[*Contribution from the Department of Zoology, University of the Philippines*]

THE ECOLOGICAL DISTRIBUTION OF THE ECHINODERM FAUNA OF THE PUERTO GALERA MARINE BIOLOGICAL STATION[1]

JOSE S. DOMANTAY

ABSTRACT

An ecological study of the distribution of the echinoderms in the Puerto Galera region is presented in this paper. It is shown that the type of bottom influences a good deal the distribution of these organisms.

The Puerto Galera Marine Biological Station has many good collecting grounds, the richest of which is Puerto Galera Bay, (Pl. I, figs. 2 and 3; Pl. III, fig. 10) a small completely land-locked body of water about four miles in circumference. It possesses numerous indentations with varied coast-line ranging from muddy, grassy, sandy and rocky shores with extensive coral reef shoals. This is a rich bay not only in echinoderns but also in other phyla of marine animals.

Varadero Bay (Pl. II, fig. 8; Pl. III, fig. 10), though an open bay, possesses numerous indentations and presents varied shore-lines ranging from muddy-grassy to rocky coral reefs. It also harbors a varied fauna. The richness of some of its coves and points is probably due to the absence of a river which tends to disturb the salinity of the water and to the protection of the bay from the north or northwest winds which prevail during the roughest part of the year.

The same thing may be said of Sabang (Pl. III, figs. 9 & 10) Recodo, Small and Big Balatero coves (Pl. II, fig. 7; Pl. III, fig. 10), which though exposed to the open sea, are sheltered from the wind during some part of the year because of the hilly topography of the surrounding land.

[1] Read before the Fourth Philippine Science Convention, February 25, 1937.

ECOLOGICAL DISTRIBUTION OF THE ECHINODERMS

The southern part of Puerto Galera Bay locally known as "Muelle" (Pl. I, fig. 3) has varied depths and types of shore line. The greater part of its eastern and western sides, which are muddy and are lined with mangrooves, are poor in echinoderms. The southwestern part of the bay near the landing shore is rocky with some corals. It is here where a great number of *Diadema setosum* are to be found in groups of fifty or so, exposed in the bottom. Over them and among their long black spines are to be seen numerous small colorless fishes which seem to aggregate only where these echinoids congregate. This part of "muelle" used to be rich in corals and in a number of holothurians, crinoids and echinoids (*Echinotrix calamaris* and *Diadema setosum*). Lately, the corals have greatly diminished and no echinoderms can be seen except the last one aforementioned. A great number of *Archaster typicus* and *Oreaster nodosus* were transplanted to this part of the bay in the Summer of 1936 by the writer with the object in view of finding whether or not transplanted adult forms will thrive in their new habitat. This same place has lately been accidentally restocked with crinoids and holothurians which escaped out from a collection left in a live boat the opening of which was not properly closed. The deeper part of this place is still rich in corals and in some of the bigger forms of holothurians, like *Thelonota ananas* and *Holothuria* (*Bohadschia*) *vitiensis*. The rocky northern part of its eastern and western sides adjoining the rougher part of the bay abound in corals and alcyonarians. There are also some echinoderms. A decade ago the north-eastern side was very rich in holothurians, especially *Stichopus chloronotus*, *Holothuria* (*Holothuria*) *edulis* and *Synapta maculata;* now, these species are quite rare. The western side is rich in crinoids. Some echinoids are also present, like *Diadema setosum* and *Echinotrix calamaris*. Among the asteroids, *Linckia laevigata* is occasionally found. In this same region further north from the Sandbar (Pl. II, fig. 6; Pl. III, fig. 10), toward the northwest channel (Manila Channel) (Pl. II, fig. 5; Pl. III, fig. 10) are found many asteroids, ophiuroids, echinoids, holothurians and

crinoids. Among the asteroids found in this place are *Acanthaster planci, Gymnasteria carinifera, Nardoa tuberculata, Echinaster, luzonicus, Astropecten polyacanthus* and *Linckia laevigata.* Different forms of crinoids, belonging to the genera, *Lamprometra, Comatella* and *Stephanometra,* are found here. Among the echinoids are *Echinometra oblonga, Echinometra picta, Diadema setosum, Tripneustes gratilla* and *Echinotrix calamaris.* The holothurians found here are *Thelenota ananas, Holothuria (Bohadschia) argus, Holothuria (Bohadschia) vitiensis, Holothuria (Microthele) nobilis* and the *Pseudocucumis aciculus.* The last one is very rare; so far, only two have been found at the station. Along the two sides of the Northwest Channel (Pl. II, fig. 5) toward the mouth are extensive shallow coral-reef shoals with varied forms of echinoderms. The same condition is found along the entire region up to the Batangas Channel. All these places are very rich in other forms besides echinoderms. All the different echinoderms already encountered previously within the bay are found in these regions. In addition, the following asteroids are found: *Culcita novaeguineae* var. *typica, Fromia elegans, Fromia pacifica. Fromia eusticha, Linckia guildingii, Linckia multifora, Ophidiaster granifer, Nardoa variolatus, Nardoa pauciforis, Nardoa mollis, Nardoa frianti, Nardoa squamulosa, Echinaster callosus,* and *Archaster typicus.*

Among the ophiuroids are *Ophiotrix longipeda, Ophiomastix annulosa, Ophiartrum pictum, Ophiarachana incrassata, Ophiarachnella gorgonia, Ophioplocus imbricatus.* Besides the echinoids already mentioned the following are also present: *Prionocidaris verticillata, Prionocidaris baculosa, Toxopneustes chlorocanthus, Heterocentrotus mammilatus* and *Laganum depressum.* Among the holothurians other than those already mentioned are the following: *Holothuria (Actinopyga) mauritiana, Holothuria (Actinopyga) echinites, Holothuria (Holothuria) coluber, Holothuria (Holothuria) edulis, Holothuria (Bohadschia) graeffei, Holothuria (Holothuria) impatiens, Holothuria (Holothuria) monacaria, Holothuria (Holothuria) pardalis, Holothuria (Holothuria) curiosa, Holothuria (Holothuria) atra, Stichopus chloronotus, Stichopus horrens, Stichopus variegatus, Stichopus variegatus* var. *hermanni, Phyllophorus magnus, Euapta godeffroyi, Opheodesoma spectabilis* var. *puerto galerae, Polyplectana kefersteinii.* Among the crinoids besides the many forms that are still unclassified are *Comatella nigra, Comatella stelligera, Comatula purpurea, Capillaster multiradiata, Comaster novaeguineae, Comanthus callipepla, Comaster multibrachiata, Comantheria weberi, Stephanometra coronata, Stephanometra echinus, Lamprometra protectus, Lamprometra brachypecha* and *Dichrometra protectus.*

The western side of the North Channel (Batangas Channel) (Pl. III, fig. 10), which is about a mile from the Northwest Channel, possesses a different echinoderm fauna from the other channel. It is here where the rare *Halityle regularis* and *Choriaster granulatus* were collected. The banks of this channel, particularly the western side, has a narrow shallow shore. The grassy region along the side of this channel is very rich in *Holothuria (Holothuria) atra.* Unlike the Northwest Channel, the North Channel does not harbor *Stichopus chloronotus* and *Holothuria (Holothuria) edulis.* Although the topographical condition of the two places are quite similar, they differ distinctly in their echinoderm fauna. The most common species of echinoderm found in this region besides those already mentioned are *Linckia laevigata, Echinometra picta* and *Echinometra oblonga.* Beyond this region along the shore of the open sea connecting the two channels are wide coral reef shoals. The shore harbors various forms of echinoderms, and varies from sandy to rocky. *Holothuria (Actinopyga) mauritiana, Holothuria (Actinopyga) echinites* and *Labidodemas semperianum* are found in this region.

From the eastern bank of the North Channel towards the Bay proper, about a few hundred meters away, is another extensive shallow coral reef shoal, familiarly known as the "second plateau". This place though not so extensive as the first coral reef or "first plateau" is very rich in achinoderms as well as in other forms of marine fauna. The echinoderm fauna of this place is similar to that of the extensive coral reef shoals of the Northwest Channel and that of the first coral reef shoal except for the few forms that are absent in this place, namely, *Heterocentrotus mamillatus, Echinaster callosus, Astropecten polya-*

canthus, Archaster typicus; Ophiarachna incrassata, Ophiomastix annulosa, Holothuria (Actinopyga) mauritiana and *Holothuria (Microthele) nobilis.* Toward the northeast from this shallow coral reef shoal is the Mahabang Parang cove which is quite muddy and has hardly any echinoderms. A few hundred meters away from the same shoal toward the south are two smaller coves, Tanoalan and Licot. They are muddy or sandy-muddy and are very poor in echinoderms. At the rocky points of these coves are found two species of brittle stars, *Ophiotrix longipeda* and a species of *Ophiarachnella.* One species of the small edible holothurian, *Holothuria (Holothuria) pardalis* is found here under stones. From the Camposanto Point is a rocky shore line with plenty of corals forming a shallow extensive coral reef region with reef shoal, (1st plateau) usually exposed during low tide. Its echinoderm fauna is similar to that of the second coral reef shoal (second plateau).

East of the Puerto Galera Bay is another extensive bay, Varadero Bay (Pl. II, fig. 8), a thoroughly investigated bay, is rich in different forms of echinoderm. Starting from the Boaya Point, so called because of its resemblance to the head of a huge crocodile, are found the following echinoderms: Among the asteroids are *Linckia laevigata, Culcita novaeguineae, Acanthaster planci, Fromia elegans, Astropecten polyacanthus* and some species of *Nardoa. Among the Ophiuroids* which are quite abundant in this region are *Ophiotrix longipeda, Ophiocoma erinaceus, Ophiocoma scolopendrina, Ophiocoma echinata, Ophiomastix annulosa, Ophirachnella gorgonia,* and *Ophioplocus imbricatus.* Among the echinoids which also abound in this region are *Diadema setosum, Echinotrix calamaris, Echinometra oblonga, Echinometra picta,* and *Prionocidaris baculosa.* The holothurians encountered in this region are *Holothuria (Bohadschia) argus, Holothuria (Holothuria) monacaria, Holothuria (Bohadschia) vitiensis, Pseudocucumis acicilus,* and *Phyllophorus magnus.* This place is very rich in varied forms of crinoids, mostly of the different species of *Comatella.*

Further south toward the town is Ensanada, a shallow sandy shoal with some muddy part grown with eel grasses and a rocky part with coral reefs. The echinoderms of this place

consist of *Archaster typicus, Linckia laevigata, Nardoa tuberculata, Diadema setosum, Echinotrix calamaris, Echinometra oblonga, Arachnoides placenta, Laganum depressum, Echinodiscus auritus* and a few crinoids, mostly belonging to the genus *Comatella.* It is possible that other forms lie hidden among the eel grasses. Further south is rocky Anton Point. Between the Boaya Point and Anton Point are three insignificant rocky points, which are very poor in echinoderm. Among the echinoderms at Anton Point are *Ophiocoma scolopendrina, Ophiocoma erinaceus, Ophiotrix longipeda, Ophiomastix annulosa, Holothuria (Holothuria) pulla* and *Echinometra oblonga.*

Further south of Anton Point is Balete, a wide shallow muddy and grassy shoal. The echinoderms represented in this place are *Archaster typicus, Arachnoides placenta, Echinodiscus auritus* and occasionally *Laganum depressum,* whose skeleton (test) is often found along the shore. At one time one specimen of *Pentaceropsis tyloderma* was found among *Archaster typicus* specimens. The possibilities are that this *P. tyloderma* specimen was cast ashore from deeper parts. It is also possible that *Pentaceropsis, Oreaster, Tripneustes* are to be found in deeper parts.

In the southern part of Balete, is rocky Gavino Point with a shallow shoal abounding in corals. During high tide the shoal is under water except the rocky point. During low tide, particularly during the lowest ebb, this place is a very good collecting ground for echinoderms. Among the asteroids of this region are *Linckia laevigata, Ophidiaster graniter; Ophidiaster squameus, Fromia elegans, Asterina coronata euerces, Asterina coronata puerto galerae, Hippasteria philippinensis, Astropoeten polyacanthus* and *Astropecten phragmorus.* Among the ophiuroids are found *Ophiotrix longipeda, Ophiocoma erinaceus, Ophiocoma echinata, Ophiocoma scolopendrina, Ophiomastrix annulosa, Ophiarachna incrassata, Ophiarachnella gorgonia, Ophiarachnella septemspinosa,* unidentified species of *Ophiarchnella* and *Ophioplocus imbricatus.* Among the echinoids are the *Diadema setosum, Echinometra oblonga, Echinometra picta, Prionocidaris baculosa* and *Prionocidaris verticellata.* The crinoids are represented by different species of *Lamprometra* and

Comatella. The Holothurians are represented by *Holothuria (Holothuria) impatiens, Holothuria (Holothuria) pulla, Pseudocucumis roxasi, Chiridota rigida,* and *Polycheira rufescen.* Most of them are found under rocks.

Further south is an extensive shallow sandy-muddy shoal with eel grasses. At the southern end it is partly rocky. This place is Hondura shoal which is rich in echinoderms. The asteroids of this place are *Archaster typicus, Oreaster nodosus, Oreaster nodosus* var. *hondurae, Oreaster alveolatus, Pentaceropsis tyloderma, Pentaceropsis tyloderma* var. *mindorensis, Pentaceropsis obtusatus, Astropecten phragmorus, Astropecten polyacanthus, Linckia laevigata* var. *hondurae,* and *Fromia elegans.* In the rocky part of this region along the Varadero point (Pl. III, fig. 10) locally known as Biting Point are found *Asterina (Patiriella) exigua, Acanthaster planci, Acanthaster mauritiensis.* The ophiuroids are represented by *Ophiarthrum pictum, Ophiocoma scolopendrina, Ophiocoma erinaceus, Ophiotrix longipeda, Ophiomastix annulosa, Ophiarachnella gorgonia,* and *Ophioplocus imbricatus.* Among the echinoids are *Tripneustes gratilla* and *Echinotrix calamaris* which are found in the grassy part of this region. In other places, *Echinotrix calamaris* is found among corals and in crevices of rocks. Way back in 1924 to 1926 these echinoids, especially *Tripneustes gratilla* were common and dominant in the place. At present they are very scarce and only a few are found in deeper parts of the region. Lately, precautions were taken against over collecting to give them a chance to multiply. The holothurians of the sandy and grassy region are *Holothuria (Holothuria) scabra Holothuria (Bohadscia) marmorata, Holothuria (Bohadscia) paradoxa, Synapta maculata, Opheodesoma spectabilis* var. *puerto galerae* and those of the rocky region are the *Stichopus variegatus* var. *hermanii, Stichnopus horrens, Holothuria (Microthele) parvula, Holothuria (Actinopyga) echinites* and *Holothuria (Actinopyga) miliaris.* This place is poor in crinoids except possibly in the deeper part where there are corals. So far, not a single crinoid has been found from this region.

Further south beyond Varadero Bay are other good collecting grounds but they are relatively inaccessible. These places

may be reached only on calm days in small bancas or by hiking along the shore during low tide, or on the hills at high tide. These places are Tabinay, Sigayan, Dulañgan, Bulabod, Matala, Talupak and Bisaya coves. Of these different places, the first, second, and the last have been surveyed by the writer. Of these three places Sigayan has the greatest number of echinoderms, among which are *Opeodesoma spectabilis* var. *puerto galerae, Archaster typicus, Linckia laevigata,* some species of *Nardoa,* and different forms of brittle stars belonging to *Ophiocoma, Ophiotrix, Ophiarachnella,* and *Ophioplocus.* A few *Echinoids* belonging to *Echinometra, Echinotrix* and *Diadema* are also found. Northeast of Puerto Galera Bay is Sabang cove, (Pl. III, figs. 9 and 10) which is similar topographically to Sigayan. It is beyond the North Channel toward Escarceo Point. The echinoderm fauna of this place are *Linckia laevigata, Acanthaster planci,* some species of *Nardoa* and *Fromia, Holothuria (Actinopyga) mauritiana, Synapta maculata, Opeodosoma spectabilis* var., *puerto galerae* and some other forms apparently not recorded.

West of Puerto Galera Bay beyond the sand-bar is Recodo cove. It is very rocky; in places it is sandy-muddy-grassy. The sandy-muddy-grassy part harbors *Archaster typicus, Holothuria (Holothuria) scabra* and *Synapta maculata,* and the rocky part by *Linckia laevigata, Asterina (Patiriella) exigua,* some species of *Nardoa,* different species of *Ophiocoma, Ophiotrix* and *Ophiarachnella, Holothuria (Holothuria) maculata, Holothuria (Holothuria) pulla, Stichopus variegatus, Stichopus variegatus* var. *hermanii* and *Stichopus horrens.* The echinoids ore dominant represented mostly *Echinometra oblonga* and *Echinometra picta.*

Opposite Recodo cove is small Balatero cove (Pl. II, fig. 7; Pl. III, fig. 10) with varied shorelines from sandy, muddy and partly grassy bottom to rocky with coral reefs. It is west of Puerto Galera Bay just beyond the sand-bar opposit Recodo cove. During high tide the sand-bar is usually under water and the above mentioned cove together with Recodo appear to be part of Puerto Galera Bay.

West of small Balatero is big Balatero cove (Pl. III, fig. 10), a much bigger cove facing the open sea. Like small Balatero,

it has also varied shorelines, mostly sandy or muddy and grassy and partly rocky with corals in the deeper part. In these two coves are represented the following echinoderms: *Linckia laevigata, Archaster typicus, Acanthaster planci, Nardoa tuberculata, Ophiocoma erinaceus, Ophiocoma scolopendrina, Ophiotrix longipeda, Ophioplocus imbricatus, Echinometra oblonga, Echinometra picta, Echinotrix calamaris, Diadema setosum, Tripneustes gratilla, Heterocentrotus mammillatus, Holothuria (Holothuria) atra, Holothuria (Holothuria) pulla, Holothuria (Holothuria) monacaria, Holothuria (Holothuria) impatiens, Holothuria (Actinopyga) mauritiana, Holothuria (Microthele) nobilis, Thelenota ananas, Stichopus variegatus,* var. *Puerto galerae,* and a species of *Ophiarachnella. Stichopus variegatus* var. *puerto galerae* and *Holothuria (Holothuria) atra* are the dominant forms in Big Balatero cove near Baniknik Point.

Besides all the above mentioned places, there are many other places like San Teodoro, Baco, Calapan, Verde Island, and Maricaban which are rich in echinoderms as well as in other forms of marine fauna. These places can be reached easily with an ordinary motor boat. At Calapan, along the sandy, grassy region near the wharf, the following echinoderms are found: *Oreaster nodosus, Oreaster alveolatus, Pentaceropsis tyloderma, Archaster typicus;* in deeper portions, among corals are found some species of *Nardoa and Linckia.* Among the echinoids are represented *Tripneustes gratilla, Echinotrix calamaris,* and *Diadema setosum.* The holothurians found are *Holothuria (Holothuria) scabra, Holothuria (Bohadschia) paradoxa, Holothuria (Bohadschia) marmorata, Holothuria (Holothuria) pulla.*

The following is the check list of echinoderms so far found at the Puerto Galera Marine Biological Station:

Superclass—PELMATOZOA
Class—CRINOIDEA
Order—COMATULIDA [1]
Sub-order—COMATULIDA OLIGOPHREATA
Family—Comasteridæ A. E. Clark

[1] A great number of forms are still unclassified. A collection of numerous forms for the purpose of identification is under study.

1. *Comatella nigra* (Carpenter)
2. *Comatella stelligera* (Carpenter)
3. *Comatula purpurea* (J. Muller)
4. *Capillaster multiradiata* (Carpenter)

Sub-family—Camasterinæ A. H. Clark
4. *Comaster multibrachiata* (Carpenter)
6. *Comaster novae-gwineae* (Muller)
7. *Comanthus callipepla* H. L. Clark
8. *Comanthus schlegelii* (Carpenter)
9. *Comantheria rotula* A. H. Clark
10. *Comantheria weberi* A. H. Clark

Family—Stephanometridæ A. H. Clark
11. *Stephanometra coronata* A. H. Clark
12. *Stephanometra echinus* A. H. Clark

Family—Mariametridæ A. H. Clark
13. *Lamprometra protectus* (Lutken)
14. *Lamprometra brachypecha* H. L. Clark
15. *Dichrometra protectus* (Lutken)

Class—ASTEROIDEA
Sub-class—EUASTEROIDEA
Order—PHANEROZONIA Sladen
Family—Astropectinidæ Gray
Sub-family—Astropectininæ Sladen
1. *Astropecten polyacanthus,* Muller and Troschel
2. *Astropecten phragmorus,* Fisher

Family—Luidiidæ Verrill
3. *Luidia maculata,* Muller and Troschel

Family—Archasteridæ Viguier
Sub-family—Archasterinæ Sladen
4. *Archaster typicus,* Muller and Troschel
5. *Archaster angulatus,* Muller and Troschel

Family—Goniasteridæ Forbes
Sub-family—Hippasteriinæ Verrill
6. *Hippasteria philippinensis,* nov. sp.

Family—Pentacerotidæ Gray

7. *Pentaceropsis obtusatus* (Bory de Saint Vincent)
8. *Pentaceropsis tyloderma*, Fisher
9. *Pentaceropsis tyloderma*, var. *mindorensis*, n. var.
10. *Culcita novae-guineae*, Muller and Troschel
11. *Culcita novae-guineae*, Muller and Troschel var. *plana*, Goto.
12. *Culcita novae-guineae*, Muller and Troschel var. *acutispinosa*, Goto.
13. *Culcita novae-guineae*, Muller and Troschel var. *typica*, Goto.
14. *Culcita novae-guineae*, Muller and Troschel var. *grex* Goto.
15. *Halityle regularis*, Fisher.
16. *Choriaster granulatus*, Lutken

Family—Oreasteridæ Fisher

17. *Oreaster nodosus*, (Linnæus)
18. *Oreaster nodosus* var. *hondurae* n. var.
19. *Oreaster alveolatus* (Perrier)
20. *Oreaster doederleini* Goto.

Family—Linckiidæ Perrier

Sub-family—Linckiinæ Sladen

21. *Fromia elegans*, H. L. Clark
22. *Fromia pacifica*, H. L. Clark
23. *Fromia indica*, Perrier
24. *Fromia eusticha*, Fisher
25. *Fromia japonica*, Perrier
26. *Leiaster speciosus*, v. Marten
27. *Linckia laevigata* (Linnæus)
28. *Linckia laevigata* var. *hondurae* n. var.
29. *Linckia guildingii* Gray
30. *Linckia multifora* (Lamarck)
31. *Ophidiaster granifer*, Lutken
32. *Ophidiaster squameus*, Fisher
33. *Nardoa variolatus* (Lamarck)
34. *Nardoa pauciforis*, (von Martens)

35. *Nardoa mollis*, de Loriol
36. *Nardoa frianti*, Koehler
37. *Nardoa tuberculata*, Gray
38. *Nardoa novæ-caledoniæ*, Perrier
39. *Nardoa squamulosa*, Koehler
40. *Nardoa lemonnieri*

Family—Gymnasteriidæ Perrier

41. *Gymnasteria Carinifera* (Lamarck)

Order—Spinulosa Perrier

Family—Asteriinidæ Gray

Sub-family—Asterinæ Sladen

42. *Asterina* (*Patiriella*) *exigua* (Lamarck)
43. *Asterina coronata euerces*, Fisher
44. *Asterina coronata puerto galera* subsp. nov.

Family—Echinasteridæ Verrill

Sub-family—Acanthasterinæ Sladen

45. *Acanthaster planci* (Linnaeus)
46. *Acanthaster mauritiensis*, de Loriol

Sub-family—Echinasterinæ Viguier

47. *Echinaster callosus*, von Marenzeller
48. *Echinaster luzonicus* (Gray)
49. *Echinaster purpureus*, Savigny.

Class—OPHIUROIDEA

Order—ONATHOPHIURIDA

Family—Ophiotrichidæ Ljungman

1. *Ophiotrix longipeda* (Lamarck)

Order—CHILOPHIURDA

Family—Ophiochitonidæ Matsumoto

2. *Ophiocoma erinaceus* Muller and Troschel
3. *Ophiocoma scolopendrina* (Lamarck)
4. *Ophiomastix echinata* (Lamarck)
5. *Ophiomastix annulosa* (Lamarck)
6. *Ophiarthrum pictum* (Muller and Troschel)

Family—Ophiodermatidæ Ljungman

7. *Ophiarachna incrassata* (Lamarck)

8. *Ophiarachnella gorgonia* (Muller and Troschel)
9. *Ophiarachenella septemspinosa* (Muller Torschel)

Family—**Ophiolepididæ** Ljungman

10. *Ophioplocus imbricatus* (Muller and Troschel)

Class—**ECHINOIDEA**

Order—**CIDAROIDA**

Family—**Cidaridæ** J. Muller

1. *Prionocidaris verticillata* (Lamarck)
2. *Prionocidaris baculosa* (Lamarck)
3. *Phyllacanthus Thomassi* A. Ag. and Clark

Order—**CENTRECHINOIDA**

Family—**Diadematidæ** Peters

4. *Diadema setosum* (Leske)
5. *Echinotrix calamaris* (Pallas)
6. *Astropyga radiata* (Leske)

Family—**Temnopleuridæ** DESOR

7. *Mespilia globulus* (Linnæus)

Family—**Echinidæ** Agassiz.

8. *Toxopneustes chlorocanthus*, Clark
9. *Tripneustes gratilla* (Linne)

Family—**Echinometridæ** (Gray)

10. *Echinometra picta* A. Ag. and Clark
11. *Echinometra oblonga* de Blainville
12. *Heterocentrotus mammillatus* (Linne)

Family—**Clypeastridæ** Agassiz

13. *Clypeaster reticulatus* (Linnæus)
14. *Arachnoides placenta* (Linnæus)

Family—**Laganidæ** A. Agassiz

15. *Laganum depressum*, A. Agassiz

Family—**Scutellidæ** Agassiz

16. *Echinodiscus auritus*, Leske

Class—**HOLOTHURIOIDEA**

Order—**ACTINOPODA** Ludwig

Family—**Holothuriidæ** Ludwig

Sub-family—**Holothurinæ** Ludwig

1. *Holothuria* (*Actinopyga*) *mauritiana*, (Quoy & Gaimard)
2. *Holothuria* (*Actinopyga*) *milliaris* (Quoy & Gaimard)
3. *Holothuria* (*Actinopyga*) *echinites*, Jaeger
4. *Holothuria* (*Actinopyga*) *obesa* (Selenka)
5. *Holothuria* (*Microthele*) *nobilis* (Selenka)
6. *Holothuria* (*Microthele*) *nobilis* (Selenka) var. *tigris* (Domantay)
7. *Holothuria* (*Microthele*) *parvula* (Selenka)
8. *Holothuria* (*Bohadschia*) *argus* (Jaeger)
9. *Holothuria* (*Holothuria*) *pulla* (Selenka)
10. *Holothuria* (*Holothuria*) *coluber* Semper
11. *Holothuria* (*Holothuria*) *edulis*, Lesson
12. *Holothuria* (*Bohadschia*) *graeffei* (Semper)
13. *Holothuria* (*Holothuria*) *impatiens* (Forskal)
14. *Holothuria* (*Holothuria*) *monacaria* Lesson
15. *Holothuria* (*Bohadschia*) *paradoxa* (Selenka)
16. *Holothuria* (*Holothuria*) *pardalis* (salenka)
17. *Holothuria* (*Holothuria*) *pardalis* (Salenka) var. *cebuensis* Domantay
18. *Holothuria* (*Holothuria*) *curiosa* Ludwig
19. *Holothuria* (*Holothuria*) *curiosa* Ludwig var. *philippinensis* Domantay
20. *Holothuria* (*Holothuria*) *atra* Jaeger

21. *Holothuria* (*Holothuria*) *scabra* Jaeger
22. *Holothuria* (*Bohadschia*) *vitiensis* (Semper)
23. *Holothuria* (*Holothuria*) *maculata* (Brandt)
24. *Holothuria* (*Holothuria*) *rugosa* Ludwig
25. *Holothuria* (*Bohadschia*) *marmorata* Jaeger
26. *Labidodemas semperianum* Selenka
27. *Stichopus chloronotus* Brandt
28. *Stichopus horrens* Selenka
29. *Stichpus variegatus* Semper
30. *Stichopus variegatus* var. *hermanni* Semper

Family—Cucumariidæ Ludwig

Sub-family—Cucumariinæ Ludwig

32. *Phyllophorus magnus* Ludwig
33. *Pseudocucumis aciculus* (Semper)
34. *Pseudocucumis roxasi* Domantay

Order—PARACTINOPODA

Family—Synaptidæ

35. *Euapta godeffroyi* (Semper)
36. *Opeodesoma spectabilis* Fisher var. *puerto galerae* Domantay
37. *Polyplectana kefersteinii* (Salenka)
38. *Synapta maculata* (Chamisso and Eysenhardt)

Sub-family—Chiridotinæ Ostergreen

39. *Chiridota rigida* Semper
40. *Polycheira rufescens* (Brandt)

REFERENCES

1. CLARK, A. H. 1912. The Crinoids of the Indian Ocean, Echinoderma of the Indian Museum, Pt. VII.
2. CLARK, H. L. 1921. "Papers from the Department of Marine Biology," vol. 10.
3. DOMANTAY, J. S. "Littoral Holothurioidea of Port Galera Bay and Adjacent Waters," U. P. Nat. App. Sci. Bull., **3**:

4. ———— "Development of the Anchor and Anchorplate types of Spicules of the Synaptid *Polyplectana Kefersteinii* (Selenka) and Allied Species." Phil. Jour. Sci. **52**: 371–380.
5. ———— Four additional species of Littoral Holothurioidea of Port Galera Bay and Adjacent Waters. U. P. Nat. App. Sci. Bull., **4**: 109–118.
6. ———— "Philippine Edible Holothurians," The Searchlight, **1**: 11–18.
7. ———— "Littoral Asteroidea of Port Galera Bay and Adjacent Waters." Manuscript.
8. ———— "An Unusual Kind of a Bud due to Heteromorphosis in the Starfish *Echinaster luzonicus* (Gray). Manuscript.
9. ———— "Facts about the Puerto Galera Marine Biological Station of the University of the Philippines." Manuscript.
10. ———— "Autotomy in Holothurians." U. P. Nat. App. Sci. Bull., **1**: 389–404.
11. KOEHLER, R. 1922. Ophiurans of the Philippine Seas and Adjacent Waters. Smithsonian Institution U. S. Nat. Museum, Bull. 100, vol. 5.
12. ROXAS, H. L. 1928. Philippine Littoral Echinoidea. Phil. Journ. Sci., **36**: 243.
13. ———— 1930. The Puerto Galera Marine Biological Laboratory of the University of the Philippines.
14. SIVICKIS, P. B., AND DOMANTAY, J. S. 1928. The Morphology of a Holothurian, *Stichopus chloronotus* Brandt. Phil. Journ. Sci. **37**: 299–232.

ILLUSTRATIONS

PLATE 1

Fig. 1.—Bird's eye view of the Puerto Galera Marine Biological Laboratory with the town church at the right.
Fig. 2.—Bird's eye view of the Puerto Galera Bay.
Fig. 3.—A closer view of the Puerto Galera Bay with Muelle and its landing place at the foreground.
Fig. 4.—A portion of the Puerto Galera Bay showing part of the first coral reef shoal (1st plateau).

PLATE 2

Fig. 5.—The Northwest Channel (Manila Channel) showing its shallow extensive grassy and coral reef bank.
Fig. 6.—A portion of the Puerto Galera Bay showing the sand-bar connecting the Paniquian Island with the mainland of Mindoro at the background.
Fig. 7.—A view of the Small and Big Balatero Coves taken from the Paniquian Island near the sand-bar.
Fig. 8.—Bird's eye view of the Southern part of the Varadero Bay showing the Hondura and the Small Tabinay Cove at the background.

PLATE 3

Fig. 9.—A portion of the Sabang Cove showing its shallow extensive rocky and coral reef shoal. (Taken from Roxas' "Puerto Galera Marine Biological Laboratory of the University of the Philippines").
Fig. 10.—Outline map of the Puerto Galera Bay and Adjacent Waters of the Marine Biological Station.

PLATE 4

Fig. 11.—*Ophidiaster squameus* Fisher
Fig. 12.—*Asterina coronata euerces* Fisher
Fig. 13.—*Asterina coronata puerto galerae* subsp. nov.
Fig. 14.—*Hippasteria philippinensis* Domantay
Fig. 15.—*Asterina (Patiriella) exigua* (Lamarck)
Fig. 16.—*Ophioplocus imbricatus* (Muller and Troschel)
Fig. 17.—*Ophiarachnella gorgonia* (Muller and Troschel)
Fig. 18.—*Ophiartrum pictum* (Muller and Troschel)
Fig. 19.—*Prionocidaris baculosa* (Lamarck)
Fig. 20.—*Mespilia globulus* (Linne)
Fig. 21.—*Labidodemas semperianum* Selenka
Fig. 22.—*Holothuria (Holothuria) curiosa* Ludwig var. *philippinensis* Domantay

PLATE 5

Fig. 23.—*Pentaceropsis obtusatus* (Bory de Saint Vincent)
Fig. 24.—*Ophidiaster granifer* Lutken
Fig. 25.—*Acanthaster mauritiensis* de Loriol
Fig. 26.—*Pentaceropsis tyloderma* Fisher
Fig. 27.—*Astropecten phragmorus* Fisher
Fig. 28.—*Culcita novae-guineae* Muller & Troschel var *acutispinosa* Goto
Fig. 29.—*Nardoa frianti* Koehler
Fig. 30.—*Echinaster purpureus* Savigny
Fig. 31.—*Culcita novae-guineae* Muller & Troschel var. *plana* Goto
Fig. 32—*Nardoa lemonnieri* Koehler
Fig. 33.—*Nardoa squamulosa* Koehler
Fig. 34.—*Linckia laevigata* (Linnaeus)
Fig. 35.—*Gymnasteria carinifera* (Lamarck)
Fig. 36.—*Oreaster nodosus* (Linnaeus)
Fig. 37.—*Oreaster alveolatus* (Perrier)
Fig. 38.—*Echinaster callosus* von Marenzeller
Fig. 39.—*Archaster typicus* Muller & Troschel
Fig. 40.—*Nardoa pauciforis* (von Martens)
Fig. 41.—*Archaster typicus* Muller & Troschel
Fig. 42.—*Fromia elegans* H. L. Clark
Fig. 43.—*Nardoa mollis* de Loriol
Fig. 44.—*Linckia multifora* (Lamarck)
Fig. 45.—*Astropecten polyacanthus* Muller & Troschel
Fig. 46.—*Fromia japonica* Perrier
Fig. 47.—*Fromia eusticha* Fisher

PLATE 6

Fig. 48.—*Ophiomastix annulosa* (Lamarck)
Fig. 49.—*Ophiotrix longipeda* (Lamarck)
Fig. 50.—*Ophiarachna incrassata* (Lamarck)
Fig. 51.—*Tripnuestes gratilla* (Linnaeus)
Fig. 52.—*Diadema setosum* (Leske)
Fig. 53.—*Ophiocoma erinaceus* Muller & Troschel
Fig. 54.—*Ophiocoma scolopendrina* (Lamarck)
Fig. 55.—*Tosopneustes chlorocanthus* Clark
Fig. 56.—*Prionocidaris verticillata* (Lamarck)
Fig. 57.—*Echinometra oblonga* de Blainville
Fig. 58.—*Arachnoides placenta* (Linnaeus)
Fig. 59.—*Echinotrix calamaris* (Pallas)
Fig. 60.—*Echinodiscus auritus* Leske
Fig. 61.—*Holothuria (Microthele) nobilis* (Selenka)
Fig. 62.—*Holothuria (Holothuria) maculata* (Brandt)
Fig. 63.—*Stephanometra echinus* A. H. Clark
Fig. 64.—*Pseudocucumis roxasi* Domantay

9

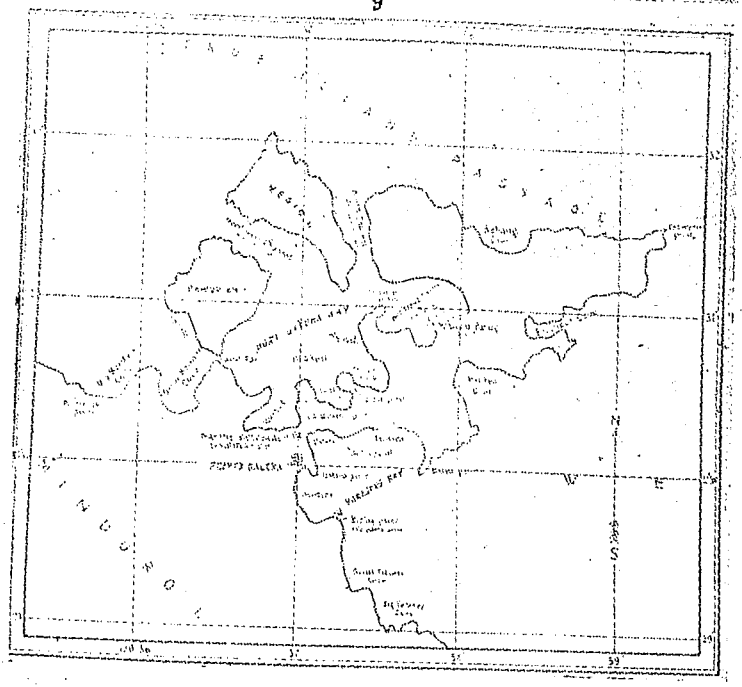

PLATE 3

Fig. 65.—*Holothuria* (*Holothuria*) *impatiens* (Forskal)
Fig. 66.—*Polyplectana Kefersteinii* (Selenka)
Fig. 67.—*Holothuria* (*Holothuria*) *monacaria* (Lesson)
Fig. 68.—*Ophiodesoma spectabilis* Fisher var. *puerto galerae* Domantay
Fig. 69.—*Holothuria* (*Holothuria*) *pulla* Selenka
Fig. 70.—*Lamprometra brachypecha* H. L. Clark

PLATE 7

Fig. 71.—*Choriaster granulatus* Lutken
Fig. 72.—*Culcita novae-guineae* Muller & Troschel var. *typica* Goto
Fig. 73.—*Culcita novae-guineae* Muller & Troschel
Fig. 74.—*Acanthaster planci* (Linnaeus)
Fig. 75.—*Oreaster nodosus* (Linnaeus) var. *hondurae* Domantay
Fig. 76.—*Oreaster doederleini* Goto
Fig. 77.—*Linckia guildingii* Gray
Fig. 78.—*Echinaster luzonicus* (Gray)
Fig. 79.—*Halityle regularis* Fisher
Fig. 80.—*Holothuria* (*Holothuria*) *coluber* Semper
Fig. 81.—*Phyllacanthus thomasii* A. Ag. and Clark
Fig. 82.—*Heterocentrotus mamillatus* (Linnaeus)
Fig. 83.—*Holothuria* (*Holothuria*) *impatiens* (Forskal)
Fig. 84.—*Stichopus horrens* Selenka
Fig. 85.—*Holothuria* (*Microthele*) *nobilis* (Selenka) var. *tigris* Domantay
Fig. 86.—*Stichopus variegatus* var. *hermanni* Semper
Fig. 87.—*Holothuria* (*Bohadschia*) *paradoxa* (Selenka)
Fig. 88.—*Holothuria* (*Bohadschia*) *marmorata* Jaeger
Fig. 89.—*Comatella stelligera* (Carpenter)
Fig. 90.—*Comaster multibrachiata* (Carpenter)

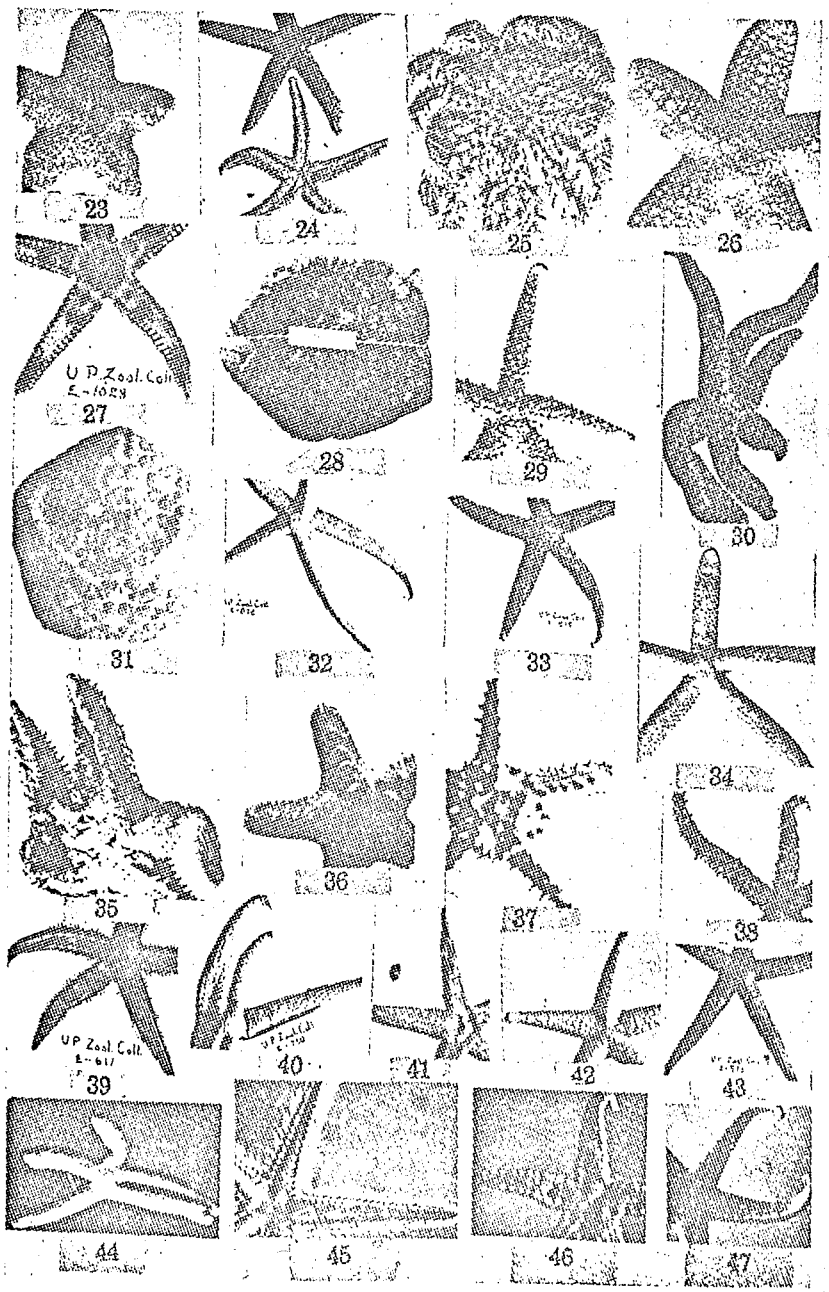

PLATE 5

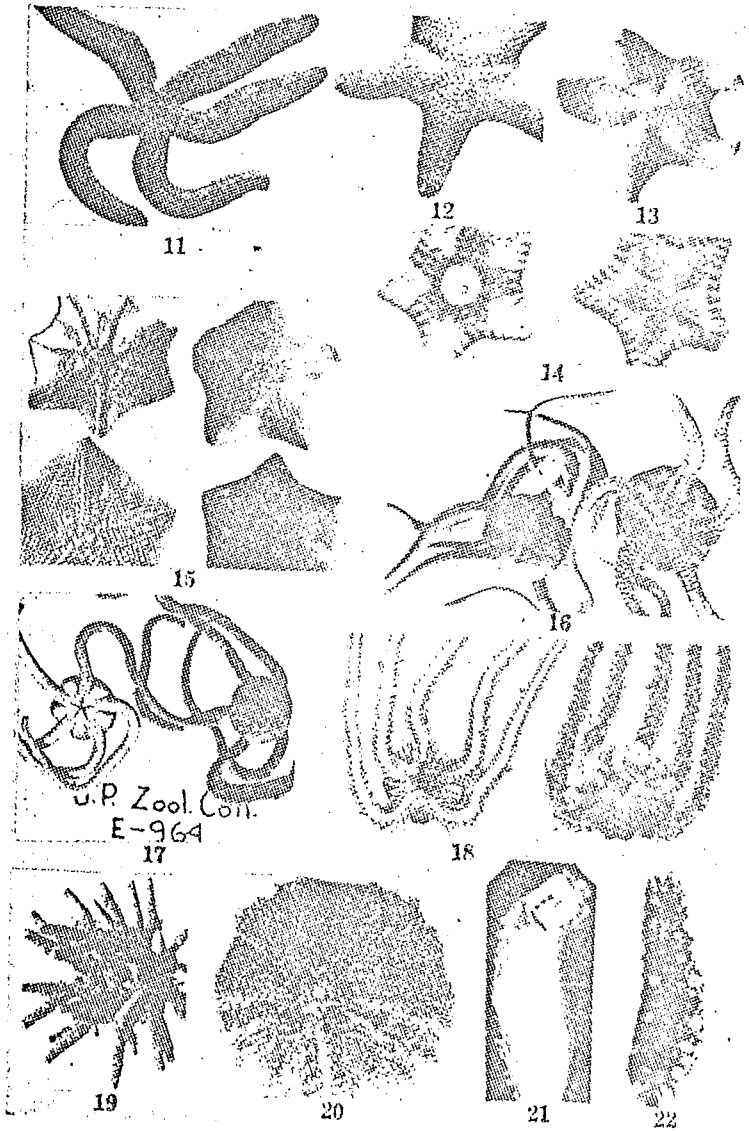

PLATE 4

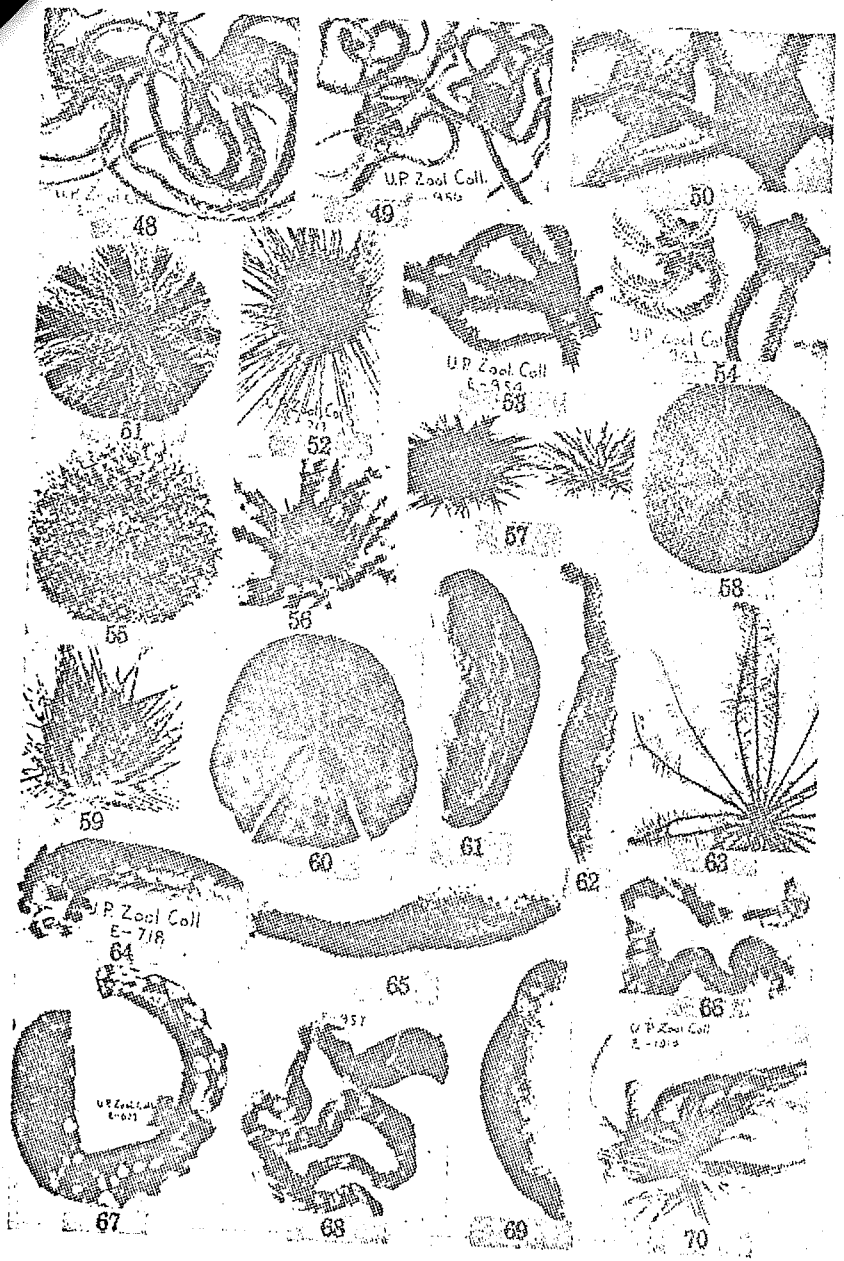

PLATE 6

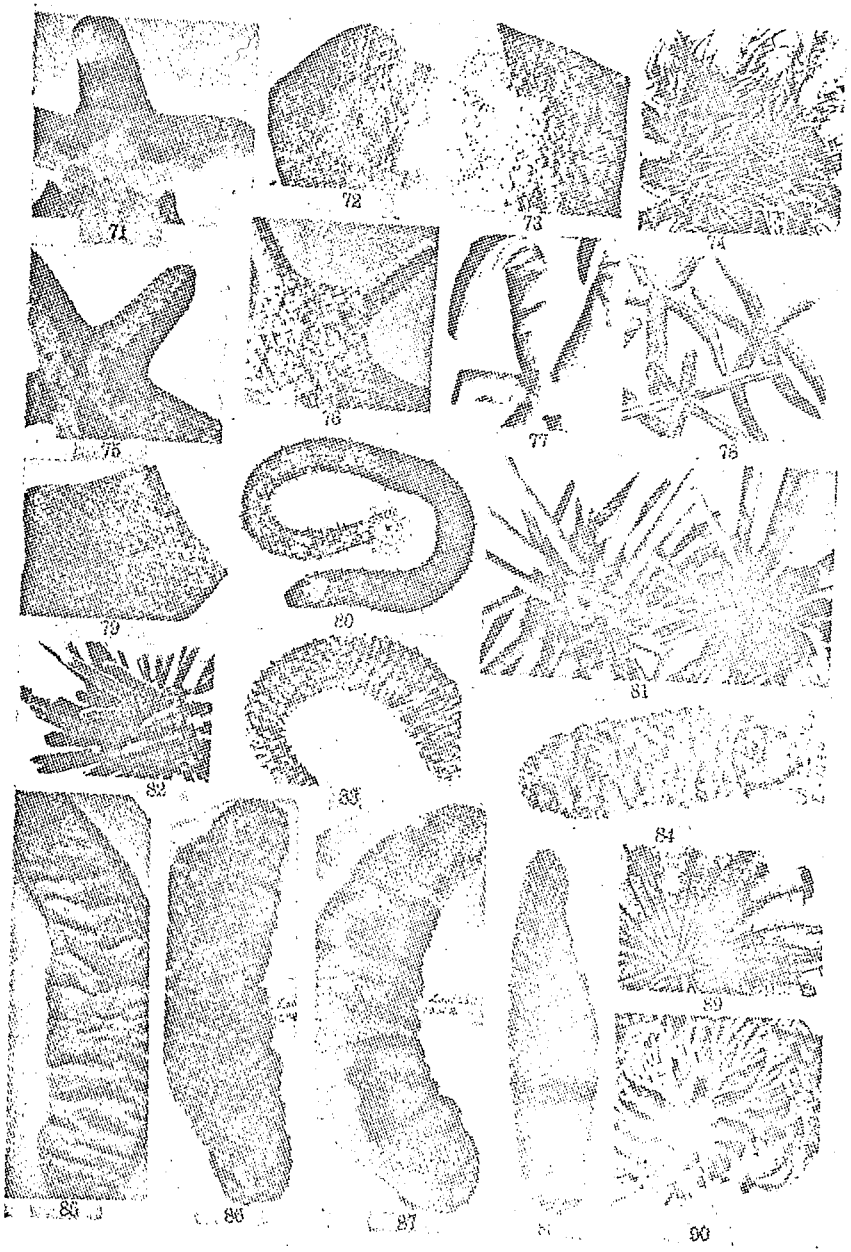

PLATE 7