

A Comparative Study of Cheilostome Bryozoa at Yokosuka, Maizuru, and Sasebo, Japan

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ABSTRACT: The cheilostome Bryozoa fauna of 65 marine fouling panels exposed at Yokosuka, Maizuru, and Sasebo, Japan, in 1966 and 1967 was studied. Nineteen species were recorded, described and photographed. Based on faunal variations between the sites, a list of the principal species diagnostic of each was prepared. The panels at the Yokosuka site were characterized by large quantities of *Watersipora subovoidea*, *Bugula neritina*, and *B. californica*; the Maizuru site by *Bugula neritina* and *Electra tenella*; and the Sasebo site by *Schizoporella unicornis* and *Celleporaria aperta*.

Faunal resemblance between the three stations on the basis of the recorded Bryozoa occurrence indicate Maizuru and Sasebo were most similar in Bryozoa composition and Sasebo and Yokosuka the least similar of the three sites.

MARINE FOULING STUDIES conducted by various activities throughout the world have, among other things, pointed up the fact that Bryozoa are among the most abundant, diverse, and consistently present groups of marine fouling organisms. Because of their sessile mode of life, short larval period, and generally stenohaline response to the environmental regime, they are excellent zoogeographic and ecologic indicators. Many species are quite ubiquitous and widely distributed; several, however, are quite sensitive to the local environmental regime and endemic to relatively small regions.

The bryozoan assemblages investigated in this study are those which occurred on panels exposed during a cooperative investigation of the marine fouling at Sasebo, Yokosuka, and Maizuru, Japan, conducted by the Japanese Maritime Self Defense Force and the U. S. Naval Oceanographic Office. The results of these fouling studies have been reported by DePalma (1967). There have been several important studies of fouling in Japanese waters by previous workers (Miyazaki, 1938; Mawatari and Kobayashi, 1954; Kazihara, 1964; and Kawahara, 1965). However, these findings are difficult to interpret comparatively, because different workers used somewhat different methods and the investigations were conducted several years

apart. Furthermore, their attention was directed toward the comprehensive investigation of the total fouling biota and not the detailed examination of a specific group of fouling organisms. There are a number of non-quantitative studies of cheilostome Bryozoa from Japanese waters. Among these are papers on Bryozoa from the Kurile Islands and neighboring districts (Okada, 1923; and Mawatari, 1956), a report of the Bryozoa of Mutsu Bay (Okada, 1928), of Kii Peninsula (Mawatari, 1952), and from along the coast of Wakayama Ken (Okada and Mawatari, 1938).

The purpose of this study was to define and compare the bryozoan assemblages occurring on identical panels at identical depths (10 meters) at three widely separated geographic localities. The bryozoan assemblages were compared from fouling test sites established in 1966 at Yokosuka, Maizuru, and Sasebo at 10 meters water depth. A list of species from all three 1966 sites and including 1967 Maizuru and Sasebo sites was compiled.

The authors are indebted to Mr. John R. DePalma of the U. S. Naval Oceanographic Office who allowed us to re-examine his test panels and provided excellent criticism and assistance throughout the study. Dr. Alan H. Cheetham of the U. S. National Museum critically reviewed the manuscript and the Bryozoa species identifications.

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METHODS

Three test sites were established in the coastal waters of Japan during the summer of 1966. The sites at Yokosuka and Maizuru are in the temperate Japonian province which is roughly

equivalent to the Californian molluscan province (Hall, 1964). The site at Sasebo is in the Osakan-Kyushan subtropical province, an equivalent to Hall's Magdalenan province in California (Fig. 1).

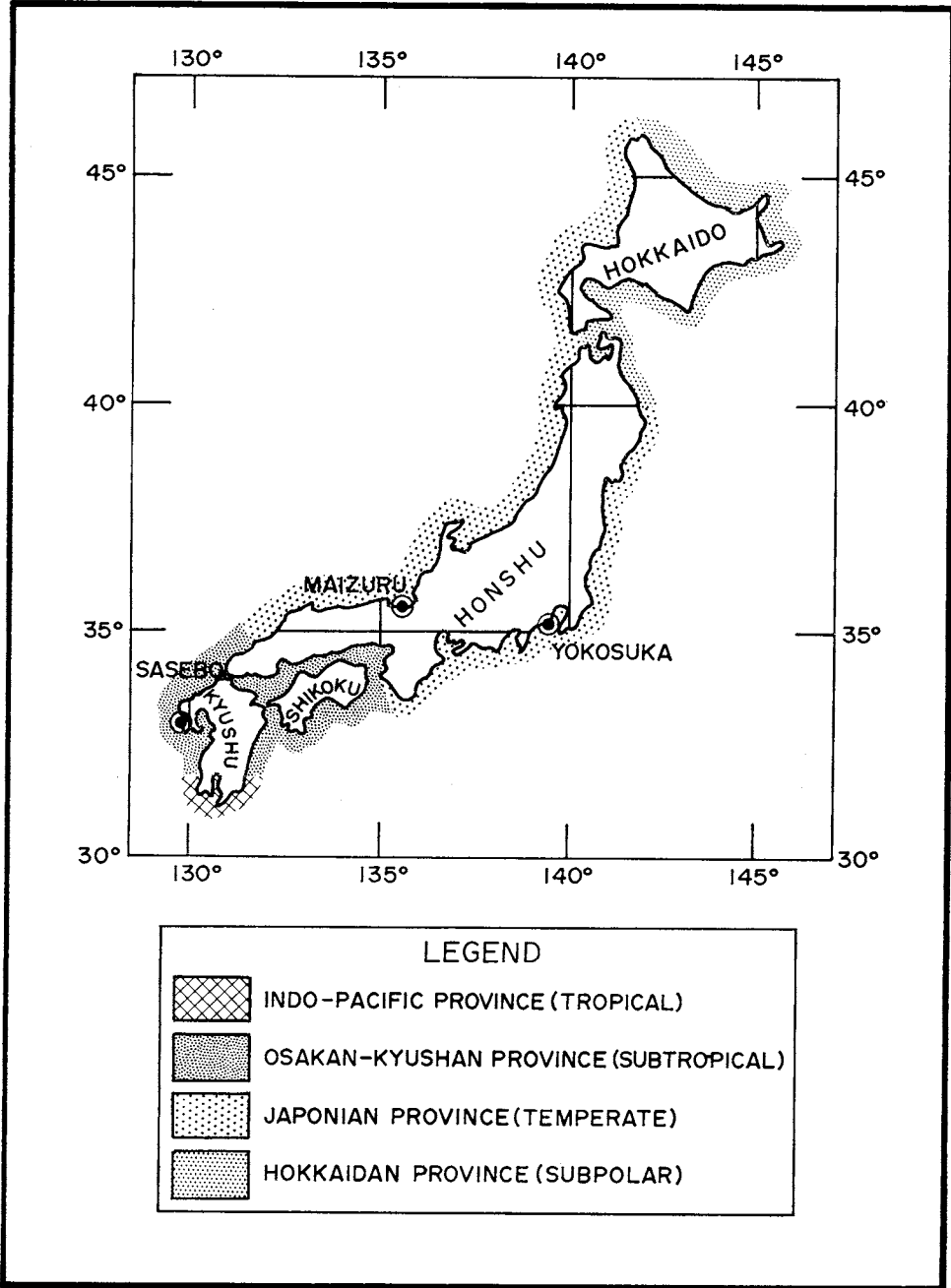


FIG. 1. Location of the three fouling study sites in Japan: Yokosuka and Maizuru in the temperate Japonian province, and Sasebo in the subtropical Osakan-Kyushan province. (Modified from Hall, 1964.)

Marine fouling test panels composed of back-to-back 6 × 12-inch pieces of asbestos and pine wood were exposed at all three test sites. The panels were attached vertically to racks and exposed near the bottom in a water depth of 10 meters. The panel holders, or racks, were placed in 10 meters water depth for a year in 1966, and subsequently moved out to deeper water for further studies in 1967. A total of 65 panels were collected at monthly and cumulative intervals: 14 at Yokosuka, 25 at Maizuru, and 26 at Sasebo. Observations were made on the occurrence, abundance, and colony size of each bryozoan species. Taxonomic and nomenclatural notes on all identified species are presented in the systematic section of this report. Specimens representing each species were photographed at magnifications of approximately 30×. The photographs were not retouched, but in order to accentuate minute details and reduce hyaline glare, specimens were lightly whitened with ammonium chloride. Illustrated specimens have been deposited in the U. S. National Museum.

DISCUSSION

Comparison of Shallow Water Stations (10 meters)

Considerable variation in both abundance and diversity of bryozoans was found at all three test sites (Table 1A). The erect, branching species, *Bugula neritina* and *B. californica*, were present at all three sites but were particularly abundant at Yokosuka. Principal differences in species composition were noted among the Bryozoa having an encrusting zoarial form. *Schizoporella unicornis*, for example, was found on all 11 of the 10-meter test panels implanted in the subtropical waters of the Osakan-Kyushan province at Sasebo. On the other hand, *S. unicornis* was less abundant on the panels recovered from the waters of the temperate Japonian province at Maizuru and Yokosuka, being least common northward toward Yokosuka. Similarly, *Celleporaria aperta* was found on 10 of the 11 shallow panels at Sasebo, and on only 1 of the 11 shallow panels at Maizuru. It was absent at Yokosuka. The variations in occurrence of all the species are given in Table 1A.

The diversity of the bryozoan assemblage was at a maximum at Maizuru. Nine different species

TABLE 1A

SPECIES OF BRYOZOA ON MONTHLY AND CUMULATIVE PANELS FROM WATER DEPTHS OF 10 M AT YOKOSUKA, MAIZURU, AND SASEBO, JAPAN*

SPECIES	TEST AREA AND NUMBER OF TEST PANELS		
	YOKOSUKA (14)	MAIZURU (11)	SASEBO (11)
<i>Watersipora subovoidea</i>	D	T	T
<i>Bugula neritina</i>	D	D	T
<i>Bugula californica</i>	D	I	T
<i>Schizoporella unicornis</i>	T	I	D
<i>Electra tenella</i>	—	D	I
<i>Celleporaria aperta</i>	—	T	D
<i>Smittoidea prolifica</i>	—	I	T
<i>Cryptosula pallasiana</i>	—	T	—
<i>Codonellina montferandii</i>	—	—	T
<i>Escharoides praestans</i>	T	—	—
<i>Fenestrulina malusi</i>	T	T	—

* Symbols used to indicate relative abundance of species: D (dominant), when the species covers more than 20% of test panel; I (influent), 1–20% of test panel covered; T (trace), less than 1% of panel covered.

were represented there, while at Sasebo eight species and at Yokosuka only six species were found. Only four species occurred at all three stations. These same four species are also the only species in common between the Yokosuka and Sasebo stations. On the other hand, seven of the eight species found at Sasebo were also present at Maizuru, and five of the six species found at Yokosuka were also found at Maizuru.

These data on faunal diversity of occurrence indicate that the fauna at Yokosuka does not closely resemble that of either Maizuru or Sasebo. The resemblance between the Maizuru and Sasebo sites is the closest of the three. When the relative number of panels upon which the species occurs at each site is considered, faunal contrast between the three sites is enhanced (Table 1A). For example, *Watersipora subovoidea* was found at all three sites; thus it would be a faunal element tending to increase the similarity between the faunas if only diversity were considered. However, when the number of panels upon which it occurred is considered, it is found to be a very important faunal element at Yokosuka but of only minor importance at Maizuru and Sasebo. *Bugula neritina*

and *B. californica* occurred with much greater frequency at Yokosuka and Maizuru than at Sasebo; and *B. californica* was most common at Yokosuka. *Schizoporella unicornis* also occurs at all sites, but in relatively minor quantities at Yokosuka compared with Maizuru and Sasebo. *Electra tenella* occurs with relatively high frequency at Maizuru and Sasebo but it is absent at Yokosuka.

The species found were categorized as dominant, influent, and trace, according to their relative abundance. Only six species occurred as dominants in the fouling community. When the relative occurrence of the principal species is compared among the three test sites, a diagnostic bryozoan assemblage characteristic of each site is evident (Table 1A).

Yokosuka is characterized by large quantities of *Watersipora subovoidea* accompanied by *Bugula neritina* and *B. californica*; and Maizuru by *Bugula neritina* and *Electra tenella*. *Schizoporella unicornis* and *Celleporaria aperta* characterize the assemblage at Sasebo. In spite of the fact that the above species are cosmopolitan in distribution, quantitative data on their occurrence can be used to form species lists of dominant species diagnostic of certain areas.

Although the north-to-south temperature gradient from Yokosuka to Sasebo may be of ecological importance, the surface temperatures at the test sites measured during the 1966–1967 panel exposures do not seem to strongly support this premise. The salinity at Yokosuka remained near normal between 32 and 35 ‰. The observed salinities at Maizuru and Sasebo fluctuated between 27 and 35 ‰; however, this range seems to be within the salinity tolerance range for most of the recorded species. Therefore, neither the temperature nor the salinity regimes recorded at these sites seems to be sufficiently different to account for the noticeable differences in the bryozoan assemblages (Fig. 2).

Deep Water Stations (20–40 meters)

In July, 1967, additional fouling racks were placed farther offshore in deeper water. Table 1B shows the preliminary list of species collected at Maizuru and Sasebo additional to those previously found in 1966.

The fauna of the offshore, deep stations generally resembled that of the inshore, shallow

TABLE 1B

SPECIES OF BRYOZOA FOUND ON PANELS EXPOSED AFTER JULY 1967 IN WATER DEPTHS OF 10, 20, AND 40 METERS AT MAIZURU AND SASEBO, JAPAN*

SPECIES	TEST AREA AND NUMBER OF TEST PANELS	
	MAIZURU (14)	SASEBO (15)
<i>Biflustra savartii</i>	X	X
<i>Cleidochasma contractum</i>	—	X
<i>Rhynchozoon bispinosum</i>	—	X
<i>Hippopodina feegeensis</i>	—	X
<i>Steganoporella magnilabris</i>	—	X
<i>Microporella tractabilis</i>	—	X
<i>Celleporina</i> cf. <i>C. costazii</i>	X	—
<i>Thalamoporella californica</i>	—	X

* Quantitative comparisons were not possible because of incomplete data. The above species were those found in addition to the ones recorded in Table 1A.

stations at each site, but the deep assemblages appeared to be more diverse. Also, the 1967 shallow bryozoan assemblages were more diverse than those of 1966. However, complete data for the purpose of comparisons will not be available until the 1967 series of panels have been collected and analyzed, at which time the data will be published.

SYSTEMATICS

Order CHEILOSTOMATA Busk

Suborder ANASCA Levinsen

Family MEMBRANIPORIDAE Busk

Genus *Biflustra* d'Orbigny

Biflustra savartii (Audouin)

Fig. 3, 2

Flustra savartii Audouin, 1826, Explication sommaire des planches de l'Égypte et de la Syrie. In: Description de l'Égypte. Hist. Nat., vol. 1, pt. 4, p. 240.

Acanthodesia savartii (Audouin) Mawatari, 1952, Bryozoa of Kii Peninsula, Publ. Seto. Mar. Biol. Lab., vol. II(2), pp. 227–228.

Acanthodesia savartii (Audouin) Kataoka, 1960, Bryozoa from Mogami-Tai, Japan Sea. Sci. Rep. Tohoku Univ. Ser. 2 (Geol.), spec. vol. 4, p. 395.

OCCURRENCE: Minor quantities at Maizuru

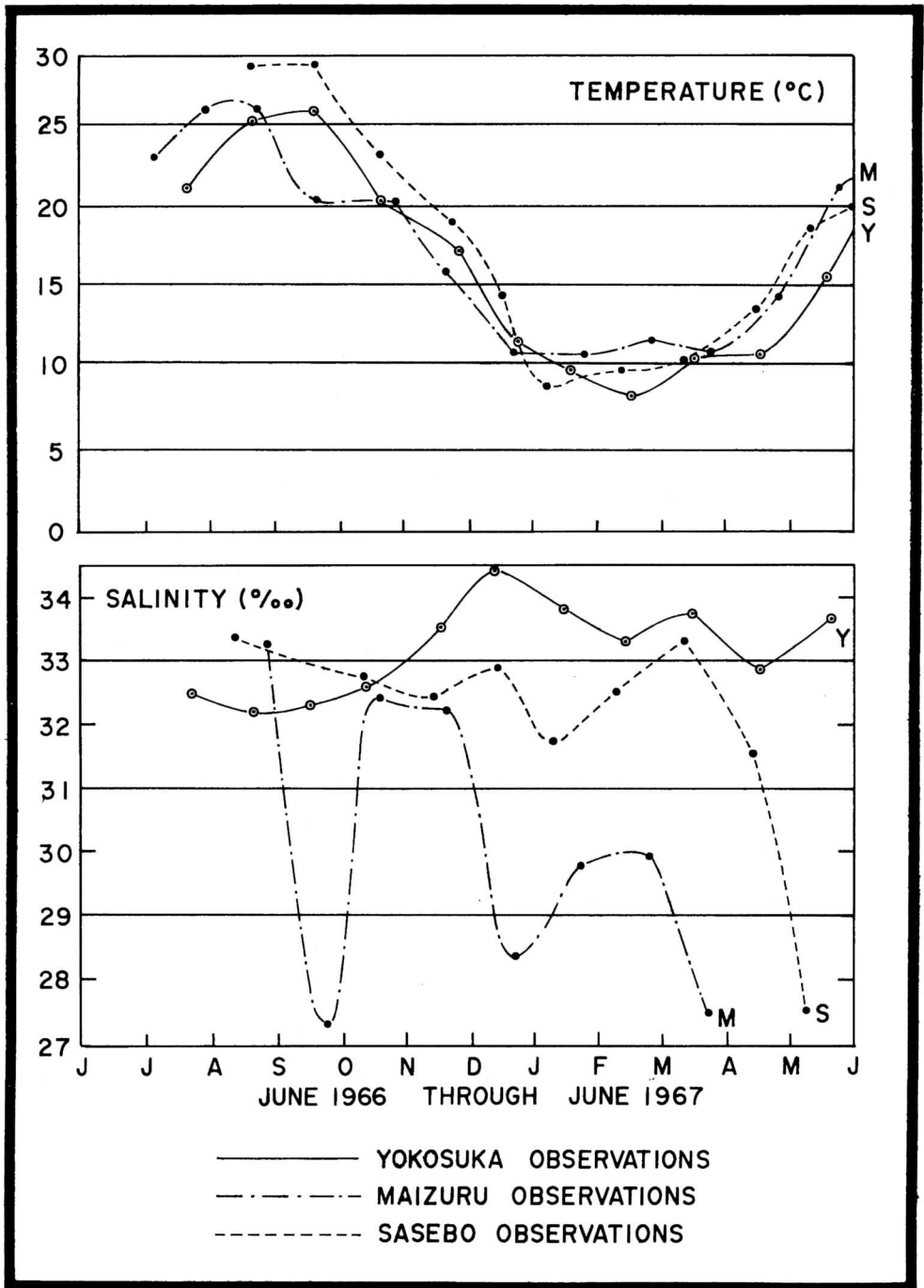


FIG. 2. Water temperatures and salinities at the three fouling sites in Japan during the period June 1966 to June 1967. Note similarity in temperature changes and marked differences in salinity changes at the three sites.

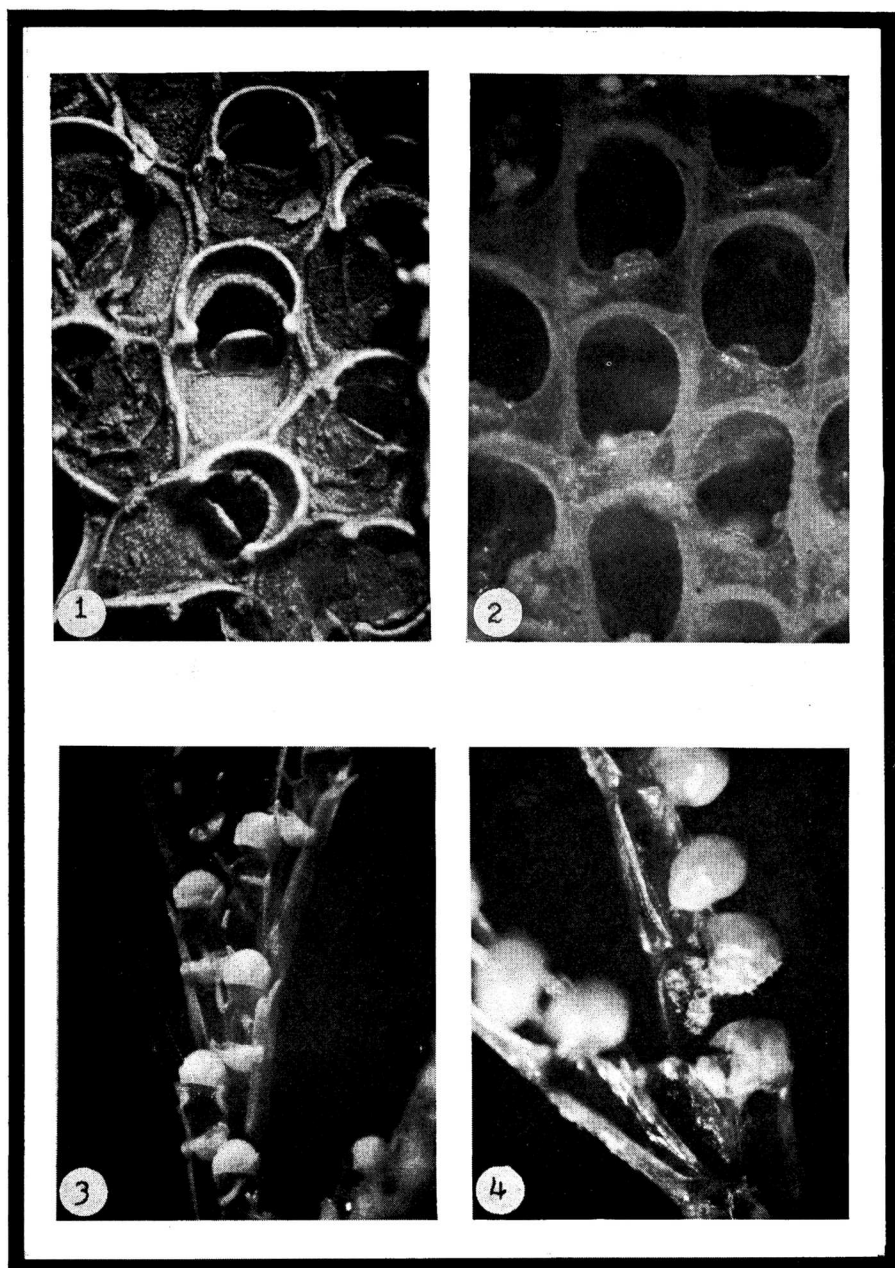


FIG. 3, 1-4

1, *Steganoporella magnilabris* (Busk); zoarial fragment showing portions of several zoecia; USNM 651028, $\times 35$.

2, *Biflustra savartii* (Audouin); zoarial fragment showing five complete zoecia; USNM 651026, $\times 35$.

3, *Bugula californica* (Osburn); branched zoarial fragment showing several complete, ovicelled zoecia, each with avicularia; USNM 651031, $\times 35$.

4, *Bugula neritina* (Linnaeus); branched zoarial fragment with several complete, ovicelled zoecia; USNM 65130, $\times 35$.

(10 m) and moderate quantities at both 10 and 20 meter depth at Sasebo; colonies small.

Family ELECTRINIDAE d'Orbigny

Genus *Electra* Lamouroux

Electra tenella (Hincks)

Fig. 4, 1

Membranipora tenella Hincks, 1880, Contributions toward a general history of the marine Polyzoa. Ann. Mag. Nat. Hist., ser. 5, vol. 6, pp. 276-384.

Electra angulata (Hincks) Okada and Mawatari, 1938, On the collection of Bryozoa along the coast of Wakayama-ken. Ann. Zool. Jap., vol. 17, nos. 3 and 4, p. 449.

Electra tenella (Hincks) Silèn, 1941, Cheilostomata Anasca (Bryozoa) collected by Prof. Dr. Sixten Bock's Expedition to Japan and the Bonin Islands. 1914. Ark. für Zool., Bd. 33A, no. 12, p. 18.

OCCURRENCE: Abundant at Maizuru and Sasebo, absent from Yokosuka. Occurs on both wood and asbestos, but more common on the wood.

Family STEGANOPORELLIDAE Smitt

Genus *Steganoporella* Smitt

Steganoporella magnilabris (Busk)

Fig. 3, 1

Membranipora magnilabris Busk, 1852, Catalogue of Marine Polyzoa in the Brit. Mus., pt. 1, p. vi (explanation of pl. 65), pl. 65, fig. 4.

OCCURRENCE: Minor quantities at Sasebo. Small colonies on asbestos and covering other Bryozoa.

Family THALAMOPORELLIDAE Levinsen

Genus *Thalamoporella* Hincks

Thalamoporella californica (Levinsen)

Fig. 4, 3

Thalamoporella rozieri var. *californica* Levinsen, 1909, Morphological and systematic studies on the cheilostomatous Bryozoa, p. 184, Copenhagen.

OCCURRENCE: A single colony was found on asbestos at Sasebo.

Family BICELLARIELLIDAE Levinsen

Genus *Bugula* Oken

Bugula neritina (Linnaeus)

Fig. 3, 4

Sertularia neritina Linnaeus, 1758, Systema naturae, 10th ed. Holmiae, vol. 1, p. 38.

OCCURRENCE: Found on both wood and asbestos in large quantities at Sasebo, Maizuru and Yokosuka.

Bugula californica Robertson

Fig. 3, 3

Bugula californica Robertson, 1905, Non-incrusting cheilostomatous Bryozoa of the west coast of North America. Proc. Calif. Acad. Sci., Zool., vol. 5, no. 4, pp. 267.

Suborder ASCOPHORA Levinsen

Family HIPPOPODINIDAE Levinsen

Genus *Hippopodina* Levinsen

Hippopodina feegeensis (Busk)

Fig. 6, 1

Lepralia feegeensis (Busk), 1884, Report on the Polyzoa collected by H.M.S. "Challenger" during the years 1873-1876. Part 1, Cheilostomata. Zool. 10, part 30, pp. i-xxiv, 144.

OCCURRENCE: Minor quantities found on barnacles on Sasebo panels.

Family SCHIZOPORELLIDAE Jullien

Genus *Schizoporella* Hincks

Schizoporella unicornis (Johnston) sensu lato

Fig. 7, 1

Lepralia unicornis Johnston, 1847, A history of British zoophytes, ed. 2, p. 320, pl. 57, fig. 1.

OCCURRENCE: Commonly found upon barnacles and attached to the asbestos substrate. Found at all three sites, but most abundant at Sasebo.

Genus *Watersipora* Neviani*Watersipora subovoidea* (d'Orbigny)

Fig. 5, 4

Lepralia subovoidea d'Orbigny, 1852, Paléontologie française; description des animaux invertébrés; terrain Crétacé, tome 5, Bryozoaires, p. 980.

OCCURRENCE: Found commonly on barnacles and less often on asbestos substrate. Present at Maizuru and Sasebo, but found in large quantities at Yokosuka.

Family CLEIDOCHASMATIDAE Cheetham and Sandberg

Genus *Cleidochasma* Harmer*Cleidochasma contractum* (Waters)

Fig. 7, 3

Lepralia contracta Waters, 1899, Roy. Micro. Soc. London, Jour., p. 11, pl. 3, figs. 4–6.

OCCURRENCE: Minor quantities upon barnacles from Sasebo.

Family EXOCHELLIDAE Osburn

Genus *Escharoides* Milne-Edwards*Escharoides praestans* (Hincks)

Fig. 6, 2

Mucronella praestans Hincks, 1882, Polyzoa of Queen Charlotte Islands: Preliminary notice of some new species and report on the Polyzoa of the Queen Charlotte Islands. Ann. Mag. Nat. Hist., ser. 5, vol. 10, p. 168.

OCCURRENCE: Found on barnacles and asbestos substrate at Yokosuka only.

Family MICROPORELLIDAE Hincks

Genus *Microporella* Hincks*Microporella tractabilis* Canu and Bassler

Fig. 5, 1

Microporella tractabilis Canu and Bassler, 1930, The bryozoan fauna of the Galapagos Islands. Proc. U. S. Nat. Mus., vol. 76, art. 13, p. 22.

OCCURRENCE: Small colonies found only in

minor quantities on the 20-meter panels at Sasebo.

Genus *Fenestulina* Jullien*Fenestulina malusi* (Audouin)

Fig. 5, 3

Cellepora malusii Audouin, 1826, Explication sommaire des planches de l'Égypte et de la Syrie. In: Description de l'Égypte, Hist. Nat., vol. 1, pt. 4, p. 239. Paris.

Microporella malusi (Audouin) Okada, 1929, Cheilostomatous Bryozoa of Mutsu Bay. Sci. Rep. Tohoku Imp. Univ., vol. 4(1), fasc. 1, p. 27.

Microporella malusi (Audouin) Sakakura, 1935, Jour. Fac. Sci. Imp. Univ. Tokyo, vol. 4(1), p. 24.

OCCURRENCE: Small colonies found only on one asbestos substrate of the 10-meter panels at Yokosuka and Maizuru.

Family SMITTINIDAE Levinsen

Genus *Smittoidea* Osburn*Smittoidea prolifica* Osburn

Fig. 4, 2

Smittoidea prolifica Osburn, 1952, Bryozoa of the Pacific coast of America, part 2, Cheilostomata-Ascophora. Allan Hancock Pacific Expeditions, vol. 14, no. 2, pp. 408–409, pl. 48.

OCCURRENCE: Relatively large colonies found at Maizuru and Sasebo.

Genus *Codonellina* Canu and Bassler*Codonellina montferrandii* (Audouin)

Fig. 7, 2 and 4

Flustra montferrandii Audouin, 1826, Explication sommaire des planches de l'Égypte et de la Syrie. In: Description de l'Égypte, Hist. Nat., vol. 1, pt. 4, p. 240. Paris.

Codonella obtusata (Ortmann) Mawatari, 1952, Bryozoa of Kii Peninsula, Publ. Seto Mar. Biol. Lab. II(2), p. 280.

Codonellina operculata Mawatari, 1956, Cheilostomatous Bryozoa from the Kurile Islands and the neighbouring districts, Pacific Science, vol. 10, no. 2, pp. 125–26, figs. 8, 9.

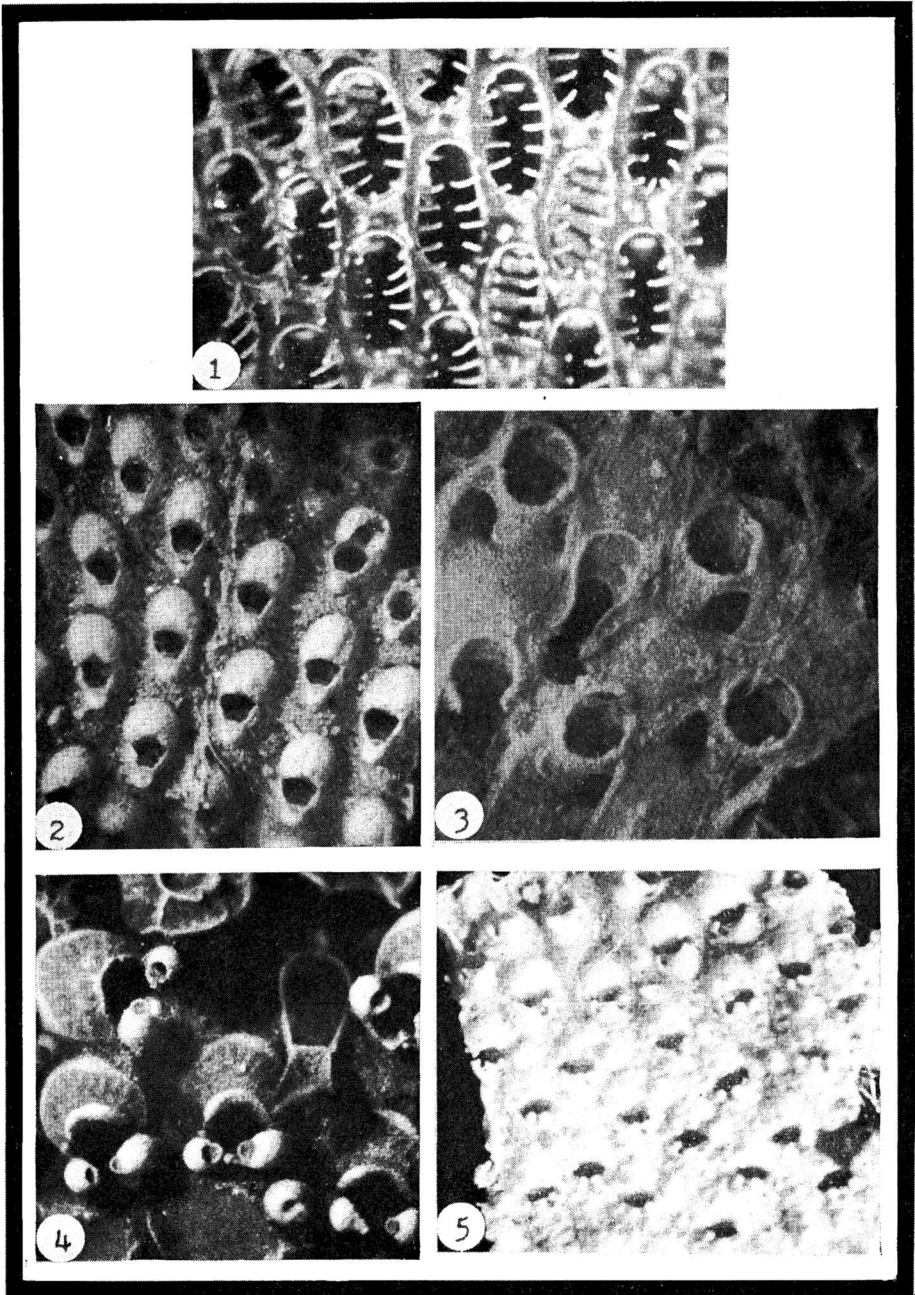


FIG. 4, 1-5

- 1, *Electra tenella* (Hincks); zoarial fragment showing eleven complete zoecia; USNM 651027, $\times 35$.
 2, *Smittoidea prolifica* (Osburn); zoarial fragment showing numerous ovicelled zoecia with suboral avicularia; USNM 651039, $\times 35$.
 3, *Thalamoporella californica* (Hincks); zoarial fragment showing several zoecia and one inter-zoecial avicularium; USNM 651029, $\times 35$.
 4, *Celleporina* cf. *C. costazii* (Audouin); zoarial fragment showing several zoecia with paired, suboral, pedunculate avicularia, and a large spatulate, interzoecial avicularium; USNM 651046, $\times 35$.
 5, *Rhychozoon bispinosum* (Johnston); zoarial fragment showing many zoecia; USNM 651042, $\times 50$.

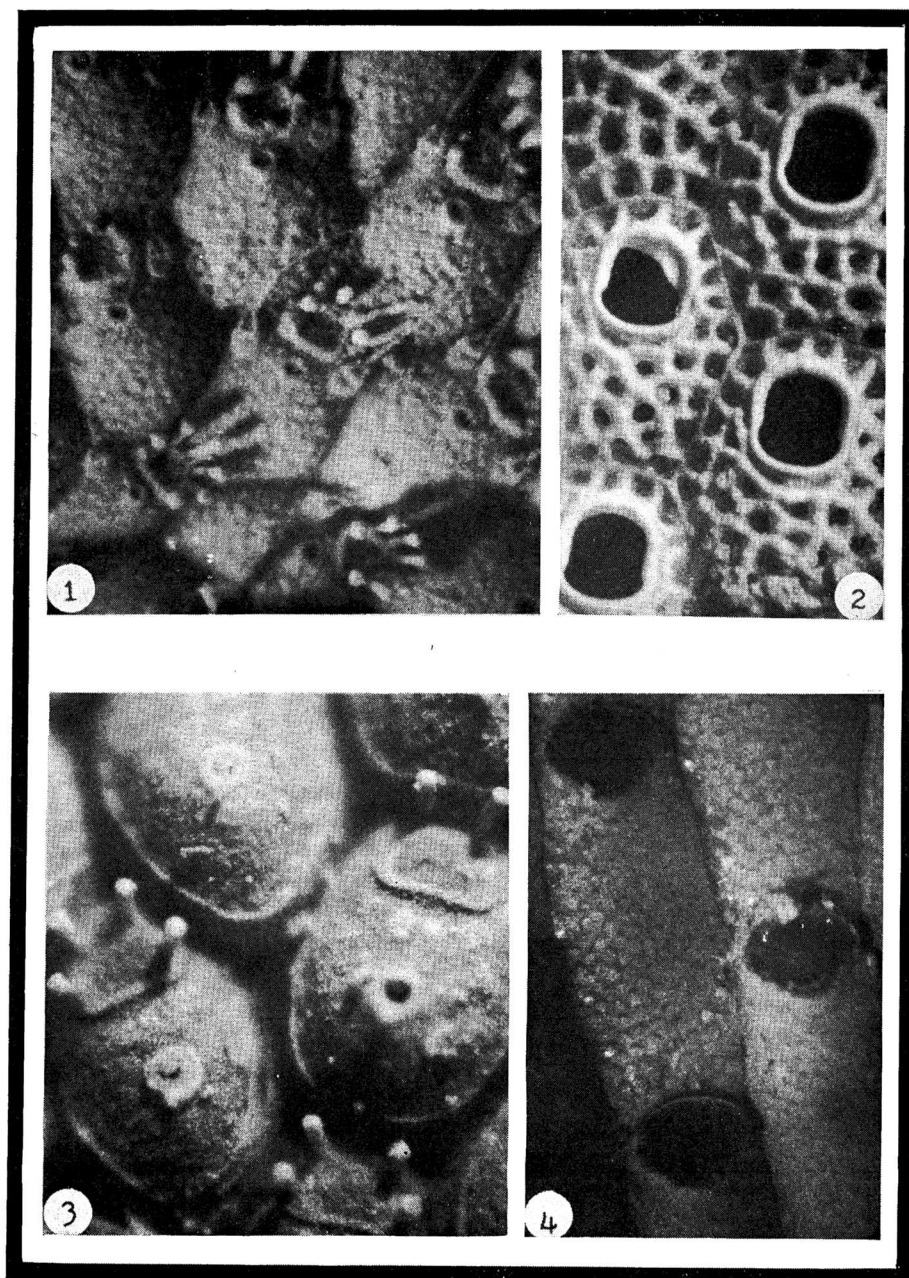


FIG. 5, I-4

1, *Microporella tractabilis* (Canu and Bassler); zoarial fragment showing several zooecia with paired avicularia, having elongate mandibles; USNM 651037, $\times 70$.

2, *Crytosula pallasiana* (Moll); zoarial fragment showing several complete zooecia; USNM 651043, $\times 50$.

3, *Fenestrulina malusi* (Audouin); zoarial fragment showing two complete zooecia, each with an ascopore and oral spines; USNM 651038, $\times 115$.

4, *Watersipora subovoidea* (Busk); zoarial fragment showing portions of five zooecia; USNM 651034, $\times 50$.

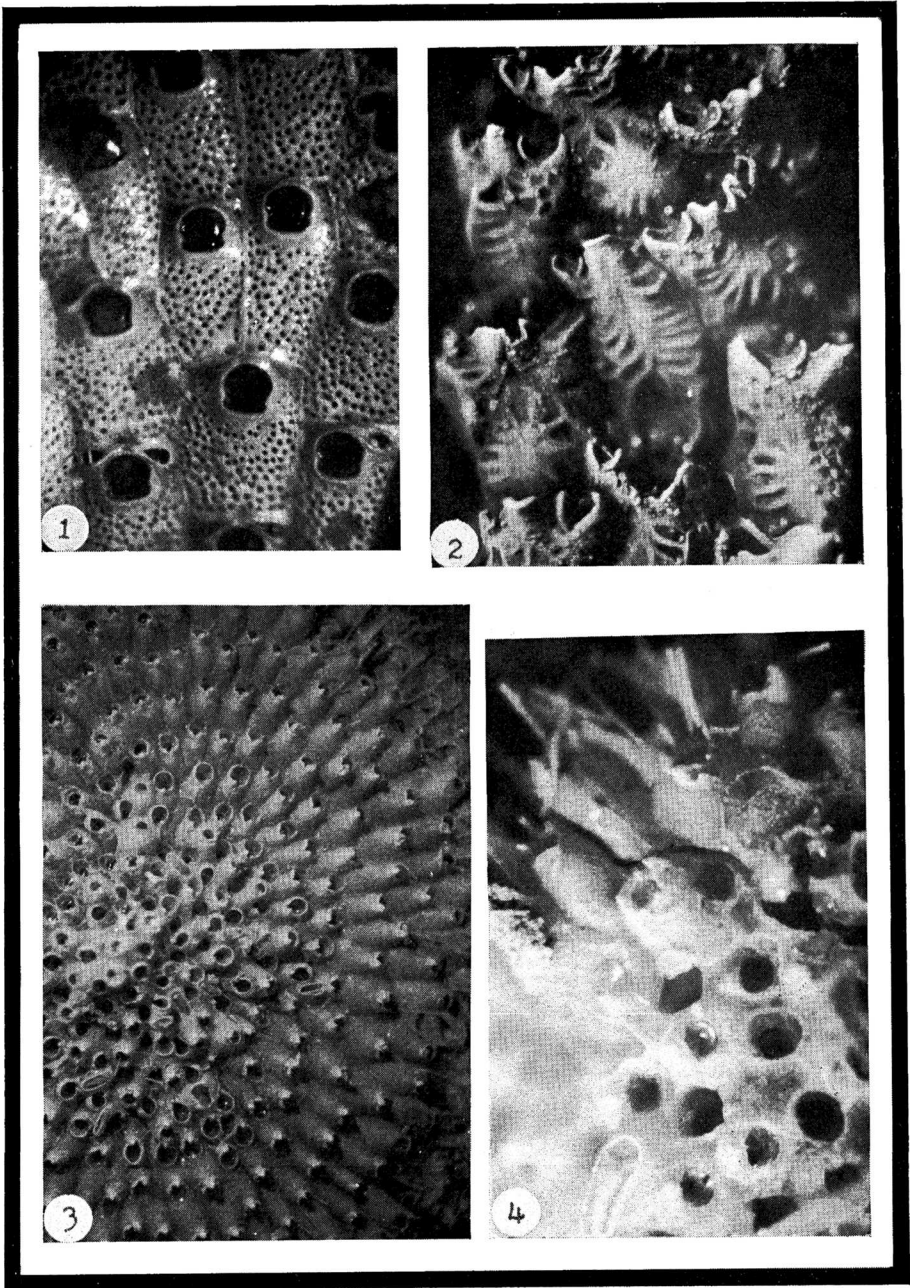


FIG. 6, 1-4

- 1, *Hippopodina feegeensis* (Busk); zoarial fragment showing eight complete zoecia, several with one or two avicularia; USNM 651032, $\times 20$.
- 2, *Escharoides praestans* (Hincks); zoarial fragment showing several complete zoecia each with lateral-oral avicularia; USNM 651036, $\times 35$.
- 3, *Celleporaria aperta* (Busk); half of a complete colony, showing many large, interzoecial avicularia; USNM 651044, $\times 12$.
- 4, Same as above; zoarial fragment showing numerous zoecia and one large, interzoecial avicularium; oral spines commonly present on young zoecia near the growing edge of the colony; USNM 651045, $\times 35$.

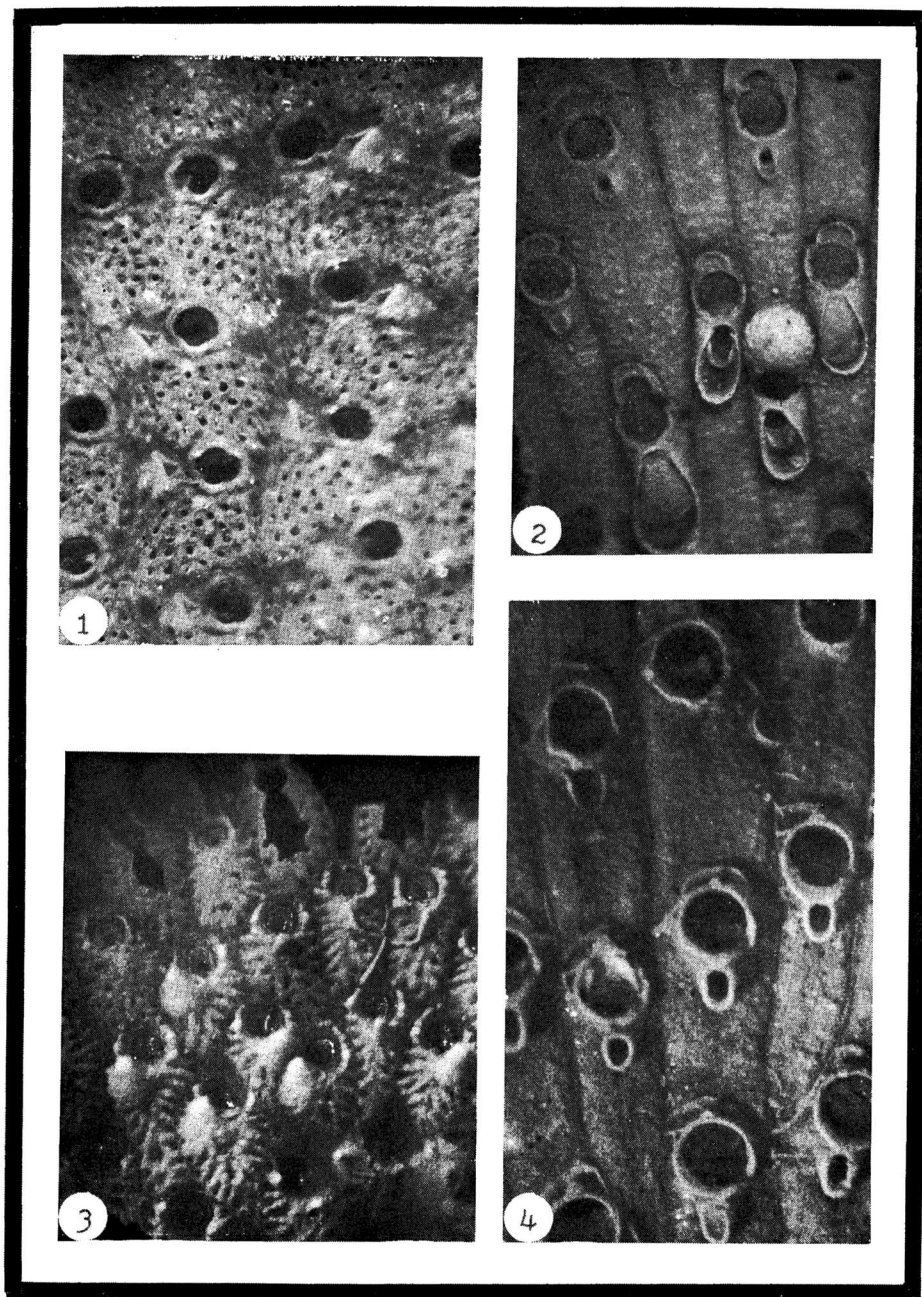


FIG. 7, 1-4

1, *Schizoporella unicornis* (Johnston) sensu lato; zoarial fragment, showing eight complete zoecia and six avicularia; USNM 651033, $\times 40$.

2, *Codonellina montferrandii* (Audouin); zoarial fragment, showing both forms of avicularia, one ovicell, and various stages of ovicell development. USNM 651040, $\times 35$.

3, *Cleidochasma contractum* (Waters); zoarial fragment showing fourteen complete zoecia; nine umbonate, suboral avicularia and several developing zoecia; USNM 651035, $\times 35$.

4, *Codonellina montferrandii* (Audouin); zoarial fragment showing young zoecia with the small type avicularia; USNM 651041, $\times 50$.

Condoellina obtusata (Ortmann) Kataoka, 1960, Bryozoa from Mogami-Tai, Japan Sea, Sci. Rep. Tohoku Univ., Ser. 2 (Geol.), spec. vol. no. 4, p. 396.

OCCURRENCE: One small colony found upon barnacles at Sasebo.

Family SERTELLIDAE Jullien

Genus *Rhynchozoon* Hincks

Rhynchozoon bispinosum (Johnston)

Fig. 4, 5

Lepralia bispinosa Johnston, 1847, A history of British zoophytes (ed. 2), vol. 1, p. 326 (text).

OCCURRENCE: Small colonies found on asbestos substrate only at Sasebo.

Family CHEILOPORINIDAE Bassler

Genus *Cryptosula* Canu and Bassler

Cryptosula pallasiana (Moll)

Fig. 5, 2

Eschara pallasiana Moll, 1803, Eschara zoophytorum seu phytozoorum, p. 57.

OCCURRENCE: Found in small colonies on asbestos and wood substrate at Maizuru and Sasebo.

Family CELLEPORARIIDAE Harmer

Genus *Celleporaria* Lamouroux

Celleporaria aperta (Hincks)

Fig. 6, 3 and 4

Holoporella aperta Waters, 1909, Bryozoa reports on the marine biology of the Sudanese Red Sea. Jour. Linn. Soc. London, Zool., Cheilostomata, pp. 123-181, pls. 10-18.

OCCURRENCE: Found on asbestos substrate. Minor quantities at Maizuru, and large quantities at Sasebo; absent from Yokosuka.

Family CELLEPORINIDAE Harmer

Genus *Celleporina* d'Orbigny

Celleporina cf. *C. costazii* (Audouin)

Fig. 4, 4

Cellepora costazii Audouin, 1826, Explication sommaire des planches de l'Égypte et de la Syrie. In: Description de l'Égypte, Hist. Nat., vol. 1, pt. 4, p. 7. Paris.

Siniopelta costazii (Audouin), Mawatari, 1956, Cheilostomatous Bryozoa from the Kurile Islands and neighbouring districts. Pacific Science, vol. 10, no. 2, p. 132.

OCCURRENCE: One small colony on asbestos substrate of 40-meter panel at Maizuru.

REMARKS: Osburn (1952) described the semi-circular frontal area of the ovicells as having "a row of radiately arranged pores extending in full width across the front above the orifice." His illustration shows the pores extending the length of the frontal area of ovicells proximal to the orifice. The present samples have a row of pores situated around the distal periphery of the ovicells. Only occasionally a short row of two or three proximal pores accompanies the peripheral row with a smooth and glossy area in between. The pair of pedicellate avicularia on each side of the orifice occasionally grow together and appear to fuse forming a bridge over the orifice.

SUMMARY

Nineteen species of cheilostome Bryozoa were found on test panels exposed at three test sites in Japan. The predominant species at each site constitute a checklist diagnostic of each site: *Watersipora subovoidea* with *Bugula neritima* and *B. californica* at Yokosuka; *Bugula neritima* and *Electra tenella* at Maizuru; and *Schizoporella unicornis* and *Celleporaria aperta* at Sasebo. Distinct annual and geographic differences were found in the bryozoan assemblages at the three sites.

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