 'locking device,' consisting of small tubercles on the fifth thoracic segment that secure the triangular or T-shaped abdomen in a depression on the ventral side of the thorax." Bliss (1982) did not describe a locking device in female crabs, but noted that females tightly hold their abdomina within a depression in the sternum. The smaller curved areas in the female sterna of *Lyreidus* are probably lateral extensions of this depression. Another dimorphic aspect was described by Sakai (1937), who noted that the male *L. tridentatus* has a proportionally longer fifth abdominal somite, and the female a proportionally wider one. This dimorphic character is apparent in mature specimens of *L. brevifrons* and *L. stenops*. This relationship is not yet established for *L. antarcticus*.

In addition to the two primary types which have well-preserved abdomina, there are four additional specimens. All six exhibit a relatively broad fifth abdominal somite, indicating that all are female. One last feature may be used to determine the sex of Recent specimens. The basis

Figure 9. *Lyreidus antarcticus* Feldmann and Zinsmeister, 1 through 11 figured hypotypes. 1, USNM 404881, ventral aspect of cephalothorax, including third maxilliped, well-preserved lower sternal elements, and right and left basal segments and left meri of the first three pereopods. 2, USNM 404882, complete elements of right and left second pereopod. 3, USNM 404883, carpus, propodus, and dactylus of right cheliped. 4, USNM 404884, propodus and dactylus of left cheliped. 5, USNM 404883, lateral view of cephalothorax, including elements of pereopods 1 through 4. 6, USNM 404885, complete upper sternal plate, lower elements (5, 6, 7) lacking. 7, USNM 404886, pereopods 3 and 4, fourth pereopod on left shows complete dactylus (arrow), third pereopod on right shows complete merus, carpus, and propodus. 8, USNM 404889, posterior view of carapace edge showing detached abdomen, abdominal somites 1 through 4, right and left ischia and meri of fifth pereopod. 9, USNM 404881, posterior view of carapace showing attached abdomen, abdominal somites 1 through 4, ischium and merus of left fifth pereopod. 10, USNM 404887, dorsal view of cephalothorax, with complete rostrum, postorbital spines, lateral carapace spines, and with merus of left cheliped, integument attached to posterior portion of carapace. 11, USNM 404888, ventral aspect of cephalothorax with complete right and left third maxilli, right and left basal segments, and left meri of pereopods 1 through 4, and abdominal somites 4 through 7. Bar scales = 1 cm.







of the fifth pereiopod is proportionally longer in the male of each species than that of the female. The basis extends to the posterior portion of the second abdominal somite in the male, and extends only midway to the second abdominal somite of the female. The sexual determinations by Feldmann and Zinsmeister (1984b) were not supported by these criteria, and are possibly in error. However, definite sex assignments may not be made at this time.

The hard-part preservation of individual specimens of *Lyreidus antarcticus* from the La Meseta Formation is variable; the extent and detail of preservation of some specimens are exceptional. Preparation and study of specimens have revealed the morphology and ornamentation of the carapace, rostrum, thoracic and cephalic appendages, sternum, and abdomen. One specimen (Fig. 10.1,2) shows a remarkably well-preserved cast of the soft-bodied portion of the cephalothorax. Of the 201 specimens examined, including the type specimens, most are preserved within calcite cemented, fine-grained sandstone concretions. Many of these concretions were exposed at the surface, and were collected as part and counterpart. Typically, part and counterpart display the dorsal aspect of the carapace with replaced integument broken and covering portions of both the internal and external molds. These specimens, generally, do not appear to be crushed, inflated, or otherwise distorted. However, one (Fig. 10.7) shows unusual breakage along the right anterolateral margin.

*Lyreidus*, like other raninids, is a burrowing crab (Bourne, 1922; Glaessner, 1969). The specimen shown in Figure 10.4 consists of a carapace of *L. antarcticus* within a very fine-grained structure which is sinuous and tubular in shape. This fossil might represent a *Lyreidus* fossil preserved in its burrow. *Ophiomorpha*, a trace fossil which has been attributed to burrowing activity of callinassid shrimp, is found in the La Meseta Formation in close association with *Lyreidus antarcticus*. Although fossil callinassids are found in the La Meseta, they typically do not occur in close association with *Ophiomorpha*. Wiedman and Feldmann (this volume) have suggested that the *Ophiomorpha* from the La Meseta Formation might have been produced by the burrowing activity of *Lyreidus antarcticus*.

The right or left merus of the first pereiopod is present and exposed

on nearly every specimen, often with some replaced integument still attached (Fig. 9.10). The carpus of the first pereiopod is preserved less often. Where intact, the claws are commonly held in parallel, with one claw in front of the other, just in front of the rostrum (Fig. 10.3). There is no preferred orientation to this arrangement of the claws; that is, the left claw is not more commonly in front of the right claw. The remaining thoracic appendages are typically held beneath the body, subperpendicular to the plane of the carapace, and are not exposed on the same surface with the carapace (Figs. 9.5,10,10.5). Paired distal tips of the second through fifth thoracic appendages are frequently exposed along the outside, weathered surface of the concretion (Fig. 10.5,6). Only four prepared specimens (Fig. 9.5,7) show specimens of the second through fifth pereiopods, including the dactyli. These are extremely fragile elements and were probably easily scattered upon the death of the animal.

In several specimens, the abdomen is preserved attached, intact, to the carapace (Fig. 9.8). However, most specimens with preserved abdomina are found in Salter's position. They exhibit the abdomen split from the carapace and projected downward with respect to the body. Although it is commonly assumed that when brachyuran crabs are preserved in Salter's position they represent molts, this manner of preservation may result from other processes (Schäfer, 1951). When found in the fossil record, Salter's position has been interpreted as occurring through molting, decomposition of the animal, or from the action of water or wind currents (Schäfer, 1951). The specimens that possess preserved abdomina, either attached to or detached from the cephalothorax, typically possess equally well-preserved thoracic appendages and ventral aspects. It is possible that sedimentary conditions were such that these animals were buried and preserved so quickly that true molts and non-molts were equally well preserved.

The integument is replaced with calcite in nearly every specimen and is best preserved on the carapace. In the less well-calcified areas, such as the individual elements and joints of the appendages, the fragile integument is usually lost, in some cases due to exposure to weathering. The finest specimens are black in color, and possess very detailed preservation of the carapace and appendage ornamentation such as the fine setal pits, minute spines, and large cardiac groove. One black specimen, encased in an extremely fine-grained and well-cemented concretion, possesses some "geodized" appendages (Fig. 9.11).

Samples of integument, taken from the carapace and appendages of *Lyreidus antarcticus* and a Recent form, *Lysirude nitidus*, were examined by scanning electron microscopy (Fig. 10.8,9). The samples revealed few morphologic differences. Each exhibits the layered integument, typical of decapods, with thin exoskeletal and endoskeletal layers, and an intermediate, thick, prismatic layer. Samples of the integument of *L. antarcticus* even show the morphology of setal pits. The similar structures and thicknesses of these samples suggest that, in this case, the fossil is not a molt.

Of the 190 specimens of *L. antarcticus* collected during the austral summer of 1983–1984, 180 were derived from nine major localities; the remainder were from various miscellaneous or undetermined localities. All of these localities are found stratigraphically in Talm2, 3, and 5 (Sadler, this volume), which correspond to Unit I and Unit II of Elliot et al. (1982). No specimens were collected from the lowermost or uppermost sections of the La Meseta Formation. The localities are listed in Table 1, associated decapods are given therein, and their locations are illustrated on Figure 1. The majority of these specimens were collected from Talm3 and 5, the middle of the La Meseta Formation. *Lyreidus* fossils do not appear to occur commonly in the deeper water facies of the unit, the lowermost portion stratigraphically, nor in the shallow-water facies of the unit, the uppermost portion stratigraphically. *Lyreidus antarcticus* was found in association with a wide variety of fossil animals and plants.

The occurrence of the concretions at Locality 7 is particularly interesting. Most are spherical to ovoid in cross section; occasionally, two

Figure 10. *Lyreidus antarcticus* Feldmann and Zinsmeister, 1 through 7 figured hypotypes; 8 and 9, scanning electron micrographs. 1 and 2, USNM 404890, internal mold of cephalothorax, dorsal and ventral, dorsal view with rostrum, muscle attachment areas; ventral view with oral and sternal areas, coxae of pereiopods 1 through 4. 3, USNM 404891, oblique anterior view, rostrum missing, showing typical juxtaposition of chelae. 4, USNM 404893, dorsal view of central portion of carapace embedded in fine-grained, sinuous-tubular matrix, possible burrow structure. 5 and 6, USNM 404892, dorsal view of cephalothorax with right and left meri of chelae and external view of concretion with weathered paired dactyli of pereiopods 2, 3, and 4 emerging at surface. 7, USNM 404894, dorsal view of cephalothorax with complete rostrum, right and left meri of chelae, showing crushed right anterolateral margin. 8 and 9, Scanning electron micrographs of integument taken from carapace of *L. antarcticus* (8) and from carapace of Recent *L. nitidus* (= *L. bairdii*). Bar scales for 1 through 7 = 1 cm, bar scales for 8 and 9 = 0.1 mm.

ovoid masses coalesce to form a dumbbell shape. The size of the concretions vary from a diameter of about 2 cm to a maximum of 25 cm; the typical size range is 7 to 10 cm. Nearly all the concretions were broken open in the field, perhaps by processes of freezing and thawing. Specimens that had been exposed were subject to abrasion by wind-blown sediment, and the surfaces had the appearance of desert varnish. In 78 cases, both halves of the concretions were found lying within a few centimeters of one another and could be positively identified as representing all the fragments of a single unit. All but two of the concretions were single units; two were doubles. Of the 78 concretions examined on the exposure, only 2 appeared to be totally devoid of organic matter. The overwhelming majority, 64, contained plant debris, primarily in the form of carbonized stem material. Of the 64 concretions containing plant fragments, 11 also contained other fossil material, bryozoans, small bivalves, small gastropods, or burrows. Ten of the concretions contained *Lyreidus antarcticus* as the nucleus. The remaining two concretions were cored—by a bivalve and a gastropod in one case, and by a burrow structure in the other. The megafauna of these concretions was delicately preserved, suggesting that little, if any, transportation had occurred prior to entombment. Therefore, based upon these observations, it can be concluded that *Lyreidus antarcticus* was a significant element in the benthic fauna at this site and that other inhabitants were small bivalves and gastropods along with bryozoans. Furthermore, formation of the concretions was induced by the presence of the organic remains; conversely, preservation of the assemblage was assured by the protective encasement of the concretion. From these occurrences and associations, it is clear that *L. antarcticus* was a part of an extremely diverse, shallow-water, variable-energy marine environment.

Recent species of *Lyreidus* are deep water dwellers. Griffin (1970) recognized and summarized the distribution of five Recent species of *Lyreidus*. *Lyreidus tridentatus*, the type species of the genus, has by far the broadest geographic range and the longest geologic range. This species is found throughout the western and central Pacific in depths ranging from 27 to 425 m; this species has a geologic range of middle Oligocene to Recent (Jenkins, 1972). *Lyreidus brevifrons* is restricted to the Indo-west Pacific and is commonly found in depths ranging from 188 to 440 m. *Lyreidus stenops*, a western Pacific form, is commonly found in depths of 55 to 160 m. As understood by Griffin (1970), the genus *Lyreidus* also included *L. channeri* and *L. nitidus*. However, Goeke (1985) recently reassigned these two species to a closely related new genus, *Lysirude*. *Lysirude channeri* is restricted to the northern Indian and western Pacific oceans and is found in depths of 366 to 820 m (Griffin, 1970). Examination of preserved biological specimens of *Lyreidus* and *Lysirude* in the National Museum of Natural History provided further depth information exceeding Griffin's maxima: *L. tridentatus*, 669 m; *L. brevifrons*, 776 m; *L. stenops*, 503 m; and *Lysirude channeri*, 1,455 m. *Lysirude nitidus* has a geographic range from the coast of Maine to the Gulf of Mexico and a bathymetric range of 119 to 475 m (Griffin, 1970). Powers (1977) listed the geographic range of this species as Massachusetts to Puerto Rico in depths of 119 to 823 meters. Powers (1977) referred to the habitat of *L. nitidus* (= *L. bairdii*) as "soft mud substrates."

Workers including Bourne (1922) and Sakai (1937) have studied the probable life habits of these animals. Such studies have been based on observations regarding functional morphology and on the nature of the sediment dredged up with the crab. Direct observations of these animals in their natural setting have not been documented. However, because we do know the approximate geologic, geographic, and bathymetric limits on each species, we can say that these are, today, deep-dwelling crabs.

Section HETEROTREMATA Guinot, 1977  
Superfamily PORTUNOIDEA Rafinesque, 1815  
Family PORTUNIDAE Rafinesque, 1815  
Subfamily PORTUNINAE Rafinesque, 1815

Genus *Callinectes* Stimpson, 1860

?*Callinectes* sp.

Figures 11.1-3, 12

**Description.** Specimen moderately large, strong, spined, consisting of partial well-preserved merus, carpus, propodus, and dactylus of right cheliped and mold of exterior of carapace fragments.

Carapace fragment appears to be right posterolateral corner with well-defined, smooth border and coarsely punctate surface.

Merus greater than 34 mm long and 8 mm wide. Upper margin angular, defined by row of closely spaced spines with diameters at base of about 1 mm. Outer surface convex with nodes, smaller than spines on upper margin, arranged in poorly defined longitudinal rows. Inner surface nodose near upper margin.

Carpus about 14.5 mm long, 7.5 mm wide. Upper surface triangular, with greatest width at midlength, flattened, ornamented by coarse spines and interspersed pustules. Distal margin finely serrate.

Propodus, including all but distal portion of fixed finger, greater than 37.5 mm long, 16.8 mm high, 9.1 mm wide. Hand generally smoothly convex; outer surface finely granular, with shallow sulcus just below upper margin extending from carpus-propodus joint distally one-half the length of hand; upper surface slightly convex in profile, narrow, ornamented by moderate-sized nodes; inner surface smooth, convex; lower margin slightly sinuous in profile. Fixed finger tapers distally; sulcus with numerous setal pits, near lower margin of outer surface; ovoid cross section. Denticles on occlusal surface low, broad domes.

Dactylus broad proximally, tapering in width and height distally; outer surface with longitudinal, pitted sulcus just above midline; denticles as on fixed finger. Maximum height, 7.0 mm; width, 4.7 mm; length, greater than 10 mm.

**Type.** The sole specimen, USNM 404880, is deposited in the U.S. National Museum of Natural History, Washington, D.C.

**Locality and stratigraphic position.** This specimen was collected from the upper part of the late Eocene La Meseta Formation at Locality 14 (Fig. 1).

**Remarks.** The right arm and claw described above is unquestionably distinct from other decapods collected from the La Meseta Formation. The elements are large, robust, and have relative proportions unlike any of the other species. The most distinctive morphologic characteristics are the great length of the merus and the strength of the ornamentation on the various segments. In most crab genera, the cheliped is carried close to the front in a defensive posture. The merus tends to be relatively short, and the ornamentation becomes more pronounced on the distal elements, the propodus and dactylus. Just the opposite condition is observed on this specimen. The merus is nearly as long as the propodus, and the ornamentation on the merus is composed of coarse tubercles, or possibly spines, whereas ornamentation on the propodus is limited to fine granulations.

Using the general proportions of the various arm elements as the primary basis for identification, the specimen would seem to represent a species within the Portunidae. Many of these swimming crabs have chelipeds with elongate, strongly ornamented meri. More specific identification is difficult, however, owing to the absence of carapace material and the unique combination of characters expressed on the arm. The

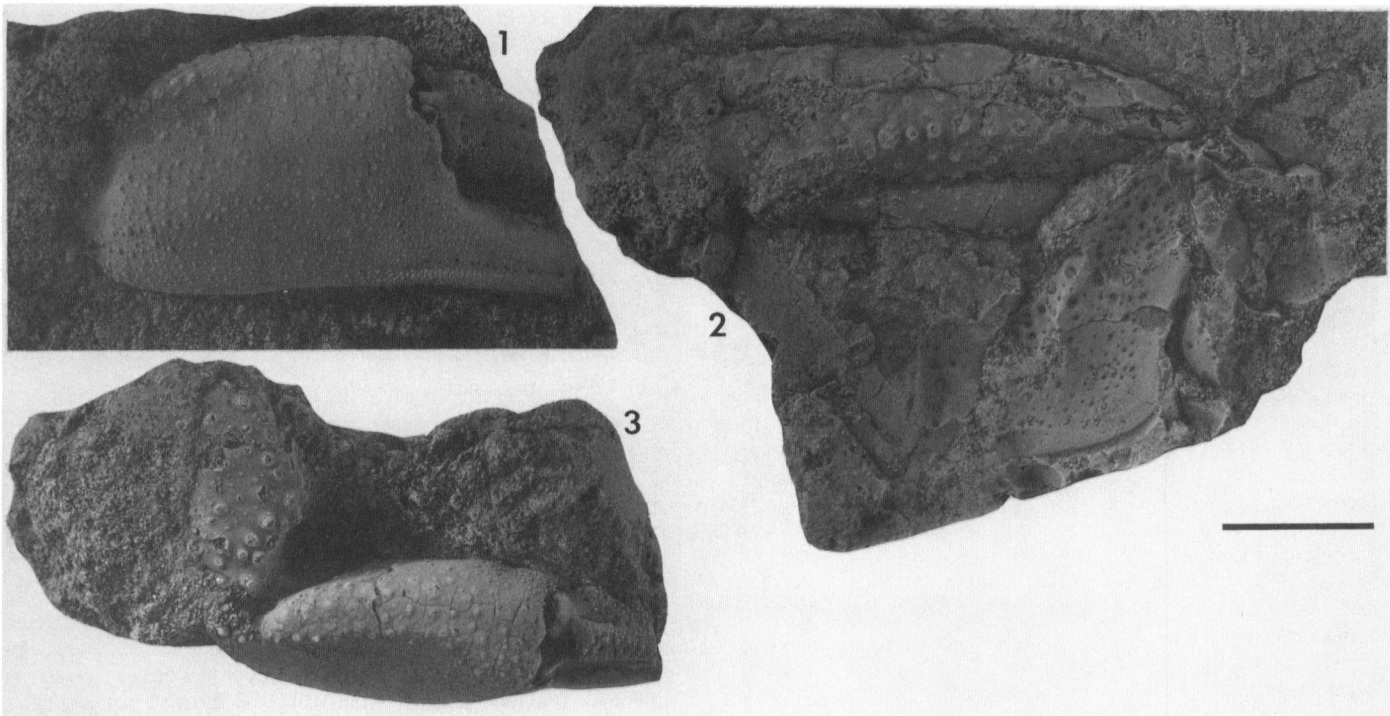


Figure 11. ?*Callinectes* sp., USNM 404880. 1, Outer surface of propodus and dactylus of right cheliped. 2, Upper surface of merus and mold of fragments of carapace. 3, upper surface of carpus, propodus, and dactylus of right cheliped. Bar scale = 1 cm.

specimen is tentatively referred to *Callinectes*, based on the absence of a mesiodistal spine on the carpus (Williams, 1984, p. 355) and coupled with the elongate, well-ornamented merus. However, the propodus on typical *Callinectes* is longitudinally keeled, which is not the case with this specimen. Taken alone, the propodus is more like that seen on Cancridae than on portunids, but the merus is typically short and relatively smooth on the former. Given this uncertainty, it seems most prudent to questionably refer the specimen to *Callinectes* sp.

**Superfamily CALAPPOIDEA de Haan, 1833**

**Family CALAPPIDAE de Haan, 1833**

**Subfamily CALAPPINAE de Haan, 1833**

**Genus *Calappa* Weber, 1795**

***Calappa zinsmeisteri* n. sp.**

Figures 13.1,2, 14

**Description.** Taxon represented by one nearly complete right claw and partial hands of one left and one right cheliped. Right and left claws similar size; strong, thick, with short, stout fingers.

Propodus generally triangular, narrow at articulation with carpus, highest at point of articulation with dactylus. Carpus-propodus joint steeply inclined to long axis of carpus. Upper margin smoothly convex, ornamented with row of more than five prominent spines. Lower margin, including base of fixed finger, straight or slightly downturned when viewed from side. Fixed finger short, about one-fourth the total length of propodus, narrows uniformly distally, occlusal surface intercepts lower

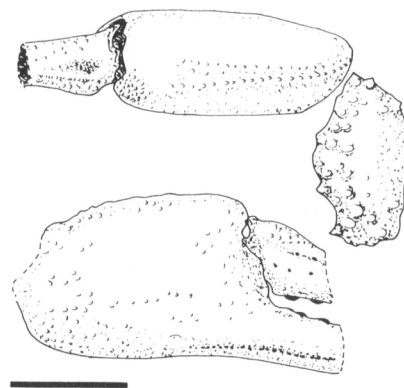


Figure 12. Line drawings showing the interpreted morphology of the carpus, propodus, and dactylus of ?*Callinectes* sp. Bar scale = 1 cm.

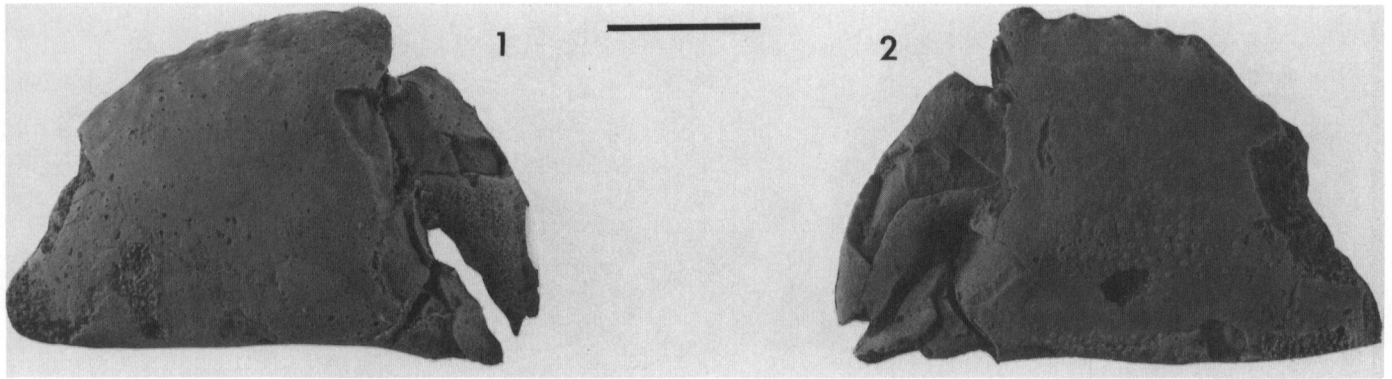


Figure 13. *Calappa zinsmeisteri* n. sp., USNM 404877. 1, Outer surface of propodus and dactylus of right cheliped. 2, Inner surface of propodus and dactylus of right cheliped. Bar scale = 1 cm.

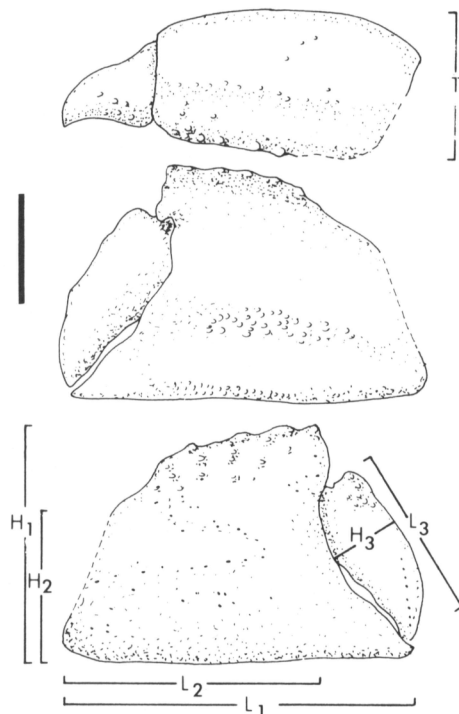


Figure 14. Line drawings showing interpreted morphology of upper, inner, and outer surfaces of the right cheliped of *Calappa zinsmeisteri* and position of measurements. Bar scale = 1 cm.

margin at about  $40^\circ$  angle. Outer surface pustulose; pustules small, some arranged in approximately longitudinal rows from base of hand to approximate level of articulation with dactylus; pustules become larger, less numerous, less systematically arranged above. Inner surface a sinuous curve with hand generally concave near upper and lower margins and thickest and convex mesially. Surface finely pustulose mesially and otherwise smooth. Claws are convex anteriorly when viewed from above.

Dactylus short, stout, pustulose only on proximal portion of upper surface, convex anteriorly when viewed from above. Upper surface gently arched. Occlusal surface of propodus and dactylus apparently with broad, domed denticles. Long axis of dactylus, when closed, makes approximate angle of  $60^\circ$  with base of propodus.

**Measurements.** Measurements, in millimeters, are given in Table 6. All measurements represent minimum dimensions, as none reflects estimates of the amount of material broken or exfoliated.

**Etymology.** The trivial name honors Dr. William J. Zinsmeister, Department of Geosciences, Purdue University, who made it possible to make the collections upon which this study is based.

**Types.** The holotype, USNM 404877, and two paratypes, USNM 404878 and 404879, are deposited in the U.S. National Museum of Natural History, Washington, D.C.

**Locality and stratigraphic position.** Specimens referred to *Calappa zinsmeisteri* were collected from the upper part of the late Eocene La Meseta Formation, at Locality 14 (Fig. 1), Seymour Island, Antarctica.

**Remarks.** Although *Calappa zinsmeisteri* is represented only by cheliped material, placement in the genus can be made with a high degree of certainty. The very strong, triangular hand is smooth and generally concave on the inner surface to conform to the front of the carapace. On its outer surface, the hand is more heavily ornamented on the upper half, and the ornamentation is in the form of rows of nodes. The upper margin projects well above the point of articulation of the dactylus, and it is ornamented by strong spines; the lower margin is smooth. The dactylus rotates downward against the short, stout fixed finger at a steep angle. The base of the fixed finger is not downturned.

This combination of characters is typical of most species of *Calappa*

**TABLE 6. MEASUREMENTS TAKEN ON SPECIMENS OF  
*CALAPPA ZINSMEISTERI* FROM THE  
LA MESETA FORMATION†**

Specimen	L1 (mm)	L2 (mm)	L3 (mm)	H1 (mm)	H2 (mm)	H3 (mm)	T (mm)
404877 Right	35.2	28.0	18.3	23.3	7.6	8.6	12.0
404878 Right				23.7	8.4		12.0
404879 Left				24.9	7.9		12.3

†Position and orientation of measurements are illustrated in Figure 14.

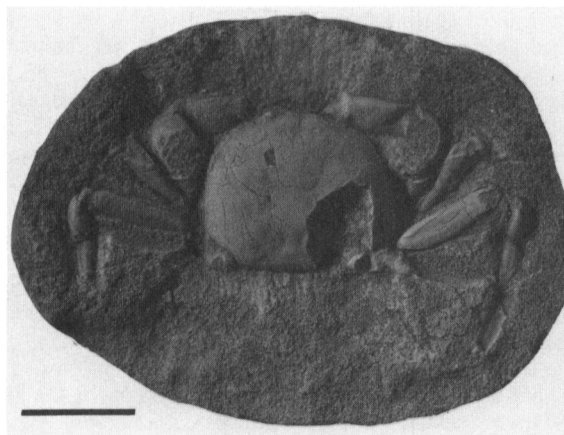


Figure 15. *Chasmocarcinus seymourensis* Feldmann and Zinsmeister. Holotype, USNM 365455. Dorsal aspect of carapace and pereopods. Bar scale = 1 cm.

and serves to distinguish the species from other members of the subfamily (Rathbun, 1937; Sakai, 1976). Species of *Matuta* typically have a longer fixed finger, and the occlusal surface is not as oblique to the long axis of the propodus. In species of *Mursia* and *Cycloes* the fixed finger tends to be elongate and downturned. The lower margin is spinose in many species of *Matuta*, *Paracyclois* and some *Mursia* and is serrate in species of *Acanthocarpus* and *Cycloes*. that surface is smooth or beaded in species of *Calappa*, but not typically spinose.

Prior to this notice, there have been only two references to *Calappa* in Eocene rocks. Bittner (1875) reported *Calappa* sp. from Eocene rocks in the Vicentia region of Italy (Glaessner, 1929, p. 72), and Toniolo (1909) noted *Calappa* sp. in rocks on Mount Staraj, in the Istria. Glaessner (1929, p. 72) concluded that this occurrence was Lutetian in age; however, the reference to age in Toniolo (1909, p. 250) is equivocal. An apparent typographical error in setting the table summarizing the stratigraphic distribution of fossils resulted in no record of occurrence of *Calappa* sp., even though the species is listed in the table. Glaessner (1969, p. R494) questioned Eocene occurrences of the genus and indicated the certain range of the genus to be Oligocene to Recent. Whether or not the Eocene records of *Calappa* cited by Bittner (1875) and Toniolo (1909) are authentic, the occurrence of the genus on Seymour Island represents the southernmost collection site and one of the oldest occurrences. It documents the genus in the Eocene with certainty.

Glaessner (1969, p. R494) reported the geographic range of fossil forms of *Calappa* to include North America, Europe, Central America, Egypt, Burma, and the East Indies. Most of the records are from the Northern Hemisphere and range from Oligocene through Pleistocene. Many, if not most, of the records are derived from identification of chelipeds. Carapace material is more scarce; however, as indicated above, chelipeds are fairly diagnostic and can be identified with confidence.

Modern representatives of *Calappa* have been described from a variety of shelf habitats and are distributed through warm temperate and tropical regions worldwide. Rathbun (1937) recorded collecting sites in North and South America on rocky and sandy substrates varying in depth from sea level to 125 fathoms. Sakai (1979) reported specimens from the western Pacific, referable to the genus, on substrates ranging from hard beaches and coral reefs to soft sand in depths varying from 10 to 150 m. A somewhat wider range of habitats was reported for African specimens (Manning and Holthuis, 1981), owing in large part to records of *C. granulata* (Linnaeus) to depths of 400 to 700 m (p. 52). Nonetheless, the bulk of collections of individuals referred to *Calappa* are from warm, shallow-water, firm substrate habitats. These conditions would seem to define the preferred habitat of *Calappa*.

**Superfamily XANTHOIDEA McLeay, 1838**  
**Family GONEPLACIDAE McLeay, 1838**  
**Subfamily CHASMOCARCININAE Serene, 1964**

**Genus *Chasmocarcinus* Rathbun, 1898**  
***Chasmocarcinus seymourensis* Feldmann and Zinsmeister, 1984**  
Figure 15

*Chasmocarcinus seymourensis* FELDMANN and ZINSMEISTER, 1984, p. 1056–1058, Figs. 8, 9.

*Chasmocarcinus*. ZINSMEISTER and FELDMANN, 1984, p. 282; FELDMANN, 1984, p. 16, unnumbered figure; FELDMANN, 1984, cover photograph; FELDMANN and ZINSMEISTER, 1984, p. 507.

*Type*. The holotype and sole specimen, USNM 365455, is deposited in the U.S. National Museum of Natural History, Washington, D.C.

*Locality and stratigraphic position*. This species was collected from unit II of Elliot et al. (1982) and Unit Telm3 of Sadler (1986, this volume) of the La Meseta Formation at Locality 12 (Fig. 1), Seymour Island, Antarctica.

*Remarks*. A single specimen of this species was collected by W. J. Zinsmeister during the 1981–1982 expedition. In the 1983–1984 season, and again in 1986–1987, Feldmann visited the type locality and found no additional specimens. If more specimens are present, they would have to be considered extremely rare. Therefore, no new information is available to expand on the description or the statements regarding the ecological setting of this little crab.

**Superfamily MAJOIDEA Samouelle, 1819**  
**Family MAJIDAE Samouelle, 1819**

**Genus ?*Micromithrax* Noetling, 1881**

*Remarks*. Assignment of the sole specimen referable to this taxon is extremely difficult, owing to partial preservation of the material. Pre-

served as a mold of the interior of the cephalothorax, the regions are distinctly defined and can be interpreted readily. However, the anterolateral and fronto-orbital margins are partially missing and difficult to interpret. It is difficult to determine whether the anterolateral margin is denticulate or generally smooth. We interpret it to be smooth, in the absence of evidence to the contrary. It appears that either a short, bifid rostrum is present, or that the rostral region is attenuated, sulcate, and broken. Orbits are either poorly developed or lacking.

Placement in *Micromithrax*, rather than in one of the other closely related genera within the Majidae, was based on the conformation and relative development of the carapace regions and on the general outline. *Micromithrax* tends to have a more circular outline than many other majids that are more strongly attenuated in the frontal region.

The tentative nature of the placement must be emphasized. It is possible, but unlikely, that the specimen belongs to one of the Eocene genera of the Portunidae. For example, *Liocarcinus* Stimpson-Pourtales, 1870, has a groove pattern and conformation of carapace regions very similar to that of the specimen in question, particularly *L. rakosensis* (Lorenthey, in Lorenthey and Beurlen), 1979 (fide Müller, 1984, p. 83, Plate 69, Figs. 2 through 6). This species, however, has a strongly denticulate anterolateral margin which is not likely to be present on the sole specimen from the La Meseta Formation. Furthermore, *L. rakosensis* has a reentrant at the posterolateral corner, as is the case in many portunids. That corner is not modified in *Micromithrax* and is not typically modified in any of the Majidae.

On the basis of the above observations, it seems prudent to refer the specimen questionably to *Micromithrax* until such time as more and better material is available for study.

#### *?Micromithrax minisculus* n. sp.

Figure 16

**Description.** Carapace small, width 5.1 mm, length including rostral region, 5.0 mm, uniformly vaulted transversely and longitudinally, outline hexagonal.

Frontal region attenuated into short, bifid rostral area with axial depression. Fronto-orbital margin nearly straight with no orbital depressions evident; anterolateral and posterolateral margins approximately equally long, straight segments joined at point of greatest carapace width just posterior to midlength; posterior margin about 45 percent total width.

Regions well defined as swollen areas separated by shallow, subtle sulci. Mesogastric region long and slender, merging posteriorly with broad, nearly circular metagastric region. Gastric regions circular with diameter about 25 percent total carapace width. Hepatic regions swollen, triangular, separated from adjacent regions by broad, smooth depressions. Urogastric region three times as wide as long, well defined. Cardiac region circular, vaulted, 30 percent of carapace width. Intestinal region not differentiated. Branchial regions not well differentiated, broadest near cervical groove, narrowing posteriorly.

Surface ornamented by fine pustules, best developed on gastric and hepatic regions, more subtle elsewhere.

Abdomen and appendages unknown.

**Type.** The holotype and sole specimen of this species USNM 404876, is deposited in the U.S. National Museum of Natural History, Washington, D.C.

**Etymology.** The trivial name is taken from the Latin word, *minisculus* = rather small, in reference to the diminutive size of the specimen.



Figure 16. *?Micromithrax minisculus* n. sp. Holotype, USNM 404876. Dorsal view of exfoliated carapace. Bar scale = 1 cm.

**Location and stratigraphic position.** The specimen was collected from unit Talm2 of Sadler (1986) in the Eocene La Meseta Formation at Locality 3, Seymour Island, Antarctica.

**Remarks.** Little can be added to what has been said above. Comparison of the La Meseta material with fossil and Recent majids confirms that it cannot be referred to a previously described species, and it certainly differs significantly from any of the other decapods from Seymour Island. However, confirmation of the generic placement and elaboration of the morphologic details must await discovery of better specimens. Studies dealing with living majids—for example, Rathbun (1925), Sakai (1976), Manning and Holthius (1981), Williams (1984), and McLay (1985)—confirm that most of these organisms have an attenuated frontal region. The poor preservation of the La Meseta specimen simply does not permit thorough interpretation of that region, and therefore, the placement must remain enigmatic.

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