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Sea-Stars (Echinodermata: Asteroidea)
from "Eltanin" Cruise 26,
with a Review of the New Zealand
Asteroid Fauna

by
Helen E. Shearburn Clark

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Sea-stars (Echinodermata: Asteroidea) from
"Eltanin" Cruise 26, with a Review of the
New Zealand Asteroid Fauna

By

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Abstract

A collection of Asteroids made by the USNS "Eltanin" in depths ranging from 167-4868 m. off the New Zealand coast is described. The material comprises 116 specimens in 19 genera and 20 species; 6 genera, *Stylasterias*, *Brisinga*, *Porcellanaster*, *Eremicaster*, *Styracaster*, and *Pectinaster* are new records for New Zealand waters and 2 species, *Brisinga tasmani* and *Plutonaster fragilis*, and one variety are new to science. The zoological relationships of the New Zealand asteroid fauna are briefly discussed. A brief historical review of literature dealing with New Zealand starfish is presented together with an annotated check-list of species known from New Zealand, the Chatham Islands, the Subantarctic Islands and the Kermadec Islands.

INTRODUCTION

IN late November and December 1966, the USNS Research Vessel "Eltanin" occupied 36 stations, (both biological and hydrographical) in New Zealand waters between 38° and 47° S., and 160° and 175° E., in depths ranging from 25-4,956 m. Starfish (Asteroidea) were taken from only 8 stations and these are described here. Classification used in this paper follows that set out in the Treatise on Invertebrate Palaeontology (1966).

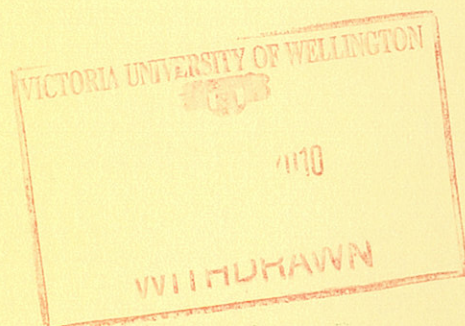
In general a 5' Blake trawl was used for dredging; a larger 10' Blake proved unsatisfactory. Colour notes in the text are of freshly caught specimens. The present addition to the New Zealand fauna of 6 genera of starfish which are new records for New Zealand and of 2 new species, together with recent records of McKnight (1967, 1968), has prompted the following review of the literature and the check lists.

DISTRIBUTION OF ASTEROIDS IN NEW ZEALAND AND OUTLYING ISLANDS

Both Fell (1949) and Pawson (1961) use the Aupourian, Cookian (including the Chathams), Forsterian and Antipodean divisions of the New Zealand region for geographic discussions (these are based on divisions used by earlier workers); a similar effect is obtained for the asteroids using the simpler geographic divisions of: the North Island (with the offshore islands in the North East), the South Island (with Stewart Island), Cook Strait and the Chatham Islands. The fauna of the Subantarctic Islands (Antipodean province, Pawson, 1961) and the Kermadec Islands are considered separately.

Altogether 75 species (54 genera) constitute the asteroid fauna of New Zealand and its outlying islands. Sixty-five* of these (48 genera) are known from New Zealand and 32 species are restricted to these waters—of these 7 species (6 genera) are known only from the North Island; 5 species (5 genera) from the South Island; 2 species (2 genera) from Cook Strait and 3 species (3 genera) are confined to the Chatham Islands; the remaining 15 species are widespread throughout the area. Of the remaining 33 species 6 (6 genera) are present in New Zealand and Australia only, a further 5 (5 genera) are shared with the Indo-Pacific area, 2 species (2

* This includes all species listed in the check-list except *Asterina novaezelandiae* Perrier, which is doubtfully valid.



genera) are common to New Zealand, Australia and South Africa and a further 3 are widespread in the Southern Hemisphere including South America. New Zealand shares at least 5 species (5 genera) with the Kermadecs (4 of these are also present in Australia) and at least 10 species (6 genera) are shared with the Subantarctic islands. Both Japan and Hawaii share one species each with New Zealand. Two genera of the exclusively deepwater family Porcellanasteridae present in New Zealand waters are also found in Antarctica (the species are widespread in the Southern Hemisphere and are included in this category above) while at least 8 genera from different families in varying depths have close relatives in Antarctica.

The main affinities then, of the New Zealand asteroid fauna are with the Australian Indo-Pacific regions in the north but there is also an Antarctic element especially in abyssal forms. It seems doubtful whether the East Cape area of the North Island forms as efficient a barrier for asteroids as it does for the echinoids (Baker, 1968), for of 23 species (18 genera) known from the Bay of Plenty-Hauraki Gulf region only 5 are confined to this area, the rest have a scattered distribution in New Zealand waters and some are more widespread.

An interesting feature is the presence in New Zealand of members of the predominantly tropical family Brisingidae. Fell (1958) described *Brisingenes delli* from the Bay of Plenty, and later species include *Brisinga tasmani* n. sp., *Astrolirus* (or *Stegnobrisinga*)—both from the Bay of Plenty area and—*Craterobrisinga* from the Chatham Islands. Also of interest is the occurrence in New Zealand waters of members of the family Porcellanasteridae which Fell (1959) predicted.

Of the 64 New Zealand species included (*Calvasterias laevigata* is omitted through lack of data) 14 are confined to abyssal areas in depths over 555 m., 6 are present in the archibenthal regions in depths from 185-555 m. and 13 are known from the shore down to 185 m. A further 15 have a wide depth tolerance from shore to abyssal regions, 9 range from the shore down to archibenthal depths and 6 are shared between archibenthal and abyssal depths.

The Subantarctic islands (excluding Macquarie Island which is separated by deeper water) have a small known asteroid fauna (possibly due to insufficient collecting) with only 12 species (8 genera) present. Only one species, shallow water *Asterodon robustus* Fell is restricted to these islands, the rest are shared with the New Zealand-Chatham complex.

Sixteen species (15 genera) are known from the Kermadec Islands to the north of New Zealand. At least 9 of these are shallow water and confined to the area, and one species has a close relative in New Zealand. The remaining species are shared with Australia and New Zealand and (2 species) with Africa also; one species is also known from the Indo-Pacific area.

CHECKLIST OF NEW ZEALAND ASTEROIDS

* new records for either region or depth.

** bathymetric range within New Zealand waters only (in metres) genera or species new to fauna underlined.

Genus & Species	Depth	North Isl.	Cook Str.	South Isl.	Chatham Isl.	Elsewhere
FAMILY LUIDIIDAE						
<i>Luidia neozelandica</i> Mrtsn.	64-555 m.	X		X	X	
<i>L. varia</i> Mrtsn.	55-64	X				
FAMILY ASTROPECTINIDAE						
<i>Astropecten polyacanthus</i> M. & Tr.	0-185	X	X			S.H.
<i>A. dubiosus</i> Mrtsn.	74-555	X				

Genus & Species	Depth	North Isl.	Cook Str.	South Isl.	Chatham Isl.	Elsewhere
<i>A. primigenius</i> Mrtsn.	55-555	X	X	X	X	
<i>Dipsacaster magnificus</i> (H. L. Clark)	101-555		X		X	A.
<i>Plutonaster fragilis</i> n.sp.	1647-1693			X		
<i>P. knoxi</i> Fell	111-1000		X		X	
<i>Proserpinaster neozelanicus</i> (Mrtsn.)	92-1693*			X	X	
<i>Psilaster acuminatus</i> Sladen	37-1757	X	X	X	X	A; S.Af.
FAMILY PORCELLANASTERIDAE						
<i>Porcellanaster caeruleus</i> Wyv. Th.	1647-4868			X		S.H.
<i>Eremicaster</i> sp.	2104-2470			X		S.H.
<i>Stryracaster horridus</i> Sladden	2104-2470			X		I.P.
FAMILY BENTHOPECTINIDAE						
<i>Benthopecten munidae</i> H. E. S. Clark	740			X		
<i>B. pentacanthus</i> Fell	555-1850	X				
<i>B. pikei</i> H. E. S. Clark	550-630	X				
<i>B. pikei</i> var. <i>australis</i> H. E. S. Clark	1647-1693			X		
<i>Benthopecten</i> spp. McKnight	203-872				X	
<i>Cheiraster richardsoni</i> Fell	555-1850		X			
<i>Pectinaster mimicus</i> Sladen	1647-1693			X		I.P.
FAMILY ODONTASTERICAE						
<i>Odontaster benhami</i> (Mrtsn.)	37-555		X	X	X	
<i>Asterodon dilatatus</i> (Perrier)	3-100	X	X	X		S. Ant.
<i>A. miliaris</i> (Gray)	92	X	X	X	?X	
<i>Eurygonias hylacanthus</i> Farquhar	3-37	X	X	X		
FAMILY GONIASTERIDAE						
<i>Anthenoides granulatus</i> Fisher	185-555	X				I.P.
<i>Hippasteria trajona</i> Fell	185-693			X	X	
<i>Mediaster sladeni</i> Benham	74-821		X	X	X	?A; ?S.Af.
<i>Mediaster</i> sp.	908-915			X		
<i>Nectria pedicelligera</i> Mrtsn.	3-100	X				
<i>Pentagonaster pulchellus</i> Gray	2-555	X	X	X	X	A.
<i>Pseudarchaster abernethyi</i> Fell	101-167	X	X			
<i>P. garricki</i> Fell	165-1017		X			
FAMILY OREASTERIDAE						
<i>Asterodiscus truncatus</i> Coleman	53-400	X				A, K.

Genus & Species	Depth	North Isl.	Cook Str.	South Isl.	Chatham Isl.	Elsewhere
FAMILY OPHIDIASTERIDAE						
<i>Ophidiaster kermadecensis</i> Benham	3-55	X				K.
<i>O. macknighti</i> H. E. S. Clark	155-207	X				
FAMILY SOLASTERIDAE						
<i>Crossaster japonicus</i> (Fisher)	92-1850		X		X	J.
<i>Paralophaster hyalinus</i> H. E. S. Clark (in press)	384			X		
FAMILY KORETHRUSTERIDAE						
<i>Peribolaster lictor</i> Fell	185-1108			X	X	
FAMILY PTERASTERIDAE						
<i>Pteraster bahamae</i> Fell	220-1850		*X	X		
FAMILY ASTERINIDAE						
<i>Asterina aucklandensis</i> Koehler	0-100	X	X	X		S. Ant.
<i>Asterina novaezelandiae</i> Perrier*						
<i>Patriella regularis</i> (Verrill)	0-28	X	X	X	X	A; K.
<i>Stegnaster inflatus</i> (Hutton)	0-20	X	X	X	?X	
FAMILY ECHINASTERIDAE						
<i>Echinaster farquhari</i> Benham	74-711		X	X	X	
<i>Henricia aucklandiae</i> Mrtsn.	0-755			X	X	S. Ant.
<i>H. compacta</i> Sladen	185-555			X		?A.
<i>H. lukinsii</i> (Farquhar)	144-1000			X	X	S. Ant.
<i>H. ralphae</i> Fell	74			X		S. Ant.
<i>Henricia</i> sp.	908-915			X		
FAMILY ZOROASTERIDAE						
<i>Zoroaster spinulosus</i> Fisher**	371-1030	X		X	X	H.
FAMILY ASTERIIDAE						
<i>Allostichaster insignis</i> (Farquhar)	0-238		X	X	X	S. Ant.
<i>A. polyplax</i> M. & Tr.	0-238	X	X	X	X	A; K.
<i>Astrostole scabra</i> (Hutton)	0-200	X	X	X	X	A.
<i>Calvasterias laevigata</i> (Hutton)	?				?X	S. Ant.
<i>C. suteri</i> (de Loriol)	0-200			X	X	S. Ant.
<i>Coscinasterias calamaria</i> (Gray)	0-40	X	X	X	X	A; S.Af; K.
<i>Cosmasterias dyscrita</i> H. L. Clark	240-549	X			X	A.
<i>Pseudechinaster rubens</i> H. E. S. Clark	102-402			X	X	
<i>Sclerasterias mollis</i> (Hutton)	37-697	X	X	X	X	S. Ant.

* *A. novaezelandiae* Perrier, data not given for this species as its validity is doubtful.

** *Z. spinulosus* Fisher, unrecorded localities for this species include Porto Bello in the south and a specimen from the Bay of Plenty in the Dominion Museum.

Genus & Species	Depth	North Isl.	Cook Str.	South Isl.	Chatham Isl.	Elsewhere
<i>Stichaster australis</i> (Verrill)	0-555	X	X	X	?X	S. Ant.; K.
<i>Stylasterias reticulata</i> (H. L. Clark)	128-421	X				A.
<i>Coronaster</i> sp.	244-397	X				
FAMILY BRISINGIDAE						
<i>Brisinga tasmani</i> n.sp.	908-2470	X		X		
<i>Astrolirus</i> or <i>Stegnobrisinga</i> sp. (arms only)	2104-2470	X		X		I.P.
<i>Astrostephane moluccana</i> (Fisher)	2470-915					I.P.
<i>Craterobrisinga</i> sp. McKnight	908-399				X	
<i>Novodinia novaezelandiae</i> (H. E. S. Clark)	549-690				X	

CHECKLIST OF KERMADEC ISLAND ASTEROIDS

Genus and Species	Depth	Kermadec Isl.	N.Z.	Australia	Elsewhere
FAMILY ASTROPECTINIDAE					
<i>Astropecten polyacanthus</i> M. & Tr.	0-185 m.	X	X	X	S.H.
FAMILY OREASTERIDAE					
<i>Asterodiscus truncatus</i> Coleman	53-400	X	X	X	
FAMILY OPHIDIASTERIDAE					
<i>Ophidiaster kermadecensis</i> Benham	3-55	X	X		
FAMILY SOLASTERIDAE					
<i>Solaster torulatus</i> Sladen	962	X			
FAMILY ASTERINIDAE					
<i>Patriella oliveri</i> (Benham)	0-35	X			
<i>P. regularis</i> (Verrill)	0-28	X	X	?X	
FAMILY PORANIIDAE					
<i>Asteropsis carinifera</i> Lam. (? <i>A. lissotergum</i> Benham)	0-5			?X	
<i>Petricia imperialis</i> (Farquhar)	0-20	X			
<i>Marginaster</i> sp.	0-30	X			
FAMILY ECHINASTERIDAE					
<i>Henricia sufflata</i> (Sladen)	962	X			
FAMILY ASTERIIDAE					
<i>Astrostole rodolphi</i> (Perrier)	0-30	X			
<i>Distolasterias edmondi</i> (Benham)	0-30	X			
<i>Allostichaster polyplax</i> M. & Tr.	0-238	X	X	X	A.
<i>Coscinasterias calamaria</i> (Gray)	0-40	X	X	X	S.Af.
<i>Stichaster australis</i> (Verrill)	0-555	X	X		
FAMILY BRISINGIDAE					
<i>Freyellaster polycnema</i> (Sladen)	1110	X			

CHECKLIST OF SUBANTARCTIC ASTEROIDS

Genus and Species	Depth	Snares Isl.	Auck- land Isl.	Camp- bell Isl.	Bounty Isl.	Anti- podes Isl.	N.Z.	Else- where
FAMILY								
ODONTASTERIDAE								
<i>Asterodon dilatatus</i> (Perrier)	3- 100	X					X	
<i>A. robustus</i> Fell	0- 20		X					
FAMILY								
ASTERINIDAE								
<i>Asterina aucklandensis</i> Koehler	0- 100		X	X			X	
FAMILY								
ECHINASTERIDAE								
<i>Henricia aucklandiae</i> Mrtsn.	0- 755	X	X	X		X	X	
<i>H. lukinsii</i> (Farquhar)	144- 1000	X	X	X			X	
<i>H. ralphae</i> Fell	74	X	X				X	
FAMILY								
ASTERIIDAE								
<i>Allostichaster insignis</i> (Farquhar)	0- 238	X	X				X	
<i>Calvasterias laevigata</i> (Hutton)	?		X	X		X	?Chathams	
<i>C. suteri</i> (de Loriol)	0- 28	X	X	X			X	
<i>Coscinasterias calamaria</i> (Gray)	0- 40	X					X	
<i>Stichaster australis</i> (Verrill)	0- 555	X					X	
<i>Sclerasterias mollis</i> (Hutton)	37- 697	X					X	

KEY TO CODE USED IN CHECKLISTS

A.	=	Australia
Af.	=	Africa
H.	=	Hawaii
I.P.	=	Indo-Pacific
J.	=	Japan
K.	=	Kermadec Islands
S.Af.	=	South Africa
S.Ant.	=	Subantarctic Island
W.Af.	=	West Africa

HISTORICAL REVIEW

The following is a brief account of literature dealing with New Zealand starfish; it deals firstly with New Zealand as a whole, then with the Chatham Islands, the Subantarctic Islands (excluding Macquarie) and lastly with the Kermadec Islands. Scientific names in current use are given in brackets.

Gray (1847) is often regarded as having described the first sea-star *Astrogonium miliare* (*Asterodon miliaris*) from New Zealand waters, however, Muller and Troschel (1842, p. 55) had already described *Astrogonium pulchellum* (*Pentagonaster pulchellus*) from New Zealand. Ayres (1851) described the same species again under the name *Stephanaster elegans*. These were the only species recorded from New Zealand until Verrill (1867) described 4 new sea stars from Auckland: *Coelasterias australis* (*Stichaster australis*), *Coscinasterias muricata* (*Coscinasterias calamaria*), *Asterina regularis* (*Patiriella regularis*), and *Astropecten edwardsi* (*Astropecten polyacanthus*).

Hutton (1872) described 12 species of asteroids, of these *Asterias mollis* (*Sclerasterias mollis*), *Margaraster ?scaber* (*Astrostole scabra*) and *Pteraster inflatus* (*Stegnaster inflatus*) were new; 3 further species were recorded as new to the New Zealand fauna—the first turned out to be *Astropecten polyacanthus* (already known), the second was probably *Henricia compacta* and the third *Astrogonium rugosum* appears to have been a nomen nudum. By 1878, Hutton had added several further species to the fauna.

The "Challenger" occupied several stations in New Zealand waters but asteroids were taken from only 3 stations in the vicinity of Cook Strait and Sladen (1889) recorded as new *Cribrella compacta* (*Henricia compacta*) and *Psilaster acuminatus*.

From 1889 to about 1909 Farquhar added substantially to the New Zealand asteroid fauna in a number of papers. Among new species which Farquhar (1895) described were *Stichaster insignis* (*Allostichaster insignis*), *Tarsaster neozelanicus* (which he later (1909) recognised as being synonymous with *Stichaster polyplax* (*Allostichaster polyplax*)) and *Stichaster littoralis* (*Calvasterias suteri*). Farquhar (1898, a) listed 28 species of starfish from New Zealand waters but many of these have now been reduced to synonymy and he also (1913) described one of the most handsome of all New Zealand starfish, *Eurygonias hylacanthus*.

In the meantime, specimens collected by the New Zealand Government Trawling Expedition of 1907 were described by Benham (1909, a); new species included *Mediaster sladeni*, *Echinaster farquhari* and *Luidia* sp. Koehler (1911) described *Goniodon augustus* (*Asterodon dilatatus*).

Mortensen (1925) listed 29 species of asteroids from New Zealand (this does not include species from the deep sea or the Kermadecs); he described 6 new species—*Astropecten dubiosus*, *A. primigenius*, *Luidia varia*, *L. neozelanicus* (the *Luidia* sp. of Benham), *Peridontaster benhami* (*Odontaster benhami*), *Nectria pedicelligera*, *Persephonaster neozelanicus* (*Proserpinaster neozelanicus*) and a new variety of *Henricia*, *H. compacta* var. *aucklandiae*. *Ophidiaster kermadecensis* is recorded as new to the New Zealand fauna. It is interesting to note that the Index Faunae Novae Zealandiae (Hutton, 1904) recorded 31 species of starfish but the number is reduced to 18 when the Kermadec Island and deep sea species are omitted.

Between about 1925 and 1947 few papers on New Zealand asteroids appeared although Bennett published two papers: on autotomous reproduction in some asteroids (1927) and on some rare New Zealand echinoderms (1928); the latter paper included remarks on *Ophidiaster kermadecensis*.

Fell published a large number of papers between 1952 and 1963 and earlier (1947) he published a key to the litoral asteroids of New Zealand, later papers include an account of species from Southern New Zealand (1952) based on material collected by the "New Golden Hind" Expedition (1946), the "Alert" (1950) and the "Discovery" II (also 1950) expeditions: this material included a new species *H. ralphae*. Fell's 1958 paper on the deep-sea echinoderms of New Zealand included 9 new species of asteroids: *Plutonaster knoxi*, *Benthopecten pentacanthus*, *Cheiraster richardsoni*, *Pseudarchaster garricki*, *P. abernethyi*, *Hippasteria trojana*, *Pteraster bathami*, *Peribolaster lictor*, *Brisingenens delli* (*Astrostephane moluccana*) and a new variety of *Allostichaster insignis*. In 1959 Fell published a key to the starfish of New Zealand and (1962) a popular account of sea stars; he also published 2 papers on fossil asteroids (1952, 1956).

Other later papers include a description of new species of both *Odinia* and *Ophidiaster* (H. E. S. Clark, 1962 b) and a new genus and species, *Pseudechinaster rubens* (H. E. S. Clark, 1962 a). Two further species of *Benthopecten* are also described (H. E. S. Clark, in press). The New Zealand Oceanographic Institute has trawled extensively around the coasts of New Zealand in recent years and the asteroids are recorded in a series of papers by McKnight (in press).

The asteroid fauna of the Chatham Islands was described by Young (1929) but many of the specimens he lists have not been taken since. More recent papers include that by Fell (1960) which lists no new species but describes a number of species new to the fauna; McKnight (1967) adds considerably to the fauna and records a species of *Craterobrisinga*.

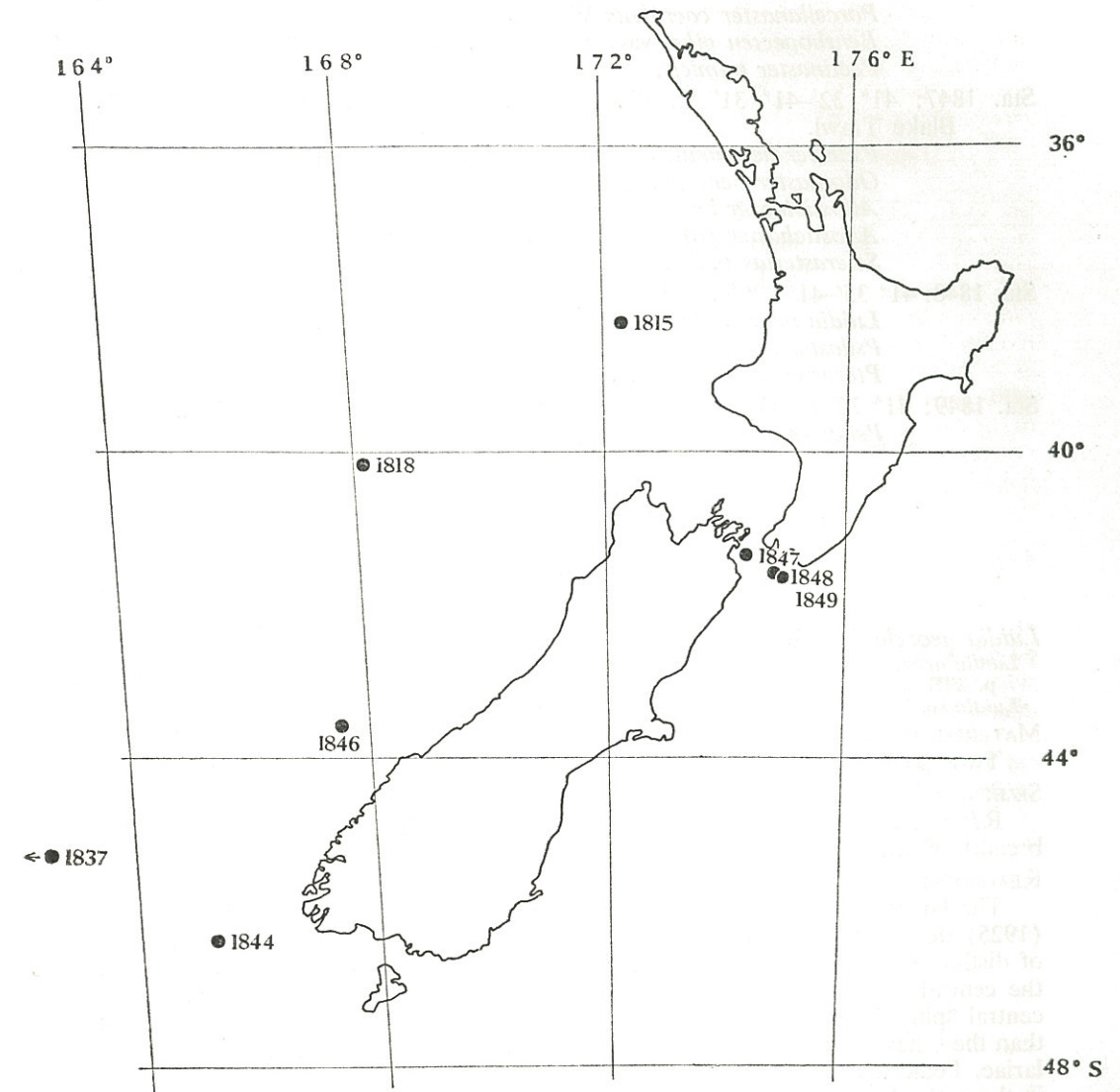
Probably the first record of an asteroid from the Subantarctic Islands is that recorded by Filhol (1874) who recorded a species of *Henricia* taken by the Transit of Venus Expedition from Campbell Island. Hutton (1879) recorded *Asterias rupicola* Verrill var. *laerigata* (*Calvasterias laevigata*) from the Auckland Islands and also described 2 species of *Henricia*, one from the Auckland and the other from the Snares Islands. Later Benham (1909 b) recorded several species from the Subantarctic Islands—including *Asterina fimbriata* (transferred to *A. aucklandensis* Koehler (1920, p. 135)) from the Auckland Islands and a species of *Henricia* found at both Campbell and Masked Islands. Mortensen (1925) added considerably to the knowledge of the Subantarctic Islands and included several species of *Henricia*, both species of *Calvasterias* and *Allostichaster insignis*, for the first time from the Auckland Islands. Fell (1953) recorded *Asterodon dilatatus* and *Stichaster australis* from the Snares and *A. robustus* from the Auckland Islands. Dawson (1965) gave the total number of asteroid species from the New Zealand Subantarctic region as 60. However, Dawson does not list names and consequently the Subantarctic records given here cannot be checked against his publication.

The checklist for the Kermadec Islands posed problems for the fauna is poorly known and little reported on. Sladen (1889) recorded several species of asteroids: *Solaster torulatus*, *Cribrella sufflata* (*Henricia sufflata*) and *Freyella polycnema* (*Freyellaster polycnema*). Farquhar (1907) mentions 2 species, *Asteropsis imperialis* (?*Petricia imperialis*) and *Asterias rodolphi* (*Astrostele rodolphi*). Benham (1910) mentioned 9 species including *Astropecten polyacanthus*, *Gymnasteria lissotergum* (?*Asteropsis carinifera*), *Asterina oliveri* (*Patiriella oliveri*), *Ophidiaster kermadecensis* and *Asterias edmondi* (?*Distolasterias edmondi*), the last 4 are all new species. Pawson (1965) listed a number of species from the Kermadecs including *Asterodiscus truncatus*, *Patiriella regularis*, *Allostichaster polyplax*, *Stichaster australis* and *Coscinasterias calamaria*.

Finally McKnight (1968) included a species of *Marginaster*, among others, from the Kermadec Islands.

STATION LIST: "ELTANIN" CRUISE 26, 1966

- Sta. 1815: 38° 43' S., 172° 36'–172° 37' E.; Nov. 30; 167–421 m.; 5' Blake Trawl.
Luidia neozelanica Mrtsn. (1)
Stylasterias reticulata (H. L. Clark) (5(5+6 arms))
- Sta. 1818: 40° 15'–40° 17' S., 168° 16'–168° 18' E.; Dec. 2; 908–915 m.; 10' Blake Trawl.
Mediaster sp. (1)
Crossaster japonicus (Fisher) (1)
Henricia sp. (1)
Brisinga tasmani H. E. S. Clark (1 disc, fragments of 12 arms)
Astrostephane moluccana (Fisher) (fragments of about 12 arms)
- Sta. 1837: 45° 38'–45° 44' S., 160° 12'–160° 09' E.; Dec. 11; 4804–4868 m., 5' Blake Trawl.
Trawl.
Porcellanaster caeruleus Wyville Thomson (2)



Map of New Zealand showing stations from which asteroids were obtained during cruise 26 of the "Eltanin" 1966.

- Sta. 1844: 46° 40'–46° 44' S.; 165° 18' E.; Dec. 15; 2104–2470 m.; 5' Blake Trawl.
Porcellanaster caeruleus Wyville Thomson (1)
Eremicaster sp. (1)
Styracaster horridus Sladen (1)
Brisinga tasmani n. sp. (1 arm)
Stegnobrisinga or *Astrolirus* (fragments of 5 arms)
- Sta. 1846: 43° 54'–43° 48' S., 167° 43'–167° 46' E.; Dec. 17; 1647–1693 m.; 5' Blake Trawl.
Proserpinaster neozelanicus (Mrtsn.) (1)
Plutonaster fragilis n. sp. (42)

- Porcellanaster caeruleus* Wyville Thomson (3)
Benthopecten pikei var. *australis* var. nov. (2)
Pectinaster mimicus (Sladen) (8)
- Sta. 1847: 41° 32'–41° 31' S., 174° 34'–174° 32' E.; Dec. 19; 192–238 m.; 5' Blake Trawl.
Psilaster acuminatus Sladen (3)
Odontaster benhami (Mrtsn.) (1)
Allostichaster insignis (Farquhar) (1)
Allostichaster polyplax (Müller & Troschel) (1)
Sclerasterias mollis (Hutton) (6)
- Sta. 1848: 41° 35'–41° 32' S., 175° 00' E.; Dec. 19–20; 220–490m.; 10' Blake Trawl.
Luidia neozelanica Mrtsn. (1)
Psilaster acuminatus Sladen (27)
Pteraster bathamae Fell (1)
- Sta. 1849: 41° 36' S., 175° 02'–175° 04' E.; Dec. 20; 311–403 m.; 5' Blake Trawl.
Psilaster acuminatus Sladen (2)

SYSTEMATICS

Order Platyasterida Spencer, 1951

Family LUIDIIDAE Verrill, 1899

LUIDIA Forbes, 1839

Luidia neozelanica Mortensen (Fig. 1, a, b)*Luidia neozelanica* Mortensen, 1925, p. 278, pl. 12, fig. 5; Fell, 1958, p. 6; McKnight, 1967, p. 297.*Luidia* sp. Benham, 1909 (a), p. 6, pl. 10, figs. 4, 5.

MATERIAL EXAMINED:

Two specimens, St. 1815 (1), 1848 (1).

SIZE:

R/r = 132/15 mm., breadth of arm at base 12 mm. (Sta. 1848); R/r = 20/3 mm., breadth of arm at base 4 mm. (Sta. 1815).

REMARKS:

The larger of the two specimens in this collection agrees well with Mortensen's (1925) description of the type; an interesting feature is the presence on the disc of distinct valvate pedicellariae (fig. a) formed by the enlarged heads of 2 or 3 of the central paxillar spines. Mortensen (1925, p. 279) mentions that "one of the central spines" (of the disc paxillae) "may be slightly elongated and more robust than the others"; this is carried a step further here where they form distinct pedicellariae. Pedicellariae of this type are not present in the slightly smaller specimen in the author's own collection. The mouth in this large specimen is full of ophiuroid plates.

The smaller specimen, damaged, almost certainly belongs in this species. It shows several interesting features: the abactinal paxillar spines (fig. b), one or 2 of which may be central and slightly enlarged, are semitransparent, flattened, and markedly spiny; there are generally only 2 inferomarginal spines, the upper spine alternating in position as in larger specimens and only 2 or 3 actinal plates are present interradially, each with one or two slender spines and no pedicellariae. It seems probable that Benham's (1909 (a), p. 6) small specimen, from off Cape Runaway, belongs in this species also.

COLOUR:

Larger specimen — brownish; smaller — pink-brown abactinally, white actinally.

GEOGRAPHICAL DISTRIBUTION:

North Island of New Zealand south to Marlborough, also the Chathams.

DEPTH RANGE:

55–490 m.

TYPE LOCALITY:

? Hauraki Gulf or ? Bay of Plenty; 64–101 m.

LOCATION OF TYPE:

Dominion Museum, Wellington New Zealand (Ech. 1043, arm only).

Order PAXILLOSIDA Perrier, 1884

Suborder DIPLOZONINA Spencer and Wright, 1966

Family ASTROPECTINIDAE Gray, 1840

Subfamily ASTROPECTININAE Gray, 1840

PROSERPINASTER Fell, 1963

Proserpinaster neozelanicus (Mortensen)*Persephonaster neozelanicus* Mortensen, 1925, p. 415, fig. 70; Fell, 1952, p. 6; —, 1959, p. 131, fig. 5; —, 1960, p. 61.*Proserpinaster neozelanicus* Fell, 1963 (a), p. 142; —, 1963 (b), p. 385, fig. 2.*Proserpinaster neozelanicus* McKnight, 1967, pp. 292, 298.

MATERIAL EXAMINED:

One specimen, Sta. 1846.

SIZE:

R/r = 123/30 mm.

REMARKS:

The present specimen agrees well with previous descriptions.

Small specimens of this species could possibly be confused with *Psilaster acuminatus* Sladen, especially when superomarginal spines are present in the latter; probably they can best be distinguished by the abactinal paxillae which are brush-like in *Proserpinaster* and distinctly granular in *Psilaster acuminatus*.

Fell (1963, p. 142) proposed a new genus *Proserpinaster*, on the basis of the broadened interradial inferomarginal plates which are separated by fascioles, to receive the present species and three other Indonesian species.

COLOUR:

Bright pink.

GEOGRAPHICAL DISTRIBUTION:

Known only from New Zealand and the Chatham Islands.

DEPTH RANGE:

92–518 m.

TYPE LOCALITY:

Unknown.

LOCATION OF TYPE:

Dominion Museum, Wellington, New Zealand. (Ech. 194).

PSILASTER Sladen, 1885

Psilaster acuminatus Sladen*Psilaster acuminatus* Sladen, 1889, p. 225, pl. 40, figs. 1, 2, pl. 42, figs. 7, 8; Clark, H. L., 1916, p. 32; —, 1923, p. 248; Mortensen, 1925, p. 274; Fell, 1958, p. 4; —, 1959, p. 131, fig. 13; McKnight, 1967, pp. 292, 298.

MATERIAL EXAMINED:

32 specimens, St. 1847 (3); 1848 (27); 1849 (2).

SIZE:

R = 70–31 mm., average 49 mm.; r = 12–6 mm., average 10 mm.

REMARKS:

This species has been well described previously. Sladen (1889, p. 227) records some specimens in which superomarginal spines are present for a short distance

along the arms; subsequent authors do not mention this. Of the 32 specimens in this collection, 14 (R/r averaging 47/10 mm.) are without any trace of superomarginal spines; 12 specimens (R/r averaging 52/11 mm.), have occasional, isolated superomarginal spines and 6 specimens (R/r averaging 52/11 mm. also), have an almost continuous row of small distinct superomarginal spines midway along the arms but these are absent proximally from the first 7-9 plates and distally near the arm tips. In other specimens examined by the author, superomarginal spines were present occasionally. Otherwise the specimens agree well with previous descriptions although as Mortensen (1925, p. 275) notes, Sladen's description of the inferomarginal plates is misleading. At least 6 specimens in the present collection, have regenerating arm tips.

COLOUR:

Dark pink to orange-pink abactinally, regenerating arm tips white; marginal plates yellow or pinkish-white, actinal surface creamy yellow and tube feet delicate pink.

GEOGRAPHICAL DISTRIBUTION:

New Zealand, Australia and ? South Africa (Australian and South African specimens are not available to the author for comparison, but from H. L. Clark's (1923, p. 248) description of South African material, there are differences).

DEPTH RANGE:

35-1757 m.

TYPE LOCALITY:

"Challenger" Sta. 167, 39° 32' S., 171° 48' E., north-west of Port Hardy, New Zealand; 277 m.

LOCATION OF TYPE:

British Museum (Nat. Hist.).

PLUTONASTER Sladen, 1885

Plutonaster fragilis n.sp. (Fig. 1, c, d; Pl. 1, a, b).

MATERIAL EXAMINED:

42 specimens, Sta. 1846.

SIZE:

R=98-66 mm., average 82 mm.; r=32-20 mm., average 26 mm.

DESCRIPTION:

Description based on specimen with R/r=75/22 mm.

Disc large, compressed dorso-ventrally; arms short, tapering evenly to sharp tip protected by saddle-shaped plate.

Abactinal paxillae small, crowded, without regular arrangement except near arm edges where they form transverse rows. Plates oval or faintly lobed, paxillar trunk short with broad expanded head bearing from 10 (near arm margin) to 25 fine rugose spinelets. Occasional inconspicuous pedicellariae, formed by enlarged tips of 3 or 4 paxillar spines, present along arm margins.

Madreporite almost circular, compound, finely dissected, large (about 10 mm.), nearer edge than centre of disc; covering paxillae large, with up to 45 spinelets each.

Supermarginal plates tumid, rectangular, 35 or 36 extending from interradial angle to arm tip, forming distinct border to abactinal surface; plates covered with small spinelets similar to those of abactinal paxillae. Each plate with one, occasionally 2, enlarged, sturdy, tapering, broad-based spines. Plates separated by distinct fascioles lined with thin, blunt-tipped, flattened spines. Inferomarginal plates

corresponding to superomarginals, forming broad edge to actinal surface. Plates separated by deep fascioles and bearing generally one (occasionally 2 proximally) enlarged, broad-based tapering spines. Occasional incipient pedicellariae formed by enlarged and clavate heads of 3 or 4 spines, near superomarginals.

Actinal interradial areas extending for at least half length of each arm, plates in regular longitudinal rows, one plate corresponding to each adambulacral and 2 to each inferomarginal. Each plate (fig. c) with numerous short spines; interradially, generally a single (occasionally near oral plates 2) central, enlarged blunt-tipped spines. Many plates interradially, with distinct pedicellariae (fig. c) formed by enlarged and clavate heads of 3-5 spines.

Adambulacral plates (fig. d) with regular fringe of 9-11 furrow spines; one conspicuous, sturdy subambulacral spine similar to enlarged spines of marginal series, surrounded by number of smaller, spaced spines. Occasional incipient pedicellariae present on outer edge of plates adjacent to actinals.

Oral plates with 10-12 subequal, slender furrow spines and numerous shorter suboral spines arranged in more or less distinct longitudinal rows.

Ambulacral grooves deep, tube feet biserial without distinct sucking discs.

VARIATIONS:

Unfortunately much of the remaining material is damaged as the specimens deteriorate very quickly out of water. Most variation seems to occur in the number of actinal and inferomarginal pedicellariae which are always present but which may be few or numerous irrespective of the animals' size.

REMARKS:

This new species is characterised by the large number of adambulacral and oral furrow spines and by the presence of abactinal, inferomarginal and actinal pedicellariae (it appears to be the only known species with inferomarginal pedicellariae). *P. knoxi* Fell from the Chatham Islands is similar but can be distinguished by its rather smaller disc, longer and more slender arms, fewer adambulacral furrow spines (7 or 8) and the lack of pedicellariae. The present species is similar to the North Atlantic *P. bifrons* Wyville Thomson but the presence of pedicellariae is distinctive; it can be distinguished from *P. abyssicola* Ludwig (Gulf of Panama) by the more numerous spines of the abactinal paxillae and the presence of generally only one inferomarginal spine.

COLOUR:

Disc centre white to pale yellow with orange or yellow arms; paxillae covering madreporite lighter than those adjacent; marginal plates orange, spines white. Actinal surface pale orange or yellow, always darker near edge; tube feet and actinostomial membrane orange.

GEOGRAPHICAL DISTRIBUTION:

Known only from the type locality, off the West coast of the South Island, New Zealand.

DEPTH RANGE:

1647-1693 m.

TYPE LOCALITY:

"Eltanin" Sta. 1846, 43° 54'-43° 48' S., 167° 43'-167° 46' E., off West Coast of South Island, New Zealand; 1647-1693 m.

LOCATION OF TYPE:

United States National Museum.

Suborder CRIBELLINA Fisher, 1911
 Family PORCELLANASTERIDAE Sladen, 1883
Porcellanaster Wyville Thomson, 1877

Porcellanaster caeruleus Wyville Thomson (Pl. 1, c-f).

Porcellanaster caeruleus Wyville Thomson, 1877, p. 378, figs. 97, 98.
Porcellanaster caeruleus Sladen, 1889, p. 134, pl. 20, figs. 1-7, pl. 20A, figs. 1-10; Clark, H. L., 1923, p. 239; Madsen, 1961, p. 126, figs. 22-24.

MATERIAL EXAMINED:

6 specimens, Sta. 1837 (2); 1844 (1); 1846 (3).

SIZE:

R=18-5 mm., average 11 mm.; r=6-2 mm., average 4 mm.

REMARKS:

The present specimens show considerable variation; however, these come within the limits described previously (Madsen, 1961). In several small specimens the apical appendage is well developed and paved with small overlapping porous plates; in the 3 larger specimens (Sta. 1846, R=18-13 mm.) it is inconspicuous. The supermarginals of all these 3 larger specimens bear distinct spines and the abactinal spines of the disc are well developed and conspicuous in all but the interradial areas; actinally, the interradial areas are paved with plates (in small specimens these areas are naked except for a few, small, scattered, isolated plates near the margins). In one small specimen (Sta. 1837, R/r=7/3 mm.) 3 straight pedicellariae are present abactinally, near the marginal plates in each interradius.

COLOUR:

Blue-grey.

GEOGRAPHICAL DISTRIBUTION:

World-wide, in deeper waters from Greenland to Antarctica.

DEPTH RANGE:

1158-6035 m.

TYPE LOCALITY:

"Challenger" Sta. 45, south-east of New York, 38° 34' N., 72° 10' W.

LOCATION OF TYPE:

British Museum (Nat. Hist.).

EREMICASTER Fisher 1905

? *Eremicaster* sp.

MATERIAL EXAMINED:

One specimen, Sta. 1844.

SIZE:

R/r=11/4 mm.

REMARKS:

This specimen is much damaged, especially actinally, but the presence of 3 cribriform organs in each interradius suggests its inclusion in *Eremicaster*. It is conceivable that damage to the arms in life could result in abnormalities in development of the cribriform organs; if this is so in the present specimen, then it probably belongs in *Porcellanaster*. In each interradius there is one conspicuous, large central cribriform organ which is flanked by a small inconspicuous organ on either side. The latter are more or less V-shaped, with the open part of the V bordering the disc and the organs scarcely reach the inferomarginals. The abactinal surface, especially near the arm bases, is paved by pitted embryonic plates; centrally on the disc and extending interradially there are small, round or oval, isolated, tumid, conspicuous plates superimposed on the pitted plates which bear short spines inter-

radially. Distally, the one intact arm tip is protected by a saddle-shaped plate with 3 broken spines.

COLOUR:

Blue-gray.

GEOGRAPHICAL DISTRIBUTION:

World-wide including Antarctica but as yet not known from north of 60° N.

DEPTH RANGE:

750-7245 m.

LOCATION OF SPECIMEN

United States National Museum.

STYRACASTER Sladen 1883

Styracaster horridus Sladen (Fig. 1, e; Pl. 1, g, h)

Styracaster horridus Sladen, 1889, p. 150, pl. 23, figs. 5-7, pl. 27, figs. 17-20; Madsen, 1961, p. 93, text-figs. 12-17, pls. 7, 8.
Chunaster scapanephorus Ludwig, 1907, p. 316; Madsen, 1961, p. 94.

MATERIAL EXAMINED:

One specimen, Sta. 1844.

SIZE:

R/r=44/8 mm.

REMARKS:

The present specimen, although somewhat damaged, agrees well with the type description. The marginals join medially at about the fourth plate and there are 9 or 10 strong spines present to the arm tips; the abactinal paxillae are composed of from 3-7 short spines. Only 7 oral furrow spines are present and although the plates are damaged there appears to have been one suboral spine situated midway along the median suture. Both the adambulacral plates and the actinal plates (fig. e)—the latter with from one to 3 small inconspicuous granules—are similar to those described for the type material.

COLOUR:

Abactinal surface—disc cream, marginal plates and spines white, cribriform organs pale yellow; actinal surface—interradially, grey-blue (probably due to ingested mud) with adambulacral and oral plates white; faint pink ?gonads in 2 interradi. Tube feet and actinostomial ring yellow.

GEOGRAPHICAL DISTRIBUTION:

Northern Hemisphere—Bay of Biscay south to Gulf of Guinea and from the Indian Ocean; south of the equator it has been collected from near Madagascar, Sumatra, the Kermadec Trench and, this report, at 46° S.

DEPTH RANGE:

2470-5610 m.

TYPE LOCALITY:

"Challenger" Sta. 346, 2° 42' S., 14° 41' W., Eastern Atlantic.

LOCATION OF TYPE:

British Museum (Nat. Hist.).

Family: BENTHOPECTINIDAE Verrill, 1894

BENTHOPECTEN Verrill, 1884

Benthopecten pikei H. E. S. Clark var. *australis* var. nov. (Fig. 1, f, g; pl. 1, i, j).

MATERIAL EXAMINED:

2 specimens, "Eltanin" Sta. 1846.

SIZE:

Larger specimen $R/r = -150/20$ mm.; smaller specimen (arms broken) $R/r = -35/5$ mm.

REMARKS:

Both the present specimens differ from *B. pikei* in having more numerous (3-6) spines (fig. f) on the abactinal plates of the disc and from 4-6 small, very thorny spines on the arm plates which give a distinctly "hairy" appearance, especially proximally. In *B. pikei* there are seldom more than three spines on the abactinal plates and these are reduced to one distally; the distinct V-shaped arrangement of abactinal plates seen in *B. pikei* is absent in both the present specimens. In the larger of the 2 specimens discussed here, the enlarged central spines of the disc are more numerous, thicker and almost bulbous when compared with similar spines in *B. pikei*; this difference can probably be attributed to the larger size of the present individual. Another difference is in the unpaired superomarginal plate (fig. f). In the larger specimen there is a single enlarged spine surrounded basally by a half circle of 6 or 7 smaller spines with scattered spinules basally; in *B. pikei* only one unpaired plate bears an enlarged spine (the others may have been lost through injury) and there is no distinct half circle of smaller spines. The curious pectinate pedicellariae shared between the adambulacral and inferomarginal plates (fig. g.) (one such pedicellaria is present in the holotype of *B. pikei*) are very distinct in the larger of the 2 present specimens, especially midway along the arms; these pedicellariae consist of from 4-7 small, slender inferomarginal spines which interlock with similar adambulacral spines; no pedicellariae are present in the smaller specimen.

The smaller specimen lacks a conspicuously enlarged second inferomarginal spine on most of the plates, the adambulacral furrow spines are 6 in number and there are generally only 2 subambulacral spines on any plate; the actinal plates are few with an indication of pedicellariae in 2 interradia only and there are 4 or 5 oral furrow spines.

Both *B. pikei* and the new variety can be distinguished from *B. munidae* H. E. S. Clark (in press) by the fewer oral furrow spines and differences in the armature of the inferomarginal plates.

COLOUR:

Large specimen red, smaller specimen "lighter".

GEOGRAPHICAL DISTRIBUTION:

Known only from "Eltanin" Sta. 1846, $43^{\circ} 54' - 43^{\circ} 48' S.$, $167^{\circ} 43' - 167^{\circ} 46' E.$, off the West Coast of the South Island of New Zealand.

DEPTH RANGE:

1647-1693 m.

LOCALITY:

"Eltanin" Sta. 1846, $43^{\circ} 54' - 43^{\circ} 48' S.$, $167^{\circ} 43' - 167^{\circ} 46' E.$, off the West Coast of the South Island, New Zealand; 1647-1693 m.

LOCATION OF SPECIMEN

United States National Museum.

PECTINASTER Perrier, 1885

Pectinaster mimicus (Sladen) (Pl. 2, a-d).

Pontaster mimicus Sladen, 1889, p. 48, pl. 6, figs. 1, 2, pl. 7, figs. 5, 6.

Pectinaster mimicus Ludwig, 1910, p. 449; Fisher, 1919, p. 182, pl. 49, fig. 1.

MATERIAL EXAMINED:

81 specimens, Sta. 1846.

SIZE:

$R = 68-11$ mm., average 43 mm.; $r = 12-13$ mm., average 7 mm.

REMARKS:

This species has been well described previously and is highly variable as Fisher (1919, p. 183) shows. The present specimens, when compared with 2 specimens of *P. mimicus* (Sladen) from Macassar Straits (U.S. National Museum, 53256) differ in having generally more abundant and stouter pedicellariae, especially abactinally, and in having rather fewer abactinal spines surrounding enlarged central spines; other differences include the more robust and stouter marginal spines and the rather more dense covering of the marginal plates—all these characters are very variable and all degrees are to be seen in the material at hand.

The accompanying table shows the variations observed in 12 specimens:

TABLE: Variations in 12 specimens of *Pectinaster mimicus* (Sladen)

R/r.	Abact. ped.	Intermarg. ped.	Inferom. adamb. ped.	No. adamb. pls. corres. to first 10 inferoms.	No. prox. adamb. furrow sp.	Act. ped.	No. of oral furrow sp.
R/r. 57/11	Abact. ped. v. few	Intermarg. ped. present, mainly inter- radially	Inferom. adamb. ped. present	No. adamb. pls. corres. to first 10 inferoms. 13	No. prox. adamb. furrow sp. 7	Act. ped. many	No. of oral furrow sp. 6-7
55/11	abs.	present, inter- radially	present	15	6	many	7
44/8	pres. mainly along arm margin	abundant first quarter of arm	present	17	6	many	6-7
43/8	occas. pres. near arm margin	present inter- radially	present	16	6	few, large	6-7
44/8	numerous	present inter- radially,	present	16	6-7	few	7
36/6	numerous, conspic. on disc and arms	present inter- radially, large	present	15-16	5-6	many, large	6-7
28/6	abs.	abs.	present	17	6	present	6
30/5	few — disc only	few — inter- radially	present	16	6	few	6
22/4	abs.	few — inter- radially	few	16	5	few	6-7
22/4	abs.	few — inter- radially	present	15	6	many	6
44/8	pres. conspic.	present	few	15	6	present	9
12/3	abs.	abs.	present	14	5	present few	6

This table is interesting when compared with that given by Fisher (1919, p. 183) as both the number of proximal adambulacral furrow spines and the number of adambulacral plates corresponding to the first 10 inferomarginals seem more stable in the present material.

Several specimens in the present collection are of particular interest. In one specimen, $R/r=34/7$ mm. the enlarged central spines of the abactinal paxillae are missing from all but a few paxillae; abactinal pedicellariae are numerous, especially centrally on the disc; between the 2 most proximal superomarginals there is a single, large, pectinate pedicellaria and indications in several interradial flanking pedicellariae; similar pedicellariae may be present between the inferomarginal plates, and occasionally indistinct pedicellariae are present between the supero—and inferomarginal series; actinal pedicellariae are few and indistinct and none is present between the inferomarginals and adambulacrals; there are 5–7 adambulacral furrow spines, one enlarged subambulacral spine and the oral plates have a furrow series of 7 or 8 spines.

In another specimen, R/r about $45/8$ mm., the enlarged subambulacral spine is very sturdy and slightly recurved towards the arm tip; it is accompanied by a second slightly shorter and finer, but similarly recurved, spine.

Small specimens ($R=25$ mm. or less) appear distinctly "hairy" abactinally, as the enlarged central spines of the abactinal paxillae are particularly long, especially near the papulae; abactinal and intermarginal pedicellariae are often absent. In one specimen, $R/r=24/4$ mm., one arm is forked, probably due to an injury, the fork beginning about one quarter of the way from the base of the arm and the ambulacral groove also forks.

Ten specimens were dissected; in all the gonads were interradial in position and well developed; in one specimen (R about 60 mm.) a branching copepod was present overlying the ambulacral plates and extending from the mouth well into the base of one arm; this arm was slightly broader and disfigured.

COLOUR:

Abactinal surface ranges from pale pink ($R=25$ mm. or less) to darker pink, papularia cream or white; actinal surface dark pink, tube feet yellow–orange, actinostomial membrane grey–yellow.

GEOGRAPHICAL DISTRIBUTION

Known from the Philippines and Indonesian area and possibly also from the Laccadive Sea and, this report, off the West Coast of the South Island of New Zealand.

DEPTH RANGE:

692–1693 m.

TYPE LOCALITY:

"Challenger" Sta. 191, $5^{\circ} 41' S.$, $134^{\circ} 04' 30'' E.$, Arafura Sea.

LOCATION OF TYPE:

British Museum (Nat. Hist.).

Order VALVATIDA PERRIER, 1884

Suborder GRANULOSINA Perrier, 1894

Family ODONTASTERIDAE Verrill, 1889

ODONTASTER Verrill, 1880

Odontaster benhami (Mortensen).

Odontaster grayi Benham, 1909, p. 7.

Peridontaster Benhami Mortensen, 1925, p. 288, text fig. 8, pl. 12, figs. 12, 13.

Odontaster benhami Fell, 1958, p. 7; McKnight, 1967, p. 299.

MATERIAL EXAMINED:

One specimen, Sta. 1847.

SIZE:

$R/r=19/9$ m.

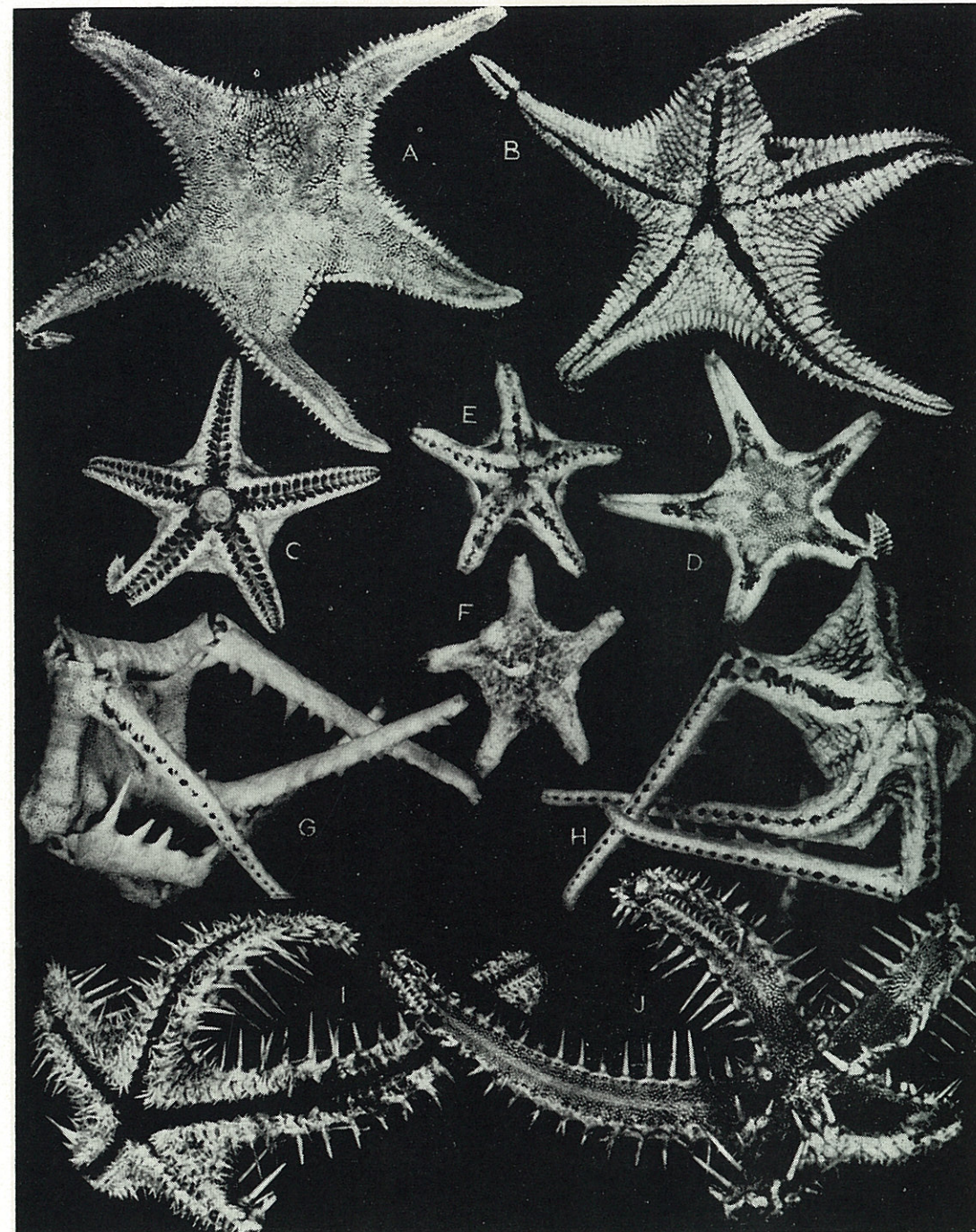


PLATE I:

Plutonaster fragilis n. sp. A, abactinal and B, actinal surfaces of type specimen from Sta. 1846. (reduced). *Porcellanaster caeruleus* Wyville Thomson. C, actinal and D, abactinal surfaces of large specimen from Sta. 1846. E, actinal and F, abactinal surfaces of small specimen from Sta. 1837. (C–F slightly enlarged). *Styrcaster horridus* Sladen. G, abactinal and H, actinal surfaces of larger specimen from Sta. 1844. (slightly enlarged). *Benthopecten pikei* var. *australis* var. nov. I, actinal and J, abactinal surfaces of larger specimen from Sta. 1846. (reduced).

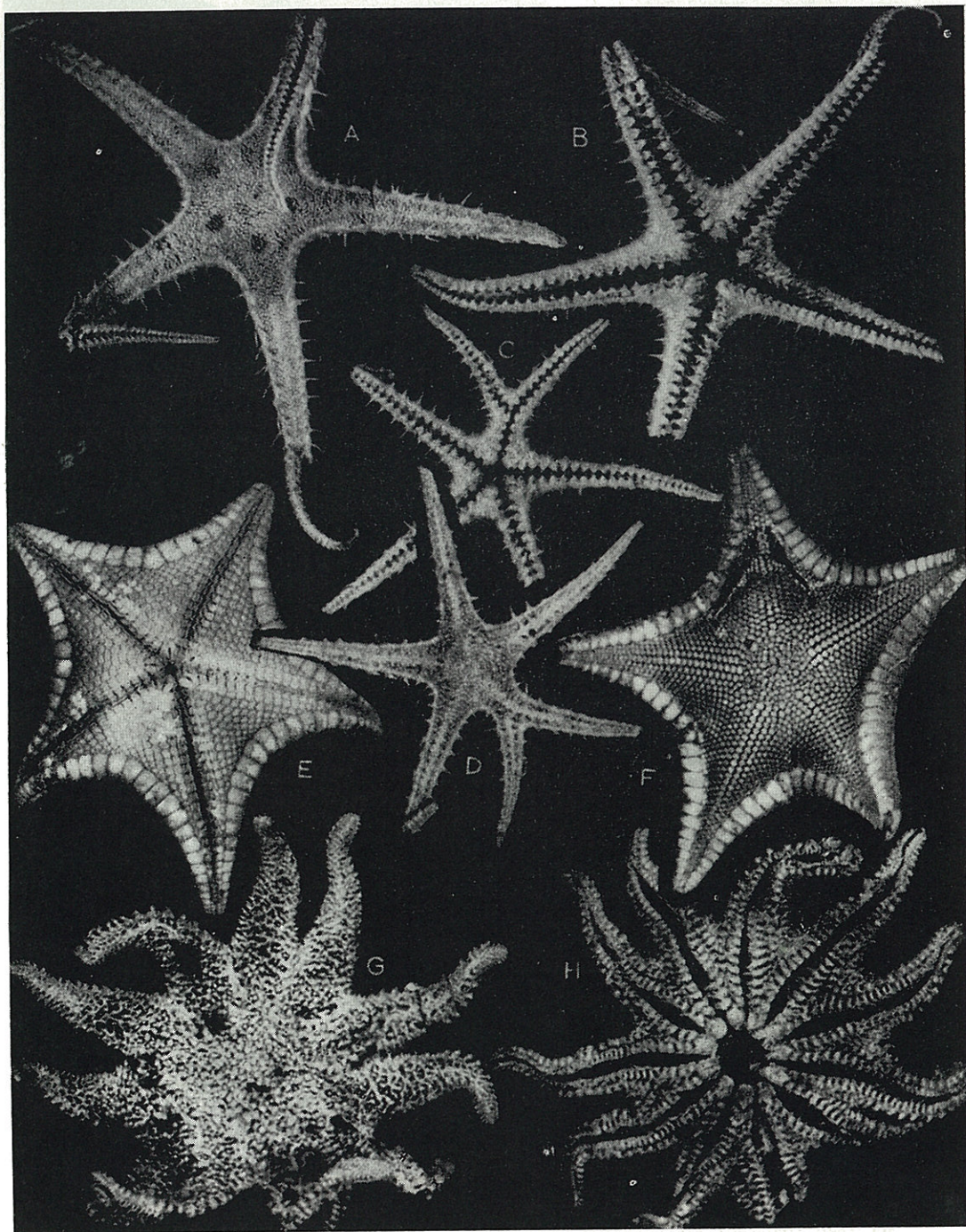


PLATE 2:
 A, abactinal and B, actinal surfaces of specimen from Sta. 1846. C, actinal and D, abactinal surfaces of 6-rayed specimen also from Sta. 1846 (A-D almost natural size). *Mediaster* sp. E, actinal and F, abactinal surfaces of specimen from Sta. 1818. (enlarged). *Crossaster japonicus* (Fisher) G, abactinal and H, actinal surfaces of specimen from Sta. 1818. (enlarged.)

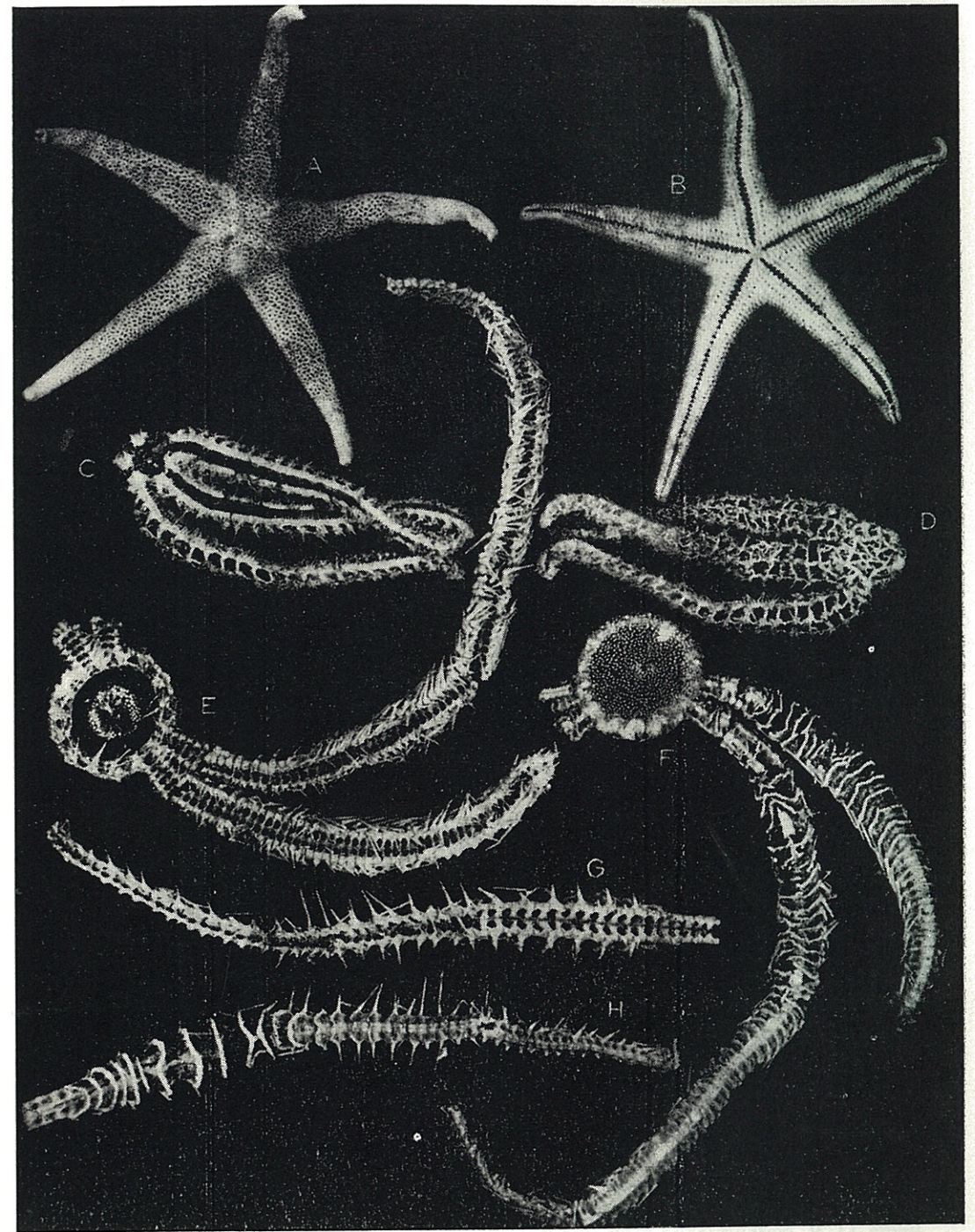


PLATE 3:
Henricia sp. A, abactinal and B, actinal surfaces of specimen from Sta. 1818. (enlarged). *Stylasterias reticulata* (H. L. Clark). C, actinal and D, abactinal surfaces of specimen from Sta. 1815. (enlarged). *Brisinga tasmani* n. sp. E, actinal and F, abactinal surfaces of specimen from Sta. 1818. (considerably reduced). *Brisingella* or *Astrostephane* sp. G, actinal and H, abactinal surfaces of specimen from Sta. 1818. (reduced).

COLOUR:

Brick red-orange abactinally, with grey patches at arm base; actinal surface white.

GEOGRAPHICAL DISTRIBUTION

From Cook Strait south to Auckland Islands and according to McKnight (in press) east to the Chatham Islands.

DEPTH RANGE:

37-555 m.

TYPE LOCALITY:

? Foveaux Strait, 37 m.

LOCATION OF TYPE:?

Family GONIASTERIDAE Forbes, 1841

MEDIASTER Stimpson, 1857

Mediaster sp. (Fig. 1, h-k; Pl. 2, e, f).

MATERIAL EXAMINED:

One specimen, Sta. 1818.

SIZE:

$R/r = 25/12$ mm.

DESCRIPTION:

Disc flat, arms 5, short, tapering to sharp tip protected by small plate.

Abactinal surface paved by small, regularly arranged (especially along midline of arms) round or oval, gently lobed plates (fig. h); each plate bears a short thick stem or trunk crowned (centrally on disc) by 5-11 (generally 8) small, thick almost triangular-shaped granules or short spines, generally one (sometimes as many as 4) similar granules centrally. Along midline of arms paxillae similar although smaller with generally only 8 or 9 peripheral granules and either none, or as many as 2, centrally; along arm edges paxillae small with often only a single row of 4 or 5 granules.

Papulae (fig. h) conspicuous along midline of arms, less conspicuous on disc centre, absent from narrow area interradially; generally 6 papulae surround each plate.

Madreporite interradial, midway between centre and edge of disc, small, deeply dissected, almost square. Paxillae immediately adjacent enlarged, with up to 16 spines.

Anus central on disc, small, inconspicuous, guarded by 5 or 6 slender spines.

Marginal plates conspicuous bordering arms and discs; 15-17 plates from interradial angle to arm tip. Supermarginals rectangular, gently tumid, with uniform covering of small, round, spinulose granules which are easily rubbed off leaving fine pits. No enlarged granules or spines.

Inferomarginals (Fig. j) corresponding to supermarginals, slightly larger, forming distinct border to actinal surface; plates with covering of granules similar to those of supermarginals.

Actinal interradial areas well developed, triangular, with plates (figs. i, j) extending for at least half length of each arm, to 7th or 8th marginal plate. Plates either rectangular or irregular in shape; adjacent to adambulcral plates regularly arranged, elsewhere irregular, each plate with, centrally and near adambulcrals, 9-11 small, squat, triangular-headed granules; near inferomarginals and along arms granules fewer, 4-8, smaller. No enlarged spines or granules; central granules on plates not enlarged. On actinal plates immediately adjacent to oral plates in all angles, single small pit present.

Adambulacral plates (fig. i) very regular with fringe of 6 or 7 (exceptionally 8) furrow spines; most proximal spine of plate smaller, set slightly in from plate edge; near oral plates it may be less than half length of first true furrow spine. Immediately adjacent to furrow spines row of 4 or occasionally 5 thicker, shorter, almost club-shaped subambulacral spines or granules and behind these from 5-8 even shorter spines arranged in one or 2 more or less regular longitudinal rows.

No pedicellariae. Oral furrow spines 11, rather flattened, of similar size, except for most distal spine adjacent to first adambulacral which is distinctly shorter; suboral spines 14 with fairly regular row of 7 or 8 spines bordering suture, rest of spines irregularly arranged.

Tube feet biserially arranged with small sucking discs.

ANATOMY

A small part of the abactinal surface (fig. k) was reflected. Abactinal plates, in papular area, connected by slender rods, midline of arms with conspicuously regular arrangement of plates; rudimentary superambulacral plates present but inconspicuous, only clearly visible in midpoint of arm; interbrachial septa membranous, gonads small.

REMARKS:

The present specimen can be distinguished from the single New Zealand representative, *M. sladeni* (Benham), by the difference in body form, the more numerous adambulacral furrow spines and the apparently fewer oral furrow spines. It is not dissimilar to *M. ornatus* Fisher from Hawaiian waters, but it differs in details of the abactinal and actinal armature and in lacking pedicellariae. This specimen resembles *M. arcuatus* (Sladen) from Japan but differs in lacking pedicellariae (this may be due to the small size of the present specimen) and there are also small differences in the armature of the abactinal and actinal plates.

COLOUR:

Abactinal surface pale pink marginally, white to pale blue-grey centrally; actinal surface white, faintest pink marginally and ambulacral grooves and tube feet pale yellow.

GEOGRAPHICAL DISTRIBUTION

Known only from "Eltanin" Sta. 1818, off the West Coast of the South Island of New Zealand.

DEPTH RANGE:

908-915 m.

LOCALITY:

"Eltanin" Sta. 1818, 40° 15'-40° 17' S.; 168° 16'-168° 18' E.; 908-915 m.

LOCATION OF SPECIMEN

United States National Museum.

Order SPINULOSIDA Perrier, 1884

Family SOLASTERIDAE Perrier, 1884

CROSSASTER Müller and Troschel, 1840

Crossaster japonicus (Fisher) (Pl. 2, g, h)

Solaster japonicus Fisher, 1911, p. 330.

Crossaster multispinus Clark, H. L., 1916, p. 66, pl. 18, figs. 5, 6.

Crossaster japonicus Djakonov, 1950, p. 74, fig. 25; Fell, 1958, p. 17, pl. 2, fig. F; McKnight, 1967, p. 302.

MATERIAL EXAMINED:

One specimen, Sta. 1818.

SIZE:

R/r=31/12 mm.

REMARKS:

The present specimen has 11 arms (as opposed to 10 in the type) and there are more numerous spines in the actinal paxillae but otherwise it agrees well with earlier descriptions.

COLOUR:

Disc white, arms blue-grey basally and for half their length, spines and arm tips white.

GEOGRAPHICAL DISTRIBUTION

This species is widely distributed and is known from Eastern Siberia, Japan, Australia and New Zealand.

DEPTH RANGE:

90-600 m., possibly even deeper, ?2090 m. (Djakonov, 1950, p. 74).

TYPE LOCALITY:

Sado Island, Sea of Japan; 416-453 m.

LOCATION OF TYPE:

United States National Museum.

Family PTERASTERIDAE Perrier, 1875

PTERASTER Müller and Troschel, 1842

Pteraster bathamae Fell.

Pteraster (Apterodon) bathamae Fell, 1958, p. 14, pl. 2, figs. G, I.

MATERIAL EXAMINED:

One specimen, Sta. 1848.

SIZE:

R/r=approx. 40/25 mm.

COLOUR:

Pale orange mottled with white, abactinally; white and pale grey, actinally.

GEOGRAPHICAL DISTRIBUTION

Previously known only from Eastern Otago, New Zealand; the present specimen extends the range north to Cook Strait.

DEPTH RANGE:

256-555 m.

TYPE LOCALITY:

East Otago, New Zealand; 462-555 m.

LOCATION OF TYPE:

Dominion Museum, Wellington, New Zealand (Ech. 517).

Family ECHINASTERIDAE Verrill, 1867

HENRICIA Gray, 1840

Henricia sp. (Pl. 3, a, b).

MATERIAL EXAMINED:

One specimen, Sta. 1818.

SIZE:

R/r=30/6 mm.

DESCRIPTION:

Disc flat, arms long, slender, tapering evenly to blunt tips; shallow sulci present interradially.

Abactinal skeleton close reticulum of oblong, trilobate or cruciform plates obscured by thick membrane; plates with from 5-15 short flattened, hyaline spinelets which terminate in a number of uneven points. Near arm tips paxillae smaller, seldom more than 5 or 6 spines.

Papulae conspicuous, one to 3 in interspaces between paxillae, present on disc and to arm tips, absent from narrow interradial sulcal areas.

Madreporite interradial in position, midway between centre and edge of disc; inconspicuous, more or less circular, dissected by number of deep grooves, ridges crowned by rows of short, thorny headed spines.

Marginal plates inconspicuous. Superomarginals rectangular or proximally slightly curved forming fairly regular row along underside of arms, each with about 23 short spinelets similar to those of abactinal surface.

Inferomarginals small, corresponding to superomarginals, spinelets fewer. Conspicuous papulae present between marginal plates.

Adambulacral plates very regular with one or 2 blunt-tipped, compressed spines deep in furrow and row of 2 or 3 finely thorny spikes actinally, more or less level with furrow edge. Subambulacral spines 15-20, thorny, crowded, irregularly arranged in 2 or 3 rows.

Oral plates with crowded rather thorny-headed spinelets; furrow spines 6-8, suboral spines similar, 9 or 10, arranged in 2 almost regular rows.

Ambulacral grooves, deep, narrow, tube feet in 2 rows with small sucking discs.

REMARKS:

There is much disagreement over the taxonomic status of New Zealand species of *Henricia*. The present specimen cannot be confused with *H. ralphae* Fell for the body form and armature of the abactinal, marginal and adambulacral plates is different. It agrees, however, with *H. lukinsii* (Farquhar) in the spinulation of the abactinal and marginal plates but it differs in the body form and also in the armature of the adambulacral and oral plates. In many ways it resembles *H. compacta* (Sladen) from a similar locality, but it can be distinguished by the different body form and the more numerous subambulacral spines. The presence of 2 spines deep in the furrow is apparently a variable character as it occurs in some specimens of *H. compacta*. There also seems considerable variation in the body form and arm length of specimens of *H. compacta* but in none recorded so far are the arms as thin and slender as in the present specimen. Differences in the adambulacral armature, the fewer abactinal papulae and the body form separate the present specimen from *H. compacta aucklandiae*.

GEOGRAPHICAL DISTRIBUTION:

Present material from west of Cape Farewell, South Island, New Zealand.

DEPTH RANGE:

908-915 m.

LOCALITY:

"Eltanin" Sta. 1818, 40° 15'-40° 17' S., 168° 16'-168° 18' E.; 908-915 m.

LOCATION OF SPECIMEN

United States National Museum.

Order FORCIPULATIDA Perrier, 1884

Family ASTERIIDAE Gray, 1840

ALLOSTICHAETER Verrill, 1914

Allostichaster insignis (Farquhar)

Stichaster insignis Farquhar, 1895, p. 203, pls. 10, 11, 12, figs. 1-14, pl. 13, fig. 1.

Allostichaster insignis Mortensen, 1925, p. 316, fig. 19; Fell, 1960, p. 66; McKnight, 1967, p. 303.

MATERIAL EXAMINED:

One specimen, Sta. 1847.

SIZE:

R/r = 36/5 mm.

REMARKS:

The present specimen has 3 longer and 3 slightly shorter arms and 4 madreporites.

COLOUR:

Pale pinkish-white abactinally; white actinally.

GEOGRAPHICAL DISTRIBUTION:

From Cook Strait to Auckland, Campbell and Chatham Islands, it is probably present north of Wellington, New Zealand also.

DEPTH RANGE:

Shore-222 m.

TYPE LOCALITY:

Wellington Harbour or Taylor's Mistake, Lyttelton, New Zealand; 18-22 m.

LOCATION OF TYPE:

Canterbury Museum, Christchurch.

Allostichaster polyplax (Müller and Troschel).

Asteracanthion polyplax Müller and Troschel, 1844, p. 178.

Stichaster polyplax Sladen, 1889, p. 432; Farquhar, 1897, p. 196.

Tarsaster neozelanicus Farquhar, 1895, p. 207, pl. 12, figs. 15-23.

Asterias polyplax Clark, H. L., 1914, p. 151.

Allostichaster polyplax Mortensen, 1925, p. 315; Clark, H. L., 1946, p. 157; Fell, 1960, p. 66;

McKnight, 1967, p. 303.

MATERIAL EXAMINED:

One specimen, Sta. 1847.

SIZE:

R/r = 30/8 mm.

REMARKS:

The present specimen is broken with the 8 more or less equal arms separated from the disc. Disc very convex, arms broken from disc at level of either second or third adambulacral plates. Only one madreporite is present.

COLOUR:

Greyish yellow.

GEOGRAPHICAL DISTRIBUTION

Widespread throughout New Zealand and the Chatham Islands, also South Australia and Tasmania.

DEPTH RANGE

Shore to 238 m.

TYPE LOCALITY:

Tasmania.

LOCATION OF TYPE:

? Berlin Zoological Museum.

SCLERASTERIAS Perrier, 1891

Sclerasterias mollis (Hutton) (Fig. 1, 1).

Asterias mollis Hutton, 1872, p. 4.

Sclerasterias mollis Fisher, 1924, p. 4; Mortensen, 1925, p. 318, pl. 14, figs. 13, 14; Fell, 1958, p. 19; —, 1960, p. 65; McKnight, 1967, p. 302.

MATERIAL EXAMINED:

6 specimens, Sta. 1847.

SIZE:

R=21–155 mm.; average 60 mm.; r=3–17 mm., average 9 mm.

REMARKS:

Most variation in the specimens occurs in the number and arrangement of the abactinal pedicellariae and spines; the straight pedicellariae of the abactinal surface may be very numerous in larger specimens between the midradial or superomarginal spines or they may be few and indistinct; similarly, the dorso-lateral row of spines may be present to almost the midpoint of the arms or the spines may be restricted proximally to the first few plates or they may be absent altogether. In the largest (broken) specimen in the present collection (R/r=155/17 mm.) straight pedicellariae are very numerous abactinally on the arms; these pedicellariae (fig. 1) may be finely unguiculate (or felipedal) with 4 or 5 teeth which interlock with those from the neighbouring valve. These teeth are very much finer than those described by Fell (1958, p. 20, pl. 2, fig. D) for *Cosmasterias dyscrita* H. L. Clark. Similar pedicellariae may also be present along the ambulacral grooves. Specimens in the author's collection also have the distinctive unguiculate pedicellariae.

COLOUR:

Large specimen—disc and marginal plates orange and yellow-white, spines and pedicellariae white; actinal surface and tube feet white-grey; smaller specimens, dark red.

GEOGRAPHICAL DISTRIBUTION:

Cook Strait south to Otago, New Zealand and Chatham Islands.

DEPTH RANGE

22–697 m.

TYPE LOCALITY:

Hutton (1872) does not give a locality.

LOCATION OF TYPE:

Dominion Museum, Wellington, New Zealand.

STYLASTERIAS Verrill, 1914

Stylasterias reticulata (H. L. Clark) (Pl. 3, c, d).

Pedicellaster reticulatus Clark, H. L., 1916, p. 69, pl. 27, figs. 3, 4.

Stylasterias reticulata Clark, A. M., 1962, p. 99, text fig. 18, pl. 6, figs. 5, 6.

MATERIAL EXAMINED:

5 specimens and 6 arms, Sta. 1815.

SIZE:

Specimens distorted but in the 5 animals R=55–40 mm., r=3–4 mm.

REMARKS:

The present specimens agree well with previous descriptions; a specimen from the British Museum (1965.8.5.290) shows few differences although it is smaller than the present specimen and has fewer crossed abactinal pedicellariae. However, variation does occur in the felipedal pedicellariae which may be short and squat or longer and more slender; similarly, the interlocking fingers may be very long and slender, or short, they are apparently easily broken. Small straight pedicellariae and occasionally enlarged felipedal pedicellariae are present along the ambulacral groove; there may also be an extra oral spine.

COLOUR:

Orange with yellow markings, madreporite white, abactinally; tube feet pale lemon yellow actinally.

GEOGRAPHICAL DISTRIBUTION:

Previously, this species has been known from off Tasmania only; the present specimen is from off the west coast of the North Island of New Zealand.

DEPTH RANGE

128–421 m.

TYPE LOCALITY:

Off Maria Island, Tasmania.

LOCATION OF TYPE:

? Australian Museum.

Family BRISINGIDAE Sars, 1875

BRISINGA Asbjornsen, 1856

Brisinga tasmani n. sp. (Fig. 2, a–f; fig. 3, a–e; pl. 3, e, f).

MATERIAL EXAMINED:

One entire disc and fragments of about 12 arms, Sta. 1818; Sta. 1844 (1 arm).

SIZE:

Diameter of disc 50–43 mm., length of longest unbroken arm approx. 303 mm.; length of genital inflation approx. 105 mm.

DESCRIPTION:

Arms 15, long, sturdy, tapering distal to genital inflation.

Disc oval with gently rounded margin. Abactinal plates (fig. 2, a, b) small, oval, very tumid, generally isolated but contiguous at disc centre, near margins and at arm bases. Each plate bears from 2–7, exceptionally 8, short, tapering, hyaline spinelets; these are often finely toothed in last quarter, terminating in 2 or 3 distinct points. Crossed pedicellariae small, scattered, indistinct, squat, jaw tips toothed, distinctive teeth medially also. Abactinal membrane thin.

Madreporite (fig. 2, a) at disc edge, interradial, damaged, irregular, tumid, finely and deeply dissected; on disc side bordered by 3 or 4 very tumid, contiguous abactinal plates with short spines and crossed pedicellariae; on outer edge broad, more or less oval, flattened, slightly depressed, membrane covered area surrounded by heavily calcified region devoid of spines.

Anus (fig. 2, b) present as irregular opening on disc centre; adjacent plates more or less contiguous, forming circle.

Papulae absent from disc centre; possibly present on disc edge as very shallow indistinct pits occurring sporadically at arm bases.

Arms deciduous, breaking either at junction of first and second adambulacral plates, or in case of 4 arms, at junction of fifth or seventh adambulacral plate. Genital inflation occupies between $\frac{1}{3}$ and $\frac{1}{4}$ total arm length.

From 20–27 more or less complete costae along arm, costae incomplete distally, absent near arm tip. Proximally, costae (fig. 2, c) salient, band-like, not sinuous, composed of small, oblong, overlapping plates, each plate with generally one or two (exceptionally as many as 5) small, conical, blunt or sharp-tipped, ridged spines which may be united basally by a thin membranous web. Crossed pedicellariae present on costal plates (fig. 2, c), also in distinct "felted" bands (fig. 2, c) between proximal costae and for some distance along arm; these bands most distinct laterally, often totally lacking abactinally. In crossed pedicellariae (fig. 3, a–d) median teeth small; blades distinctly sickle-shaped, hollow, terminating in number of teeth. Lateral plates adjacent to every second adambulacral tumid, enlarged, each with single, long, tapering 8–13 mm. spine; lateral spines increase in length distally, crossed pedicellariae similar to those described for abactinal surface present on both plates and spines. Intercostally, no scattered plates, although occasionally an isolated portion of a costa may be present. Gonads well developed, serially arranged along genital inflation, opening between lateral plates.

Adambulacral plates (fig. 2, d, e, f) band-like, with distinct aboral tongue projecting into furrow; plates separated by muscular intervals. Armature varies—

generally one slender, pointed, aboral furrow spine on tongue of plate which projects at right angles across furrow, almost meeting spine from opposite plate; one sturdy, tapering, ridged subambulacral spine almost central on plate with small, pointed subambulacral spine just below and adoral to it. In addition, occasionally a second, much shorter furrow spine (fig. 2, e) may be present immediately above first spine; in one or 2 cases a very small pointed furrow spine is present on adoral edge of plate and occasionally, proximally, 3 subambulacral spines form vertical row, that nearest furrow being smallest; distally there may be only one subambulacral spine. All spines, especially furrow spines, with numerous small crossed pedicellariae similar to those already described for abactinal surface.

Tube feet biserial with distinct sucking discs, in "pockets" formed by horizontal projecting adambulacral furrow spines; ampullae single.

Oral plates short, with 2 furrow spines, most proximal or actinostomial spine projecting horizontally across furrow, almost meeting spine from opposing plate; distal spine generally also projects horizontally across furrow; single suboral spine long, slender, ridged, tapering to sharp tip; all spines clothed along length with small crossed pedicellariae similar to those described above. Two most proximal adambulacral plates joined laterally, forming distinct carina; lateral plates corresponding to third adambulacral plates also joined, this carina being obvious from abactinal surface.

REMARKS:

Fisher (1919, p. 501) uses the presence or absence of papulae on the disc and at the arm bases to distinguish between *Brisingenus* Fisher and *Brisinga* Asbjornsen. In the holotype of *Brisingenus mimica* Fisher (U.S.N.M. No. 37021), examined by the author, the papulae, both in the wet and dry states, are very conspicuous, occurring on the rounded margin on the disc at the arm bases. In the present specimen, although small and sporadic pits are present on the disc which could possibly be mistaken for papulae, by comparison with *Brisingenus mimica*, they are unimportant. Examination of the holotype and paratype of *Brisingenus delli* Fell (Dominion Museum) from the Bay of Plenty, New Zealand fails to show these very distinct marginal papulae and suggests that this species should be included in *Brisinga*. The author also had the opportunity of examining a specimen of *Brisinga trachydisca* Fisher (N.S.N.M. No. 40315) in which there are rather conspicuous papulae on the disc suggesting that this specimen should more properly be included in *Brisingenus*. Perhaps the presence or absence of these papulae should not be regarded as being of generic significance as it can be argued that indistinct papulae occur in places in both *B. delli* and *B. tasmani*; more material is necessary for comparison.

At least 7 species of *Brisinga* are known, all from the Northern Hemisphere. *B. tasmani* resembles both *B. andamanica* Wood—Mason and Alcock and *B. gunni* Wood—Mason and Alcock (both Indian Ocean) in having 15 rays but it differs from the former in having fewer costae, well developed genital inflations and in differences in the oral armature, while from the latter it can be distinguished by its stout, well developed arms, conspicuous and continuously salient costae and differences in the adambulacral plates. From *B. trachydisca* Fisher from the Philippines, it can be distinguished by having 15 rays (as opposed to 12 or 13), in having fewer costae and conspicuous intercostal bands of crossed pedicellariae, the pedicellariae being markedly smaller than those of *B. trachydisca*, and there are also differences in the adambulacral armature.

COLOUR:

Abactinally, disc centre orange, edges white with orange patches at arm bases, arms orange-red, costae lighter, gonads showing through yellow-white. Actinally, actinostomial membrane dark red-brown, blue-grey at edges, tube feet pinkish-

brown, adambulacrals white to pale orange; distinct white areas between arms.

GEOGRAPHICAL DISTRIBUTION:

Known only from "Eltanin" Sta. 1818, 40° 15'–40° 17' S., 168° 16'–168° 18' E., west of Cape Farewell, New Zealand.

DEPTH RANGE

908–915 mm.

TYPE LOCALITY:

40° 15'–40° 17' S., 168° 16'–168° 18' E., west of Cape Farewell, New Zealand.

LOCATION OF TYPE:

United States National Museum.

Brisingid arms (Fig. 3, f, g; Pl. 3, g, h).

MATERIAL EXAMINED:

Fragments of about 23 arms, Sta. 1818.

SIZE:

Length of longest intact arm approx. 185 mm.; length of genital inflation 30–45 mm.; breadth of genital inflation, 5–8 mm.

DESCRIPTION:

Genital inflation small, commencing short distance from disc; costae (fig. f) 10–15 very conspicuous, salient, composed of contiguous rectangular plates, each with generally one (occasionally proximally 2 or 3) small, sharp-tipped spines; most proximal costae often incomplete. Gonads 2 in number, with branches extending along arms on either side of ambulacral plates; opening at beginning of genital inflation; gonads (fig. f) visible through abactinal membrane. Distal to genital inflation costae very indistinct, generally only 2 lateral plates and spines remaining. Membranous intercostal areas devoid of spines or plates although indistinct and incomplete bands of small crossed pedicellariae may be present, especially proximally; similar pedicellariae may also be present on costal spines. Lateral costal spines large, distinct, slender, tapering; proximally costae occur opposite every second adambulacral plate. On one arm, possibly result of injury, costae sinuous, fragmentary, individual plates tumid, crowded, each with one or 2 small sharp-tipped spines.

Adambulacral plates (fig. 3, g) rectangular, separated by distinct muscular intervals, each plate with short aboral tongue extending into furrow and a similar but less conspicuous adoral tongue projecting abactinally; in places this appears to form a separate hemispherical plate. Generally, one short, sharp-tipped adoral furrow spine, situated short distance from lateral edge of plate projecting across furrow; single aboral subambulacral spine—sturdy, hyaline, sharp-tipped; small crossed pedicellariae, similar to those already described, present both on furrow, and less conspicuously, on subambulacral spines. Occasionally, a second furrow spine may be present adjacent to first, and on several arms, proximally, there is a small, slender aboral furrow spine situated on distal extension of plate.

Tube feet biserial with small distinct sucking discs.

REMARKS:

The presence of only 2 gonads in a ray, one on either side, combined with the delicate nature of the subambulacral spines suggests that these arms, according to Fisher's (1919, p. 501) key, belong either in *Astrostephane* Fisher or in *Brisingella* Fisher. It is difficult to go further than this as there is no disc. The 2 known species of *Astrostephane* are both from the Philippines-Indonesian region and the present arms differ considerably in both the adambulacral armature and in lacking conspicuous intercostal bands of pedicellariae.

Fisher (1928, p. 13) recognises 8 species of *Brisingella* and believes that 4 species described by Sladen probably also belong here; a further species was added by

Djakonov (1950) from Soviet Waters. Of these 9 definite species 7 are known only from the Northern Hemisphere, *B. tenella* (Ludwig) has been collected from near the Galapagos Islands and *B. monacantha* H. L. Clark is from Peru. Of Sladen's 4 doubtful species, 2 are from the Southern Hemisphere. The present arms appear similar to *B. fragilis* (Fisher) from Hawaii, especially in the adambulacral armature but they have markedly fewer costae; they are also similar to *B. exilis* (Fisher) from Southern California both in the adambulacral armature and in the number of costae. They differ from *B. monacantha* H. L. Clark in possessing adambulacral furrow spines, and from *B. membranacea* (Sladen)—from between Marion and Crozet Islands—they differ in the position of the furrow spines and there are also differences in the costae.

COLOUR:

Abactinally, pink along arm edges, costae very delicate pale pink, gut purple. Actinally, pale yellow-pink.

GEOGRAPHICAL DISTRIBUTION:

Known only from "Eltanin" Sta. 1818, 40° 15'–40° 17' S., 168° 16'–168° 18' E., west of Cape Farewell, New Zealand, and Sta. 1844, 46° 40'–46° 44' S., 165° 18' E., west of Stewart Island, New Zealand.

DEPTH RANGE

908–2470 m.

LOCATION OF SPECIMENS:

United States National Museum.

Brisingid arms (Fig. 3, h, i).

MATERIAL EXAMINED:

Fragments of 5 arms from Sta. 1844.

SIZE:

Largest fragment approximately 100 mm.; breadth at genital inflation approximately 4 mm.

DESCRIPTION:

Costae (fig. h) conspicuous on genital inflation; distally inconspicuous, confined to lateral regions only. Costal plates tumid, rectangular, imbricating, or sometimes overlapping; each plate with generally one, but occasionally (proximally) as many as 3 spines. Lateral costal plates with larger spines; spines short, round-tipped, fluted. Primary costae generally present opposite every third adambulacral plate. Secondary incomplete costae present abactinally; plates small, rather flat, often with only one small spine. Between costae, surface (fig. h) paved with small, contiguous, rectangular, square or round plates which show a less regular arrangement laterally; plates porous, thin, without spines; distal to genital inflation, plates fewer, less regular in arrangement and size. Occasional small crossed pedicellariae present intercostally, possibly also present around costal spines.

Adambulacral plates (fig. i) separated by distinct muscular intervals; single furrow spine aboral, slender, tapering, pointed, projecting over furrow, covered with small crossed pedicellariae. Crossed pedicellariae very small with flaring shafts terminating in a head armed with numerous small teeth. Subambulacral spine conspicuous, short, fluted, occasionally a second smaller subambulacral spine may be present.

Tube feet biserial with distinct sucking discs, each more or less enclosed in "pocket" formed by projecting furrow spines.

REMARKS:

The absence of distinct papulae and the presence of intercostal plates places these arms in the second part of Fisher's (1919, p. 501) key and seem to limit the

choice to either *Stegnobrisinga* Fisher or *Astrolirus* Fisher; however the absence of the disc and most proximal part of the arms makes differentiation between the 2 difficult.

These arms resemble *Astrolirus panamensis* (Ludwig)—from Central America and from the Cocos Islands in the Indian Ocean—in having widely-spaced costae, incomplete secondary costae, short, stumpy costal spines, and in details of the crossed pedicellariae; there are differences, however in the adambulacral armature. The arms differ from the 2 known species of *Stegnobrisinga* (from Indonesia and the Indian Ocean) in the arrangement of the costae and in the adambulacral armature. This would be the first record of either of these genera from south of the equator.

COLOUR:

No colour notes were made.

GEOGRAPHICAL DISTRIBUTION:

Known only from "Eltanin" Sta. 1844, 46° 40'–46° 44' S., 165° 18' E., west of Stewart Island, New Zealand.

DEPTH RANGE

2104–2470 m.

LOCATION OF SPECIMENS:

United States National Museum.

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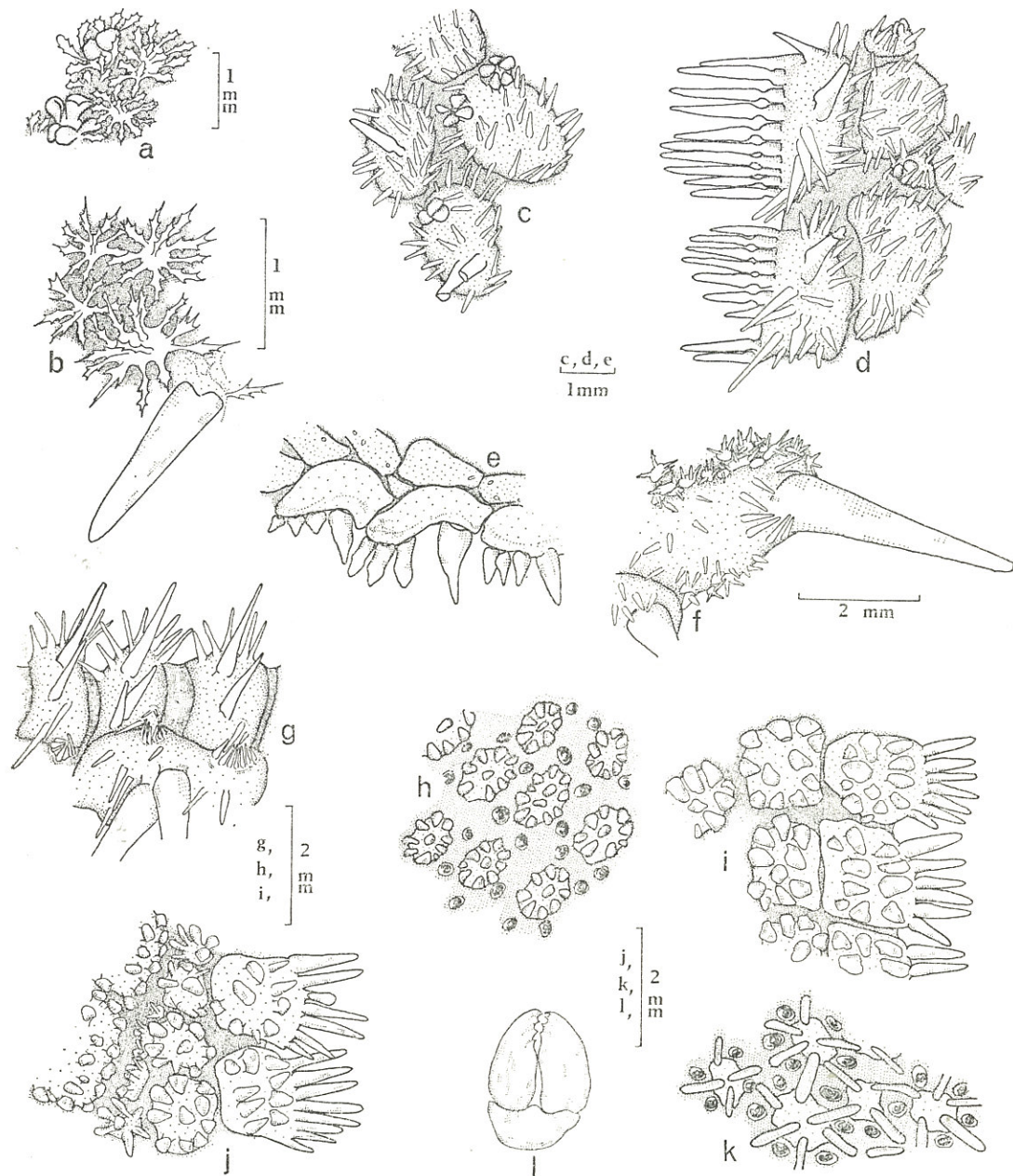


FIGURE 1.—*Luidia neozelanica* Mortensen (a) Abactinal paxillae and pedicellariae from near disc centre. (Sta. 1818; R/r=132/20 mm.) (b) Abactinal, superomarginal and inferomarginal plates with enlarged inferomarginal spine (Sta. 1815; R/r=15/3 mm.) *Plutonaster fragilis* n. sp. (c) Group of actinal plates, interradially, showing enlarged spines and pedicellariae. Note: one plate with 2 enlarged spines. (d) Adambulacral and actinal plates, about halfway along arm. (Sta. 1846; R/r=75/22 mm.) *Styracaster horridus* Sladen (e) Adambulacral plates and spines and actinal plates and granules. (Sta. 1844; R/r=44/8 mm.) *Benthopecten pikei* var. *australis* var. nov. (f) Superomarginal and abactinal plates and spines. (g) Adambulacral and inferomarginal plates, spines and pedicellariae. (type: Sta. 1846; R/r=150/20 mm.) *Mediaster* sp. (h) Group of abactinal paxillae and papulae from midline of arms. (i) Adambulacral and adjacent actinal plates. (j) Group of adambulacral, actinal and inferomarginal plates. (k) Abactinal plates reflected, showing rods and papulae. Sta. 1818; R/r=25/12 mm.) *Sclerasterias mollis* (Hutton) (l) Abactinal straight pedicellariae from proximal part of arms.—Note: toothed tips (Sta. 1847; R/r=155/17 mm.).

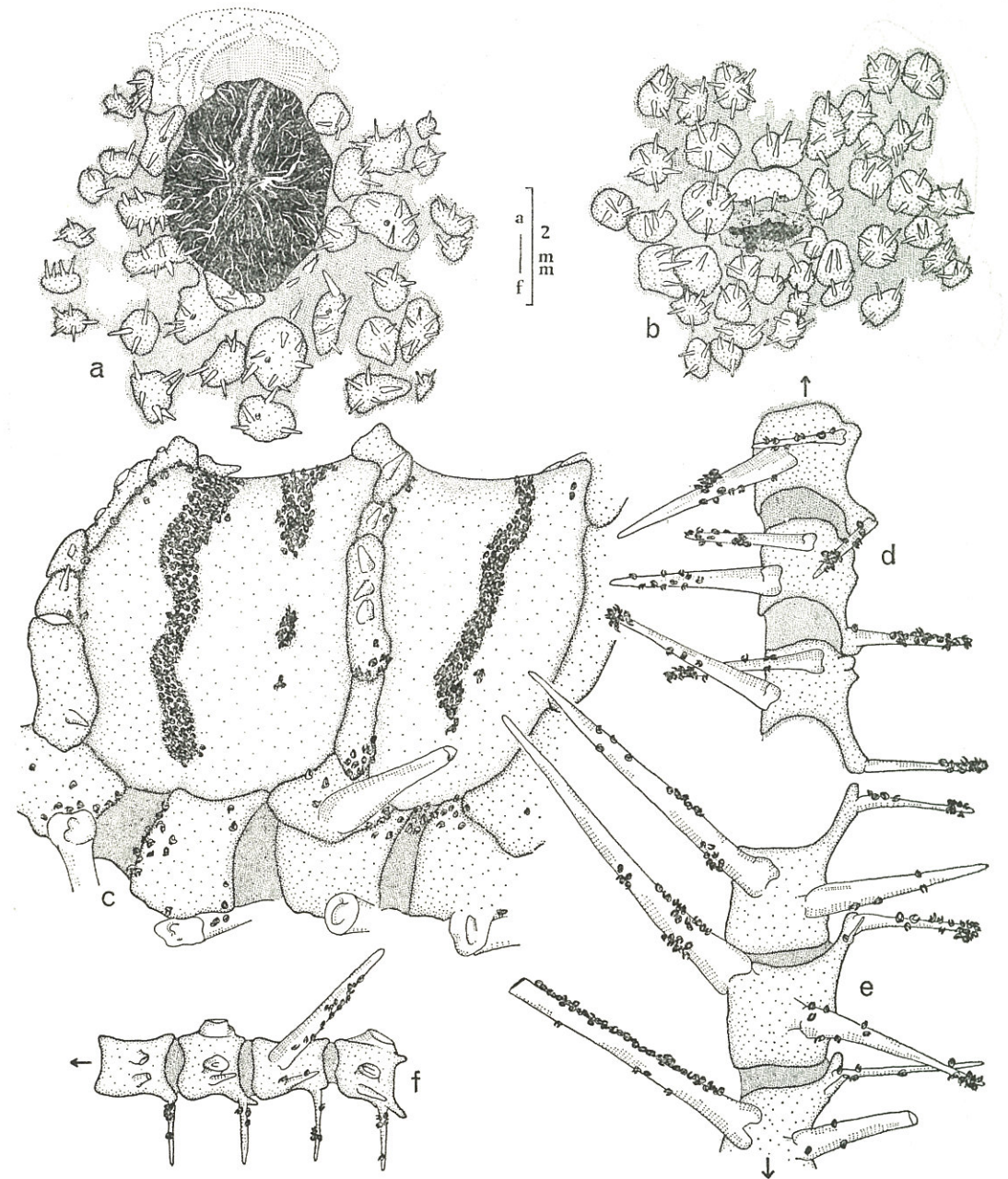


FIGURE 2.—*Brisinga tasmani* n. sp. (a) Madreporite, abactinal paxillae and naked membranous area at top. (b) Anus and surrounding plates. (c) Lateral view of arm near beginning of genital inflation showing 3 costae, pedicellariae, lateral plates and spines and adambulacral plates and spines. (d) Proximal fourth, fifth and sixth adambulacral plates and spines. (e) Three adambulacral plates and spines in region of genital inflation. (f) Adambulacral plates and spines near arm tip. (Sta. 1818—large specimen). N.B.—Arrows indicate direction of mouth.

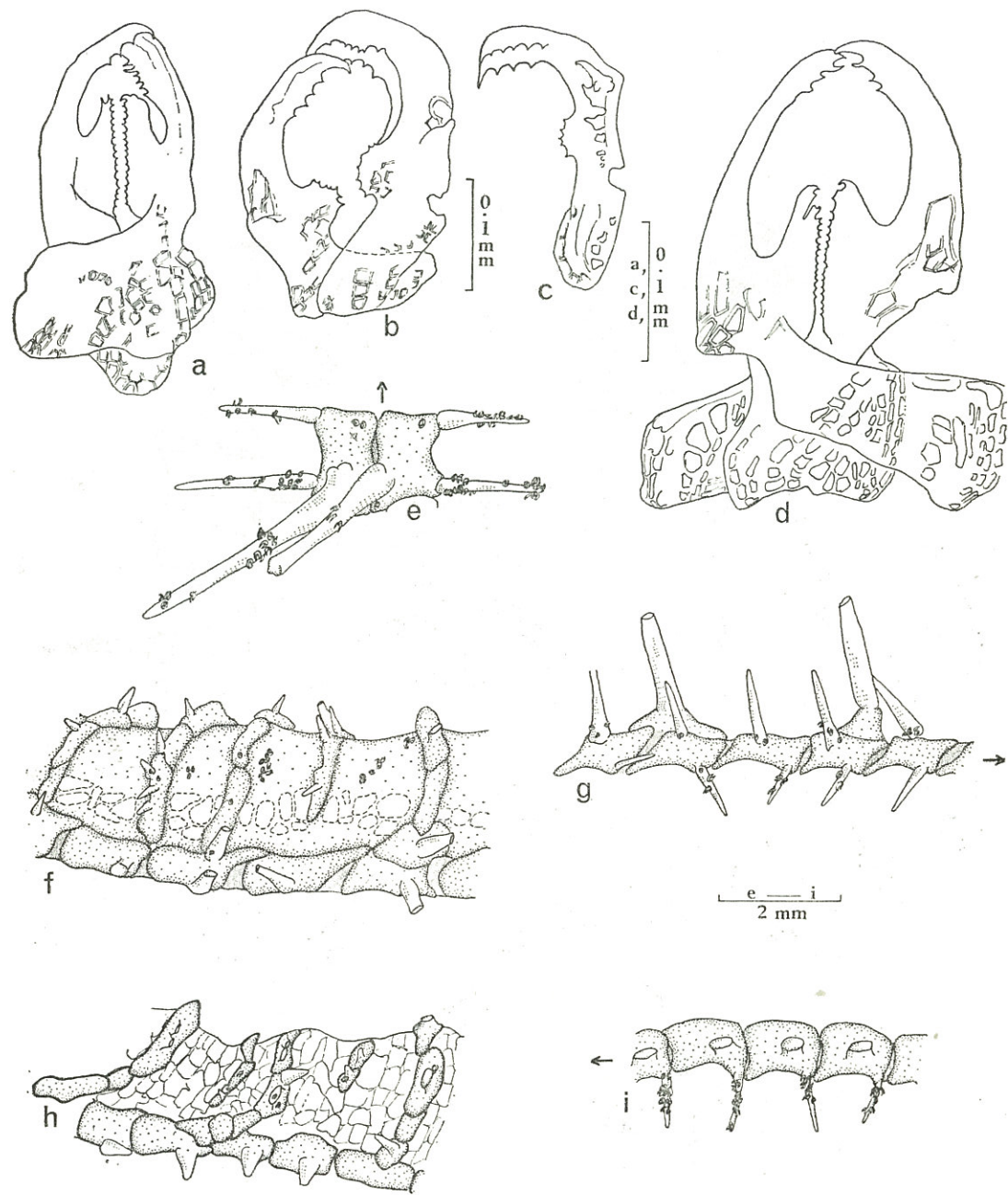


FIGURE 3.—*Brisinga tasmani* n. sp. (a) Crossed pedicellariae from abactinal surface. (b) Crossed pedicellaria from costal plates on genital inflation. (c) Single jaw of crossed pedicellaria from costal plates on genital inflation. (d) Crossed pedicellaria from adambulacral furrow spine. (e) Oral plates and spines. (Sta. 1818—large specimen). *Brisingella* or *Astrostephane* sp. (f) Lateral view of arm in genital region. (g) Lateral view of arm distally. (Sta. 1818). *Stepnobrisinga* or *Astrolirus* sp. (h) Lateral view of genital inflation. Note: small paving plates between costae. (i) Adambulacral plates and spines (Sta. 1844). N.B. Arrows indicate direction of mouth.