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XLIII.—*Report on the Corals from the Tizard and Macclesfield Banks, China Sea.* By P. W. Bassett-Smith, Surgeon R.N.

[Plates XII.–XIV.]

In April 1888, by order of Capt. Wharton, F.R.S., Hydrographer to the Navy, a short survey was made of these interesting coral-banks by H.M.S. 'Rambler,' in charge of Commander W. U. Moore, R.N. Sectional lines were run across the margins of the banks, both from within and without, into moderately deep water, and dredging-operations were carried on, which resulted in obtaining a large collection of corals &c., which were brought to England for further examination, and subsequently presented by the Lords Commissioners of the Admiralty to the British Museum (Natural History). The corals were for the most part dredged up under my own personal superintendence, and on the return of the vessel to England I obtained permission from the Admiralty to study and arrange the collection there through the kindness of Dr. Günther, F.R.S. In the original Report of the Survey several of the corals were incorrectly specified from want of books of reference. On my return home I was enabled to devote several months to their detailed study, but should not have ventured to publish my generic and specific

determinations, if Dr. G. J. Hinde had not, at the sacrifice of much time, most kindly gone over the whole of the collection and revised my work. Owing to various circumstances the present Report is limited to an enumeration of the different species which have been determined; amongst them are many forms which in Dr. Hinde's opinion are apparently new, but a detailed description of these is delayed until they can be reexamined with the assistance of additional material, and until an opportunity can be found to figure them suitably. I have thought it desirable to subjoin some brief notes on the character of the reefs whence the corals were obtained.

The Tizard Bank (Pl. XII.) is situated in lat. 10° N., long. 114° E., near the centre of the China Sea between the Philippines and the Malay Peninsula. Like many others in the same region it is irregularly circular in outline; and it has an extreme length of 32 miles and a breadth of 10, and it is surrounded by deep water.

But with such an extended margin the only portions of the bank which project above the surface of the sea consist of three small islets, each from half a mile to one mile in length, and two very small sand-kays of about one mile each. For the greater part of the circumference of the bank, that is for 50 out of 67 miles, the rim is within 10 fathoms of the surface. On the north-east side there are two extensions of the bank, 5 and 4½ miles in length respectively; the first of these is nearly uncovered at low water, whilst the other is at a depth of 6 fathoms.

The area of the lagoon inclosed within this bank is very extensive; it has an average depth of 40 fathoms, with a few scattered elevations here and there, the eastern end being the most shallow portion. The bottom of the lagoon is covered by a fine foraminiferal sand, and the same material extends over the floor of the narrow channels which cut through the rim and connect the lagoon with the outer sea. At depths of 6 to 10 fathoms long channels paved with this sand can be seen bounded on either side by walls of living coral.

From the central portion of this sandy floor of the lagoon, at a depth of 45 fathoms, a living Astræan coral belonging to an apparently new species of *Favia* was dredged up, thus showing the existence of these reef-building forms at depths much greater than it has been supposed they could flourish in. I may here point out that the evidence obtainable by the lead alone regarding the presence of *living* corals is entirely misleading and almost worthless. For example, judging from the observations obtained by the lead, the greater part of the corals on the surface of the Macclesfield Bank appeared

to be dead; but the dredge with swabs attached brought up from this bank an abundance of living forms.

Of the three islets on the Tizard Bank (see Pl. XII.), that named *Sand-Kay* is the smallest and the most recent; though it has increased in size within the last twenty years, it is still only a quarter of a mile in length. The surface is somewhat depressed in the centre; it is entirely composed of sand and small coral débris. Surrounding the island is a platform of coral-rock half a mile broad, covered generally with sand, but here and there with patches of growing coral which increase in number as the water becomes deeper, and they grow very luxuriantly amongst the breakers on the outer edge of the platform both next the sea and next the lagoon. Just below high-water mark there are parallel lines of hard solid rock formed by coral débris and sand cemented together, and a reef at a depth of 5 fathoms extends uninterruptedly to the westward for a distance of 4 miles.

The islet of *Nam-Yit* is rather larger than Sand-Kay; its highest part is not more than 12 feet above high water, and in bad weather the waves, according to the natives, break all over it. It is well covered with small trees, and the surface-soil is therefore of a brown and earthy character; beneath this is a conglomerate of sand and small coral débris. A well, 6 feet deep, passed through loose sandy rock.

The striking parallel lines of cement-rock are well marked on both sides of this island, more particularly on the south or weather side; they have an apparent dip of about 60° from the centre, one layer superimposed on the other. This islet is likewise surrounded by an extensive shore-platform with isolated rocks at its edge, and at its northern end there are sand-banks forming horn-shaped prolongations, which partially inclose a small lagoon; on the open side of this, facing the lagoon, there are many rocks just below the surface.

Itu-Aba, the largest islet, is three quarters of a mile in length and covered with large trees of considerable age; it is similarly surrounded by a shallow-water platform. Outside this, in 6 fathoms water, the number of living corals was found by the diver to be much fewer than elsewhere; but from the reef, in 21 fathoms water, several massive specimens were obtained, and a rich variety of species was found on the lagoon side of the reef.

A comparison of the sections (Pl. XIII.) taken across different portions of the Tizard Bank shows very great similarity in the form and slope of the bank throughout. Thus in all, with the exception of section C near Nam-Yit, there is a broad plateau sloping very gradually to a depth of 10–12 fathoms,

on which coral-growth is most luxuriant; from the edge of this there is a more or less abrupt descent to a depth of about 30 fathoms, followed by a gradual slope to 50 fathoms; then there is an abrupt descent to 100–150 fathoms, and beyond this the average slope to deeper water is at an angle of about 30°, except in section F, near Itu-Aba, where it is somewhat less. In section C the slope of the plateau continues gradual to a depth of 30 fathoms, and in this respect is similar to the Macclesfield Bank.

The Macclesfield Bank (Pl. XIV.) is situated 300 miles to the north of the Tizard; it is 76 miles in length and 36 broad. This bank is entirely submerged; the shallowest portion of the rim is 9 fathoms beneath the surface, and inside the bank the depth is from 40 to 50 fathoms. Dredging on this bank was carried on from a small steam-cutter, but at depths of 20 to 45 fathoms there was considerable difficulty in moving the dredge with swabs attached. Living corals were found very abundantly to a depth of 30 fathoms, and some were obtained from a depth of 44 fathoms.

It will be seen from the subjoined tabular list that 129 species of Madrepore corals (Hydrocorallines and Alcyonarians are not here included) have been determined from the Tizard and Macclesfield Banks; of this number 99 species are from the Tizard and 26 from the Macclesfield Bank, whilst 4 only are common to both. Of the Madreporaria Aporosa there are 48 species, belonging to 23 genera; of the Madreporaria Fungida 23 species, included in 9 genera; and of the Madreporaria Perforata 58 species and 8 genera. The preponderance of the species of this latter division is principally due to the number of forms of the genus *Madrepora*, of which there are as many as 31 species.

An analysis of the bathymetrical distribution of these corals shows that at depths of 5 fathoms and under there are 45 species; between 5 and 10 fathoms 43 species; between 10 and 20 fathoms only 1 species; between 20 and 30 fathoms 30 species; between 30 and 40 fathoms 13 species; and between 40 and 50 fathoms 6 species. The rarity of species at depths between 10 and 20 fathoms may be accounted for by the fact that the shore-platform abruptly ceases at the upper limit of this zone, and there is a nearly vertical descent of 10 or more fathoms to a lower platform.

A very noticeable fact is the number of species which have been found living at depths of over 30 fathoms, a depth until lately supposed to be the extreme limit at which reef-building corals could exist. On these banks, however, we find 19 species occurring at depths between 31 and 45 fathoms; but

of these there are 7 species belonging to genera which may properly be considered deep-water corals rather than reef-builders; these are *Desmophyllum*, *Flabellum*, *Cyathohelia*, *Lithophyllia*, *Tridacophyllia*, and *Balanophyllia*. The remaining 12 species of reef-corals living at these unusual depths belong to the following genera:—*Stylophora*, 1 sp.; *Favia*, 1 sp. at 45 fath.; *Pavonia*, 1 sp.; *Leptoseris*, 1 sp.; *Phyllastræa*, 1 sp.; *Psammocora*, 1 sp.; *Montipora*, 3 spp. (one of these at 44 fath.); *Rhodaræa*, 1 sp.; and *Alveopora*, 2 spp.

It is also worthy of mention that five new species of the genus *Madrepora*—a genus usually limited to depths of under 10 fathoms—were found living at depths of 20 to 27 fathoms both on the Tizard and Macclesfield Banks.

Of the 18 species found growing on the coral-head inside the lagoon 15 were not found elsewhere, and the diver reported that the bottom looked different. This is rather a remarkable fact, considering the size of the lagoon and the depth of water.

Tabular List of Genera and Species of Corals obtained from the Tizard and Macclesfield Banks.

[T. = Tizard Bank. M. = Macclesfield Bank.]

		Genera and Species.	Depth in Fathoms.						
			0–5.	5–10.	10–20.	20–30.	30–40.	40–50.	50–60.
		MADREPORARIA APOROSA.							
		Stylophora, *Schw.*							
1.	T.	—— digitata, *Pallas*, sp.	..	7					
2.	M., T.	—— prostrata, *Klunz.*	..	.	..	26–27			
3.	T.	—— pistillata, *Esper*, sp.	..	7					
4.	T.	—— ? Ehrenbergi, *E. & H.*	3						
5.	M.	—— Guentheri, sp. n.	..	..	..	..	32		
		Seriatopora, *Lam.*							
6.	M.	—— gracilis, *Dana*	..	..	..	$20\frac{1}{2}$			
7.	T.	—— imbricata, sp. n.	$\frac{1}{2}$						
8.	T.	—— compacta, sp. n.	..	$5\frac{3}{4}$					
9.	T.	—— tenuis, sp. n.	..	6					
10.	T.	—— armata, sp. n.	..	7					
		Pocillopora, *Lam.*							
11.	T.	—— elongata, *Dana*	2	$6\frac{3}{4}$					
12.	M., T.	—— verrucosa, *Ell. & Sol.*, sp.	1	10					
13.	T.	—— brevicornis, *Lam.*	$\frac{2}{3}$–1	$6\frac{1}{2}$					
14.	T.	——, sp.	2						

Tabular List of Genera &c. (continued).

		Genera and Species.	Depth in Fathoms.						
			0–5.	5–10.	10–20.	20–30.	30–40.	40–50.	50–60.
		Flabellum, *Lesson*.							
15.	T.	—— Stokesi, *E. & H.*	..	..	..	..	40		
		Desmophyllum, *Ehrenberg*.							
16.	M.	——, sp.	..	..	..	..	32		
		Cyathohelia, *E. & H.*							
17.	T.	—— axillaris, *Ell. & Sol.*	..	..	..	..	..	50	
		Lithophyllia, *E. & H.*							
18.	M.	—— lacrymalis, *E. & H.*	..	..	..	..	..	44	
19.	T.	——, sp.	..	..	..	26			
		Tridacophyllia, *Blainv.*							
20.	T.	—— cervicornis, *Moseley*	..	..	..	..	..	50	
		Galaxea, *Oken*.							
21.	T.	—— æqualis, sp. n.	..	6					
		Symphyllia, *E. & H.*							
22.	T.	—— radians	2						
23.	T.	—— labyrinthica, sp. n.	5						
		Mussa, *Oken*.							
24.	T.	—— multilobata, *Dana*	5						
25.	T.	—— sinuosa, *Lam.*	..	6					
		Meandrina, *Lam.*							
26.	T.	—— strigosa ?, *Dana*	2						
27.	T.	—— dædalea, *Ell. & Sol.*, sp.	2–4						
		Leptoria, *E. & H.*							
28.	T.	—— phrygia, *Ell. & Sol.*, sp.	..	6					
		Scaphophyllia, *E. & H.*							
29.	T.	—— cylindrica, *E. & H.*	..	6					
		Hydnophora, *Fischer*.							
30.	T.	—— microcona, *Lam.*, sp.	..	6					
31.	T.	—— rigida, *Dana*, sp.	..	6					
		Favia, *Oken*.							
32.	T.	—— denticulata (?), *Ell. & Sol.*, sp.	..	7					
33.	T.	—— Okeni, *E. & H.*	..	7					
34.	T.	—— Ehrenbergi, var. sulcata, *Kl.*	5						
35.	T.	—— pandanus, *Dana*, sp.	2						
36.	T.	—— rotulosa, *Ell. & Sol.*, sp.	2						
37.	T.	——, sp.	..	..	..	..	..	45	
		Goniastræa, *E. & H.*							
38.	T.	—— Bournoni, *E. & H.*	2						
		Prionastræa, *E. & H.*							
39.	T.	—— obtusata, *E. & H.*	2						
40.	T.	—— spinosa, *Kl.*	½						
41.	T.	—— robusta, *Dana*, sp.	2						
		Plesiastræa, *E. & H.*							
42.	T.	—— Urvillei, *E. & H.*	..	6					
		Cyphastræa, *E. & H.*							
43.	T.	—— Brueggemanni, *Quelch*	5						

Tabular List of Genera &c. (continued).

		Genera and Species.	Depth in Fathoms.						
			0–5.	5–10.	10–20.	20–30.	30–40.	40–50.	50–60.
		Leptastræa, *E. & H.*							
44.	T.	—— Ehrenbergana (?), *E. & H.*	..	7					
45.	T.	—— solida, *E. & H.*, sp.	..	6					
		Orbicella, *Dana.*							
46.	T.	—— annuligera, *E. & H.*	5	10					
47.	T.	——, sp.	..	7					
		Echinopora, *Lam.*							
48.	T.	—— rosularia, *Lam.*	..	6					
		MADREPORARIA FUNGIDA.							
		Siderastræa, *Blainv.*							
49.	T.	—— (?), sp. n.	..	6					
		Fungia, *Lam.*							
50.	T.	—— scutaria, *Lam.*	½						
		Pavonia, *Lam.*							
51.	M.	—— papyracea	..	..	..	..	40		
52.	T.	—— pretiosa, sp. n.	..	..	..	27			
53.	M.	—— ramosa, sp. n.	..	..	..	26			
54.	T.	—— clivosa, *Verr.*	..	8–10					
55.	M.	——, sp.	..	..	..	26½			
56.	M.	——, sp. n.	..	..	..	20½			
		Cycloseris, *E. & H.*							
57.	T.	—— cyclolites, *Lam.*, sp.	..	..	..	28			
58.	T.	—— tenuis, *Dana*, sp.	..	..	..	27–28			
59.	M.	—— sinensis, *E. & H.*	..	..	..	26			
60.	T.	—— Freycineti, *E. & H.*, sp.	..	..	..	27			
61.	T.	—— distorta, *Mich.*, sp.	..	..	..	28			
		Leptoseris, *E. & H.*							
62.	T.	—— striatus, *MS.* (?)	..	..	..	..	35		
63.	T.	——, sp.	..	..	..	28			
		Phyllastræa, *Dana.*							
64.	T.	—— Okeni (?), *E. & H.*, sp.	..	..	..	..	32		
65.	M.	—— tubifex, *Dana*	..	..	..	26½			
		Pachyseris, *E. & H.*							
66.	M.	—— levicollis, *Dana*, sp.	..	..	..	26½			
		Oxypora, *Sav. Kent.*							
67.	M.	—— contorta, *Quelch*	..	..	..	26			
		Psammocora, *Dana.*							
68.	M.	—— planipora (?), *E. & H.*	..	..	..	26–27	32		
69.	M.	——, sp.	..	..	..				
70.	T.	—— Haimeana	..	6					
71.	T.	Gen. et sp. ind.	..	6					

Tabular List of Genera &c. (continued).

		Genera and Species.	Depth in Fathoms.						
			0–5.	5–10.	10–20.	20–30.	30–40.	40–50.	50–60.
		MADREPORARIA PERFORATA.							
		Balanophyllia, *Searles Wood.*							
72.	T.	—— parvula?, *Moseley*	..	..	..	..	..	50	
73.	T.	—— scabrosa (?), *Dana*, sp.	..	..	..	..	40		
		Dendrophyllia, *Blainv.*							
74.	T.	—— gravis, *Brugg. MS.*?	..	..	..	26			
		Montipora, *Quoy et Gaim.*							
75.	T.	—— papillosa, *Lam.*, sp.....	..	..	..	25			
76.	M.	—— foliosa, *Pallas*, sp.	..	..	..	$20\frac{1}{2}$			
77.	M.	—— prolifica, *Brugg. MS.*?	..	..	..	$26\frac{1}{2}$			
78.	M.	—— lima (?), *Lam.*, sp.	..	..	..	$26\frac{1}{2}$			
79.	T.	——, sp.	..	$8\frac{1}{4}$					
80.	T.	—— Danæ, *E. & H.*	$\frac{1}{2}$						
81.	M.	——, sp.	..	..	..	..	40		
82.	M.	—— porosa, sp. n.	..	..	..	..	35		
83.	M.	——, sp.	..	..	..	..	..	44	
		Turbinaria, *Oken.*							
84.	T.	—— stellulata, *Blainv.*, sp. var...	5–	10					
		Madrepora, *Linn.*							
85.	T.	—— robusta, *Dana*	5						
86.	T.	—— crebripora, *Dana*.....	$\frac{1}{2}$						
87.	T.	—— secunda, *Dana*.....	5						
88.	T.	—— scabrosa, *Quelch*	..	$6\frac{1}{2}$					
89.	T.	—— horrida, *Dana*.....	2						
90.	T.	—— Ehrenbergi, *E. & H.*	5						
91.	M., T.	—— dendrum, sp. n.	..	..	20	27			
92.	T.	—— compressa, sp. n.....	5						
93.	M.	——, sp. n.	..	..	..	$26\frac{1}{2}$			
94.	T.	—— plantaginea, *Lam.*	..	6					
95.	T.	—— valida, *Dana*	..	6					
96.	T.	—— paxilligera, *Dana*	1						
97.	M., T.	—— pyramidalis, *Kl.*	2						
98.	T.	—— seriata, *Ehrenb.*, sp.	2						
99.	T.	—— tenuis, *Dana*	1						
100.	T.	—— nasuta, *Dana*	5						
101.	T.	—— effusa, *Dana*	5						
102.	T.	—— globiceps, *Dana*	..	7					
103.	T.	—— acervata, *Dana*	..	$8\frac{1}{2}$					
104.	T.	—— aculeus, *Dana*	..	$8\frac{1}{2}$					
105.	T.	—— corymbosa, *Lam.*.....	..	$5\frac{1}{2}$–$9\frac{1}{2}$					
106.	T.	—— prostrata, *Dana*	..	$6\frac{1}{2}$					
107.	T.	—— cytherea (?), *Dana*	..	6					
108.	T.	—— efflorescens, *Dana*	..	6					
109.	T.	—— spicifera (var. abbreviata), *Dana*	..	5					

Tabular List of Genera &c. (continued).

		Genera and Species.	Depth in Fathoms.						
			0–5.	5–10.	10–20.	20–30.	30–40.	40–50.	50–60.
110.	T.	—— hyacinthus, *Dana*	..	$9\frac{1}{2}$					
111.	T.	—— vastula (?), *Quelch*	..	7					
112.	T.	—— flabelliformis, *E. & H.*, var.	2						
113.	T.	—— labrosa, *Dana*	5						
114.	T.	—— fragilis, sp. n.	..	..	..	27			
115.	M.	—— Rambleri, sp. n.	..	..	..	$26\frac{1}{2}$			
116.	M.	—— Rambleri, var.....	..	..	..	$20\frac{1}{2}$			
		Porites, *Lam.*							
117.	T.	—— mucronata, *Dana*	$\frac{1}{2}$						
118.	T.	—— conferta, *Dana*	$2\frac{1}{2}$						
119.	T.	—— lutea, *Quoy et Gaim.*	$\frac{1}{2}$						
120.	T.	—— tenuis, *Verr.*	$\frac{1}{2}$						
121.	T.	—— arenosa, *Esper*, sp.	2–6						
122.	T.	—— lichen (?), *Dana*	$2\frac{1}{2}$						
123.	T.	—— solida, *Forsk.*, sp.	2						
124.	T.	—— crassa (?), *Quelch*	..	7					
		Rhodaræa, *E. & H.*							
125.	T.	—— gracilis, *E. & H.*	2						
126.	M.	—— (?) Lagrenii?, *E. & H.*	..	..	..	..	40		
		Alveopora, *Quoy et Gaim.*							
127.	M.	—— dædalea, *Forsk.*, sp.	..	..	..	27–40			
128.	M.	—— retepora, *Ell. & Sol.*, sp.....	..	..	..	..	35		
129.	T.	—— Tizardi, sp. n.	..	..	..	27			

References to Genera and Species.

MADREPORARIA.

Section MADREPORARIA APOROSA, Ed. & H.

Genus STYLOPHORA, Schweigger.

Stylophora digitata, Pallas, sp.

Madrepora digitata, Pallas, Elench. Zooph. p. 326.

Two fragmentary specimens.
Tizard Bank. Depth from 3 feet to 7 fath.

Stylophora prostrata, Klunz.

1879. *Stylophora prostrata*, Die Korallth. des rothen Meeres, Th. ii. p. 62, pl. vii. fig. 8, pl. viii. fig. 7.

Two specimens were obtained.
Tizard and Macclesfield Banks. Depth 26–27 fath.

Stylophora pistillata, Esper, sp.

1797. *Madrepora pistillata*, Esper, Madre. pl. lx.

A single fragment doubtfully belonging to this species.
Tizard Bank, 7 fath.

Stylophora (?) *Ehrenbergi*, E. & H.

1859. *Stylophora Ehrenbergi*, E. & H., Ann. des Sci. Nat. 3e sér. t. xiii. p. 105.

A small fragment was obtained which apparently belongs to this species. It is doubtful, however, whether the form can properly be retained in the genus *Stylophora*, since there is apparently no cœnenchyma and in character the septa much resemble those of an Astræan coral.
Tizard Bank, 3 fath.

Stylophora Guentheri, sp. n.

Corallum incrusting, growing in thin successive layers over foreign objects; upper surface uneven, with nodose projections. Base with wrinkled epitheca formed of delicate concentric lines. The layers from 1 to 3·5 millim. in thickness. Calices circular, without regular arrangement, not projecting, but on a level with the general surface; no definite lip developed. The calices from ·8 to 1 millim. in diameter, from ·3 to 1 millim. apart, usually four in 5 millim., rarely five in this distance. The septa delicate, six small as well as the six large can be recognized, the free edges markedly dentate. Columella styliform, prominent, reaching nearly to the level of the calice. Interspaces between the calices thickly beset with minute blunt spines. In places fine lines can be seen in the interspaces, marking polygonal outlines of the corallite. Occasionally there is a small papilla-like prominence on one side of a calice apparently connected with one of the large septa; but this character does not appear to be general.

This species is characterized by its incrusting mode of growth, the small size and insert character of the calices, and the strongly dentate septa. Two specimens were obtained, one (alive) from a depth of 32 fath., the other (dead) from a depth of 22 fathoms.

Macclesfield Bank, China Seas, 22 and 32 fathoms.

Genus SERIATOPORA, Lam.

Seriatopora gracilis, Dana.

1848. *Seriatopora caliendrum*, var. *gracilis*, Dana, U. S. Explor. Expedition, Zoophytes, p. 522, pl. xlix. fig. 4.
1875. *Seriatopora gracilis*, Dana, Corals and Coral Islands, p. 334.

There are three fragmentary specimens which do not fully agree with Dana's description; but the differences do not appear sufficient to justify placing them in a new species. They form bushy masses of very slender branches from 2·5 to 3 millim. in thickness in the lower part, the terminal branchlets acutely pointed, slightly winged at their apices, from 2 to 5 millim. long and about 1 millim. thick at the base. Branches round to subangular, divergently bifurcating in lower portions of the colony and giving off antler-like spikes. Calices in five series, circular to oval, from ·4 to ·5 millim. in width, sometimes without prominent lips, at others the upper lip projecting; distance from each other in rows variable, from ·3 to ·6 millim.; there are from five to six calices in a length of 5 millim. Septa not recognizable, columella visible but not prominent. Spaces between the rows abundantly covered with acute spines.

From Dana's figured type these specimens differ in the less upright and more divergent mode of growth and the slightly winged apices of the branchlets. They differ materially from the form referred by Quelch to this species ('Challenger' Report, vol. xvi. p. 58), which has calices of about twice the size mentioned by Dana.

Macclesfield Bank, 20½ fath.

Seriatopora imbricata, sp. n.

Corallum forming fairly large bushy masses; branches dichotomizing at intervals, occasionally a distance of 15 millim. between the furcations, branches sometimes coalescing. The summit-branches furcating and giving off short, pointed, divergent apical spikes, not winged, about 2 millim. thick at their bases. Branches in lower portion about 4 millim. in thickness, distinctly subangular, the calices in five series on the angles. Calices transversely suboval, with their upper lips very prominent and strongly arching over the aperture, very spinous; in the lower branches the upper lip hardly at all developed. The calices about ·6 millim. in diameter, very closely arranged in the rows, so that there are seven in the space of 5 millim. The interspaces between the calices flattened, sometimes 1 millim. in width, closely covered with

short stout spines, which are in places disposed in longitudinal wavy lines.

There is only a single specimen of this species; it is 120 millim. in height and 140 in width, but the lower portion of it was dead when dredged and the branches are hollowed out by boring-sponges and incrusted by Nullipores.

In its mode of growth and in the prominent lip of the calices this form belongs to the same group as *S. angulata*, Kl., *S. pacifica*, Brugg., and *S. spinosa*, M.-Edw. It approaches nearest to *S. angulata*, but the calices are much smaller and closer arranged in the rows than in this species, and the branches are less acuminate.

There are in this specimen several instances of those peculiar abnormalities of growth which Ehrenberg compared to galls in plants. They assume the form of flattened hollow disks, with thin walls formed of the coral; the margins of the disks are perforated. Imprisoned within each of these discoid cages is a small crab which cannot escape.

From the Tizard Bank, at a depth of $\frac{1}{2}$ fath.

Seriatopora compacta, sp. n.

Corallum growing in small clumps consisting of rounded or somewhat compressed branches about 6 millim. thick, which dichotomize at intervals of from 5 to 7 millim. and frequently coalesce, so that the coral has a fenestrate appearance. The summit branchlets are short, from 3 to 5 millim., conical, about 2 millim. thick at their bases, summits obtuse, occasionally winged, crowded with young calices. Calices closely arranged on branches; the serial arrangement is not distinct, but there appear to be about nine rows on a branch; the calices are from 2 to 3 millim. apart in the rows and about an equal distance laterally; there are from five to six calices in a length of 5 millim. The calices are nearly circular, from ·6 to ·75 millim. in width, their margins scarcely at all prominent, but the upper lip is occasionally indicated by longer spines. The calices are deep and the large septa and the pits at the bottom can be distinguished. The narrow interspaces between the calices are covered with short spines.

This species is of the type of *S. crassa*, Quelch, and *S. transversa*, Quelch, but differs from these forms in having less robust and closer arranged branches, whilst the calices are larger and closer together.

Only two imperfect examples of this species have been obtained; the largest is 40 millim. in height by 60 in width.

Tizard Bank, $5\frac{3}{4}$ fath.

Seriatopora tenuis, sp. n.

Corallum forming small bushy masses of closely arranged branches, which in the lower portions are subpalmate, but above cylindrical; they are from 4 to 5 millim. in thickness, bifurcating at intervals of from 5 to 7 millim.; the apical branchlets depressed, conical, winged, so as to show the rows of calices very distinctly; they are 4 to 5 millim. in length by 2·5 millim. thick at their bases. Calices nearly circular, ·6 millim. in diameter, without projecting lip, from ·2 to ·4 millim. apart in rows, or five calices in 5 millim. There are seven or eight rows on the branches, the rows about ·4 millim. apart. Calices deep, showing a sharp thin edge of the axial septa, with occasionally a columellar tubercle slightly rising from the centre, the calicinal pits well shown. Intermediate space finely spinous.

This species approaches closely to *S. compacta*, but the branches are more slender; the calices are smaller, and they are in fewer rows. There is a single fairly complete specimen 40 millim. in height by 75 millim. in width.

Tizard Bank, 6 fath.

Seriatopora armata, sp. n.

Corallum growing in low depressed clumps of delicate thickly-set branches, from 3 to 4 millim. in thickness, somewhat compressed in their lower portions, bifurcating at intervals of about 5 millim., and frequently coalescing. Near the summit the branches furcate more frequently and give off numerous short spike-like branchlets, conical, acute, winged, and from 3 to 5 millim. long by 1·5 millim. thick at their bases. Calices in five rows on the branches, oval, about ·75 millim. long by ·6 wide, about 3 millim. apart in the rows; margins well marked by stout spines but not exsert. There are five calices in 5 millim. and the rows are about ·6 millim. apart. Calices showing the axial septa distinctly, in the centre a slight crestiform elevation (columella?). Areas between the calices with short spines which have sometimes a linear arrangement.

There is only a single perfect example of this species, which is 35 millim. in height and about 90 wide across the summit. In its mode of growth and in the character of the calices this form approaches *S. compacta* and *S. tenuis*; but its branches are more delicate, the rows of calices are fewer, and the surface more spinous; the numerous short apical branchlets is also a distinguishing feature.

Tizard Bank, 7 fath. On block of coral-rock in association with specimens of *Madrepora*, *Favia*, &c.

Genus Pocillopora, Lam.

The examples of this species are fairly numerous; with one exception, which was found in 26 fathoms, they have all been obtained in depths under 10 fathoms. The specific determination of these forms is extremely difficult; the definitions given by Lamarck, Edwards and Haime, and other older authors are so general that it is impossible to know what they include; and, on the other hand, the variations in the characters of the corallites appear to be so slight in the different forms that they may almost be considered as forming a continuous series separated only by slight modifications in their mode of growth. In the absence of authenticated specimens of known species the list given below can only be regarded as provisional.

Pocillopora elongata, Dana.

1848. *Pocillopora elongata*, Dana, Zoophytes, p. 531, pl. 50. fig. 4.

Three specimens from depths of 2–6¾ fath.
Tizard Bank.

Pocillopora verrucosa, Ell. & Sol., sp.

1786. *Madrepora verrucosa*, Ell. & Sol. Nat. Hist. Zooph. p. 172.
1836. *Pocillopora verrucosa*, Lam. Hist. des Anim. sans Vertèbr. éd. 2, t. ii. p. 443.

There are several examples of this species, which appears to have flourished all over the reef. Depth 1–10 fathoms.
Tizard and Macclesfield Banks.

Pocillopora brevicornis, Lam.

1836. *Pocillopora brevicornis*, Lam. Hist. des Anim. sans Vertèbr. éd. 2, t. ii. p. 443.
1848. *Pocillopora brevicornis*, Dana, Zooph. p. 526, pl. xlix. fig. 8.

Several examples from depths ⅔–1 fath.; one specimen 6½ fath.
Tizard Bank.

Pocillopora, sp.

A single specimen, which in its mode of growth resembles *P. brevicornis*; but the branches are considerably thicker and the corallites somewhat larger.
Garvan Reef, Tizard Bank, 2 fath.

Genus Flabellum, Lesson.

Flabellum Stokesi, Ed. & Haime.

1848. *Flabellum Stokesi*, E. & H. Ann. des Sc. Nat. 3e sér. t. ix. p. 278, pl. viii. fig. 12.

One dead specimen, probably referable to this species.
Tizard Bank, 40 fath.

Genus Desmophyllum, Ehrenberg.

Desmophyllum, sp.

A single small example of this genus taken alive; it may be a young form of an undescribed species. The coral is attached by a short curved stem and a spreading base. The calice is elliptical in outline, 18 millim. long by 10 millim. wide, and about 19 millim. in height. There are about forty septa; ten of these are subequal and principal, reaching to the centre of the calice, where their inner, free, lateral margins slightly curve round; the septa are thin and furnished laterally with minute spines. Between each pair of the larger septa there are three smaller secondary septa which project but a short distance from the wall. The costæ of the larger septa project slightly as sharp-edged ribs on the exterior.
Macclesfield Bank, 32 fath.

Genus Cyathohelia, Ed. & H.

Cyathohelia axillaris, Ell. & Sol.

1786. *Madrepora axillaris*, Ell. & Sol. Nat. Hist. Zooph. p. 153, pl. xiii. fig. 5.

A single specimen, living, was obtained from the Tizard Bank, depth 50 fath.

Genus Lithophyllia, Ed. & H.

Lithophyllia lacrymalis, Ed. & H.

1848. *Caryophyllia lacrymalis*, E. & H. Ann. des Sci. Nat. 3e sér. t. x. p. 319, pl. viii. fig. 1.
1857. *Lithophyllia lacrymalis*, E. & H. Hist. Nat. des Corall. vol. ii. p. 292.

A single specimen, dead, attached to a nodule of *Lithothamnion*.
Macclesfield Bank, depth 44 fath.

Lithophyllia, sp.

A living specimen, but much broken. It has a wide surface of attachment; the coral is short, subcircular, and widely expanded; septa in four cycles, upper margins dentate or lobate and finely crenulate, costæ echinulate.

Tizard Bank, depth 26 fath.

Genus Tridacophyllia, Blainville.

Tridacophyllia cervicornis, Moseley.

1881. *Tridacophyllia cervicornis*, Moseley, Chall. Report, Zool. vol. ii. p. 183, pl. x. figs. 2, *a*, *b*, *c*, B*a*.

A single specimen, living, 11 millim. in height by 9 in width, growing attached by a spreading base and short peduncle.

From the Tizard Bank, depth 50 fathoms.

This is the first time that a locality and depth have been recorded for this species, these not being known for the type form described by Moseley.

Genus Galaxea, Oken.

Galaxea æqualis, sp. n.

Corallum forming extended masses with flattened or slightly convex surfaces. Calices very regular in height and distance from each other, circular, subcircular, or slightly compressed, so as to become subpolygonal, from 3·5 to 5 millim. in diameter at the summit. From twenty to twenty-four septa in three cycles, the septa varying in size according to the cycle, thick at the peripheral margin, becoming thin towards the free internal margins, strongly exsert. Low down the septal margins unite and form a perforate pseudocolumella. Lateral surfaces of the septa with numerous minute spines. The costæ formed by the peripheral margins of the septa, which can be distinguished individually. The calices are only from 1·5 to 2 millim. apart, and they project about 10 millim. above the platform of the cœnenchyma. The vesicles of the cœnenchyma small, from ·5 to ·75 millim. apart; at intervals compact platforms appear to be formed which grow over the former surfaces.

This species is allied to *G. Esperi*, Schweig., and *G. Ellisii*, E. & H., but is distinguished by the close arrangement of the corallites and their short extension above the cœnenchyma.

Only a single specimen was obtained, which is about 50 millim. in width at the summit and ·45 millim. in thickness; but the mass below the summit-platform of cœnenchyma is apparently dead and extensively eaten into by sponges.

East lagoon, Tizard Bank, 6 fath.

Genus Symphyllia, Edw. & Haime.

Symphyllia radians, E. & H.

1849. *Symphyllia radians*, E. & H. Ann. des Sci. Nat. 3e sér. t. xi. p. 255.

A single specimen from the Garvan Reef, Tizard Bank, depth 2 fath.

Symphyllia labyrinthica, sp. n.

Corallum large, massive, rudely inverted, conical, with plane or slightly convex surface. Lateral and under surface with longitudinal striæ, apparently not spinous, this surface usually covered by attached organisms quite close to the upper margin. Upper surface of sinuous labyrinthine calicinal series, the walls completely amalgamated, with no traces of grooves between. Width of calices 13 to 15 millim., depth 8 millim. There are usually two septa connecting the calicinal centres, sometimes traces of a third, sometimes only one is present. There are about fourteen large and small septa in the distance of 10 millim., the large septa with prominent spinous teeth, the smaller serrate or unequally jagged.

There is but a single specimen, which is 7·5 centim. in height and 25 centim. across the surface.

This species is nearest allied to *S. agaricia*, E. & H., and to *S. acuta*, Quelch, but from these it is readily distinguished by the narrowness and less depth of the calicinal valleys. It has been compared with *S. neglecta*, a MS. species in the British Museum, but its mode of growth and other features readily distinguish it from the type of this form.

Tizard Bank, 5 fath.

Genus Mussa, Oken.

Mussa multilobata, Dana (non Ed. & H.).

1848. *Mussa multilobata*, Dana, Zoophytes, p. 181, pl. viii. fig. 2.

A single specimen, 70 millim. in height and 170 millim. across the summit.

Tizard Bank (section C), 5 fath.

Mussa sinuosa, Lamarck.

1816. *Caryophyllia sinuosa*, Lam. Anim. sans Vert. éd. 1, t. ii. p. 229, éd. 2, t. ii. p. 357.

A single specimen, probably a young form ; it is 20 millim. in height by 60 in width above.

Tizard Bank, 6 fath.

Genus Meandrina, Lamarck.

Meandrina strigosa?, Dana.

1848. *Meandrina strigosa*, Dana, Zoophytes, p. 257, pl. xiv. fig. 4.

A single specimen, cylindrical, truncate, gyri about 6 millim. in width and 3·5 millim. deep, about fifteen septa in 10 millim. Referred doubtfully to this species, which, according to Quelch, can be seen to vary considerably in its characters when a large series of forms is examined.

East of Nam-Yit, Tizard Bank, 2 fathoms.

Meandrina dædalea, Ell. & Sol., sp.

1786. *Madrepora dædalea*, Ell. & Sol. Nat. Hist. Zoophytes, p. 163, pl. xlvi. fig. 1.

Two specimens. Sand-Kay, Nam-Yit, Tizard Bank, 2–4 fathoms.

Genus Leptoria, Ed. & H.

Leptoria phrygia, Ell. & Sol., sp.

1786. *Madrepora phrygia*, Ell. & Sol. Nat. Hist. Zoophytes, p. 162, pl. xlviii. fig. 2.

One specimen from the Tizard Reef, depth 6 fath.

Genus Scapophyllia, Ed. & H.

Scapophyllia cylindrica, Ed. & H.

1849. *Scapophyllia cylindrica*, Edw. & Haime, Ann. des Sci. Nat. 3e sér. t. x. pl. viii. fig. 8, and t. xi. p. 278.

One specimen from lagoon, Tizard Bank, depth 6 fath.

The specimen is depressed, spreading, with irregular lobate slight elevations. The calicinal valleys are much curved, 4 millim. in width and about 2·5 millim. in depth; septa thin, with frilled edges. The so-called columella consists of irregular tooth-like projections from the free edges of the septa.

The description of this species states that it is cylindro-conical in form; but in what appears to be a genuine specimen of it in the British Museum there is a spreading basal platform, with here and there elevations, some of which are subcylindrical and rise to a considerable height. In the present specimen the subcylindrical portions are not developed.

Genus Hydnophora, Fischer de Waldheim.

Hydnophora microcona, Lam., sp.

1816. *Monticularia microconos*, Lam. Hist. des Anim. sans Vert. t. ii. p. 251, 2nd ed. (1836) p. 393.
1786. *Madrepora exesa*, Ell. & Sol. (non Pallas), Zoophytes, p. 161, pl. xlix. fig. 3.

A single specimen of this species from the east lagoon, Tizard Bank, China Seas, at a depth of 6 fath.

Hydnophora rigida, Dana, sp.

1846. *Merulina rigida*, Dana, Expl. Exp. Zoophytes, p. 276, pl. xvii. fig. 1.

A single specimen from the east lagoon, Tizard Bank, at a depth of 6 fath.

Genus Favia, Oken.

Favia denticulata?, Ell. & Sol., sp.

1786. *Madrepora denticulata*, Ell. & Sol. Nat. Hist. Zoophytes, p. 166, pl. xlix. fig. 1.

A small specimen incrusting the base of a Madrepore. Tizard Bank, 7 fath.

Favia Okeni, Ed. & H.

1857. *Favia Okeni*, Ed. & H. Hist. Nat. des Corall. t. ii. p. 430.

A small specimen on the same block of rock with the preceding species.
Tizard Bank, 7 fath.

Favia Ehrenbergi, Klunz., var. *sulcata*, Klunz.

1879. *Favia Ehrenbergi*, Klunz. Die Korallth. des rothen Meeres, Th. iii. p. 29, Taf. iii. fig. 8 (var. *sulcata*).

Tizard Bank, 5 fath.

Favia pandanus, Dana, sp.

1848. *Astræa pandanus*, Dana, Expl. Exp. Zooph. p. 222, pl. xi. fig. 2.

Tizard Bank, 2 fath.

Favia rotulosa, Ell. & Sol., sp.

1786. *Madrepora rotulosa*, Ell. & Sol. Nat. Hist. Zooph. p. 166, pl. lv.

Garvan Reef, Tizard Bank, 2 fath.

Favia, sp.

A portion of a specimen 80 by 50 millim. was dredged up in a bag full of foraminiferous sand from the centre of the lagoon, Tizard Bank, at a depth of 45 fathoms. There were sixteen bright green living polyps on it, each with twelve yellow tentacles. Calices circular or irregularly oval, about 8 millim. wide, furrow between them well marked, septa with prominent denticles.

Tizard Bank, 45 fath.

Genus Goniastræa, Ed. & H.

Goniastræa Bournoni, E. & H.

1850. *Goniastræa Bournoni*, E. & H. Ann. des Sci. Nat. 3e sér. t. xii. p. 162.

A single specimen, taken alive, from Itu-Aba, depth 2 fath. Tizard Reef.

Genus Prionastræa, Ed. & H.

Prionastræa obtusata, Ed. & H.

1850. *Prionastræa obtusata*, E. & H. Ann. des Sci. Nat. 3e sér. t. xii. p. 130.

One specimen only, taken alive.
Garvan Reef, Tizard Bank, 2 fath.

Prionastræa spinosa, Klunzinger.

1879. *Prionastræa spinosa*, Klunz. Die Korallenth. des roth. Meeres, Th. iii. p. 39, Taf. iv. fig. 7.

One specimen only. Nam-Yit, Tizard Bank, $\frac{1}{2}$ fath.

Prionastræa robusta, Dana, sp.

1848. *Astræa robusta*, Dana, Expl. Exp. Zooph. p. 248, pl. xiii. fig. 10.

Tizard Reef, 2 fath.

Genus Plesiastræa, Ed. & H.

Plesiastræa Urvillei, Ed. & H.

1850. *Plesiastræa Urvillei*, Ed. & H. Ann. des Sci. Nat. 3e sér. t. x. pl. ix. fig. 2, and t. xii. p. 117.

Tizard Bank, 6 fath.

Genus Cyphastræa, Ed. & H.

Cyphastræa Brueggemanni, Quelch.

Cyphastræa Brueggemanni, Quelch, Chall. Report, Reef-Corals, p. 106.

Tizard Bank, 5 fath.

Genus Leptastræa, Ed. & H.

Leptastræa Ehrenbergana?, Ed. & H.

1850. *Leptastræa Ehrenbergana*, E. & H. Ann. des Sci. Nat. 3e sér. t. xii. p. 120.

A small incrusting lobed specimen, which approaches close to the above species; but it does not exhibit the deformed corallites, which are stated to be usually present. From *L. transversa*, Kl., it differs in the character of the columella.

Tizard Bank, 7 fath.

Leptastræa solida, Ed. & H., sp.

1850. *Baryastræa solida*, Ed. & H. Ann. des. Sci. Nat. 3e sér. t. xii. p. 144.

Tizard Bank, 6 fath.

Genus Orbicella, Dana.

Orbicella annuligera, Ed. & H., sp.

1880. *Astræa annuligera*, E. & H. Ann. des Sci. Nat. 3e sér. t. xii. p. 103.

Tizard Bank, 5–10 fath.

Orbicella, sp.

A small incrusting specimen on mass of coral with Madrepore and other species of corals.

Tizard Bank, 7 fath.

Genus ECHINOPORA, Lam.

Echinopora rosularia, Lam.

1816. *Echinopora rosularia*, Lam. Hist. des Anim. sans Vertèbr. éd. 2, t. ii. p. 397.

Lagoon, Tizard Bank, 6 fath.

[To be continued.]

XLIV.—*Descriptions of new Species of* Pedaria, *with Observations on allied* Scarabæidæ. By CHARLES O. WATERHOUSE.

Pedaria tuberculigera, sp. n.

Elongato-oblonga, nigro-fusca, parum nitida, clypeo leviter emarginato; thorace confertim sat fortiter punctato, antice tumiditate ovali sat elevata parcius subtiliter punctulata nitida instructo; elytris thorace paullo latioribus, convexis, ad apicem arcuatim angustatis, sat fortiter punctato-striatis, interstitiis creberrime fortiter punctatis.

Long. 9 millim.

Hab. Senegambia (*Bocandé*).

Dark smoky brown, with a slight purple-bronze shade. The head is evenly and closely punctured, the punctures small but very distinct, usually separated from each other by a diameter of a puncture; the clypeus has a very few punctures; the anterior margin is distinctly but not very deeply emarginate, the angles of the emargination rounded; and between this emargination and the posterior angle of the head there is a distinct angulation. The thorax is transverse, parallel-sided, with a slight sinuosity before the anterior angles, convex, closely punctured; the punctures at the sides are moderately large, separated from each other by about one quarter the diameter of a puncture; but towards the disk the punctures become a little smaller and the intervals proportionately greater; halfway towards the side about twenty-