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LATE CRETACEOUS AND PALEOCENE DECAPOD CRUSTACEANS FROM JAMES ROSS BASIN, ANTARCTIC PENINSULA

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JANUARY 1993

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LATE CRETACEOUS AND PALEOCENE DECAPOD CRUSTACEANS FROM JAMES ROSS BASIN, ANTARCTIC PENINSULA

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ABSTRACT—Seventeen species of decapod crustaceans have been described from Campanian through Paleocene rocks in the Santa Marta, López de Bertodano, and Sobral Formations of the James Ross Basin, Antarctica. Of these, nine are new species: *Metanephrops rossensis, Glyphea australensis, Paguristes santamartaensis, Munidopsis foersteri, Retrorsichela laevis, Plagiophthalmous collinsi, Rhinopoupinia bicornis, Cristafrons praescientis,* and *Torynomma* (*Torynomma*) *australis.* One new family, Retrorsichelidae, and three new genera, *Retrorsichela, Rhinopoupinia,* and *Cristafrons,* were also named. This assemblage includes the first notice of brachyurans from the Cretaceous of Antarctica; six species are described. The nephropid lobster *Hoploparia stokesi* (Weller), the most common decapod throughout the section, exhibits significant morphological change throughout its range from late Santonian or earliest Campanian to Paleocene; however, variation of key features is asynchronous. The raninid brachyuran, *Cristafrons praescientis,* is second in abundance to *H. stokesi.* The occurrence of *Metanephrops rossensis* and *Munidopsis foersteri* represents the oldest geological records for these genera and the recognition of species of *Paguristes, Plagiophthalmous, Torynomma,* and *Necrocarcinus* constitutes the first notice of these genera in Antarctica. Of those taxa that have living congenors, the species of *Metanephrops, Linuparus,* and *Munidopsis* occupied habitats at inner shelf depths in the Cretaceous whereas their extant descendants are restricted to outer shelf and bathyal depths. This diverse decapod fauna is dominated by genera that range into the Cenozoic and appears to be a pioneer assemblage.

INTRODUCTION

THE CRETACEOUS and Paleogene rocks of the James Ross Basin, situated on the eastern margin of the Antarctic Peninsula, have yielded some of the most diverse and well-preserved assemblages of fossils from anywhere in Antarctica. Representatives of nearly every phylum of organisms known from the fossil record have been identified from the area. Among these groups, the decapod crustaceans are unusually diverse.

The first record of a decapod crustacean from the James Ross Basin was that of *Hoploparia stokesi* (Weller, 1903), which may have been the first species of fossil described from specimens collected in Antarctica. Subsequently, several investigators have reported upon decapod occurrences within the area. The field work of W. N. Croft and R. Stoneley resulted in collections of decapods studied by Ball (1960). He described the details of *Hoploparia stokesi* and added two additional species, *Callianassa meridionalis* Ball and *Meyeria crofti* Ball, to the list of species known from the region. Subsequently, del Valle and Rinaldi (1975) recognized the presence of *Hoploparia stokesi* on Seymour Island.

Within the past decade, numerous works have been devoted to the decapods of this region. Five species of macrurans, three species of anomurans, and seven species of brachyurans have been described (Feldmann and Zinsmeister, 1984; Feldmann and Wilson, 1988; Tshudy and Feldmann, 1988; Aguirre-Urreta, 1989; Feldmann, 1989, 1992; Aguirre-Urreta et al., 1990) (Appendix). These studies documented a rich and abundant brachyuran fauna in the Eocene La Meseta Formation on Seymour Island, providing a foundation for the conclusion that the Antarctic was the site of origin of several taxa whose descendants currently inhabit lower latitude, deeper water settings. In addition, a macruran fauna, consisting of three species, was described from the Cretaceous and Paleocene rocks of the López de Bertodano Formation on Seymour, Vega, and Snow Hill Islands. One of the species, *Hoploparia stokesi,* was demonstrated to be one of the most abundant and widely distributed taxa within the area (Feldmann and Tshudy, 1989).

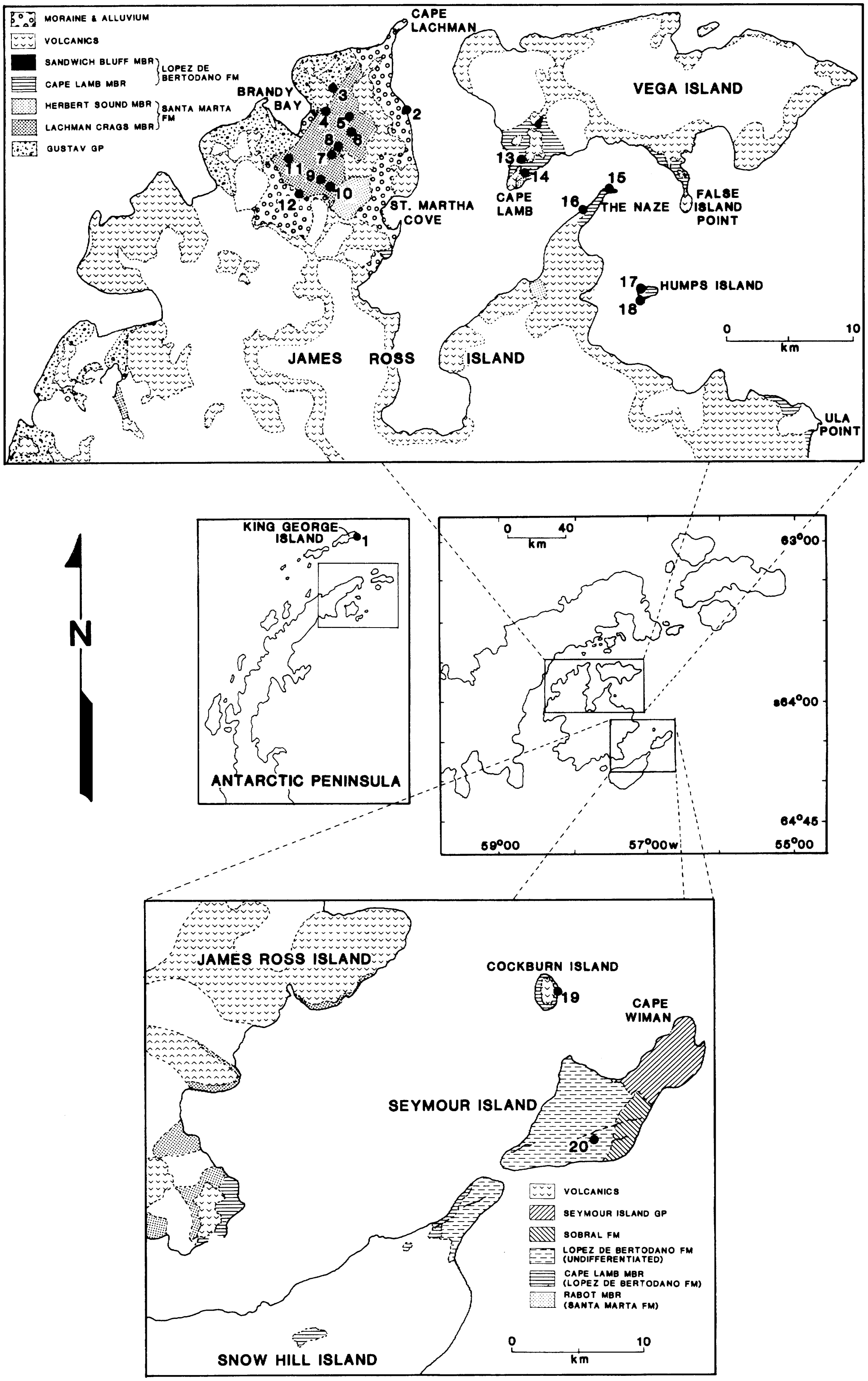
Much of this recent work has been concentrated on Maastrichtian through Eocene rocks on Seymour Island, although it has long been known that Campanian and possibly Santonian rocks of James Ross Island contain decapods. Ball (1960) reported on the occurrence of decapods from these older rocks. Important collections of decapods were made in the course of studies by E. Olivero and material that he collected has been made available for the present work.

In the austral summers of 1985/1986 and 1987/1988, field work conducted under the auspices of the British Antarctic Survey examined the stratigraphic sequence ranging from Santonian through Campanian on western James Ross and Vega Islands as well as conducted reconnaissance collecting on Seymour, Humps, and Cockburn Islands. It is the material collected as a result of this work that forms the primary basis for this study. The purpose of this work is to describe the systematic paleontology of several newly discovered decapod taxa from the James Ross Basin area as well as to provide new information regarding the paleobiology of previously known forms. In so doing, the study provides a comprehensive treatment of the previously undescribed decapods from the James Ross Basin area and a summary of information regarding previously described taxa.

Most of the specimens forming the basis of the this work were collected from the Santa Marta Formation at localities in northwestern James Ross Island and from the Cape Lamb Member (Crame et al., 1991) of the López de Bertodano Formation near Cape Lamb, southwestern Vega Island (Figure 1). Additional specimens were collected from Humps, Cockburn, and Seymour Islands. Because the details of stratigraphy and correlation have been treated recently (Pirrie et al., 1991; Crame et al., 1991), only a summary of relevant details will be given herein. The stratigraphic and geographic positions of sites from which decapods were collected will be based largely upon their work.

STRATIGRAPHIC SETTING

General.—The James Ross Basin evolved during late Mesozoic and early Cenozoic time as a back-arc basin produced during the eastward to southeastward subduction of proto-Pacific oceanic crust beneath the Antarctic Plate. From the Late Jurassic through the Eocene, the basin filled with sediments shed from an active magmatic arc at the "northern" end of the Antarctic Peninsula to the northwest (Elliot, 1988). Throughout this history, Antarctica was situated in a polar position and the James Ross Basin would have been at a latitude similar to the present-day 64°S.


MORAINE & ALLUVIUM
VOLCANICS
SANDWICH BLUFF MBR
CAPE LAMB MBR
LOPEZ DE BERTODANO FM
HERBERT SOUND MBR
LACHMAN CRAGS MBR
SANTA MARTA FM
GUSTAV GP
CAPE LACHMAN
BRANDY BAY
1 2 3 4 5 6 7 8 9 10 11 12
ST. MARTHA COVE
VEGA ISLAND
13 14
CAPE LAMB
15
16
THE NAZE
FALSE ISLAND POINT
17
18
HUMPS ISLAND
0 10 km
JAMES ROSS ISLAND
ULA POINT
KING GEORGE ISLAND
1
ANTARCTIC PENINSULA
N
0 40 km
63°00
64°00
64°45
59°00
57°00W
55°00
JAMES ROSS ISLAND
COCKBURN ISLAND
19
CAPE WIMAN
SEYMOUR ISLAND
20
SNOW HILL ISLAND
VOLCANICS
SEYMOUR ISLAND GP
SOBRAL FM
LOPEZ DE BERTODANO FM (UNDIFFERENTIATED)
CAPE LAMB MBR (LOPEZ DE BERTODANO FM)
RABOT MBR (SANTA MARTA FM)
0 10 km

The total exposed basin-fill, totaling approximately 6,000 m of sediment, dominantly sandstones and siltstones, has been formally divided into the Kimmeridgian–Tithonian Nordenskjöld Formation, and the overlying Gustav, Marambio, and Seymour Island Groups. The Nordenskjöld Formation was deposited in an anoxic marine basin (Aguirre-Urreta et al., 1990, citing Farquhharson, 1982, 1983, and del Valle et al., 1988). The Gustav Group, of approximately Barremian to Santonian age, was deposited in a submarine fan slope complex (Ineson, 1989, *in* Pirrie et al., 1991, p. 229) and crops out along the northwestern coast of James Ross Island. The Marambio Group, of approximately Santonian to Paleocene age (Pirrie et al., 1991, p. 229), crops out in several localities which, together, span nearly the entire width of the basin. The group is divided into the Santa Marta, López de Bertodano, and Sobral Formations. The Seymour Island Group, of Paleocene to Eocene age, is exposed only on eastern Seymour Island, and is subdivided into the Cross Valley and La Meseta Formations.

Only one decapod, an allochthonous crab from the Nordenskjöld Formation (Aguirre-Urreta et al., 1990), is known from pre-Upper Cretaceous strata within the basin, but decapods are diverse, abundant, and often well preserved in the Marambio and Seymour Island Groups. The decapod-rich Marambio and Seymour Island Groups together record an overall transgressive, basin-filling sequence.

The stratigraphy of the Marambio Group is currently in a very dynamic state. Revisions have been frequent and they continue. In the most recent revision of the basin's Campanian–Maastrichtian strata, Crame et al. (1991) discussed what is the biggest impediment to more interpretive work on the decapods, that being the confident correlation of isolated exposures currently referred to the López de Bertodano Formation. The reader is referred to Crame et al. (1991), and also Pirrie et al. (1991), for detailed reviews of the problem. The stratigraphic section and correlations accepted herein are given in Figure 2.

The Paleocene through Eocene strata of the Seymour Island Group are known only from Seymour Island and are, therefore, without the controversies of correlation that surround the underlying Marambio Group. The ages and environments of deposition of these units also seem better understood.

Santa Marta Formation. — The Santa Marta Formation is best exposed on James Ross Island at St. Martha Cove, but also crops out on the island along the northwest shore of Croft Bay, as well as at Cape Lamb on Vega Island and on Humps Island (Crame et al., 1991). This formation consists mostly of "massive, very fine- to medium-grained sandstones and silty sandstones" but includes coarser beds in its lower part (Crame et al., 1991, p. 1130). Ammonites indicate an early–late Campanian age (Crame et al., 1991, p. 1133, citing Olivero, 1984, and Olivero et al., 1986) for the Santa Marta Formation, but some mollusks and dinoflagellates suggest that the lower portion of the formation may be as old as Santonian (Crame et al., 1991, p. 1133).

The Santa Marta Formation is currently subdivided into three members: the Lachman Crags Member, Herbert Sound Member, and Rabot Member. The former two each contain several decapod taxa; the Rabot has yielded none.

The Lachman Crags Member comprises the lower 850 m of the Santa Marta Formation, and has yielded a diverse decapod fauna. One astacid (true lobster), two palinurids (spiny lobsters), one anomuran, a callianassid, and four brachyurans (true crabs) have been identified. The unit is best exposed on the northwestern portion of James Ross Island, "between Abernethy Flats and the north-western face of Lachman Crags," and "at Hidden Lake, and possibly at Seacatch Nunataks, James Ross Island" (Crame et al., 1991, p. 1131). The lower 500 m of the unit consists mostly of "massive, friable sandstones, silty sandstones and siltstones" but with some finer and coarser beds. The upper 350 m consists of conglomerates and sandstones. The unit is interpreted as having been deposited below storm-wave base in mid to outer shelf depths (Crame et al., 1991, p. 1129). Age of the Lachman Crags Member is given by Crame et al. (1991, fig. 2) as ?late Santonian to middle Campanian.

The Herbert Sound Member embraces 250 m of sediment overlying the Santa Marta Formation. The Herbert Sound Member has yielded a very diverse decapod assemblage, including three astacids, two palinurids, three anomurans, and four brachyurans. On James Ross Island, the unit is best exposed in the region of St. Martha Cove but also crops out on the northwest shore of Croft Bay, Cape Lamb on Vega Island, and possibly also on Humps Island (Crame et al., 1991, p. 1131). The Herbert Sound Member consists of "well-sorted, fine-grained quartzose sandstones, interbedded with minor cross-bedded sandstones, shell coquinas, and rarer finer-grained beds" (Pirrie, 1989, 1990 *in* Crame et al., 1991, p. 1131). Based on hummocky cross-bedding and thicker shelled bivalves, this member is interpreted by Pirrie to have been deposited above storm wave base, probably at inner shelf depths. Age of the Herbert Sound Member is given by Crame et al. (1991, fig. 2) as early late Campanian. Pirrie and Riding (1988 *in* Crame et al., 1991) suggested that some beds on Humps Island may represent the outer shelf equivalent to the inner shelf deposits of the Herbert Sound Member.

López de Bertodano Formation. — The López de Bertodano Formation crops out at several localities in the James Ross Basin, but is exposed in greatest thickness on Seymour Island, the easternmost exposure of the formation. The mollusks indicate a late Campanian–Paleocene age for the López de Bertodano Formation on Seymour Island, but dinoflagellates suggest that the lower portion of the formation is slightly older, probably Santonian (Crame et al., 1991).

The westernmost exposure of the López de Bertodano Formation occurs on Cape Lamb on Vega Island, where a 480-m section has recently been studied in detail by Pirrie et al. (1991). Between Cape Lamb and Seymour Island, the López de Bertodano Formation crops out at The Naze on James Ross Island, Humps Island, at False Island Point on Vega Island, Snow Hill Island, and Cockburn Island. Decapods were collected at all these exposures.

The precise stratigraphic relationship of these exposures is uncertain. Part of the problem has been that these localities lie in a proximal–distal transect across the basin, so that beds on Cape Lamb represent the most proximal deposits of the formation, and those on Seymour Island the most distal. It is uncertain which of the biotic differences between the isolated exposures are age-related and which are due to facies differences.

The most recent, albeit tentative, judgment regarding the relationship between the Cape Lamb beds and the Seymour Island beds is that of Crame et al. (1991), who correlated the

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FIGURE *1* — Maps of the James Ross Island area showing the distribution of stratigraphic units discussed in the text and the locations from which new occurrences of decapod fossils are described. Locality numbers are keyed to locality descriptions given in the text and to the stratigraphic sections shown in Figure 2. (Geologic map details from Crame, Pirrie, Riding, and Thomson, 1991.)

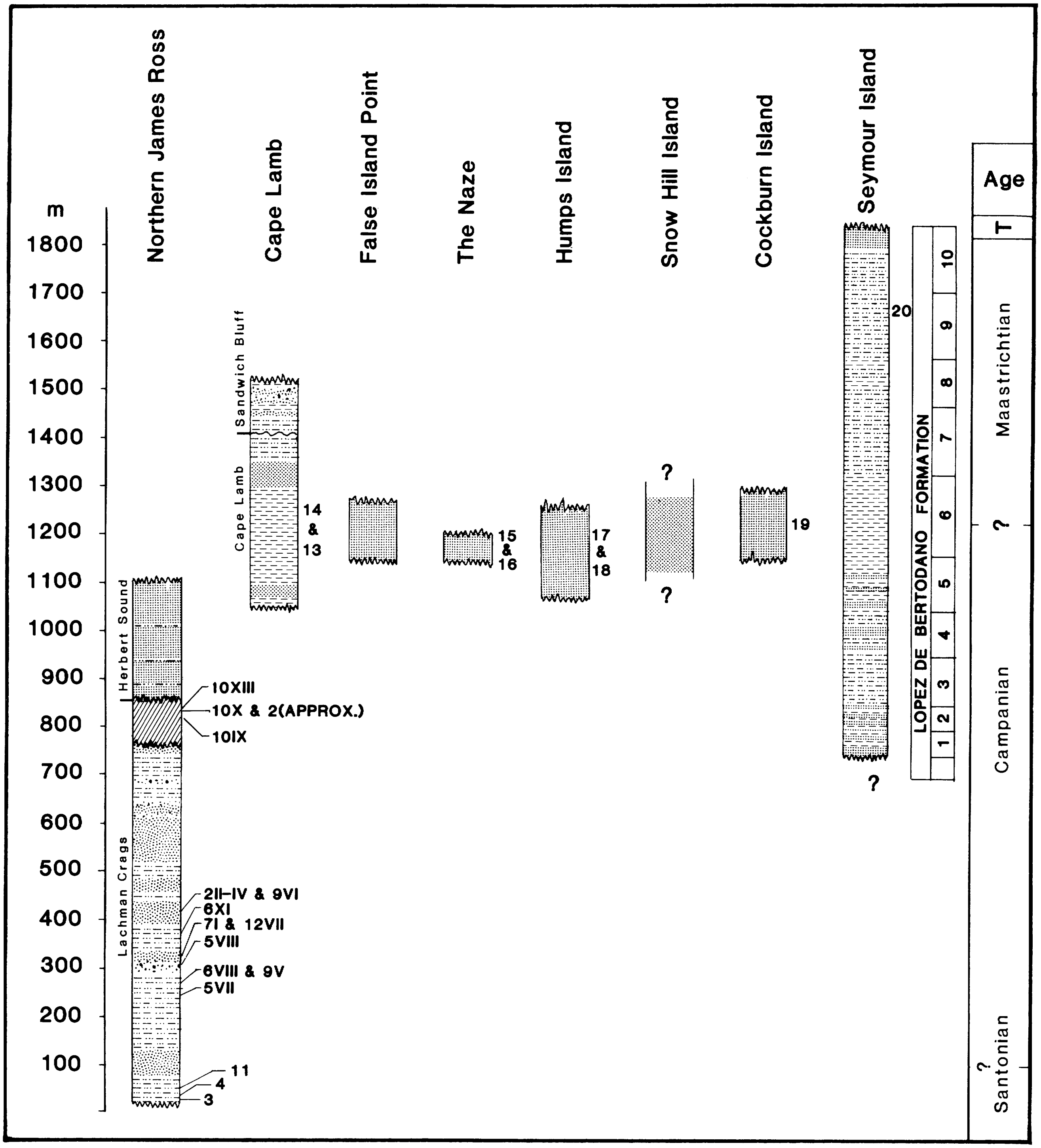


FIGURE 2—Stratigraphic sections from selected sites in the James Ross Island area showing the positions from which decapod fossil collections were made. Members of the Santa Marta Formation, the Lachman Crags and Herbert Sound, are identified in the northern James Ross Island section. The diagonally lined portion of that section denotes scattered exposures within the Lachman Crags Member whose precise stratigraphic position is questionable. Members of the López de Bertodano Formation, Cape Lamb and Sandwich Bluff, are identified in the Cape Lamb section. The member status of exposures of the López de Bertodano Formation at False Island Point, The Naze, Humps Island, Snow Hill Island, and Cockburn Island has not been established. (Modified from Crame et al., 1991.)

Cape Lamb beds with the middle portion of the López de Bertodano Formation on Seymour Island. They suggested that faunal differences between the two sections are due to proximal–distal facies changes across the basin. The same authors included intervening exposures of the López de Bertodano Formation, except for some of the latter on Snow Hill Island, within the Cape Lamb Member.

To date, the López de Bertodano Formation has yielded eight decapod species, including two astacids, three palinurids, and three brachyurans. The Cape Lamb Member and Seymour Island beds contain five and four species, respectively. The astacid *Hoploparia stokesi* is found throughout the formation.

The López de Bertodano Formation on Seymour Island was interpreted by Macellari (1988) as a transgressive–regressive sequence. Macellari recognized 10 informal units in the 1,190-m sequence, referring to the lower six as *Rotularia* Units and the upper four as Molluscan Units. The *Rotularia* Units exhibit a low-diversity macrofauna that includes no decapods, whereas the Molluscan Units contain a rich and abundant macrofauna, including several decapod taxa.

Macellari suggested that the *Rotularia* Units, which "form a distinctive lithologic sequence composed of friable silty mudstone and sandy siltstone predominantly gray in color, usually strongly bioturbated, and interbedded with fine-grained gray sandstone" (1988, p. 28), were deposited in a "very shallow delta/estuary-influenced environment" (1988, p. 50), and that the low macrofaunal diversity, especially in Units 1–4, may have been due to low salinity or high turbidity. Fossil evidence, including unbored fossil wood and, in Units 5 and 6, common mosasaur remains, supports deposition near a delta or estuary (1988, p. 49). There is, however, conflicting evidence for deposition in fully marine conditions. Macellari noted that ^{18}O values for benthic foraminifera did not reflect fluctuations in salinity (E. Barrera, personal commun., 1986 *in* Macellari, 1988, p. 48). Similarly, Huber (1988, p. 169) stated that foraminiferal stable isotope data and foraminiferal and siliceous (Harwood, 1988) microfossil distributions indicated that normal marine conditions persisted during deposition of Seymour Island beds from at least above 200 m through to the K/T boundary. Elliot (1988, p. 550) concluded that "on balance, a shelf environment below storm wave base and with turbid waters seems most likely."

The Molluscan Units on Seymour Island consist of "generally monotonous, sandy siltstone" deposited in deeper, open marine conditions. Units 7 and 8 were deposited in middle shelf depths, whereas Unit 9 represents outer shelf deposition and maximum transgression for the formation. Unit 10 was interpreted as representing middle to inner shelf deposition (Macellari, 1988, p. 50).

At its type locality on Vega Island, the Cape Lamb Member of the López de Bertodano Formation rests conformably upon the Herbert Sound Member of the Santa Marta Formation. Pirrie et al. (1991, p. 252) interpreted these deposits as representing deposition in outer to mid-?inner shelf depths. They also stated that Member A and part of Member B of the Cape Lamb section may be equivalent to the *Rotularia* Units on Seymour Island. Units A and B were subsequently combined into a formal unit by Crame et al. (1991) as the Cape Lamb Member of the López de Bertodano Formation. Their correlation diagram (Pirrie et al., 1991, fig. 9) suggests a correlation of what is now the Cape Lamb Member to units as high as Unit 8; 7 and 8 are Molluscan Units. The tentative correlation is based mainly on ammonites and dinoflagellates. Firm correlations are not possible at this time as correlations based on the ammonite *Gunnarites* do not agree with those based on other ammonites. It is possible that this discrepancy is due to facies differences (Crame et al., 1991).

Crame et al. (1991) supported a slightly different correlation between the Cape Lamb Member and the beds on Seymour Island. Their correlation (Crame et al., 1991, fig. 2) diagram indicated that the Cape Lamb Member is equivalent to Seymour Island Units 4 or 5 through 7.

Based upon their tentative correlation of the lower Cape Lamb Member to *Rotularia* Units on Seymour Island, Pirrie et al. (1991) suggested that the environment of deposition of the *Rotularia* Units was probably deeper than interpreted by Macellari (1988), who considered these to be very shallow marine deposits. The lower Cape Lamb Member is interpreted as outer shelf deposition, which may require an even deeper setting for the more distal Seymour Island beds. Such varying interpretations of key stratigraphic sections underscore the need for more stratigraphic work.

Member C of the Cape Lamb section of Pirrie et al. (1991) was formalized as the Sandwich Bluff Member by Crame et al. (1991). This member was considered to be late Maastrichtian (Pirrie et al., 1991), as are some of the Molluscan Units on Seymour Island, but the Sandwich Bluff Member is considered to have direct physical equivalents on Seymour Island (Crame et al., 1991, p. 20).

Sobral Formation.—The Paleocene Sobral Formation lies unconformably upon the López de Bertodano Formation on Seymour Island (Macellari, 1988). This formation, 255 m thick, consists of "maroon, well-laminated silts at the base, followed by cleaner sandstones that become more glauconitic and cross-bedded toward the top" (Macellari, 1988, p. 25). Macellari (1988, p. 25) interpreted the Sobral Formation as the "filling of the basin by the progradation of a delta system." The unit is not as fossiliferous as the underlying molluscan units of the López de Bertodano Formation, but yielded two astacid lobster species, *Hoploparia stokesi* and *Metanephrops jenkinsi.*

Cape Melville Formation.—The Cape Melville Formation crops out on King George Island and has been assigned a Miocene age (Gazdzicki, 1987). Although this unit is exposed well beyond the geographic bounds of this study, two hermit crab claws were collected from the Cape Melville Formation that are thought to be conspecific with claws collected in the Santa Marta Formation. The Cape Melville Formation is a sequence of glacio-marine sediments known to contain fossils derived from older rock units in the peninsular region (see, for example, Birkenmajer et al., 1987).

TAPHONOMY

The general quality of preservation of fossil decapod material in the James Ross Basin is excellent. Cuticle is often preserved in fine enough detail that ultrastructure can be examined (Feldmann and Tshudy, 1987). In general, damage to the cuticle has occurred as a result of exposure at the surface rather than during the degradational period surrounding the death, dismemberment, and burial of the organisms.

With the exception of the specimens of *Retrorsichela laevis* n. sp., all decapod fossils described from Late Cretaceous and Paleocene rocks of the James Ross Basin were preserved within ovoid to spherical calcareous concretions. As noted previously (Feldmann, 1989), the dimensions of the concretions seldom exceed twice the greatest length of the enclosed specimen. The formation of the enclosing concretions would appear to be related to burial and diagenetic processes, perhaps induced by the decomposition of the decapod remains, rather than as fillings of burrow structures. There has been no observation of structures surrounding the fossils that would suggest burrow fillings.

Burial of the decapod remains, and concretion formation, probably occurred rapidly. Tshudy et al. (1989) suggested the importance of cephalopods and other organisms as scavenging agents on decapods and concluded that fossils of these organisms would form only under circumstances of extremely rapid burial. This interpretation is supported by observations of specimens examined in this study. In fact, the preservation of *Callianassa* cf. *C. meridionalis* Ball provides an independent indication of timing of burial and concretion formation. Three specimens referred to this species are preserved as entire specimens. This is a very rare occurrence in species of *Callianassa* because the cuticle of all but the claws and pereiopods tends to be extremely thin and uncalcified. It is highly unlikely that these specimens would have been preserved in this fashion unless burial had been nearly instantaneous.

Retrorsichela laevis is preserved typically as entire individuals within a calcareously cemented conglomerate. The specimens are not surrounded by concretionary structures. Although no field observations were made regarding the orientation of the specimens within the rock unit, it is possible that the specimens were preserved in living position. This tentative conclusion is based upon the observation that, of the specimens that are complete and that appear to represent corpses, all exhibit the same posture. The claws are carried in a characteristic "preying mantis" position beneath the carapace. Although this posture could result from rigor mortis, the presence of several specimens in the same position would seem to make that possibility unlikely. However, because the organisms lived as burrowing organisms in a very coarse sediment, there is no way to identify burrow structures.

Decapod fossils are preserved both as corpses and as exuviae (Feldmann and Tshudy, 1987; Feldmann, 1989). Distinction between these two preservational styles is based upon observations on entire specimens. The separation of the carapace from the abdomen and preservation in Salter's position in the macrurans is taken to indicate that the specimen was a molt. Recognition of molting in brachyurans and anomurans may be more difficult as the carapace may return to its original position following molting. A molted skeleton may be positioned exactly as in life. Displacement of the carapace, relative to the rest of the skeleton, is the criterion used to recognize molting.

COLLECTING LOCALITIES

Throughout the following pages, collection sites will be referred to by numbers. The complete description of these collecting localities is given below. The sites are plotted on Figure 1.

1. Cape Melville, eastern King George Island: 62°01'15"S, 57°37'30"W; western end of the Cape Melville peninsula, on summit of cliffs; reconnaissance geology and general fossil collection. Sample locality: DJ.94

2. West coast of Herbert Sound: 63°51.2'S, 57°47.0'W; James Ross Island, 8 km south of Cape Lachman; spot collections from two small exposures of conglomerate on either side of a small stream; uppermost part of the Lachman Crags Member, Santa Marta Formation.

3. North side of Crame Col: 63°50'S, 57°53.7'W; rough stratigraphical section from the top of Hidden Lake Beds to base of the main section exposed in Crame Col; basal Lachman Crags Member, Santa Marta Formation. Sample locality: D.8612

4. Southeast Brandy Bay: 63°50.3'S, 57°55.5'W; spot collection from isolated exposures approximately correlated with the lower 50 m of the Lachman Crags Member, Santa Marta Formation.

5. West side of Lachman Crags: 63°51.0'S, 57°52'W; measured section, 2.5 km southeast of Crame Col; Lachman Crags Member, Santa Marta Formation; crustaceans were collected from reworked nodules in the conglomerates. Sample locality: D.8616

6. Eastern Abernethy Flats: 63°52.3'S, 57°54.0'W; measured section in fine sandstones and conglomerates exposed on either side of an isolated and prominent basaltic dike (trend 314°); Lachman Crags Member, Santa Marta Formation. Sample locality: D.8617

7. Southwest Lachman Crags: 63°53.0'S, 57°54'W; measured section northwest of a prominent roof-shaped hill extending from the southwestern corner of the crags; Lachman Crags Member, Santa Marta Formation; near the top of the section, just below the debris-covered slopes of the volcanic cap, are three prominent conglomerate beds, rich in crustacean remains; spot collections were also made in conglomerate exposures about 309 m below the base of the section. Sample localities: D.8618 and 8621, DJ.377

8. Corrie, southwest Lachman Crags: 63°53.2'S, 57°54.2'W; spot collections from isolated exposures, largely covered in morainic debris; Lachman Crags Member, Santa Marta Formation; possible correlation with the conglomerate levels at the top of locality.

9. West side of San José Pass: 63°53.0'S, 57°56.0'W to 63°64.0'S, 57°55.0'W; rough stratigraphical section over poorly exposed sequence in the NW–SE trending valley on the western side of San José Pass and off the southern end of Lachman Crags; Lachman Crags Member, Santa Marta Formation. Sample locality: D.8623

10. Western San José Pass: 63°54.5'S, 57°49.0'W; stratigraphical section in the upper part of the valley on the western side of San José Pass; upper part of Lachman Crags Member, Santa Marta Formation.

11. Western margin of Abernethy Flats: 63°53.4'S, 57°58.5'W to 63°53.3'S, 57°58'W; stratigraphical section in poorly exposed ground and in section in ridges oblique to strike in the area due south of Brandy Bay; lower part of Lachman Crags member, Santa Marta Formation. Sample locality: D.8630

12. Southwestern margin of Abernethy Flats: 63°53.3'S, 57°58'W to 63°54.5'S, 57°58'W; detailed stratigraphical section continuing upwards from the top of section at locality 11. The section repeats the beds studied at localities 6, 7, and 10; upper part of Lachman Crags Member, Santa Marta Formation. Sample locality: D.8629

13. West side of Leal Bluff, Cape Lamb, Vega Island: 63°52.7'S, 57°36'W; spot collections from the slopes on the western side of Leal Bluff; Cape Lamb Member, López de Bertodano Formation. Sample locality: D.8641

14. East side of Leal Bluff, Cape Lamb, Vega Island: 63°53.4'S, 57°35'W; spot collections from numerous scattered concretions weathered out of poorly lithified sandstones; slopes south of Leal Bluff; Cape Lamb Member, López de Bertodano Formation. Sample localities: D.8644 and 8645, DJ.230, 231

15. Col between Dagger Peak and Comb Ridge, The Naze, James Ross Island: 63°55'S, 57°28.2'W; collection from concretions weathered out of poorly lithified sandstone beds exposed on the eastern side of the col; Cape Lamb Member, López de Bertodano Formation. Sample localities: D.8643, DJ.355

16. North side of Fortress Hill, the Naze, James Ross Island: 63°56'S, 57°31'W; spot collection from poorly exposed sandstones with concretions on the NW slope of the hill in an area largely covered with debris from overlying basaltic rocks; Cape Lamb Member, López de Bertodano Formation.

17. Northwest side of Humps Island: 63°59.5'S, 57°25.5'W; collection of fossils in concretions, loose on slope extending down from the col between the two peaks; Cape Lamb Member, López de Bertodano Formation. Sample localities: DJ.355 and 368

18. Western end of Humps Island: 63°59.5'S, 57°26'W; collection of fossils from a measured section extending from beach level to just beneath a residual volcanic cap on the westernmost of the two peaks; Cape Lamb Member, López de Bertodano Formation.

19. East coast of Cockburn Island: 64°12.3'S, 56°50'W; spot collection in prominent pale-colored gully about midway along the coast; Cape Lamb Member, López de Bertodano Formation. Sample locality: DJ.351

20. Southwestern Seymour Island: 64°17'58"S, 56°45'8"W; north-facing slope along a drainage exposing unit Klb9 (Sadler, 1988), López de Bertodano Formation. Maastrichtian.

DEPOSITORIES

Specimens that formed the basis for this work have been deposited in the following collections. The abbreviations denoting those depositories, and used throughout the text, are as follows. BAS. IN., British Antarctic Survey, Invertebrate Type Collection, British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET, United Kingdom. CIRGEO, Centro de Investigaciones en Recursos Geológicos, Ramírez de Velazco 847, 1414-Buenos Aires, Argentina. CPBA, Cátedra de Paleontología, Universidad de Buenos Aires, Ciudad Universitaria, Pabellón 2, Geologia, 1428-Buenos Aires, Argentina. KSU, Kent State University, Department of Geology, Paleontology Collection, Kent, Ohio, U.S.A. USNM, United States National Museum of Natural History, Department of Paleobiology, Washington, D.C., U.S.A.

SYSTEMATIC PALEONTOLOGY

Order DECAPODA Latreille, 1803
Suborder PLEOCYEMATA Burkenroad, 1963
Infraorder ASTACIDEA Latreille, 1803
Family NEPHROPIDAE Dana, 1852
Subfamily HOMARINAE Huxley, 1879
Genus HOPLOPARIA McCoy, 1849

Type species.—*Hoploparia longimana* (Sowerby), 1826.

HOPLOPARIA STOKESI (Weller, 1903)
Figures 3–5

Glyphea stokesi WELLER, 1903, p. 418, Pl. 1, fig. 1.

Hoploparia stokesi (Weller). BALL, 1960, p. 6, Pl. 1, figs. 1–5, Pl. 3, figs. 1, 2, text-figs. 2, 3a; DEL VALLE AND RINALDI, 1975, p. 4, figs. 2–9; FELDMANN, 1984, fig. 2a; 1989, p. 64; FELDMANN AND TSHUDY, 1987, p. 1194; 1989, p. 183; TSHUDY AND FELDMANN, 1988, p. 291; AGUIRRE-URRETA, 1989, p. 525; AGUIRRE-URETTA ET AL., 1991, p. 797.

Emendation to description.—Claws highly variable, of two general morphology-ornamentation categories. Less sculptured, typically granulose claws, isochelous on juveniles, heterochelous on adults; right or left larger (Ball, 1960, p. 11); similarly ornamented. Crusher claw palm larger than cutter; palm length–width ratio typically greater for cutter (1.7–2.4) than for crusher (1.6–1.8), but ratio may be similar for the two (1.7; USNM 410889). Palms subrectangular in dorsal view; palm gradually widens distally to a greater or lesser extent on different specimens. Upper and lower surfaces convex; lower surface more so. Some undeformed claw pairs rather compressed (BMNH 51777), others subcylindrical (USNM 458920). Upper surface on subcylindrical forms, and lower surfaces on all forms, more convex proximally than distally. On both surfaces, broad, shallow or deep depression at base of fixed finger continues onto finger as narrow outer marginal furrow. Both palm surfaces also with shallow inner marginal furrow. Upper and lower surfaces with small process on distal margin, between median and inner margin, which articulates with spine on upper or lower surface of dactylus base. Upper and lower surfaces typically granulose; coarseness of ornamentation ranges from finely granulose (USNM 458915) to coarsely granulose (USNM 458920). Row of minute pits along front of each coarse granule or tubercle on palm (USNM 458904).

Outer margin with subtle, rounded carina proximally; carina wider, flatter near base of fixed finger and continuing onto finger. Carina with stout tubercle at proximal end; otherwise ornamented as on upper and lower surfaces.

Inner margin broadly rounded; large process at distal end articulates with base of dactylus. Ornamentation of inner margin varies greatly among specimens; all with granules or tubercles as elsewhere on palm, but many specimens also with anteriorly directed spines of varying size on upper and lower corners of keel (USNM 458910). Ball (1960, p. 11) first observed that some of the less sculptured, granulose claws bear spines on the inner margin. Presence or absence of these spines varies by locality, with no clear stratigraphic pattern. They are present on specimens from the Santa Marta Formation and from the López de Bertodano Formation on Humps Island and at most localities on Seymour Island. They are absent on those examined from the López de Bertodano Formation at The Naze on James Ross Island, False Island Point on Vega Island, and Seymour Island locality MAK 87-50 (Unit 7) (USNM 458921).

Fingers of crusher claw broad, shorter than palm (about 0.7×–0.8× palm length). Fingers of cutter claw more slender than those of crusher claw, much longer than palm (about 1.5×–1.6× palm length; based on just four specimens). Fingers of both claws typically slightly incurved. Fixed finger on both claws somewhat pear-shaped in cross section, thickest toward occlusal surface, with narrow outer marginal furrow on upper and lower surfaces. Dactylus of crusher claw ovate in cross section, compressed; cutter claw dactylus subcircular in cross section. Fingers proximally ornamented less coarsely than palms; usually smooth over most of length but may be granulose. Dactylus base with one or two spines on upper side of inner margin.

Crusher claw dentition poorly known. Cutter claw fixed finger with sharp, small, variably sized denticles; some of former with long, conical, sharp, distally directed denticle at about one-quarter length (BAS 2264). Cutter claw dactylus with sharp, small, variably sized denticles along length.

Sculptured, typically tuberculate, claws slightly heterochelous with respect to palm size, relative lengths of palm and fingers, curvature of fixed finger, and dentition. Palm shape variable, typically subrectangular, with palm width gradually expanding distally to a greater or lesser extent on different specimens; palm of crusher claw rarely subtriangular (USNM 410903); length–width ratios typically 1.7–1.8 for crusher claw but range to 1.2 for rare subtriangular palm and about 2.0 for cutter.

Palms of crusher and cutter similar in topography. Upper surface of palm broadly convex medially; outer marginal furrow originates near proximal end; typically deeper distally than proximally; furrow forms a basin-like concavity near base of fixed finger. Broad, well-impressed, inner marginal furrow extends over length of palm's upper surface; terminates just before distal margin. On lower surface, outer marginal furrow absent or subtle proximally, becoming broader, deeper distally. Inner marginal furrow extends over entire length of palm; typically subtle proximally, broader, deeper distally; on some specimens (USNM 458908) furrow well impressed over entire length.

Upper and lower surfaces ornamented with variably sized tubercles, coarser on medial surface, finer in furrows. Process on distal end of palm's upper and lower surfaces, between median and inner margin, receives spine on upper and lower surface of dactylus base.

Outer margin a thin, sharply rounded keel extending over most of length, widening distally to near base of fixed finger, where it becomes flattened and continues onto finger. Palm outer margin ornamented with tubercles that can be as large as those on median.

Inner margin a thin, sharply rounded keel ornamented with tubercles as large or larger than those on median; tubercles directed slightly upward. Large process on distal end articulates with base of dactylus.

Fingers on crusher claw about 0.7×–0.8× palm length; fingers on cutter claw about 1.0×–1.1× palm length. Fixed finger strongly incurved on crusher claw, slightly incurved on cutter claw (USNM 458908). On both upper and lower palm surfaces, median ridge and adjacent outer marginal furrow curve onto fixed finger. Position of ridge on fingers varies. Typically, it occupies a medial position on finger's upper surface and borders occlusal margin on lower surface. On a few specimens, the ridge is shifted toward the occlusal surface (USNM 458911; crusher) on both upper and lower surfaces. On two others (USNM 458905, 458917; both crushers), the ridge is situated medially on both upper and lower surfaces. Fixed finger with tubercles of varying size near base, otherwise pitted.

Dactylus of both crusher and cutter claws straight or nearly so; ovate or subovate in cross section. Upper and lower surfaces smoothly convex (KSU 6409, right lower) or with one (USNM 458908, right lower) or two (USNM 410913, right lower) submedial longitudinal furrows. Dactylus with tubercles of varying size proximally on upper surface and inner margin; remainder pitted. Some individuals with large tubercle proximally on upper side of inner margin of dactylus.

Crusher and cutter claws with somewhat different dentition. Details of dentition also vary between specimens from the same locality (e.g., specimens KSU 6409, USNM 458905, 458906, 458917, 458919 from locality 6-86 in López de Bertodano Unit 9). Fixed finger of crusher claw proximally edentate (KSU 6409) or with a few small, variably sized teeth (USNM 458906). Large, longitudinally elongate, multicusped platform at midlength or, more commonly, before midlength, followed distally by main row of contiguous, blunt, mostly ovate (transversely elongate), variably sized teeth generally decreasing in size distally.

Dactylus on crusher claw (KSU 6409) with a few variably sized, generally small, teeth at proximal end, followed by longitudinally elongate, multicusped platform, followed, in turn, by teeth which are contiguous, mostly ovate (transversely elongate) in cross section, and variably sized but finer than on fixed finger and generally decreasing in size distally. Platform on dactylus crusher claw situated proximal to that of fixed finger.

Dentition on fixed finger of cutter claw poorly known; one specimen (USNM 458919) with small, conical, probably pointed, denticles. Dentition on dactylus of cutter claw (USNM 458908) also poorly known. Latter appears to lack the "platform"-like tooth evident on crusher claw dactylus. Denticles conical, contiguous, variably sized but all very small.

Type.—The holotype, No. 9705 in the Field Museum of Natural History, Chicago, is represented by the right side of a cephalothorax and its associated, but incomplete, abdomen and appendages.

Occurrences.—*Hoploparia stokesi* is known from Campanian through Paleocene strata at numerous localities spanning the James Ross Basin, from Seymour Island westward to northwestern James Ross Island.

Remarks.—Since the publication of Ball's (1960) description of *Hoploparia stokesi,* several hundred specimens have been collected, many from stratigraphic horizons below and above the units in which the type series was preserved. This new material reveals significant variation in several morphologic features, including aspects of cephalothorax and abdomen topography and ornamentation (Figures 3, 4) and, most notably, claw shape and ornamentation (Figure 5).

The record of *Hoploparia stokesi* spans 10, perhaps 15, my in the James Ross Basin, occurring in the Santa Marta, López de Bertodano, and Sobral Formations. Moreover, *H. stokesi* has been collected from several different horizons in a sequence lacking major hiatuses. Therefore, its record presents a unique opportunity to examine morphologic variation through time. More than 200 specimens of *H. stokesi* have been examined to determine the nature and rate of morphologic change in this species over its long range, and to determine the relative stability of various morphologic characters in this species. In addition, the abundance of these lobsters at several localities permits examining the nature of variability within single stratigraphic horizons.

A few characters vary markedly through the section and also within single stratigraphic units. In some horizons, the range of variability in some characters is as great as that which occurs through the section.

Directional morphologic changes through the section were observed to include: the degree to which the thoracic region is inflated, the presence or absence of various spines on the cephalothorax, the outline and ornamentation of the abdominal pleura, and the claw morphology and ornamentation. Thoracic inflation exhibits continuous variation, ranging from uninflated to very inflated, whereas the presence or absence of cephalothorax spines, and aspects of the abdominal pleura, vary discontinuously. A wide range of claw forms is observed, but nearly all can be placed in one of two morphology-ornamentation categories so that, for simplicity, we can regard variation in claws as discontinuous. Except for one character, the nature of the tergum–pleuron boundary on the abdominal somites, frequency of expression of the various character states changes gradually up section.

Cephalothorax shape and groove pattern are constant through the section. Morphometric analysis of these characters reveals no stratigraphic trends in these characters (Feldmann and Tshudy, 1989, fig. 5, and new, unpublished data).

Inflation of the thoracic region generally decreases with decreasing geologic age. There is also usually intralocality variation, but the stratigraphic pattern is significant, particularly in light of the vulnerability of this feature to distortion by compression. The thoracic region is typically inflated or strongly inflated (Figure 3.2) on geologically older specimens, those on specimens collected below López de Bertodano Formation Unit 7. Thoracic inflation varies in Units 7 and 8 on Seymour Island, but the thoracic region is almost invariably uninflated or only slightly inflated (Figure 3.3) in Unit 9. In Unit 10, the single satisfactorily preserved specimen has a thoracic region which is only slightly inflated. Intralocality variation is significant in Units 7 and 8 but is minor in the units above and below. Differential compaction due to burial, by itself, is an inadequate explanation for this variation.

Spines on the postantennal and hepatic regions vary by locality but, overall, become less common up section. The postantennal spine is almost always present (Figure 3.5) on specimens from the Santa Marta Formation and from several localities in the Cape Lamb Member of the López de Bertodano Formation, including those on Vega Island and The Naze on James Ross Island. Conversely, it is absent on specimens from the Cape Lamb Member on Humps Island, rare on specimens from the same unit on Cockburn Island, and absent or rare at most Seymour Island localities (Figure 3.3). The hepatic spine is present or absent, varying by locality, on specimens collected below López de Bertodano Formation Unit 9, but is invariably absent in Units 9 and 10.

No significant stratigraphic trends are evident in the general surface ornamentation of the cephalothorax. Ornamentation is generally as Ball described it (1960, p. 10), although the relative size and elongation of granules of various regions varies, even among specimens from the same locality. One specimen from Humps Island (USNM 458913) has an obvious pair of postcervical spines (Figure 3.4), which are otherwise unknown in the species.

Sexual dimorphism is exhibited within certain aspects of the morphology of abdomens (Ball, 1960, and others), but abdomen morphology also varies stratigraphically. Ball described "Type A" and "Type B" morphologies, which he tentatively concluded to be female and male, respectively, based on a similar, though less well pronounced, dimorphism in *Homarus gammarus* (Linnaeus). In addition to differences in pleuron shape and ornamentation at just below the tergum–pleuron boundary, Type A pleura lack lateral spines above their terminations, which (Ball, 1960, p. 12) would facilitate the enrollment of the abdomen to protect the eggs attached to its underside. Tshudy and Feldmann (1988) corroborated the interpretation of sexual dimorphism, based on the complete overlap of the size distribution for Type A and B and the lack of intermediate morphologies. Ball's reconstruction (his figure 2) incorrectly shows Type B pleura as directed ventrally. In actuality, both Type A and B pleura angle posteroventrally. Taylor (1979, p. 20) and Tshudy and Feldmann (1988, p. 293) mistakenly

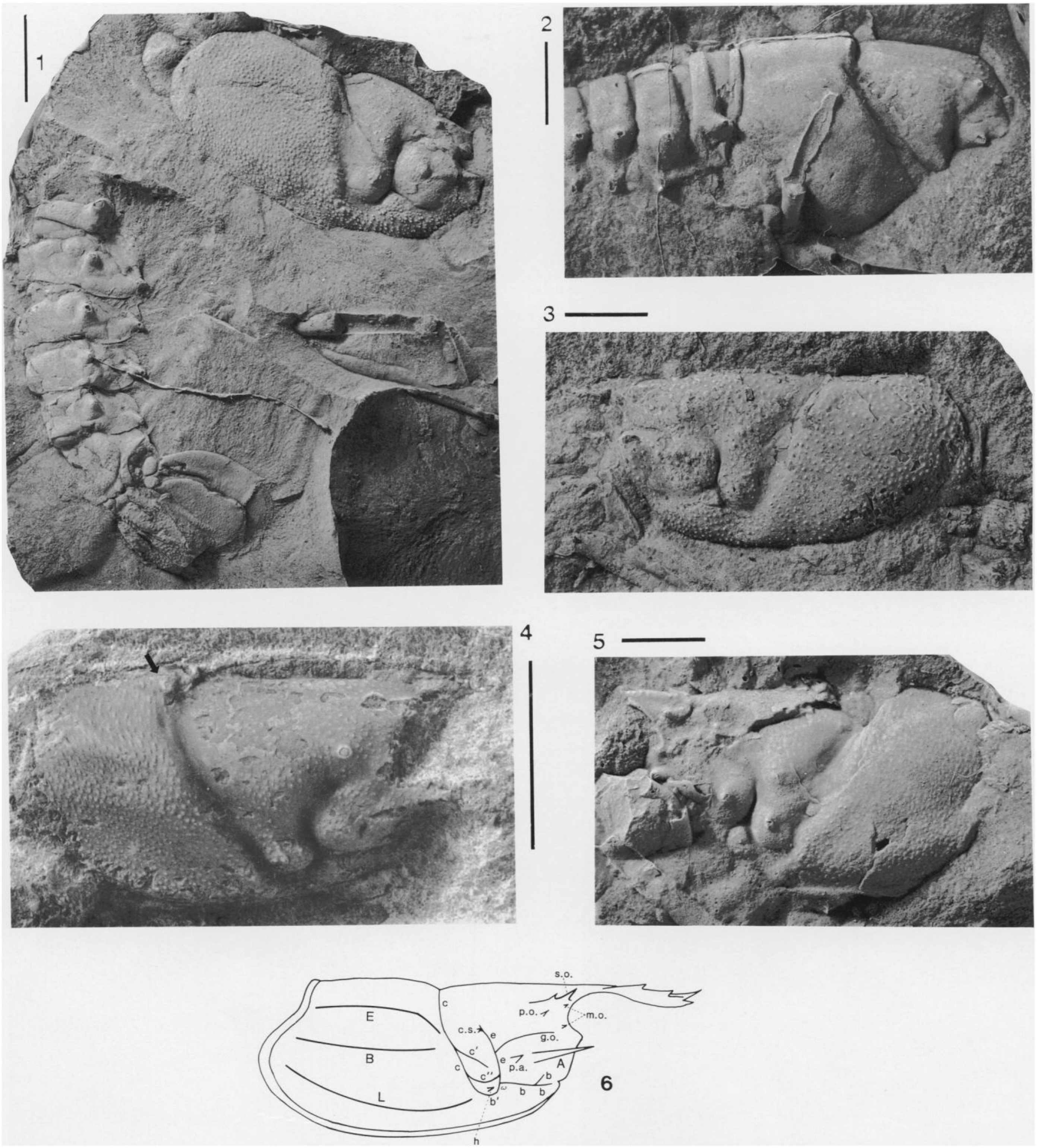
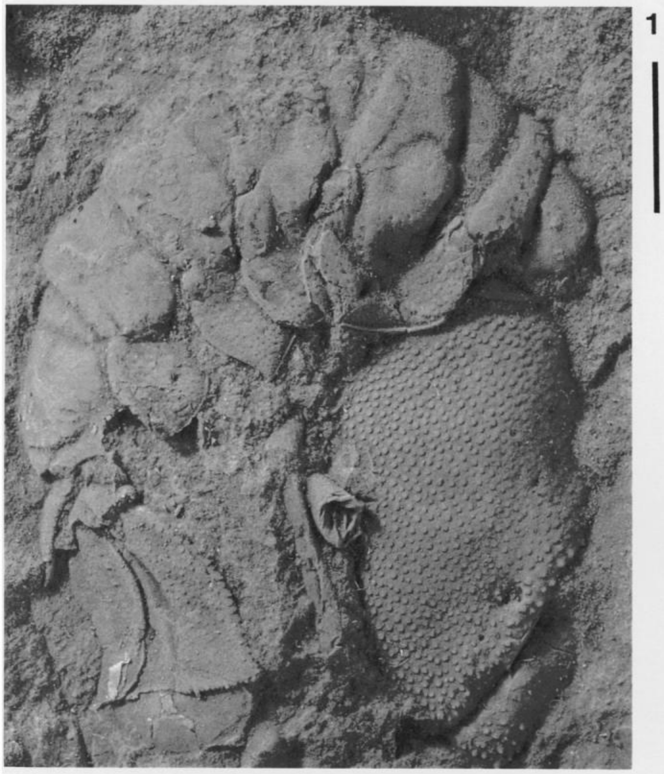


FIGURE *3*—*Hoploparia stokesi* (Weller). *1,* right view of cephalothorax, Type B abdomen, and tail fan (BAS 2085); Cape Lamb Member of Lopez de Bertodano Formation, locality 14. *2,* right view of cephalothorax and Type B abdomen showing very inflated thoracic region (USNM 430023); Santa Marta Formation, James Ross Island. *3,* left view of cephalothorax showing slightly inflated thoracic region and absence of postantennal and hepatic spines (USNM 430025); Lopez de Bertodano Formation, Unit 7, Seymour Island. *4,* left view of cephalothorax showing postcervical spine indicated by arrow (USNM 498913); Cape Lamb Member, Humps Island. *5,* left view of cephalothorax showing postantennal and hepatic spines (USNM 430024); Santa Marta Formation, James Ross Island. *6,* schematic lateral view of nephropid lobster carapace showing the position of grooves, carinae, and spines found on species of *Hoploparia* and *Metanephrops* described herein (modified from Holthuis, 1974, p. 734). Abbreviations: E, intermediate carina; B, branchial carina; L, lateral carina; A, antennal carina; c, postcervical groove; c′, intercervical groove; c″, second intercervical groove; e, cervical groove; b, antennal groove; b′, hepatic groove on region χ; c.s., cervical spine; g.o., gastro-orbital groove; p.c., postcervical spine; h, hepatic spine; p.a., postantennal spine; s.o., supraorbital spine; p.o., postorbital spine; m.o., metorbital spines; ω, prominence omega. Scale bar equals 1.0 cm.



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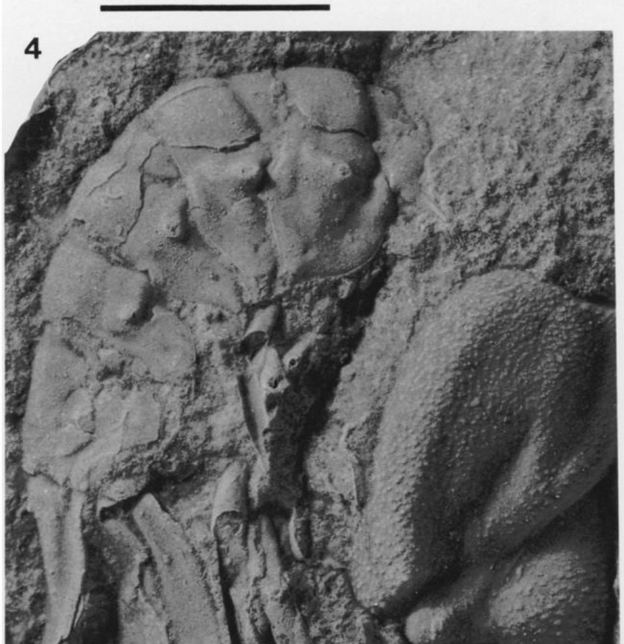

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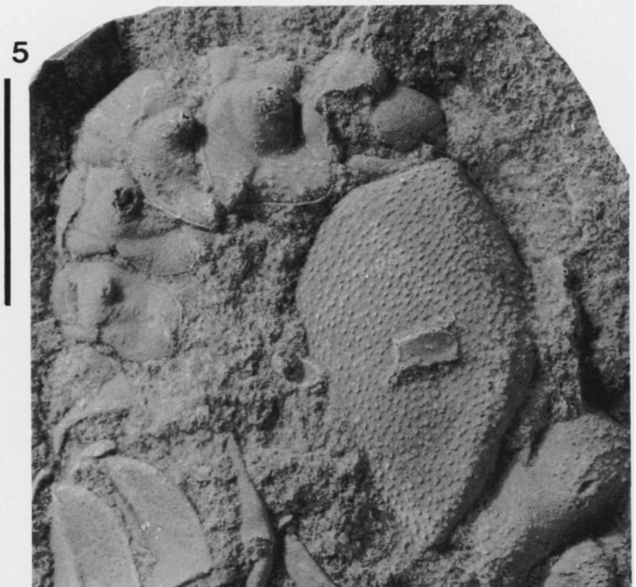

corrected Ball's sexual symbols in his figure 2; Types A and B are, indeed, probably female and male, respectively. It should be noted, however, that Ball (p. 12) referred to Types A and B as the "second" and "first" groups, respectively.

The top of the pleuron in both Type A (Figure 4.4) and B (Figure 4.5) specimens collected from below Cockburn Island strata is marked by a spine that is more prominent on Type B, as illustrated in Ball's figure 2. On Cockburn and Seymour Islands, however, only Type B (Figure 4.3) abdomens bear this lateral spine. On Type A pleura at these localities, the top of the pleuron is marked, instead, by an oblique, rounded, lateral ridge (Figure 4.1).

Both of the Type A specimens (CIRGEO 879, 880) from the Herbert Sound Member, as well as one (USNM 458903) from Unit 9 of the López de Bertodano Formation, have a second pleuron with an anterolateral angle that is more square (Figure 4.2) than on other Type A abdomens. In addition, specimens from the Santa Marta Formation, and perhaps some individuals from the Cape Lamb Member on Vega Island, bear a lateral spine on their sixth tergum that is absent on geologically younger specimens. Abdomen morphology is rather constant within any locality, except for some differences in surface ornamentation.

Claw morphology and ornamentation vary stratigraphically. Overall, claws become stouter and more coarsely ornamented in younger layers. The majority of claws are embraced by two general morphology-ornamentation categories: those which are less sculptured and typically granulose (Figure 5.1) and those which are highly sculptured and typically tuberculate (Figure 5.3). There are also intermediate (Figure 5.2) and unusual morphologies. Left and right claws are similar in general morphology and in ornamentation, but typically differ in their proportions and dentition.

The less sculptured claws have palms with a broadly convex upper surface and convex lower surface, each marked by a shallow inner marginal furrow and shallow, basin-like concavity at the base of the fixed finger. The palms of these claws, typified by BMNH In. 51777, illustrated by Ball (1960, Pl. 1, fig. 1), are almost invariably granulose. On sculptured claws, which are usually tuberculate, the median is broadly convex on the upper surface and strongly convex on the lower surface, and both surfaces are marked by outer and inner marginal furrows.

Variation in dentition of *H. stokesi* remains poorly understood. On the less sculptured claws, distal ends and denticles on fingers are infrequently preserved. Although many sculptured claws from the upper López de Bertodano Formation have been examined, most of these are preserved singularly, commonly as molds of the exterior or as poorly preserved positives. This, coupled with the similarity between major or minor claws, makes recognizing patterns of variation difficult.

Those below López de Bertodano Formation Unit 7 invariably exhibit less sculptured, granulose claws. Intralocality and intraunit variation over this lower part of the section is minor, but there is striking variation among geologically younger Seymour Island specimens, even among those from the same collecting locality. While some claws from Units 7–9 are similar to those typical of older units, some specimens in Unit 7, and

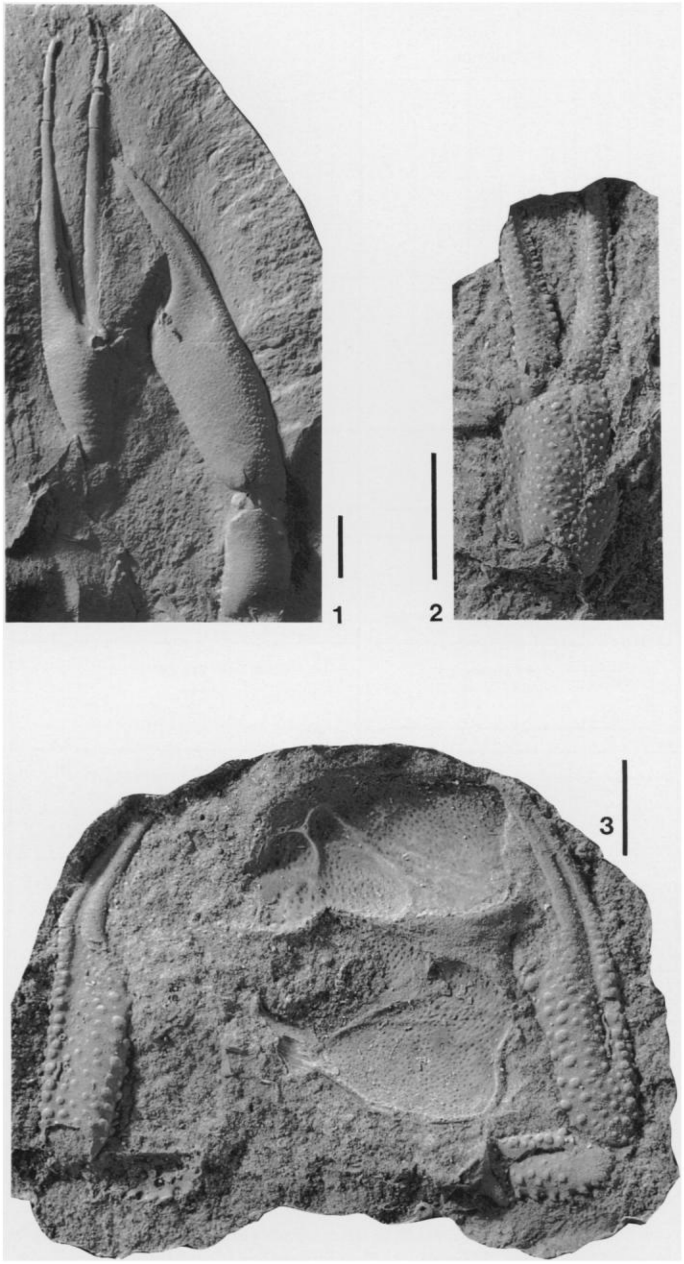

FIGURE 5—*Hoploparia stokesi* (Weller). *1*, upper view of less sculptured, granulose claws (BAS DJ 231.9); Cape Lamb Member, locality 14. *2*, lower view of left claw showing intermediate condition of sculpture and ornamentation (USNM 458907); López de Bertodano Formation, Unit 9, Seymour Island. *3*, lower view of sculptured, tuberculate claws (USNM 458908); López de Bertodano Formation, Unit 9, Seymour Island. Scale bar equals 1.0 cm.

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FIGURE 4—*Hoploparia stokesi* (Weller). *1*, left view of Type A abdomen showing oblique ridge across tergum–pleuron boundary (USNM 458909); López de Bertodano, Unit 9, Seymour Island. *2*, right view of Type A abdomen showing boss at tergum–pleuron boundary (CIRGEO 880); Herbert Sound Member of Santa Marta Formation, James Ross Island. *3*, left view of Type B abdomen showing boss at tergum–pleuron boundary (BAS DJ 231.9); Cape Lamb Member of López de Bertodano Formation, locality 14. *4*, left view of Type A abdomen showing boss at tergum–pleuron boundary (USNM 458912); Cape Lamb Member, Humps Island. *5*, left view of Type B abdomen showing boss at tergum–pleuron boundary (USNM 458914); Cape Lamb Member, Cockburn Island. Scale bar equals 1.0 cm.

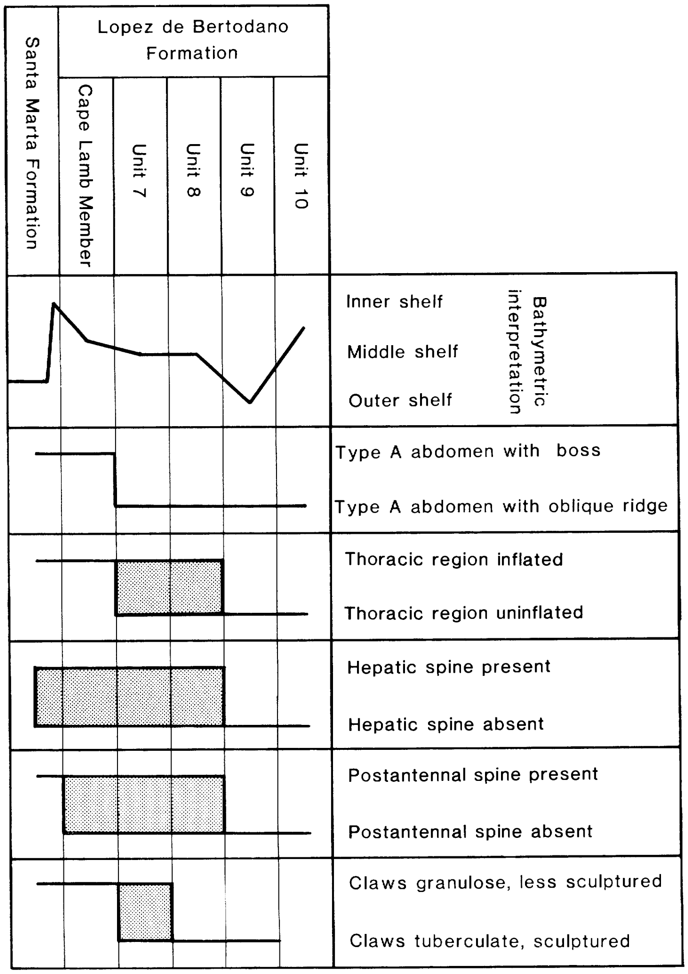

FIGURE 6—Summary of stratigraphic changes in the morphology of *Hoploparia stokesi* (Weller) and interpreted bathymetric framework for each unit.

the great majority of those in Units 8 and 9, have shorter, stronger fingers and tuberculate palms that are more sculpted than those of geologically older specimens. Units 7–9 have also yielded a few intermediate and unusual morphologies.

The possibility exists that the observed variation is simply facies controlled. However, that hypothesis is rejected because, while the basin's sequence stratigraphy is not yet well understood, the current interpretation includes several facies changes through the composite section, and these are not paralleled by directional morphologic trends in the morphology of the lobsters (Figure 6). The adaptive significance of the morphologic changes is unknown.

With regard to the types and magnitudes of changes that occur through the section, perhaps none by itself would warrant separation of the lineage into two or more species. The abrupt change in abdomen ornamentation in the middle of the section may provide the one exception. More clearly, however, the sum of changes in each of the four characters produces two morphologic end members—the geologically oldest and youngest specimens—that are quite distinct. In fact, the end members differ as much as some modern nephropid lobster species. However, we cannot draw meaningful species boundaries because characters change asynchronously. Nevertheless, the directional changes that occurred within the lineage may indicate the existence of two or more biological species. Certainly, if one was to consider only the end members of this morphological spectrum, the recognition of two species would be warranted.

HOPLOPARIA ANTARCTICA Wilckens, 1907
Figures 7, 8

?*Hoploparia antarctica* WILCKENS, 1907, p. 12, Pl. 3, fig. 5.
Hoploparia antarctica Wilckens. AGUIRRE-URETTA, 1989, p. 524, Pl. 57, figs. 4, 5; in press, Pl. 1, fig. H (not Pl. 2, fig. A) (fide Aguirre-Uretta, 1991, p. 797); AGUIRRE-URETTA ET AL., 1991, p. 797, figs. 3.1–3.11, 4.1–4.4.

Diagnosis.—*Hoploparia* with subtle branchial carina and subtle or very subtle intermediate thoracic carina. Antennal field with three large, somewhat alate projections, each supporting an anteriorly directed spine, including the antennal spine and two postantennal spines. Post-supraorbital spine followed by row of tubercles comprising supraorbital carina. Chelipeds strongly asymmetrical; major claw very broad, compressed; minor claw subcylindrical.

Emendation to description.—Cephalothorax, excluding rostrum, about 1.8× long as high; highest slightly posterior to midlength; laterally compressed. Rostrum base strong, upturned slightly. Subdorsal ridges granulose, extend posteriorly to near supraorbital spine. Orbits moderately deep; orbital ridges rounded, prominent.

Postcervical groove deeply incised; extends ventrally, very slightly posteriorly, from median line to just above intermediate carina, then angles anteroventrally to join hepatic groove. Urogastric groove narrow, shallow; extends from dorsomedian at short distance behind postcervical groove to postcervical groove at its anteroventral inflection; carapace very slightly depressed along urogastric groove. Dorsal surface immediately behind postcervical groove with short, rounded, smooth, transverse keel. Two broad, very shallow intercervical grooves branch from postcervical groove. The more dorsal intercervical groove arises at just slightly above branchial carina, extends anteroventrally toward, but does not reach, upper portion of cervical groove. Second, more ventral, intercervical groove extends in concave-upward arc to cervical groove, defining upper boundary of prominence χ over attachment of adductor testis muscle.

Hepatic groove semicircular; subtle posteriorly; distinct as it curves upward to join antennal and cervical grooves. Cervical groove deeply incised, slightly arcuate, parallels post-cervical groove; originates slightly above level of branchial carina, joins antennal groove without inflection in arc. Antennal groove slightly arcuate, well impressed over prominence ω, becoming progressively fainter anteriorly; meets reentrant of anterior margin. Prominence ω distinct, triangular, slightly smaller and more ventrally situated than prominence χ. Gastro-orbital groove subtle, extends slightly anterodorsally from near upper end of cervical groove, becoming obscure near base of deepest part of orbit.

Supraorbital spine strong, anteriorly directed. Post-supraorbital spine somewhat smaller, anteriorly directed, followed by a row of anteriorly directed tubercles, the supraorbital carina, which, on Antarctic specimens, extends to point above cervical groove; carina diverges from, then converges toward, dorsomedian line. Carina may be subtler and shorter on Patagonian specimens. Postorbital spine small, rounded, anteriorly directed; followed by short, slightly anteroventrally directed carina usually bearing a couple of tubercles. Metorbital spine small, round, situated behind deepest part of orbit. Antennal region with three large, somewhat alate, equally spaced projections, each of which supports an anteriorly directed spine, including antennal spine and two postantennal spines.

Thoracic region with parallel intermediate and branchial carinae; branchial carina subtle, intermediate carina subtle or very subtle. Both slightly concave-downward, oriented slightly anterodorsally, and ornamented slightly more coarsely than surrounding surfaces. Posteromarginal ridge wide; widest at level of branchial carina; bordered internally by narrow posteromarginal furrow.

General surface ornamentation varies somewhat among Antarctic specimens, but is consistently coarsest posterodorsally on cephalic region. Cephalic region posterodorsally with granules of varying size and some tubercles; minutely or finely granulose and pitted anterodorsally. Lateral cephalic surface pitted, very densely so between level of metaorbital spine and antennal ridge. Cephalic region finely granulose below antennal groove. All grooves and marginal ridge smooth.

Thoracic region dorsally with transversely elongate pits or, less commonly, round pits. Posterior margins of many transversely elongate pits swollen. Thoracic surface along and below branchial carina densely granulose and pitted; granules coarser on carinae.

Abdominal terga 2–5 rectangular, pitted. Terga posteriorly with very subtle, narrow transverse furrow extending dorsally from pleuron; furrow shallows dorsally, becoming obscure well below dorsomedian. Tergum–pleuron boundary marked anteriorly by oblique ridge extending from anteroventral corner of tergum to midlength on pleuron. Second pleuron subquadrate, pleura 3–5 cordate, sixth broadly triangular. Pleura 2–5 terminate in sharp, posteroventrally directed points; pointed termination of sixth directed ventrally. On second pleuron, anterior margin straight, angles slightly posteroventrally. Ventral margin straight; anteroventral corner smoothly rounded. Posterior margin slightly convex, angles anteroventrally; posteroventral corner with posteroventrally directed tooth. Axial portion of second pleuron broadly inflated, separated from inflated margins by submarginal furrows extending from anterodorsal and posterodorsal corners and joining ventrally just below center of pleuron, defining a broad "U." Second pleuron very inflated above posterolateral tooth; boss on summit. Some granules along ventral margin. Pleura 3–5 broadly convex axially, concave along anterior margin, inflated along posterior margin. Pleura 3–5 with submarginal furrow that extends ventrally from posterodorsal corner before curving axially at midheight on pleuron and becoming obscure at about midlength. Pleura pitted much more densely than terga. Sixth tergum subtrapezoidal, narrower posteriorly; anterior margin concave-forward; posterior margin straight. Sixth tergum separated from pleuron by rounded ridge and supradjacent furrow which extend posterodorsally from anterior corner to near posterior corner, where furrow bifurcates. One branch of furrow continues to posterior margin; other traverses tergum along posterior margin in concave-forward arc most closely approaching posterior margin at dorsal midline. Ridge with a few transversely elongate, scale-like tubercles becoming smaller posteriorly.

Telson longer than wide, generally narrowing posteriorly. Lateral margins slightly sinuous, each terminating in posterolateral spine; posterior margin convex. Smooth, shieldlike, transverse region along anterodorsal margin. Surface otherwise with median groove and four other longitudinal grooves diverging from median line posteriorly; surfaces convex between grooves. Remainder of telson covered by pits and transversely elongate tubercles becoming smaller posteriorly.

Chelae of moderate and nearly equal length but strongly asymmetrical in shape; major (left) claw very broad, compressed; minor (right) claw narrow, subcylindrical. Major claw palm slightly greater than half length of cephalothorax; very wide, expanding progressively to just past articulation of dactylus, then narrowing rapidly over proximal portion of fixed finger. Outer margin convex, inner margin nearly straight. Proximal end of claw narrow, incurved. Upper surface broadly convex medially, concave along outer margin, broadly and deeply so distally and on proximal portion of fixed finger. Surface along inner margin slightly concave, except at distal end. Lower surface broadly convex medially, very subtly concave along inner margin; outer margin concave along distal half of palm; concavity deepens at base of fixed finger and continues at least over proximal portion of fixed finger. Upper surface with minute granulations. Lower surface with small tubercle on distal end of medial ridge; otherwise smoother than upper surface. On both surfaces, process on distal palm margin articulates with spinelike projection from base of dactylus. Outer palm margin a very broad, thin, upturned keel. Keel widest at articulation of dactylus, becomes greatly constricted on fixed finger. Keeled outer margin smooth, except for small tubercle at proximal end. Inner margin of palm sharply rounded, thickens distally. Large process at distal end of inner margin articulates with base of dactylus. On Antarctic specimens, upper surface of inner margin with two large, anteriorly directed spines. On same specimens, lower surface of inner margin with a small anteriorly directed spine or tubercle between the two larger on upper surface, but closer to the more proximal of the two. Inner margin also with a few low, rounded granulations of varying size. Entire surface of claw minutely pitted. Fingers laterally compressed; dactylus ovate, fixed finger subovate, in cross section. Dactylus with tubercle on base of inner margin. Both fingers with variably sized, laterally compressed, domelike denticles.

Minor claw elongate, fingers longer than palm. Palm subcylindrical in cross section, width expands slightly distally; palm thickest proximally, progressively thinning distally. Upper surface convex medially and along inner margin; lower surface strongly convex medially. Upper and lower surfaces with sharply incised outer marginal furrow. Furrow extends onto fixed finger, probably for entire length on lower surface but gradually disappearing on upper surface. Palm lower surface with sharply incised inner marginal furrow except at proximal and distal ends. Outer margin a rather broad, flat, smooth keel gradually expanding in width to base of fixed finger, where it gradually narrows over proximal portion of fixed finger. Inner margin sharply rounded, with two large, anteriorly directed spines, the more proximal of the two being situated on the upper surface of the inner margin. Large process on distal end of inner margin receives dactylus base. Dactylus ovate, fixed finger pear-shaped, in cross section. Occlusal surface of fixed finger peaked, with summit closer to lower than upper surface and projecting obliquely toward plane of lower surface. Denticles on summit of fixed finger rather densely spaced, variably sized but all very fine, with bases ovate in cross section. Larger denticle, ovate in cross section, situated on upper side of peaked occlusal surface at about two-thirds finger length. Dactylus dentition very fine, densely spaced. Entire surface of claw pitted. Carpus subcircular in cross section, thickens distally; longer than wide, two-thirds palm length. Upper surface convex, with a few tubercles on inner and outer margins. Lower surface triangular, slightly convex, smooth except for broad spine directed distally and outwardly on distal outer margin. Outer surface convex, traversed diagonally upward by ridge with three alate spines. Small, distally directed spine at upper, proximal corner. Inner surface convex, with two or three tubercles becoming larger distally on subtle lower marginal ridge. Carpus finely pitted and variously ornamented with subtle granules.

Merus laterally compressed, subovate in cross section. Upper margin sharply rounded; terminates in high, distally directed spine. Outer surface broadly convex; terminates in very elongate


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TABLE *1*—Measurements (in mm) taken on specimens of *Hoploparia antarctica* Wilckens. Orientations of measurements are illustrated in Figure 8.

Specimen	Lc	La	Lp	Hc	Lz	Ly	Lr
CIRGEO 883	34	Ca. 19	13	21	16.7	11	
CIRGEO 877	54	28	20	28	22.4	16.5	
CIRGEO 881	Ca. 33	16.7	11.2	19	16	10.8	
BAS. IN. 2162		19.6			16.8	12.8	16
BAS. IN. 2181		21.5		26	21	14.8	
BAS. (15-12)	Ca. 42	23.5	14.7		18.4	Ca. 17	
BAS. (15-12) (1)		21.5			18	13	

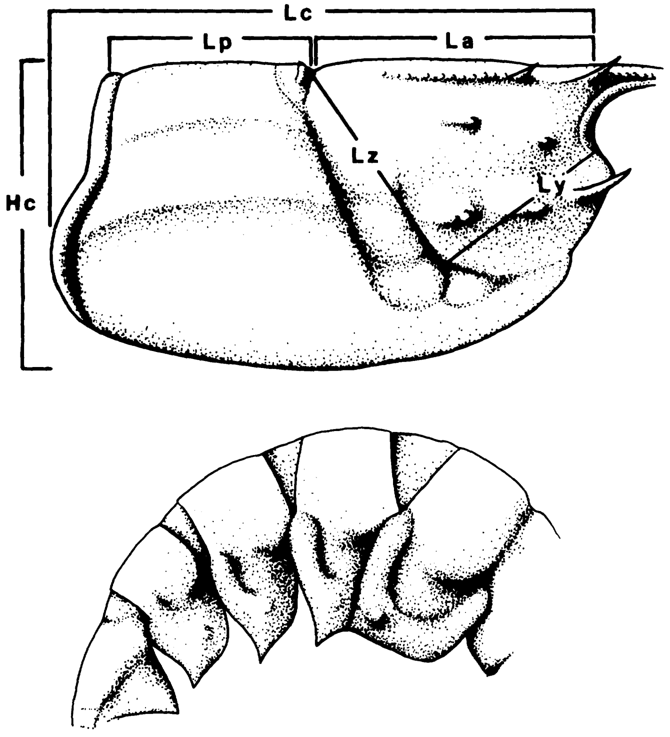

FIGURE *8*—*Hoploparia antarctica* Wilckens. Line drawing reconstruction of cephalothorax and abdomen showing orientations of measurements recorded in Table 1.

projection on distal, upper corner. Outer surface smooth medially, finely granulose near upper margin, very finely granulose near lower margin. Upper margin with a few broad, low tubercles. Lower margin with small spines.

Measurements.—Measurements (in mm) are given in Table 1.

Types.—The holotype, an abdomen with an incomplete telson from the Campanian–Maastrichtian of the Austral Basin, is deposited in the Museo de la Plata (MLP 4213) (Aguirre-Urreta et al., 1991, p. 797). Aguirre-Urreta's specimens are deposited in the Centro de Investigaciones en Recursos Geologicos, Argentina. Specimens from James Ross Island, BAS. IN. 2079, 2124, 2125, 2260, 2266, 2292, 2427, and some unnumbered specimens, are deposited in the Natural History Museum, London.

Occurrences.—*Hoploparia antarctica* was reported previously from the Campanian–Maastrichtian Cerro Cazador Formation of the Austral Basin of southern Patagonia and in the Maastrichtian Lefipan Formation of Chubut, central Patagonia (Aguirre-Urreta et al., 1991, p. 799). It is now also reported from the Campanian portion of the Lachman Crags Member of the Santa Marta Formation on James Ross Island, Antarctic Peninsula (Figure 1, map localities 2 and 10).

Remarks.—*Hoploparia antarctica* was first described by Wilckens (1907), based on a specimen from the late Cretaceous of southern Patagonia, and later redescribed by Aguirre-Urreta (1989) from the Campanian–Maastrichtian of southern Patagonia and Maastrichtian of central Patagonia (Aguirre-Urreta et al., 1991). The James Ross Island collection, which includes several complete and well-preserved specimens of *H. antarctica,* permits further elucidation of the morphology of the species. In particular, the Antarctic specimens include cephalothoraxes with well-preserved anterior portions. This region was not available to Aguirre-Urreta.

There may be a few subtle differences between the Antarctic and Patagonian specimens, but it seems best to refer them all to *H. antarctica.* The Antarctic specimens have a supraorbital carina that may be more prominent and longer than on those from Patagonia. Also, claws of the Antarctic and Patagonian specimens may differ in the arrangement of spines along the inner margin. We agree with Wilckens and Aguirre-Urreta that the species *antarctica* belongs in *Hoploparia,* mainly on the basis of its cephalothorax groove pattern, abdomen, telson, and several aspects of its carapace ornamentation. However, generic placement is complicated by the presence of branchial and intermediate thoracic carinae on this species. The carinae are subtle, at best, but the fact that ornamentation on the carinae is coarser than elsewhere on the thoracic region indicates that the carinae are real, not preservational features. Aguirre-Urreta noted both branchial and intermediate carinae on *H. antarctica* from Patagonia (1991, p. 797), but the intermediate carina is indistinct (Aguirre-Urreta et al., 1991, fig. 3.1) or even absent (Aguirre-Urreta et al., 1991, fig. 3.11) on her figured specimens. While the intermediate carina is also indistinct on some Antarctic specimens, most exhibit an intermediate carina nearly as distinct as the branchial carina above it.

Thoracic carinae, traditionally considered to be generic characters, are unknown in other species of *Hoploparia,* except for a very closely related species, *H. arbei* Aguirre-Urreta, from slightly older rocks of southern Patagonia. Multiple thoracic carinae are exhibited by several other nephropid genera, although the carinae may not be homologous among all of them. Regardless, none of these genera could accommodate *H. antarctica,* or *H. arbei,* as neatly as does *Hoploparia.* The genus least different from *Hoploparia, Metanephrops,* exhibits branchial and intermediate, as well as a lateral, thoracic carinae. *Hoploparia antarctica* differs from species of *Metanephrops* in several aspects, notably in lacking a lateral thoracic carina and various cephalothorax spines and in the distinctly different mor-

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FIGURE *7*—*Hoploparia antarctica* Wilckens. *1, 2,* upper and lower views of left claw. *3, 4,* lower and upper views of right claw (BAS. IN. 2292); Lachman Crags Member of the Santa Marta Formation, locality 2. *5,* dorsal view of cephalothorax (BAS. IN. 2124); Lachman Crags Member, locality 10. *6,* right view of cephalothorax (BAS. IN. 2124); Lachman Crags Member of Santa Marta Formation, locality 10. *7,* right view of cephalothorax (BAS. IN. 2292); Lachman Crags Member, locality 2. *8,* right view of cephalothorax. *9,* right view of abdomen. *10,* left view of cephalothorax and abdomen. *11,* dorsal view of abdomen (BAS. IN. 2260); Lachman Crags Member, locality 2. *12,* dorsal view of abdomen (BAS. IN. 2124); Lachman Crags Member, locality 10. Scale bar equals 1.0 cm.

phology of its telson. Also, the thoracic carinae on *Metanephrops* are much more prominent than those on *H. antarctica.* In light of the subtlety of the carina on *H. antarctica* and *H. arbei,* it does not seem prudent to erect a new genus to accommodate them.

Hoploparia antarctica most clearly resembles, and is extremely similar to, the Turonian–Coniacian *H. arbei* Aguirre-Urreta, 1989, from the Puesta El Alamo Formation of southern Patagonia. At the time that Aguirre-Urreta erected *H. arbei, H. antarctica* was incompletely known; its cephalothorax was only represented by a small portion of the thoracic region (1989, p. 524). When she redescribed (1991) *H. antarctica* based on more complete material, she did not compare the cephalothoraxes of the two species, which are, in fact, very similar or indistinguishable at the species level.

Aguirre-Urreta stated (1989, p. 519) that *H. arbei* could be distinguished from *H. antarctica* (then known only by its abdomen) by the absence of a rim on the abdominal pleura, and by the presence of a boss at the end of each pleuron. In our opinion, these differences are not reproducible and the abdomens of *H. antarctica* and *H. arbei* are indistinguishable.

Aguirre-Urreta's description (1989, p. 518) and reconstructions (1989, p. 518, 519) of *H. arbei* indicate that the intermediate thoracic carina is absent on that species, but on some figured specimens (e.g., CPBA 14583; Aguirre-Urreta, 1989, Pl. 56, fig. 5) this feature is as visible as on any figured specimen of *H. antarctica.* In both species, expression of the intermediate carina ranges varies, probably due mostly to enhancement in some due to burial compression.

The biggest differences between the two species exist in claw morphology. The claws of *H. arbei,* though poorly known, differ from those of *H. antarctica* in being ovate in cross section and lacking the distinctive, broad, outer marginal keel. The claws of *H. arbei* also have a few more spines on the inner margin.

Hoploparia antarctica is easily distinguished from *H. stokesi,* which occurs at the same collecting localities in the Campanian portion of the Lachman Crags Member, by its branchial and intermediate ridges, conspicuously trilobed antennal region, a supraorbital carina, and its distinctive, strongly asymmetric claws. The abdomens of the two species are similar, and the telsons are nearly identical. There is no dimorphism evident in the few known abdomens of *H. antarctica.* The abdomen of *H. antarctica* resembles the Type A abdomens of *H. stokesi* from Cockburn and Seymour Islands (compare Figure 6.8 and Figure 4.1).

Genus METANEPHROPS Jenkins, 1972

METANEPHROPS JENKINSI Feldmann, 1989

Diagnosis.—*Metanephrops* with three pairs of thoracic carinae; antennal field lacking prominent carina. Regions χ and ω well defined, granulose; ω larger. Abdominal terga with narrow transverse furrow posteriorly, becoming obscure dorsally; subtle, rounded ridge at tergum–pleuron boundary. Claws very large, with elongate palms; upper and lower surfaces with longitudinal row of four large medial spines; outer margin with two nodose keels forming quadrate edge.

Types.—The holotype (USNM 424598) and paratypes (USNM 424599–424614) are deposited in the U.S. National Museum of Natural History, Washington, D.C. Paratypes (KSU 5990–6000) are deposited in the Department of Geology, Kent State University, Kent, Ohio.

Occurrence.—*Metanephrops jenkinsi* occurs in the López de Bertodano Formation Units 9–10 and Sobral Units 1–3 (Maastrichtian–Paleocene) of Seymour Island, Antarctica.

METANEPHROPS ROSSENSIS n. sp.

Figures 9–11

Metanephrops jenkinsi FELDMANN, 1989, p. 67, figs. 2.1–2.6, 3.1, 3.2; FELDMANN AND TSHUDY, 1989, p. 190, fig. 6.

Diagnosis.—*Metanephrops* with three pairs of well-developed thoracic carinae and prominent supraorbital and antennal carinae. Abdominal terga 2–5 laterally with narrow, slightly sinuous transverse furrow across posterior third; terga 2–5 also with sharply defined, terrace-like ridge at tergum–pleuron boundary. Right claw palm very large, elongate, lacking longitudinal ridges; outer palm margin a thin, slightly downturned keel; inner margin with two rows of large spines.

Description.—Cephalothorax subcylindrical. Excluding rostrum, approximately 1.6× (CIRGEO #883) to 1.9× (CIRGEO #887) long as high; highest at about mid-length. Rostrum large, slightly less than one-half cephalothorax length; slightly upturned over proximal third, downturned over middle third, upturned over distal third; with strong terminal spine and at least one pair of lateral spines; one ventral spine at inflection in curvature. Orbits deep; deepest near bases; bordered by narrow rounded ridge.

Postcervical groove deeply impressed over most of length; extends transversely from dorsomedian to branchial carina, where it extends anteroventrally in slightly sinuous path toward obvious prominence χ, becoming shallow near latter. Subtle intercervical groove evident on some specimens; extends from postcervical groove at level of gastro-orbital groove toward middle of antennal field, terminating just before cervical groove. Hepatic groove semicircular, well impressed as it curves upward to meet cervical and antennal grooves. Prominence ω distinct, triangular. Cervical groove deeply impressed, slightly sinuous; concave backward above antennal region, concave forward behind antennal region; meets well-impressed antennal groove without inflection. Antennal groove doubly concave upward, with inflection at about midlength on antennal region; anterior termination meets reentrant in anterior margin, the incisura clavicularis of Holthuis (1974, p. 737). Gastro-orbital groove bounds upper margin of antennal region; extends anterodorsally, slightly sinuously, to near base of orbit.

Cephalic region with narrow median carina extending from supraorbital spine to near postcervical groove; carina most pronounced posteriorly. Supraorbital carina extends from lateral ridges on rostrum to point above cervical groove; bears three pairs of prominent, anteriorly directed spines; spines progressively larger anteriorly, largest being supraorbital spine. Postorbital spine strong, anteriorly directed, with base dorsoventrally compressed. On some specimens, postorbital spine followed by much smaller tubercle. Metorbital spine small, rounded, somewhat anteriorly directed. Antennal carina very prominent; extends over width and length of antennal region, becoming higher, slightly narrower, anteriorly. Small postantennal spine or tubercle evident on posterior end of carina on some specimens. Antennal spine long; projects anterodorsally from carina. Small cervical tubercle evident. Hepatic spine rather large.

Cephalic region with low granules posterodorsally; granules finer anterodorsally. Surface between postcervical and cervical grooves smooth, except over prominence χ, which has spinules around all but posterodorsal side of hepatic spine and is otherwise granulose. Antennal region smooth above carina, with fine granules below. Surface along ventral margin with granules generally coarser and higher than those elsewhere on cephalic region. Cephalic region with minute pits; many situated adjacent to anterior sides of granules. Surface densely pitted in narrow band immediately above gastro-orbital groove; moderately densely so in band immediately below groove.

Thoracic region with seven prominent longitudinal carina. Median carina extends from posteromarginal furrow to close to postcervical groove; ornamented with tubercles of varying size. Both sides of carina's anterior termination with anteriorly directed postcervical tubercle or spine. Branchial carina extends from posteromarginal furrow to postcervical groove in concave downward arc. Intermediate carina extends from posterior margin to postcervical groove; nearly straight or slightly concave upward along most of length, curving rather sharply anteroventrally behind postcervical groove. Lateral carina extends from posteromarginal furrow to prominence χ in long, concave upward arc. Posteromarginal ridge broad; broadest between branchial and lateral carinae; bordered internally by adjacent furrow. Thoracic surfaces between carinae broadly, slightly concave.

Surface ornamentation of thoracic region varies somewhat between specimens, but invariably, the three carinae and ventral surface below lateral carina are ornamented more coarsely than elsewhere. Lateral carina and ventral surface below with round granules. Some individuals with transversely elongate, scale-like granules above intermediate carina; granules with abruptly terraced anterior sides adjacent to a single pit. Other specimens nearly smooth between granulose carinae.

Abdominal terga 1–5 strongly convex, 6 convex. Tergum 1 very short, trapezoidal. Anterior and posterior margins diverge slightly over most of width; strongly at just above pleuron. Pleuron 1 very short, semicircular, separated from tergum along mid-length by longitudinal ridge. Terga 2–5 nearly rectangular; slightly wider laterally than dorsally, with narrow, transverse furrow across posterior third. Furrow extends dorsally from posterodorsal corner of pleuron in a slightly sinuous path which, overall, diverges progressively from posterior margin of tergum. Furrow extends to near dorsum on second pleuron, progressively less high on subsequent terga. Terga 2–5 with sparse, round pits. Terga and pleura 2–5 separated by sharp, terrace-like, ridge. Second pleuron subquadrate. Anterior margin straight, angles anteroventrally. Ventral margin straight; anteroventral corner broadly rounded. Posterior margin slightly convex over most of length, angles anteroventrally; posteroventral corner terminates in posteriorly directed tooth. Second pleuron surface slightly convex medially and inflated along margins. U-shaped furrow between convex median and margins extends from near anterodorsal and posterodorsal corners on pleuron. Boss on upper end of inflated posterior margin. Pleura 3–5 cordate, terminating in posteroventrally directed tooth. Surfaces broadly convex, with boss on upper end of posterior margin; 3–4 locally inflated above terminal tooth. Sixth tergum trapezoidal, narrower posteriorly. Sixth tergum and pleuron separated by broadly rounded ridge. Pleuron broadly triangular; surface broadly convex, featureless, sparsely pitted.

Telson probably about 1.3 times as long as wide, with longitudinal furrows; covered with transversely elongate, scale-like tubercles.

Major (right) claw very large, greater than twice length of cephalothorax excluding rostrum (based on one large individual). Palm very elongate; widens progressively, three times longer than maximum width. Upper surface gently convex medially over length; surface along outer margin convex proximally, otherwise slightly concave; surface along inner margin convex proximally, concave distally. Lower surface convex medially and along inner margin, more so proximally; outer margin convex proximally, strongly concave along remainder of length. Outer margin a thin, slightly downturned keel. Inner margin sharply rounded, thinning distally, with two rows of large, distally directed spines. Row of about four spines along corner of upper surface extends from proximal end to less than mid-length on palm. Row along corner of lower surface appears to extend entire length of palm. Fingers strong; fixed finger subcircular, dactylus dorsoventrally compressed, broadly ovate in cross section. Dactylus much wider than fixed finger. Outer marginal furrow on lower surface of palm extends onto proximal portion of fixed finger. Surface of entire claw smooth, free of granules and with very few pits evident. Fixed finger proximally with domelike denticles of varying size, ranging in cross-sectional shape from circular to longitudinally elongate–ovate. Fifth denticle from proximal end large. Dactylus edentate over proximal end; first tooth large, domelike.

Table 2—Measurements (in mm) taken on specimens of *Metanephrops rossensis* n. sp. Orientations of measurements are illustrated in Figure 11.

Specimen	Lc	La	Lp	Hc	Lz	Ly
BAS. IN. 2079	41	22.4	17	Ca. 23	Ca. 20	14
BAS. IN. 2124	41	70.8	16	23.0	18.6	Ca. 15
BAS. IN. 2260	40.4	20.1	16.0	22.0	17.8	13.6
BAS. IN. 2266	30.0	15.7	11.0	17.4	14	10
BAS. IN. 2292			18.3	27.7	23.3	
BAS. IN. 2427	Ca. 61			Ca. 33	29.7	

Minor claw poorly known; smaller than major claw. Inner margin of palm with large spines. Fingers slightly incurved, with small, variably sized, conical denticles. Carpus subcylindrical, with several distally directed spines. Upper surface convex, with a few spines each, proximally, along corners of inner and outer margins. Outer surface convex, with spine medially on proximal margin, and on lower and upper portion of distal margin. Merus elongate, about 3.5 times as long as carpus, subclindrical, somewhat laterally compressed; outer surface smooth, terminates medially in distally elongate projection.

Measurements.—Measurements (in mm) are given in Table 2.

Types.—The holotype (CIRGEO 883) and two paratypes (CIRGEO 877 and 881) are deposited in the Centro de Investigaciones en Recursos Geologicos. Paratypes BAS. IN. 2162, 2181, and two unnumbered specimens are deposited in the Natural History Museum, London.

Occurrence.—*Metanephrops rossensis* occurs in the Campanian portion of the Lachman Crags Member of the Santa Marta Formation on James Ross Island, Antarctica (Figure 1, map localities 6, 7, 8, 9, 10).

Etymology.—The species name alludes to its occurrence on James Ross Island.

Remarks.—The new species is referred with certainty to *Metanephrops* Jenkins, 1972, mainly on the basis of its three pairs of thoracic carinae, well-developed supraorbital and antennal carinae, long antennal spine, and large rostrum with one pair of lateral spines.

Metanephrops rossensis is, in its cephalothorax and abdomen, most similar to the Recent *M. rubellus,* which inhabits shelf (50–150 m) depths off of the southeast coast of South America (Jenkins, 1972, p. 192). *Metanephrops rubellus* differs from *M. rossensis* in having a cervical and postcervical groove that are more divergent dorsally, and in the details of ornamentation. The very large claws of *M. rossensis* are very different from those of *M. rubellus* and are most similar to those of the Maastrichtian–Paleocene *M. jenkinsi* Feldmann, 1989, from the James Ross Basin.

Metanephrops rossensis is easily distinguished from the only Cretaceous *Metanephrops, M. jenkinsi.* The most obvious differences in the cephalothoraxes of *M. rossensis* and *M. jenkinsi* exist in the morphology of the antennal field and prominence χ, and in the pattern of spines on the cephalic region. The rostrum on *M. jenkinsi* is poorly known. Like that of *M. rossensis,* it probably had a ventral spine although it was not shown

FIGURE 9—*Metanephrops rossensis* n. sp. *1,* dorsal view of cephalothorax (BAS. IN. 2181); Lachman Crags Member of Santa Marta Formation, locality 7. *2,* right view of abdomen (BAS. IN. unnumbered specimen). *3,* oblique view of cephalothorax (BAS. IN. 2181); Lachman Crags Member, locality 7. *4,* right view of cephalothorax (BAS. IN. unnumbered specimen); Lachman Crags Member, locality 9. *5,* left view of cephalothorax and second abdominal pleuron of holotype (CIRGEO 883); float, James Ross Island. Scale bar equals 1.0 cm.

in its reconstruction by Feldmann, 1989, p. 67), but *M. jenkinsi* almost certainly had more lateral spines than did the rostrum of *M. rossensis.* The abdomen of the new species differs from *M. jenkinsi* in having a more quadrate second pleuron and in having a more sharply defined lateral carina at the tergal–pleural boundary. *Metanephrops jenkinsi* and the new species have similar, very large, elongate-triangular claws, which are very different from those of Pliocene or Recent *Metanephrops.* The claws of *M. rossensis* are, however, proportionately longer and differently ornamented than those of *M. jenkinsi.*

The two oldest known species of *Metanephrops* occur in the James Ross Basin. Of these, the Campanian *M. rossensis* more closely resembles modern *Metanephrops* than does the Maastrichtian–Paleocene *M. jenkinsi. Metanephrops rossensis* strongly resembles modern species in several important characters, including the morphology of its thoracic and cephalic carinae, rostrum, and abdomen. It seems certain to have been ancestral to most or all modern species. *Metanephrops jenkinsi,* although geologically younger than *M. rossensis,* is clearly less similar to modern *Metanephrops* than the latter in the morphology of its

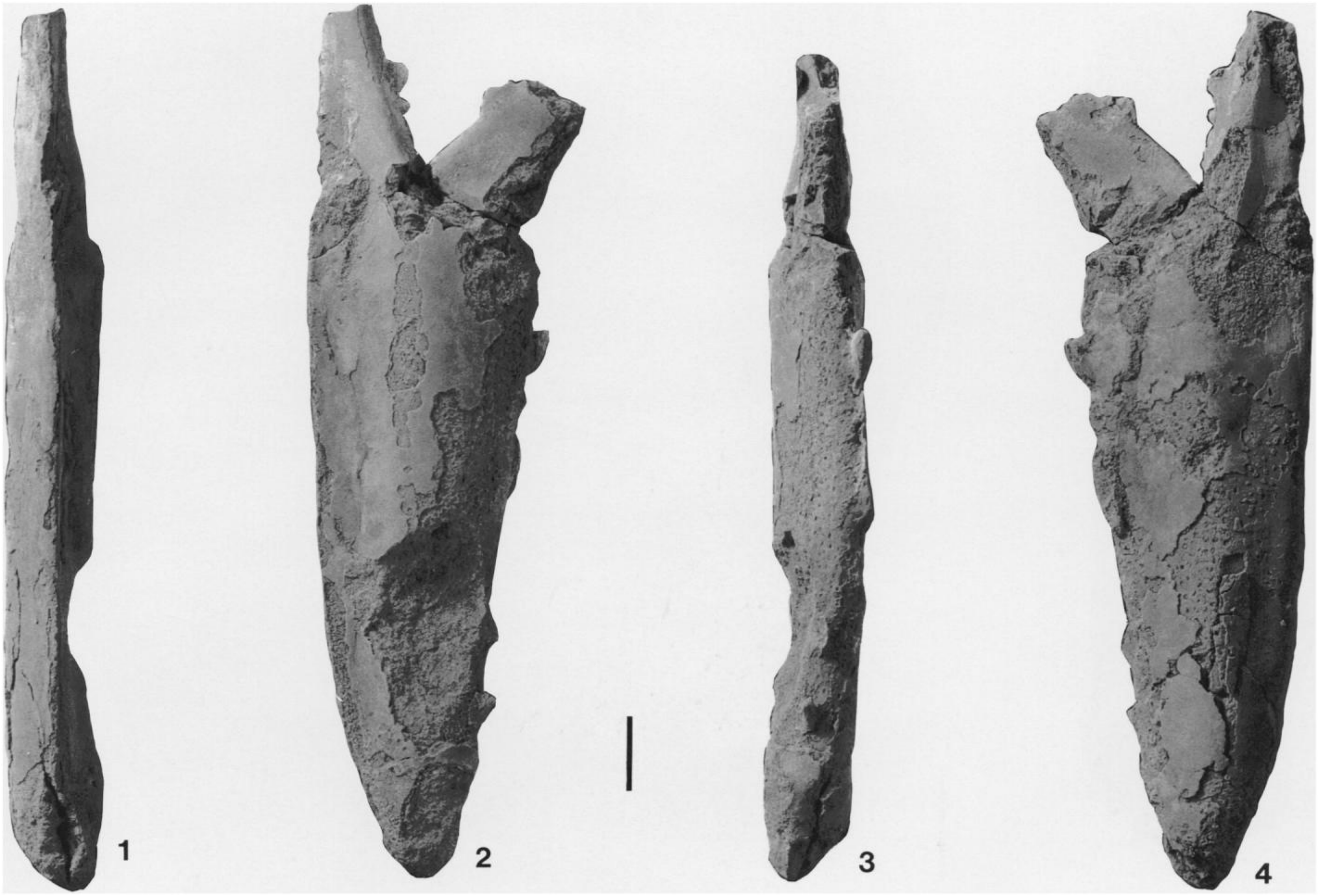


Figure *10—Metanephrops rossensis* n. sp. *1–4,* outer, upper, inner, and lower surfaces of left (major claw). Scale bar equals 1.0 cm.

supraorbital carina, antennal carina and spine, and probably its rostrum. These morphologic differences suggest that *M. jenkinsi* may be an offshoot off the *Metanephrops* main lineage.

The Antarctic fossil occurrences suggest that the genus originated in the southern high latitudes. The Antarctic species predate the next oldest species, *M. motunauensis* Jenkins, 1972, from the Pliocene of New Zealand, by 60 my. Today, *Metanephrops* has a wide latitudinal distribution, ranging from New Zealand to Japan.

The three fossil species of *Metanephrops* were inhabitants of the continental shelf whereas modern forms are rare in shelf depths and common on slope depths. While the near absence of a deepwater record prohibits us from concluding that there were no deepwater *Metanephrops* in the Cretaceous, we do know they are rare on modern continental shelves. Thus, it appears that *Metanephrops,* like diverse other decapod and nondecapod taxa, originated in shallow waters in the southern high latitudes and then radiated into lower latitude, deepwater habitats.

Infraorder Palinura Latreille, 1803
Superfamily Glypheoidea Winckler, 1883
Family Glypheidae Winckler, 1883
Genus Glyphea von Meyer, 1835
Glyphea australensis n. sp.
Figures 12, 13

Diagnosis.—Glypheid with weakly developed postcervical groove, cephalic carinae with larger, more coarsely set spines ventrally. Forward directed spines on the remainder of carapace becoming more numerous dorsally and posteriorly.

Description.—Cephalothorax average size for genus, height about 0.3 times length, excluding rostrum. Dorsal margin straight; posterior margin concave dorsally, strongly convex ventrally; posteroventral margin smoothly curved, greatest depth toward anterior; anteroventral margin straight, inclined posteroventrally, strongly downturned at base of cervical groove; anterior margin apparently nearly vertical; rostrum not known.

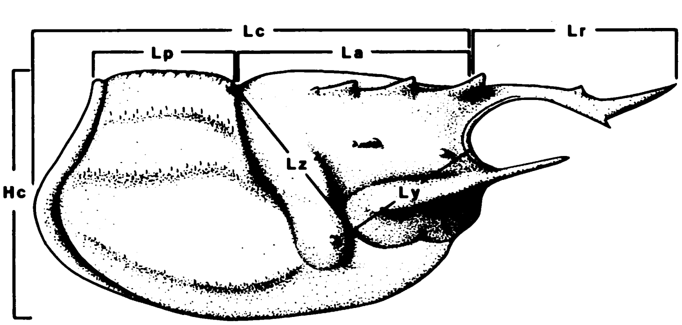
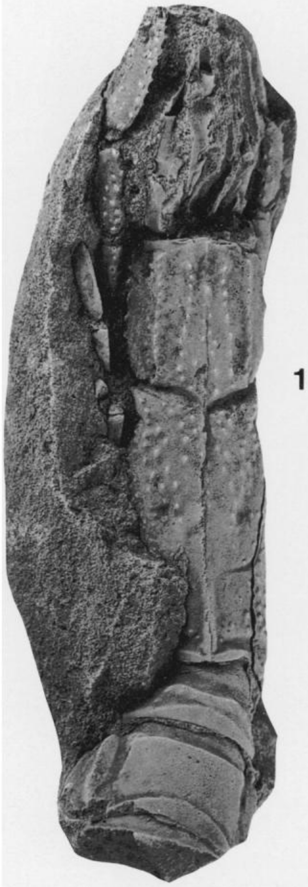


Figure *11—Metanephrops rossensis* n. sp. Line drawing reconstruction of cephalothorax showing orientation of measurements recorded in Table 2.



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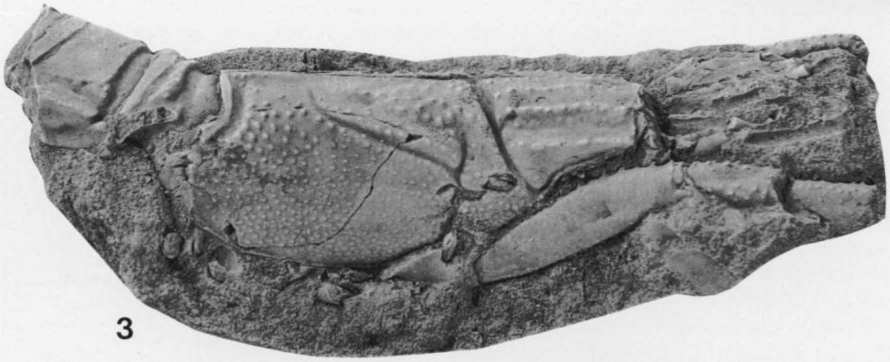

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TABLE *3*—Measurements (in mm) taken on specimens of *Glyphea australensis* n. sp. Positions and orientations of measurements are illustrated in Figure 13.

Specimen	L_1	L_2	L_3	H
BAS. IN. 2236, holotype	44.7	38.2	23.5	15.6
BAS. IN. 2197, paratype	38.0	33.5	20.8	14.2
BAS. IN. 2424, paratype	33.8	29.3	17.3	14.1
BAS. IN. 2421, paratype	46.8	40.1	25.9	17.8
BAS. IN. 2248, paratype	>44	>40	26.2	20.6

Cervical groove straight, steeply inclined, intercepting dorsal midline at 65 degree angle at distance of 0.36 length measured along dorsum. Branchiocardiac groove oblique, approaching midline at 25 degree angle and curving abruptly to cross midline at 70 degree angle. Postcervical groove weak, paralleling branchiocardiac groove, defined at either extremity by depressed area and curving abruptly posteroventrally to meet branchiocardiac groove. Inferior groove straight, inclined posteroventrally. Hepatic groove biconvex joining base of postcervical groove to cervical groove near its base. Antennar groove parallels ventral border of cephalic region. All grooves, except cervical groove deep, narrow, and well defined.

Cephalic region with three strong, well-defined, spinose carinae on flanks and narrow, triangular field of small spines axially. Rostral carina weakest, slightly convergent anteriorly, with 8–10 small spines. Supraorbital carina stronger, slightly inclined posteroventrally, with 10–12 serrations; antennal ridge broader, more elevated, with 6–8 coarser spines. Dorsal region between cervical and postcervical grooves with about 48 moderately coarse spines on either side of midline; spines becoming larger and more prominent anteriorly. Branchiostegite finely granulose anteroventrally becoming more coarsely nodose posterodorsally. All spines and granules on cephalothorax directed anteriorly. Marginal furrow well developed posteriorly, moderately strong ventrally. Corneal surface of eyes very large, situated at flaired end of long eyestalks, about 23 percent length of cephalothorax, excluding rostrum. Diameter of eyestalk about half length of eyestalk.

Endophragmal skeleton known from exposed parts of somites p_1–p_4, similar to that in *Glyphea robusta* Feldmann and McPherson, 1980.

Abdomen well developed. Somite 1 shorter than 2, tergum with arcuate transverse nodose ridge in posterior half and smooth, broad posterior border. Somite 2 with smooth tergum and arcuate groove crossing tergum defining posterior border. Pleuron 2 separated from tergum by sulcus. Longitudinal ridge connects points of articulation; pleural border straight ventrally, gently curved anteriorly and posteriorly. Remaining abdominal somites similar to somite 2. Telson not preserved.

Pereiopods with elongate elements, flattened laterally, merus of first pereiopod with smooth outer surface, coarsely spinose above and nodose below. Carpus and propodus with rows of distally directed nodes and spines on upper, outer and lower surface. Dactylus a blunt spine, about twice as along as high, downturned, closes against downturned, distal spine on lower end of propodus. Remainder of appendages more slender than first pereiopod.

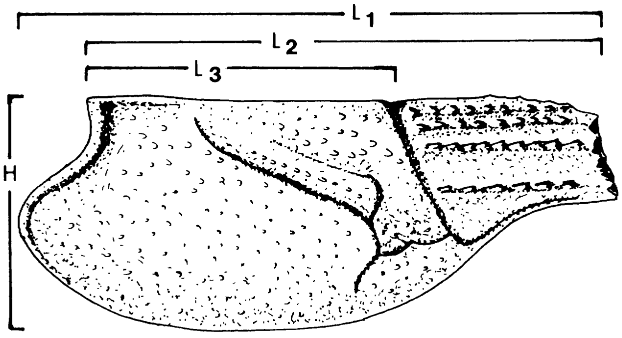

FIGURE *13*—Line drawing of *Glyphea australensis* n. sp. showing the positions and orientations of measurements recorded in Table 3.

Measurements.—Measurements (in mm) are given in Table 3. Position and orientation of measurements are shown on Figure 13.

Types.—The holotype, BAS. IN. 2236, and paratypes, BAS., IN. 2197, 2245, 2421, 2424–2426, 2428, are deposited in the Natural History Museum, London.

Localities and stratigraphic position.—Specimens were collected from the Lachman Crags Member of the Santa Marta Formation at locality 9, from the Herbert Sound Member of the Santa Marta Formation at locality 10, and from the Cape Lamb Member of the López de Bertodano Formation at locality 14.

Etymology.—The trivial name is taken from the Latin, *australis,* southern, in reference to the occurrence of this species in the high southern latitudes.

Remarks.—Species of *Glyphea* are distinguished from one another on the degree of development and the relative position of carapace grooves, particularly the postcervical and the branchiocardiac. Additionally, a group of species possesses an auxilliary groove connecting the latter two grooves at about midlength. Species are also distinguished on the basis of the number and development of carinae on the cephalic region. Finally, the nature of carapace ornamentation, ranging from coarse and scabrous to fine spines, and even to finely pitted, serves as a distinguishing feature of species. The combination of characters exhibited on the specimens from the Santa Marta Formation clearly separate them from all previously described species.

Glyphea australensis has a very weakly developed postcervical groove in which the two ends are deeply depressed into the carapace but the middle part of the groove is obscure. There is no suggestion of an accessory groove connecting the postcervical and branchiocardiac grooves. The three spinose carinae that cross the cephalic region are adorned with larger and more coarsely set spines ventrally. These features, coupled with the nature of the carapace ornamentation, which is formed of forward-directed spines that become larger and more numerous dorsally and posteriorly, distinguish the species from all others.

Eyes and eyestalks are rarely preserved in decapods. A single specimen of *Glyphea australensis* exhibits one of the eyes. It is positioned on a very long eyestalk, about 23 percent of the carapace length, excluding rostrum, and has a very large corneal surface that is an abrupt expansion of the eyestalk. The diameter

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FIGURE *12*—*Glyphea australensis* n. sp. *1, 3, 4,* dorsal and two right lateral views of the holotype, BAS. IN. 2236; a portion of the brancheostegite has been removed to expose the endophragmal skeleton in *4. 2,* left lateral view of paratype, BAS. IN. 2197; this is a molted individual preserved in Salter's position; note that the carapace is flattened, wrinkled, and distorted. Scale bar equals 1 cm.

of the corneal surface is more than one-half the length of the stalk, whereas the diameter of the stalk, measured proximal to the terminal flair, is less than one-fourth the length. The morphology of the eye structures very closely resembles that on the living *Neoglyphea inopinata* Forest and Saint Laurent (1975).

Glyphea arborinsularis Etheridge Jr., from the Aptian of Queensland, Australia, and *G. oculata* H. Woods, from the upper Albian of Queensland, are the most similar species, morphologically (J. T. Woods, 1957). In both of the Australian species, the ornamentation is much coarser, particularly in the ventral region of the branchial areas and in the region between the postcervical and branchiocardiac grooves. In addition, the antennar carina appears to be situated closer to the ventral margin in *Glyphea australensis* than on either of the Australian species. *Glyphea willetti* (Woodward) from the Upper Greensand and Lower Chalk in England also has a very weakly developed postcervical groove (H. Woods, 1925–1931). The ornamentation is rather more uniformly coarse on this species and the fields between cephalic carinae tend to be tuberculate. Those areas are generally smooth in *G. australensis.*

Two other species of *Glyphea* have been named previously from Antarctica. Based upon specimens collected from the Lower Cretaceous rocks of Alexander Island, Taylor (1979) named *Glyphea alexandri* and *G. georgiensis.* The former was compared by Taylor to *Glyphea arborinsularis* and the latter to *G. oculata.* The carapace ornamentation exhibited by *Glyphea alexandri* is much coarser than that on *G. australensis* although the pattern of decrease in coarseness in a posteroventral direction is shared by both species. The postcervical groove is, apparently, not recognizable on the carapace of *G. alexandri* whereas it is clearly present on the new species. The pattern of ornamentation is uniform over the entire thoracic region of *Glyphea georgiensis,* which makes it readily distinguishable from the new species. The postcervical groove becomes less distinct anteriorly in *G. georgiensis.*

It is interesting to note that the species characterized by the most weakly developed postcervical groove are those known from the Cretaceous. The earlier forms tend to have a much more strongly expressed postcervical groove. This trend continues, apparently, as the sole living representative of the family, *Neoglyphea inopinata* Forest and Saint Laurent, possesses a very weak postcervical groove (Forest and Saint Laurent, 1989).

Family MECOCHIRIDAE van Straelen, 1925
Genus MEYERIA McCoy, 1849
MEYERIA CROFTI Ball, 1960

Holotype.—The holotype, BM. IN. 51769, and sole specimen, is deposited in the Natural History Museum, London.

Locality and stratigraphic position.—"Station D.84.4. Dagger Peak col, The Naze, James Ross Island. Latitude 63°55′S, long. 57°29′W" (Ball, 1960, p. 14). This locality is near locality 15, herein. At locality 15, rocks of the Cape Lamb Member of the López de Bertodano Formation crop out and it is presumed that these are the strata from which *Meyeria crofti* was collected.

Remarks.—The sole specimen representing this species was well illustrated by Ball (1960, fig. 3B, Pl. II, figs. 1a, b) and is not reproduced here. The holotype was examined by Feldmann and the placement in *Meyeria* was confirmed. No new information can be added either to the morphology or the occurrence of this taxon. It is interesting that, despite extensive collecting in the area of The Naze in the past few years, no additional material has been collected that could be referred to this species.

Superfamily PALINUROIDEA Latreille, 1803
Family PALINURIDAE Latreille, 1802
Genus LINUPARUS White, 1847
LINUPARUS MACELLARII Tshudy and Feldmann, 1988
Figure 14

Remarks.—This species of *Linuparus,* the first noted from Antarctica, was originally described from a single specimen, USNM 410888, collected in the uppermost part of Unit 9 of the López de Bertodano Formation on Seymour Island (Tshudy and Feldmann, 1988). The bases for distinguishing this species from previously described forms were the development of prominent, pustulose ornamentation on the cephalothorax, distinctive development of spines on the abdominal pleurae, and presence of a single row of subpyramidal, axial nodes on the sternal elements, among others. Collection of specimens from James Ross Island has added three specimens that can be referred to this species. The morphological characters that unite the material are limited, owing to the preservation of partial remains in all cases; however, the presence of distinctive sternal elements, coupled with fragments of carapace material exhibiting pustulose ornamentation, confirms the identification. The abdominal pleura are not preserved on any of the newly collected specimens so that there is no possibility of making a comparison based upon this region.

The strength of the pustulose ornamentation varies among the three specimens available for comparison. The smallest specimen, BAS. IN. 2196, measures 10.8 mm from the midline to the lateral keel, just posterior to the cervical groove. The ornamentation on this specimen is uniformly finely pustulose. A larger specimen, USNM 458921, measures 12.4 mm in the same dimension and exhibits slightly coarser ornamentation. The holotype, USNM 410888, measures 16.2 mm from the midline to the lateral keel and is most coarsely pustulose. Similarly, the pustules on the abdominal somites of the holotype are much coarser than those on either USNM 458921 or BAS. IN. 2244. These observations are suggestive of ontogenetic changes in the coarseness of ornamentation; however, more specimens would be required to confirm the conclusion.

The nature of the ornamentation on the sternum is, perhaps, most diagnostic of *Linuparus macellarii.* A single specimen, BAS. IN. 2213, preserves the sternum. It is smaller than, but otherwise very much like, that of the holotype, USNM 410888. Tshudy and Feldmann (1988) noted that no previously described species of *Linuparus* possessed a row of nodes along the axis of the sternum. These nodes are well developed on the James Ross Island specimens.

The discovery of these specimens extends the geological range of *Linuparus macellarii* downward, possibly into the late Santonian, to include nearly all the time interval represented by the Santa Marta Formation. The upper extent of the range, established on the position of the holotype, is Maastrichtian.

Localities and stratigraphic positions.—The holotype, USNM 410888, was collected from Unit 9 of the López de Bertodano Formation at locality B of Tshudy and Feldmann (1988, p. 292). Additional specimens have been collected from the Lachman

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FIGURE *14*—*Linuparus macellarii* Tshudy and Feldmann. *1,* latex cast showing dorsal view of thoracic portion of cephalothorax of USNM 458921. *2,* dorsal view of cephalothorax of BAS. IN. 2196. *3,* latex cast of last three abdominal somites, telson, and uropods of BAS. IN. 2244. *4,* latex cast of sternum and ventral aspect of appendages of BAS. IN. 2213. Scale bar equals 1 cm.


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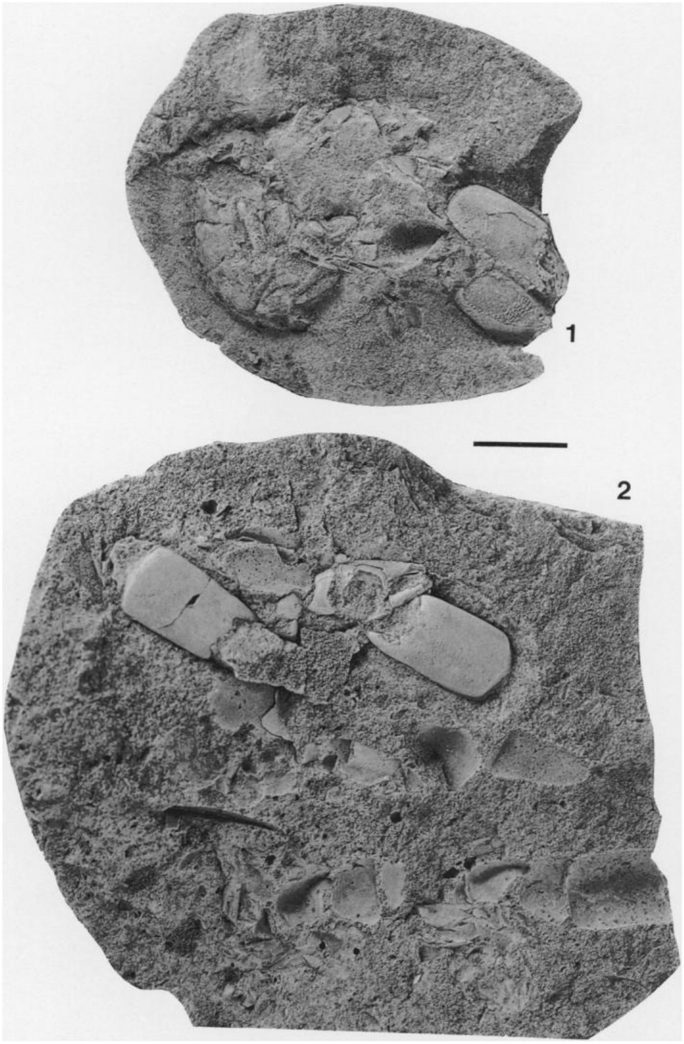

FIGURE *15*—*Callianassa* cf. *C. meridionalis* Ball. *1*, right lateral view of poorly preserved, but nearly complete specimen, BAS. IN. 2585. *2*, chelae, and molds of the exterior of chelae, of at least two individuals, BAS. IN. 2586. Scale bar equals 1 cm.

Crags Member of the Santa Marta Formation at locality 11 (BAS. IN. 2196) and from the Herbert Sound Member of the Santa Marta Formation at locality 10 (BAS. IN. 2213 and 2244). One specimen, USNM 458921, was collected from sediments, presumed to be part of the López de Bertodano Formation, at Ula Point, James Ross Island, by T. Kelley, in January 1987. The stratigraphic position of this specimen has not been confirmed.

Infraorder ANOMURA H. Milne Edwards, 1832
Superfamily THALASSINOIDEA Latreille, 1831
Family CALLIANASSIDAE Dana, 1852
Genus CALLIANASSA Leach, 1814
CALLIANASSA cf. C. MERIDIONALIS Ball, 1960
Figure 15

Diagnosis.—"Propodus small, quadrate; margins sub-parallel. Upper margin rounded with a sharp, obliquely inclined, distal ridge, immediately outside which is a row of up to six pits and on the inside a row of 6–9 sockets, rounded proximally, transversely elongated distally. Lower margin sharp, with a row of rounded pits on the outside and a row of over fourteen closely spaced, longitudinally elongated pits on the inside. Surface smooth with a few small, isolated sockets on the inner and outer surfaces. Fingers short." (Ball, 1960, p. 15.)

Localities and stratigraphic positions.—Specimens were collected from the Lachman Crags Member of the Santa Marta Formation at localities 6, 8, and 10, and from the La Meseta Formation at locality 21.

Remarks.—Ball (1960, p. 15–16) named *Callianassa meridionalis* based upon six specimens collected east of Lachman Crags, on James Ross Island. The diagnosis and the description are consistent with placement of the specimens in the genus *Callianassa*; however, the specimens do not bear any characteristics which unequivocally distinguish them from several other species within the genus. A compilation of species of callianassids that is being made by L. Chirino-Galvez and R. Feldmann lists over 110 named species, although the criteria for distinguishing species in the fossil record have never been clearly articulated. Therefore, it is not possible to make distinctions between the material serving as the basis for description of Ball's species and those recently collected from the Santa Marta Formation. In addition, six specimens collected by Jeremy Hooker from unit II of the Eocene La Meseta Formation can also be referred to this species.

Although the genus *Callianassa* has been reported from Antarctica previously (Ball, 1960; Feldmann and Zinsmeister, 1984), the collections described herein do expand the number of localities from which it has been collected in the Cretaceous rocks of James Ross Island and document its presence in the la Meseta Formation for the first time. Feldmann and Wilson (1988) described *Protocallianassa* cf. *P. faujasi* from the La Meseta Formation but characters of shape and ornamentation, the most important of which is the orientation of the carpus–propodus joint, readily distinguish the taxa.

It is noteworthy that three specimens referred to this species are preserved as entire animals (Figure 15.1). Because the exoskeleton of callianassids is not strongly calcified, the fossil record of the group is confined almost entirely to claws. The three specimens from the Sanata Marta Formation in which additional material is preserved retain well-defined abdominal somites, very poorly preserved cephalothoraxes, and fragments of walking legs. None of these elements is preserved well enough, however, to permit description.

Superfamily PAGUROIDEA Latreille, 1803
Family PAGURIDAE Latreille, 1802
Genus PAGURISTES Dana, 1851
PAGURISTES SANTAMARTAENSIS n. sp.
Figure 16

Paguristes sp. AGUIRRE-URRETA AND OLIVERO, 1992, p. 208, fig. 22b.

Diagnosis.—Isochelous pagurid with flattened upper surface on propodus and uniformly strong ornamentation over propodi.

Description.—Moderate sized chelipeds for genus; claws apparently isochelous.

Merus quadrate, slightly longer than high, greatest height near proximal articulation, narrowing to constriction, deepest on upper surface, which extends as groove parallel to distal articulation along upper, outer, and lower surfaces; outer surface with uniformly spaced, low, sharp spines with apices spaced about 1 mm from one another. Upper surface flattened, separated from outer surface by finely spinose keel, less spinose than outer surface.

Carpus triangular; upper surface with 5–8 distally directed small spines; outer surface with fine, sharp, distally directed spines, smaller and more closely spaced than on merus; inner surface nodose above and smooth below.

Propodus curved longitudinally, quadrate laterally. Hand about as long as high; upper surface generally smooth, bounded by nodose keels on inner and outer edges; outer surface with densely and uniformly spaced nodes; lower surface a sharp, nodose keel; inner surface inflated, generally smooth; fixed finger stout, about as long as maximum height, uniformly tapering distally; ornamented as hand; occlusal surface not visible. Dactylus of similar size, shape, and proportions as fixed finger.

Measurements.—Measurements (in mm) are as follows. Holotype, BAS. IN. 2209; right merus height, 10.5, length, 9.7; hand height, 11.6, length, 10.6; fixed finger length, 4.8, height, 4.8; left manus height, 10.4, length, 8.5; hand height, 11.4, length 10.5; fixed finger height, 4.8, length >4.8; dactylus height 4.2, length 7.0. Paratype, BAS. IN. 2239: right? propodus height, 11.1, length, 12.4.

Types.—The holotype, BAS. IN. 2209, and paratype, BAS. IN. 2239, are deposited in the Natural History Museum, London.

Locality and stratigraphic position.—The holotype, BAS. IN. 2209, was collected from the Herbert Sound Member of the Santa Marta Formation at locality 10. The paratype, BAS. IN. 2239, was collected from the lower Miocene Cape Melville Formation at locality 1 on King George Island. Because derived fossils are known to occur in the Cape Melville Formation (Birkenmajer et al., 1987) and because there is no unequivocal evidence that the specimens in question are not derived, a Miocene age for this species should be considered questionable.

Etymology.—The trivial name refers to the Santa Marta Formation, from which the material was collected.

Remarks.—The general form of pagurid claws, in which the hands are curved, stout, generally equant, and the fingers are relatively short, coupled with the pattern of ornamentation makes them relatively easily placed within the Paguridae. However, placement of fossil material into genera is somewhat more difficult in that claws and, occasionally, meri and carpi are all that is preserved typically. These specimens have been assigned to *Paguristes* primarily because members of this genus tend to be isochelous whereas most other genera contain species that are dominantly heterochelous. The demonstration that *Paguristes santamartaensis* is isochelous is not absolute; however, the holotype consists of right and left claws which constitute the entire collection of pagurid material from the type locality. These two claws are similar in size and proportions, but there is no unequivocal evidence that the claws are from the same individual.

Comparison of *Paguristes santamartaensis* with North American species (Rathbun, 1926, 1935) and those from Hungary (Müller, 1984) confirms than none of the previously named species exhibit a flattened upper surface on the propodus nor do any of the earlier named species have such uniform ornamentation. In fact, because the generic placement of this, and previously named, pagurids is equivocal, comparisons were made with forms assigned to *Pagurus* and *Petrochirus*. The combination of characters mentioned above remains useful to distinguish the Antarctic material from other species-level taxa, but the problem of generic placement is reinforced.

For example, the claws of *Paguristes santamartaensis* are remarkably similar to the right cheliped of *Pagurus clifdenensis* Hyden and Forest, 1980, from the early Miocene of new Zealand and, for that matter, not dissimilar to the right claw of the modern *Pagurus spinulimanus* (Miers), also from New Zealand. In both of these species the left cheliped is very much smaller than the right, which is typical of the genus. It is not within the scope of this work to revise the systematics of fossil pagurids and, therefore, assignment to *Paguristes* seems to be most reasonable.

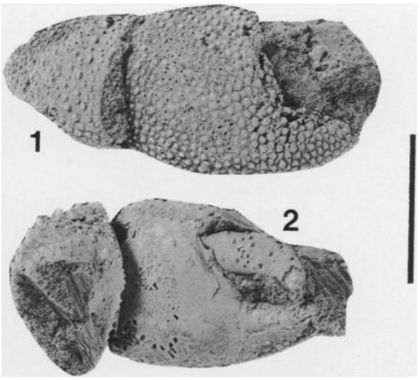

FIGURE *16*—*Paguristes santamartaensis* n. sp. *1*, outer surface of right cheliped of holotype, BAS. IN. 2209. *2*, inner surface of left cheliped of holotype, BAS. IN. 2209. Scale bar equals 1 cm.

The occurrence of the genus in the Santa Marta Formation was first described by Aguirre-Urreta and Olivero (1992). In that work they also developed a strong argument that the hermit crabs preyed upon, and occupied, the shells of *Taioma* sp. Furthermore, those gastropod shells were encrusted by bryozoans, which led Aguirre-Urreta and Olivero to conclude (1992, p. 212) that the bryozoans had established a symbiotic relationship with the hermit crabs.

Paguristes santamartaensis represents the first record of the Paguridae in Antarctica. The geological range of *Paguristes* is late Senonian to Recent (Glaessner, 1969). Fossils have been reported from North America (Rathbun, 1926, 1935) and Europe (Müller, 1984). Recent species are reported (Glaessner, 1969) from warm-water regions. Because of the uncertainty of the generic assignment, no firm conclusions can be drawn regarding paleoecological implications of this record.

Superfamily GALATHEOIDEA Samouelle, 1819
Family GALATHEIDAE Samouelle, 1819
Subfamily MUNIDOPSINAE Ortmann, 1898
Genus MUNIDOPSIS Whiteaves, 1874
MUNIDOPSIS FOERSTERI n. sp.
Figures 17, 18

Diagnosis.—Large *Munidopsis* with long slender, axially spined rostrum, weakly defined regions and coarse, scabrous ornamentation.

Description.—Moderately large for genus; carapace, excluding rostrum, slightly longer than wide, vaulted transversely, flat longitudinally; greatest width near posterolateral corner.

Rostrum more than eight times as long as wide at base, with broad axial crest arising in frontal region and bearing three or four axial spines, the most distal of which is large and upturned, ventrolateral border with prominent, smooth rim which merges with smooth supraorbital rim. Supraorbital borders transverse long axis of carapace. Anterolateral corner not well preserved. Lateral margin straight, except for shallow reentrant at cervical groove, convergent anteriorly. Posterolateral border smoothly rounded. Posterior border concave.

Carapace regions moderately well defined. Cervical groove formed of weakly impressed, nearly straight to slightly concave-forward lateral portion and deeply impressed, smoothly concave-forward axial element. Mesogastric region about half as wide as carapace; anterolateral grooves defining mesogastric region straight. Hepatic region large, defined by weakly developed groove. Urogastric region very narrow axially, not as wide as mesogastric region. Cardiac region about half carapace width, straight sided, diamond shaped, well defined on anterolateral

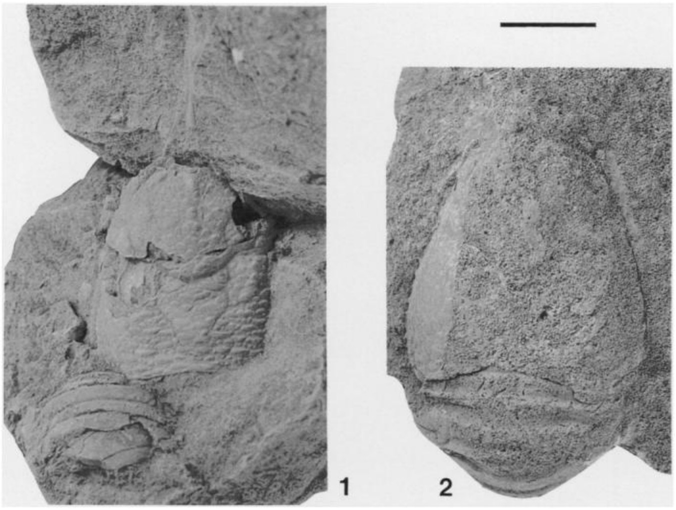

Figure *17*—*Munidopsis foersteri* n. sp. *1,* holotype, BAS. IN. 2430, showing dorsal aspect of carapace and a displaced portion of the abdomen. *2,* paratype, BAS. IN. 2200, showing eroded carapace and first three somites of articulated abdomen. Scale bar equals 1 cm.

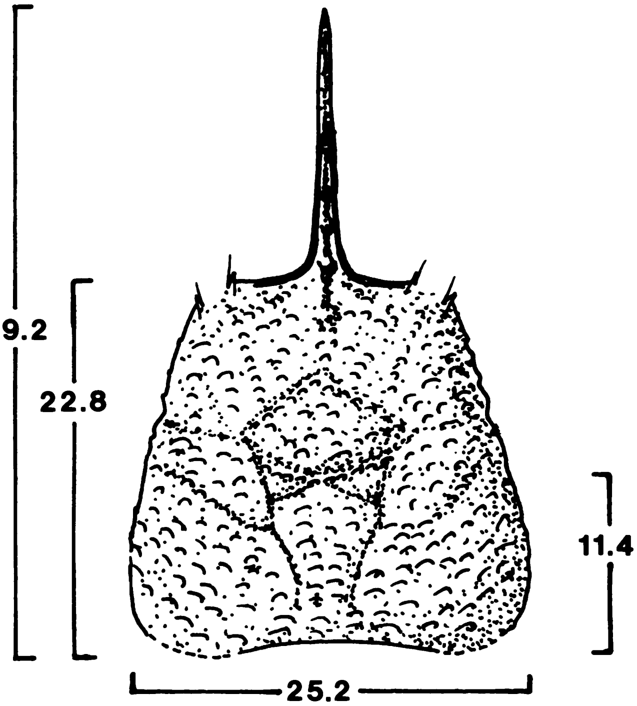

Figure *18*—Line drawing of *Munidopsis foersteri* showing the measurements taken, in mm.

and posterolateral margins, merging posteriorly with intestinal region. Epibranchial region distinguished from remainder of branchial area by shallow, subtle branchiocardiac groove.

Surface of carapace with finely serrated scabrous elements, which are more or less equidimensional anteriorly, becoming transversely broader posteriorly to become as much as three times as wide as long.

Sternum poorly preserved; sternites 1–3 poorly known, small, fused, apparently quadrate, wider than long; sternites 4–7 similarly shaped with anterolaterally directed articulations, not fused, broadening posteriorly and attaining maximum width at sternites 6 and 7; axis with narrow cleft on somites 5–7.

Abdominal somites approximately as wide as carapace, short, with transverse furrow extending across terga, bordered anteriorly by scalloped, or scabrous, border; pleurae, where observed, smoothly rounded, anteriorly directed.

Appendages long, slender, finely spinose or nodose on upper surface and more coarsely spinose on outer margin with forward directed spines increasing in size distally, meri very long, as much as 1.5 times carapace length, excluding rostrum, and narrow, about 15 times as long as wide.

Measurements.—Measurements, in millimeters, taken on the holotype are recorded on Figure 18.

Types.—The holotype, BAS. IN. 2430, and paratype, BAS. IN. 2200, are deposited in the Natural History Museum, London.

Locality and stratigraphic position.—Specimens were collected from the Herbert Sound Member of the Santa Marta Formation at localities 2 and 10.

Etymology.—The trivial name honors Dr. Reinhard Förster, who collected much of the material forming the basis of this study, was one of the pre-eminent students of fossil decapod crustaceans, and was a good friend.

Remarks.—The description of this species brings to two the records of fossil *Munidopsis* and extends the geologic range of the genus into the Late Cretaceous. The only other species currently known from the fossil record is *Munidopsis scabrosa* Feldmann and Wilson, 1988, from the Eocene La Meseta Formation on Seymour Island.

Placement of this species in *Munidopsis* can be made with confidence. Central to the description of the genus is the possession of a keeled rostrum, generally without lateral spines; absence of supraorbital spines; and presence of well-developed, transverse rows of spines, setae, or rugae (Ambler, 1980). All of these features are present on *M. foersteri.* Most species of galatheids are characterized by more spinose rostra and supraorbital areas.

Munidopsis foersteri may be readily distinguished from *M. scabrosa.* The former is much larger, has a longer, more narrow rostrum bearing axial spines, has less well defined regions, as well as coarser and much more densely spaced scabrous ornamentation on the dorsal carapace. Comparison of this species to all extant species within the genus has not been made; however, examination of species described by Ambler (1980) and Baba (1988) and examination of preserved specimens in the U. S. National Museum of Natural History confirms that the architecture of the rostrum and the development of scabrous ornamentation are characters that serve to distinguish the new species.

As has been summarized previously (Feldmann and Wilson, 1988), species of *Munidopsis* appear to be confined either to deep-water environments, including association with deep-sea vent assemblages (Corliss and Ballard, 1977), or localized cryptic habitats (Miyake and Baba, 1970). Thus, this occurrence in coarse clastic sediments that accumulated in continental shelf habitats represents an additional example of high-latitude, shallow-water origin of a taxon currently restricted to deep-water environments.

Munidopsis is the only genus of galatheid that has been reported from Antarctic waters. Zarenkov (1968) noted the presence of *Munidopsis antoni* (A. Milne Edwards) in the southeastern Indian Ocean. This reference was not documented by any indication of collection localities. He indicated that the species is also known from the coast of Peru and the Azores.

Superfamily ?GALATHEOIDEA Samouelle, 1819
Family RETRORSICHELIDAE n. fam.
Genus RETRORSICHELA n. gen.

Diagnosis.—Large, smooth, domed carapace, longer than wide. Chelae curved and folded ventrally and posteriorly beneath carapace.

Description.—Carapace ovoid, generally smooth, weakly calcified; rostrum triangular, simple; abdomen well calcified; somite one dorsal, remaining abdominal somites turned under carapace; sternum strongly calcified, somites 1–3 a small, fused plate, remaining somites separated by sutures, deeply cleft axially. First pereiopod strongly chelate, chelae carried in reflexed position beneath carapace; last well-developed pereiopod (4?) with large, flabellate dactylus.

Etymology.—The generic name is derived from two Latin words, *retrorsus,* turned or bent backward, and *chela,* claw. The combination alludes to the distinctive manner in which the chelipeds were carried and are preserved on the animals.

Type species.—*Retrorsichela laevis* n. sp.

Remarks.—Because the family includes only one species, it is not possible to clearly distinguish characters diagnostic of the family and the sole enclosed genus. However, by analogy to other families, the form of the carapace, abdomen, and sternum may be significant at the familial level whereas the morphology of the pereiopods may be more useful generic descriptors.

The combination of characters exhibited by the type species is unique. The form of the claws is reminiscent of some pagurids, including *Orhomalus* Étallon, 1861; however, the carapace and sternum are not at all like those of the Paguroidea. The form of the rostrum, carapace, sternum, and abdomen are comparable to various Galatheoidea, although none of the described families seems to adequately embrace these forms. The outline of the sternum is comparable to some Galatheidae and to the Aeglidae. Within these families, only the galatheid *Uroptychus* Henderson, 1888 (see, for example Baba, 1988), possesses a carapace and abdomen that is similar to that of *Retrorsichela.* However, the sterna and the nature of the pereiopods of the two genera differ significantly. Species of *Aegla* carry their claws in the same manner as does *Retrorsichela* but the carapace outline, absence of linea in the latter genus, and manner of recurving of the abdomen excludes the new genus from the Aeglidae.

RETRORSICHELA LAEVIS n. sp.
Figures 19, 20

Diagnosis.—As for genus.

Description.—Carapace, large, ovate; width about 75 percent length; markedly vaulted transversely, more gently vaulted longitudinally, highest elevation in mesogastric region, surface smooth.

Front narrow, less than 30 percent maximum width; rostrum bluntly triangular, downturned, sulcate, with small spines at base; orbits poorly formed, projecting anterolaterally; postorbital spine small, projecting anterolaterally; remainder of margins smoothly rounded, not differentiated; posterior margin slightly concave. Lateral walls of carapace smoothly rounded, nearly vertical, not differentiated from dorsal surface.

Dorsal surface generally smooth, cephalic region somewhat more inflated than post-cephalic regions. Broadly triangular mesogastric region and short, narrow cardiac region defined by subtle grooves. Cervical groove weakly defined axially and undefined laterally. Posterior gastric muscle scars arcuate, pustulose surfaces, broadest axially, narrowing anterolaterally, deeply impressed on carapace interior and faintly expressed on shell exterior. Small muscle scars, possibly antennar extensor muscle scars, faintly impressed on carapace interior, situated at midpoint between lateral termination of cervical groove and postorbital spine.

TABLE *4*—Measurements (in mm) taken on specimens of *Retrorsichela laevis* n. gen. and sp.

Specimen	Total length	Frontal length	Width
A	70.0	ca. 14	54.9
BAS. IN. 2215	–	–	54.7
BAS. IN. 2214	ca. 81	–	60.9
B	68.3	ca. 16	52.3

Buccal frame rectangular, slightly longer than wide; pterygstomian regions not well differentiated from carapace. Sternum well calcified, fused, broadening progressively from small, triangular, sulcate, somites 1–2, to maximum width at anterior portion of deeply sulcate posterolaterally directed somite 5; somite 6 directed posterolaterally, not fused to anterior somites, narrowing, deeply sulcate axially in male and bearing gonopore in posterolateral portions; elements 7 and 8 unknown but presumed to be reduced, subdorsal.

Abdomen poorly preserved; at least three somites situated in dorsal position, about 30 percent as wide as maximum carapace width; abdominal somite 1 short, narrower than other somites, smooth, terminating laterally in rounded margins; somite 2 slightly longer, wider, with transversely elongate axial crest and posterolaterally directed, pointed pleurae; somite 3 reflexed at mid-length so that posterior portion lies in ventral position, with elongate axial crest, pleurae unknown; remainder of abdominal somites not well known, apparently narrowing rapidly in male.

Maxillipeds unknown. First pereiopods large, isochelous, smooth compressed, lateral margins sharply defined; ischium about as long as wide; merus about three times as long as wide, markedly flattened, curved upward distally to conform to contour of pterygostomian region; carpus very small, about as wide as long; propodus with short, broad hand and narrower, curved finger about twice as long as hand, denticles moderately large, dome-shaped proximally and more broadly spaced, smaller, and more pointed distally; dactylus curved, narrower than fixed finger, with one dome-shaped denticle situated proximally; entire chela curved to conform to ventral carapace surface, the position in which it is apparently carried. Remainder of pereiopods represented only by basal elements and isolated fragments; pereiopods 2 and 3 large, ventral; 4 situated above and axial to pereiopod 3, smaller in size; pereiopod 5 very small, situated above and axial to pereiopod 4, may extend beneath carapace.

Measurements.—Measurements (in mm), taken on *Retrorsichela laevis,* are given in Table 4.

Types.—The holotype, BAS. IN. 2215, and paratypes, BAS. IN. 2098, 2203, 2211, 2214, and 2235 (41 specimens), are deposited in the Natural History Museum, London.

Locality and stratigraphic position.—Specimens were collected from the Lachman Crags Member of the Santa Marta Formation at localities 5, 6, 7, and 9.

Etymology.—The trivial name is derived from a Latin word, *laevis,* smooth or polished, in reference to the generally smooth and featureless nature of the surface of the carapace.

Remarks.—Comments regarding the biological affinities of this taxon have been made above and will not be repeated here. Suffice it to say that although the animal is almost certainly an anomuran, the combination of characters exhibited is unique at the family level.

It is interesting to speculate on the life habits of the organism, based upon the morphology and the inferred living site as judged from the enclosing sediment. The fossils are preserved in a

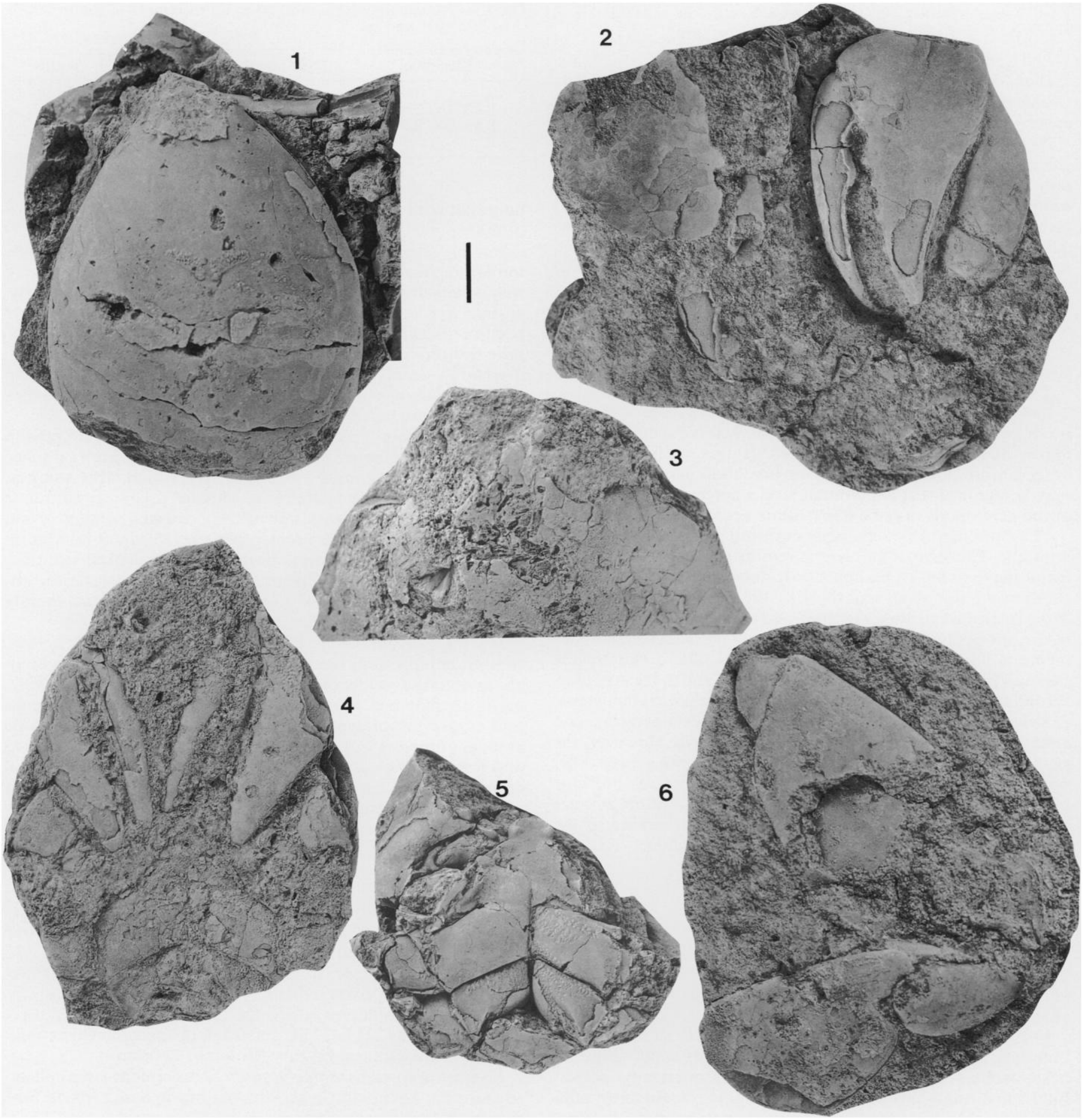

FIGURE *19—Retrorsichela laevis* n. gen. and sp. *1*, dorsal view of carapace of BAS. IN. A. *2*, ventral view of BAS. IN. A, showing well-preserved outer surface of left cheliped and partial outer surface of right cheliped. *3*, enlargement of frontal region of BAS. IN. 2214, showing rostrum and orbital region. *4*, ventral surface of BAS. IN. 2214, showing part of sternum and fingers of chelae. *5*, sternum of holotype, BAS. IN. 2215. *6*, partial ischium, merus, propodus, and dactylus of fifth pereiopod. Scale bar equals 1 cm for all figures, except *3*. Scale bar for *3* equals 0.5 cm.

conglomeratic sandstone that would appear to represent a shoreface accumulation. Although several other decapods were collected from the same localities as *Retrorsichela laevis*, all other species seem to have been transported to the site of deposition within concretions. Within the conglomeratic sandstone, complete and fragmentary remains of this crab occur in close proximity to one another and in great numbers. Because several of the specimens are complete, or nearly so, it is reasonable to

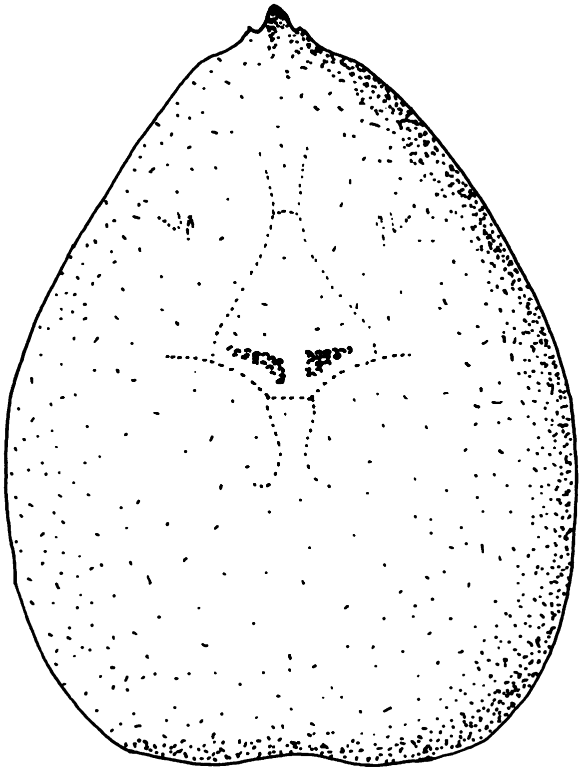

FIGURE 20—Line drawing of the carapace of *Retrorsichela laevis* n. gen. and sp., showing pattern of grooves described in text.

conclude that there has been little, if any, postmortem transportation and that the animals lived in the setting in which the sandstone was accumulating.

It is likely that *Retrorsichela laevis* was a burrower, perhaps in the manner of the hippids. The carapace outline, absence of coarse ornamentation, form of the abdomen, and compact carriage of the chelipeds are all consistent with this life style. In addition, the expansion of the dactylus on one of the pereiopods, presumed to be the fourth, would serve as an efficient burrowing adaptation. A similar form of dactylus is, of course, present on swimming portunids but the overall form of *Retrorsichela* is not suggestive of a swimming lifestyle. The chelipeds may have been used to search from debris and detritus within the sediment and only secondarily as defensive weapons.

Most of the common, actively burrowing crabs in intertidal and shallow subtidal habitats seem to be much smaller than *Retrorsichela laevis*; however, most inhabit regions of much finer sediment size. It is possible that rapid burrowing in pebbly sand could best be accomplished by a relatively large, strong animal.

Infraorder Brachyura Latreille, 1803
Section Podotremata Guinot, 1977
Subsection Dromiacea de Haan, 1833
Superfamily Dromioidea de Haan, 1833
Family Prosopidae von Meyer, 1860
Subfamily Pithonotinae Glaessner, 1933
Genus Plagiophthalmous Bell, 1863
Plagiophthalmous collinsi n. sp.
Figures 21, 22

FIGURE 21—Holotype of *Plagiophthalmous collinsi* n. sp., BAS. IN. 2216. Scale bar equals 1 cm.

Diagnosis.—Plagiophthalmid with nodose swelling on margin anterior to cervical groove, strongest lateral spine posterior to postcervical groove and smaller, bifid spine anterior to branchiocardiac groove.

Description.—Moderate sized for genus, ovoid to pentagonal in outline, slightly longer than wide, strongly vaulted transversely and longitudinally.

Frontal margin downturned; rostrum short, bifid, with sulcate axial region. Orbits directed anterolaterally, about equal in length to anterolateral margin and separated from anterolateral margin by broad, low node. Anterolateral margin short, slightly convex, terminating posteriorly in anterolateral node or blunt spine. Lateral margin with prominent, blunt spine just posterior to cervical groove and smaller bifid spine anterior to branchiocardiac groove. Posterolateral margin weakly convex, convergent posteriorly. Posterior margin broader than front, poorly preserved.

Carapace surface with shallow sulcus extending from rostrum onto mesogastric region, becoming obsolete at midpoint between rostrum and cervical groove. Cervical groove broad, well defined, moderately deep, concave forward with subtle convex portion in axial region. Posterior gastric pits subtle, small, situated just in advance of cervical groove. Branchiocardiac groove as well developed as cervical groove, concave forward, but less so than cervical groove. Lateral margin of urogastric region defined by shallow, subtle, axially convex grooves. Cardiac region triangular, defined posterolaterally by shallow grooves; nodes on either side of axis at level of branchiocardiac groove and single axial node near posterior termination of cardiac groove. Remainder of carapace smooth.

Ventral surface, abdomen, and appendages unknown.

Measurements.—Measurements (in mm) taken on the sole specimen are recorded in Figure 22.

Type.—Holotype and sole specimen, BAS. IN. 2216, is deposited in the Natural History Museum, London.

Locality and stratigraphic position.—The specimen was collected from the Lachman Crags Member of the Santa Marta Formation at locality 7.

Etymology.—The trivial name honors Mr. J. S. H. Collins, London, who has added so much to the understanding of Cretaceous crabs.

Remarks.—Species of this genus, which have a very distinctive morphology, have previously been known only from the

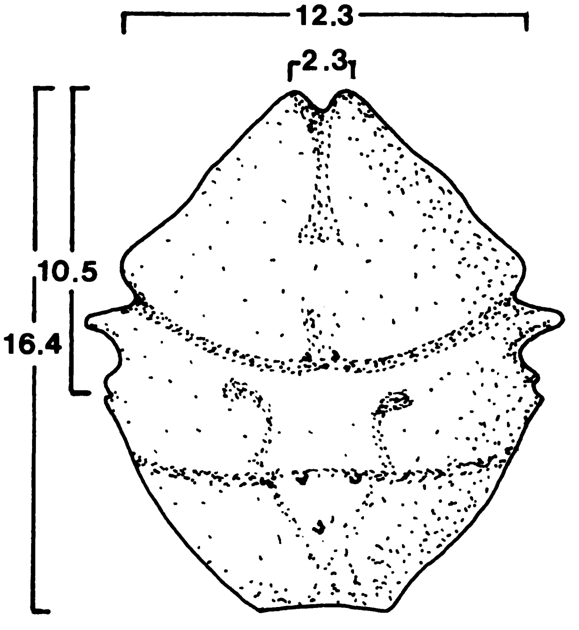

FIGURE *22*—Line drawing of *Plagiophthalmous collinsi* n. sp., showing the measurements made, in mm.

Cretaceous of Europe. Wright and Collins (1972) discussed the relationships between *Plagiophthalmous* and the most closely related genus, *Pithonoton* von Meyer, 1842. Both are characterized by possession of strongly convex, slightly longer than wide carapaces; equally well developed, subparallel cervical and branchiocardiac grooves; and downturned, sulcate rostra. They differ in the form of the anterolateral and lateral margins. That region tends to be smoothly curved in species of *Pithonoton* whereas spines and nodose protuberances are developed in that area in species of *Plagiophthalmous.*

Within the genus, *Plagiophthalmous collinsi* most closely resembles *P. nitonensis* Wright and Wright, 1950, from Lower Albian rocks on the Isle of Wight (Wright and Collins, 1972). The two species differ, however, in development of spines on the lateral margin. *Plagiophthalmous collinsi* exhibits a nodose swelling just anterior to the cervical groove, a very strong, laterally directed spine just posterior to the cervical groove, and a smaller, bifid spine just anterior to the branchiocardiac groove. The pattern of spines on *P. nitonensis* is quite different in that the posteriormost spine is best developed and is not bifid, and the region just anterior to the cervical groove exhibits a better defined spine. Other species within the genus are readily distinguishable based upon carapace outline, size, and development of lateral spines.

The record of *Plagiophthalmous* in Late Cretaceous rocks of the James Ross Basin represents the first established record of the genus outside Europe, to our knowledge. This suggests that further study of Cretaceous rocks in areas bounding the South Atlantic ocean might yield more species of this distinctive crab.

Subsection Archaeobrachyura Guinot, 1977
Superfamily Homoloidea de Haan, 1839
Family Poupiniidae Guinot, 1991
Genus Rhinopoupinia n. gen.

Diagnosis.—Like *Poupinia* but with hypertrophied spines and narrower front.

Description.—Large pyriform poupiniid, with a pair of long, slender, divergent rostral spines; hypertrophied anterolateral spines; and two prominent carapace grooves.

Etymology.—The generic name is derived from the Greek prefix, *rhino-*, nose, snout, beak, or bill, and *Poupinia,* the type genus of the family.

Type species.—*Rhinopoupinia bicornis* n. sp.

Remarks.—The distinctive spine development of the frontal and anterolateral spines, coupled with the development of two transverse grooves and the general outline of the carapace, distinguishes this organism from all previously defined genera.

Placement within the Poupiniidae, however, must be done with some caution. Many of the bases for definition of the family, which presently includes a single extant species from the Society Islands, are characters of the ventral surface, abdomen, and appendages (Guinot, 1991). None of these is available for study on the single specimen upon which the new genus is based. However, the morphology of the carapace which Guinot described as typical of the family (Guinot, 1991, p. 578), carapace outline widening posteriorly, groove pattern, lack of a marginal border, and absence of linea homolica, closely links this animal with the Poupiniidae and exclude it from the Homolidae. The only other family in which *Rhinopoupinia* might be placed would be the Homolodromiidae; however, members of this family, including *Homolodromia chaneyi* Feldmann and Wilson from the Eocene La Meseta Formation of Seymour Island, exhibit a more quadrate outline, have broader, forward directed orbital regions, and lack prominently developed postorbital or anterolateral spines.

The placement of this genus within the Poupiniidae provides the first documentation of the family in the fossil record. More specimens, preserving other parts of the anatomy, will be necessary to confirm the placement and to consider their place in the geological history of the Podotremata.

Rhinopoupinia bicornis n. sp.
Figures 23, 24

Diagnosis.—As for genus.

Description.—Carapace moderately large, pyriform, strongly spinose in anterior, widest in branchial region, strongly vaulted transversely and moderately vaulted longitudinally; regions well defined by broad grooves.

Fronto-orbital margin about 25 percent maximum width measured in branchial region, situated below level of remainder of carapace and produced as a rectangular sulcate platform from which two long, slender rostral spines project upward and anterolaterally, diverging at an angle of about 40 percent. Orbits poorly known, situated on lateral margins short, strongly divergent, terminating in long, slender, anterolaterally projecting anterolateral spines diverging to form 60 percent angle. Lateral margins sinuous with reentrants at cervical and branchiocardiac grooves; small spine situated on lateral margin just anterior to branchiocardiac groove. Posterolateral margin smoothly rounded. Posterior margin poorly known. Carapace sides not well differentiated except in branchial region where a weak inflection and small nodes define boundary. Mesogastric region defined by shallow grooves forming equilateral triangle with narrow anterior projection extending to base of rostral platform. Protogastric and hepatic regions not well differentiated, each with small spines. Cervical groove broad, deep, sinuous, slightly concave forward. Branchiocardiac groove V-shaped, less deeply impressed than cervical groove. Subtle arcuate groove between cervical and branchiocardiac grooves defines anterior border of mesobranchial region. Branchial regions moderately inflated, broad nodes bound margins of branchiocardiac groove at level

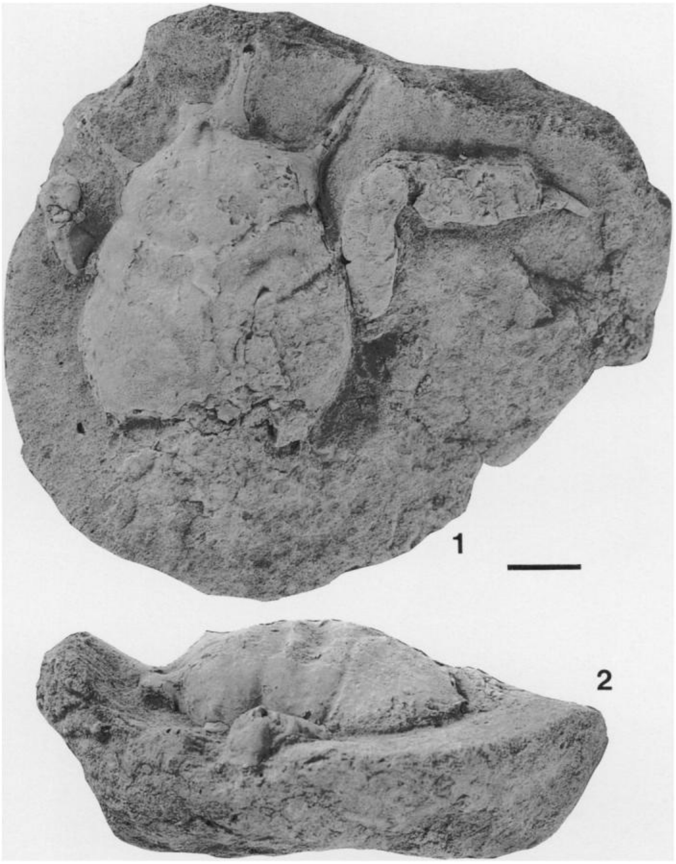

FIGURE 23—*1,* dorsal and *2,* left lateral view of the carapace of the holotype of *Rhinopoupinia bicornis* n. sp., USNM 457696. Scale bar equals 1 cm.

of posterior termination of cardiac region. Cardiac region weakly defined, with two nodes situated at mid-length. Surface with moderate sized pustules increasing in size and density posteriorly.

Ventral surface unknown.

Appendages known only from badly weathered elements; appear to be stout, with one or more rows of spines on upper surface.

Measurements.—Measurements (in mm) are denoted on Figure 24.

Type.—The holotype, and sole specimen, USNM 457696, is deposited in the U. S. National Museum of Natural History, Washington, D.C.

Locality and stratigraphic position.—The sole specimen was collected from locality 20, in the López de Bertodano Formation, Seymour Island, Antarctica. The age of these rocks is Maastrichtian.

Etymology.—The trivial name is constructed from the Latin prefix, *bi-*, two, and the Latin word *cornis,* horned, bearing horns, referring to the two prominent rostral spines characteristic of the species.

Remarks.—Primary comments regarding this species were made above. The only other species within the family, *Poupinia hirsuta* Guinot, 1991, has a very similar carapace morphology but differs from *Rhinopoupinia bicornis* in that *P. hirsuta* lacks the hypertrophied spines and the frontal region is proportionately somewhat narrower. These characters would readily distinguish the two forms.

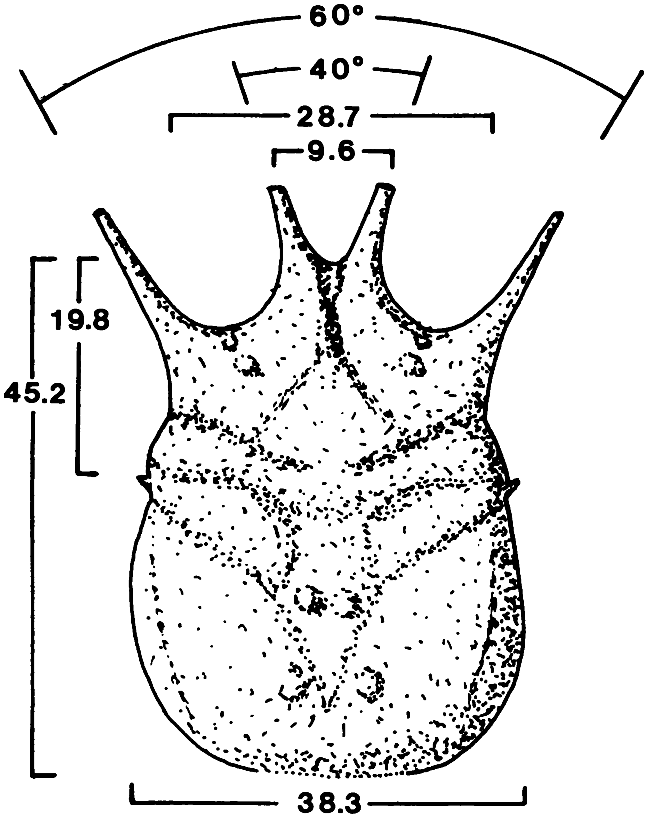

FIGURE 24—Line drawing of *Rhinopoupinia bicornis* n. sp., showing the measurements made. Linear measurements in mm.

The López de Bertodano Formation on Seymour Island has yielded numerous specimens of macruran decapods referrable to three species: *Hoploparia stokesi* (Weller), *Metanephrops jenkinsi* Feldmann, and *Linuparus macellarii* Tshudy and Feldmann. The occurrence of *Rhinopoupinia bicornis* marks the first record of brachyurans from that unit.

Poupinia hirsuta is known from only two specimens collected from bathyal depths. A male and a female were collected from a depth of 440 m in Polynesia (Guinot, 1991). The discovery of a fossil representative of the family provides documentation of the origin of the family in high southern latitudes, at shelf depths.

Superfamily RANINOIDEA de Haan, 1841
Family RANINIDAE de Haan, 1841
Genus CRISTAFRONS n. gen.

Diagnosis.—General form of *Notopocorystes* spp. but with straight, not bifurcate, rostrum, narrower front, and fused sternal elements. Cephalic crest lobose.

Description.—Raninid with fronto-orbital margin less than one-half maximum width; rostrum narrow, triangular; orbits with two fissures; prominent lobose, cephalic ridge generally parallels anterolateral and anterior margin; cephalic region defined by well-developed cervical groove. Sternum fused, elongate, uniformly broad; elements 1–3 separated from posterior elements by narrow isthmus.

Etymology.—The generic name is derived from two Latin words: *crista,* crest, or ridge, and *frons,* brow, or forehead. The name alludes to the distinctive development of a lobose ridge on the cephalic region.

Type species.—*Cristafrons praescientis* n. sp.

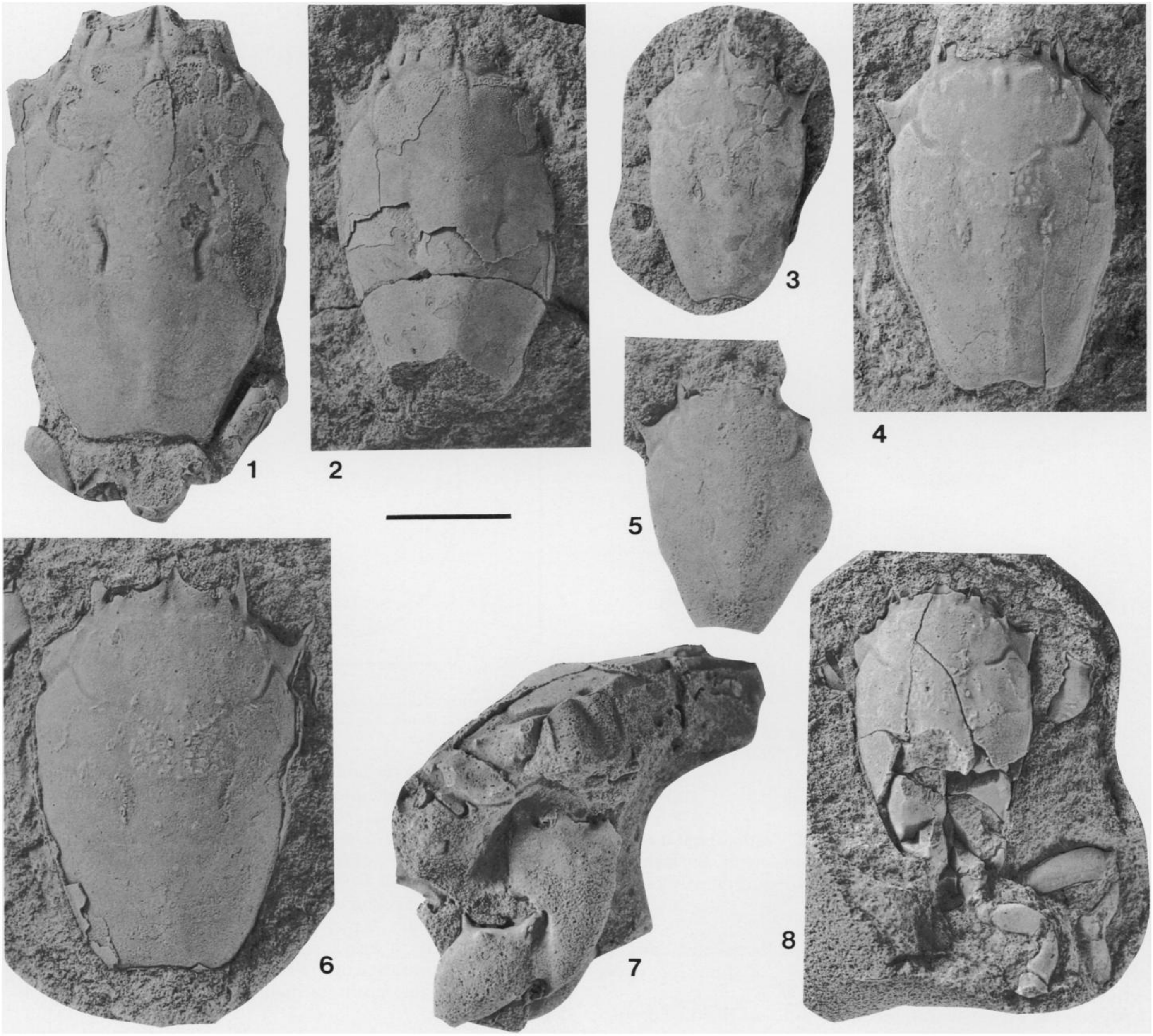

FIGURE 25—*Cristafrons praescientis* n. gen. and sp. *1,* holotype, BAS. IN. 2225, showing dorsal carapace. *2,* dorsal carapace of paratype, BAS. IN. 2229. *3,* dorsal carapace of paratype, BAS. IN. 2233. *4,* dorsal carapace of paratype, BAS. IN. 2207. *5,* dorsal carapace of paratype, BAS. IN. 2222; note the large swelling on the right branchial region, probably caused by a parasitic bopyrid isopod. *6,* dorsal carapace of paratype, BAS. IN. 2429. *7,* mold of the interior of right carpus and propodus of cheliped and part of internal (endophragmal) skeleton of paratype, BAS. IN. 2221. *8,* dorsal carapace and part of right pereiopods of paratype, BAS.IN. 30/11. Scale bar equals 1 cm.

Remarks.—Genera of raninids are defined on the basis of the overall outline of the cephalothorax, shape of the frontal region, form of the rostrum, development of orbital fissures, degree of development of carapace grooves, ornamentation of the cephalothorax, and form of the sternum. The combination of characters exhibited by *Cristafrons* is unique so that it is not possible to place the specimens under consideration in any previously defined genus without significantly altering its description.

Cristafrons resembles *Notopocorystes* McCoy in the development of the cervical groove and the possession of a well-developed crest in the cephalic region; however, the latter genus invariably has a bifid rostrum, tends to have a broader front, and has a sternum in which the elements are not fused and which tend to narrow posteriorly. *Laeviranina* Lörenthey and Beurlen appears to be similar to *Cristafrons* in general outline, form of the frontal region, and development of the rostrum. Placement within this genus is not possible because the cephalic crest on *Laeviranina* is not lobose; the cephalic groove is extremely subtle or, more commonly, lacking; and the sternum has a different configuration. Sternal elements 1–3 are closely set upon the anterior portion of element 4, alations at the anterior and posterior of element 4 are more strongly developed,

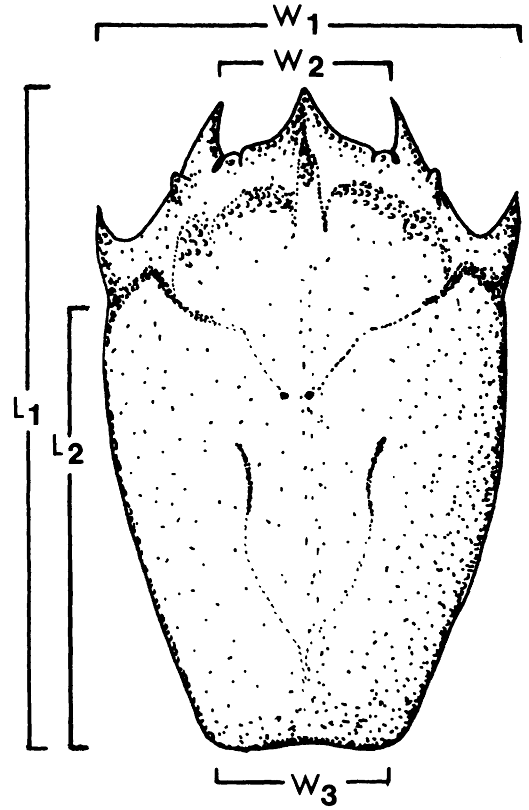

FIGURE 26—Line drawing of the carapace of *Cristafrons praescientis* n. gen. and sp., showing the position and orientation of measurements taken.

and a prominent cleft is developed along the midline of elements 4 and 5. Other genera within the Raninidae are more obviously distinguished from the new genus.

It would appear that *Cristafrons* exhibits a combination of morphological characters that suggest a position intermediate between *Notopocorystes,* one of the most common Cretaceous raninids, and *Laeviranina,* a genus which is found worldwide in the Eocene and which is closely related to *Notosceles* Bourne and *Raninoides* H. Milne Edwards. The former genus ranges from Late Cretaceous to Recent and the latter from Eocene to Recent (Tucker and Feldmann, 1990). Thus, *Cristafrons* may be an intermediate link in the evolution of these modern genera.

CRISTAFRONS PRAESCIENTIS n. sp.
Figures 25, 26

Diagnosis.—As for genus.

Description.—Moderate to small sized raninid, 1.5 times as long as wide, moderately vaulted transversely, gently arched longitudinally.

Fronto-orbital margin about 40 percent maximum width, which is attained at anterolateral spines; rostrum an equilateral triangle, sulcate, projects anteriorly to same position as sharp, inturned postorbital spines; orbits moderately deep, with two orbital fissures situated between midpoint on orbits and postorbital spines, innermost fissures narrower and shallower than outer fissures. Anterolateral margins straight to slightly concave, steeply inclined abaxially, terminating in strong, curved, anteriorly directed anterolateral spine. Lateral margins about 33 percent total length parallel carapace axis, merging into straight or weakly concave, convergent posterolateral margins. Posterior margin equal in width to fronto-orbital margin, concave. Lateral, posterolateral, and posterior margins defined by finely pustulose border.

TABLE 5—Measurements (in mm) taken on specimens of *Cristafrons praescientis* n. sp. Because the material is not uniformly well preserved, and rostra, postorbital spines, and anterolateral spines may be broken, the measurements must be taken to be best estimates of actual dimensions. Positions and orientation of measurements are illustrated in Figure 26.

Specimen	L_1	L_2	W_1	W_2	W_3
BAS. IN. 2225, holotype	34.5	24.2	22.9	11.2	10.2
BAS. IN. 2207(1)	>25.3	17.6	17.2	9.9	10.5
BAS. IN. 2207(2)	—	17.9	15.0	—	6.2
BAS. IN. 2226	26.7	20.7	17.3	9.2	8.3
BAS. IN. 2227	30.5	20.5	19.6	10.2	8.2
BAS. IN. 2230	12.6	7.0	8.8	5.5	3.7
BAS. IN. 2233	22.5	14.1	14.3	8.2	6.0
BAS. IN. 2229	33.5	23.1	23.7	11.7	10.0

Carapace surface with lobate, pustulose ridge separating frontal, orbital, and hepatic regions from rest of carapace, moderately well-defined cervical and branchiocardiac grooves. Frontal region narrow, triangular, sulcate on rostrum, broadening posteriorly into raised mesogastric area; frontal and orbital regions pustulose anteriorly, smooth elsewhere; hepatic region smooth with single prominent hepatic spine. Lobose, pustulose ridge extends from base of anterolateral spine to midline, approximately paralleling front; median lobe defines mesogastric region; adjacent paired lobes convex anteriorly, about as wide as orbits; next pair of lobes convex anteriorly, about as wide as bases of postorbital spines; outermost lobes define lateral portion of cervical groove. Cervical groove well impressed laterally and forms anteriorly directed lobe, becoming progressively more subtle axially; medial portion of cervical groove concave anteriorly to point of inflection where groove projects posteromesially to terminate at well-developed posterior gastric pits. Branchiocardiac grooves well defined anteriorly as arcuate depressions and converging posteriorly as subtle ridges.

Sternum relatively slender, somites 1–5 fused. Somites 1–3 broad, ovoid, separated from somite 4 by parallel-sided isthmus one-half width of somites 1–3. Width at midpoint of somite 4 narrower than 1–3, sides concave, rimmed by subtle ridge; basal articulations nearly parallel long axis. Alation separating somites 4 and 5 at least twice as wide as somites 1–3, with arcuate depressions connecting two pits on either side of midline. Somite 5 slightly narrower than 4, lateral margins concave, with strong marginal rim, basal articulations nearly parallel long axis. Surface of sternum smooth, slightly raised axially, not cleft longitudinally.

Pereiopods typical of Raninidae. Chelipeds with broad, flattened triangular propodus with finger projecting nearly at right angles to axis of hand; margins of hand smooth, not spinose; carpus bulbous with three spines situated distally on outer surface. Pereiopods 3 and 4 about equal size, elongate cylindrical elements, posteriorly directed; pereiopod 4 subdorsal. Remainder of appendages unknown.

Measurements.—Measurements, taken on specimens of *Cristafrons praescientis,* are given in Table 5. The position and orientation of measurements is shown on Figure 26.

Types.—The holotype, BAS. IN. 2225, and paratypes, BAS. IN. 2206, 2207, 2220–2222, 2224, 2226–2234, 2247, 2427, 2429, 2434, and four unnumbered specimens, are deposited in the Natural History Museum, London.

Localities and stratigraphic positions.—Specimens were collected from the Lachman Crags Member of the Santa Marta Formation at localities 6 and 7, in the Herbert Sound Member of the Santa Marta Formation at locality 10, and in the Cape

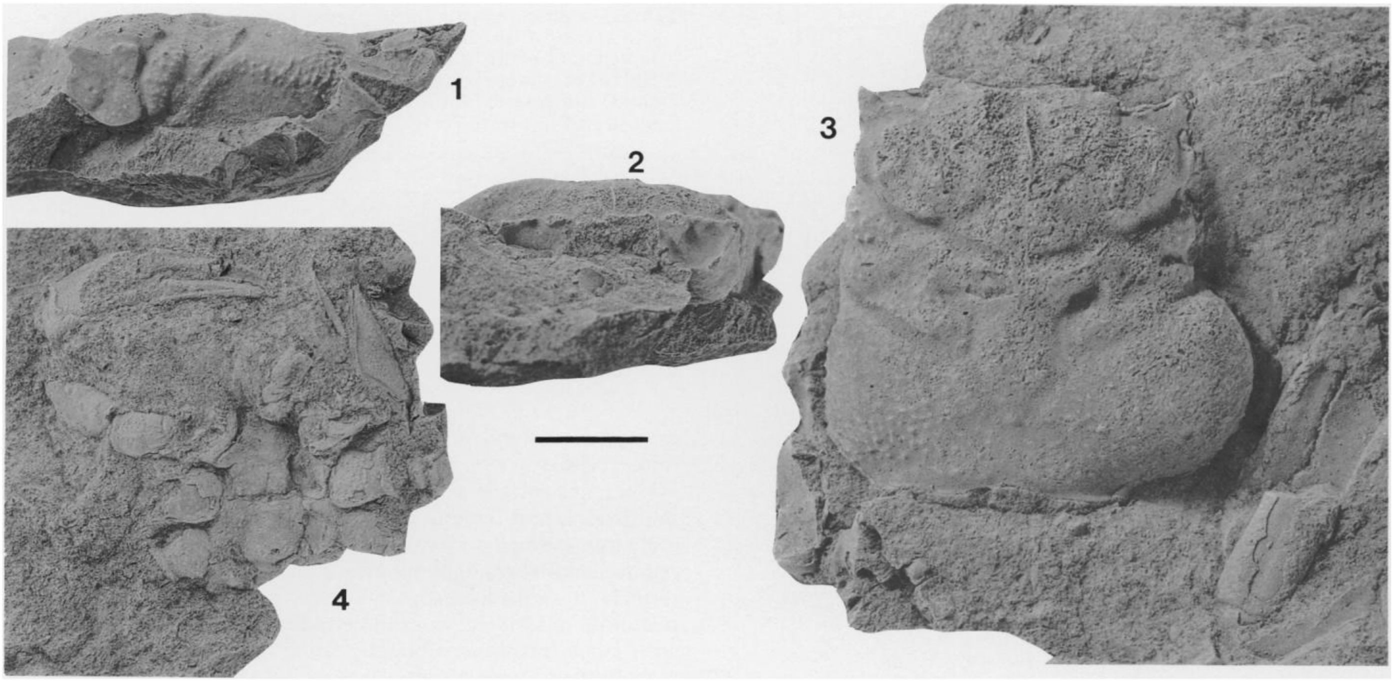

FIGURE 27—Holotype, BAS. IN. 2422, of *Torynomma* (*Torynomma*) *australis* n. sp. *1*, left lateral view. *2*, frontal view. *3*, dorsal view of carapace showing large swelling on the right branchial region, probably caused by a parasitic bopyrid isopod. *4*, ventral view showing sternum, bases of several pereiopods, and lower surface of the right cheliped. Scale bar equals 1 cm.

Lamb member of the López de Bertodano Formation at locality 14.

Etymology.—The trivial name is derived from the Latin word, *praescientis*, to foreknow, which alludes to the generally modern appearance of the species suggesting its position as the ancestor of species known from Tertiary and modern settings.

Remarks.—Raninids are moderately abundant and diverse elements in Tertiary faunas in Antarctica (Feldmann and Zinsmeister, 1984; Feldmann and Wilson, 1988; Feldmann, 1991) and New Zealand (Feldmann and Maxwell, 1990; Feldmann, 1991); however, none has been reported previously from Cretaceous rocks of the high southern latitudes.

This is one of the most common species in the decapod fauna of James Ross Island. Because the morphology of the carapace is so distinctive, there is little possibility of confusing it with any other crabs in the Santa Marta Formation. As with the much rarer *Torynomma australis*, *Cristafrons praescientis* was infected by branchial parasites, probably bopyrid isopods. Three specimens, BAS. IN. 2222 (Figure 25.5) and 2224 (two specimens), exhibit nearly circular swellings in the mesiolateral portion of the branchial region, two in the right chamber and one in the left. Examination of an exposed cross section of one of the swellings does not reveal remains of the isopod so that its identity as a bopyrid is inferred from the morphology of the swelling. Similar deformities have been attributed to bopyrids by previous workers (Glaessner, 1969; Müller, 1984).

Superfamily TYMOLOIDEA Alcock, 1896
Family TORYNOMMIDAE Glaessner, 1980
Genus TORYNOMMA Woods, 1953
Subgenus TORYNOMMA (TORYNOMMA) Woods, 1953
TORYNOMMA (TORYNOMMA) AUSTRALIS n. sp.
Figures 27, 28

Diagnosis.—Quadrate carapace with well-defined, vertical walls, inflated, well-defined carapace regions, and generally granular ornamentation.

Description.—Carapace quadrate, slightly longer than wide; sides distinct, vertical, very weakly arched transversely and longitudinally; regions well defined.

Front broad, about 38 percent fronto-orbital width; rostrum, if present, broken. Orbits vertical, equidimensional, shallowly concave; upper margin with shallow orbital notches abaxial from midpoint of orbit, separated by supraorbital spine; outer margin defined by strong postorbital spine directed anteriorly and upward. Lateral margins generally straight, slightly divergent posteriorly; invaginated at position of cervical groove, groove on epibranchial region, and branchiocardiac groove; spinose along distinct inflection between upper and lateral carapace surfaces, spines diminishing in size posteriorly. Posterolateral corner smoothly rounded; posterior margin broad, about 67 percent maximum width measured in metabranchial region.

Carapace regions inflated, well defined by pronounced grooves; gastric regions with single spine somewhat less inflated than mesogastric; hepatic regions domed, with four spines. Cervical groove shallow V-shaped, entire. Branchial regions a series of lobose areas; epibranchial region and branchial regions comprising three smaller lobes and mesobranchial region consists of a single lobe. Cardiac region longer than wide, inflated, narrowing posteriorly, with three small spines situated in triangle near posterior part of region. Intestinal region weakly developed.

Ventral carapace poorly exposed; sternal elements 1–3 unknown but presumably narrow; element 4 triangular with concave sides, widest at posterior articulation of cheliped; element 5 with concave sides, subparallel long axis of carapace, element 6 tapering posteriorly; elements 7 and 8 not exposed, apparently dorsal in position; surface of sternum finely pustulose with single elevated region situated between pereiopods 3.

Abdomen unknown.

Cheliped hand inflated, slightly longer than high, length of hand equal to length of slender, uniformly tapering, slightly downturned fixed finger; dactylus long slender, slightly curved. Right meri of second and third pereiopods elongate, flattened, spinose on upper surface; basal elements of pereiopods 2 and 3 very slightly smaller than that of pereiopod 1 and larger than that of pereiopod 4. Pereiopod 5 poorly preserved, apparently dorsal.

Measurements.—Measurements (in mm) are recorded in Figure 28.

Type.—The holotype and sole specimen, BAS. IN. 2422, is deposited in the Natural History Museum, London.

Locality and stratigraphic position.—The specimen was collected from the Herbert Sound Member of the Santa Marta Formation at locality 10.

Etymology.—The specific name alludes to the southernmost occurrence of the species thus far described.

Remarks.—Placement of this specimen with *Torynomma* is based upon the general outline of the carapace, morphology of the lateral carapace margins, development of carapace regions and groove patterns, position and orientation of the orbits, form of the sternum, and shape of the cheliped. This combination of characters does not seem to apply to any other group of the primitive crabs possessing box-shaped carapaces. The species to which *Torynomma australis* is most similar morphologically is *T. flemingi* Glaessner, 1980. However, it may be distinguished from *T. flemingi* because the former exhibits a smoother cephalic region, slightly weaker development of the cervical groove than the branchiocardiac groove, and a broader cardiac region. *Torynomma quadratum* Woods, 1953, is much smaller and has a more rounded outline and relatively more robust chelipeds. *Torynomma* (*Paratorynomma*) *dentatum* Glaessner is smaller than *T. australis* and is covered by relatively coarse granules.

Placement in other genera within the Torynommidae may be eliminated on the basis of more obvious morphological features. Species of *Dioratiopus* (=*Glaessneria* Wright and Collins, 1972 = *Glaessnerella*) exhibit a more produced front and obliquely set orbits while the monotypic genus *Mithracites* Gould has a more rounded carapace, less distinct sides, and pustulose ornamentation. The morphology of the cephalic regions of species of *Binkhorstia* Noetling, 1881, bears little in common with this species and the orbits of the former are narrower than in *Torynomma australis.* Absence of any evidence of linea eliminates the possibility of affinities with the Homolidae.

It is tempting to observe that there are numerous similarities between this species and *Homolodromia chaneyi* Feldmann and Wilson, collected from the Eocene La Meseta Formation on Seymour Island, Antarctica (Feldmann and Wilson, 1988). The similarities are great enough, in fact, to suggest that a species of *Torynomma,* or of some other genus within the Torynommidae, gave rise to the Homolodromiidae, possibly in the high southern latitudes. Species of *Homolodromia* have more produced, narrower, bifid fronts, anterolaterally directed orbital regions, less well defined sides, and markedly reduced, dorsal or subdorsal pereiopods 4 and 5.

This record of *Torynomma* in Antarctica represents the first record of the genus on that continent. The other records of the genus also are from the Southern Hemisphere, and include New Zealand (*Torynomma flemingi* Glaessner) and Australia (*T. quadratum* Woods and *T. dentatum* Glaessner).

Section HETEROTREMATA Guinot, 1977
Superfamily CALAPPOIDEA de Haan, 1833
Family CALAPPIDAE de Haan, 1833
Genus NECROCARCINUS Bell, 1863
NECROCARCINUS WRIGHTI n. sp.
Figures 29.1–29.5, 30

Diagnosis.—*Necrocarcinus* with circular outline, well-developed regions, and large spines; shallowly sulcate rostrum of three equally sized spines.

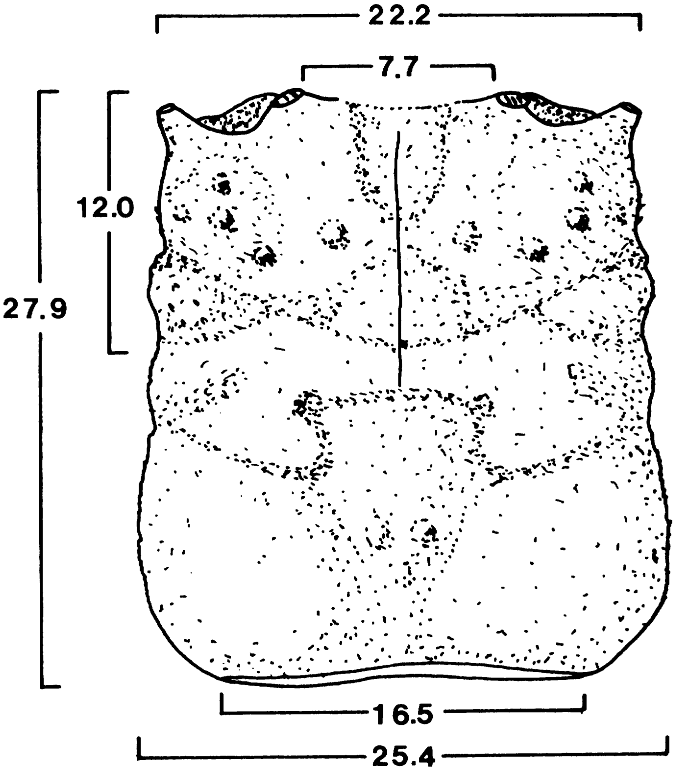

FIGURE 28—Line drawing of *Torynomma* (*Torynomma*) *australis* n. sp., showing the measurements taken, in mm.

Description.—Moderately large for genus; circular outline, as long as wide, more vaulted transversely than longitudinally; regions well defined by broad, deep grooves; tumid, with prominent spines in all regions.

Fronto-orbital margin less than half maximum width measured in branchial region at mid-length; rostrum prominent with long, slender axial spine and shorter, upturned lateral spines; orbits directed forward, with two short supraorbital spines and bounded laterally by prominent, stout postorbital spine. Anterolateral margin convex, with two poorly formed spines. Lateral and posterolateral margins smoothly convex, pustulose where visible, but not spined. Posterior margin concave, narrower than fronto-orbital margin. Flanks of carapace not differentiated from carapace surface.

Carapace surface with strongly inflated regions, each bearing one or more spines and prominent grooves. Cervical groove with convex forward lateral segment, less convex to straight segment, and concave forward axial segment. Mesogastric region triangular to pyriform with longitudinal axial crest upon which two axial spines are situated. Gastric region more or less circular with four spines; hepatic region with two smaller spines. Epibranchial region with three spines, the posteriormost of which is largest. Branchial lobe asymmetrically domed, steepest posterolaterally, with single blunt spine on posterolateral border; mesobranchial and metabranchial lobes not differentiated, with two spines at mid width forming a line paralleling axis. Urogastric and cardiac regions a pair of circular spine domes, slightly narrower than mesogastric region.

Buccal frame approximately as long as wide, slightly wider anteriorly; ischium of third maxilliped one-half length of merus; maxillipeds nearly cover buccal opening. Pterygostomian regions smooth, with sulcus extending from posterodorsal corner to anteroventral margin. Sternal elements 1–3 fused into small

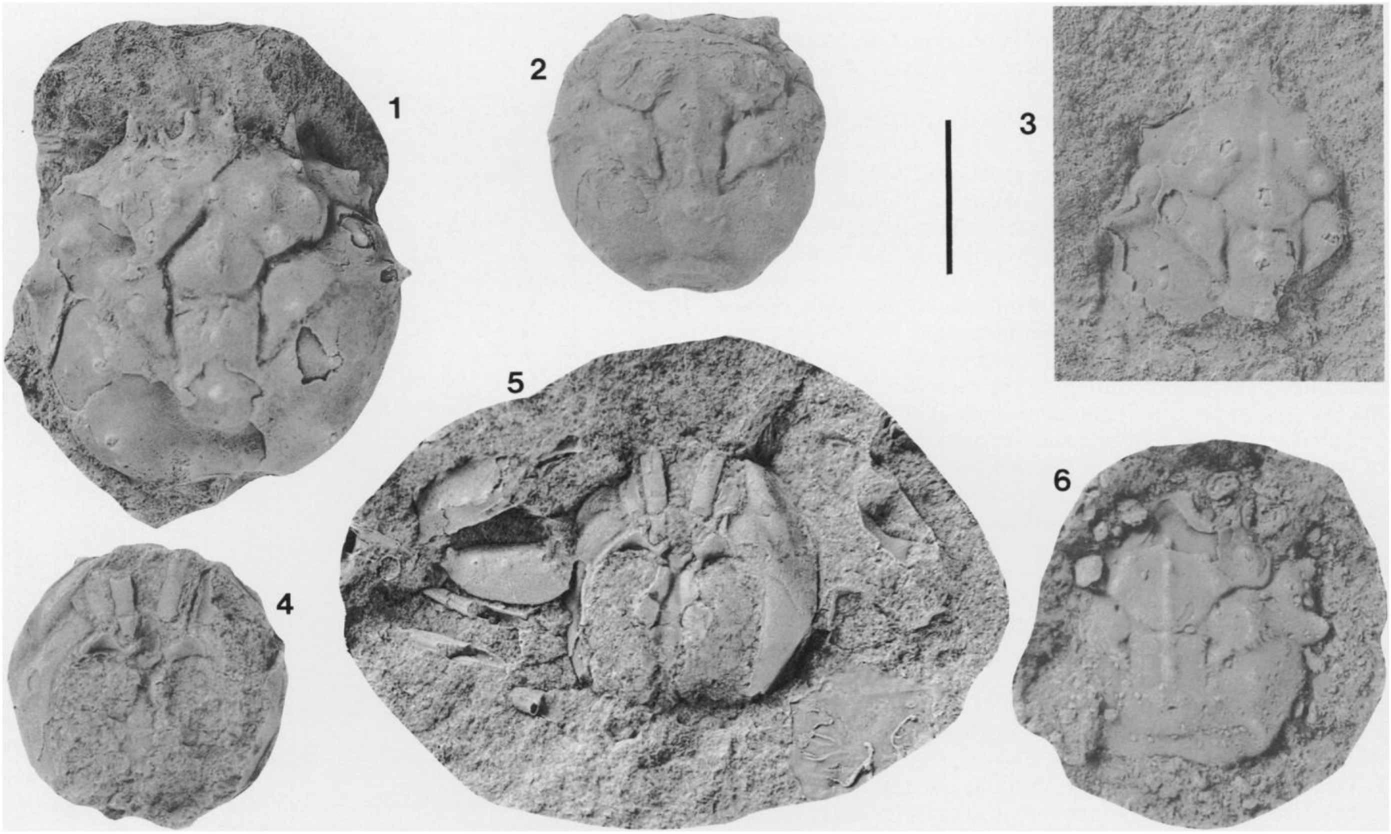

FIGURE 29—*Necrocarcinus* spp. *1–5, Necrocarcinus wrighti* n. sp. *1,* dorsal view of carapace of holotype, BAS. IN. 2237. *2,* dorsal view of paratype, CIRGEO 882. *3,* dorsal view of paratype, BAS. IN. 2243. *4,* ventral surface and *5,* latex cast of ventral surface of paratype, CIRGEO 882. *6,* latex cast of dorsal surface of carapace of holotype, BAS. IN. 2238, of *Necrocarcinus carinatus* n. sp. Scale bar equals 1 cm.

V-shaped, flat plate; element 4 with arcuate lateral margins, widening posteriorly, axially depressed; elements 5 and 6 wider than 4, with arcuate lateral margins, equally wide anteriorly and posteriorly; axially depressed.

Chelipeds isochelous. Merus of cheliped generally smooth, robust, slightly longer than wide, with three spines on upper surface. Carpus poorly preserved. Propodus about as wide as high, with four rows of 3–4 stout spines on upper, lower, and outer surfaces; fixed finger slightly shorter than hand.

Measurements.—Measurements, taken on specimens of *Necrocarcinus wrighti,* are given in Table 6. The position and orientation of measurements are shown on Figure 30.

Types.—The holotype, BAS. IN. 2237, and five paratypes, BAS. IN. 2242, 2246, and three unnumbered specimens, are deposited in the Natural History Museum, London. An additional paratype, CIRGEO 882, is deposited in the collections of CIRGEO, Buenos Aires, Argentina.

Locality and stratigraphic position.—Specimens were collected from the Lachman Crags Member of the Santa Marta Formation at localities 6, 7, and 9; from the Herbert Sound Member of the Santa Marta Formation at locality 10; and from the Cape Lamb Member of the López de Bertodano Formation at locality 14.

Etymology.—The trivial name honors Mr. C. W. Wright who, with J. S. H. Collins, has contributed to paleontology an excellent study of Cretaceous crabs from Britain.

Remarks.—*Necrocarcinus wrighti* bears several close points of comparison with *N. labeschii* (Deslongchamps), from the Albian and Cenomanian of Great Britain and France, and *N. woodwardii* Bell, from Albian and Cenomanian of Great Britain (Wright and Collins, 1972). All are characterized by a generally circular outline, well-developed regions, and relatively large spines on the dorsal carapace. However, certain characteristics of the front of the carapace are clearly distinctive. The rostrum of *Necrocarcinus wrighti* bears only a shallow sulcus and consists of three spines of nearly equal size, the medial one bearing a shallow sulcus. The postorbital spines on this species are longer and more slender than those on the European species. Additionally, the spines on the gastric region of the Antarctic specimens are smaller and more numerous than on *Necrocarcinus labeschii,* although the development of spines is similar to that of *N. woodwardii.*

This description of *Necrocarcinus* is the first notice of the genus in Antarctica and one of the few records of the genus in the Southern Hemisphere. Glaessner (1969) reported species from West Africa and India but we know of no other occurrences.

NECROCARCINUS CARINATUS n. sp.
Figure 29.6

Diagnosis.—*Necrocarcinus* with ovoid outline, wider than long, axial keel well developed, lateral keels defined by rows of elongate spines.

Description.—Moderate size for genus; ovoid outline, wider than long; moderately vaulted transversely and longitudinally; regions well defined by deep grooves, tumid; axis with nodose keel; row of elongate spines define lateral crests.

Fronto-orbital margin about half maximum width measured

TABLE *6*—Measurements (in mm) taken on specimens of *Necrocarcinus wrighti* n. sp. Positions and orientation of measurements are illustrated in Figure 30.

Specimen	Length	Width	Front width	Posterior width
BAS. IN. 2237, holotype	27.2	25.3	11.2	9.2
BAS. IN. 2246, paratype	ca. 19.5	22.5	9.8	—
D8755, paratype	>18.1	18.5	9.5	6.4
CIRGEO 882, paratype	>20.4	19.3	7.7	6.8

just posterior to midlength; rostrum blunt, slightly downturned, sulcate, with raised border; orbits forward directed, bounded by prominent slender postorbital spine; anterolateral margin convex, with at least one small spine; lateral margin convex with large spine just posterior to midlength; posterolateral margin smoothly convex; posterior margin short, concave.

Carapace surface with inflated regions bearing nodose keels or spines. Cervical groove nearly V-shaped. Mesogastric region diamond shaped, not clearly distinguished from front, with narrow keel bearing three small nodes along midline. Gastric region with short oblique keel along groove between gastric and mesogastric region and centrally located spine. Hepatic region not well known. Epibranchial regions with two sharp spines forming a subtle ridge directed posterolaterally; branchial region with elongate spine defining anterior part of ridge which is continuous onto mesobranchial and metabranchial lobes directed slightly posterolaterally; urogastric and cardiac regions broad, elevated, bearing nodose axial keel continuous with that on mesogastric region; cardiac region slightly wider than urogastric region.

Surface of carapace smooth except on finely granulose posterior area.

Ventral surface and appendages unknown.

Measurements.—Measurements taken on the sole specimen are as follows: L, 18.6; W_1, 23.2; W_2, 9.4; W_3, 8.0. The position and orientation of measurements is the same as that for *N. wrighti* and are shown on Figure 30.

Type.—The holotype, and sole specimen, BAS. IN. 2238, is deposited in the Natural History Museum, London.

Locality and stratigraphic position.—The sole specimen was collected from the Lachman Crags Member of the Santa Marta Formation at locality 6.

Etymology.—The trivial name is derived from the Latin word, *carinatus,* meaning keeled, alluding to the nodose and spinose crests that distinguish the species from near relatives.

Remarks.—The species most nearly like *Necrocarcinus carinatus* is *N. tricarinatus* Bell, 1863, from upper Aptian to lower Cenomanian rocks in England (Wright and Collins, 1972). They suggested that a single specimen from the upper Albian of Angola (BM.IN. 29588), deposited in the Natural History Museum, may be conspecific. The latter species, however, has a more angular outline and lacks the smaller crests developed on the gastric and epibranchial regions. North American species of *Necrocarcinus* bearing axial keels include *N. oklahomensis* Rathbun, 1935, *N. texensis* Rathbun, 1935, and *N. mosleyi* Stenzel, 1945, all from upper Albian rocks of Texas. In all these species the regions tend to be far less tumid and are expressed as depressed regions between relatively broad crests. *Necrocarcinus scotti* Stenzel, 1945, also from upper Albian rocks in Texas, exhibits inflated regions and has an outline similar to that of *N. carinatus* but lacks the narrow keels.

This species is represented only by a mold of the exterior of a single specimen so that, although generic placement is certain, it is not prudent to draw extensive conclusions regarding systematic position. It is, nonetheless, tempting to consider the impact of this discovery on the validity of the genus *Cenomanocarcinus* Van Straelen, a genus considered to be distinct by Förster (1968) but synonymous with *Necrocarcinus* by Wright and Collins (1972). We concur with the later judgement by considering this new species a member of *Necrocarcinus.*

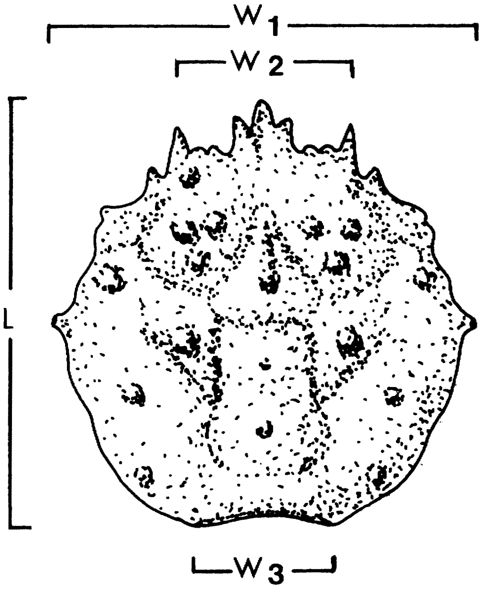

FIGURE *30*—Line drawing of *Necrocarcinus wrighti* n. sp., showing the position and orientation of measurements taken on both species of *Necrocarcinus.*

SUMMARY AND CONCLUSIONS

A total of 28 species of decapod crustaceans has been described from the James Ross Basin, to date. Of these, 15 species are known solely from Cretaceous rocks; two, *Hoploparia stokesi* and *Metanephrops jenkinsi,* range from the Cretaceous into the Paleocene; nine are Eocene; one, *Callianassa* cf. *C. meridionalis,* is known with certainty from Cretaceous occurrences and is tentatively recognized in the Eocene La Meseta Formation; and one, *Paguristes santamartaensis,* occurs with certainty in the Cretaceous Santa Marta Formation and has been recognized also in the Miocene Cape Melville Formation on King George Island. The Cretaceous fossil record in this basin is dominated by macruran, anomuran, and podotremate brachyuran species. The relatively large number of brachyuran species, six, is unusual for Cretaceous decapod faunas. All are new species.

Hoploparia stokesi is the most abundant and long-ranging of the species of decapods. It has been identified in rocks ranging in age from late Santonian or early Campanian through Paleocene. Although there are distinctive, and directional, variations in morphology through this range, individual characters vary independently and no distinct breaks in morphology can be defined.

Most of the Cretaceous species of decapods can be referred to genera that have been described previously from other regions of the world. Only four, *Antarcticheles, Retrorsichela, Rhinopoupinia,* and *Cristifrons,* of the 22 genera recognized are unique to the James Ross Basin. *Cristafrons* is morphologically intermediate between the dominantly Cretaceous *Notopocorystes* and the Tertiary *Laeviranina* so that *Cristafrons,* which is currently known only in Antarctica, may be the precursor of the *Laeviranina–Raninoides* lineage within the Raninidae. *Munidopsis* is known from the fossil record only in Antarctica although it has extant descendants in lower latitude, deep-water habitats. *Metanephrops* and *Torynomma* are genera that are best known in Southern Hemisphere regions, notwithstanding the fact that *Metanephrops* contains living species in both hemispheres. By contrast, *Paguristes, Plagiophthalmous,* and *Necrocarcinus* are dominated by Northern Hemisphere species. The remaining genera are cosmopolitan in distribution.

Two of the Cretaceous taxa found in the James Ross Basin, *Metanephrops* and *Munidopsis,* represent the first occurrence of their genus in the geological record, here in inner shelf deposits. Both are known to live only in outer shelf and slope habitats in modern seas. Relatively few of the decapods collected from Cretaceous rocks (*Hoploparia, Glyphea, Meyeria, Plagiophthalmous, Torynomma,* and *Necrocarcinus*) could be considered "typical" Mesozoic forms, and, of these genera, only *Torynomma* is restricted in its range to the Cretaceous. The diverse and abundant Cretaceous decapod crustacean fauna of the James Ross Basin was dominated by pioneer forms, several of which were the rootstock of modern species, inhabiting other regions of the world. This high-latitude region did not serve as a refugium for genera that largely had disappeared from lower latitude areas but instead was an important site of origin of new taxa.

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APPENDIX

Systematic list of decapod crustaceans that have been described from the James Ross Island Basin, Antarctica. Geologic ages and formations from which decapods have been collected are abbreviated as follows: A = Aptian; C = Campanian; M = Maastrichtian; P = Paleocene; E = Eocene; Mi = Miocene; K = Kotick Point Formation in which decapods, presumed to be from the Jurassic Nordenskjöld Formation, have been described; SM = Santa Marta Formation; LB = López de Bertodano Formation; S = Sobral Formation; LM = La Meseta Formation; CM = Cape Melville Formation.

Order Decapoda Latreille, 1803
Suborder Pleocyemata Burkenroad, 1963
Infraorder Astacidea Latreille, 1803
Family Nephropidae Dana, 1852
Genus *Hoploparia* McCoy, 1849

Hoploparia stokesi (Weller), 1903 [C, M, P—SM, LB, S]
Hoploparia antarctica Wilkens, 1907 [C—SM]

Genus *Metanephrops* Jenkins, 1972

Metanephrops jenkinsi Feldmann, 1989 [M, P—LB, S]
Metanephrops rossensis n. sp. [C—SM]

Infraorder Palinura Latreille, 1803
Superfamily Glypheoidea Winckler, 1883
Family Glypheidae Winckler, 1883
Genus *Glyphea* von Meyer 1835

Glyphea australensis n. sp. [C? M—SM, LB]

Family Mecochiridae Van Straelen, 1925
Genus *Meyeria* McCoy, 1849

Meyeria crofti Ball, 1960 [C—LB]

Superfamily Eryonoidea de Haan, 1841
Family Polychelidae Wood-Mason, 1874
Genus *Antarcticheles* Aguirre-Urreta, Buatois, Chernoglasov, and Medina, 1990

Antarcticheles antarcticus Aguirre-Urreta, Buatois, Chernoglasov, and Medina, 1990 (may = *Cycleryon* sp. Quilty, 1988 (=*Eryon* sp. Laudon, Lackey, Quilty, and Otway, 1969)) [A—KP]

Superfamily Palinuroidea Latreille, 1803
Family Palinuridae Latreille, 1802
Genus *Linuparus* White, 1847

Linuparus macellarii Tshudy and Feldmann, 1988 [S?, C, M—SM, LB]

Infraorder Anomura H. Milne Edwards, 1832
Superfamily Thalassinoidea Latreille, 1831
Family Callianassidae Dana, 1852
Genus *Callianassa* Leach, 1814

Callianassa meridionalis Ball, 1960 [C—SM]
Callianassa cf. *C. meridionalis* herein [C, E—SM, LM]

Genus *Protocallianassa* Beurlen, 1930

Protocallianassa cf. *p. faujasi* Feldmann and Wilson, 1988 [E—LM]

Superfamily Paguroidea Latreille, 1803
Family Paguridae Latreille, 1802
Genus *Paguristes* Dana, 1851

Paguristes santamartaensis n. sp. [C, Mi—SM, CM]

Superfamily Galatheoidea Samouelle, 1819
Family Galatheidae Samouelle, 1819
Genus *Munidopsis* Whiteaves, 1874

Munidopsis scabrosa Feldmann and Wilson, 1988 [E—LM]
Munidopsis foersteri n. sp. [C—SM]

Superfamily Galatheoidea?
Family Retrorsichelidae n. fam.
Genus *Retrorsichela* n. gen.

Retrorsichela laevis n. sp. [C—SM]

Infraorder Brachyura Latreille, 1803
Section Podotremata Guinot, 1977
Superfamily Homolodromioidea Alcock, 1899
Family Homolodromiidae Alcock, 1899
Genus *Homolodromia* A. Milne Edwards, 1880

Homolodromia chaneyi Feldmann and Wilson, 1988 [E—LM]

Superfamily DROMIOIDEA de Haan, 1833
Family PROSOPIDAE von Meyer, 1860
Genus *Plagiophthalmous* Bell, 1863

Plagiophthalmous collinsi n. sp. [C—SM]

Superfamily HOMOLOIDEA Guinot, 1977
Family POUPINIIDAE Guinot, 1991
Genus *Rhinopoupinia* n. gen.

Rhinopoupinia bicornis n. sp. [M—LB]

Superfamily RANINOIDEA de Haan, 1841
Family RANINIDAE de Haan, 1841
Genus *Lyreidus* de Haan, 1841

Lyreidus antarcticus Feldmann and Zinsmeister, 1984 [E—LM]
Lyreidus hookeri Feldmann, 1992 [E—LM]

Genus *Cristafrons* n. gen.

Cristafrons praescientis n. sp. [C, M?—SM, LB]

Superfamily TYMOLOIDEA Alcock, 1896
Family TORYNOMMIDAE Glaessner, 1980
Genus *Torynomma* Woods, 1953

Torynomma (*Torynomma*) *australis* n. sp. [C—SM]

Section HETEROTREMATA Guinot, 1977
Superfamily CALAPPOIDEA de Haan, 1833
Family CALAPPIDAE de Haan, 1833
Genus *Necrocarcinus* Bell, 1863

Necrocarcinus wrighti n. sp. [C, M?—SM, LB]
Necrocarcinus carinatus n. sp. [C—SM]

Subfamily CALAPPINAE de Haan, 1833
Genus *Calappa* Weber, 1795

Calappa zinsmeisteri Feldmann and Wilson, 1988 [E—LM]

Superfamily PORTUNOIDEA Rafinesque, 1815
Family PORTUNIDAE Rafinesque, 1815
Genus *Callinectes* Stimpson, 1860

Callinectes sp. Feldmann and Wilson, 1988 [E—LM]

Superfamily XANTHOIDEA Dana, 1851
Family GONEPLACIDAE Macleay, 1838
Genus *Chasmocarcinus* Rathbun, 1898

Chasmocarcinus seymourensis Feldmann and Zinsmeister, 1984 [E—LM]

Superfamily MAJOIDEA Samouelle, 1819
Family MAJIDAE Samouelle, 1819
Genus ?*Micromithrax* Noetling, 1881

?*Micromithrax minisculus* Feldmann and Wilson, 1988 [E—LM]