

Records of Indo-Pacific Echinoderms

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THE ECHINODERMS recorded herein were for the most part collected in connection with the studies of the Pacific Science Board, National Research Council. They represent incidental activities of 15 members of survey parties, all of whom were intensively engaged in other work. It has seemed advisable to supplement these records with those of other specimens from the Indo-Pacific region not previously recorded which were received from 15 donors, most of whom were members of the armed forces, chiefly during and after the war. The specimens from New Caledonia were presented to the National Museum by the late Lieutenant General Alexander McCarrell Patch, Jr., through the National Geographic Society.

All the specimens listed are in the United States National Museum. A large collection of echinoderms from the Marshall Islands, including 2,674 specimens resulting from the Navy's Operation Crossroads and the Bikini Scientific Resurvey, has previously been described (Clark, 1952). This paper should be consulted in connection with the present contribution.

All the sea urchins collected by Dr. F. S. MacNeil are dead tests.

Our knowledge of the details of the distribution of the littoral echinoderms of the

Indo-Pacific is very limited, especially in regard to the central Pacific area. Extensive work has been done only in Australia, the Netherlands East Indies, the Malayan region, the Philippines, and the Hawaiian Islands, and even here the records, though very numerous, are very spotty.

About the large, high, forested islands where the available nutrients in the sea are enriched by a constant accession of vegetable waste from the land, the fauna, both littoral and abyssal, is exceedingly rich and varied, with many large species and unusually large individuals of other species. A curious side light on the importance of vegetable detritus is afforded by the flexible-shelled sea urchins of the genus *Araeosoma* which occur at depths of from 70 to 1,289 meters and are known to feed on the leaves of dicotyledonous plants. Even a fossil *Araeosoma* from California was surrounded by leaf impressions. In the Pacific area *Araeosoma* occurs among the Malayan Islands and the Philippines, off Tonga and Fiji, off southern Japan, and off the Galápagos Islands and Panama, but not in the central Pacific or on the American coast except at Panama. The species of *Araeosoma* are large, one of them up to 180 millimeters in diameter.

Although certain faunal subregions may be distinguished in the region of the larger and higher islands from Ceylon eastward, these are not very distinctive, the tropical Australian, including the Aru Islands and the south

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coast of New Guinea, being the most notable. Northward and eastward among the low islands, as conditions become less and less favorable for littoral echinoderms, the fauna becomes progressively poorer, and segregation into definite faunal regions appears to become more marked.

The majority of the Indo-Pacific species are small or at most of medium size and are present everywhere, though many become fewer in individuals among the atolls. In some cases the individuals here are noticeably smaller. The large species in many cases disappear or become segregated and confined to special areas in which they may become differentiated into recognizable subspecies or even distinct species.

The very large and heavy sea stars of the family Oreasteridae are especially characteristic of tropical coasts, but, except for the genus *Culcita*, the cushion stars, the most specialized of the family, ranging from east Africa eastward, they are absent from the central Pacific area. The largest genus, *Pentaceraster*, with 14 species, is found from the Red Sea and eastern Africa to Australia, New Guinea, New Britain, New Caledonia, and Samoa, and also on the coast of China, in the Philippines, among the Ryukyu Islands, in southern Japan, in the Hawaiian Islands, and on the west coast of Central America. The species found in the Hawaiian Islands and on the American west coast are very similar. The genus *Protoreaster*, with four species, ranges from eastern Africa to western Australia, New Guinea, the Bismarck Archipelago, New Caledonia, the Mariana Islands, the Palau Islands, Yap, the Ryukyu Islands, and southern Japan. If species of these two or related genera occurred among the atolls, they could scarcely be overlooked and certainly would be known to the natives.

Among the sea urchins the genus *Astropyga* is characteristic of tropical regions in from 5 to 88 meters. The species are large, up to 180 millimeters in diameter. They range from eastern Africa to Australia, New Britain, and

the Hawaiian Islands. One species occurs from the Gulf of California to Panama, and another is known from off the Dry Tortugas, Florida. No species is known from the central Pacific, though one may occur there, as there is an old specimen in the Copenhagen Museum said to be from Nukahiva in the Marquesas; but Dr. Mortensen regards the locality as doubtful. Too much faith cannot be placed on the absence of records of this genus, as the species seem to be easily overlooked. The Caribbean species was not described until 1934 and is still known only from the four original specimens.

Among the brittle stars, the very large and conspicuous basket stars of the family Gorgonocephalidae, otherwise cosmopolitan, have not been reported from the small islands, nor have any of the species of Trichasteridae, with many-branched arms. However, the species of these two families occur in water of from a few fathoms downward, not along the shores, so, although they are frequently brought up on fishermen's lines, the absence of records is not necessarily significant.

Among the more conspicuous and characteristic of Indo-Pacific sea urchins are the limpet, pavement, or helmet urchins of the genus *Colobocentrotus*. These are of fairly large size and live in the surf zone, usually in large colonies, so that they are not easily overlooked. One species, *C. atratus*, occurs at Zanzibar, Natal, Madagascar, Mauritius, the Seychelles, Christmas Island, Java, Timor, and Amboina, and also in the Hawaiian Islands, though not between the Moluccas and Hawaii. A related species, *C. pedifer*, is confined to the Tuamotus. A third species, *C. mertensi*, is found in the Bonin and Mariana Islands. A related genus with normal instead of modified spines, *Zenocentrotus*, occurs in Tonga and Samoa. The latter, first described in 1931, may have a more extended distribution as it is easily confused with sea urchins of other families.

Among the largest, most conspicuous, and most characteristic of the Indo-Pacific sea

urchins are the two species of slate-pencil or cigar urchins of the genus *Heterocentrotus*. One of these, *H. mammillatus*, occurs from the Red Sea and Tanganyika, Madagascar, Mauritius, and Rodriguez to the Cocos-Keeling Islands, northwestern Australia, New Guinea, Torres Strait, the Philippines, New Caledonia, and Fiji, and also in the Mariana, Bonin, Ryukyu, and Hawaiian Islands. It appears to be absent from the central Polynesian region except for Johnston Island and the Tuamotus, where it was recently found by Dr. Morrison.

The other more specialized species, *H. trigonarius*, occurs at Zanzibar, Natal, Madagascar, Mauritius, Rodriguez, Java, the Philippines, Tonga, Samoa, and throughout Polynesia.

Both species occur at Madagascar, Mauritius, Rodriguez, the Philippines, the Tuamotus, and Johnston Island.

As both species have apparently the same habits, living normally in holes and crevices in the reefs and sometimes together in the same group, the reason for the difference in distribution in the extreme western and in the eastern part of their ranges is obscure. It may, of course, be due in part to insufficient knowledge of their distribution among the atolls; *H. mammillatus* may be more generally distributed here than the records available at present indicate.

It appears somewhat paradoxical that, although large species and large individuals for the most part do not extend into the groups of small Polynesian islands, a few species reach their maximum size in this area, on the northeastern periphery of their range. The largest specimen of *Heterocentrotus trigonarius* I have seen is from Johnston Island and measures 123 by 100 millimeters with a height of 68 millimeters and with the longest spines 150 millimeters. In another specimen, possibly larger, the longest spines are 165 millimeters long. Some from Bikini are almost as large (Clark, 1949: 71). The largest known specimens of *Brissus latecarinatus* are those

from the Marshall Islands recorded in the following pages.

In the Atlantic, *Echinometra lucunter* reaches its maximum size on the northern and southern limits of its range in Bermuda and Brazil (Clark, 1933: 83), and *Brissus brissus* in the Mediterranean reaches nearly twice the size that it does in the Caribbean (*ibid.*, p. 91). The largest known specimen of *Linckia guildingii*, with a radius of 215 millimeters, is from Bermuda.

From the zoogeographical and historical points of view, the most interesting and significant echinoderms are not to be found in the warm and brilliantly illuminated tropical littoral, but in the dimly illuminated and cooler zones from 5 or 6 fathoms downward to the depth, which differs in different areas, where a localized fauna, if present, begins to merge into the increasingly widespread abyssal fauna. That such an intermediate fauna may be of much significance is indicated by the genus *Psychocidaris*, the only representative of the family Psychocidaridae, related to the Creraceous *Tylocidaris*, known only from the Bonin Islands in about 100 fathoms.

COLLECTION DATA

Onotoa Atoll, Gilbert Islands

The localities in the Onotoa Atoll, Gilbert Islands, are listed by numbers. The data for each numbered locality are as follows.

G.O.C.-24. Toward the southern end of a lee reef stretch known as Rakai Ati, in an area of small coral patches fairly thickly interspersed on lime sand and coral debris; the bottom is at depths of 3-4 feet at low tide. Preston E. Cloud, Jr., and D. W. Strasburg, July 26, 1951.

G.O.C.-25. About 4.25 miles S.86°W. from Aiki Maneaba on the lagoon side of the broad reef passage north of a narrower passage called Rawa Bao, from small patch reefs rising to within 4-6 feet of the surface from a lime-sand and coral-gravel bottom at 12 feet. P.

E. Cloud, Jr., A. H. Banner, and D. W. Strasburg, July 27, 1951.

G.O.C.-26. From an isolated patch reef in the main reef passage about 1.5 miles directly offshore from Government Station jetty (on south portion of northern main island); depth about 20 feet. A. H. Banner and D. W. Strasburg, July 28, 1951.

G.O.C.-27. About 9,200 feet S.72°W. from offshore end of Government Station jetty (on south portion of northern main island) just south of main passage out of lagoon (Rawa ni Karoro) where coral shoals known as Aon te ra Bata begin to deepen; collection made from an area where patch reefs rise above the lime-sand bottom, at 16 feet depth; most specimens from a low coral patch about 14 feet below the surface. P. E. Cloud, Jr., July 29, 1951.

G.O.C.-28. Slightly less than 4 miles N.-85°W. from Aiaki Maneaba in outer lagoon; patch reefs rising above the lime-sand surface at 14 feet to within 6 feet of the surface. P. E. Cloud, Jr., D. W. Strasburg, A. H. Banner, E. Moul, and J. Randall, July 30, 1951.

G.O.C.-29. About 1 mile S.32°W. from Tekawa church at lagoon margin of south end of reef stretch known as Aon te Baba; collection from patch reefs rising about 9 feet (reduced to mean low tide) lime-sand bottom to within 1 foot of the surface. P. E. Cloud, Jr., D. W. Strasburg, and A. H. Banner, July 31, 1951.

G.O.C.-30. *Heliopora* flat at south end of the northern main island of Onotoa at 1+ feet at low tide. P. E. Cloud, Jr., and D. W. Strasburg, August 1, 1951.

G.O.C.-32. Back ridge trough, about 600 feet offshore from PSB camp (Onotoa) at the outer margin of the windward reef, just inshore from the algal ridge and surge channels; this part of the reef never dries even at low tide and generally has at least a foot or two of water above it. P. E. Cloud, Jr., August 1, 1951.

G.O.C.-35. About 8,600 feet N.18°W. from Tabuarorae Maneaba in 17 feet of water at

mean low tide. P. E. Cloud, Jr., August 10, 1951.

G.O.C.-36. Southeastern end of reef area known as Rakai Ati, south side of big windward point of reef near center of the atoll; collection made from a strip about 0.5 mile long running clear across the reef. P. E. Cloud, Jr., August 20, 1951.

G.O.C.-39. Northwestern Onotoa, about 1,300 feet northeast from Namokoro, in an area of gravelly sand bottom with maximum depths of about 12-14 inches at low tide and with occasional heads of digitate *Porites lobata*. P. E. Cloud, Jr., August 21, 1951.

G.O.C.-41. Green algal flats crusting dead coral-algal rock at northwest corner of atoll; collections were made over an area extending about 300 feet north and 1,000 feet west from a point about 3,000 feet north of the monument on Aonteuma; the area is exposed at low tide. P. E. Cloud, Jr., August 21, 1951.

G.O.C.-51. About 3.25 miles N.31°W. from Tabuarorae Maneaba near the center of Te Rawa ni Bao, a pass in the south part of the leeward reef; collected from thickly set coral masses rising from 15 feet (sounded at low tide) of water to within about 8-10 feet of the surface locally. P. E. Cloud, Jr., August 23, 1951.

G.O.C.-53. About 9,300 feet N.30°W. from Tabuarorae Maneaba in southern part of Te Rawa Tekatobibi, a pass through the south end of the leeward reef; collected from patch reefs rising to an occasional maximum of within 4 feet of the surface from a bottom sounded at 18 feet. P. E. Cloud, Jr., August 23, 1951.

G.O.C.-54. About 3,500 feet N.20°E. from Tabuarorae Maneaba, near the south end of the atoll, in about 2 feet of water over dead coral-algal bottom patchily veneered with calcareous gravel and scattered small patches of living coral. P. E. Cloud, Jr., August 23, 1951.

G.O.C.-55. About 13,400 feet S.75°W. from Aiki Maneaba in the deep central part of the lagoon; the bottom is of low scattered

dead and living coral patches on intervening lime sand and lime mud about 30–40 per cent sediments and 60–70 per cent coral. P. E. Cloud, Jr., August 25, 1951.

Banner, A-1, A-2. Windward reef flat, July, 1951.

Banner, A-11. Same locality, July 24, 1951.

Banner, B-1. Extensive shallow sand flats near shore.

Banner, B-4. Sand and decadent coral reef.

Banner, B-4-6. Sand and decadent coral reef, turtle grass, and mud flat, and "incipient beach rock," July, 1951.

Banner, B-8. Decadent coral reef.

Tuamotu Archipelago

The specimens from the Tuamotus were supplied with tin tag numbers in the field, and these numbers are listed under the species. The data for these numbers are as follows:

1841. Raroia Atoll, Ngarumaoa Island, zone just behind the outer reef edge. Joseph P. E. Morrison, July 5, 1952.

1842. Ngarumaoa Island, middle section or zone of outer reef. J. P. E. Morrison, July 5, 1952.

1855. Ngarumaoa Island, from edge of outer reef opposite village. J. P. E. Morrison, July 6, 1952.

1860. Ngarumaoa Island, middle zone of outer reef opposite village, on and under coral rock. J. P. E. Morrison, July 6, 1952.

1861. Ngarumaoa Island, from under rocks on middle to inner section or zone of outer reef opposite village. J. P. E. Morrison, July 6, 1952.

1879. Ngarumaoa Island, outer reef edge. J. P. E. Morrison, July 8, 1952.

1884. Ngarumaoa Island. J. P. E. Morrison, July 8, 1952.

1886. Ngarumaoa Island. J. P. E. Morrison, July 8, 1952.

1889. Ngarumaoa Island, from middle zone of outer reef flat. J. P. E. Morrison, July 9, 1952.

1906. Ngarumaoa Island, inshore pool area

of outer reef at north end. J. P. E. Morrison, July 9, 1952.

1917. Ngarumaoa Island, from under side of, and boring into, coralline rocks just below low-tide line on inner reef at north end of island. J. P. E. Morrison, July 11, 1952.

1920. Ngarumaoa Island, outer reef flats. N. D. Newell, July 11, 1952.

1921. Ngarumaoa Island, outer reef flats. N. D. Newell, July 11, 1952.

1922. Fakatomo Island, outer reef. Robert Harry, July 11, 1952.

1952. Nataira Island, under rocks on outer reef flats. J. P. E. Morrison, July 16, 1952.

1959. Homohomo Island, round depressions in outer reef pavement edge. J. P. E. Morrison, July 21, 1952.

1963. Homohomo Island. J. P. E. Morrison, July 21, 1952.

1994. North of Kahongi Island. J. P. E. Morrison, July 25, 1952.

2002. Tahuna riri Island, outer reef pavement flats. J. P. E. Morrison, July 27, 1952.

2023. Ngarumaoa Island, off inner reef, south end of island, 15 feet depth. N. D. Newell, August 1, 1952.

2040. Oneroa Island, outer reef pavement area. J. P. E. Morrison, August 4, 1952.

2043. Oneroa Island, from outer reef lithothamnion ridge in one local area. J. P. E. Morrison, August 4, 1952.

2050. Oneroa Island, from the lithothamnion ridge of outer reef outside the island, 0.5 mile south of camp. J. P. E. Morrison, August 5, 1952.

2059. Oneroa Island, from edge of inner reef, lagoon shore. M. Doty, August 5, 1952.

2060. Raroia Atoll, from patch reef 2 kilometers inside southeast corner of lagoon. R. Harry, August 4, 1952.

2103. Oneroa Island, coral gravel talus to lagoon mouth of channel and north end of island, 10 feet depth. J. P. E. Morrison, August 9, 1952.

2116. Ngarumaoa Island, Ohave teu patch reef. J. Newhouse, August 12, 1952.

2118. Raroia Atoll, in lagoon 100 yards east of Ohave Karena patch reef, 60 feet depth. J. Newhouse, August 12, 1952.

2120. In the lagoon 200 yards south of Okumekume patch reef. J. Newhouse, August 12, 1952.

2121. In the lagoon 200 yards northeast of the eastern tip of Miramirau reef, Ngarumaoa Island; 55 feet depth. J. Newhouse, August 13, 1952.

2122. Ngarumaoa Island, in lagoon 100 yards east of north edge of reef flat (Miramirau), south end of island; in 40 feet of water. J. Newhouse, August 13, 1952.

2124. Ngarumaoa Island, in lagoon 400 yards southwest of Tomanganga patch reef. J. Newhouse, August 13, 1952.

2172. Brought in by Kahea from patch reef off Tapatahiti Island (lagoon). J. P. E. Morrison, August 23, 1952.

2184. Rocky (coral gravel) beach of sand island (no name), second channel east of Kakapuka Island. J. P. E. Morrison, August 26, 1952.

2185. Second channel east of Kakapuka Island, under rocks just below low-tide line on beach of sand island (no name). J. P. E. Morrison, August 26, 1952.

2236. Collected from coral-studded bottom in the Ava pass. Huri Estill, September 1, 1952.

2238. Ngarumaoa Island, from inner reef in sandy patch near reef edge only, north end of island. J. P. E. Morrison, September 2, 1952.

2245. Ngarumaoa Island, from just below and 1 foot below low-tide line on gravel and rocks of sandy gravel bottom, inner reef flats near shore. J. P. E. Morrison, September 2, 1952.

2250. Ngarumaoa Island, northern end. J. P. E. Morrison, September 3, 1952.

2252. Ngarumaoa Island, from coralline algae from outer reef. M. Doty, September 3, 1952.

2253. Ngarumaoa Island, south end, from pool and pavement zone. M. Doty, September 3, 1952.

2254. Ngarumaoa Island, edge of pond section of lagoon reef flat (Miramirau), south of village. M. Doty, September 3, 1952.

LIST OF SPECIES COLLECTED

Class CRINOIDEA

Family COMASTERIDAE

Genus COMASTER L. Agassiz

Comaster gracilis (Hartlaub)

Actinometra gracilis Hartlaub, Nachr. Ges. Göttingen, May, 1890, pp. 170, 187 (Pulo Edam, near Batavia [Djakarta], Java).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-25 (1 specimen); G.O.C.-53 (1 specimen).

Genus COMANTHERIA A. H. Clark

Comantheria polycnemis A. H. Clark

Comantheria polycnemis A. H. Clark, U. S. Natl. Mus., Proc. 36: 396, 1909 ("Albatross" stations 5139, 5147, 5248, 5249 [type locality], 5350, 5251, 5252, 5253, 5354).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-25 (2 specimens); G.O.C.-53 (2 small specimens).

NOTE: A note with the specimens from G.O.C.-53 reads: "These and other ones lacking tendril grips [cirri] on base maroon with a scattering of golden threads on terminal (small) branches [pinnules] of food-gathering arms."

Genus COMANTHUS A. H. Clark

Comanthus bennettii (J. Müller)

Alecto bennettii J. Müller, Preuss. Akad. der Wiss., Monatsber. 1841: 187 (locality unknown).

LOCALITIES: Marshall Islands, Arno Atoll (3 small specimens); M.A.C.-1 (1 small specimen).

New Caledonia (1 large specimen).

Comanthus samoana A. H. Clark

Comanthus (Comanthus) samoana A. H. Clark,
U. S. Natl. Mus., Proc. 37: 30, 1909
(Samoa).

LOCALITIES: Gilbert Islands, Onotoa Atoll,
G.O.C.-25 (8 specimens); G.O.C.-51 (1
specimen); G.O.C.-53 (6 specimens).

Comanthus parvicirra (J. Müller)

Alecto parvicirra J. Müller, Preuss. Akad. der
Wiss., Monatsber. 1841, p. 185 (locality
unknown).

LOCALITY: Gilbert Islands, Onotoa Atoll,
G.O.C.-25 (4 specimens).

Genus **COMATELLA** A. H. Clark**Comatella maculata** (P. H. Carpenter)

Actinometra maculata P. H. Carpenter, "Chal-
lenger" Rpts., Zoology 26(60): 307, 1888
("Challenger" station 186).

LOCALITY: Mariana Islands, Rota, D. G.
Frey, November 12, 1945 (1 specimen).

Family **HIMEROMETRIDAE**Genus **HIMEROMETRA** A. H. Clark**Himerometra robustipinna** (P. H.
Carpenter)

Actinometra robustipinna P. H. Carpenter, Ley-
den Mus., Notes 3: 201, 1881 (Moluccas).

LOCALITY: Solomon Islands, New Georgia,
Wilfred G. Iltis (1 specimen).

Family **MARIAMETRIDAE**Genus **STEPHANOMETRA** A. H. Clark**Stephanometra spicata** (P. H.
Carpenter)

Antedon spicata P. H. Carpenter, Leyden Mus.,
Notes 3: 190, 1881 (Banda Sea).

LOCALITY: Guam, tide pools, D. G. Frey,
November 25, 1945 (1 specimen).

**Stephanometra indica
protectus** (Lütken)

Antedon protectus Lütken, Mus. Godeffroy
Cat. 5: 190, 1874 (Tonga Islands; nomen
nudum); in P. H. Carpenter, Linn. Soc.
London, Trans. (Zool.), ser. 2, 2: 19, 1879
(character of the oral pinnules).

LOCALITIES: Gilbert Islands, Onotoa Atoll,
G.O.C.-25 (1 small specimen); G.O.C.-51
(1 specimen).

Okinawa, reef off Odomari, A. R. Loeb-
lich, Jr., June 12, 1945 (3 specimens).

Genus **LAMPROMETRA** A. H. Clark**Lamprometra palmata palmata** (J. Müller)

Alecto palmata J. Müller, Preuss. Akad. der
Wiss., Monatsber. 1841: 185 (India).

LOCALITIES: Gilbert Islands, Onotoa Atoll,
G.O.C.-25 (1 specimen). Philippines, Green
Island Bay, Palawan, Lt. William A. Bartos,
1944 (1 specimen).

Class **ECHINOIDEA**Family **CIDARIDAE**Genus **EUCIDARIS** Pomel**Eucidaris metularia** (Lamarck)

Cidarites metularia Lamarck, Histoire naturelle
des animaux sans vertèbres, vol. 3, p. 56,
1816 (Ocean of the Great Indies, Mauri-
tius, and Santo Domingo).

LOCALITIES: Tuamotus, Morrison, 1879 (1
specimen); 1941 (1 specimen); 1952 (1 spec-
imen).

Guam, Oca Point, D. G. Frey, November,
1945 (1 specimen).

Genus **PHYLLACANTHUS** Brandt**Phyllacanthus imperialis** (Lamarck)

Cidarites imperialis Lamarck, Histoire naturelle
des animaux sans vertèbres, vol. 3, p. 54,
1816 (Red Sea).

LOCALITY: New Caledonia (fragments of
several specimens).

Family *DIADEMATIDAE*Genus *DIADEMA* Gray*Diadema paucispinum* A. Agassiz

Diadema paucispinum A. Agassiz, Mus. Compar. Zool., Bul. 1: 19, 1863 (Sandwich [Hawaiian] Islands).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-24 (1 specimen); G.O.C.-30 (1 specimen); G.O.C.-36 (1 specimen).

Diadema setosum (Leske)

Echinometra setosa Leske, Additamenta ad Jacobi Theodori Klein, 1778, p. 36.

LOCALITY: Saudi Arabia, ¼ mile north of West Pier, Ras Tanura, Donald S. Erdman, June 23, 1948.

NOTES: In his account of the echinoderms of the Iranian Gulf (Danish Scientific Investigations in Iran, part 2: 59, 1940) Dr. Th. Mortensen says: "Above all it is unbelievable that *Diadema* should not occur there, seeing that it occurs as far north as the Gulf of Suez in the Red Sea." In his notes on the echinoderms of Tarut Bay and vicinity, Saudi Arabia, Richard LeBaron Bowen wrote (A. H. Clark, 1949, Amer. Mus. Novitates No. 1390: 11, 13, 14) that on May 25, 1945, he found *Diadema* in Tarut Bay, and in one locality it was predominant and common. Later when he visited the locality to collect specimens, it had totally disappeared. In 1948 Mr. Erdman collected a specimen in the same general region and brought it to Washington. This specimen was mentioned as *Diadema setosum*, but without data of occurrence, in 1950 (Report on the Progress and Condition of the United States National Museum for the year ending June 30, 1949, p. 29).

Genus *ECHINOTHRIX* Peters*Echinothrix diadema* (Linné)

Echinus diadema Linné, Systema naturae, ed. 10, vol. 1, p. 664, No. 7, 1758 (Indian Sea).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-24 (2 small specimens, one with a parasitic gastropod).

Marshall Islands, Ailuk Atoll, leeward reef just west of Ailuk Island, seaward side, F. S. MacNeil, 1951-52 (2 specimens).

Tuamotus, Morrison, 1842 (4 specimens); 2238 (1 specimen).

Guam, Oca Point, David H. Johnson, May, 1945 (1 specimen); D. G. Frey, November, 1945 (3 specimens).

Saipan, Unai Taloforo, P. E. Cloud, Jr., June 12, 1949 (1 specimen).

Echinothrix calamaris (Pallas)

Echinus calamaris Pallas, Spicilegia zoologica . . . vol. 1, fasc. 10, p. 31, pl. 2, figs. 4-8, 1774 (East Indies).

LOCALITY: Solomon Islands, Bougainville Island, U. S. Navy, 1944 (1 specimen).

Family *TEMNOPLEURIDAE*Genus *MESPILIA* Desor*Mespilia globulus* (Linné)

Echinus globulus Linné, Systema naturae, ed. 10, vol. 1, p. 664, No. 2, 1758 (Indian Ocean).

LOCALITY: New Caledonia (6 bare tests).

Family *TOXOPNEUSTIDAE*Genus *TRIPNEUSTES* L. Agassiz*Tripneustes gratilla* (Linné)

Echinus gratilla Linné, Systema naturae, ed. 10, vol. 1, p. 664, No. 4, 1758 (Indian Ocean).

LOCALITIES: Gilbert Islands, Onotoa Atoll, reef near Abenecne, at a depth of 2 feet, Banner, October 7, 1951 (collected by Strasburg) (1 specimen).

Tuamotus, Morrison, 1889 (1 specimen); 1921 (1 specimen); 2175 (1 specimen).

Palmyra Island, Dr. W. H. Jones, U. S.

Navy, U.S.S. "Portsmouth" (1 specimen).

Guam, Oca Point, David H. Johnson, May, 1945 (1 specimen).

Solomon Islands, Bougainville, U. S. Navy, 1944 (1 specimen); New Georgia, Wilfred G. Iltis (1 specimen).

Seleo Island, about 5 miles off the northern New Guinea coast at Aitape, about midway between Hollandia and Wewak, Capt. Marvin Clinton Meyer (3 specimens).

New Caledonia (1+ specimens).

Family *PARASALENIIDAE*

Genus *PARASALENIA* A. Agassiz

Parasalenia pöhlii Pfeffer

Parasalenia pöhlii Pfeffer, Ver. Naturw. Unterhalt. Hamburg, Verhandl. 6: 110, 1887 (Tahiti).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-28 (1 specimen).

Tuamotus, Morrison, 2250 (1 specimen).

New Caledonia (2 bare tests).

Family *ECHINOMETRIDAE*

Genus *ECHINOMETRA* Gray

Echinomatra mathaei (de Blainville)

Echinus mathaei de Blainville, Dict. de sci. nat., vol. 37, Oursin, p. 94, 1825 (Mauritius).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-24 (3 specimens); G.O.C.-27 (1 specimen); G.O.C.-29 (1 specimen); G.O.C.-36 (2 specimens); G.O.C.-41 (2 specimens); Banner, A-11 (1 specimen); lagoon, in coral, Banner, July, 1951 (1 specimen).

Marshall Islands, Ailuk, F. S. MacNeil (1 specimen); Eniwetok, Lt. William C. Harrington, July 9, 1944 (1 specimen); Kwajalein Atoll, Loi and South Loi Islands, F. S. MacNeil (4 specimens); Lae Atoll, Lae Island, F. S. MacNeil (1 specimen); Taka Island, beach, F. S. MacNeil (3 specimens); Ujae Atoll, Ally Island, F. S. MacNeil (1 specimen); Ujelang Atoll, sand bar east of Moron Island,

F. S. MacNeil (2 specimens); Uterik Atoll, beach at west end of Uterik Island, lagoon side, F. S. MacNeil (1 specimen).

Tuamotus, Morrison, 1860 (3 specimens); 1879 (4 specimens); 1994 (1 specimen); 2116 (fragments); 2118 (dead test); 2184 (1 specimen); 2253 (1 small specimen).

Guam, Oca Point, David H. Johnson, May, 1945 (3 specimens); D. G. Frey, November, 1945 (3 specimens).

Saipan, P. E. Cloud, Jr., April 6, 1949 (1 specimen); lagoon west of Saipan, P. E. Cloud, Jr., April 12, 27, May 13, June 20, 1949 (19 specimens).

Okinawa, reef off Ogimi, A. R. Loeblich, Jr., June 12, 1945 (32 specimens).

Solomon Islands, Bougainville, Lt. William A. Bartos, 1944 (1 specimen); U. S. Navy, 1944 (2 specimens).

Seleo Island, about 5 miles off Aitape, northern New Guinea, about midway between Hollandia and Wewak, Capt. Marvin Clinton Meyer (5 specimens).

Netherlands New Guinea, about 5 miles north of Sansapor, Lt. George H. Penn, August 15 to October 3, 1944 (11 specimens).

New Caledonia (8 tests).

Echinometra mathaei var. *oblonga* (de Blainville)

Echinometra oblongus de Blainville, Dict. de sci. nat., vol. 37, Oursin, p. 95, 1825 (no locality).

LOCALITIES: Tuamotus, Morrison, 1841 (17 specimens); 2002 (1 specimen); 2185 (9 specimens).

Genus *ECHINOSTREPHUS* A. Agassiz

Echinostrephus aciculatus A. Agassiz

Echinostrephus aciculatus A. Agassiz, Mus. Compar. Zool., Bul. 1: 20, 1863 (Kingsmill [Gilbert] and Hawaiian Islands).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-51 (5 specimens).

Marshall Islands, Kwajalein Atoll, Loi and

South Loi Islands, F. S. MacNeil (1 specimen); Ujae Atoll, Wotya Island, F. S. MacNeil (1 small specimen); Ujelang Atoll, sand bar east of Moron Island, F. S. MacNeil (1 specimen).

Genus COLOBOCENTROTUS Brandt

Colobocentrotus atratus (Linné)

Echinus atratus Linné, Systema naturae, ed. 10, vol. 1, p. 655, 1758.

LOCALITY: Spouting Horn, south shore of Kauai, Hawaiian Islands, P. E. Cloud, Jr., September 13, 1951 (25 specimens).

Colobocentrotus pedifer (de Blainville)

Echinus pedifer de Blainville, Dict. de sci. nat., vol. 37, Oursin, p. 97, 1825 (southern seas).

LOCALITIES: Tuamotus, Morrison, 1922 (1 specimen); 1959 (1 specimen); 2043 (7 specimens); 2050 (5 specimens).

NOTE: This species is known only from the Tuamotus.

Colobocentrotus mertensi Brandt

Colobocentrotus mertensi Brandt, Prodrom. descr. anim. ab H. Mertensio observ., p. 66, 1835.

LOCALITIES: Guam, Oca Point, David H. Johnson, May, 1945 (8 specimens).

Saipan, near Talofofo, Alice Davis and Betsy Weld, transmitted through P. E. Cloud, Jr., June 12, 1949 (49 specimens).

NOTES: This species, long known from the Bonin Islands, was first recorded from the Marianas by Shozo Nishiyama who listed it from Pagan Island (Japan Oceanogr. Soc., Jour. 1[1,2], May, 1942 [in Japanese]). In 1949 I mentioned its occurrence at Guam (A. H. Clark, 1949; 71).

Genus HETEROCENTROTUS Brandt

Heterocentrotus trigonarius (Lamarck)

Echinus trigonarius Lamarck, Histoire naturelle

des animaux sans vertèbres, vol. 3, p. 51, 1816 (?Mediterranean).

LOCALITIES: Marshall Islands, Ailuk, F. S. MacNeil (1 specimen); Kwajalein Atoll, Loi and South Loi Islands, F. S. MacNeil (1 specimen); Lea Atoll, on windward reef flat, Lea Island, F. S. MacNeil, 1951-52 (1 specimen); Likiep Atoll, Lado Island, outer reef behind lithothamnion ridge, F. S. MacNeil (2 specimens); Uterik Atoll, Uterik Island, F. S. MacNeil (2 specimens); Wotho, F. S. MacNeil (2 specimens).

Tuamotus, Morrison, 1855 (4 specimens); 1889 (1 specimen); 1959 (1 small specimen).

Canton Island, Charles A. Ely, November 18, 1941 (1 specimen).

Guam, Oca Point, David H. Johnson, May, 1945 (2 specimens).

Heterocentrotus mammillatus (Linné)

Echinus mamillatus Linné, Systema naturae, ed. 10, vol. 1, p. 664, No. 9, 1758 (no locality).

LOCALITIES: Tuamotus, Morrison, 1959 (3 small specimens).

Saipan, near Talofofo, P. E. Cloud, Jr., June 12, 1949 (2 specimens).

New Caledonia (8 bare tests).

Family CLYPEASTRIDAE

Genus CLYPEASTER Lamarck

Clypeaster latissimus (Lamarck)

Scutella latissima Lamarck, Histoire naturelle des animaux sans vertèbres, vol. 3, p. 12, 1816 (?Southern Ocean).

LOCALITY: New Caledonia (1 specimen, 110 by 104 mm.).

Clypeaster reticulatus (Linné)

Echinus reticulatus Linné, Systema naturae, ed. 10, vol. 1, p. 606, No. 15, 1758 (American Ocean).

LOCALITIES: Marshall Islands, Taka Atoll, F. S. MacNeil (1 specimen, length 75 mm.,

width at anterior pair of petals 54 mm., thickness of margin 13 mm.); Ujae Atoll, Ally Island, F. S. MacNeil (3 specimens).

Family *LAGANIDAE*

Genus *LAGANUM* Linck

Laganum depressum L. Agassiz

Laganum depressum L. Agassiz, Monographie des scutelles, p. 110, pl. 23, figs. 1–7, 1841 (Moluccas).

LOCALITIES: Marshall Islands, Ailuk, F. S. MacNeil (1 specimen); Taka Atoll, beach, F. S. MacNeil (4 specimens); Ujelang Atoll, sand bar east of Moron Island, F. S. MacNeil (2 specimens); Wotho Atoll, Wotho Island, F. S. MacNeil (88 specimens).

New Caledonia (11 dead tests, the largest 74 by 61 mm.).

Laganum sp.

LOCALITY: Tuamotus, Morrison, 2120 (fragments).

Genus *PERONELLA* Gray

Peronella lesueuri (L. Agassiz)

Laganum lesueuri L. Agassiz, Monographie des scutelles, p. 116, pl. 24, figs. 3–6, 1841 (southern lands, Péron and Lesueur; also Guadeloupe).

LOCALITY: Okinawa, Shioya, Shanawan, D. Flint, 1947 (1 specimen).

Family *FIBULARIIDAE*

Genus *FIBULARIA* Lamarck

Fibularia australis Desmoulins

Fibularia australis Desmoulins, Études sur les échinides, p. 240, 1837 (southern seas).

LOCALITY: Marshall Islands, Wotho Island, F. S. MacNeil (77 specimens).

Fibularia ovulum (Linné)

Echinus ovulum Linné, Systema naturae, ed. 13, vol. 1, pt. 6, p. 3194, No. 83, 1788 (no locality).

LOCALITIES: Marshall Islands, Ujelang Atoll, sand bar east of Moron Island, F. S. MacNeil (39 specimens); Wotho Atoll, F. S. MacNeil (5 specimens).

Genus *ECHINOCYAMUS* van Phelsum

Echinocyamus megapetalus H. L. Clark

Echinocyamus megapetalus H. L. Clark, Mus. Compar. Zool., Mem. 46(1): 60, pl. 128, figs. 5–8, 1914 (Mauritius).

LOCALITIES: Marshall Islands, Ujelang Atoll, sand bar east of Moron Island, F. S. MacNeil (255 specimens); Wotho Island, F. S. MacNeil (11 specimens).

Family *ECHINONEIDAE*

Genus *ECHINONEUS* van Phelsum

Echinoneus cyclostomus Leske

Echinoneus cyclostomus Leske, Additamenta ad Jacobi Theodori Klein, p. 173, pl. 37, figs. 4, 5, 1778.

LOCALITIES: Marshall Islands, Kwajalein Atoll, Loi and South Loi Islands, F. S. MacNeil (1 specimen); Likiep Atoll, Nada Island, F. S. MacNeil (1 specimen); Taka Atoll, Taka Island, beach, F. S. MacNeil (8 specimens); Ujae Atoll, Ally Island, F. S. MacNeil (8 specimens); Wotya Island, F. S. MacNeil (1 specimen); Ujelang Atoll, sand bar east of Moron Island, F. S. MacNeil (93 specimens); Wotho Atoll, Wotho Island, F. S. MacNeil (5 specimens).

Tuamotus, Morrison, 1861 (2 specimens); 1883 (1 specimen); 1906 (2 specimens); 1963 (1 specimen).

Family *SPATANGIDAE*

Genus *METALIA* Gray

Metalia sternalis (Lamarck)

Spatangus sternalis Lamarck, Histoire naturelle des animaux sans vertèbres, vol. 3, p. 31, 1816 (southern oceans).

LOCALITY: New Caledonia (1 specimen).

Metalia spatagus (Linné)

Echinus spatagus Linné, *Systema naturae*, ed. 10, p. 665, 1758 (oceans everywhere).

LOCALITIES: Guam, Oca Point, David H. Johnson, May, 1945 (1 specimen).

New Caledonia (fragments of a very large specimen bored by a gastropod).

Metalia dicrana H. L. Clark

Metalia dicrana H. L. Clark, *Mus. Compar. Zool., Mem.* 46(2): 211, pl. 146, fig. 16, pl. 160, figs. 1-4, 1917 (Panglao, Bohol Province, Philippines).

LOCALITY: Marshall Islands, Likiep Atoll, Uado Island, F. S. MacNeil (1 specimen).

Genus **MARETIA** Gray**Maretia ovata** (Leske)

Spatangus ovatus Leske, *Additamenta ad Jacobi Theodori Klein*, p. 188, pl. 49, figs. 12, 13, 1778.

LOCALITY: Marshall Islands, Uterik, F. S. MacNeil (fragments).

Genus **BRISSUS** Leske**Brissus latecarinatus** (Leske)

Spatangus brissus var. *latecarinatus* Leske, *Additamenta ad Jacobi Theodori Klein*, pp. XX, 185, 1778.

LOCALITIES: Marshall Islands, Taka Atoll, F. S. MacNeil (2 specimens; the larger, length 123 mm., width 100 mm., height 65 mm.); Ujelang Atoll, sand bar east of Moron Island, F. S. MacNeil (19 specimens; the largest, length 137 mm., width 105 mm., height 78 mm.); Wotho Island, F. S. MacNeil (1 specimen, length 135 mm., width 113 mm., height 81 mm.); no definite locality, F. S. MacNeil (1 specimen).

Class **ASTEROIDEA**Family **ARCHASTERIDAE****Archaster typicus** Müller and Troschel

Archaster typicus Müller and Troschel, *Preuss. Akad. der Wiss., Monatsber.* 1840: 104 (Indian Ocean).

LOCALITY: New Caledonia (3 specimens).

Family **OREASTERIDAE**Genus **PROTOREASTER** Döderlein**Protoreaster nodosus** (Linné)

Asterias nodosa Linné, *Systema naturae*, ed. 10, p. 661, 1758 (Indian Ocean).

LOCALITIES: Guam, Oca Point, David H. Johnson, May, 1945 (1 specimen); D. G. Frey, November, 1945 (5 specimens).

Seleo Island, about 5 miles off the northern New Guinea coast at Aitape, about midway between Hollandia and Wewak, coral reef, Capt. Marvin Clinton Meyer (2 specimens).
New Caledonia (3 specimens).

Genus **CULCITA** L. Agassiz**Culcita novae-guineae**

Müller and Troschel

Culcita novae-guineae Müller and Troschel, *System der Asteriden*, 1842, p. 38 (New Guinea).

LOCALITIES: Marshall Islands, Bikini Atoll, inside pools of outer reef, southeastern Bikini Island, H. S. Ladd, March 23, 1946 (1 specimen); Ailuk, windward reef, F. S. MacNeil, 1951-52 (1 specimen).

Gilbert Islands, Onotoa Atoll, P. E. Cloud, Jr. (1 specimen); G.O.C.-54 (1 specimen).

Tuamotus, Morrison, 2023 (1 specimen); 2059 (1 specimen); 2060 (1 specimen); 2172 (1 specimen).

Guam, Oca Point, David H. Johnson, May, 1945 (4 specimens); D. G. Frey, November, 1945 (5 specimens).

Seleo Island, about 5 miles off the northern coast of New Guinea at Aitape, about midway

between Hollandia and Wewak, Capt. Marvin Clinton Meyer (1 specimen).

New Caledonia (1 specimen).

Family LINCKIIDAE

Genus FROMIA Gray

*Fromia hemiopl*a Fisher

*Fromia hemiopl*a Fisher, U. S. Natl. Mus., Proc. 46: 212, 1913 (Tonquil Island, Gumila reef, south of Mindanao, Philippines).

LOCALITIES: Marshall Islands, Ailuk Atoll, near outer edge of seaward reef, leeward side of Ailuk Island, near west end of island, F. S. MacNeil, 1951–52 (1 specimen).

Gilbert Islands, Onotoa Atoll, G.O.C.-36 (3 specimens); G.O.C.-55 (1 specimen).

Fromia milleporella (Lamarck)

Asterias milleporella Lamarck, Histoire naturelle des animaux sans vertèbres, vol. 2, p. 564, 1816 (?seas of Europe).

LOCALITIES: Saipan, lagoon west of the island, P. E. Cloud, Jr., July 4, 1949 (1 specimen).
New Caledonia (1 specimen).

Fromia balansae Perrier

Fromia balansae Perrier, Arch. de Zool. Expt. et Gén. 4: 552, 1875 (New Caledonia).

LOCALITIES: Fiji, Mukuluva reefs, June 12, 1922 (1 specimen).

Samoa, Pago Pago, Vernon L. Kellogg, August, 1902 (3 specimens).

Fromia pacifica H. L. Clark

Fromia pacifica H. L. Clark, Echinoderms of Torres Strait, 1921, p. 42, pl. 31, figs. 5, 6 (Hawaiian Islands).

LOCALITY: Samoa, Pago Pago, Vernon L. Kellogg, August, 1902 (2 specimens).

NOTE: Dr. Clark in the original description recorded this species from the Gilbert Islands.

Fromia monilis Perrier

Fromia monilis Perrier, Arch. de Zool. Expt. et Gén. 4: 443, 1875 (no locality).

LOCALITY: Gilbert Islands, Onotoa Atoll, G.O.C.-36 (2 specimens).

Samoa, Pago Pago, Vernon L. Kellogg, August, 1902 (1 specimen).

No locality (1 specimen).

Genus FERDINA Gray

Ferdina offreti Koehler

Ferdina offreti Koehler, Indian Mus. Asterioidea, p. 143, pl. 16, figs. 2–5, 1910 (Little Andaman, 10 fathoms; Ceylon, 34 fathoms).

LOCALITY: New Caledonia (1 specimen).

Genus GOMOPHIA Gray

Gomophia egyptica Gray

Gomophia egyptica Gray, Ann. and Mag. Nat. Hist. 6: 286, 1840 (Egypt).

LOCALITY: Gilbert Islands, Onotoa, 4–10 feet, Banner, July, 1951 (1 specimen).

Genus NARDOA Gray

Nardoa pauciforis (von Martens)

Linckia pauciforis von Martens, Arch. f. Naturgesch. 32(1): 69, 1866 (Adenare Island, near Flores).

LOCALITY: Solomon Islands, New Georgia, Wilfred G. Iltis (1 specimen).

Nardoa mollis de Loriol

Nardoa mollis de Loriol, Soc. Phys. Nat. Hist. Genève, Mém., Suppl. 8: 26, pl. 3 (12), figs. 4–4f, 1891 (New Britain).

LOCALITY: Seleo Island, about 5 miles off the northern coast of New Guinea at Aitape, about midway between Hollandia and Wewak, Capt. Marvin Clinton Meyer (7 specimens).

Nardoa frianti Koehler

Nardoa frianti Koehler, Indian Mus. Asterioidea, 1910, p. 158, pl. 17, figs. 3, 4 (Andaman Islands, 20 fathoms).

LOCALITY: New Caledonia (1 broken specimen).

Genus **OPHIDIASTER** L. Agassiz**Ophidiaster granifer** Lütken

Ophidiaster granifer Lütken, Vidensk. Meddel. 1871: 276 (Tonga Islands).

LOCALITY: Seleo Island, about 5 miles off the northern New Guinea coast at Aitape, about midway between Hollandia and Wakwak, coral reef, Capt. Marvin Clinton Meyer (2 specimens).

Ophidiaster pustulatus (von Martens)

Linckia pustulata von Martens, Arch. f. Naturgesch. 32(1): 62, 1866 (Flores; Amboina).

LOCALITY: Guam, Oco Point, David H. Johnson, May, 1945 (2 specimens).

Ophidiaster perplexus sp. nov.

DESCRIPTION: Rays 5, equal, with parallel sides until near the tip, well arched aborally, flat orally below the marginals; interbranchial angles acute. $R = 33$ mm., $r = 5.5$ mm., $R = 6r$; breadth of arms at base 6 mm.

At the base of the rays on the aboral surface there are three rows of plates between the marginals, but almost immediately additional rows appear by branching of the median row and its successive branches, so that in the outer half of the rays there are seven or eight rows. At the base of the rays all the aboral plates are of about the same size, the marginals only very slightly larger than the others, but on the outer part of the rays, while the plates of the rows adjoining the superomarginals are of about the same size as the latter or only very slightly smaller, those of the inner rows are considerably smaller and more or less irregular in arrangement.

All the plates are completely covered with a continuous coating of very small contiguous spherical granules; a small group of granules on the summit of each plate, or, especially on the marginals, a single granule, are slightly though inconspicuously larger than the others. The aboral and marginal plates are slightly tumid, each longitudinal series forming a low convex ridge, the ridges and the individual plates in the ridges being separated from each other by similar shallow though prominent furrows.

The marginals number about 32; the superomarginals are directly above the inferomarginals, and the plates of the outermost aboral rows are for the most part directly above the superomarginals. The terminal plate is aboral, somewhat flattened-hemispherical, bare, with 4-6 tubercles in an irregular longitudinal series.

In the center of the disc there is a group of about 15 irregularly arranged plates enclosed in a pentagon of 10 subequal larger plates which are broader than long. The radially situated plates in the pentagon are followed by the median row of aboral plates. The plate in this row immediately following the radial plate in the pentagon is somewhat larger than those succeeding, and the next following plate may be slightly enlarged. The interradial plates in the pentagon are separated from the interradial superomarginals by two smaller plates similar to and contiguous with the plates of the lateral rows of the aboral surface between the median row and the superomarginals.

The madreporite, which is about the size of the adjacent interradial plate in the central pentagon, is halfway between the center of the disc and the interradial angle. There is only a single madreporite.

The papulae appear to be single or in small groups of 2 or 3, but are difficult to distinguish between the granules.

On the oral surface of the rays there are at the bases of the rays 4 rows of plates between the adambulacrals and the inferomarginals.

The outermost row extends to about the eighth inferomarginal, and the next disappears in the outer third of the ray. The plates of the oral surface are completely covered with densely crowded small spherical uniform granules resembling those on the aboral surface. The plates are only slightly elevated and are separated by shallow grooves. There appear to be no papulae on the oral surface.

There are no pedicellariae on either the oral or aboral surfaces.

The furrow spines are flattened at right angles to the longitudinal axis of the ray and have broadly rounded tips. Of the two on each adambulacral plate, the adoral is slightly smaller than the aboral. Between the two spines on each plate there are two elongated grains, one above the other, 2 or 3 times as long as broad, the uppermost reaching to the upper third of the spines. These grains are visible only after dissection. On the mouth plates and on a few of the adambulacrals immediately following, grains (usually two) from the oral surface are intercalated between the spines. The outer portion of each adambulacral plate bears a rounded tubercle which is a little larger than the rounded end of the larger spine; this tubercle is separated from the furrow spines by usually two irregular rows of tubercles similar to those covering the oral surface.

The color (dry) is buff white, with small irregular darker blotches.

TYPE: U.S.N.M., E.7999, from pool and pavement zone at the south end of Ngaru-maoa Island, Tuamotus; collected by Dr. Joseph P. E. Morrison, September 3, 1952.

REMARKS: *Ophidiaster perplexus* falls within that section of the genus *Ophidiaster* which includes species with granules on the inner surface of the furrow between the furrow spines; with a single madreporite; with few papular pores in each papular area; and with few or no pedicellariae. This group includes only *O. pustulatus* and *O. squameus*, from which *O. perplexus* differs markedly in the arrangement of the plates on the aboral surface; in

the fineness and uniformity of the granular covering; in the spherical form of the tubercles on the outer part of the adambulacral plates; and in having the granules on the furrow series double and between pairs of spines instead of between individual spines.

In size and in general appearance *Ophidiaster perplexus* resembles *Linckia multifora* more closely than it does any other species of *Ophidiaster*, and it is possible that in the past it has been confused with it. The rays are slightly stouter than those of *L. multifora*, and the plates on the aboral surface are larger, more tumid, and, at least on the bases of the rays and on the aboral surface of the disc, more regular in arrangement; the papular areas are much smaller, with fewer papulae. On the oral side the armature of the adambulacral plates is strikingly similar, but in *L. multifora* the grains on the inner face of the furrow are between the individual spines instead of between pairs of spines, as in *O. perplexus*. In *L. multifora* there are two madreporites which are much nearer the interbrachial angles than they are to the center of the disc.

Genus LINCKIA Nardo

Linckia multifora (Lamarck)

Asterias multifora Lamarck, Histoire naturelle des animaux sans vertèbres, vol. 2, p. 565, 1816 (?Seas of Europe).

LOCALITIES: Marshall Islands, Eniwetok, Lt. William C. Harrington, July 9, 1944 (1 specimen); Ujae Atoll, soft fine sandy tidal flat at the north end of Ujae Island, F. S. MacNeil, 1951–52 (3 specimens); Uterik Atoll, F. S. MacNeil, November 28, 1951 (3 specimens); Wotho Atoll, Wotho Island, F. S. MacNeil (2 specimens).

Gilbert Islands, Onotoa Atoll, G.O.C.-24 (1 specimen); G.O.C.-36 (3 specimens and 4 comets); G.O.C.-41 (1 specimen); Banner, B-8 (1 comet).

Tuamotus, Morrison, 1884, 1886 (4 specimens); 1860 (46 specimens); 1917 (2 comets);

1920 (1 specimen); 2103 (1 comet); 2121 (4 specimens); 2185 (3 specimens); 2243 (1 comet); 2245 (15 specimens).

Canton Island, L. P. Schultz, June 5, 1939 (1 specimen).

Saipan, lagoon west of the island, P. E. Cloud, Jr., April 27, 1949 (1 specimen); April 27 and May 13, 1949 (5 specimens); May 6, 1949 (1 specimen).

Linckia laevigata (Linné)

Asterias laevigata Linné, *Systema naturae*, ed. 10, vol. 1, p. 662, No. 8, 1758 (Mediterranean and Indian Seas).

LOCALITIES: Marshall Islands, Bikini Atoll, Bikini Island, from shore (coral head) in Bikini lagoon near Bikini Island, depth 40 feet, J. P. E. Morrison, March 13, 1946 (1 specimen).

Gilbert Islands, Onotoa Atoll, G.O.C.-39 (1 specimen).

Guam, Oca Point, David H. Johnson, May-June, 1945 (16 specimens); D. G. Frey, November, 1945 (2 specimens).

Solomon Islands, New Georgia, Wilfred G. Iltis (5 specimens, one of them 6-rayed). New Caledonia (1 specimen).

Family *ASTEROPIDAE*

Genus *ASTEROPE* Müller and Troschel

Asterope carinifera (Lamarck)

Asterias carinifera Lamarck, *Histoire naturelle des animaux sans vertèbres*, vol. 2, p. 556, 1816 (voyage of Péron and Lesueur).

LOCALITIES: Fiji, Mukuluva reefs (1 specimen).

Guam, Oca Point, David H. Johnson, May, 1945 (1 specimen).

Seleo Island, about 5 miles off the northern coast of New Guinea at Aitape, about midway between Hollandia and Wewak, coral reef, Capt. Marvin Clinton Meyer (1 specimen).

Family *ASTERINIDAE*

Genus *ASTERINA* Nardo

Asterina cephea (Müller and Troschel)

Asterias cephea (Valenciennes, MS.) Müller and Troschel, *System der Asteriden*, p. 41, 1842 (Batavia [Djakarta], Java).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-51 (4 specimens, one 4-rayed).

Okinawa, reef off Odomari, A. R. Loeblich, Jr., June 12, 1945 (1 specimen).

Seleo Island, about 5 miles off the northern New Guinea coast at Aitape, about midway between Hollandia and Wewak, coral reef, Capt. Marvin Clinton Meyer (3 specimens).

Genus *PATIRIELLA* Verrill

Patiriella exigua (Lamarck)

Asterias exigua Lamarck, *Histoire naturelle des animaux sans vertèbres*, vol. 2, p. 554 (Seas of America, etc.).

LOCALITIES: Admiralty Islands, Manus, D. G. Frey, January 12, 1946 (15 specimens).

Seleo Island, about 5 miles off the northern New Guinea coast at Aitape, about midway between Hollandia and Wewak, coral reef, Capt. Marvin Clinton Meyer (7 specimens).

Genus *DISASTERINA* Perrier

Disasterina spinulifera H. L. Clark

Disasterina spinulifera H. L. Clark, *Mus. Compar. Zool., Mem.* 55: 156, pl. 22, fig. 6, 1938 (Broome, Western Australia).

LOCALITY: Saipan, lagoon west of the island, P. E. Cloud, Jr., May 4, 1949 (1 specimen).

Family *ECHINASTERIDAE*

Genus *OTHILIA* Gray

Othilia luzonica Gray

Othilia luzonica Gray, *Ann. and Mag. Nat. Hist.* 6: 282, 1840 (Isle of Luzon, Philippines).

LOCALITIES: Marshall Islands, Ailuk Atoll, near outer edge of seaward reef, leeward side of Ailuk Island, near west end of island, F. S. MacNeil, 1951–52 (1 specimen).

Gilbert Islands, Onotoa Atoll, lagoon, A. H. Banner, July, 1951 (1 specimen).

Palmyra Island (2 specimens).

Saipan, lagoon west of the island, P. E. Cloud, Jr., May 13, 1949 (1 specimen).

Family ACANTHASTERIDAE

Genus ACANTHASTER Gervais

Acanthaster planci (Linné)

Asterias planci Linné, Systema naturae, ed. 10, p. 823, Appendix, 1758 (Goa [Portuguese India]).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-36 (1 specimen).

Tuamotus, Morrison, 2236 (1 specimen).
New Caledonia (2 specimens).

Class OPHIUROIDEA

Family OPHIACTIDAE

Genus OPHIACTIS Lütken

Ophiactis savignyi (Müller and Troschel)

Ophiopsis savignyi Müller and Troschel, System der Asteriden, p. 95, Species 12, 1842 (Egypt).

LOCALITIES: Gilbert Islands, Onotoa Atoll, Banner, B-4, in old heads (9 specimens).

Tuamotus, Morrison, 2122 (1 specimen).

Family OPHIOTRICHIDAE

Genus OPHIOTHRIX Müller and Troschel

Ophiotrix propinqua Lyman

Ophiotrix propinqua Lyman, Boston Soc. Nat. Hist., Proc. 8: 83, 1861 (Kingsmill [Gilbert] Islands).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-35 (2 specimens); G.O.C.-36 (1 specimen); G.O.C.-51 (3 specimens).

Canton Island, Charles A. Ely, 1942 (1 specimen).

Ophiotrix trilineata Lütken

Ophiotrix trilineata Lütken, Additamenta ad historiam Ophiuridarum, part 3, pp. 58, 100, 1869 (Samoan Islands).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-51 (6 specimens).

Tuamotus, Morrison, 1920 (1 specimen).

Ophiotrix picteti de Loriol

Ophiotrix picteti de Loriol, Rev. Suisse de Zool. 1: 423, pl. 15, figs. 3–3e (Amboina).

LOCALITY: Canton Island, lagoon, in coral, Charles A. Ely, January, 1942 (2 specimens).

Ophiotrix demessa Lyman

Ophiotrix demessa Lyman, Boston Soc. Nat. Hist., Proc. 8: 82, 1861 (Sandwich [Hawaiiian] and Gilbert [Kingsmill] Islands).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-30 (2 specimens); exact locality lost, A. H. Banner (1 specimen).

Ophiotrix longipeda (Lamarck)

Ophiura longipeda Lamarck, Histoire naturelle des animaux sans vertèbres, vol. 2, p. 544, 1816 (Mauritius).

LOCALITY: Saipan, lagoon north of Matuis Beach, northwestern Saipan, P. E. Cloud, Jr., December 12, 1948 (1 specimen).

Family OPHIOCHITONIDAE

Genus OPHIONEREIS Lütken

Ophionereis porrecta Lyman

Ophionereis porrecta Lyman, Boston Soc. Nat. Hist. Proc. 7: 260, 1860 (?Florida).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-51 (3 specimens).

Saipan, lagoon west of the island, P. E. Cloud, Jr., May 4, 13, 1949 (9 specimens).

Family OPHIOCOMIDAE

Genus OPHIOCOMA L. Agassiz

Ophiocoma anaglyptica Ely

Ophiocoma anaglyptica Ely, Wash. Acad. Sci. Jour. 34(11): 373, fig. 1, 1944 (Canton Island, reef).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-30 (1 specimen); G.O.C.-32 (4 specimens).

Ophiocoma scolopendrina (Lamarck)

Ophiura scolopendrina Lamarck, Histoire naturelle des animaux sans vertèbres, vol. 2, p. 544, 1816 (Mauritius).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-41 (2 specimens); G.O.C.-51 (9 specimens); Banner, A-1, A-2 (13 specimens); Banner, exact locality lost (2 specimens).

Tuamotus, Morrison, 1879 (1 specimen); 1994 (1 specimen); 2185 (12 specimens); 2252 (1 specimen); 2254 (2 specimens).

Fiji, Mukuluva reefs, June 12-16, 1922 (26 specimens); reef east of Mukuluva, June 14, 1922 (3 specimens).

Guam, Oca Point, D. G. Frey, November 1945 (2 specimens); January 1946 (2 specimens).

Saipan, lagoon west of the island, P. E. Cloud, Jr., April 19, 1949 (2 specimens).

Solomon Islands, New Georgia, Lt. William A. Bartos, 1944 (2 specimens).

New Guinea, J. E. Hadley (15 specimens).

Ophiocoma erinaceus Müller and Troschel

Ophiocoma erinaceus Müller and Troschel, System der Asteriden, p. 98, 1842 (Red Sea; Indian Ocean).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-24 (8 specimens); G.O.C.-30 (9 specimens); G.O.C.-36 (5 specimens).

Tuamotus, Morrison, 1920 (6 specimens); 2040 (1 specimen).

Saipan, lagoon west of the island, P. E.

Cloud, Jr., May 13, 1949 (1 specimen); on Tanapag reef, P. E. Cloud, Jr., April 29, 1949 (3 specimens).

Ophiocoma schoenleinii Müller and Troschel

Ophiocoma schoenleinii Müller and Troschel, System der Asteriden, p. 99, 1842 (India).

LOCALITY: Gilbert Islands, Onotoa Atoll, G.O.C.-41 (2 specimens).

Ophiocoma pica Müller and Troschel

Ophiocoma pica Müller and Troschel, System der Asteriden, p. 101, 1842 (locality unknown).

LOCALITIES: Gilbert Islands, Onotoa Atoll, exact locality lost, Banner (1 specimen).

Tuamotus, Morrison, 1994 (1 specimen).

Ophiocoma brevipes Peters

Ophiocoma brevipes Peters, Preuss. Akad. der Wiss., Ber. 1851: 466 (Mozambique; Querimba Island).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-24 (1 specimen); G.O.C.-30 (1 specimen).

Tuamotus, Morrison, 1920 (1 specimen).

Fiji, Mukuluva reefs (2 specimens).

Netherlands New Guinea, Amsterdam Island, about 5 miles north of Sansapor, Lt. George H. Penn, August 15 to October 3, 1944 (1 specimen).

Ophiocoma sp.

LOCALITY: Gilbert Islands, Onotoa Atoll, G.O.C.-26 (1 specimen).

Genus OPHIOCOMELLA A. H. Clark

Ophiocomella clippertoni A. H. Clark

Ophiocomella clippertoni A. H. Clark, Smithsn. Inst., Misc. Collect. 98(11): 7, pl. 1, figs. 1, 2 (as *O. parva*), 1939 (Clipperton Island).

LOCALITY: Saipan, lagoon west of the island, P. E. Cloud, Jr., May 13, 1949 (4 specimens).

Genus *OPHIOMASTIX* Müller and Troschel

***Ophiomastix mixta* Lütken**

Ophiomastix mixta Lütken, Additamenta ad historiam Ophiuridarum, pt. 3, pp. 42, 99, 1869 (Samoa and Fiji).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-24 (1 specimen); G.O.C.-36 (1 specimen); G.O.C.-51 (1 specimen).

Saipan, lagoon west of the island, P. E. Cloud, Jr., March 7, 1949 (2 specimens).

Fiji, reef east of Mukuluva, June 14, 1922 (1 specimen).

***Ophiomastix bispinosa* H. L. Clark**

Ophiomastix bispinosa H. L. Clark, Mus. Compar. Zool., Bul. 61(12): 442, pl. 2, figs. 1, 2, 1917 (Paumotu [Tuamotu] Islands, Makemo).

LOCALITY: Gilbert Islands, Onotoa Atoll, Banner, B-1 (1 specimen).

***Ophiomastix notabilis* H. L. Clark**

Ophiomastix notabilis H. L. Clark, Mus. Compar. Zool., Mem. 55: 337, fig. 27, 1938 (Cape Lévéque, Western Australia).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-35 (1 specimen); G.O.C.-51 (2 specimens).

Saipan, lagoon west of the island, P. E. Cloud, Jr., May 13, 1949 (1 specimen).

***Ophiomastix annulosa* (Lamarck)**

Ophiura annulosa Lamarck, Histoire naturelle des animaux sans vertèbres, vol. 2, p. 543, 1816 (from the voyage of Péron and Lesueur).

LOCALITY: Netherlands New Guinea, Amsterdam Island, about 5 miles north of San-

apor, Lt. George H. Penn, August 15 to October 3, 1944 (1 specimen).

Genus *OPHIARTHURUM* Peters

***Ophiarthrum elegans* Peters**

Ophiarthrum elegans Peters, Preuss. Akad. der Wiss., Ber. 1851: 463 (Querimba Island).

LOCALITIES: Saipan, lagoon west of the island, P. E. Cloud, Jr., May 13, 1949 (1 specimen).

Fiji, Mukuluva reefs, June 8, 1922 (6 specimens).

***Ophiarthrum pictum* (Müller and Troschel)**

Ophiocoma picta Müller and Troschel, System der Asteriden, p. 102, 1842 (Java).

LOCALITY: Guam, Oca Point, D. G. Frey, November, 1945 (2 specimens).

Family *OPHIODERMATIDAE*

Genus *OPHIARACHNELLA* Ljungman

***Ophiarachnella gorgonia* (Müller and Troschel)**

Ophiarachna gorgonia Müller and Troschel, System der Asteriden, p. 105, 1842 (locality unknown).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-30 (1 specimen).

Guam, Oca Point, D. G. Frey, November, 1945 (1 specimen).

***Ophiarachnella infernalis* (Müller and Troschel)**

Ophiarachna infernalis Müller and Troschel, System der Asteriden, p. 105, 1842 (Indian Ocean).

LOCALITY: Guam, Oca Point, D. G. Frey, November, 1945 (4 specimens).

Genus *OPHIOPEZELLA* Ljungman

***Ophiopezella spinosa* (Lungman)**

Ophiarachna spinosa Ljungman, Öfvers. K.

Vetensk. Akad. Förhandl., vol. 23, part 6, p. 305, 1867 (Foua).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-30 (1 specimen); G.O.C.-51 (5 specimens).

Saipan, lagoon west of the island, P. E. Cloud, Jr., May 13, 1949 (1 specimen).

Family OPHIOLEPIDIDAE

Genus OPHIURA Lamarck

Ophiura kinbergi Ljungman

Ophiura (vel *Ophioglypha*) *kinbergi* Ljungman, Öfvers. K. Vetensk. Akad. Förhandl. 23: 166, 1866 (Sydney, New South Wales, Australia).

LOCALITY: Tuamotus, Morrison, 2124 (1 specimen).

Genus OPHIOLEPIS Müller and Troschel

Ophiolepis cincta Müller and Troschel

Ophiolepis cincta Müller and Troschel, System der Asteriden, p. 90, 1942 (Red Sea).

LOCALITIES: Fiji, Mukuluva reefs (1 specimen).

Saipan, lagoon west of the island, P. E. Cloud, Jr., April 19, 1949 (1 specimen).

Genus OPHIOPLOCUS Lyman

Ophioplocus imbricatus (Müller and Troschel)

Ophiolepis imbricata Müller and Troschel, System der Asteriden, p. 93, 1842 (Mauritius; Timor).

LOCALITIES: Gilbert Islands, Onotoa Atoll, G.O.C.-30 (2 specimens).

Canton Island, reef on the south side under stones, 3-4 feet, Charles A. Ely, October 28, 1941.

Seleo Island, about 5 miles off the northern New Guinea coast at Aitape, about midway between Hollandia and Wewak, Capt. Marvin Clinton Meyer (1 specimen).

ATOLLS AND ISLANDS AT WHICH COLLECTIONS WERE MADE, WITH THE SPECIES COLLECTED AT EACH

ADMIRALTY ISLANDS, Manus: *Patiriella exigua*.

Fiji ISLANDS: *Fromia balansae*, *Asterope carinifera*, *Ophiocoma scolopendrina*, *Ophiocoma brevipes*, *Ophiomastix mixta*, *Ophiarthrum elegans*, *Ophiolepis cincta*.

GILBERT ISLANDS, Onotoa Atoll: *Comaster gracilis*, *Comantheria polycnemis*, *Stephanometra indica protectus*, *Lamprometra palmata palmata*, *Diadema paucispinum*, *Echinothrix diadema*, *Tripneustes gratilla*, *Parasalenia pöblii*, *Echinometra mathaei*, *Echinostrephus aciculatus*, *Culcita novae-guineae*, *Fromia hemiopl*, *Fromia monilis*, *Gomophia egyptica*, *Linckia multifora*, *Linckia laevigata*, *Asterina cephea*, *Othilia luzonica*, *Acanthaster planci*, *Ophiactis savignyi*, *Ophiothrix propinqua*, *Ophiothrix trilineata*, *Ophiothrix demessa*, *Ophionereis porrecta*, *Ophiocoma anaglyptica*, *Ophiocoma scolopendrina*, *Ophiocoma erinaceus*, *Ophiocoma schoenleinii*, *Ophiocoma pica*, *Ophiocoma brevipes*, *Ophiocoma* sp., *Ophiomastix mixta*, *Ophiomastix bispinosa*, *Ophiomastix notabilis*, *Ophiarachnella gorgonia*, *Ophiopezella spinosa*, *Ophioplocus imbricatus*.

HAWAIIAN ISLANDS, Kauai: *Colobocentrotus atratus*.

MARIANA ISLANDS, Guam: *Stephanometra spicata*, *Eucidaris metularia*, *Echinothrix diadema*, *Tripneustes gratilla*, *Echinometra mathaei*, *Colobocentrotus mertensi*, *Heterocentrotus trigonarius*, *Metalia spatagus*, *Protoreaster nodosus*, *Culcita novae-guineae*, *Ophidiaster pustulatus*, *Linckia laevigata*, *Asterope carinifera*, *Ophiocoma scolopendrina*, *Ophiarthrum pictum*, *Ophiarachnella gorgonia*, *Ophiarachnella infernalis*. Pagan Island: *Colobocentrotus mertensi* [quoted from Nishiyama]. Rota Island: *Comatella maculata*. Saipan: *Echinothrix diadema*, *Echinometra methaei*, *Colobocentrotus mertensi*, *Heterocentrotus mammillatus*, *Fromia milleporella*, *Linckia multifora*, *Disasterina spinulifera*, *Othilia luzonica*, *Ophiothrix longipeda*, *Ophionereis porrecta*, *Ophiocoma*



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