

## *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

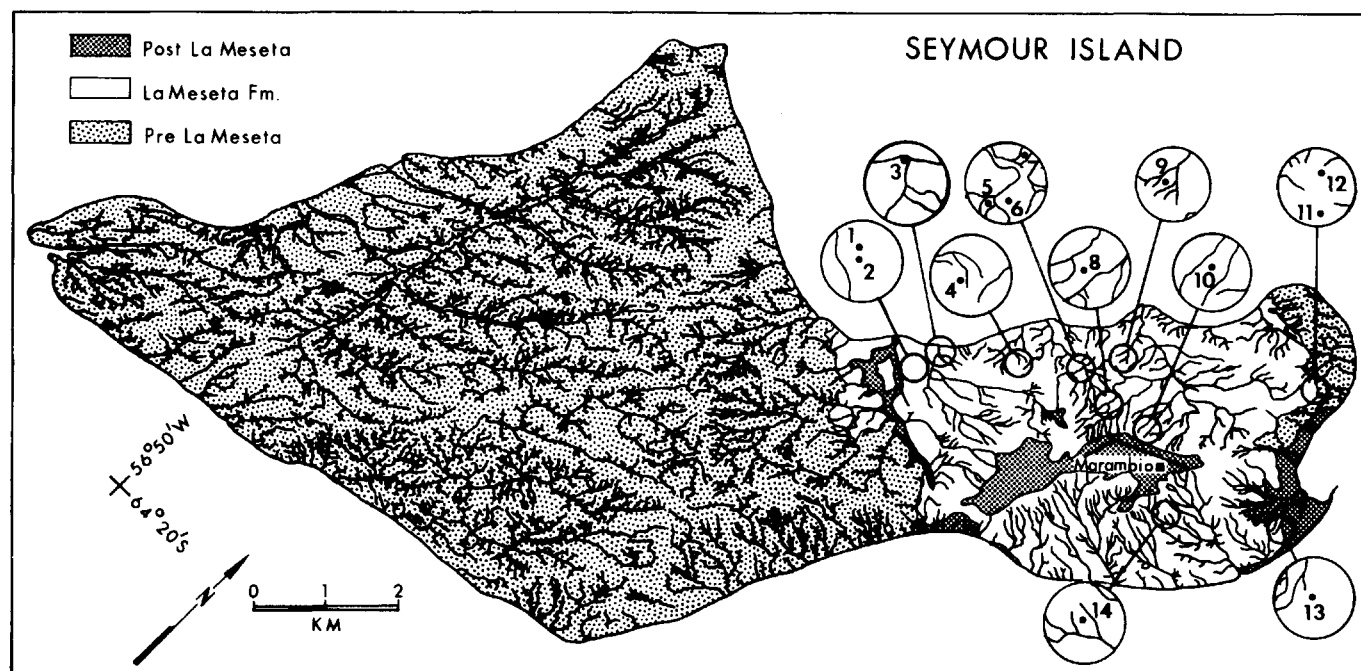


Figure 1. Map of Seymour Island showing the localities from which decapod crustaceans have been collected in the La Meseta Formation.

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

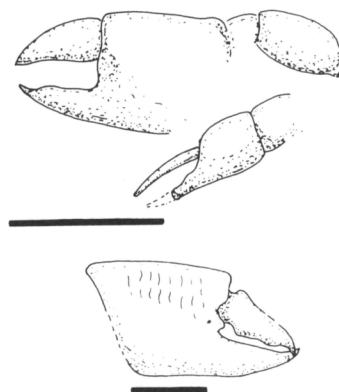


Figure 3. Line drawings of chelipeds of *Protocallianassa* cf. *P. faujasi* based on USNM 404850 (upper) and 404849 (lower). Bar scales = 1 cm.

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.

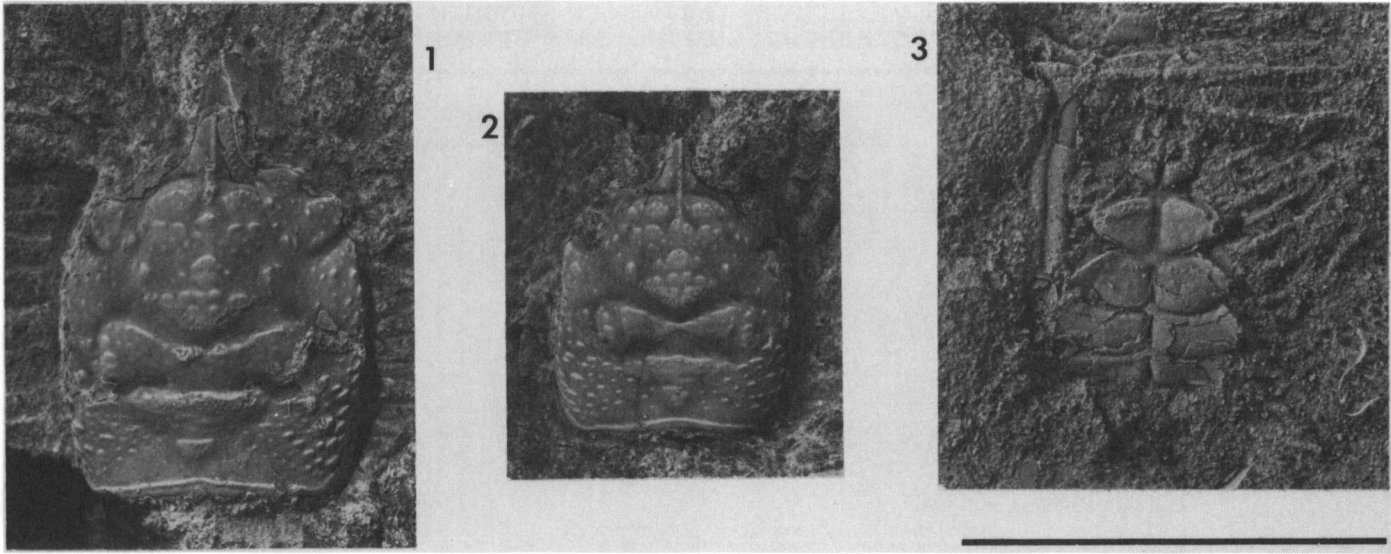


Figure 4. *Munidopsis scabrosa* n. sp. 1, Holotype, USNM 404851, dorsal aspect of cephalothorax. 2, Paratype, USNM 404860, dorsal aspect of cephalothorax. 3, Paratype, USNM 404859, sternum and portions of two pereopods. Scale bar = 1 cm.

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

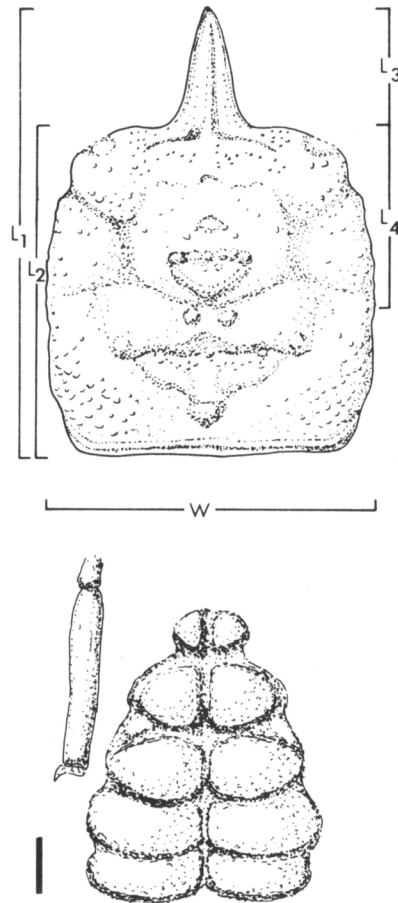


Figure 5. Line drawings of the cephalothorax (upper) and sternum (lower) of *Munidopsis scabrosa*, showing positions and orientations of measurements. Bar scales = 1 mm.

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 chaneyi* 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 inturned.

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.