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SCLERACTINIA OF EASTERN AUSTRALIA

PART IV

Family Poritidae

by

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and

Michel Pichon

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Contents

I
Introduction

Family Poritidae is made up of three major extant genera, *Porites*, *Goniopora* and *Alveopora*, and one monospecific genus, *Stylaraea*. The last is rare, east Australian specimens having been collected only from Low Isles in 1928–32 and described by Crossland (1952). The three major genera all occur throughout the Great Barrier Reef and all are distributed south as far as Lord Howe Island. Within the Great Barrier Reef, *Porites* is second only to *Acropora* in abundance and only *Acropora* and *Montipora* have a greater number of species (Veron & Wallace, in prep.). *Goniopora* and *Porites* have the same number of east Australian species, as recognised in the present study, but *Goniopora* is much less abundant except on some types of fringing reefs. *Alveopora* has fewer species and all are uncommon or rare in most reef areas.

All three major genera are very distinct morphologically as well as ecologically. Most *Porites* species have similar (massive) growth forms and all have very small corallites. They may therefore be difficult to recognise *in situ* but are usually readily identified in the laboratory. Most *Goniopora* and *Alveopora* species have distinctive growth forms and relatively large polyps which remain extended during the day. This allows many to be identified *in situ* and all to be separated into probable species units *in situ*. In this study, therefore, different methods have been adopted in the study of these genera: *Porites* has been primarily studied in the laboratory from large collections while *Goniopora* and *Alveopora* have, at least initially, been separated into species *in situ*.

The three major genera have also had very different taxonomic histories which has necessitated different approaches in this study. *Porites* species were confused with those of other genera by early taxonomists, presumably because of their small corallites. They are also disproportionately well represented in most coral collections because of their abundance on reefs and because they make small robust specimens which are easily transported. These factors have all contributed to a proliferation of species descriptions of *Porites* which have seldom involved appropriate field study or analysis of earlier species descriptions (see p. 10). This now makes the determination of synonymies a difficult process and one which cannot be comprehensively undertaken in a regional study such as the present one, but which must await a total revision based on several regional studies. This situation does not apply to *Goniopora* and *Alveopora*, both of which have relatively few nominal species. All appropriate type material was therefore re-examined in this study and synonymies are relatively complete.

The field methods used in this study were similar to those used for other taxa and are described in Part I of the present series. Some of the material used was collected from the principal collecting stations listed in Parts I–III, many of which were revisited. Additional collections were made from the collecting stations listed below. This involved many studies on reefs in the vicinity of Townsville as well as three expeditions, one to the northern and one to the southern ends of the Great Barrier Reef (Torres Strait and the Capricorn/Bunker groups of reefs respectively) and one to the reefs of the Coral Sea. Scanning electron microscopy has been used instead of light microscopy for illustrations of small corallites or fine skeletal detail.

Study of type specimens and other collections of both Poritidae and Acroporidae was carried out by the senior author, primarily in the British Museum (Natural History), the Paris Museum, Yale University, Harvard University, the Smithsonian Institution and the

University of the Philippines. Type specimens were also borrowed from other museums and universities, and thus all specimens which appeared relevant to the present species descriptions and synonymies were re-examined.

II
Principal Collecting Stations

OUTER REEFS INCLUDING BARRIER REEFS

Biotopes of reef fronts

1–4. (Great Detached, Tijou, Yonge and Bowl Reefs) see Part I.

61. (Jewell Reef) see Part II.

106, 107. (Ashmore Reef) see Part III.

148. Cat Reef; partly exposed outer slope, sloping gently, substrate of cemented rock, one collection, 10–20m.

149. Franklin Reef; outer slope exposed to strong wave action, steeply sloping, consolidated reef substrate; one collection, 5–15m.

Biotopes of reef flats and very shallow lagoons

5, 6. (Great Detached and Tijou Reefs) see Part I.

62, 63. (Waining and Ribbon Reefs) see Part II.

108. (submerged northern barrier reefs) see Part III.

150. Franklin Reef; near reef front, exposed to strong wave action, substrate of cemented rock; one collection, 1–2m.

Biotopes of reef backs

7–10. (barrier reefs NE from Murray Islands; Tijou, Yonge and Bowl Reefs) see Part I.

64–66. (a plug reef S of Ribbon Reef; Ribbon and Jewell Reefs) see Part II.

109, 110 (barrier reefs NE and E from Murray Islands) see Part III.

151. Raine Island, NW side; sloping steeply, substrate of unconsolidated rubble and coral; 2 collections, 10–20m.

152. Raine Island, SW side; sloping steeply, substrate of consolidated rock and coral; 4 collections, 1–25m.

153. Great Detached Reef, S end; dissected back reef margin, substrate of rock and rubble irregularly intermixed with sand at 12m; one collection, 4–12m.

154. Martha Ridgway Reef; dissected back reef margin, substrate of rock and rubble irregularly intermixed with sand at 15m; one collection, 5–15m.

155. Tijou Reef; protected reef back, substrate of unconsolidated rubble, below collecting station 8; one collection, 10–15m.

156. Tijou Reef, S end; dissected back reef margin, substrate of unconsolidated rubble, one collection, 10–18m.

Biotopes of reef channels

The three types of barrier reefs of the Northern Region (Veron & Hudson, 1978; Veron, 1978) each have different types of channels cutting across them, or separating individual reefs. Most of those channels have very strong tidal currents of clear water. They usually have steeply sloping sides with abundant coral, mostly *Acropora*. Similar channels also occur in the Pompey complex.

49–52. (barrier reefs NE from Murray Islands, Tijou and Yankee Reefs) see Part I.

103-105. (Pompey Complex) see Part II.

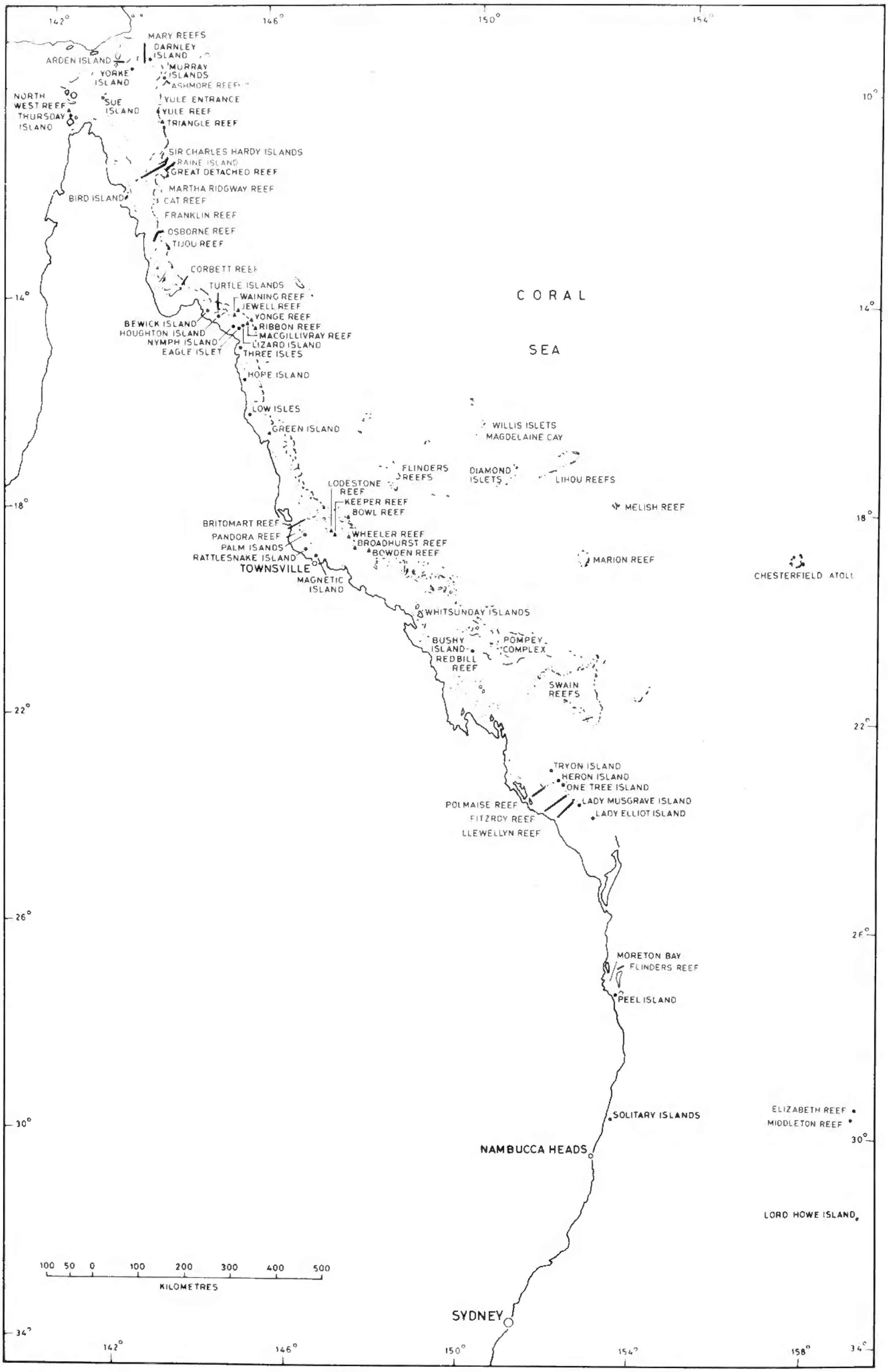

MARY REEFS
DARNLEY ISLAND
ARDEN ISLAND
MURRAY ISLANDS
YORKE ISLAND
ASHMORE REEF
NORTH WEST REEF
THURSDAY ISLAND
SUE ISLAND
YULE ENTRANCE
YULE REEF
TRIANGLE REEF
SIR CHARLES HARDY ISLANDS
RAINE ISLAND
GREAT DETACHED REEF
MARTHA RIDGWAY REEF
BIRD ISLAND
CAT REEF
FRANKLIN REEF
OSBORNE REEF
TIJOU REEF
CORBETT REEF
TURTLE ISLANDS
WAINING REEF
JEWELL REEF
YONGE REEF
BEWICK ISLAND
HOUGHTON ISLAND
NYMPH ISLAND
EAGLE ISLET
RIBBON REEF
MACGILLIVRAY REEF
LIZARD ISLAND
THREE ISLES
HOPE ISLAND
LOW ISLES
GREEN ISLAND
CORAL
SEA
WILLIS ISLETS
MAGDELAINE CAY
FLINDERS REEFS
DIAMOND ISLETS
LIHOU REEFS
LODESTONE REEF
KEEPER REEF
BOWL REEF
MELISH REEF
BRITOMART REEF
PANDORA REEF
PALM ISANDS
RATTLESNAKE ISLAND
TOWNSVILLE
WHEELER REEF
BROADHURST REEF
BOWDEN REEF
MAGNETIC ISLAND
MARION REEF
CHESTERFIELD ATOLL
WHITSUNDAY ISLANDS
BUSHY ISLAND
REDBILL REEF
POMPEY COMPLEX
SWAIN REEFS
TRYON ISLAND
HERON ISLAND
ONE TREE ISLAND
POLMAISE REEF
FITZROY REEF
LLEWELLYN REEF
LADY MUSGRAVE ISLAND
LADY ELLIOT ISLAND
MORETON BAY
FLINDERS REEF
PEEL ISLAND
SOLITARY ISLANDS
ELIZABETH REEF
MIDDLETON REEF
NAMBUCCA HEADS
LORD HOWE ISLAND
100 50 0 100 200 300 400 500
KILOMETRES
SYDNEY
142°
146°
150°
154°
158°
10°
14°
18°
22°
26°
30°
34°

Fig. 1

157. Triangle Reef, N side; steeply sloping substrate of consolidated rock, strong tidal currents; one collection, 8–15m.

158. near Triangle Reef, S side of a channel; steeply sloping substrate of consolidated rock, strong tidal currents, abundant *Acropora* to 10m; one collection, 1–10m.

159. Martha Ridgway Reef, W side of reef channel; steeply sloping substrate of partly consolidated rubble; one collection, 10–25m.

160. Tijou Reef, SW corner; steeply sloping substrate of partly consolidated rubble; one collection, 3–10m.

INNER REEFS AND ASSOCIATED CAYS AND LAGOONS
(except Torres Strait, Capricorn and Bunker Groups)

Biotopes of semi-enclosed lagoons

11, 12. (Lizard Island and Low Isles) see Part I.

67–73. (Swain Reefs, Pompey Complex, Bushy Island-Redbill Reef) see Part II.

111. (Pandora Reef) see Part III.

179. (Sue Island) see below.

Biotopes of reef outer slopes

15, 16, 18–22. (Howick and Houghton Island; Bewick, Eagle, Keeper and Wheeler Reefs) see Part I.

74-81. (MacGillivray Reef; reef 8 km W of Pompey Reef; Swain Reefs; Bushy Island-Redbill Reef, N end; Frigate Cay) see Part II.

112–114. (Redbill Island; Gould Reef) see Part III.

161. Bird Island, NW corner; protected, turbid water, substrate of unconsolidated rubble sloping onto sand; one collection, 5–8m.

162. Osborne Reef, E side; protected, substrate of coral rubble intermixed with sand, turbid water, very high diversity; 2 collections, 3–10m.

163. 8 km E of Wye Reef, SE side; substrate of unconsolidated coral rubble, clear water; one collection, 8–12m.

164. Corbett Reef, W end; substrate of unconsolidated coral rubble and sand; one collection, 3–6m.

165. Turtle Islands, W point of a southern island; substrate of sand and rubble; one collection, 2–7m.

166. Low Isles, W side; substrate of rock and rubble sloping onto sand; one collection, 3–6m.

167. Britomart Reef, S side; two concentric reef fronts of consolidated rock and rubble separated by a moat of sand and rubble; 12 collections, 0.25m.

168. Britomart Reef, NW side; protected, dissected back reef margin, irregularly intermixed rubble, sand and rock; 6 collections, 1–20m.

169. Bushy Island-Redbill Reef, NW side; outer slope of dissected back reef margin, two collections, 1–10m.

170. Bushy Island-Redbill Reef, N side; outer slope of consolidated rock and rubble sloping onto sand, one collection, 2–4m.

171. Pandora Reef, S side; outer slope of unconsolidated rubble sloping gently onto sand; two collections, 6–11m.

172. Pandora Reef, E end; outer slope of unconsolidated rubble sloping gently onto sand; two collections, 4–12m.

Fig. 1 Eastern Australian place names cited in the text.

HIGH ISLANDS

Biotopes of flat ocean floors

23-25. (Murray, Lizard and Palm Islands) see Part I.

173. Brisk and Falcon Islands, E side; flat ocean floor of sand and rubble; three collections, 2–10m.

174. Between Orpheus and Pelorus Islands; flat ocean floor of sand and rubble; one collection, 13–15m.

Biotopes of the front of fringing reefs

26–41. (Murray, Darnley, Lizard, Fantome and Great Palm Islands) see Part I.

82–83. (Lizard and Palm Islands) see Part II.

135. (Murray Islands) see Part III.

175. Howick Island, N end; substrate of rubble; one collection, 2–5m.

176. Great Palm Island, S side; fringing reef exposed to moderate wave action, substrate of rubble; one collection, 2–8m.

177. Curacao Island, Palm Islands, N. side; fringing reef of consolidated rubble sloping steeply to sand; three collections, 4–20m.

178. Orpheus Island, Palm Islands, NE side; fringing reef of consolidated and unconsolidated rubble sloping to sand; two collections, 3–8m.

Biotopes of intertidal and sub-intertidal mud flats

39, 40. (Bewick and Houghton Islands) see Part I.

84–86. (Magnetic Island and Bushy Island-Redbill Reef) see Part II.

Biotopes of the zone of coral growth on the protected side of high islands

41–43. (Palm Islands) see Part I.

87–98. (Lizard, Palm and Whitsunday Islands) see Part II.

136–141. (Wai-Weer, Thursday, Turtle Backed, Murray and Whitsunday Islands) see Part III.

179. Sir Charles Hardy Islands, NW side; protected bay, substrate of coral and rubble sloping to sand; three collections, 2–5m.

180. Brisk Island, Palm Islands, S end; substrate of coral and rubble sloping to sand; one collection, 2–8m.

Lagoons of high islands

99, 100. (Lizard Island) see Part II.

see also *73. (Bushy Island-Redbill Reef) see Part II.*

Biotopes of muddy ocean floors and other non-reefal biotopes

44–46. (Lizard and Palm Islands) see Part I.

47, 48. (upper continental slope) see Part I.

53, 54. (sea grass beds, Thursday Island) see Part I.

55, 56. (exposed non-reefal rock, Palm Islands) see Part I.

57–60. (partly protected sand and rubble banks, Great Palm Island) see Part I.

Lord Howe Island

142–147. see Part III.

REEFS OF TORRES STRAIT (see Part III, p.2)

Biotopes of high islands (see above)

23, 26–30, 53–56. (Thursday, Murray and Darnley Islands) see Part I.

135–139. (Wai-Weer, Thursday and Murray Islands) see Part III.

181. Reefs between Maer and Dewar Islands, Murray Islands; substrate of mostly unconsolidated rubble sloping onto sand; 10–20m.

Biotopes of platform reefs and cays and barrier reefs

13, 14, 17. (Yorke, North-west and Sue Islands) see Part I.

119-134. (Jervis, Warrior, Dungeness, Big Mary and Newman Reefs; Pearce and Bramble Cays; Yorke, Murray, Campbell and Aureed Islands and Black Rocks) see Part III.

182. Sue Island, NW corner; intertidal reef flat ponded to $\frac{1}{2}$m; one collection.

183. Arden Island, NW corner; narrow shelf adjacent to deep water; one collection, 1–15m.

184. Yorke Island, SW corner; substrate of unconsolidated coral rubble sloping gradually to sand; one collection, 1–5m.

185. Little Mary Reef; reef patches adjacent to a channel, strong currents; three collections, 0–12m.

186. Little Mary Reef; partly enclosed lagoon substrate of consolidated rock sloping to sand; one collection, 0–4m.

187. Big Mary Reef, W side; reef slopes steeply near a channel, strong currents; two collections, 2–15m.

REEFS OF THE CAPRICORN AND BUNKER GROUPS

These are two adjacent groups of reefs at the southern end of the Great Barrier Reef. They are mostly platform reefs with entire, well defined margins, separated by deep water. Most reefs have a lagoon and many have a cay.

Biotopes of reef slopes

115–118. (Heron Island and Wistari Reef) see Part III.

188. Heron Island, SE side; substrate of consolidated rock sloping gradually to sand; one collection, 10–14m.

189. Fitzroy Reef, N side; irregular substrate of consolidated rock sloping to sand; two collections, 2–12m.

190. Fitzroy Reef, SE side; substrate of consolidated rock sloping to sand; two collections, 3-12m.

191. Fitzroy Reef, S side; substrate of consolidated rock and rubble sloping to sand, 4–10m.

192. Llewellyn Reef, SE side; substrate of consolidated rock sloping gradually to sand; one collection, 4–12m.

193. Musgrave Reef, N side; substrate of partly consolidated rock sloping to sand; one collection, 10–15m.

194. Musgrave Reef, NE side; substrate of partly consolidated rock sloping to sand; one collection, 4–12m.

195. Musgrave Reef, NW side; substrate of partly consolidated rock and rubble; one collection, 8–12m.

Biotopes of reef lagoons

196. Llewellyn Reef lagoon; substrate of coral and rubble on a sandy lagoon floor; three collections, 2–8m.

197. Fitzroy Reef lagoon; substrate of coral and rubble on a sandy lagoon floor; one collection, 2–4m.

Biotopes of sea grass beds

198. Palmaise Reef, W side; substrate of flat rubble and sand covered with sea grass and algae; one collection, 3m.

REEFS, ISLANDS AND ATOLLS OF THE CORAL SEA

The Coral Sea can be divided into upper and lower halves, the northern half consisting of a broad abyssal plain between the northern Great Barrier Reef and the New Hebrides Islands and the southern half consisting of a wide variety of reefs, cays and atolls between the central and southern Great Barrier Reef and New Caledonia. The southern half is again divided by deep oceanic troughs, leaving the Townsville Plateau in the north, the Marion Plateau in the south and Mellish Reef and the Chesterfield Plateau in the east. Reefs on each of these three plateaus were selected for the present study.

Reefs of the Townsville Plateau

199. South Islet, Willis Islands; outer slope, exposed to strong wave action, substrate of consolidated rock intermixed with sand; two collections, 5–15m.

200. Magdelaine Cay; outer slope, exposed to strong wave action, substrate of consolidated rock intermixed with sand; three collections, 10–25m.

201. Magdelaine Cay; intertidal reef flat, exposed to strong wave action, substrate of consolidated rock, one collection.

202. Turtle Islands, Lihou Reefs; exposed to strong wave action, substrate of denuded, consolidated rock, one collection, 15–20m.

Reefs of the Marion Plateau

203. South Cay, Marion Reef, S side; exposed to moderate wave action, substrate of irregular consolidated reef sloping to sand; two collections, 10–20m.

204. South Cay, Marion Reef; reef back, protected from strong wave action, substrate of eroded reef sloping to sand; one collection, 3–8m.

205. Lagoon pinnacles, Mellish Reef; exposed to moderate wave action, substrate of eroded reef sloping steeply to sand; two collections, 3–25m.

Mellish Reef and the Chesterfield Plateau

206. Mellish Reef, NE side; exposed to moderate wave action, substrate of eroded reef sloping to sand, one collection, 15–20m.

207. Mellish Reef, SW end; exposed to strong wave action, substrate of consolidated reef sloping to sand; one collection, 5–15m.

208. Mellish Reef, E side; detached piece of reef exposed to moderate wave action, substrate of consolidated reef sloping to partly consolidated rubble; three collections, 5–28m.

209. Mellish Reef Lagoon, W end; substrate of sand and coral rubble; one collection, 4m.

210. Chesterfield Atoll, SW reefs; outer slope, exposed to strong wave action, substrate of consolidated reef sloping to sand; six collections, 5–20m.

211. Long Island, Chesterfield Atoll; outer slope, exposed to strong wave action, substrate of consolidated reef sloping to sand; two collections, 10–20m.

212. Long Island, Chesterfield Atoll; inner slope, protected from strong wave action, substrate of unconsolidated rubble, one collection, 7–10m.

213. Cay N of Long Island, Chesterfield Atoll; outer slope, exposed to strong wave action, substrate of consolidated reef sloping to sand; one collection, 10–20m.

214. Cay N of Long Island, Chesterfield Atoll; inner slope, protected from wave action, substrate of unconsolidated rubble, one collection, 2–5m.

215. Bennett Island, Chesterfield Atoll; outer slope, exposed to strong wave action, substrate consists of consolidated reef sloping to sand; two collections, 15–20m.

216. Bennett Island, Chesterfield Atoll; inner slope, protected from wave action, substrate of consolidated reef and rubble sloping to sand; four collections, 8–12m.

217. Bennett Island, Chesterfield Atoll; inner reef flat lagoon, substrate of sand; one collection, 0.5–2m.

218. Observatory Cay, Chesterfield Atoll; inner reef flat lagoon, substrate of sand and rubble; one collection, 0.5–4m.

III
Family Poritidae Gray, 1842

The Poritidae are all colonial and hermatypic. Colony formation is primarily by extratentacular budding. Corallites have porous walls of clearly differentiated synapticulae and trabeculae and corallites are closely compacted with little coenosteum. Except for *Alveopora,* septa are formed from a regular pattern of trabeculae, the inner one of which may be differentiated as a palus.

The genera of the Poritidae are well defined but are not always clearly interrelated, making this family one of the most structually diverse of the Scleractinia.

GENUS *PORITES* LINK, 1807

Generic synonymy

Porites Link, 1807 (see note p. 141)

Neoporites Duchassaing & Michelotti, 1860

Cosmoporites Duchassaing & Michelotti, 1860

Napopora Quelch, 1886

Type species *Porites polymorphus* Link, 1807 = *P. porites* Pallas, 1766.

Characters of the genus (after Wells, 1958)

Massive, remose or encrusting. Corallites smaller (to 2mm) than *Goniopora,* with only 2 septal cycles. Septa formed by 3 to 4 trabeculae.

Introduction

The taxonomic history of *Porites* has been outlined in detail by Bernard (1905). As Bernard shows, many of the early taxonomists included a large number of nominal species in *Porites,* species now known to belong to other genera, notably *Montipora.* Of the nominal species that were correctly included in *Porites,* many if not most are now known to be synonyms. Lamarck (1816), for example, cited 16 species of *Porites* only 6 of which actually were *Porites.* Clearly, the small corallites of *Porites,* which must be examined closely before their characteristic structure can be recognised, had led to confusion at both generic and species levels and has also led to a proliferation of species names.

To date there are approximately 120 nominal species of *Porites,* the majority of which were described without their authors taking the formidable array of earlier species descriptions into account. These names have, in turn, not been used by subsequent authors or have had a regional use only.

This was the situation which Bernard (1905, 1906) faced when he attempted his monographic revision of the genus. Simultaneously he was faced with the impossible task of trying to divide collections of *Porites* into species without relevant field studies. The inevitable confusion this caused led him to continue his abandonment of binomial nomenclature, as he did, for the same reason, with *Goniopora* (see p. 65). This contrasts greatly with the concurrent studies of Vaughan (1907a) who, in his work on Hawaiian *Porites,* gave one of the earliest and still one of the most comprehensive accounts of how species of corals can vary yet still remain recognisable as discrete species.

In 1918 Vaughan published a much extended, although less detailed account of *Porites* from other geographic regions, including the Great Barrier Reef, a study which has formed the basis of all subsequent work on *Porites*, including the present study.

Although Bernard contributed little more than added confusion to *Porites* taxonomy, he did provide a detailed and accurate account of *Porites* skeletal structure. As described on p. 65, he showed how the *Porites* septal formula can be derived from that of *Goniopora* by reduction of the third septal cycle. His conclusion that *Porites* is the more recent of the two genera is supported by the known fossil record where *Goniopora* extends back to the Cretaceous but *Porites* only to the Eocene. Bernard also gave a clear account of the bilateral symmetry of the *Porites* septal arrangement.

Skeletal structure

All *Porites* species have the following septal arrangement or a reduction of it. (a) One dorsal and one ventral septum about which the other septa are symmetrically arranged. (b) Four pairs of lateral septa, the two elements of each being fused at their margins. In each pair, one septum belongs to the first cycle, the other belongs to the second cycle, but they are usually structurally identical. (c) A ventral triplet composed of the ventral directive septum with a lateral septum on each side of it. The lateral septa may have free inner margins, or may fuse with the inner margin of the ventral directive, or may develop a trident formation where synapticulae connect the laterals to the ventral directive which itself is often joined to the columella by a radial element. These arrangements are illustrated in Fig. 2.

Usually the septa of the lateral pairs are better developed than the lateral septa of the triplet.

Pali are usually present as indicated in Fig. 2, the only east Australian exception being *P. solida.* Usually the pali on the lateral pairs are larger or taller than the others.

There are usually two distinct synapticular rings, one below the pali encircling the columella fossa, the other near the wall or fused with the wall.

All septa have one or more denticles on their margins which resemble small, granulated dentations. These are often arranged in concentric rows. The wall may be primarily composed of these denticles, one row from each adjacent corallite plus a central row (Fig. 13). The outer margins of septa frequently bifurcate at the level of the wall, each arm of the bifurcation being associated with a denticle. In this case the denticles have the same position as, and may have a similar appearance to, the larger trabecular pillars in the walls of *Goniopora.*

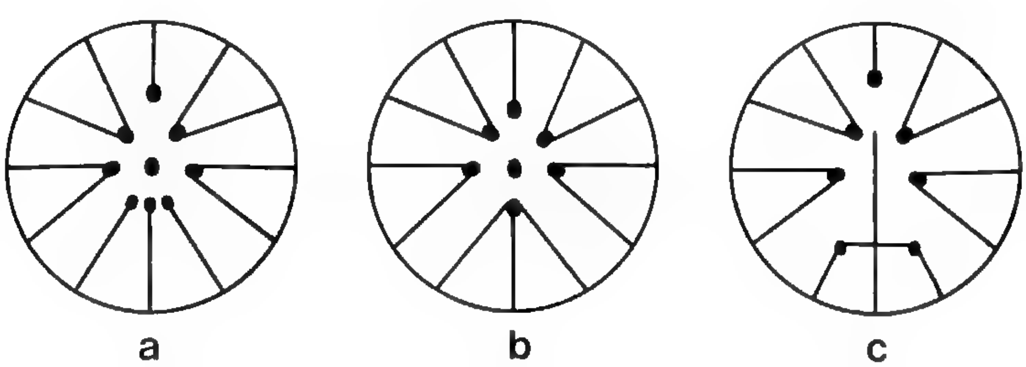


Fig. 2 Patterns of fusion of the triplet in *Porites* (a) triplet with free lateral septa and three pali, (b) triplet with lateral and ventral directive fused at their extremities, and one palus, (c) triplet with lateral septa connected to the ventral directive by a synapticular bar, the ventral directive fused with the columella, and two pali.

Subgenera of Porites

Three groups of species have been separated from *Porites* proper by various authors since Bernard.

Stylaraea Edwards & Haime (1851) has been variously considered a separate genus, a synonym of *Porites*, or a subgenus of *Porites*. In agreement with Crossland (1952), it is treated here as a separate genus (p. 63).

Napopora Quelch, 1886 was established for the single species *P. irregularis* and used by Nemenzo (1976) for this and two other species, one of which is a synonym of *P. (N.) vaughani*.

Synaraea Verrill, 1864 includes species with small, superficial corallites separated by an extensive, finely reticulated coenosteum. *Porites* subgenus, notably *P. (P.) lichen* may develop *Synaraea*-like corallites by intratentacular budding.

Subgenus Porites

East Australian species of *Porites* subgenus are arranged below according to structural similarities of their corallites. They are also divisible by general appearance into four groups:

(a) Species forming very large, massive, generally hemispherical or helmet-shaped colonies with ledges around their bases: *P. solida, P. lobata, P. australiensis, P. lutea* and *P. mayeri*. These species are all readily separated by calicular characters. A sixth species remains undescribed and is called sp. 1.

(b) Species forming massive hemispherical or spherical colonies which do not attain large sizes: *P. murrayensis, P. stephensoni* and *P. densa*. These species are also readily separated from each other and from group (a) species by calicular characters.

(c) Species forming branching colonies: *P. cylindrica* and *P. nigrescens*. These species are readily separated by minor differences in growth form and major differences in calicular characters.

(d) Species forming flat plates or columns or irregular branches: *P. lichen* and *P. annae*. These species both have extremely variable calicular characters. They may be difficult to separate from each other and both may readily be confused with *P. (N.) vaughani*. A number of specimens in the present collection cannot satisfactorily be attributed to any of these species and further work is likely to reveal one or two additional members of this group.

Porites (Porites) solida (Forskål, 1775)

Synonymy

Madrepora solida Forskål, 1775.

Porites solida (Forskål); Klunzinger (1879, *pars*); Ortmann (1888, 1892); Rehberg (1892); von Marenzeller (1901, 1907, *pars*); Vaughan (1918); Crossland (1941, 1948, 1952); Wells (1950); Rossi (1954); Scheer (1967); Pillai (1972); Scheer & Pillai (1974); Pillai & Scheer (1976); *non* Verrill (1865); *non* Gravier (1911).

?*Madrepora conglomerata* Esper, 1797.

?*Porites conglomerata* (Esper); Lamarck (1816); de Blainville (1830, 1834); Ehrenberg (1834); Edwards & Haime (1851, 1860).

?'*Porites* Red Sea 1' (Bernard, 1905).

Figs. 3, 4 *Porites solida* (× 1.0)
Fig. 3 From Lihou Reefs, collecting station 202.
Fig. 4 From Mellish Reef, collecting station 206.

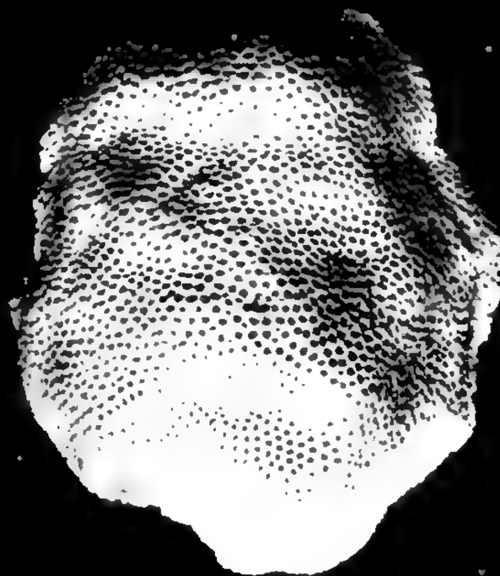
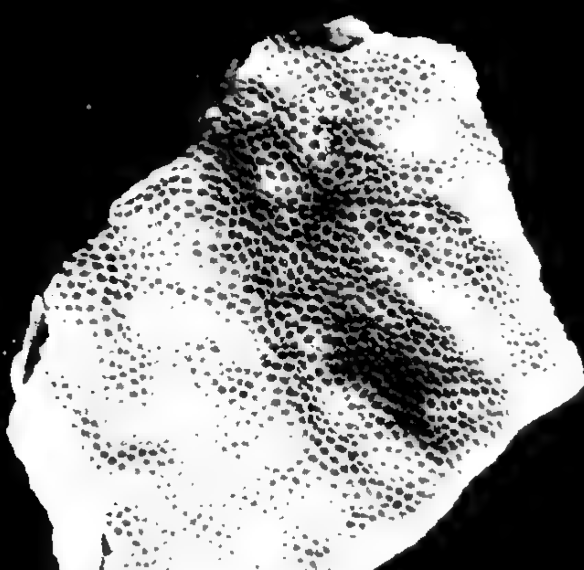


Fig. 3▲

Fig. 4▼



The taxonomic history of *P. solida* is complicated, for Forskål's name was not used by the early authors who cited Esper's and Lamarck's *P. conglomerata* instead. The *P. conglomerata* of Quoy & Gaimard and Dana, however, is *P. lutea*. Klunzinger cited both *P. lutea* and *P. solida* separately but his *P. solida* was a mixture of these species. Vaughan (1918) published the first clear description and figure of *P. solida* and later Crossland (1941, 1948), who studied Forskål's types in detail, gave a comprehensive account of the species in the Red Sea, its type locality.

Because of its uncertain taxonomic history, it is probable that *P. solida* is more abundant than the literature would tend to indicate.

Material studied

Great Detached Reef (2 specimens), **Tijou Reef, Lizard Island** (4 specimens), **Willis Islet, Magdelaine Cay** (7 specimens), **Lihou Reefs** (3 specimens), **Mellish Reef** (4 specimens), **Palm Islands** (3 specimens), **Chesterfield Atoll, Palmaise Reef** (2 specimens), **Bird Island.**

These localities include collecting stations 1, 8, 11, 33, 37, 55, 198, 199, 200, 202, 206, 212.

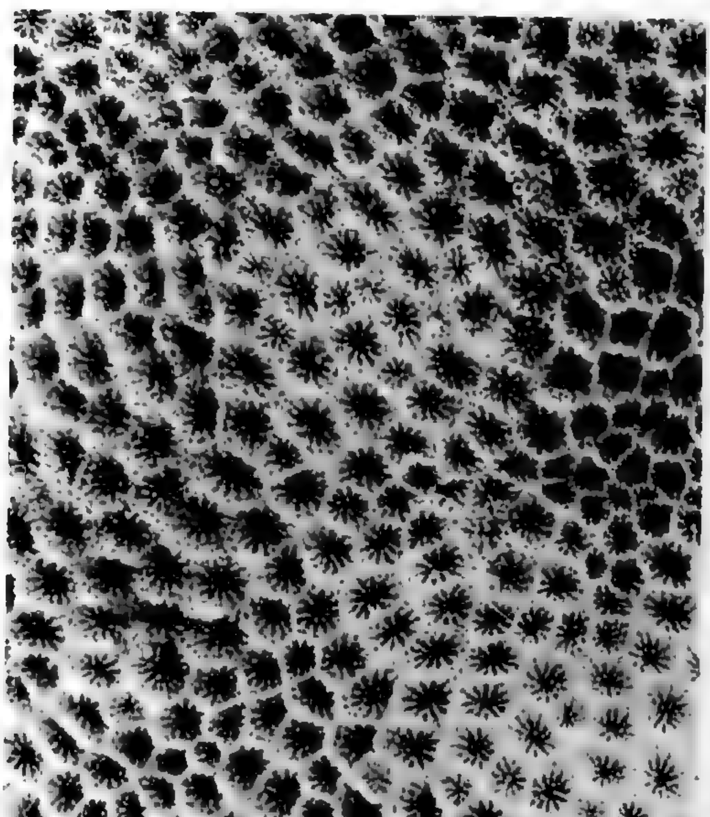
Previous records from Eastern Australia

Low Isles; Crossland (1952).

Characters

Colonies are massive, hemispherical, and may be several m in diameter. They have a

Figs. 5, 6 *Porites solida* (×5)
Fig. 5 From Lihou Reefs, same corallum as Fig. 3.
Fig. 6 From Mellish Reef, same corallum as Fig. 4.



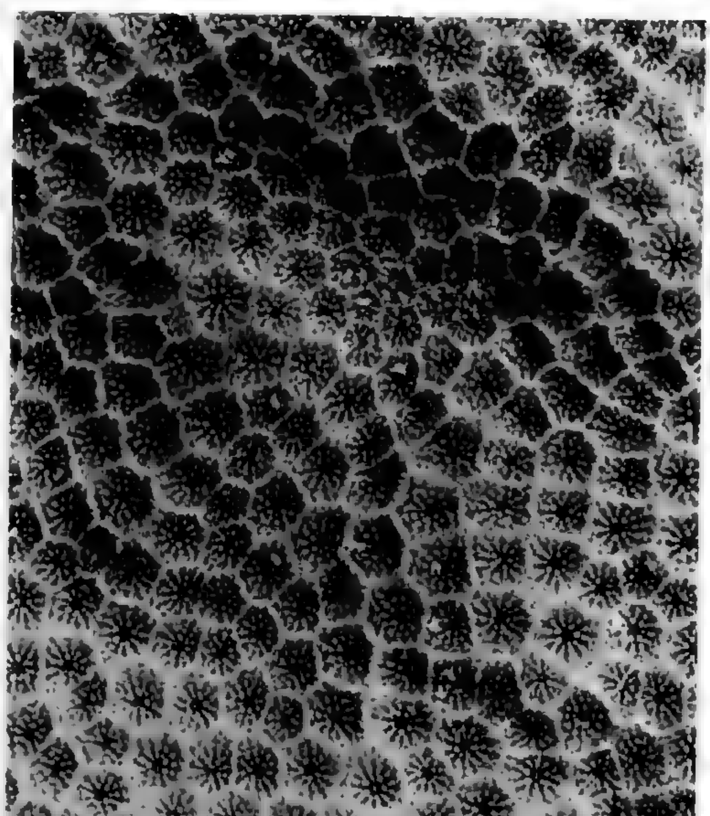


Fig 5◄ Fig. 6►

smooth, sometimes undulated surface. Calices are 1.5–2.0mm diameter and corallites have thin walls with approximately 24 denticles on them. Septa do not reach the upper wall margin but slope gently towards the columellae. They are usually wedge-shaped and sometimes divide near the wall. There are usually 2, or sometimes 3 denticles which decrease in height towards the centre, and which have a hirsute appearance. The inner denticle resembles a poorly developed palus. Otherwise there is no development of pali. The dorsal directive septum and the lateral septa of the triplet are usually shorter than the lateral pairs. In many coralla one septum of each lateral pair is longer than the other. The shorter septum is curved towards, and fuses with, the longer septum, which bears the innermost denticle. The palar synapticular ring is clearly developed. Columellae are present, but are sometimes weakly developed and laterally compressed in the direction of the directive septa.

Affinities

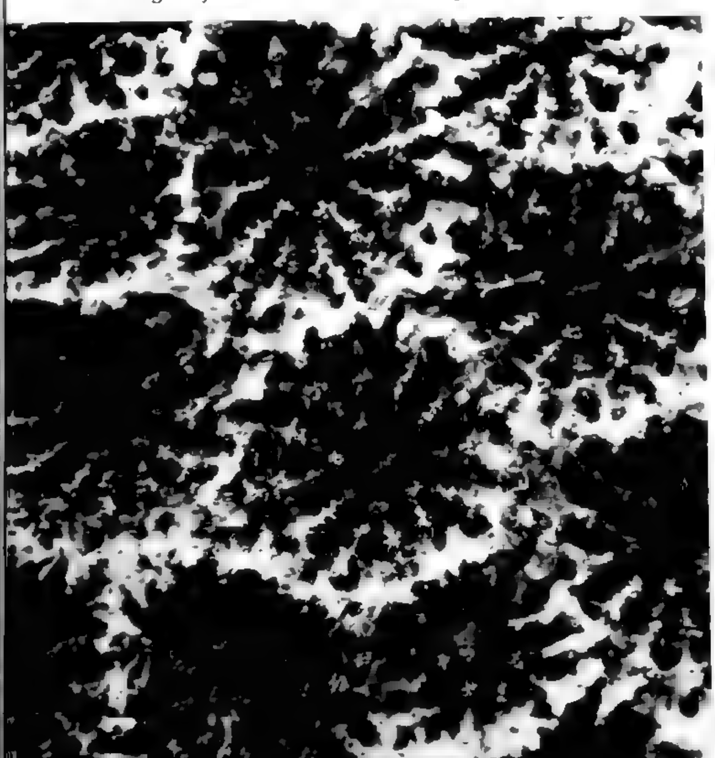
Although *P. solida* has been confused with *P. lutea* by several authors, these species are very distinct.

Porites solida is close to *P. lobata,* these species having no pali or weakly developed pali. Corallites of *P. lobata* are usually more excavated, have thinner, more even and more steeply sloping septa, and pali are better developed. However, in some coralla these differences become unclear. Hawaiian specimens of *P. lobata* have less calcified calicular structures than Hawaiian *P. solida,* but these differences are less obvious in Great Barrier Reef specimens.

Distribution

Widely distributed throughout the tropical Indo-Pacific from the Red Sea to Hawaii.

Figs. 7, 8 *Porites solida* showing different parts of the same corallum, from Yonge Reef (× 30).



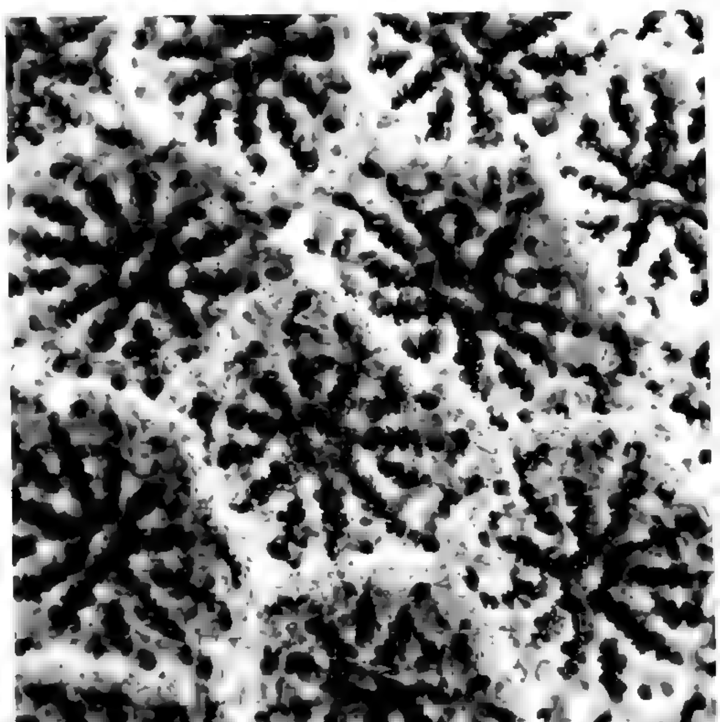


Fig 7◄ · Fig 8►

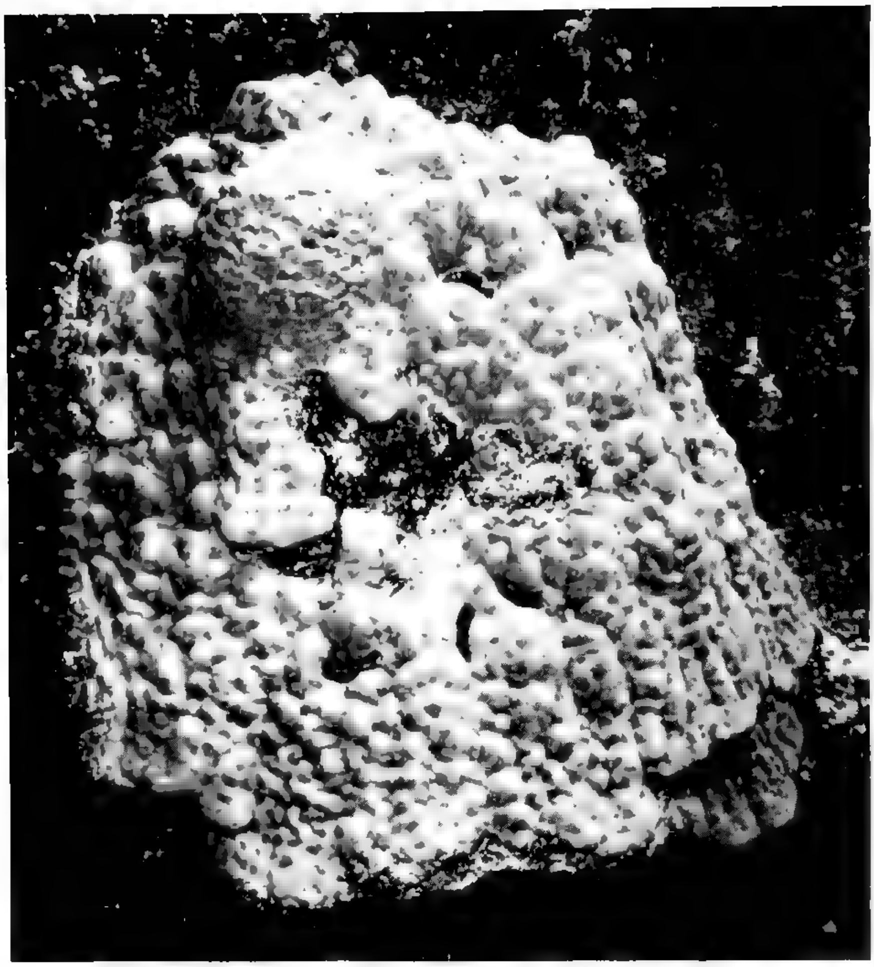


Fig. 9 *Porites lobata* from Mellish Reef.

Porites (Porites) lobata Dana, 1846

Synonymy

Porites lobata Dana, 1846; Edwards & Haime (1860); Rathburn (1887); Whitelegge (1898); Studer (1901); Vaughan (1907a, 1918); Matthai (1923); Hoffmeister (1925); Yabe & Sugiyama (1935); Crossland (1952); Wells (1954, 1972); Stephenson & Wells (1955); Ma (1959); Durham (1962); Chevalier (1968); Scheer & Pillai (1974); Maragos (1977); Veron (1981).

'*Porites* Great Barrier Reef 22' Bernard (1905).

Although *P. lobata* was originally described from Fiji by Dana (1846), it is best known from Vaughan's detailed descriptions of specimens from the Hawaiian Islands. Most east Australian specimens are more heavily calcified than the Hawaiian specimens, and only colonies with deeply excavated corallites and thin septa are close to Vaughan's description.

Material studied

Yorke Island, Murray Islands, Sue Island, Tijou Reef, Yonge Reef, Lizard Island (62 specimens), **Willis Islet, Low Isles** (2 specimens), **Magdelaine Cay** (20 specimens), **Lihou Reefs** (10 specimens), **Mellish Reef** (29 specimens), **Britomart Reef, Palm Islands** (39 specimens), **Pandora Reef** (3 specimens), **Magnetic Island** (3 specimens), **Darley Reef** (4 specimens), **Whitsunday Islands, Bushy Island-Redbill Reef, Swain Reefs** (5 specimens), **Heron Island, Palmaise Reef** (2 specimens), **Fitzroy Reef, Llewellyn Reef, Solitary Islands.**

Figs. 10–13 *Porites lobata* (× 25)

Fig. 10 From Lizard Island showing thin walls and calicular structures.

Figs. 11, 12 Same corallum from Mellish Reef, collecting station 207 showing corallites on the upper and lower surface of a corallum ledge respectively.

Fig. 13 From Lizard Island showing thickened septa and walls with three denticles.

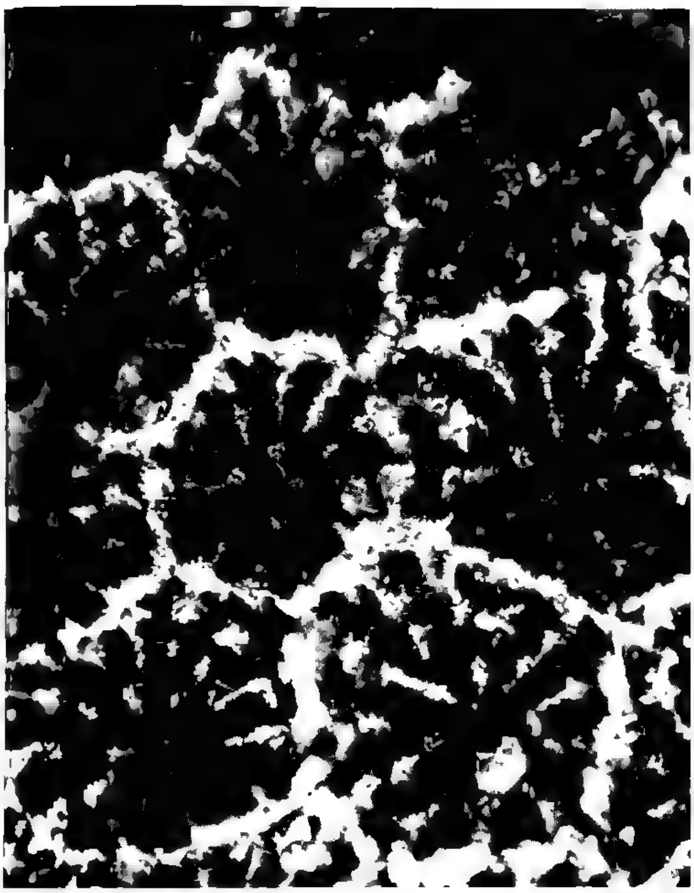


Fig. 10▲

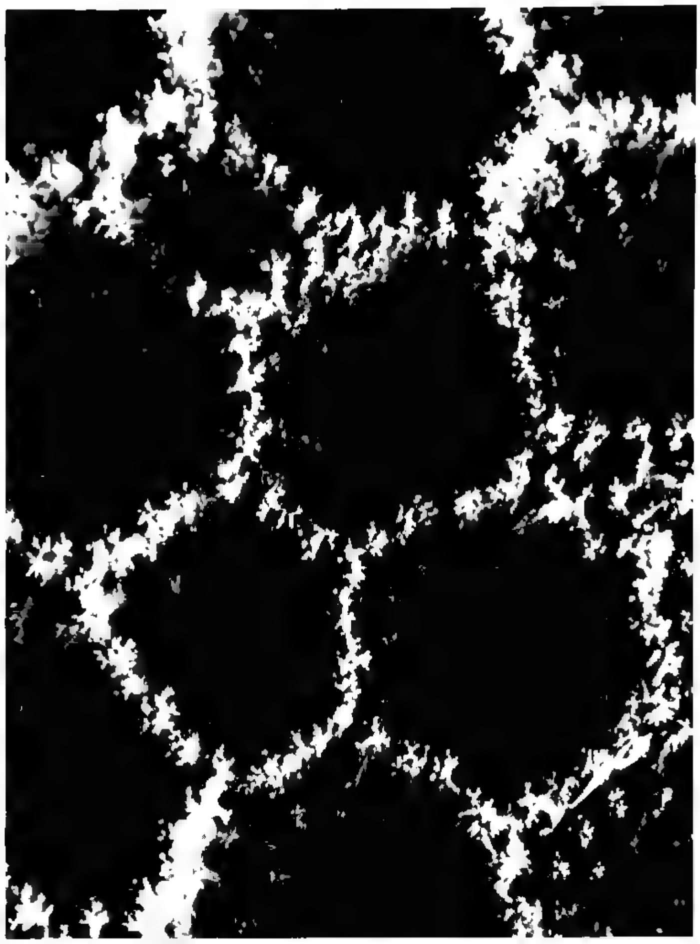
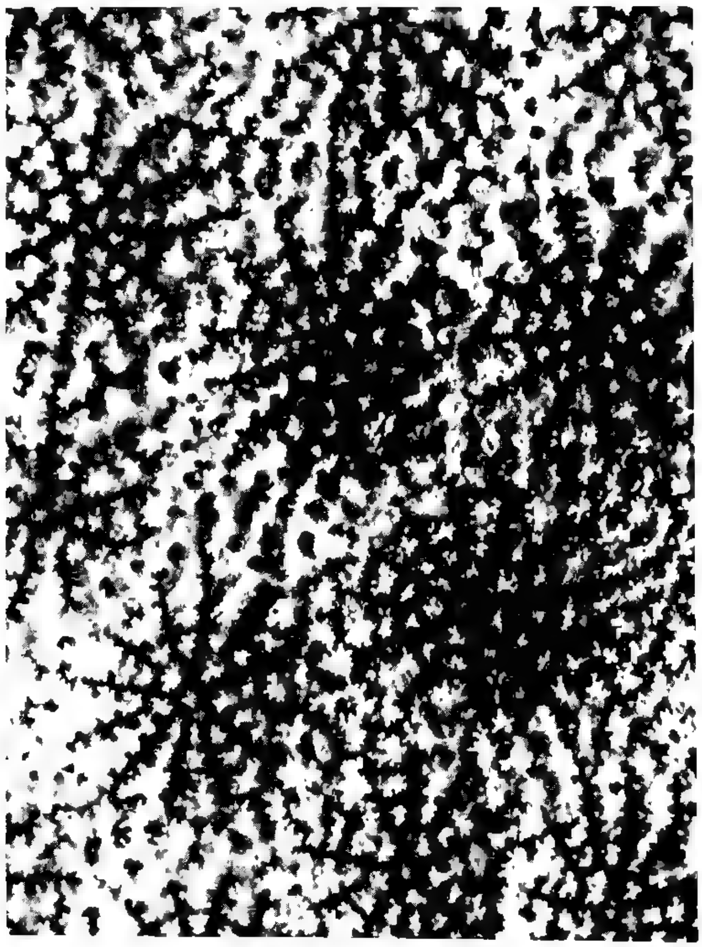


Fig. 11▲

Fig. 12▼

Fig. 13▼



These localities include collecting stations 6, 11, 13, 28, 32, 33, 36, 38, 41, 42, 43, 45, 55, 60, 69, 73, 78, 79, 81, 89, 92, 102, 116, 171, 174, 182, 190, 196, 198.

Previous records from Eastern Australia

Low Isles, Crossland (1952); Stephenson & Wells (1955); **Bushy-Redbill Reef**, Wallace & Lovell (1977); **Moreton Bay**, Lovell (1975).

Characters

Colonies are massive, usually hemispherical or helmet-shaped and may be several m in diameter and height. Most big colonies have thick ledges, or a series of thick ledges, around their base. They have a smooth surface, sometimes with humps or columnar expansions.

Calices average 1.5mm diameter. Corallite walls are < 1.0mm thick but vary greatly. The upper surface of thick walls is composed of three rows of denticles, the two outer rows following along the rim of their respective calices leaving a central row along the wall summit. Septa usually have two denticles between the pali and the wall. The septa of the triplet always have free margins. The lateral pairs and the dorsal directive septum are well developed. There are usually 8 weakly developed pali, those of the dorsal directive septum and triplet usually being smaller than those of the lateral pairs. They are usually similar in size or smaller than the respective septal denticles. Columellae are present, sometimes in the form of an inconspicuous vertical rod, sometimes laterally compressed in the plane of the directive septa.

Living colonies have uniform colours, usually cream or pale brown but may be bright blue, purple or green, especially in shallow water.

Skeletal variations

Vaughan (1907a) distinguished six 'formae' of *P. lobata: lobata, lacera, infundibulum, parvicalyx, aperta* and *centrales,* the last being itself further subdivided into five 'subformae'. A seventh forma (*nodulosa*) was added by Hoffmeister (1925) for specimens from Samoa. These divisions, however, have no taxonomic significance (especially as a similar range of variation is seen in most other *Porites* species). Nonetheless, Vaughan was able to recognise *P. lobata* as a single definable species in contrast to the concurrent work of Bernard who, without field study, was unable to separate inter- from intra-specific variations.

East Australian *P. lobata* vary continuously between coralla with (a) shallow corallites and thick wedge-shaped septa which slope gradually almost to the columella and which have thick denticles, and (b) deep corallites with thin laminar septa which slope steeply inside the corallite and have tall pali and denticles.

Affinities

Porites lobata is closest to *P. solida* and *P. australiensis.* In particular, coralla with narrow walls and poorly developed pali are difficult to distinguish from *P. solida* (see p. 15). *Porites australiensis,* which also has a triplet with free margins, is usually distinguished by having taller pali, especially on the lateral pairs.

Distribution

Widely distributed in the tropical Indo-Pacific from the Nicobar Islands in the west, to the Tuamotu Islands, Hawaii, Bonin Island and possibly the Galapagos Islands.

Porites (Porites) murrayensis Vaughan, 1918

Synonymy

Porites murrayensis Vaughan, 1918; Matthai (1923); Hoffmeister (1925); Yabe &

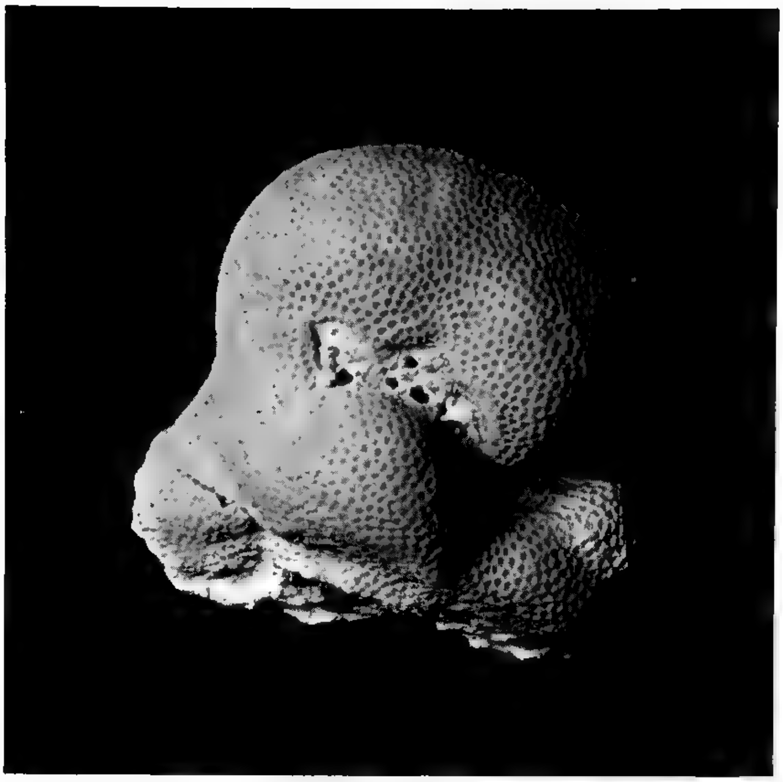


Fig 14▲

Figs. 14, 15 *Porites murrayensis*, same colony from Lady Musgrave Reef, collecting station 194 (× 0.72 and × 5 respectively).

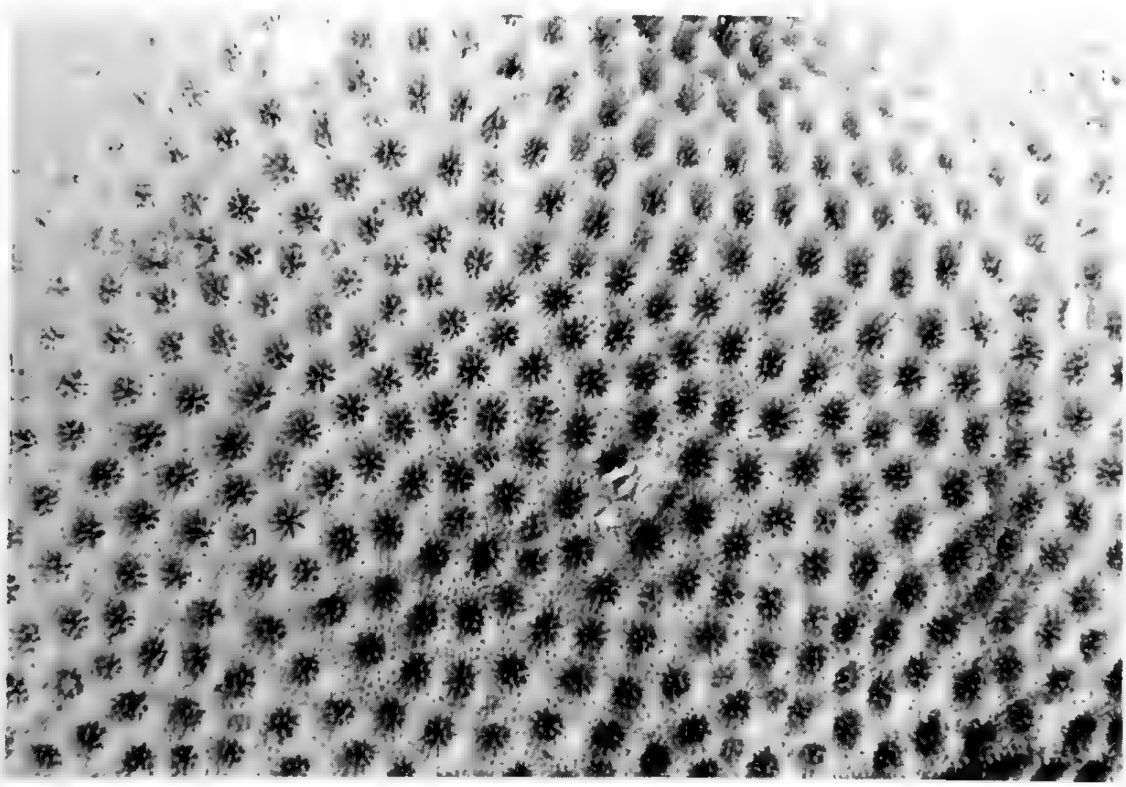


Fig. 15▲

Sugiyama (1935); Wells (1954); Chevalier (1968); Scheer & Pillai (1974); Pillai & Scheer (1976).

Porites brighami Vaughan; *sensu* Eguchi (1938); Nemenzo (1955).

Material studied

Little Mary Reef, Lizard Island (6 specimens), **Magdelaine Cay, Lihou Reefs, Fitzroy Reef** (2 specimens), **Heron Island** (8 specimens).

These localities include collecting stations 186, 189, 191, 200, 202.

Previous records from Eastern Australia

Murray Islands, Vaughan (1918); **Low Isles**, Stephenson & Wells (1955).

Characters and skeletal variations

Coralla are massive, forming small hemispherical to spherical colonies with a maximum diameter of approximately 20cm. Calices are 0.8–1.0mm diameter. Corallite walls are usually thin, but sometimes reach half the corallite diameter. Corallites are deep, with short septa (particularly the three septa of the ventral triplet) reaching $\frac{1}{2}$R, leaving a conspicuous central fossa. They slope gently and bear a well-developed denticle between the wall and the palus.

The septal arrangement is similar to that of *P. lobata*. The septa of the ventral triplet have free margins and are slightly shorter than septa of the lateral pairs. Pali are well developed on the lateral pairs and are inconspicuous or absent on the dorsal directive septum and on the ventral triplet. They remain smaller than the septal denticles, as in *P. lobata*. There are two incomplete synapticular rings, the palar ring and the outer ring below the septal denticles. Columellae are absent or are irregularly developed, deep within the central fossa where they are laterally compressed in the plane of the directive septa.

All these variations can be found within a single corallum (including the type specimen).

Affinities

Porites murrayensis groups with *P. lobata*. Both species have a triplet with free margins and pali smaller than the septal denticles. The two species can be distinguished by *P. lobata* having septa extending further towards the corallite centre and *P. murrayensis* having deeper corallites, with a well-defined central fossa and inconspicuous columellae.

Porites murrayensis is also close to *P. brighami* Vaughan from the Hawaiian Islands, which can be distinguished by its very deep, hollow corallites, absence of pali, and very steeply sloping septa.

Distribution

Recorded from the Maldive and Nicobar Islands, the Great Barrier Reef, Samoa, the Marshall Islands, Palau, the Philippines and the Mariana Islands.

Porites (Porites) australiensis Vaughan, 1918

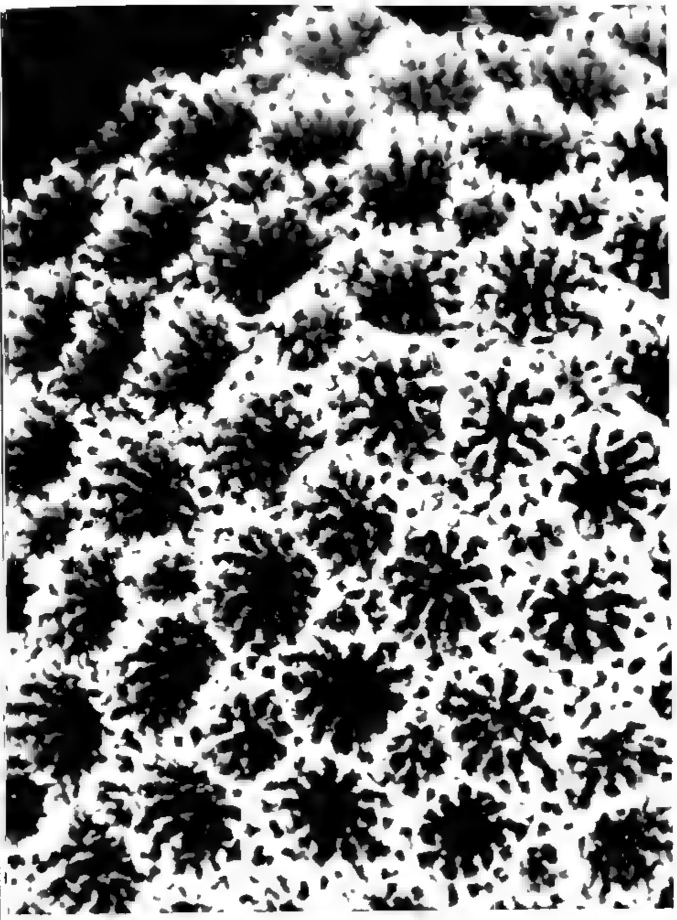
Synonymy

Porites australiensis Vaughan, 1918; Matthai (1923); Faustino (1927); Yabe & Sugiyama (1932, 1935); Eguchi (1938); Crossland (1952); Wells (1954); Nemenzo (1955); Chevalier (1968).

'*Porites* Great Barrier Reef 14, 20, 23, 29 (*pars*), 30, 33, 38' Bernard (1905).

Figs. 16–19 *Porites murrayensis*

Figs. 16–18 Same corallum from Brisk Island, Palm Islands (× 20, × 40 and × 80 respectively).
Fig. 19 From Britomart Reef (× 40).



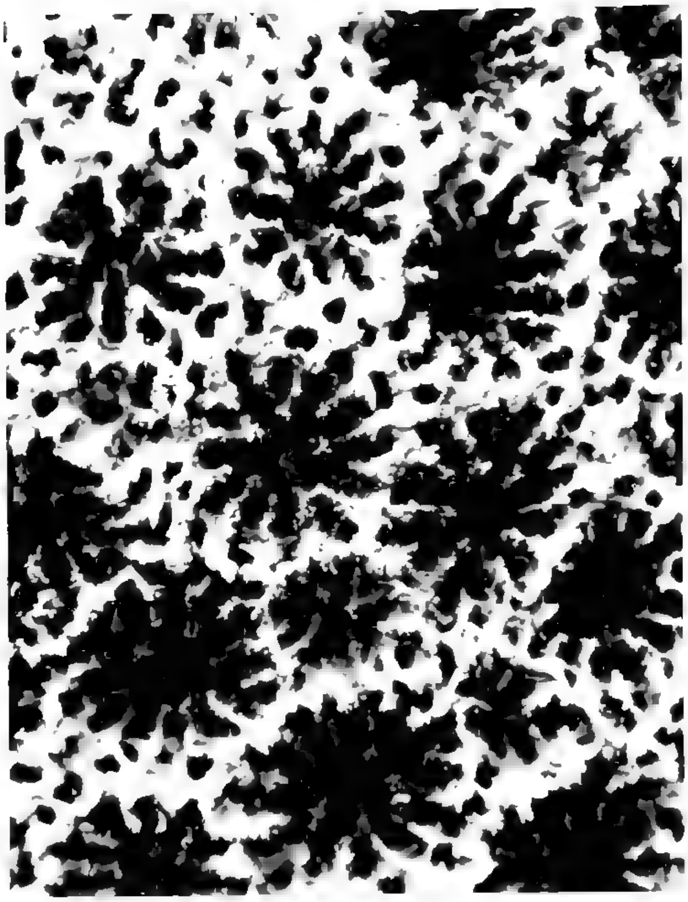
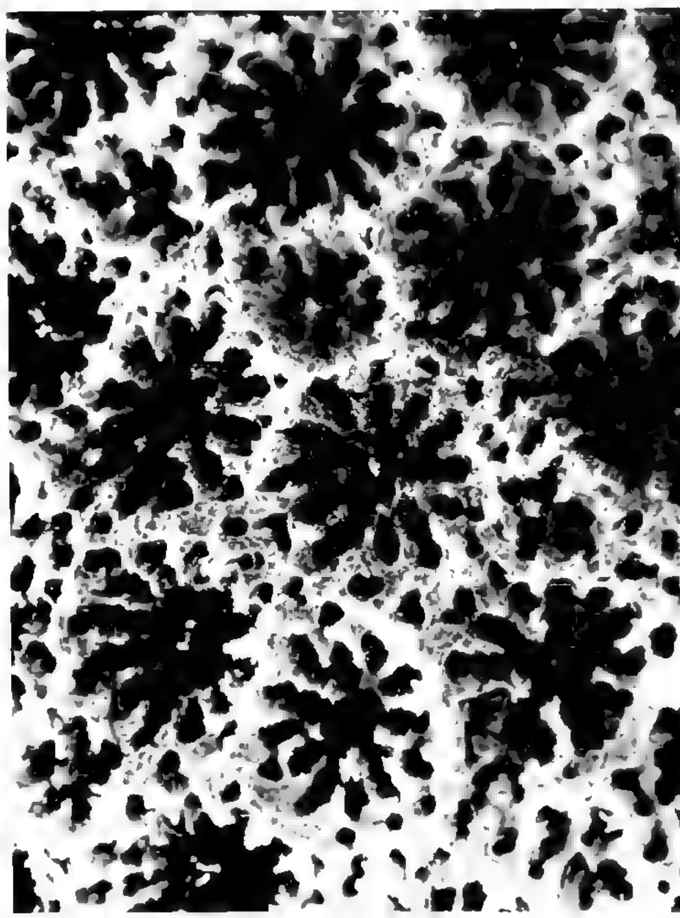


Fig 16▲ Fig 18▼ Fig 17▲ Fig 19▼



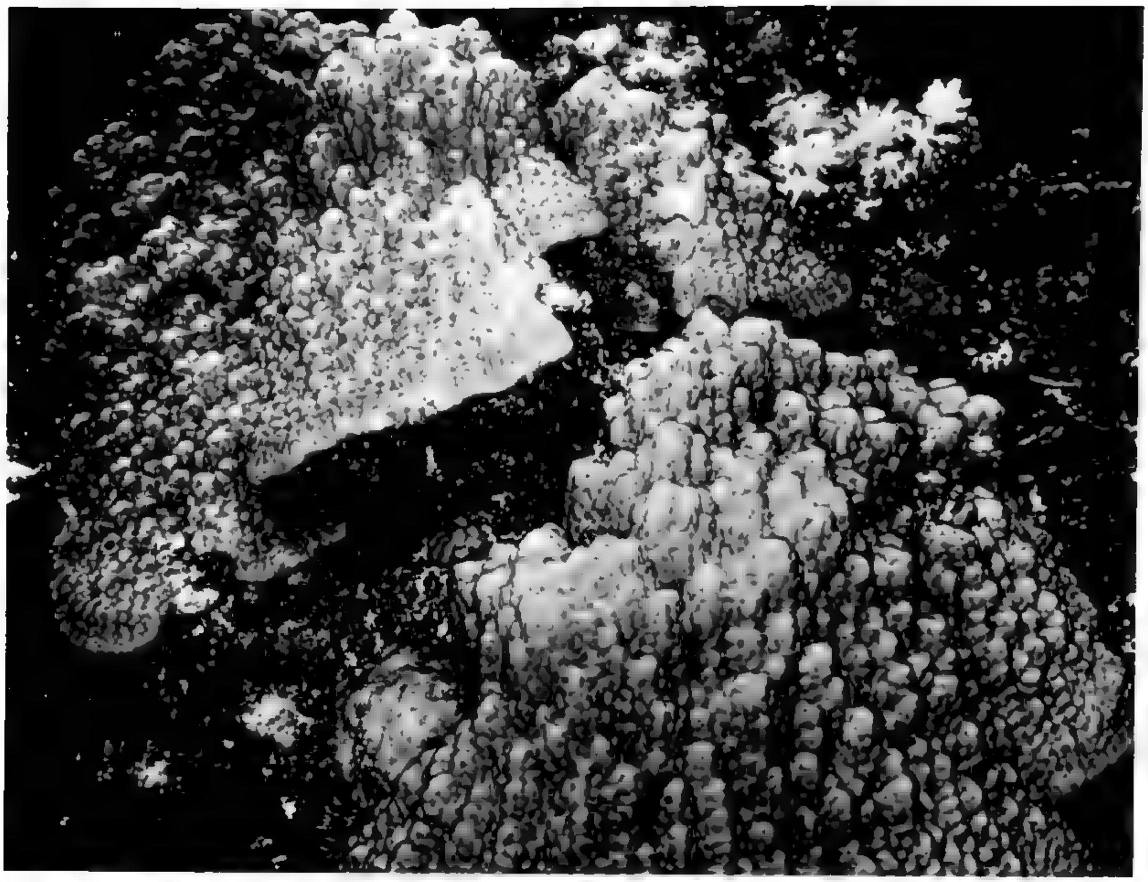


Fig. 20 *Porites australiensis* from Willis Island, collecting station 199.

Material studied

Raine Island, Martha Ridgway Reef, Wye Reef, Corbett Reef (2 specimens), **Jewell Reef, Howick Reef, Houghton Island, Yonge Reef** (3 specimens), **Nymph Island, Lizard Island** (44 specimens), **Low Isles** (8 specimens), **Magdelaine Cay** (9 specimens), **Lihou Reefs** (5 specimens), **Mellish Reef** (3 specimens), **Britomart Reef** (3 specimens), **Palm Islands** (19 specimens), **Wheeler Reef, Magnetic Island** (9 specimens), **Darley Reef, Chesterfield Atoll** (4 specimens), **Whitsunday Islands** (2 specimens), **Pompey Reef** (2 specimens), **Bushy Island-Redbill Reef, Swain Reefs** (2 specimens), **Lady Musgrave Reef.**

The localities include collecting stations 9, 11, 12, 15, 22, 33, 37, 41, 43, 45, 55, 57, 60, 65, 69, 70, 78, 86, 97, 102, 151, 159, 163, 164, 166, 167, 168, 195, 200, 202, 206, 208, 213, 216.

Previous records from Eastern Australia

Murray Islands, Vaughan (1918); **Low Isles,** Crossland (1952), Stephenson & Wells (1955); **Heron Island,** Stephenson & Wells (1955).

Characters

Colonies are massive, hemispherical to almost spherical or helmet-shaped. They can be several m in diameter and height. Most big colonies have thick ledges, or a series of thick ledges around their base, similar to *P. lobata* colonies. Colonies have smooth, undulated surfaces or sometimes develop humps or nodules.

Calices are 1.1–1.5mm diameter. Corallite walls are thick and ridge-like or have three rows of denticles on their upper margin as in *P. lobata.* Corallites may be shallow with gently sloping septal margins, or deep with correspondingly steeply sloping septa. The outline of the septal margin, however, is often masked by variation in the development of the pali and

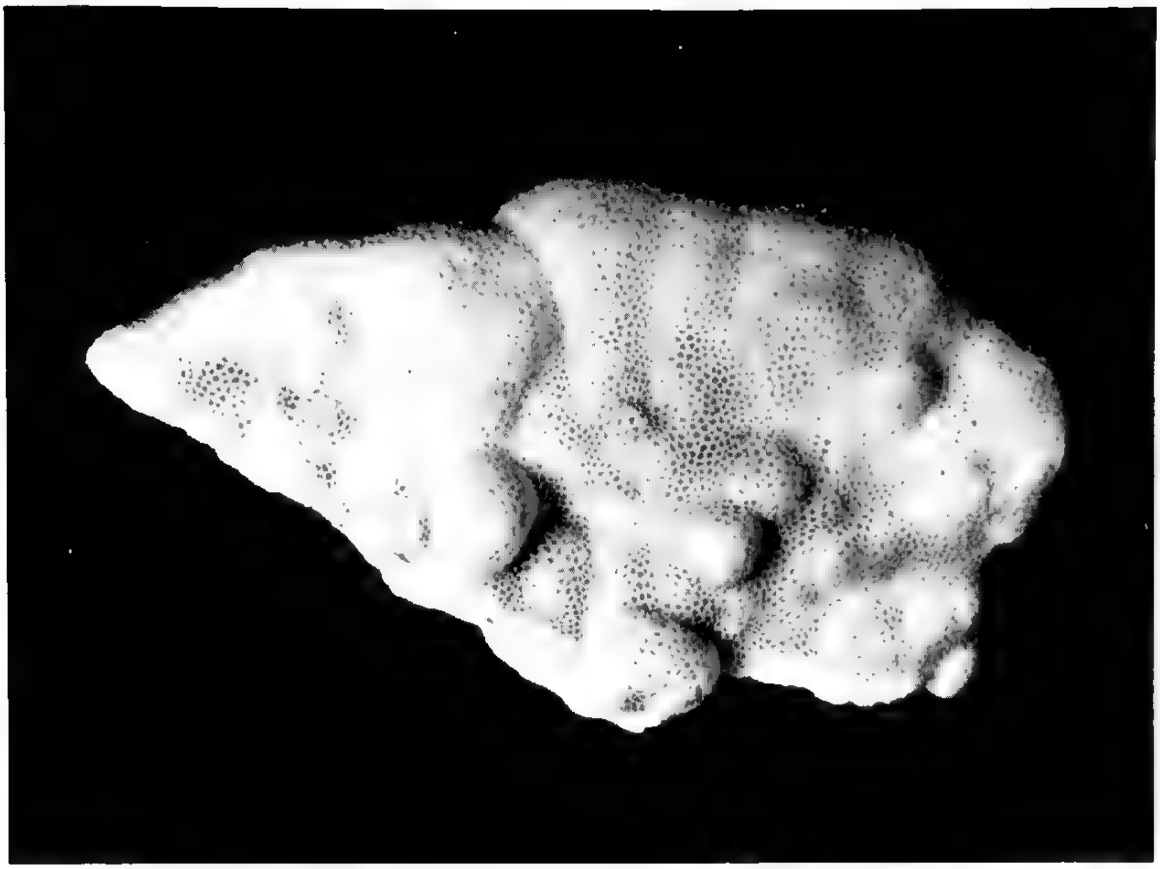
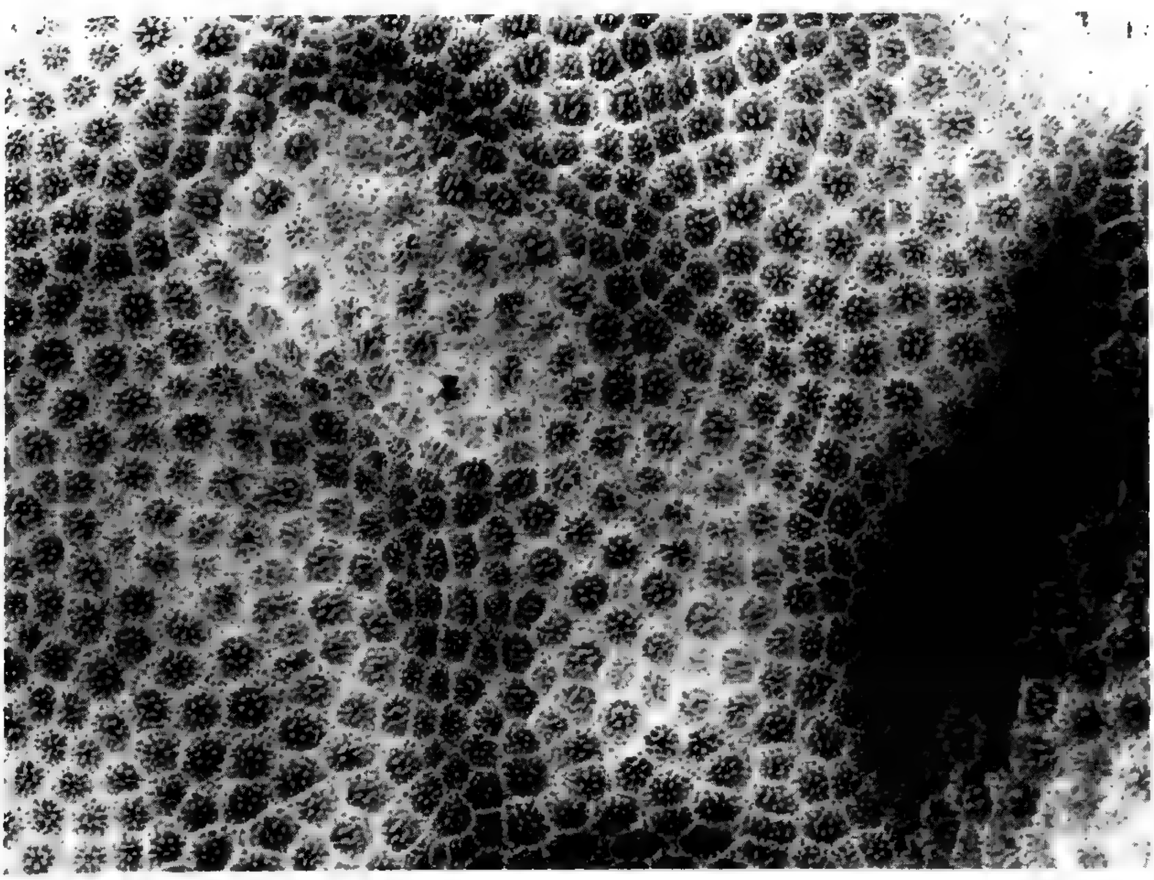
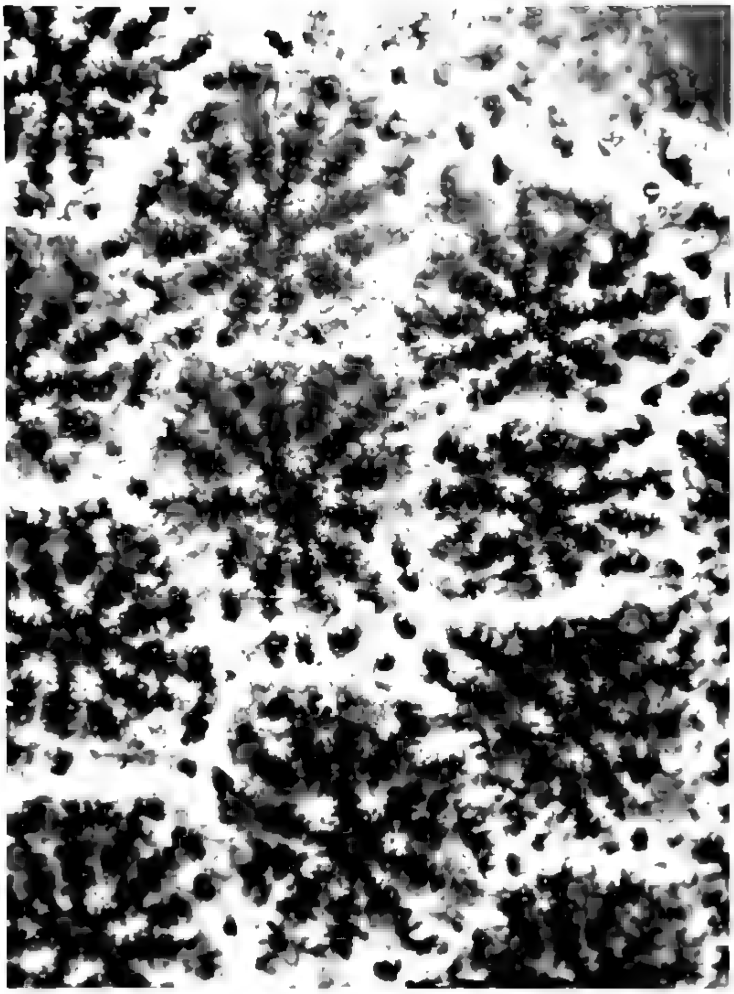


Fig 21▲

Figs. 21, 22 *Porites australiensis*, same corallum from Lihou Reefs, collecting station 202 (× 1 and × 5 respectively).

Fig 22▼





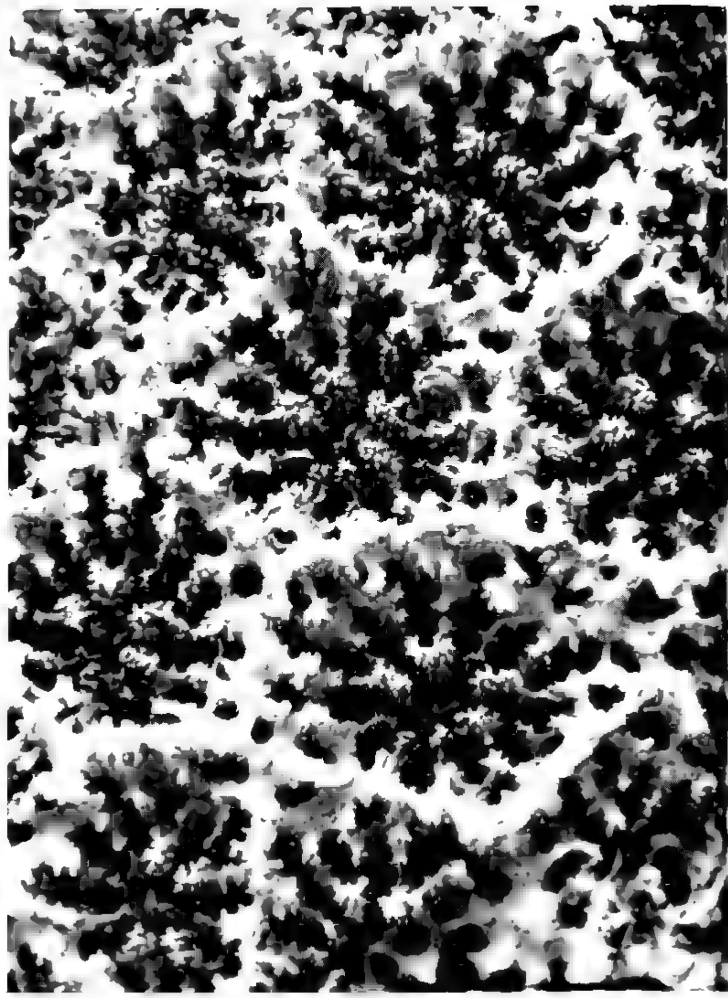
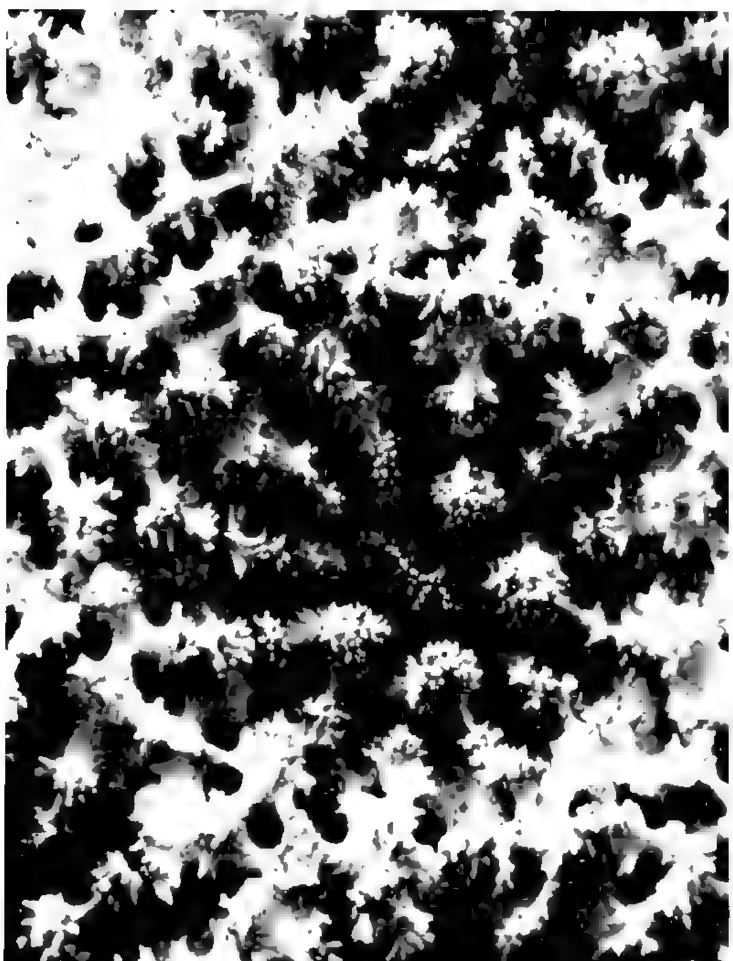


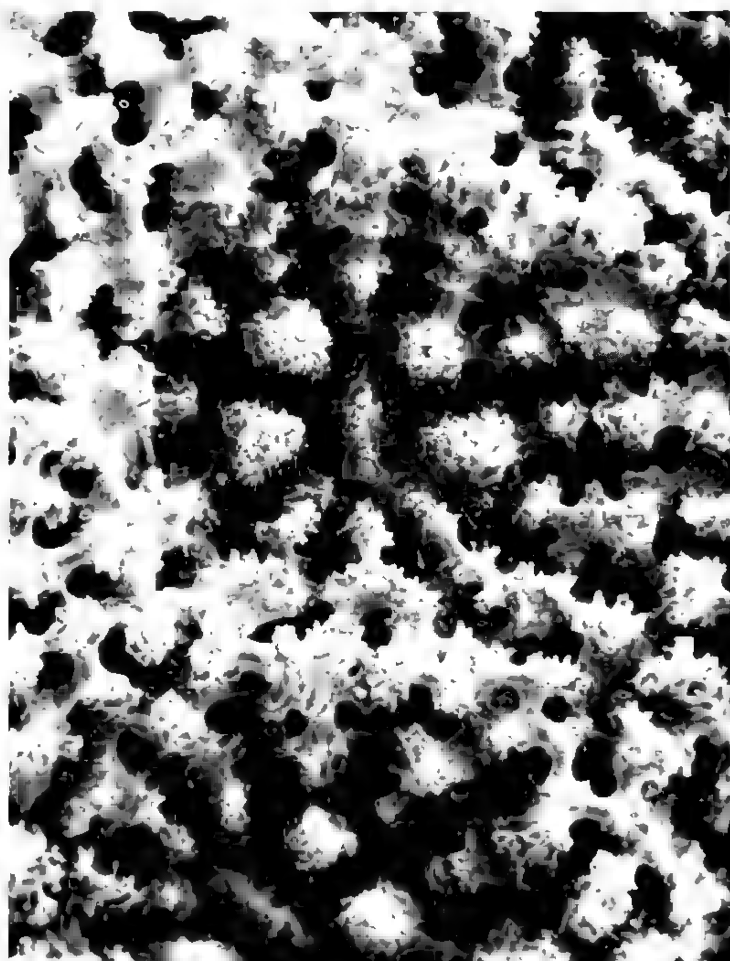
Fig. 23▲

Fig. 25▼

Fig. 24▲

Fig. 26▼





denticles. Septa also vary in width, thick septa being slightly wedge-shaped and thicker than the interseptal loculi. The septa of the ventral triplet usually have free margins; the two lateral septa are smaller than the ventral directive septum. Occasionally the triplet is fused or a trident is formed. There are two denticles on septa of the lateral pairs and (less commonly) on the directive septa, and usually one on the lateral septa of the triplet. Two synapticular rings at the level of the pali and outer septal denticles are usually present but are rarely complete. As noted by Vaughan (1918), septa may bifurcate between the outer synapticular ring and the corallite wall, each limb of the fork corresponding to a discrete denticulation on the wall. A full complement of 8 pali are present, those of the lateral pairs are larger than those of the directives while those of the lateral septa of the triplet are the smallest. Pali are generally higher than the septal denticles and may reach the level of the wall denticles. Columellae are usually well developed and are usually laterally compressed in the plane of the directives.

Living colonies are cream or yellow except for those from shallow water which have a wide range of bright colours.

Affinities

The septal arrangement of *P. australiensis* is similar to that of *P. lobata*, both species usually having triplets with free inner margins. The two species are best separated by their pali, which are much taller in *P. australiensis* and, at least for the pali of the lateral pairs, are higher than the septal denticles.

The development of the pali in *P. australiensis* is similar to that of *P. lutea*, although these species are separated by many characters, including the fusion of the triplet which usually occurs in *P. lutea*.

Porites fragosa Dana from Fiji is very close to, if not synonymous with, *P. australiensis*, the two supposed species differing only by the thinner wall, deeper corallites and more wedge-shaped septa of *P. fragosa*.

Distribution

Widely distributed in the tropical Indo-Pacific from the Chagos Islands in the west to the Marshall Islands in the east.

Porites (Porites) lutea Edwards & Haime, 1860

Synonymy

Porites conglomerata var. *lutea* Quoy & Gaimard, 1833.

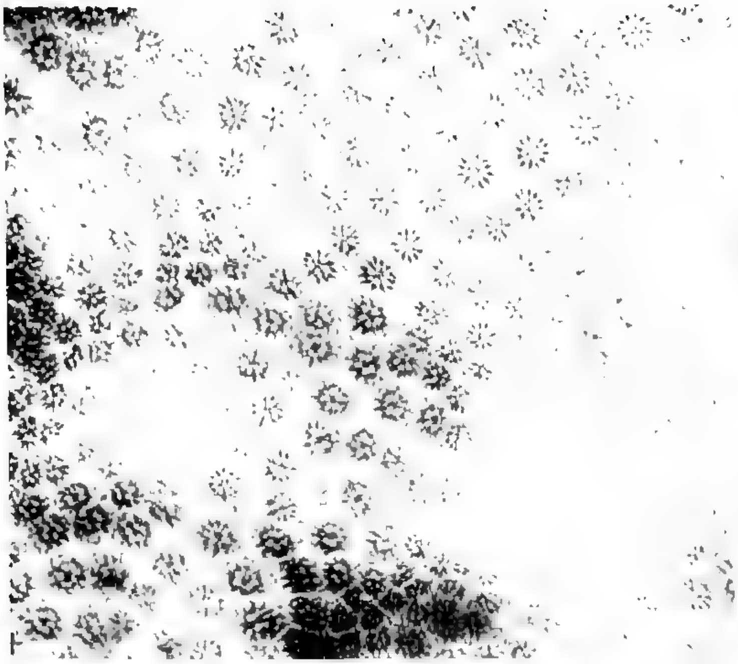
Porites lutea Edwards & Haime, 1860; Klunzinger (1879); Quelch (1886); Rathburn (1887); Ortmann (1888, 1889, 1892); Whitelegge (1898); Vaughan (1918); Matthai (1932); Hoffmeister (1925); Yabe & Sugiyama (1932, 1935); Eguchi (1938); Umbgrove (1939); Crossland (1941); Rossi (1954); Wells (1954); Nemenzo (1955); Stephenson & Wells (1955); Searle (1956); Chevalier (1968); Scheer & Pillai (1974); Pillai & Scheer (1976); Veron (1981).

Figs. 23–26 *Porites australiensis*

Figs. 23, 24 Same corallum from Cateran Bay, Border Island, Whitsunday Islands, collecting station 101 (×25).
Fig. 25 From the Palm Islands (×50).
Fig. 26 From Lizard Island (×50).

Figs. 27–32 *Porites lutea*

Figs. 27, 28 From Mellish Reef, collecting station 226 (×5 and ×25 respectively).
Fig. 29 Same corallum from Yonge Reef (×25).
Fig. 30 From Lihou Reefs, collecting station 202 (×25).
Fig. 31 From Keeper Reef (×25).
Fig. 32 From Lihou Reefs, same corallum as Fig. 30 (×50).



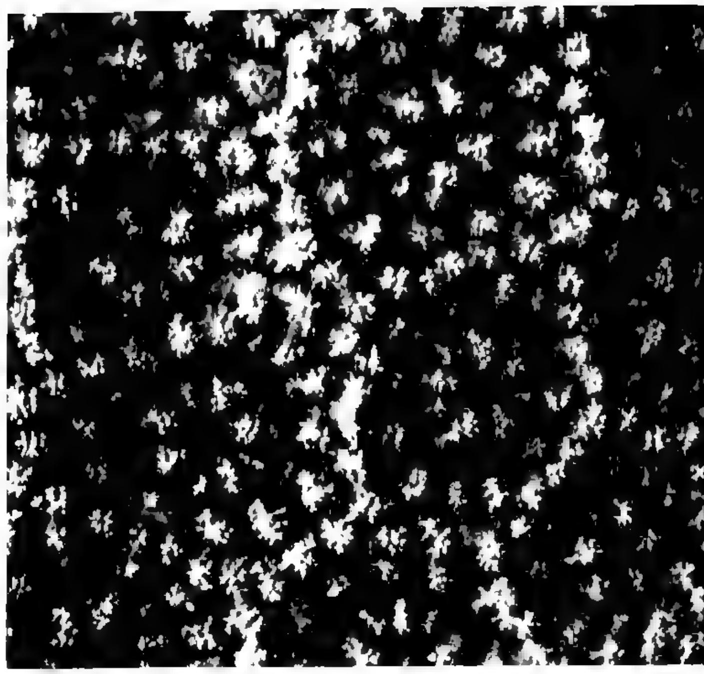
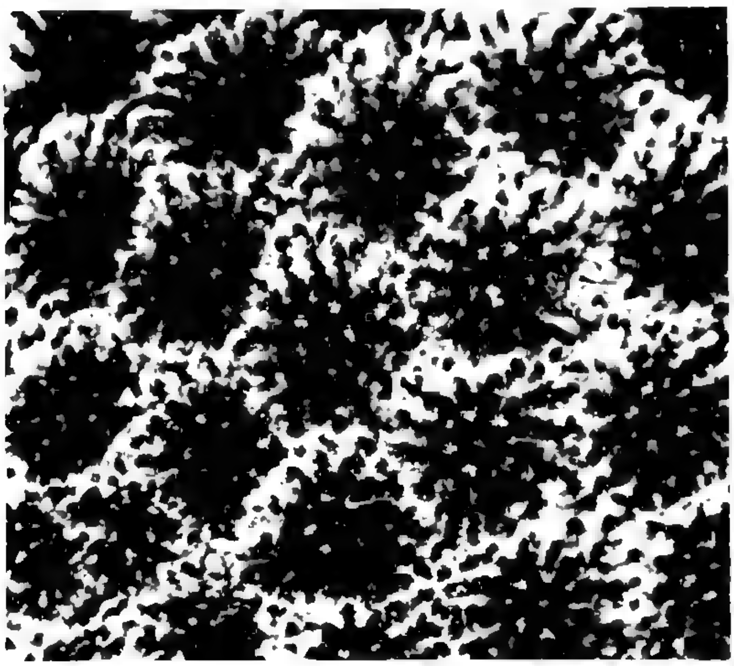


Fig. 27▲

Fig. 29▼

Fig. 28▲

Fig. 30▼



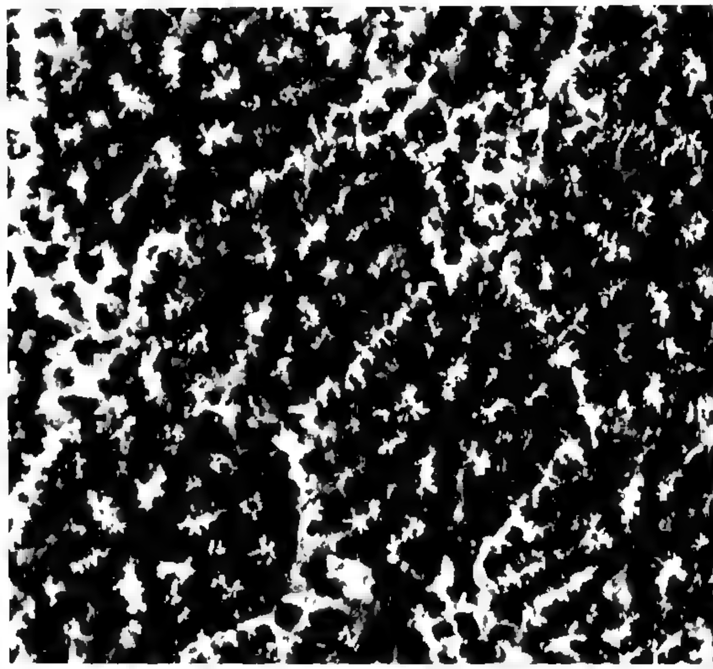
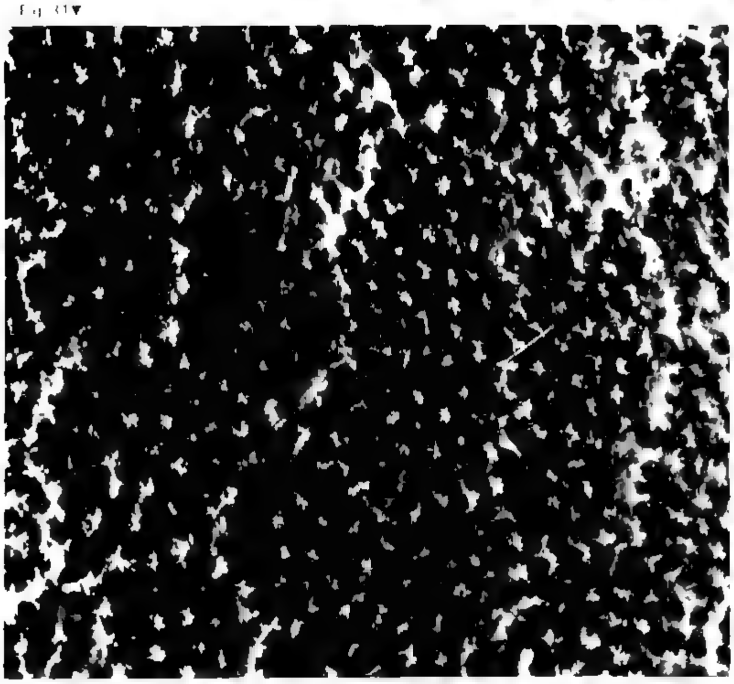
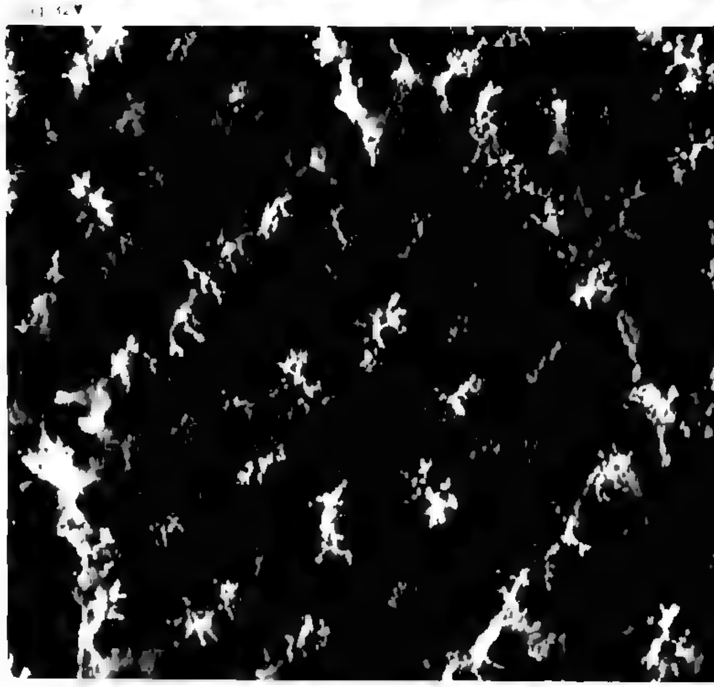


Fig. 31▼

Fig. 32▼





Porites arenosa Quelch, 1886.

Porites arenosa var. *lutea* Gardiner, 1898.

Porites solida Ortmann (1892); von Marenzeller (1907, *pars*); Gravier (1911).

Porites haddoni Vaughan 1918; Yabe & Sugiyama (1932, 1935); Crossland (1952).

?*Porites somaliensis* Gravier, 1911.

'*Porites* Fiji 2' Bernard (1905).

The historical confusion between *P. lutea*, *P. solida* and *P. conglomerata* is noted on p. 14.

Vaughan separated *P. haddoni* from *P. lutea* on the basis of variation in the wall structure and size of the pali, but Hoffmeister elegantly demonstrated that the two structures can occur within the one colony. Crossland's misunderstanding of the history of *P. lutea* led him to name the *P. lutea* specimens from the Great Barrier Reef *P. haddoni*, but there is no doubt about the synonymy of these species.

Whether *P. somaliensis* Gravier, 1911 is distinct from *P. lutea* remains doubtful. The major distinction between the two species, according to Vaughan (1918), is in the structure and ornamentation of the wall.

Material studied

Sue Island (2 specimens), **Triangle Reef, Raine Island** (5 specimens), **Great Detached Reef** (6 specimens), **Wye Reef** (2 specimens), **Corbett Reef** (3 specimens), **Houghton Island** (3 specimens), **Yonge Reef** (8 specimens), **Nymph Island** (2 specimens), **Lizard Island** (2 specimens), **Hope Island** (5 specimens), **Willis Islet, Low Isles** (4 specimens), **Magdelaine Cay** (18 specimens), **Lihou Reefs** (9 specimens), **Mellish Reef** (18 specimens), **Britomart Reef** (6 specimens), **Palm Islands** (16 specimens), **Keeper Reef** (2 specimens), **Magnetic Island** (6 specimens), **Darley Reef** (2 specimens), **Chesterfield Atoll** (4 specimens), **Whitsunday Islands, Bushy Island-Redbill Reef, Fitzroy Reef** (3 specimens).

These localities include collecting stations 1, 5, 16, 17, 21, 36, 37, 45, 55, 57, 60, 86, 89, 94, 99, 151, 157, 163, 164, 166, 167, 168, 189, 190, 191, 200, 202, 206, 207, 212, 215, 216.

Previous records from Eastern Australia

Murray Islands, Vaughan (1918); **Low Isles**, Crossland (1952, as *P. haddoni*); **Bushy-Redbill Reef**, Wallace & Lovell (1977); **Heron Island**, Salter (1954); **Solitary Islands**, Veron *et al.* (1974).

Characters and skeletal variations

Coralla are massive, rarely thin and encrusting and are up to several m diameter. They have a smooth even surface often developing irregular humps of variable size, or (more rarely) develop columniform lobes. Very large colonies often have a series of thick ledges around their base. Calices are 1–1.5mm diameter. Corallites have thin walls; the septation between adjacent corallites is often marked by a series of laterally compressed denticles which sometimes fuse into a ridge. Corallites are mostly shallow and have a distinctive septation: the dorsal directive septum is usually shorter than the lateral pairs and the ventral triplet is fused. This fusion is effected by a transverse rod connecting the margins of the lateral septa to the sides of the ventral directive forming a trident (see Fig. 2), or by having the margins of all three septa fused at their extremities. Both types of fusion may occur in the one corallum. Pali are usually well developed, reaching the level of the wall. Those on the lateral pairs are usually the largest. Those on the laterals of the ventral triplet are smaller than the palus on the ventral directive and all three may be compressed radially. Two synapticular rings are present, the palar ring and an outer ring. Outside the outer ring, which is often incomplete, septa of the lateral pair become wedge-shaped or bifurcate.

Columellae are mostly well developed. Septa are joined to the columellae by (usually) five radii, the most conspicuous being the prolongation of the ventral directive septum.

Affinities

Porites lutea is closest to *P. australiensis*, which has similar development of pali but which does not have a fused triplet.

Distribution

Widely distributed from Red Sea and Western Indian Ocean to the Tuamotu Islands.

Porites (Porites) stephensoni Crossland, 1952

Synonymy

Porites stephensoni Crossland, 1952; Nemenzo (1955).

Porites haddoni Vaughan; *sensu* Stephenson (1931); Marshall & Stephenson (1933).

Material studied

Low Isles (6 specimens), **Palm Islands** (4 specimens).

These localities include collecting station 166.

Previous records from Eastern Australia

Low Isles, Crossland (1952).

Characters

Coralla are massive, hemispherical, spherical or columnar and are usually $<$ 10cm diameter. They have an irregularly humped or lobate surface. Calices are 0.8–1.2mm diameter. Corallites have thin walls, reduced to a ridge composed of laterally flattened denticles. Septa are thin and short (approximately $\frac{1}{2}$R), the triplet and dorsal directive septum being shorter than the lateral pairs. A full set of pali are usually present, although those of the triplet and dorsal directives may be small or absent. All have vertical inner margins plunging into the central fossa.

The upper margins of all septa bear one denticle which is remote from the palus and is sometimes embedded in the wall structure. Usually pali are more prominent than the denticles. Two synapticular rings are present, sometimes incomplete. The outer one is close to the wall below the septal granules, the inner one is below the pali. The columellar fossa is deep and columellae are absent or occur only as a deep-seated, single, smooth granule, connected by a variable number of radii to the septa.

Affinities

Porites stephensoni and *P. murrayensis* are both typically reef flat species; both have short septa, triplets with free margins and little or no columellae. However, the two species are readily separable by *P. stephensoni* having thin, ridge-shaped walls and more prominent pali.

Distribution

Recorded from the Great Barrier Reef and the Philippines.

Figs. 33–36 *Porites stephensoni*
Figs. 33, 34 Holotype from Low Isles (× 1 and × 5 respectively).
Figs. 35, 36 Both from Low Isles (× 25).

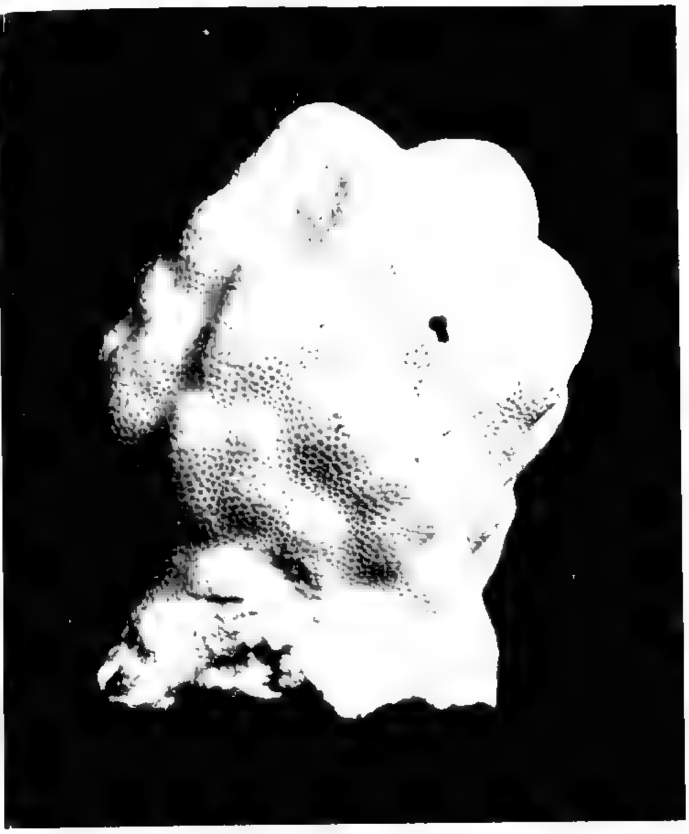
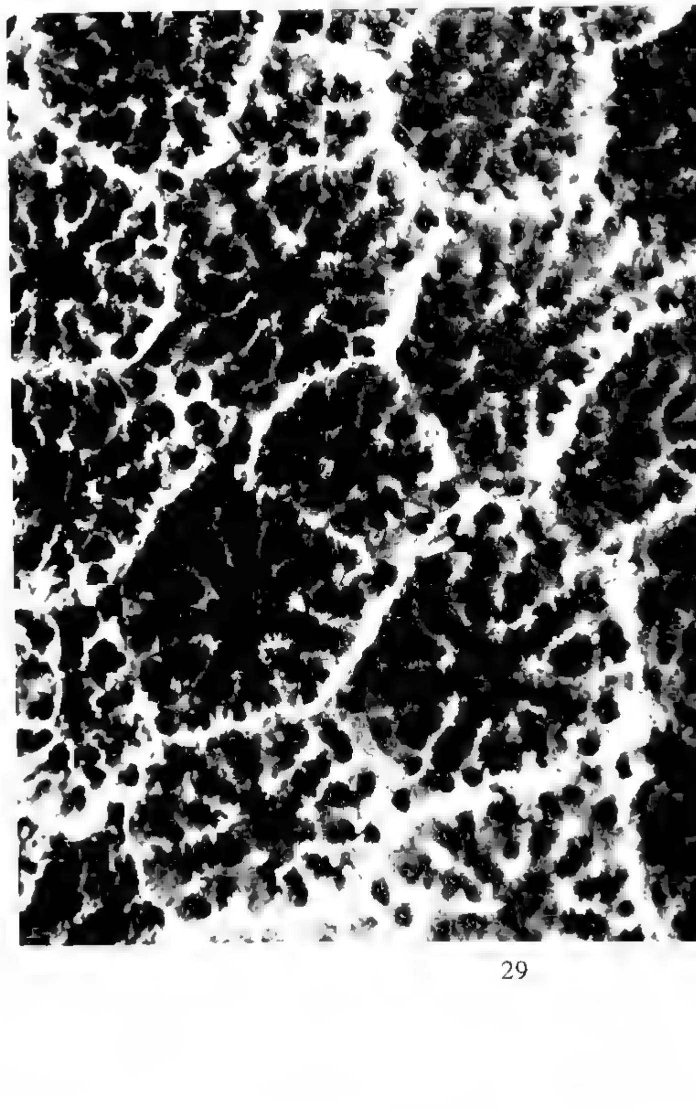


Fig 33▲

Fig 34▲

Fig 35▼

Fig 36▼



Porites (Porites) mayeri Vaughan, 1918

Synonymy

Porites mayeri Vaughan, 1918; Mayor (1918).

Material studied

Murray Islands, Sue Island, Great Detached Reef (3 specimens), **Tijou Reef, Corbett Reef, Yonge Reef, Lizard Island** (10 specimens), **Wheeler Reef, Pandora Reef, Magnetic Island** (2 specimens), **Darley Reef, Pompey Reef, Palmaise Reef, Llewellyn Reef**.

These localities include collecting stations 1, 2, 5, 9, 22, 28, 72, 164, 171, 182, 196, 198.

Previous records from Eastern Australia

Murray Islands, Vaughan (1918); Mayor (1918); **Low Isles,** Yonge (1940).

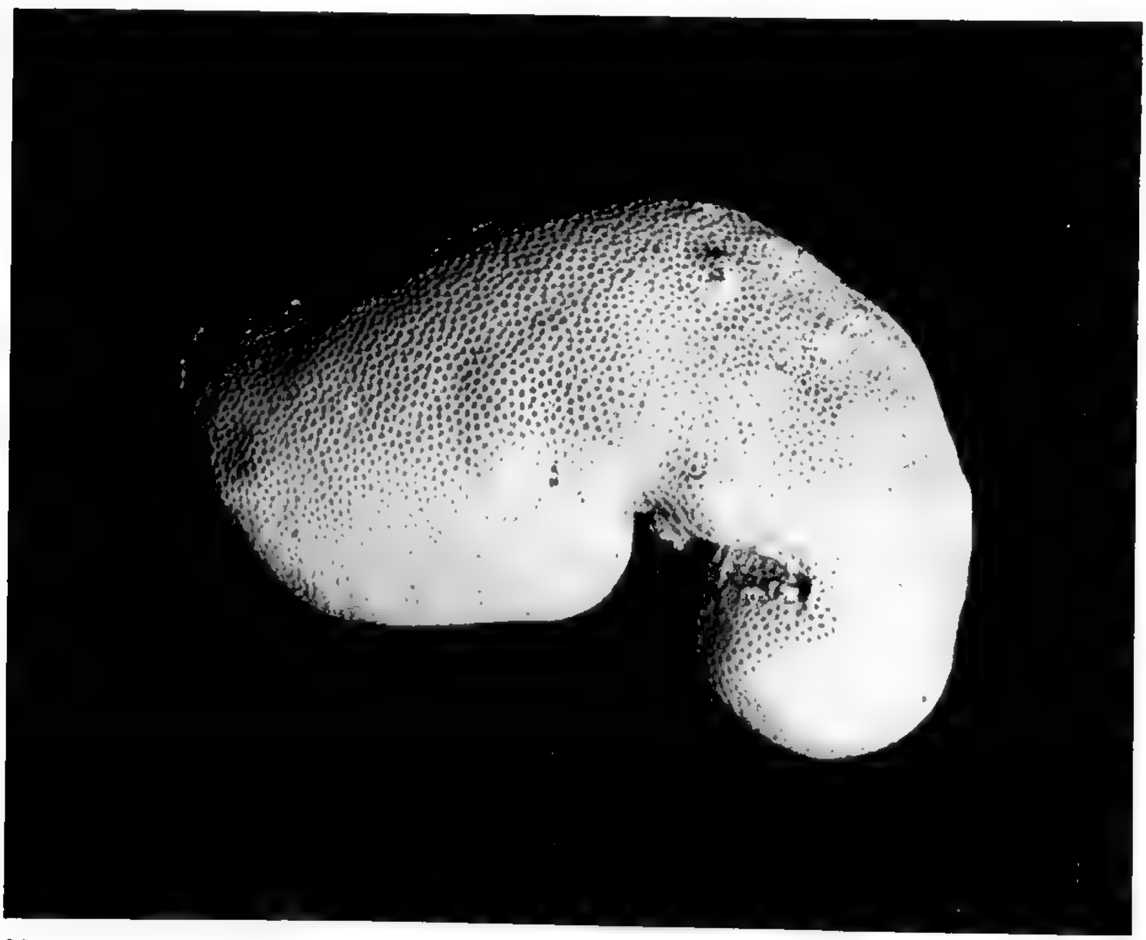
Characters

All coralla of the present series are small, although this species may form large colonies. Coralla are massive with a smooth, even surface or have an irregular humped or lobate surface (similar to the holotype). Corallites are evenly distributed and are separated by approximately 1 calice diameter. The walls have vertical sides and rounded tops, sometimes with 3 rows of denticles distinguishable. Calices are 0.8–1.1mm diameter. Septa do not reach

Figs. 37–40 *Porites mayeri*

Fig. 37 From Magnetic Island (× 0.6).
Fig. 38 From Darley Reef (× 0.6).
Fig. 39 From Darley Reef, same corallum as Fig. 38 (× 5).
Fig. 40 From Lizard Island (× 5).

Fig 37▼



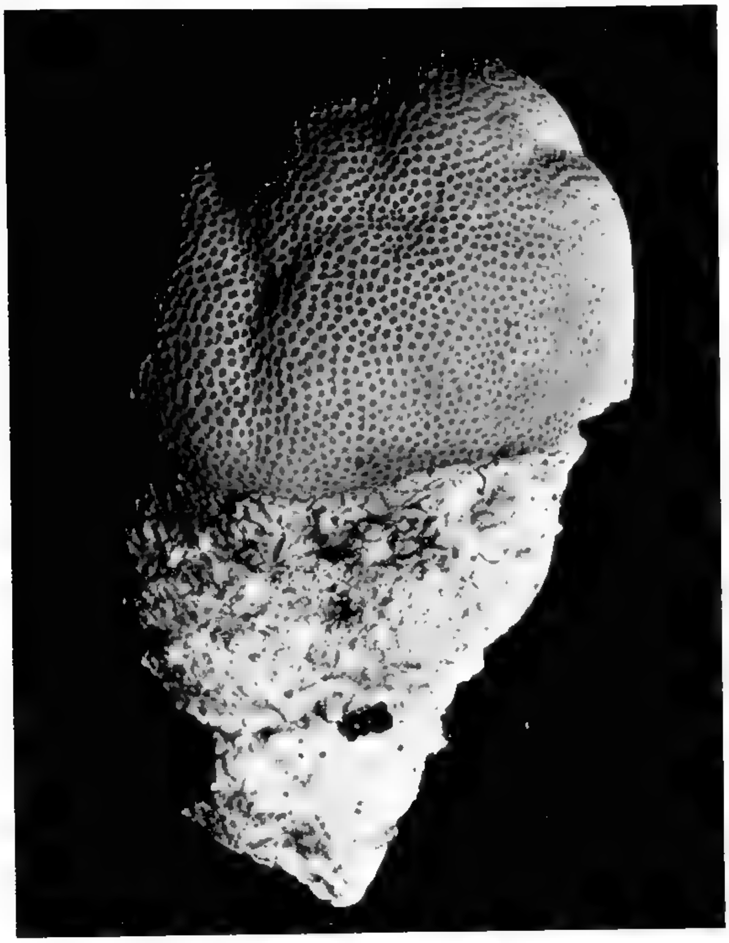


Fig. 38▲

Fig. 39▼

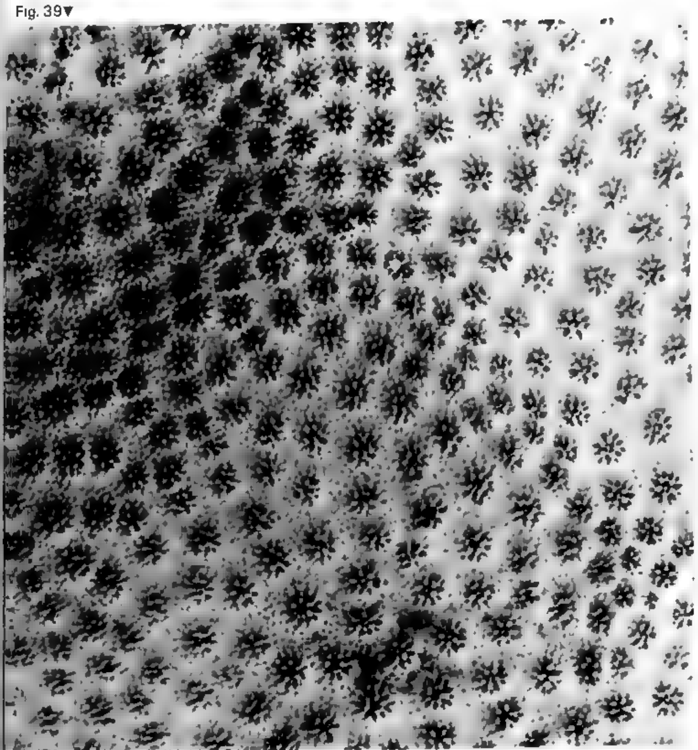
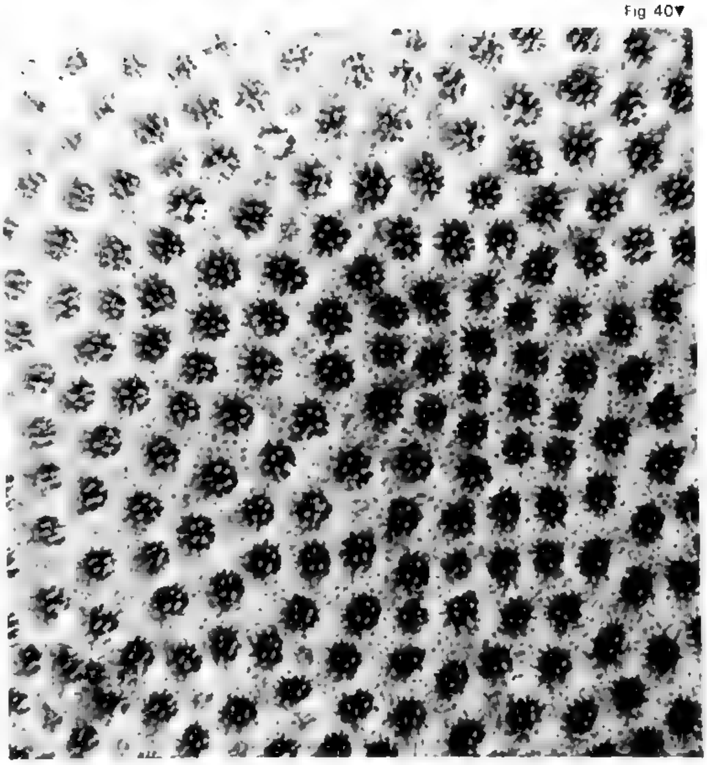


Fig. 40▼



the tops of walls. They are thin and very irregular in number so that the *Porites* pattern of fusion may not be recognisable. Usually the triplet is not fused or fused only deep within the calice. Pali are tall and very prominent. One is usually developed on each lateral pair, a fifth may develop on the dorsal directive and, rarely, three small pali can be developed on the ventral triplet. Septal denticles are absent, or one per septum is situated against the wall. Columellae are small, style-like, or absent. The palar synapticular ring is prominent and usually complete, the outer synapticular ring is hardly discernible.

Skeletal variation

Corallites vary in size according to the degree of exposure of the colony to wave action, the greater the exposure the smaller the corallites. Small corallites tend to have a reduced septation so that only the dorsal directive and 1 or 2 lateral pairs may be clearly developed. Pali are correspondingly reduced in number but not in size. However, most coralla have corallites which fall within the range of variation described above and many have corallites with a full complement of septa and pali.

Affinities

Porites mayeri shows greatest superficial similarity with *P. stephensoni* and *P. densa*. *Porites stephensoni* has thinner walls and a better defined septal pattern with a full set of pali usually present. *Porites densa* has larger more deeply excavated corallites with thicker walls, thicker septa and less well developed pali.

Distribution

Known only from the Great Barrier Reef.

Figs. 41, 42 *Porites mayeri*, same corallum from Gould Reef (× 25 and × 50 respectively).

Fig. 41▼

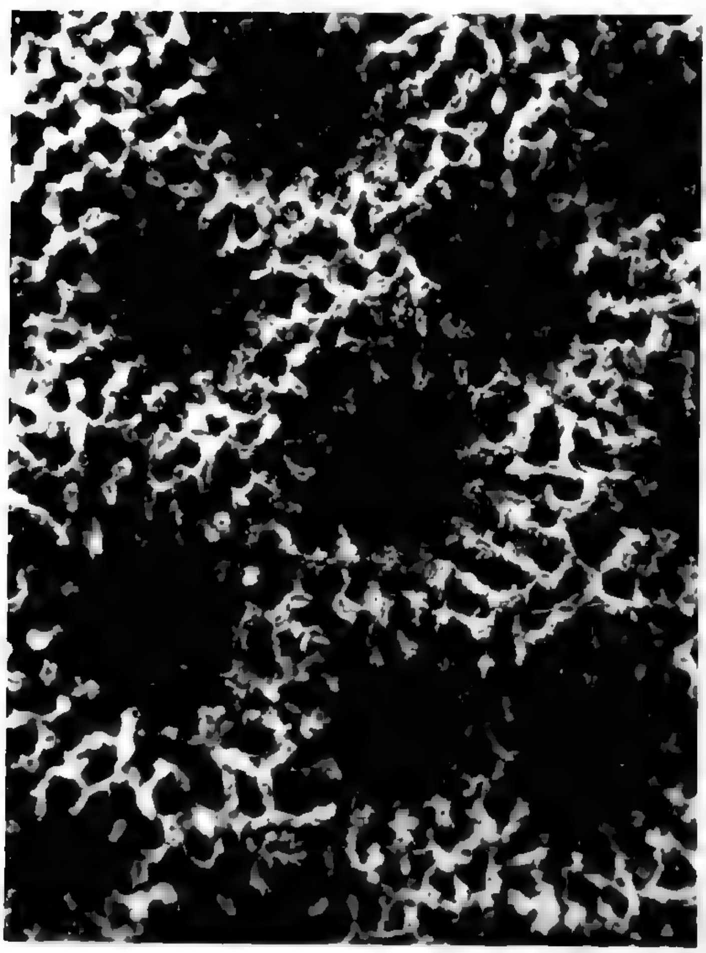


Fig 42▼

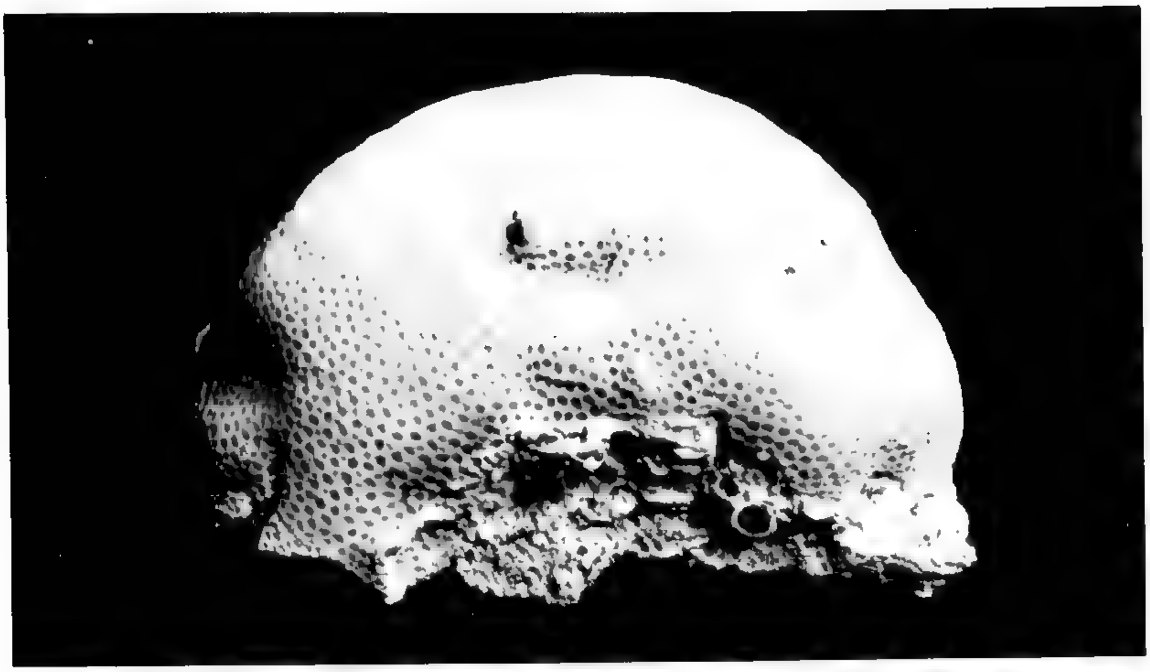


Fig. 43 *Porites densa* from Great Detached Reef, collecting station 5 (× 0.75).

Porites (Porites) densa Vaughan, 1918

Synonymy

Porites densa Vaughan, 1918; Crossland (1952).

Vaughan's type specimen is at the extreme of the range of variations of this species, especially as no pali are developed.

Material studied

Little Mary Reef, Triangle Reef, Great Detached Reef (11 specimens), **Jewell Reef** (2 specimens), **Bewick Island, Lizard Island, Britomart Reef, Pompey Reef, Bushy Island-Redbill Reef**.

These localities include collecting stations 1, 5, 18, 75, 86, 157, 168, 186.

Previous records from Eastern Australia

Murray Islands, Vaughan (1918); **Low Isles**, Crossland (1952).

Characters and skeletal variations

Coralla are massive, hemispherical to spherical. They have an even surface, usually with low humps several cm across and are usually <15cm diameter. Calices are up to 2mm diameter and are sunk in deeply excavated pits. They are approximately 2mm apart, the thick walls being composed of a reticular, evenly convex coenosteum. Septa are usually short and thick, plunging very steeply into the central fossa with septal processes forming thick spines projecting horizontally or obliquely towards the corallite centre in a *Montipora*-like manner. Septa of the triplet have free margins. Occasionally one member of the triplet, or of a lateral pair may be absent. Fusion of the two septa of each lateral pair may be achieved only deep within the calicular fossa. The outer synapticular ring is adjacent to the wall. The palar synapticular ring is usually incomplete. Pali are indistinct or are slightly developed, in which case they are on the lateral pairs. Columellae are absent, the deep calicular fossa being filled by septa and their denticles. Some corallites have septa arising well below the calicular margin and sloping gently, almost to the corallite centre. These septa are usually wedge-shaped, with pali present on the lateral pairs. Corallites at the base of most coralla are usually very distinctive with wedge-shaped septa and 8 well-developed pali. Adjacent corallites may be separated by low narrow walls and sometimes corallites form short straight series, sunk below the surface of the corallum.

Fig 44▲

Fig 46▼

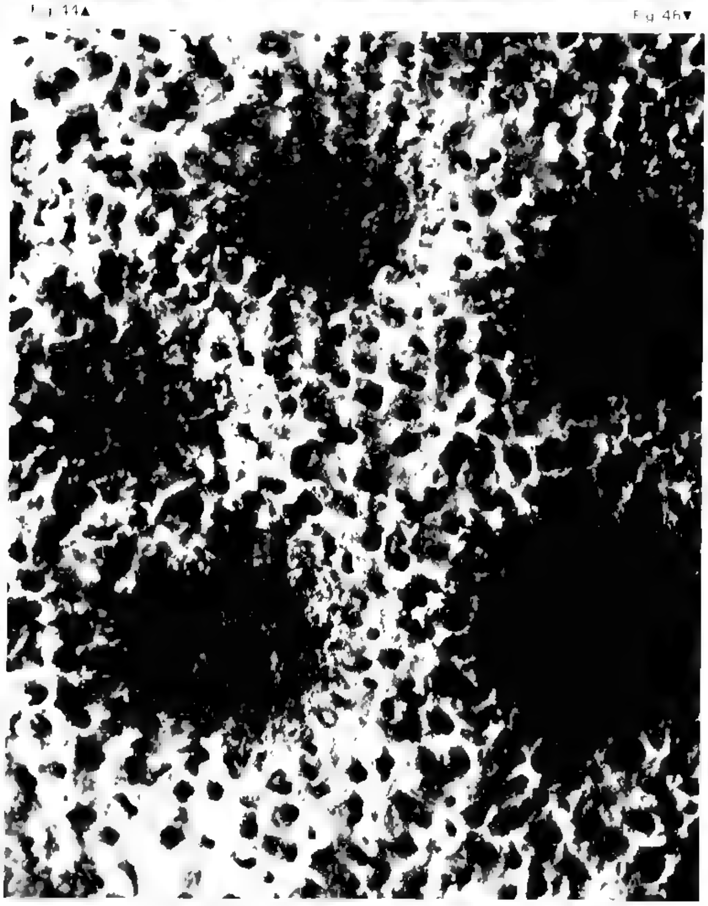


Fig 45▲

Fig 47▼

Affinities

Porites densa is very close to *P. mayeri* and also *P. lichen*, which it resembles when corallites form short series (see p. 46). *Porites densa* is primarily distinguished from *P. mayeri* by its invariably massive growth form and deeply excavated corallites with thick walls. It usually has less well-developed pali, although these are seldom completely absent, as in Vaughan's type.

Distribution

Recorded only from the Great Barrier Reef.

Porites (Porites) cylindrica Dana, 1846

Synonymy

Porites cylindrica Dana, 1846; Rathburn (1887); Rehberg (1892); Bernard (1905); Vaughan (1918); Matthai (1923); Eguchi (1938); Chevalier (1968); Veron (1981).

Porites levis Dana, 1846; Edwards & Haime (1851, 1860); Ortmann (1888); Bernard (1905).

Porites capricornis Rehberg, 1892; Eguchi (1938); Umbgrove (1940).

Porites andrewsi Vaughan, 1918; Hoffmeister (1925); Thiel (1932); Yabe & Sugiyama (1932, 1935); Eguchi (1938); Umbgrove (1939); Crossland (1952); Wells (1954); Stephenson & Wells (1955); Pichon (1964, 1978); Utinomi (1971); Pillai (1972); Pillai & Scheer (1973, 1976); Zou (1975); Faure (1977).

'*Porites* Fiji 1'; Bernard (1905).

'*Porites* Palau 1'; Bernard (1905).

'*Porites* Solomon Islands 9'; Bernard (1905).

'*Porites* Great Barrier Reef 12, 18, 25, 27, 37, 42' Bernard (1905).

Although this species is generally known as *P. andrewsi*, the type specimen of *P. cylindrica* clearly falls within its range of variation. The only significant difference cited by Vaughan is that the septal denticles of *P. cylindrica* are smaller and not arranged in conspicuous rings. This often occurs in the present series and is related to differences in degree of calcification (Vaughan's specimens were all from the reef flat of Maer Island).

Porites capricornis Rehberg was separated from *P. andrewsi* primarily by differences in growth form. Umbgrove's (1940) specimen of *P. capricornis* shows calicular structures very similar to Vaughan's description of *P. andrewsi*.

Porites decipiens Brüggemann may also be this species, but the type specimen has not been re-examined in this study.

The type specimen of *P. cylindrica* shows a slight thickening of the horizontal elements and inconspicuous pali. Septal ends of the triplet often fuse together, sometimes with the ventral directive connected to a flattened columellar plate. Such a structure is also present in a number of specimens of the present series.

Material studied

Murray Islands, Sue Island (2 specimens), **Bird Island** (3 specimens), **Great Detached Reef, Corbett Reef, Bewick Island** (3 specimens), **Houghton Island** (9 specimens), **Yonge Reef** (2 specimens), **Nymph Island, Lizard Island** (12 specimens), **Low Isles** (7 specimens), **Britomart Reef, Palm Islands** (66 specimens),

Figs. 44–47 *Porites densa* (× 25)

Figs. 44, 45 From Great Detached Reef, same corallum as Fig. 43.
Fig. 46 From Great Detached Reef, collecting station 1.
Fig. 47 From Great Detached Reef, collecting station 5.

Fig. 48▲

Fig. 49▲

Fig. 50◀

Magnetic Island (29 specimens), **Darley Reef**, **Whitsunday Islands**, **Parker Reef**, **Pompey Reef** (3 specimens), **Bushy Island-Redbill Reef** (3 specimens), **Swain Reefs** (9 specimens), **Fitzroy Reef** (3 specimens).

These localities include collecting stations 11, 16, 17, 18, 28, 34, 37, 40, 41, 42, 43, 45, 55, 57, 59, 67, 69, 72, 73, 75, 76, 79, 81, 89, 90, 164, 167, 182, 191, 197.

Previous records from Eastern Australia (as *Porites andrewsi*).

Murray Islands, Vaughan (1918); **Low Isles**, Yonge (1940), Crossland (1952), Stephenson & Wells (1955); **Bushy-Redbill Reef**, Wallace & Lovell (1977); **Heron Island**, Stephenson & Wells (1955).

Figs. 48–50 *Porites cylindrica* (× 0.5)
Figs. 48, 49 From Eclipse Island, Palm Islands, collecting station 59.
Fig. 50 From the Swain Reefs, collecting station 69.

Figs. 51, 52 *Porites cylindrica* (× 25)
Fig. 51 From Bushy Island-Redbill Reef, collecting station 73.
Fig. 52 From Lizard Island, collecting station 11.

Fig 51▼

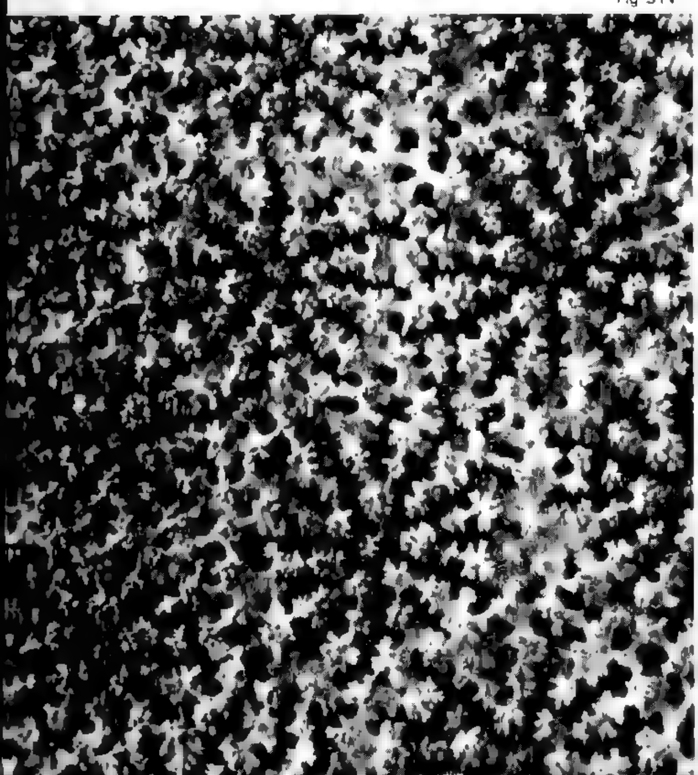
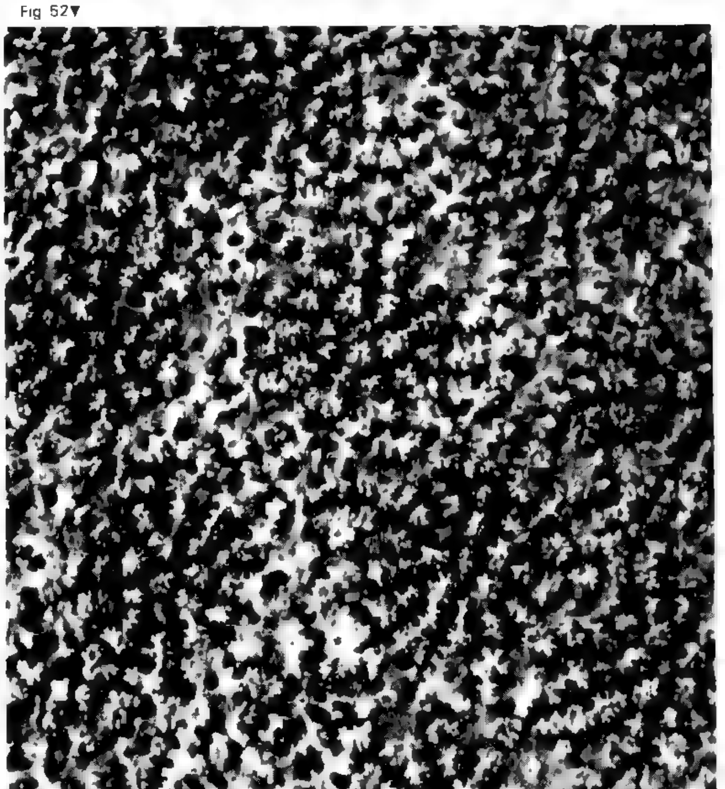


Fig 52▼



Characters

Colonies are branching, sometimes with an encrusting or massive base and may be very large (>10m diameter). They may have long thick branches dividing almost at right angles to give a lax, open appearance or have shorter branches dividing at acute angles giving a compact, bushy appearance. Branches are usually <30cm long and <40mm in diameter near their base. They are generally cylindrical and taper evenly towards their tips, which are blunt or conical or are flattened where a branch division is forming. They may anastomose. Some colonies infected with parasitic cirripeds have crooked or nodular branches.

Corallites are very superficial, flush with the corallum surface. The maximum diameter of calices is 1.5mm and the distance between corallites is up to 7 calice diameters but is usually less. Corallite walls are ill-defined, without ridges. Septa are generally thick, triangular or wedge-shaped, and extend almost to the centre of the corallites, leaving only a narrow central fossa.

The ventral triplet is usually fused, the ventral directive being smaller than the two laterals. Pali are well developed; those on the lateral pairs being larger than those on the directives. As noted by Vaughan (1918), the palus on the dorsal directive is similar to the intermediate denticles of the other septa and the denticles on the triplet may be larger than the ventral palus. More often, however, the lateral septa of the triplet each have pali while the smaller ventral directive has not. All septa have two denticles between the pali and the wall. Two synapticular rings are usually present, the palar ring and a second ring below the outer row of denticles. Columellae are well developed and almost as tall as the pali.

Living colonies have a very wide range of colours, especially those occurring in shallow water. Yellows, blues and greens are the most common.

Affinities

The only other branching *Porites* from eastern Australia is *P. nigrescens*, which is readily distinguished from *P. cylindrica* by having more excavated and more compacted corallites and the presence of only one concentric circle of septal denticles.

Distribution

Widely distributed throughout the tropical Indo-Pacific from Madagascar and the Mascarene Archipelago to the South China Sea, Samoa, Tonga and the Marshall Islands.

Porites (Porites) nigrescens Dana, 1848

Synonymy

Porites nigrescens Dana, 1848; Edwards & Haime (1851, 1860); Rathburn (1887); Rehberg (1892); Bernard (1905); Vaughan (1918); Faustino (1927); Yabe & Sugiyama (1932, 1935); Eguchi (1938); Umbgrove (1940); Nemenzo (1955); Searle (1956); Ma (1959); Pichon (1964, 1978); Zou (1975); Faure (1977).

Porites saccharata Brüggemann (1878); Studer (1880); Ortmann (1888); Bernard (1905).

Porites suppressa Crossland, 1952; Scheer & Pillai (1974).

'*Porites* Fiji 8'; Bernard (1905).

'*Porites* Tonga 10'; Bernard (1905).

'*Porites* Singapore 7'; Bernard (1905).

Porites suppressa Crossland, 1952 falls well within the range of variation of *P. nigrescens*, as suggested by Wells (1954). The holotype of *P. suppressa* shows the same thickening of the horizontal elements as that of *P. nigrescens*, and some corallites have a complete palar formula, with eight conspicuous pali.

Fig. 53 *Porites cylindrica* (above) and *Porites nigrescens* (below) at Lizard Island, collecting station 11.

Material studied

Yorke Island (2 specimens), **Little Mary Reef** (11 specimens), **Murray Islands** (10 specimens), **Sue Island** (2 specimens), **Bird Island** (2 specimens), **Raine Island** (2 specimens), **Tijou Reef** (3 specimens), **Corbett Reef** (4 specimens), **Jewell Reef** (4 specimens), **Bewick Island** (6 specimens), **Yonge Reef** (2 specimens), **Nymph Island** (4 specimens), **Lizard Island** (29 specimens), **Hope Island** (2 specimens), **Willis Islet** (2 specimens), **Magdelaine Cay** (2 specimens), **Britomart Reef** (4 specimens), **Palm Islands** (14 specimens), **Magnetic Island** (7 specimens), **Pompey Reef** (3 specimens), **Swain Reefs** (9 specimens).

These localities include collecting stations 2, 11, 13, 17, 18, 26, 27, 30, 41, 55, 72, 76, 77, 90, 151, 156, 164, 167, 185, 199, 200.

Previous records from Eastern Australia

Low Isles (as *Porites suppressa*) Crossland (1952).

Fig. 54▲

Fig. 55◄

Fig. 56►

Fig. 57◄

Fig. 58◄

Characters

Colonies are branching, sometimes with an explanate or encrusting base. Branches are cylindrical or slightly compressed laterally and gradually taper from near the base which is <25mm thick, to the tip which is usually acute. Branch tips are flattened when branching is commenced. In most colonies branches are compact and straight, dividing at acute angles and frequently anastomosing. Some colonies have a more lax, *P. cylindrica*-like growth form, with less acute angles of branching.

Calices are <1.5mm diameter. They are usually slightly excavated, polygonal in outline and are separated by a thin wall or ridge of coenosteum into which they are slightly sunk. The distance between them is less than 1.5 calice diameters. Septa are thick, triangular in outline and wedge-shaped and extend almost to the corallite centre. Those of the ventral triplet are usually free but may be fused, especially in specimens with greatly thickened horizontal elements (including the type). Pali are thick and well developed, particularly those of the lateral pairs, which may be large and very conspicuous. A palus is usually present on the triplet only when the septa are fused. The palar synapticular ring is well developed although often incomplete. Septa have only one denticle, close to the wall, giving a distinctly crenellated appearance to the upper septal margin. The central fossae are deep.

Figs. 54–58 *Porites nigrescens* (× 0.95)

Fig. 54 From Magdelaine Cay.
Fig. 55 From Lizard Island, collecting station 11.
Fig. 56 From Maer Island, Murray Islands, collecting station 26.
Fig. 57 From Magdelaine Cay, collecting station 200.
Fig. 58 From Thursday Island, collecting station 54.

Figs. 59, 60 *Porites nigrescens* from Lizard Island (× 25 and × 5.0 respectively).

Fig 59▼

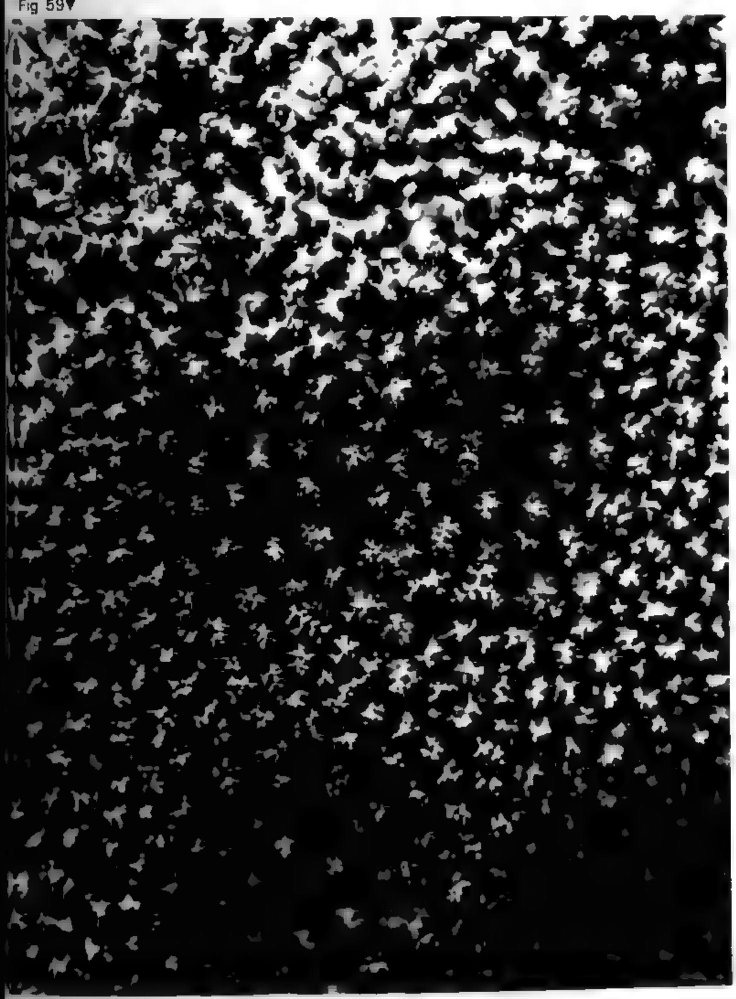
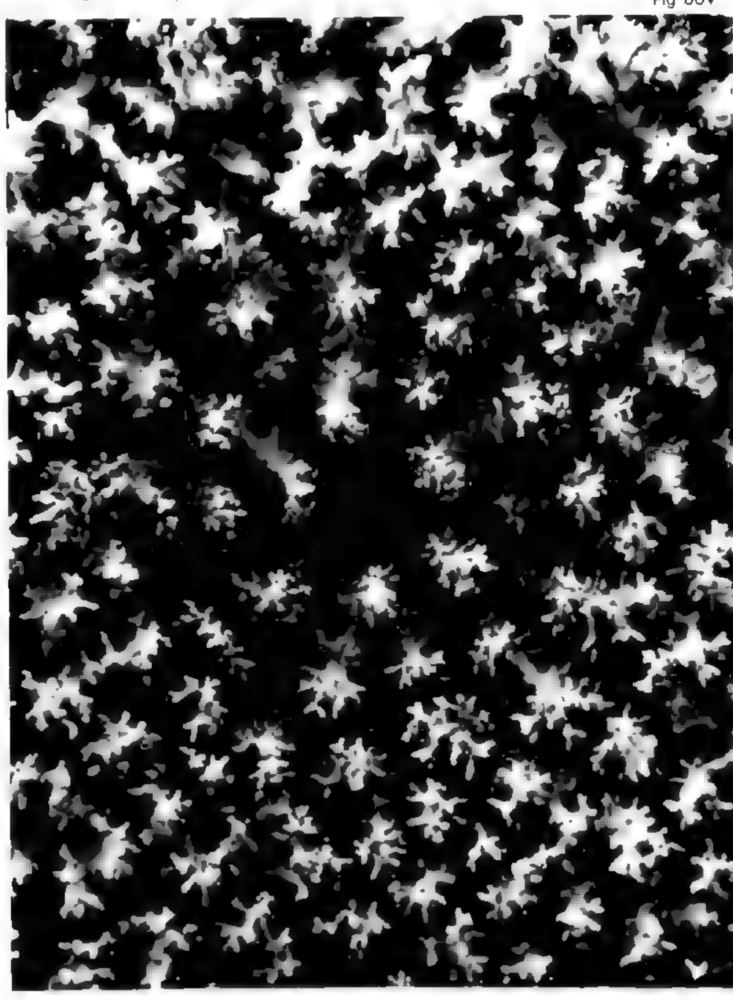


Fig 60▼



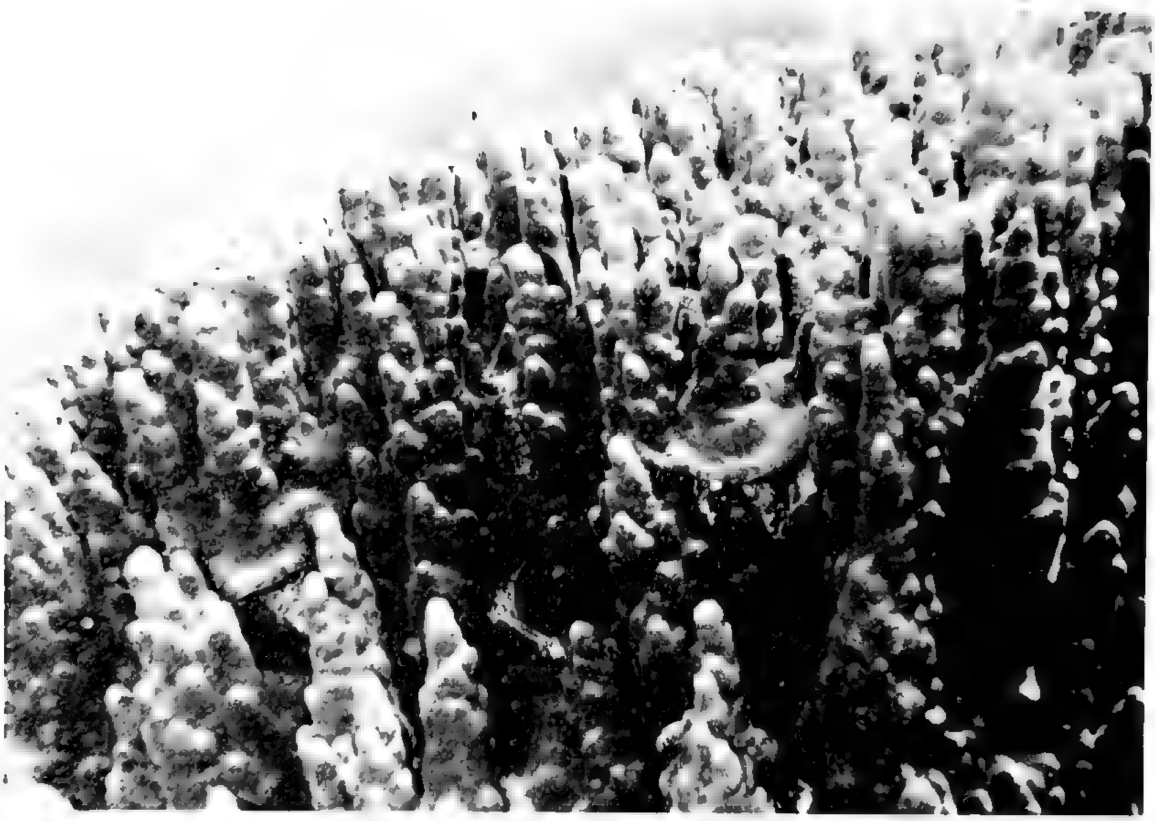


Fig 61▲

Figs. 61, 62 *Porites lichen* from Lord Howe Island, collecting station 143 and 145 respectively.

Fig. 62▼

Columellae are irregularly developed and may have deep styliform or granular processes or be composed of laterally compressed, twisted laminae.

Living colonies are usually cream or brown. Polyps are frequently extended during the day.

Affinities

Porites nigrescens resembles only *P. cylindrica*, from which it is readily distinguished by its more compacted, excavated corallites and by the presence of a single septal denticle.

Distribution

Widely distributed throughout the tropical Indo-Pacific from Madagascar and the Mascarene Archipelago to the South China Sea, Fiji and Tonga.

Porites (Porites) lichen Dana, 1846

Synonymy

Porites lichen Dana 1846; Quelch (1886); Rathburn (1887); Whitelegge (1898); Bernard (1905); Vaughan (1907, 1918); Yabe & Sugiyama (1932, 1935); Wells (1954); Scheer (1964); Wells & Davies (1966); Eguchi (1968); Pillai (1978).

Goniopora ? lichen Edwards & Haime (1851, 1860).

Goniopora lichen Klunzinger, 1879.

Porites reticulosa Dana, 1846; Rathburn (1887); Bernard (1905); Vaughan (1907); Chevalier (1968).

Porites viridis Gardiner, 1898; Bernard (1905); Vaughan (1918); Eguchi (1938); Umbgrove (1940).

Porites purpurea Gardiner, 1898; Bernard (1905); Yabe & Sugiyama (1932, 1935).

Goniopora klunzingeri von Marenzeller, 1907.

Porites eridani Umbgrove, 1940; Pillai & Scheer (1974).

'*Porites* Fiji 16, 17, 18' Bernard (1905).

'*Porites* Great Barrier Reef 32 (*pars*)' Bernard (1905).

'*Porites* Ellice Islands 3' Bernard (1905).

The synonymy of *Porites lichen* has been discussed by Wells: *P. reticulosa*, *P. viridis* and *P. purpurea* are all synonyms of the one very variable species. *Porites mayeri*, however, is maintained as a separate species. The type of *P. lichen* is a small laminar plate with comparatively thin walls and straight series.

Figs. 63–66 *Porites lichen* (× 0.65)

Fig. 63 From Lord Howe Island, collecting station 145.
Fig. 64 From Great Detached Reef, collecting station 5.
Fig. 65 From Britomart Reef, collecting station 168.
Fig. 66 From Magnetic Island.

Figs. 67–72 *Porites lichen* (× 5)

Fig. 67 From Lord Howe Island, same corallum as Fig. 63, showing branch ends.
Fig. 68 From Yonge Reef.
Fig. 69 From Great Detached Reef, same corallum as Fig. 64.
Fig. 70 From Britomart Reef, same corallum as Fig. 65.
Fig. 71 From Great Detached Reef.
Fig. 72 From Magnetic Island, same corallum as Fig. 66.

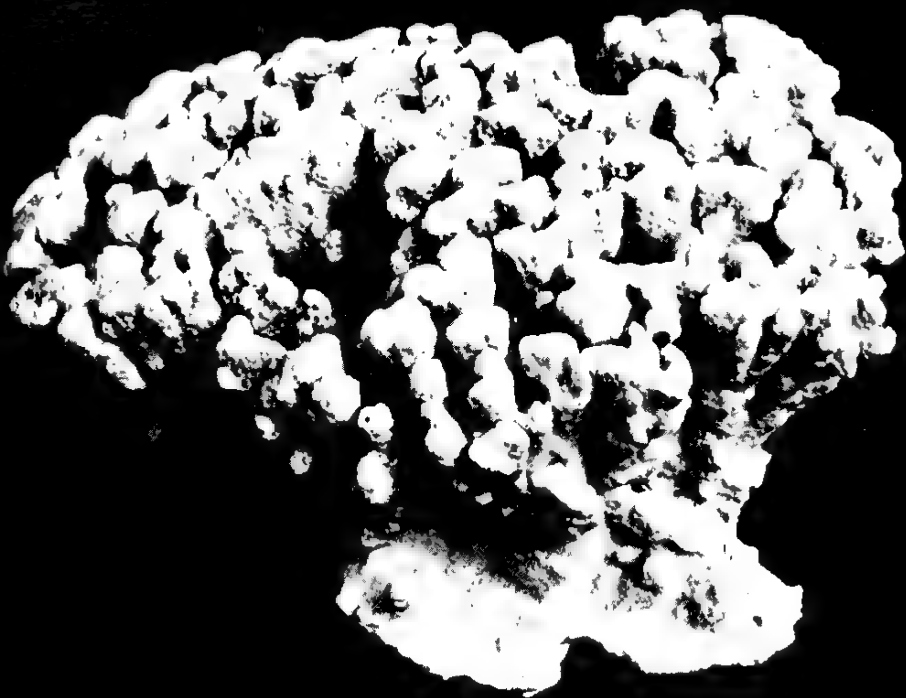


Fig. 63▲

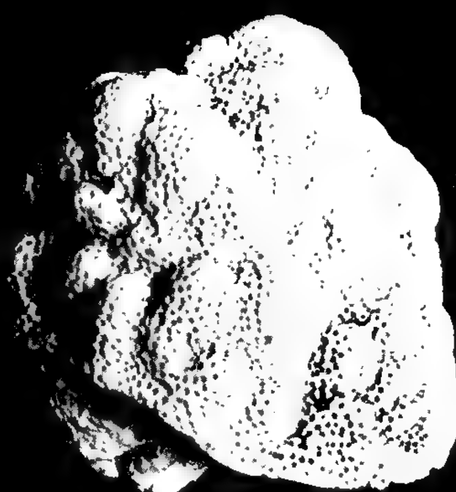


Fig. 64▲

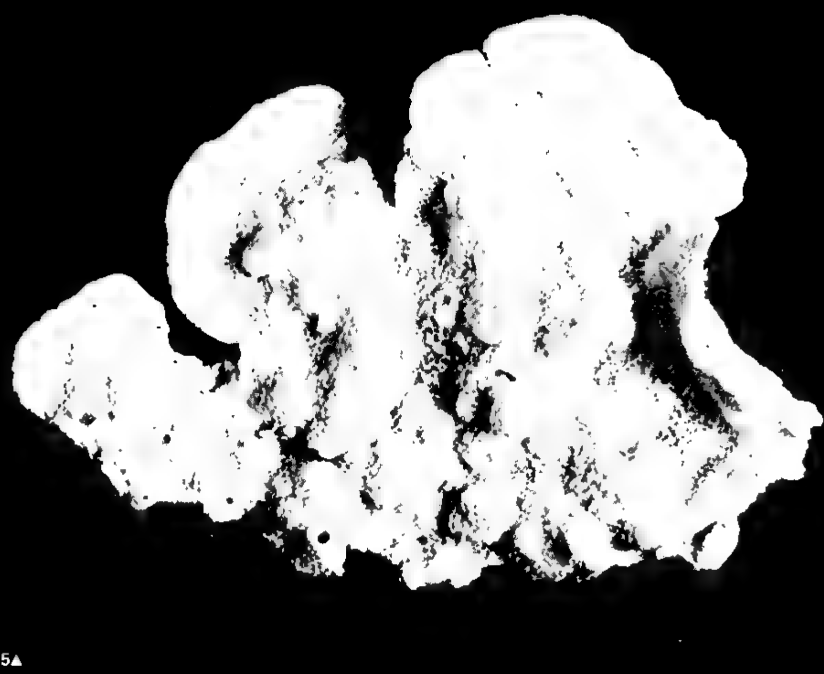
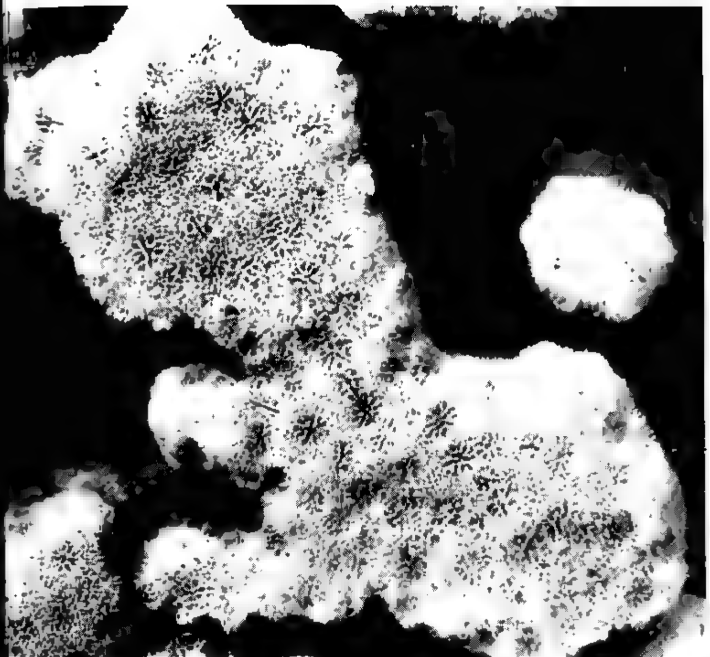
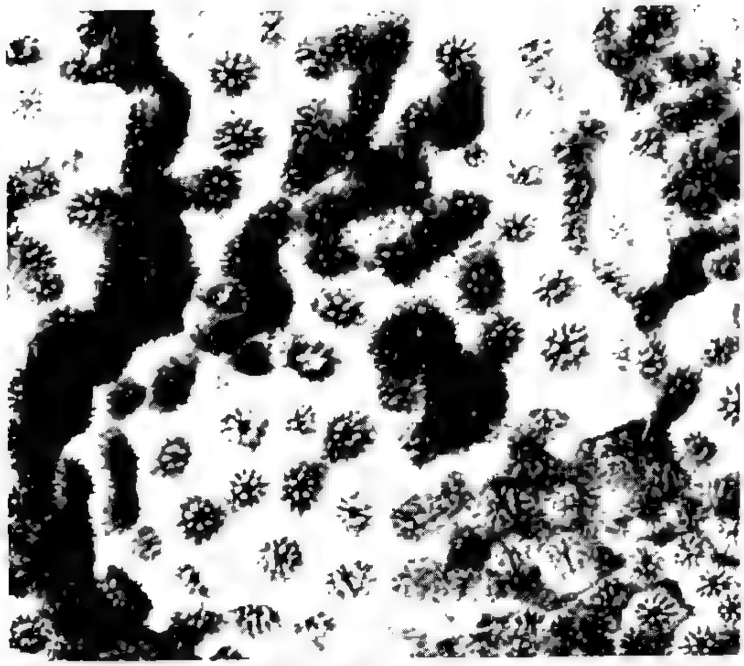


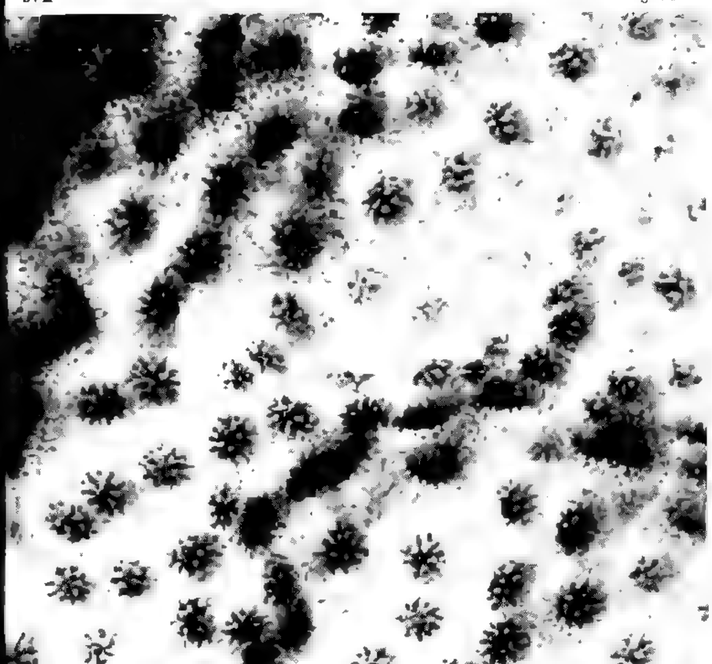
Fig. 65▲

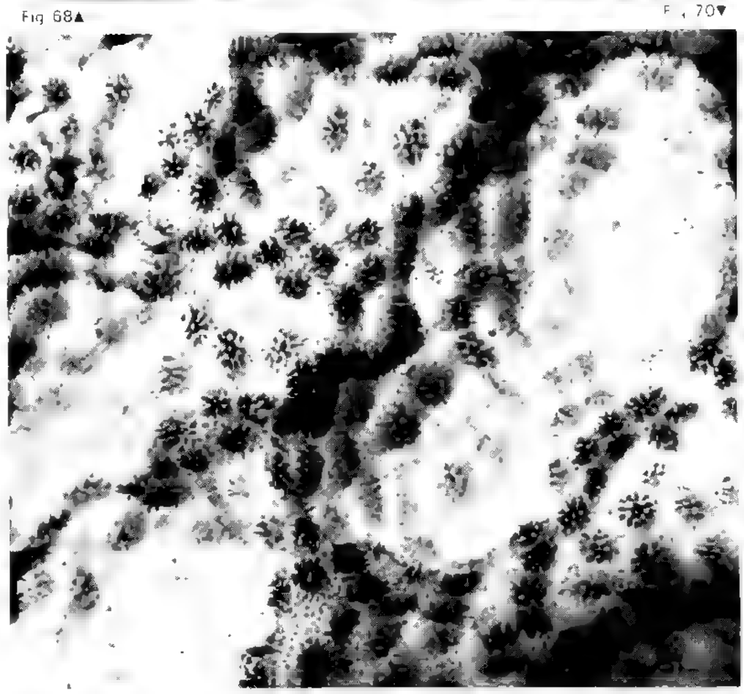
Fig. 66▲



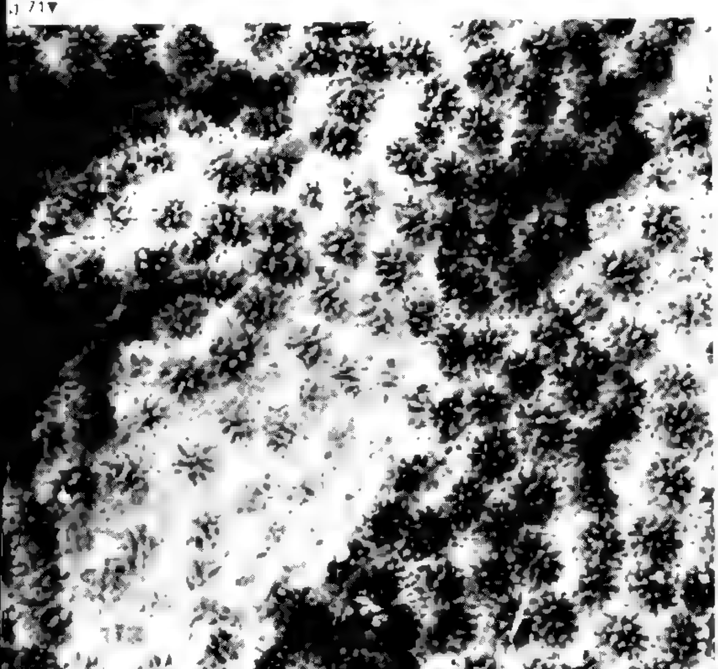


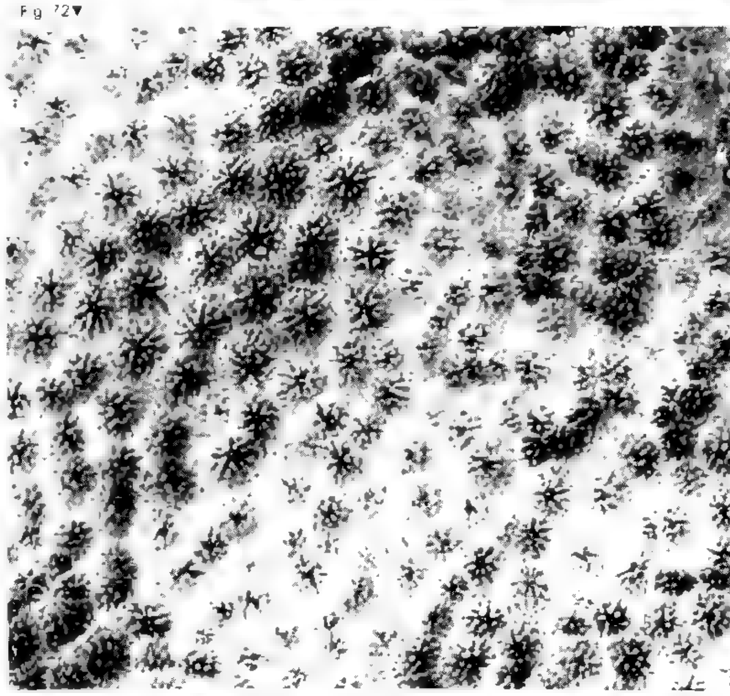
67▲ Fig 69▼ Fig 68▲ F , 70▼





.g 71▼ Fig 72▼





Material studied

Bramble Cay, Big Mary Reef, Yorke Island (4 specimens), **Little Mary Reef** (2 specimens), **Arden Island** (4 specimens), **Murray Islands** (5 specimens), **Dungeness Reef, Sue Island** (4 specimens), **North West Reef** (3 specimens), **Triangle Reef, Raine Island** (2 specimens), **Great Detached Reef** (2 specimens), **Sir Charles Hardy Islands, Martha Ridgway** (3 specimens), **Cat Reef, Tijou Reef** (7 specimens), **Corbett Reef, Bewick Island, Houghton Island, Yonge Reef, Lizard Island** (5 specimens), **Hope Island** (2 specimens), **Willis Islet** (7 specimens), **Low Isles** (2 specimens), **Lihou Reefs, Mellish Reef, Britomart Reef** (20 specimens), **Palm Islands** (30 specimens), **Pandora Reef** (9 specimens), **Chesterfield Atoll** (15 specimens), **Pompey Reef** (14 specimens), **Bushy Island-Redbill Reef** (20 specimens), **Swain Reefs** (5 specimens), **Fitzroy Reef** (21 specimens), **Lord Howe Island** (6 specimens).

These localities include collecting stations 2, 5, 8, 9, 13, 14, 17, 18, 26, 27, 28, 30, 34, 35, 36, 37, 41, 42, 43, 45, 55, 58, 67, 70, 72, 73, 76, 79, 80, 86, 91, 93, 103, 105, 122, 128, 131, 143, 145, 147, 148, 151, 154, 157, 164, 166, 167, 168, 169, 171, 172, 178, 179, 181, 183, 185, 186, 189, 190, 191, 197, 199, 200, 202, 207, 210, 211.

Previous records from Eastern Australia

Murray Islands, Vaughan (1918); **Bushy-Redbill Reef**, Wallace & Lovell (1977).

Characters and variations

Coralla have a very wide range of growth forms. They may form thin encrusting laminae, thick plates, or be sub-massive with columns or branches. Corallites characteristically form straight or contorted rows by intratentacular budding. Within each row, corallites are only separated by thin, low walls or by fused septa. Rows of corallites are separated by higher walls, which can be thin (as in foliate growth forms) but which are usually very thick, giving the corallum surface a smooth appearance. Calices are 0.9–1.4mm diameter.

The structure of corallites shows more variation than found in most *Porites* species and much of this variation is found in nearby corallites of the same corallum. Septa of the ventral triplet may have free or fused margins. Up to 8 pali may be present, although most coralla have 6 pali (on the 2 directives and the 4 lateral pairs), with those of the lateral pairs being relatively well developed. When the lateral septa of the triplet have free margins they may have pali; these are relatively small. Septa usually have a single denticle near the corallite wall. A palar synapticular ring and an outer ring are present, the latter sometimes fused into the wall. The central fossa is either empty or has a small columella connected to the lower septal margins by radii which often fuse into a plate.

Affinities

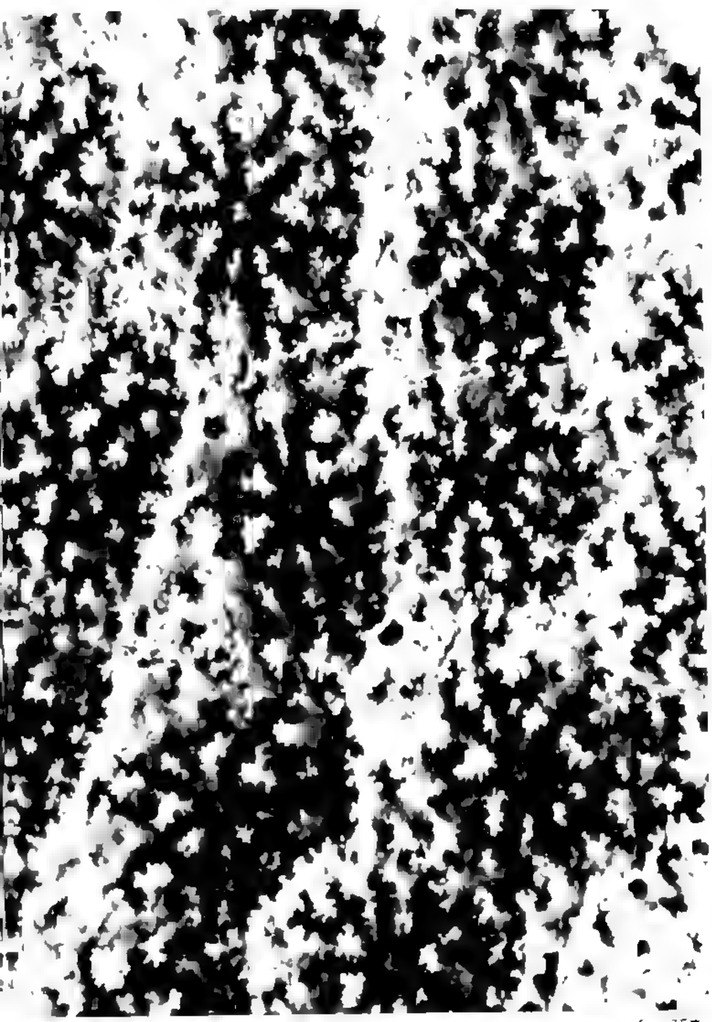
Porites lichen shows little affinity with any other species of *Porites* subgenus, except *P. annae* (p. 51), but the thickening of the walls, becoming reticular between the series, makes it somewhat a transition between the other species of the subgenus *Porites*, and the subgenus *Napopora*, especially *P. (N.) vaughani*.

Distribution

Widely distributed throughout the tropical Indo-Pacific from the Red Sea to the Ellice and Marshall Islands, Fiji and Samoa.

Figs. 73–76 *Porites lichen*

Fig. 73 From Britomart Reef, collecting station 167 (× 25).
Fig. 74 From Great Detached Reef, collecting station 5 (× 25).
Fig. 75 From Raine Island, collecting station 151 (× 30).
Fig. 76 From Yonge Reef (× 60).



ig 73▲

Fig 75▼

Fig 74▲

Fig 76▼

Fig. 77▲

Fig. 78▲

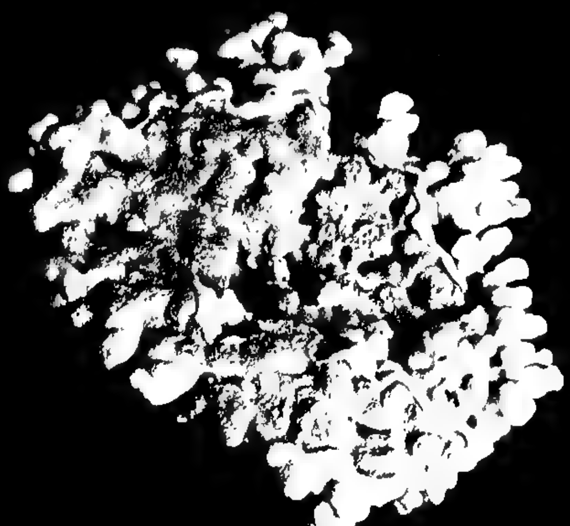


Fig. 79▲

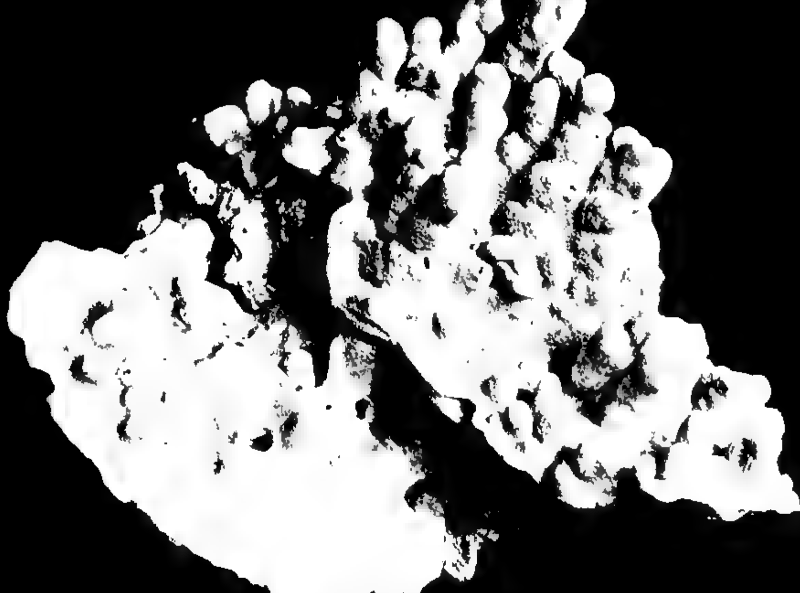


Fig. 80▲

Porites (Porites) annae Crossland, 1952

Synonymy

Porites annae Crossland, 1952.

'*Porites* Great Barrier Reef 1, 2, 26, 32 (*pars*) and 39', Bernard (1905).

Material studied

Sue Island (2 specimens), **Lizard Island, Hope Island, Low Isles, Palm Islands** (2 specimens), **Pandora Reef** (3 specimens), **Swain Reefs**.

These localities include collecting stations 17, 38, 45, 77, 172, 182.

Previous records from Eastern Australia

Thursday Island (as '*Porites* Great Barrier Reef 26') Bernard (1905); **Batt Reef,** Crossland (1952); **Bushy-Redbill Reef,** Wallace & Lovell (1977).

Characters

All coralla of the present series essentially consist of branches which usually anastomose, together with horizontal basal plates. Branches may be straight so that the corallum is composed of fused columns, but usually they are irregular, <20cm long.

Calices are 1.1–1.4mm diameter. As noted by Crossland, they have a variable septal configuration and it is not uncommon for adjacent corallites to have different numbers of pali or septal granules and different patterns of fusion of the triplet. Corallites with the most developed septal structures have an open triplet, each septum having a small palus. The dorsal septum has a larger palus and the lateral pairs have pali similar to, or larger than, those of the dorsal septum. Thus there are 5 large and 3 small pali. Some corallites have a palus on the central member of the triplet and these are similar in size to the pali on the other septa. Other corallites again have a fused triplet with only one palus. Pali are usually linked by the palar synapticular ring deep within the corallite. Most septa have 1 or 2 denticles, although this also varies within the same corallum. Columellae, when present, are short and like small pali.

Living colonies have no consistent colour patterns and may be dark or pale, irregular or uniform green, yellow, purple or brown.

Skeletal variation

Porites annae may develop into large monospecific stands on steeply sloping substrates protected from strong wave action. Coralla from turbid environments are predominantly plate-like (Fig. 77) with a few twisted branches. Corallites are relatively shallow and septa are thick, with the triplet usually fused.

Coralla from shallow water protected from strong wave action with good light availability primarily consist of short, anastomosed branches (Fig. 78). Corallites have thinner, more widely separated septa. The triplet is almost always open and consists of short septa, each with a palus.

Coralla from very shallow lagoons or intertidal flats where this species is abundant may form 'micro-atolls' (Fig. 79). Corallites have thin septa. The triplet is open, with a palus developed only on the central septum which is longer than the others. There are thus 5 or 6 pali, depending on whether the dorsal septum has one or not.

Figs. 77–80 *Porites annae* (× 0.45)

Fig. 77 From Ashmore Reef.
Fig. 78 From Fantome Island, Palm Islands, collecting station 43.
Fig. 79 From Houghton Island, collecting station 40.
Fig. 80 From the Palm Islands.

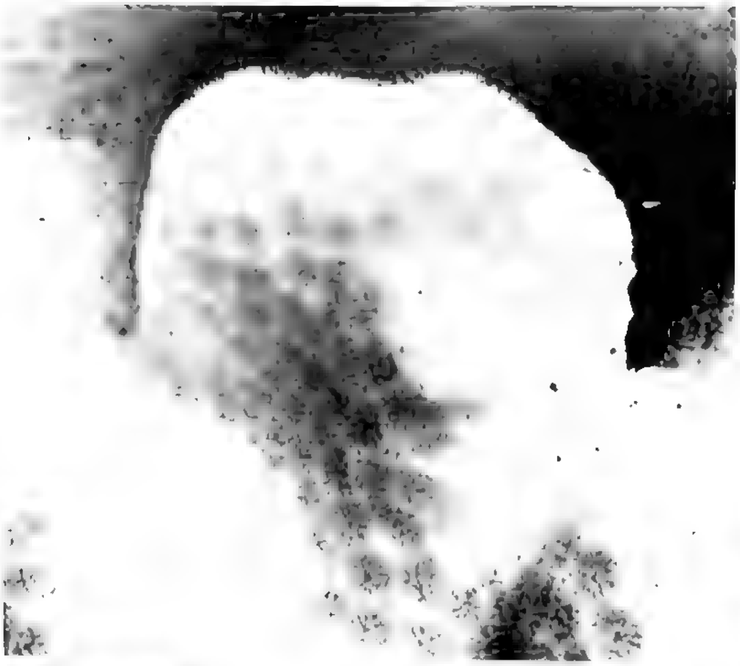


Fig. 81▲

Fig. 82▲

Fig. 83▼

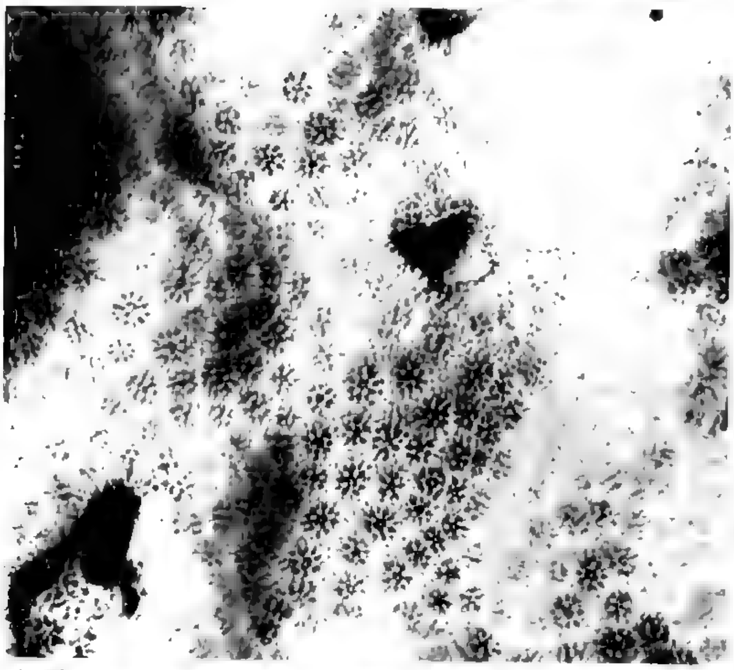


Fig. 84▼

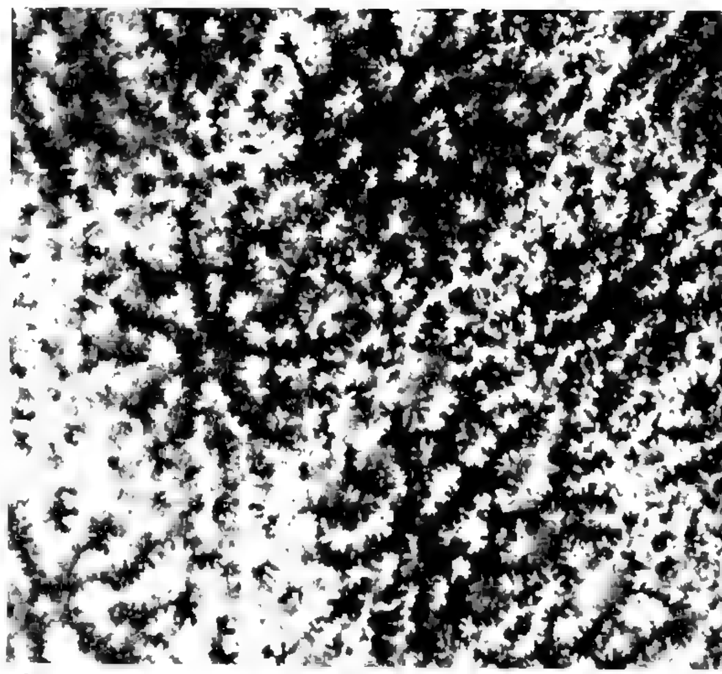


Fig. 85▼

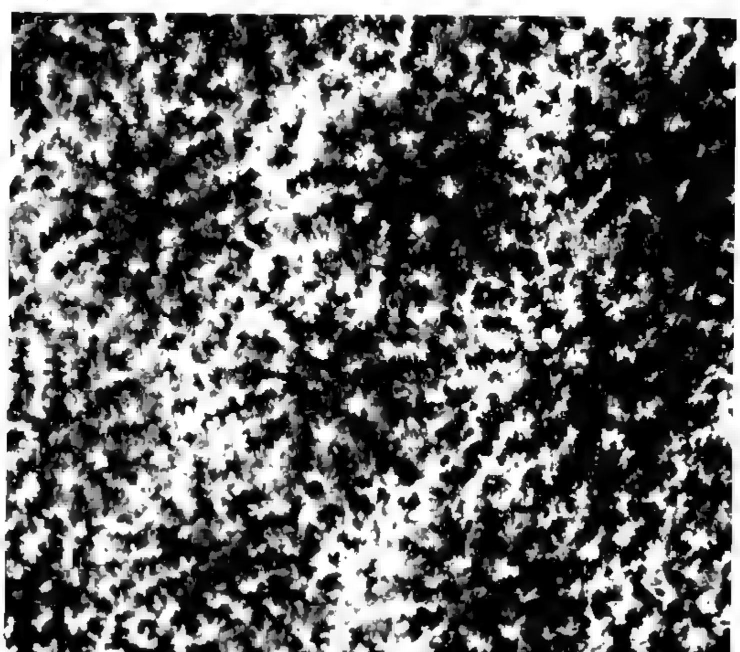
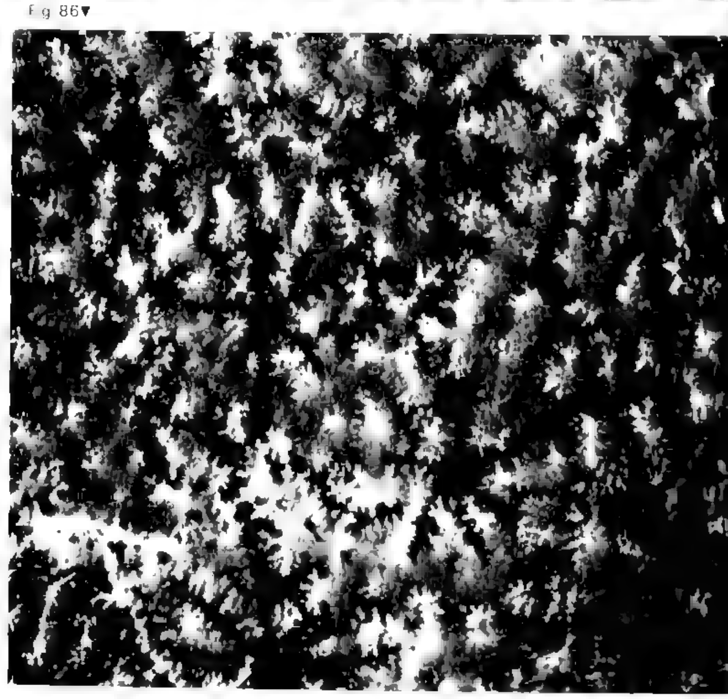


Fig. 86▼



Affinities

Porites annae has corallites similar in structure to those of *P. (N.) vaughani*, although these species are separated at subgeneric level. *Porites annae* does not have coenostial ridges separating corallites.

The growth forms of *P. annae*, although variable, are distinctive, allowing this species to be readily recognised *in situ*. It is closest to *P. lichen*, which is initially distinguished by its growth form and also by the even surface of the corallites which are not excavated as they are in *P. annae*. *Porites lichen* also tends to have larger corallites with a less distinguishable paliform crown.

Distribution

So far, *P. annae* is known only from Eastern Australia.

Porites (Porites) sp. 1

This species will be given a name after further study of relevant type specimens.

Material studied

Murray Islands, Triangle Reef, Great Detached Reef (3 specimens), **Martha Ridgway, Tijou Reef** (2 specimens), **Yonge Reef, Lizard Island, Willis Island** (14 specimens), **Magdelaine Cay** (9 specimens), **Pompey Reef, Swain Reefs**.

These localities include collecting stations 1, 2, 5, 6, 9, 11, 26, 76, 103, 105, 143, 157, 199, 200.

Characters

Coralla are massive with undulating or hillocky surfaces or are plate-like. Most massive coralla have a plate-like or encrusting periphery. Calices are deeply excavated and are 1.1–1.3mm diameter. The walls are 0.2–0.5mm thick. Corallites sometimes form a series through intratentacular budding, as described for *P. lichen*. Septa have a very uniform pattern. The septa of the triplet have free margins and each has small pali. The lateral pairs and dorsal septum each have large pali, making a total of 8 pali per corallite. Septa are long and usually thick and wedge-shaped. The palar synapticular ring is very well developed. A thick styliform columella is present in some corallites, absent in others.

The colours of living colonies have not been recorded.

Skeletal variation

Massive colonies of the present series closely resemble each other except for those where corallites form short series. Plate-like coralla usually have shallower corallites and thinner septa and pali. The columellae are also more conspicuous.

Affinities

In general appearance this species is close to *P. solida*, although the smaller corallites and the presence of pali clearly distinguish it. Structurally it is closest to *P. australiensis*, but is readily separated from it by its deeper corallites, its tendency to form series by intratentacular budding and by its very clearly defined septal pattern.

Figs. 81–86 *Porites annae* (Figs. 81–83, × 5 Figs. 84–86, × 35)

Fig. 81 From Ashmore Reef, same corallum as Fig. 77.

Fig. 82 From Fantome Island, Palm Islands, same corallum as Fig. 78.

Fig. 83 From Houghton Island, same corallum as Fig. 79.

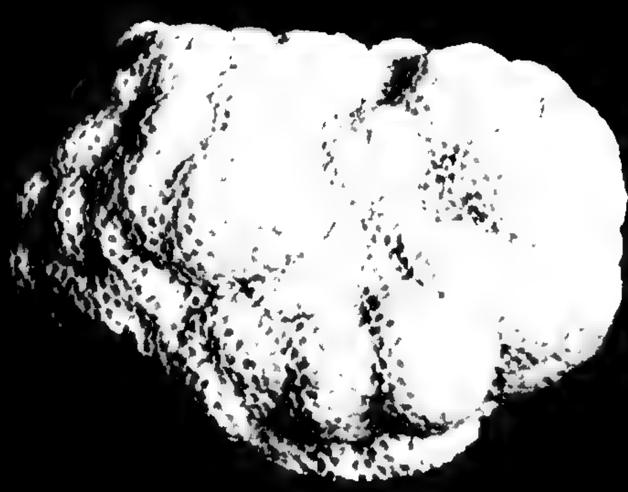
Fig. 84 From Fantome Island, Palm Islands, corallites near a branch tip of same corallum as Figs. 78 and 82.

Fig. 85 From Bushy Island-Redbill Reef, collecting station 73.

Fig. 86 From Happy Bay, Long Island, Whitsunday Islands, collecting station 102.

Fig. 87▲

Fig. 88▼



SUBGENUS *NAPOPORA* QUELCH, 1884

Quelch (1884, 1886) established *Napopora* as a separate genus for *P. irregularis*, a single specimen from Tahiti. It has not been used by subsequent authors except Nemenzo (1976) for *P. horizontalata* Hoffmeister, *P. semilunaris* Nemenzo and *P. sillimaniana* Nemenzo.

Corallites are like subgenus *Porites* (especially *P. (P.) lichen*) and may form series by intratentacular budding. However, they are also like subgenus *Synaraea*, as they are widely separated by a broad wall of coenosteum.

Porites (Napopora) vaughani Crossland, 1952

Synonymy

Porites (Synaraea) vaughani Crossland, 1952.

Porites semilunaris Nemenzo, 1976.

'*Porites* North Australia 5' Bernard (1905).

'*Porites* Great Barrier Reef 9' Bernard (1905).

'*Porites* North-west Australia 4' Bernard (1905).

'*Porites* China Sea 10' Bernard (1905).

Porites semilunaris is a shallow-water form of *P. vaughani*, the holotype of which was dredged from deep water and exhibits few of the usual characters of the species. *Porites horizontalata* Hoffmeister, 1925, from Samoa, is superficially similar to *P. vaughani* but differs in having a fused triplet and weakly developed pali.

Figs. 87, 88 *Porites* sp. 1 from Magdelaine Cay, collecting station 200 (×1.0).

Figs. 89, 90 *Porites* sp. 1 from Magdelaine Cay, same coralla as Figs. 87, 88 respectively (× 5).

Fig. 89▼

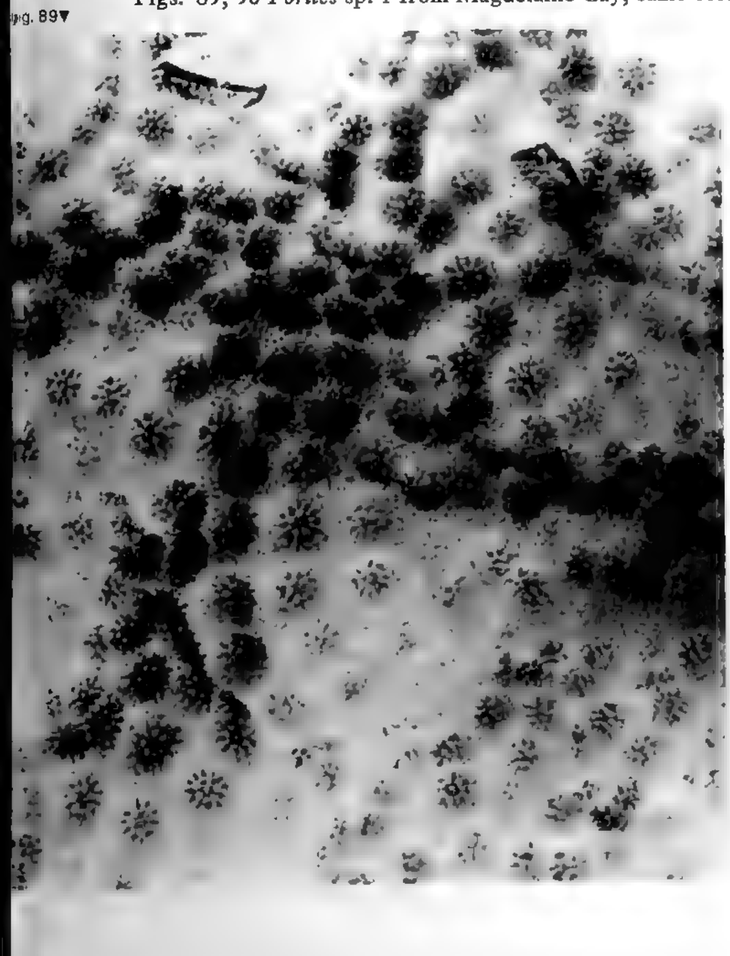
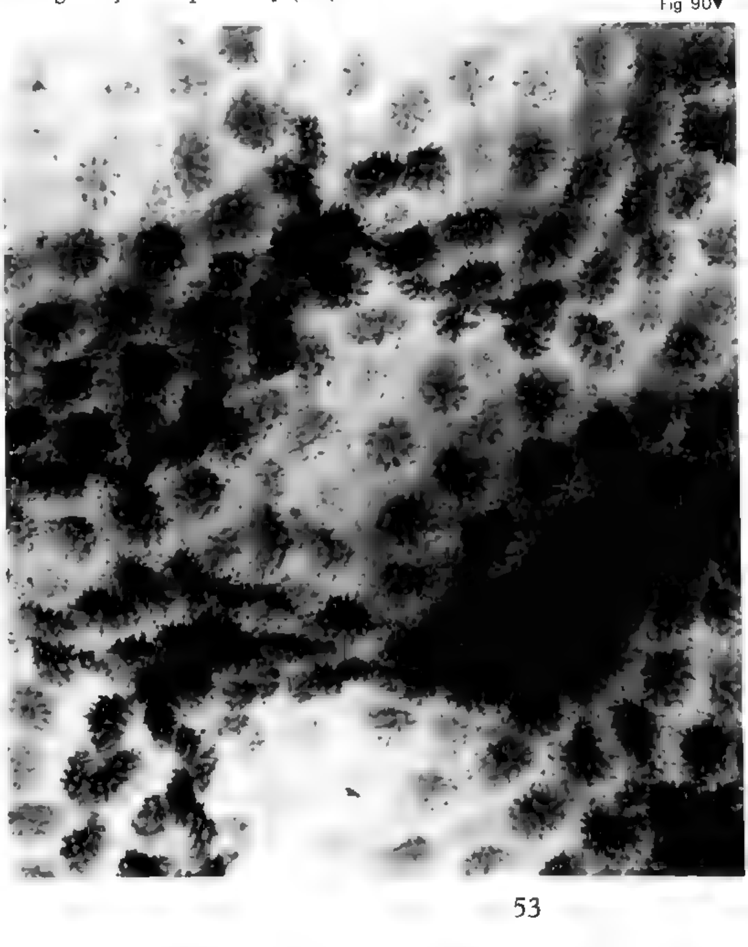


Fig 90▼



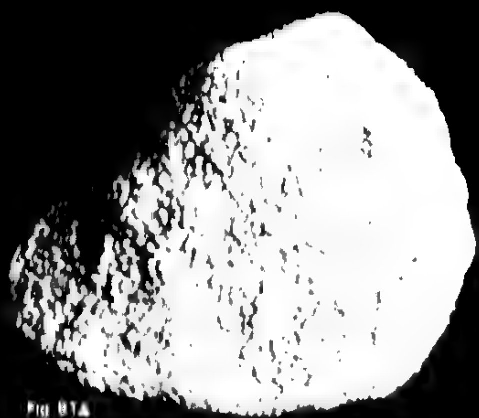


Fig. 91▲

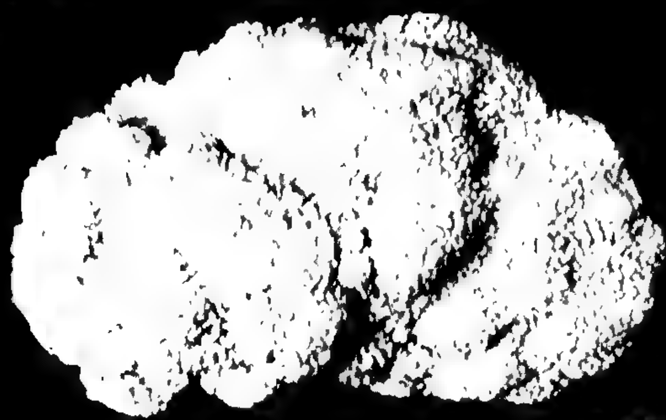


Fig. 92◄

Fig. 93▲

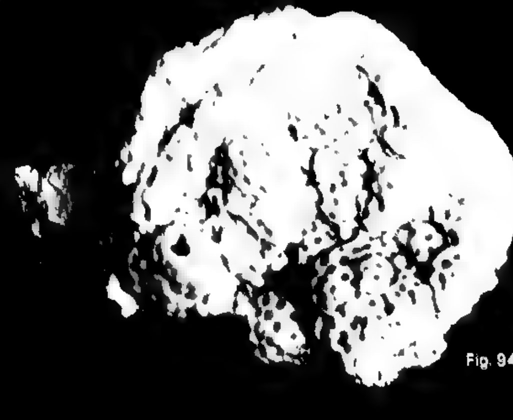


Fig. 94◄

Material studied

Murray Islands (4 specimens), **Sue Island, North West Reef, Triangle Reef, Raine Island** (3 specimens), **Great Detached Reef** (11 specimens), **Martha Ridgway** (10 specimens), **Tijou Reef** (4 specimens), **Corbett Reef** (3 specimens), **Houghton Island** (2 specimens), **Lizard Island** (7 specimens), **Willis Islet** (4 specimens), **Magdelaine Cay** (14 specimens), **Lihou Reefs** (4 specimens), **Mellish Reef** (11 specimens), **Britomart Reef** (8 specimens), **Palm Islands** (9 specimens), **Chesterfield Atoll** (2 specimens), **Pompey Reef, Swain Reefs** (3 specimens).

These localities include collecting stations 1, 5, 6, 8, 14, 17, 27, 32, 33, 37, 43, 45, 55, 57, 72, 77, 79, 89, 130, 156.

Previous records from Eastern Australia

Vicinity of Low Isles, Crossland (1952).

Characters

Coralla are columnariform, massive, plate-like or encrusting. Columns, when formed, are up to 20cm diameter and are irregularly fused. The bases of large columnariform coralla are always massive and columns are short. Most coralla have encrusting periphery.

The surface of most coralla is rough with corallites separated by ridges of coenosteum. These ridges seldom form a regular pattern and in encrusting coralla the distribution of corallites is mostly independent of coenostial ridges or growth irregularities. Corallites are 0.8–1.5mm diameter and are 1.0–2.5mm apart. Corallite sizes and distributions are relatively uniform within individual colonies. Septa are thick and have well-defined patterns. The septa of the triplet usually have free margins; each has a palus which is usually smaller than the other 5 pali. Sometimes 2, sometimes all 3 members of the triplet are fused and have only one palus between them. The lateral pairs and the dorsal septa are usually of equal size as are their pali. There may be 1 or 2 denticles per septum between the pali and corallite perimeter (as in the holotype) and these may form neat concentric circles. Columellae, if present, have the form of a single vertical style well below the level of the pali. When the columella is absent, the palar synapticular ring linking the pali is usually readily seen. In some cases, the presence or absence of a columella and the degree of development of a synapticular ring may be associated with parasites.

Living colonies are usually cream or pale brown in colour, but may be very bright colours, usually green or purple.

Skeletal variation

The very wide range of growth forms exhibited by *P. vaughani* is always associated with variations in corallite structure and appearance. Massive coralla exposed to strong wave action (Figs. 92, 93) have small, relatively compact corallites, whereas columnariform coralla have larger, more widely spaced corallites which have a free triplet and a distinct synapticular ring. Both massive and columnar coralla have coenostial ridges separating corallites. Plate-like or encrusting coralla, including the holotype, again have small corallites but they are usually widely spaced and may be distributed independently of coenostial ridges (Fig. 94). Septa are usually thick and those of the triplet are frequently fused, in which case they have only one common palus.

Figs. 91–94 *Porites vaughani* (×0.65)

Fig. 91 From Hope Island.
Fig. 92 From Mellish Reef, collecting station 209.
Fig. 93 From Mellish Reef, collecting station 206.
Fig. 94 From the Palm Islands.

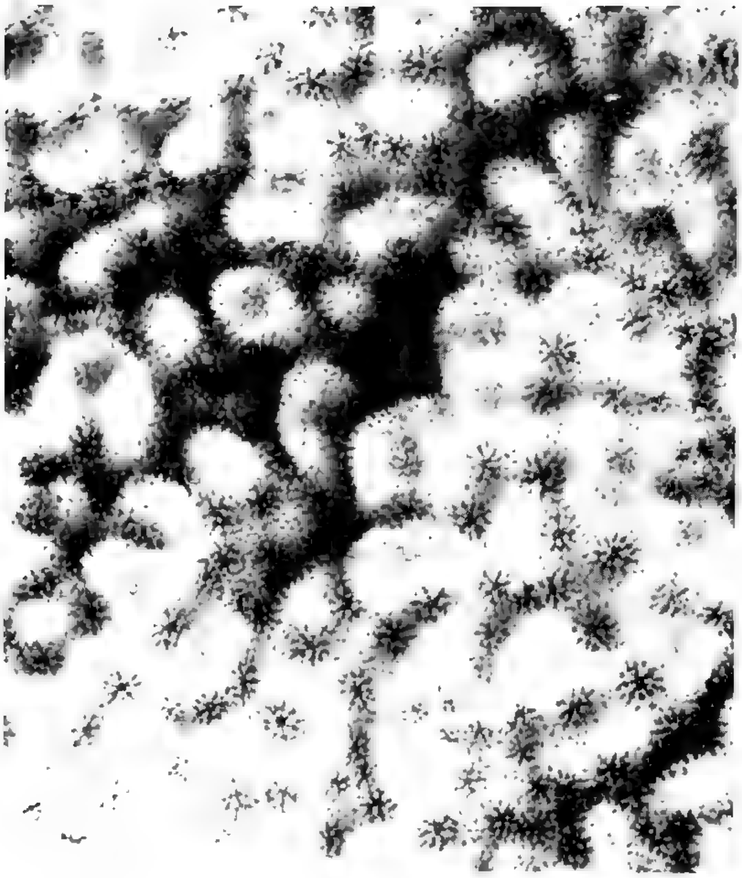


Fig 95▲

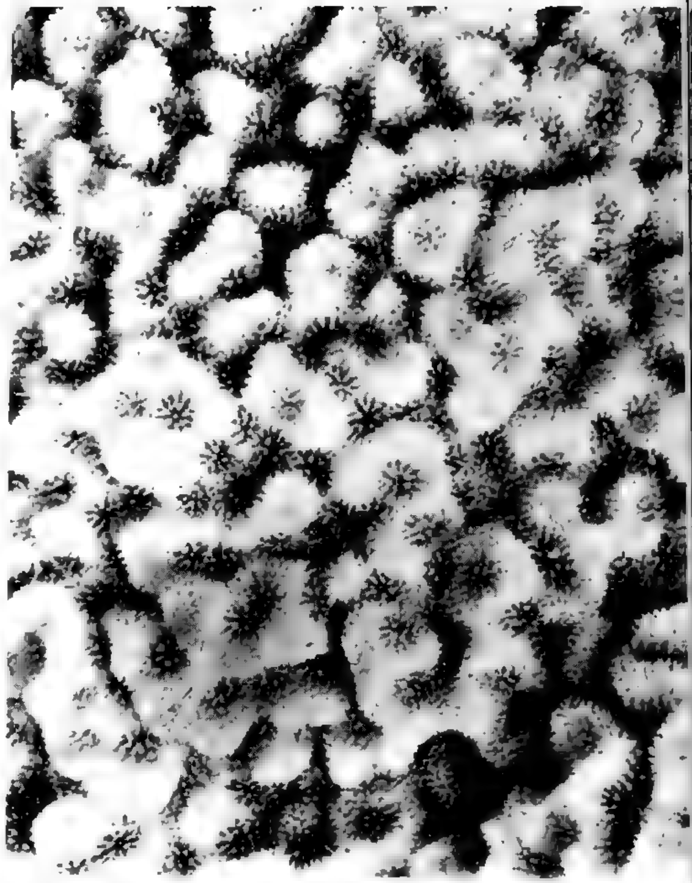


Fig 96▲

Fig 97▼

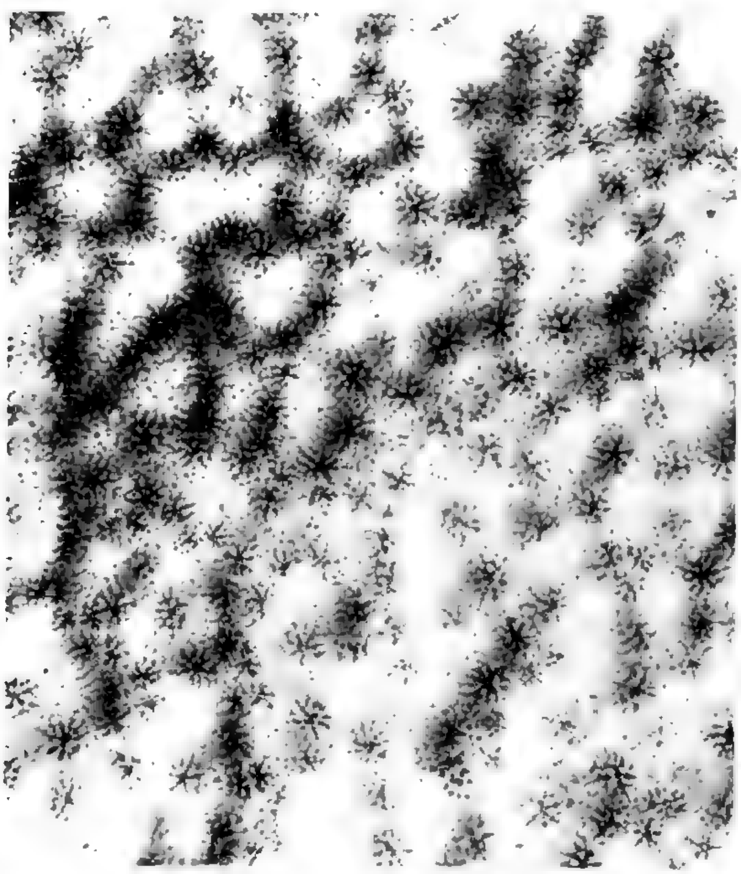
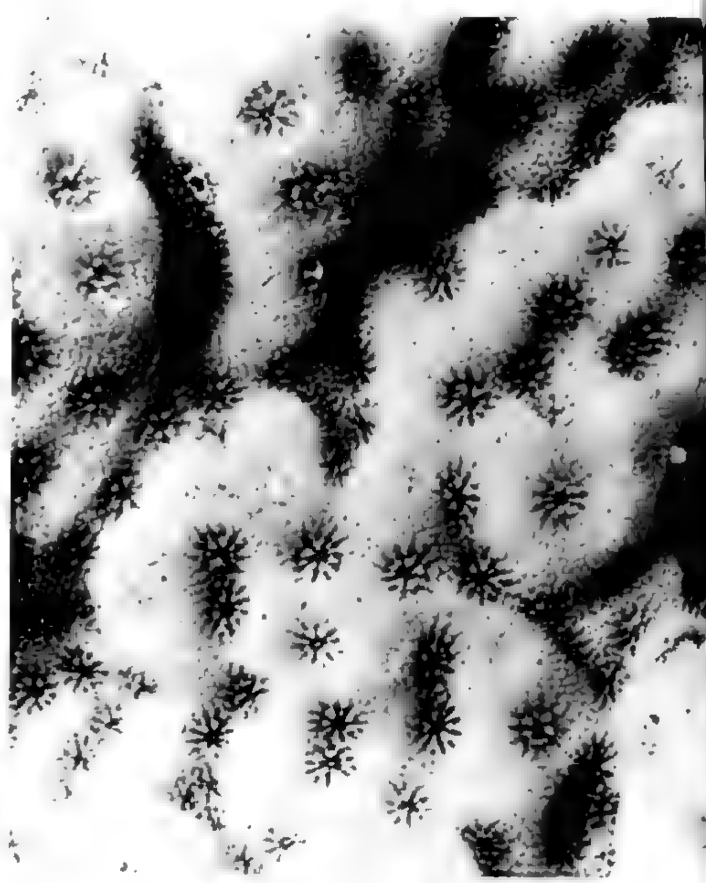


Fig 98▼



Affinities

The two species separated from *Porites* subgenus in this study are very readily separated from each other, as *P. vaughani* has much larger corallites than *P. rus*. The affinities of *P. vaughani* are primarily with *P. lichen* and *P. annae* rather than *P. rus* or other species of *Synaraea*.

Distribution

Occurs on the north-western, northern and eastern coasts of Australia and in the South China Sea.

Figs. 95–98 *Porites vaughani* (× 5)

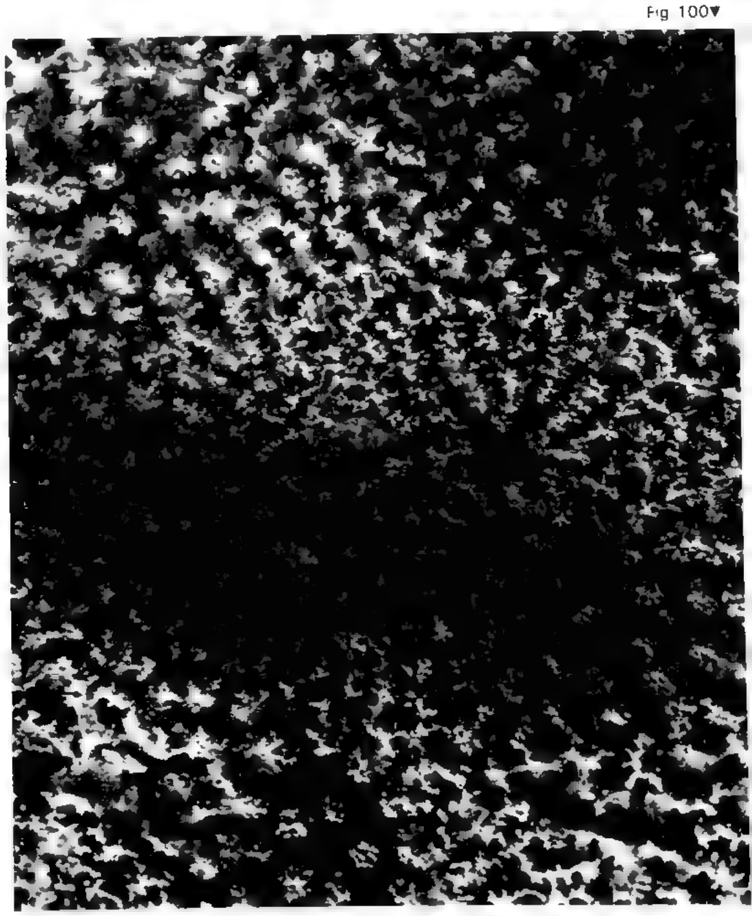
Fig. 95 From Hope Island, same corallum as Fig. 91.
Fig. 96 From Mellish Reef, same corallum as Fig. 92.
Fig. 97 From Mellish Reef, same corallum as Fig. 93.
Fig. 98 From the Palm Islands, same corallum as Fig. 94.

Figs. 99–100 *Porites vaughani* (× 30)

Fig. 99 From Mellish Reef, collecting station 206.
Fig. 100 From Martha Ridgway Reef, collecting station 154.

Fig. 99▼

Fig. 100▼



SUBGENUS *SYNARAEA* VERRILL, 1864

Corallites are small and superficial and are widely separated by an extensive, finely reticulated coenosteum.

Porites (Synaraea) rus (Forskål, 1775)

Synonymy

Madrepora rus Forskål, 1775.

Porites rus (Forskål); de Blainville (1830, 1834).

Porites monticulosa Dana, 1846.

Synaraea irregularis Verrill, 1864.

Synaraea convexa Verrill, 1864.

Synaraea undulata Klunzinger, 1879.

Porites danae Studer, 1901.

Porites undulata (Klunzinger); von Marenzeller (1907).

Porites (Synaraea) irregularis (Verrill); Nemenzo (1955).

Porites (Synaraea) hawaiiensis Vaughan 1907a; Yabe & Sugiyama (1935); Crossland (1952); Wells (1954).

Porites (Synaraea) undulata (Klunzinger); Hoffmeister (1925, 1929); Crossland (1941).

Porites iwayamaensis Eguchi, 1930.

Porites (Synaraea) iwayamaensis Eguchi; Wells (1954); Zou (1975); Faure (1977); Pichon (1978).

Porites (Synaraea) convexa (Verrill); Yabe & Sugiyama (1932, 1933); Crossland (1935); Nemenzo (1955); Searle (1956); Pillai (1972)

Porites (Synaraea) monticulosa Dana; Wells (1954); Wells & Davies (1966); Pillai (1972).

'*Porites* Fiji Islands 15' Bernard (1905).

'*Porites* Caroline Islands 3' Bernard (1905); Yabe & Sugiyama (1932).

'*Porites* Society Islands 3' Bernard (1905).

The seven nominal species in this synonymy have type localities spanning the Indo-Pacific from the Red Sea (type localities of *P. rus* and *P. undulata*) to Hawaii (type localities of *P. irregularis* and *P. hawaiiensis*). Forskål's species (*rus*) was placed in *Montipora* by Klunzinger, who redescribed the species as *Synaraea undulata*. It was not found in the Red Sea by Crossland (1941), although Crossland considered it to be related to, but distinct from, *P. convexa* Verrill from the Society Islands. However, neither he nor Verrill defined how these species differed.

The two nominal species from Hawaii have not been distinguished in the literature; Vaughan (1907) noted that he saw no *P. irregularis* in Hawaii.

Figs. 101–106 *Porites rus* (×0.65)
Fig. 101 From Jewell Reef, collecting station 61.
Fig. 102 From Raine Island, collecting station 151.
Figs. 103–106 From Mellish Reef, collecting station 206.

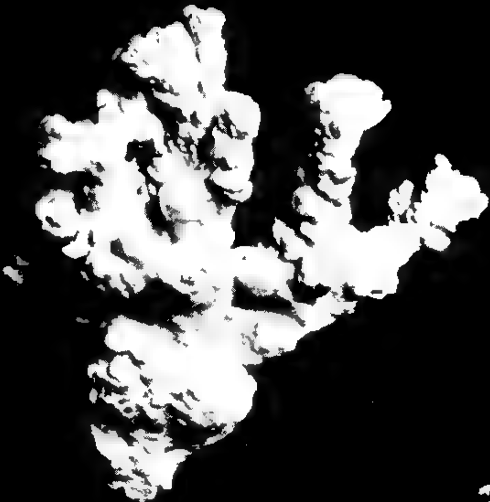


Fig. 101▲

Fig. 102▲

Fig. 103▲

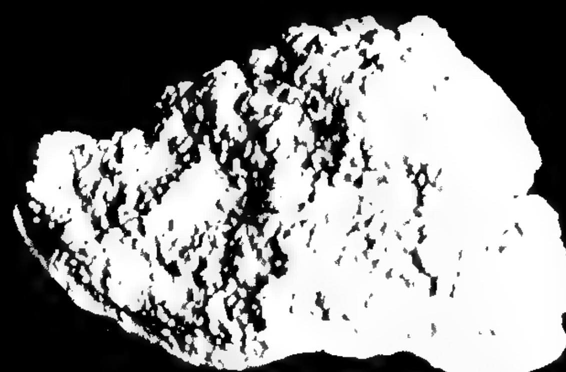


Fig. 104▲

Fig. 105▲

Fig. 106▲

Fig 107▲

Fig 109▼

Fig 108▲

Fig 11

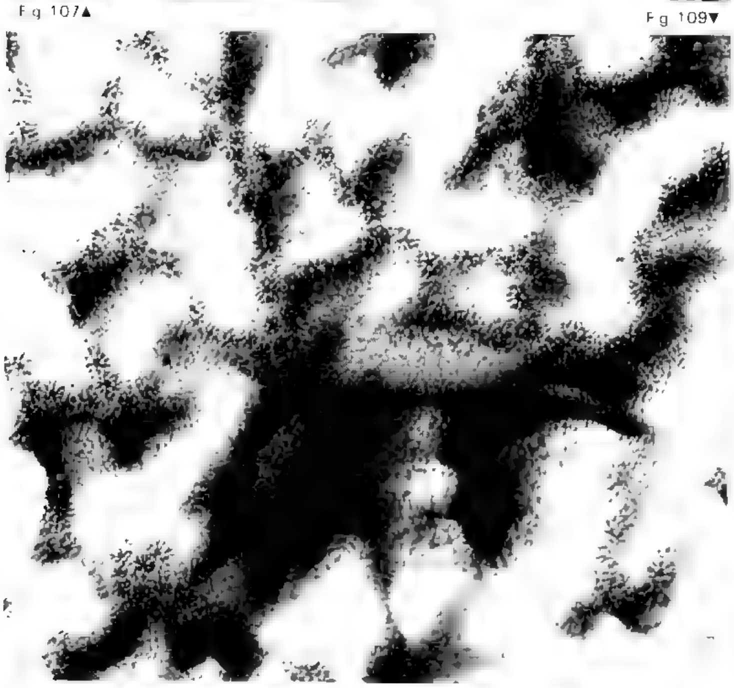


Fig 111▼

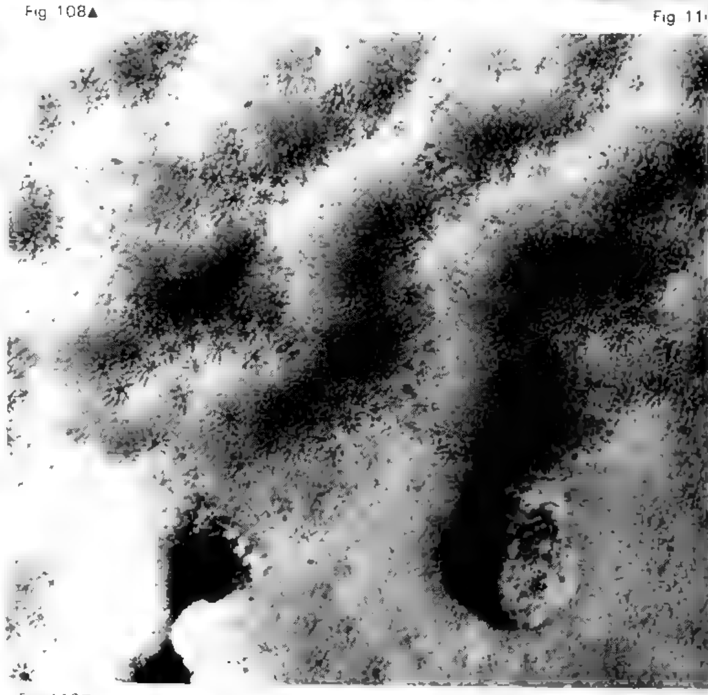
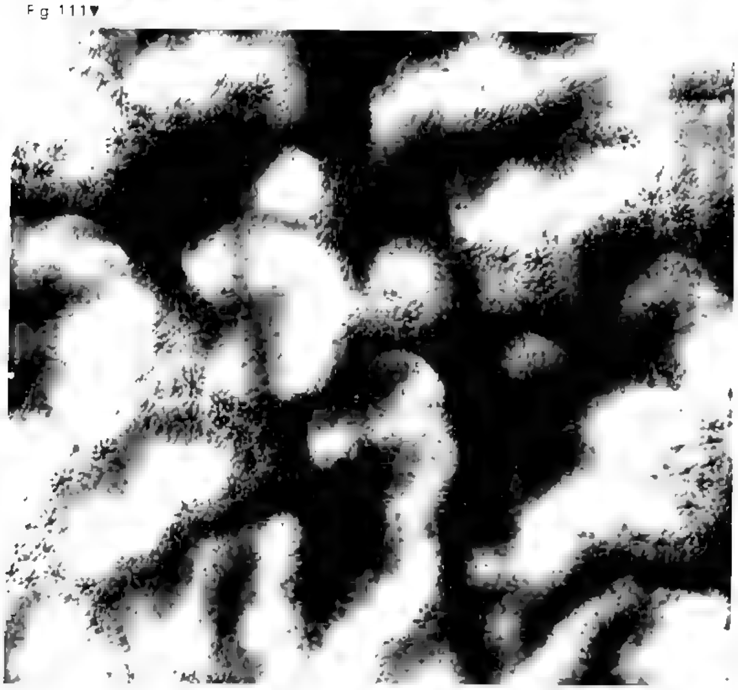


Fig 112▼



Wells (1954) records *P. hawaiiensis*, *P. monticulosa* and *P. iwayamensis* from the Marshall Islands, but does not distinguish them from each other or from the Red Sea 'species'.

The present series contains specimens identical to Forskål's type, which is massive and has relatively large, well-defined corallites. Topotypes of *P. convexa* also show no significant differences from specimens in the present series or from Red Sea specimens in the present collection. Likewise, Vaughan's type of *P. hawaiiensis* has no significant differences from the east Australian specimens and is similar to the type of *P. monticulosa* from Fiji, which is primarily characterised by a lack of conspicuous ridges and flattened, anastomosed branches.

Material studied

Yorke Island (13 specimens), **Murray Islands** (4 specimens), **Newman Reef** (2 specimens), **Sue Island, North-west Reef** (4 specimens), **Turtle Islands, Raine Island** (5 specimens), **Sir Charles Hardy Islands, Martha Ridgway** (4 specimens), **Jewell Reef** (2 specimens), **Houghton Island** (3 specimens), **Yonge Reef, Lizard Island** (4 specimens), **Low Isles** (13 specimens), **Mellish Reef** (31 specimens), **Britomart Reef** (10 specimens), **Palm Islands** (39 specimens), **Bait Reef, Whitsunday Islands** (2 specimens), **Pompey Reef** (3 specimens), **Bushy Island-Redbill Reef** (10 specimens), **Swain Reefs** (3 specimens).

These localities include collecting stations 3, 12, 13, 14, 17, 26, 30, 31, 34, 36, 37, 38, 40, 41, 43, 45, 55, 57, 61, 67, 70, 72, 73, 79, 80, 86, 88, 89, 91, 97, 102, 145, 151, 154, 165, 166, 167, 168, 174, 177, 179, 206.

Characters and skeletal variation

Coralla can be flat, horizontally expanded laminae, or submassive, composed of thick columnariform lobes with a laminar skirt extended at the base, or branching, or irregularly massive. Branches have irregular shapes and usually anastomose, sometimes forming a continuous plateau. Large coralla may have different combinations of these growth forms. The surface of coralla may be smooth, without ridges or crests, but usually these are developed.

Calices are small (<0.7mm diameter), and are separated from each other by an extensive coenosteum. This develops into papillae, crests or short ridges, which are rounded or convex, sometimes angular or keeled (particularly towards the tips of the branches, where they have the appearance of flame-like projections), with series of ridges all oriented towards the upper part of the colony. Corallites are concentrated in certain parts of the corallum, such as the margins of expanding laminae, or the concave parts between branches, and in the hollows between the ridges or crests. They are generally distant from each other, and separated by an extensive development of reticular coenosteum. In some coralla, corallites tend to form short series separated by narrow walls, but the series themselves are separated by larger extensions of coenosteum. Corallites are only exceptionally present on crests or ridges. They are flush with the surface of the coenosteum. Septa are thick often triangular in outline in older corallites. The septa of the triplet are usually fused, occasionally having a trident formation. Pali are well developed, usually 6 in number with one on

Figs. 107–112 *Porites rus* (×5)

Fig. 107 From Jewell Reef, same corallum as Fig. 101.
Figs. 108, 109 Same corallum as Fig. 103.
Fig. 110 From Yorke Island, collecting station 13.
Fig. 111 From Mellish Reef, same corallum as Fig. 105.
Fig. 112 From Mellish Reef, same corallum as Fig. 106.

each of the four lateral pairs, one on the dorsal directive, and one at the point of fusion of the triplet. The palus on the dorsal directive may be absent. All pali reach the level of the surface of the coenosteum, or may even be exsert above the surface. Upper septal margins have 1 or (rarely) 2 denticles. When only 1 denticle is present, it is usually close to the wall, which is indistinct from the coenosteum. In general, pali are thicker and more prominent than the denticles. A palar synapticular ring is usually seen deep below the pali. The central fossa is deep. Columellae are absent or nearly so. The coenosteum is reticular, with a granular upper surface, the size and shape of the granules being similar to denticles.

Living colonies are usually cream or yellow, but may be a range of dark colours, especially blue. Corallites are readily seen and the distinctive pattern they form makes *P. rus* readily identifiable *in situ*.

Affinities

Porites rus has smaller corallites than any other *Porites* species and, with the distinctive pattern they form, this species is readily distinguished from all other east Australian species.

Distribution

Widely distributed throughout the tropical Indo-Pacific from the Red Sea to Hawaii and the Society Islands.

Figs. 113, 114 Same corallum of *P. rus* from Mellish Reef, collecting station 206 (×30 and ×75 respectively).

Fig 113▼

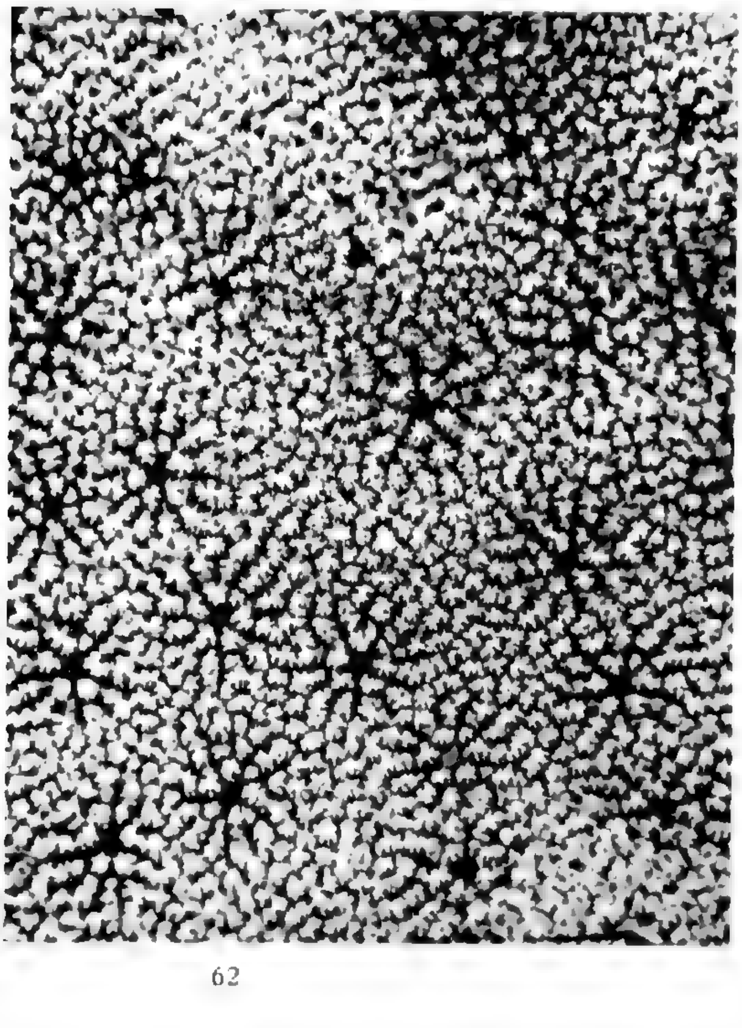
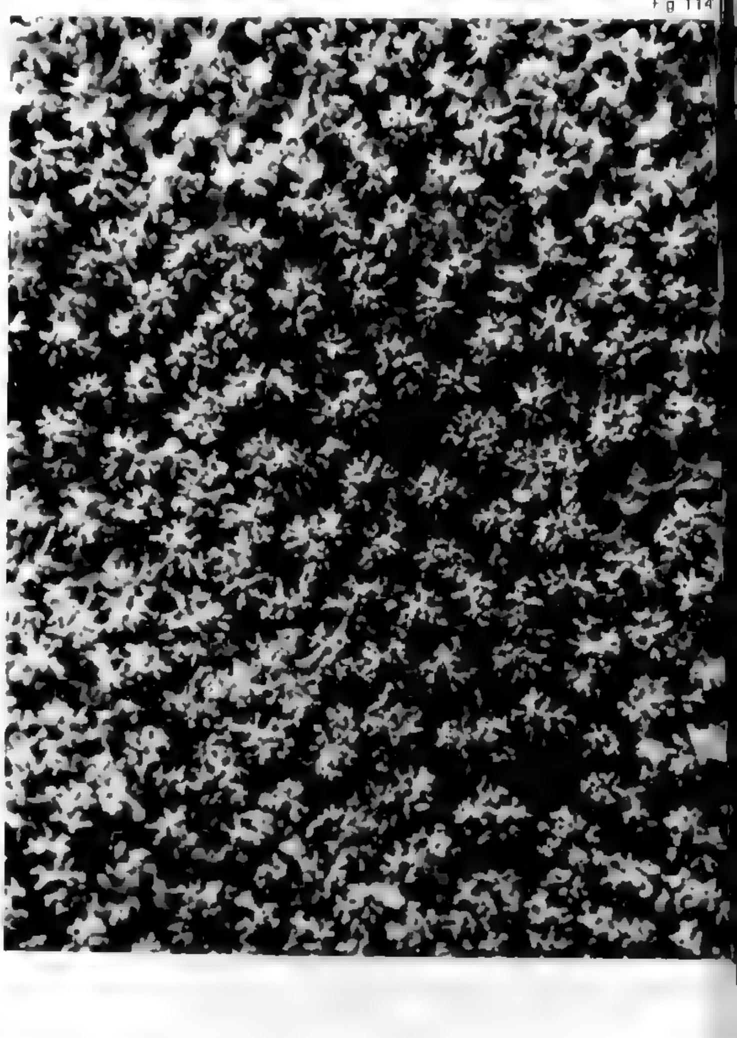


Fig 114



Generic synonymy

Stylaraea Edwards & Haime, 1851; Klunzinger (1879).

Type species *Porites punctata* Linnaeus, 1758.

Introduction and characters of the genus

Stylaraea is a monospecific genus, the characters of which are therefore those of *S. punctata*. *Stylaraea* is like *Porites*, but has a reduced septation without the *Porites* pattern of fusion, no pali and a styliform columella. Colonies are always very small (the smallest of all Scleractinia) and are only found in very marginal environments. *Stylaraea* is therefore well isolated from *Porites*, both morphologically and ecologically.

Edwards & Haime (1851) created the genus *Stylaraea* for their single specimen of *S. punctata*, but in 1860 synonymised it with *Porites*. It was treated as a valid genus by Klunzinger (1879), but was again synonymised by Bernard (1905), who believed Klunzinger's specimens were young colonies of *Porites*. Wells (1956) listed *Stylaraea* with *Porites* with a question. Crossland (1952) remains the only author since Klunzinger to maintain *Stylaraea* as a separate genus and he gives an accurate account of it.

Figs. 115, 116 Same corallum of *Stylaraea punctata* from Low Isles (× 25).

Fig 115▼

Fig 116▼

Stylaraea punctata (Linnaeus, 1758)

Synonymy

Madrepora punctata Linnaeus, 1758; Linnaeus (1767).

Porites punctata (Linnaeus); ? Ehrenberg (1834); Edwards & Haime (1860); Ridley (1883); Ortmann (1889); Bernard (1905).

Stylaraea punctata (Linnaeus); Klunzinger (1879); Crossland (1952).

'*Porites* Red Sea 9' Bernard (1905).

'*Porites* Mollucas 1' Bernard (1905).

The generic designations of this species are discussed above (p. 63), and its taxonomic history is discussed by Bernard (1905, p. 11 and 161).

Material studied

Stylaraea punctata has not been collected or seen by the authors on the Great Barrier Reef. The only specimens studied are Klunzinger's specimens from the Red Sea and the specimens collected by the Great Barrier Reef Expedition from mangroves at Low Isles and described by Crossland (1952, p. 236).

Characters

"The colonies of *Stylaraea* form cushion-shaped crusts, with a thin line of "epitheca" appearing round their bases. The largest is 15mm across and about 7mm high; most are not much smaller, but the smallest is only 7mm across and has 12 calices and some buds' (Crossland, 1952, p. 236).

Calices are 0.9–1.1mm diameter. They have deep interseptal loculi. Septa are in 2 cycles of 6 each, reaching $\frac{1}{2}$R and $\frac{1}{4}$R respectively, except where 1, 2 or 3 first cycle septa fuse with the columella at irregular intervals in the calice. The columella is a single, irregular pinnule. Both the columella and the septa are covered by elongated, tapering granules. The walls are composed of thickened septa and what appears to be a single layer of synapticulae.

The appearance of living colonies has not been recorded.

Affinities

Stylaraea punctata superficially resembles *Stylophora pistillata* Esper and *Stylocoeniella guentheri* Bassett-Smith. All species have similar sized corallites, a similar septal pattern, a styliform columella and similar tapering granules on the columellae and septa. *Stylaraea* is distinguished, however, by having more compact corallites and a completely different (synapticulothecal) wall structure with very little exothecal skeleton.

Distribution

Recorded only from the Red Sea, Tulear, Aldabra, the Moluccas and the Great Barrier Reef.

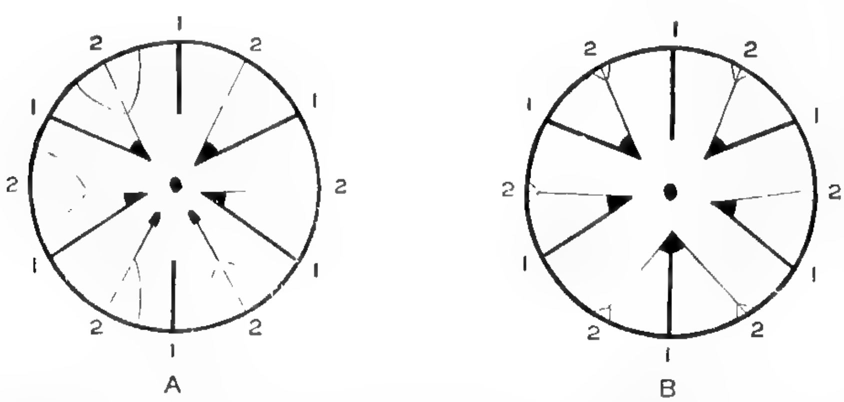


Fig. 117 Diagrammatic comparison between the septal arrangement of *Goniopora* (left) and *Porites* (right) showing how the latter may be derived from the former (after Bernard, 1905, p. 13).

GENUS GONIOPORA DE BLAINVILLE, 1830

Generic synonymy

Goniopora de Blainville, 1830; Quoy & Gaimard (1833); Quelch (1886).

Litharaea Edwards & Haime, 1850.

Rhodaraea Edwards & Haime, 1849b; Quelch (1886).

Tichopora Quelch, 1886.

Type species *Goniopora pedunculata* Quoy & Gaimard, 1833

Introduction

Goniopora has not come under any major revision or review since the work of Bernard (1903, 1906). Up till that time a total of 14 species had been described and these names were in use under the generic names *Litharaea* Edwards & Haime (fossil), *Rhodaraea* Edwards & Haime and *Tichopora* Quelch (a single specimen). Bernard, in the first volume of his major study of the Poritidae (1903), gives a detailed account of the history of these genera, as well as his reasons for merging them. At a specific level, however, Bernard found *Goniopora* and *Porites* impossible to classify: 'I have no hesitation in asserting that in the present state of our knowledge coral species are indeterminable. The long list of names which were steadily growing as I proceeded to designate every apparent different form of *Porites* and *Goniopora* in the old way, got completely out of hand' (p. 3). Faced with the impossible task of classifying corals without field experience or knowledge and without detailed collection, Bernard abandoned the Linnean system of nomenclature in favour of a numerical system based on geographic locality and growth form. His reasons for doing this were discussed widely at the time (see Cock, 1977) but are now of historical interest only, as the final result was only to increase confusion in an already confused subject.

Crossland (1952, p. 232) appropriately comments 'The synonymy of this genus is in a hopeless condition. Bernard's obsession with growth forms naturally led him to abandon attempts at synonymy, and spoils his descriptions. Consequently we have sound descriptions, such as those of Bedot and Vaughan, for very few species.'

Thirty-eight nominal species of *Goniopora* have been described (Table 1). Of those described this century, only *G. petiolata* Nemenzo, 1955 appears to be unrecognisable from the original description and illustration, or a cross reference to Bernard. Earlier species names, however, depend primarily on type specimens, many of which are lost or whose identity cannot be satisfactorily established. Thus the identities of *G. planulata* (Ehrenberg), *G. viridis* (Quoy & Gaimard), *G. lagreneii* (Edwards & Haime), *G. tenella* (Quelch) and *G. parvistella* Ortmann have not been satisfactorily established in the present study.

Of the thirty-two nominal species that are recognisable from specimens or descriptions, a total of twenty fall within, or come close to, the ranges of variation of east Australian species redescribed here. Descriptions of Bernard are not considered to be species descriptions as in most cases they are simple descriptions of single specimens or groups of specimens without valid names or systematic relationships and thus are not, except for east Australian specimens, included in synonymies.

Affinities

Morphologically, *Goniopora* is a well-defined genus having closest affinities with *Porites*, *Stylaraea* and *Alveopora*. *Porites* is readily distinguished from *Goniopora* by having smaller corallites and a distinctive septal configuration consisting of a dorsal directive, a ventral triplet and four pairs of lateral septa, or some recognisable reduction of this pattern (see p. 11). *Stylaraea* also has smaller corallites, with a much reduced septation still further removed from that of *Goniopora* (see p. 64). *Goniopora* has three septal cycles which are distinguishable in some species, not in others. Septa may be fused, but seldom is there any clearly consistent pattern to the fusion, such as occurs in *Porites*. Nevertheless, Bernard

(1903, p. 21) proposed that the *Porites* formula is a derivation of a pattern in *Goniopora* (Fig. 117), the differences being the reduction of the third cycle in *Porites*. His conclusions are supported in the present study by the septal configuration of *G. stutchburyi* (see p.105) and sometimes specimens of other species which have Bernard's pattern clearly discernible. This provides clear evidence of the affinity of *Goniopora* with *Porites*. *Goniopora bernardi* Faustino from the Philippines is another such example, but it must be emphasised that in most *Goniopora* this pattern is not distinct, rather, there is usually a less well-defined 'gonioporoid' pattern of fusion. It should also be noted that pali, when present, are associated with the second septal cycle (which is often larger than the first) and that four pali may be fused with two septa each, leaving the remaining two pali (which are often smaller) associated with single septa.

Table 1 The nominal species of *Goniopora* and their type localities.

	Type locality
Astrea calicularis Lamarck, 1816	N.W. Australia
Astrea planulata Ehrenberg, 1832	Red Sea
Goniopora pedunculata Quoy & Gaimard, 1833	New Guinea
Astrea viridis Quoy & Gaimard, 1834	New Guinea
Goniopora columna Dana, 1846	Fiji
Goniopora savignyi Dana, 1846	Seychelles & Red Sea
Goniopora lobata Edwards & Haime, 1860	Red Sea
Goniopora stokesi Edwards & Haime, 1851	Not recorded
Rhodaraea lagreneii Edwards & Haime, 1860	South China Sea
Rhodaraea gracilis Edwards & Haime, 1860	Red Sea
Goniopora malaccensis Brüggemann, 1878	Singapore
Rhodaraea tenuidens Quelch, 1886	Philippines
Goniopora parvistella Ortmann, 1888	Samoa, Tonga
Goniopora fruticosa Saville-Kent, 1893	Great Barrier Reef
Goniopora somaliensis Vaughan, 1907b	Somalia
Goniopora djiboutiensis Vaughan, 1907b	Somalia
Goniopora bernardi Faustino, 1927	Zoamboanga
Goniopora duofaciata Thiel, 1932	Maldive Islands
Goniopora crassa Crossland, 1948	South Africa
Goniopora minor Crossland, 1952	Great Barrier Reef
Goniopora hirsuta Crossland, 1952	Great Barrier Reef
Alveopora irregularis Crossland, 1952	Great Barrier Reef
Goniopora pulvinula Wells, 1954	Marshall Islands
Goniopora muscosa Wells, 1954	Marshall Islands
Goniopora traceyi Wells, 1954	Marshall Islands
Goniopora stutchburyi Wells, 1955b	Moreton Bay
Goniopora undulata Nemenzo, 1955	Philippines
Goniopora petiolata Nemenzo, 1955	Philippines
Goniopora burgosi Nemenzo, 1955	Philippines
Goniopora nigra Pillai, 1967	India
Goniopora wotouensis Zou, 1975	South China Sea
Goniopora granulosa Pillai & Scheer, 1976	Maldive Islands
Alveopora polyformis Zou, 1978	Xisha Islands
Goniopora norfolkensis Veron & Pichon (this study)	Great Barrier Reef
Goniopora pandoraensis Veron & Pichon (this study)	Great Barrier Reef
Goniopora eclipsensis Veron & Pichon (this study)	Great Barrier Reef
Goniopora palmensis Veron & Pichon (this study)	Great Barrier Reef

At species level, the only confusion that has occurred between *Goniopora* and *Porites* is with *P. lichen* Dana (see p. 43). Edwards & Haime (1860) misidentified this species as *Goniopora ? lichen* (Dana), a name adopted by Klunzinger (1879) and which remained until von Marenzeller (1907) re-named Edwards & Haime and Klunzinger's species *Goniopora klunzingeri*.

Affinities between *Goniopora* and *Alveopora* are much more obscure. Bernard (1903, p. 2) concluded 'that the analysis of the genus *Alveopora* resulted in the confirmation of the view which regards it as a survival of the Palaeozoic Favositidae, a family which, except for the genus *Alveopora*, has long become extinct. The place, then, of this genus . . . must be . . . with the most primitive forms and nowhere with the Poritidae, which stands at the very head of the tribe [Scleractinia] as the most recent and specialised'. Bernard (1878, 1899) gives a fuller account of the relationships of *Alveopora*, all observations being based on skeletal morphology (see p.109). However, his opinions have not been adopted by subsequent authors, especially as it is clear that both genera occupy similar environments and have similar, very distinctive polyps which have similar behavioural patterns. It may also be added that the appearance of the epitheca and the patterns of growth form which are considered by Bernard to be so distinctive for *Goniopora* may also be applied to *Alveopora*. In general, there are few convincing arguments against the notion that *Alveopora* has been derived from *Goniopora* by reduction of the complexity of the skeleton. This question, however, still remains open. One major difference between these genera that has not been previously observed is that *Goniopora* polyps have 24 tentacles, whereas *Alveopora* polyps have 12.

Goniopora djiboutiensis Vaughan, 1907

Synonymy

Goniopora djiboutiensis Vaughan, 1907b.

?*Goniopora pulvinula* Wells, 1954.

'*Goniopora* Great Barrier Reef 1' Bernard (1903).

Both these species, as well as *G. granulosa* Pillai & Scheer, 1979, have the gonioporoid septal pattern as described by Bernard (1903) similarly developed. The type and only specimen of *G. pulvinula* differs from the type of *G. djiboutiensis* in having thicker walls and thinner, less distinct septa, otherwise they are very similar.

Material studied

Big Mary Reef (2 specimens), **Arden Island** (2 specimens), **Murray Islands, Turtle Islands, Jewell Reef, Lizard Island** (3 specimens), **Hope Island, Magdelaine Cay** (2 specimens), **Britomart Reef** (3 specimens), **Palm Islands** (38 specimens), **Pandora Reef** (9 specimens), **Magnetic Island, Chesterfield Atoll, Whitsunday Islands** (2 specimens), **Bushy Island-Redbill Reef** (2 specimens).

These localities include collecting stations 27, 34, 36, 38, 45, 46, 55, 57, 59, 60, 61, 97, 102, 165, 170, 171, 172, 174, 178, 183, 187, 200, 215.

Previous records from Eastern Australia

Not previously recorded.

Characters

Coralla are sub-massive or columnar, usually with an encrusting margin. Corallites are rounded or polygonal, with calices up to 4.5mm diameter and up to 1.5mm deep. Columellae are very prominent. They are usually dome-shaped and are divided into 6 fused parts, each corresponding to pali, and appear to be composed of the inner margins of 4 fused septa. Septa are short, of uniform size, and regularly spaced. Sometimes the gonioporoid pattern of fusion is distinguishable, as it is in Vaughan's type. All septa are finely dentated. The walls of corallites near column tips are approximately 1.5mm thick, while they reach 3mm

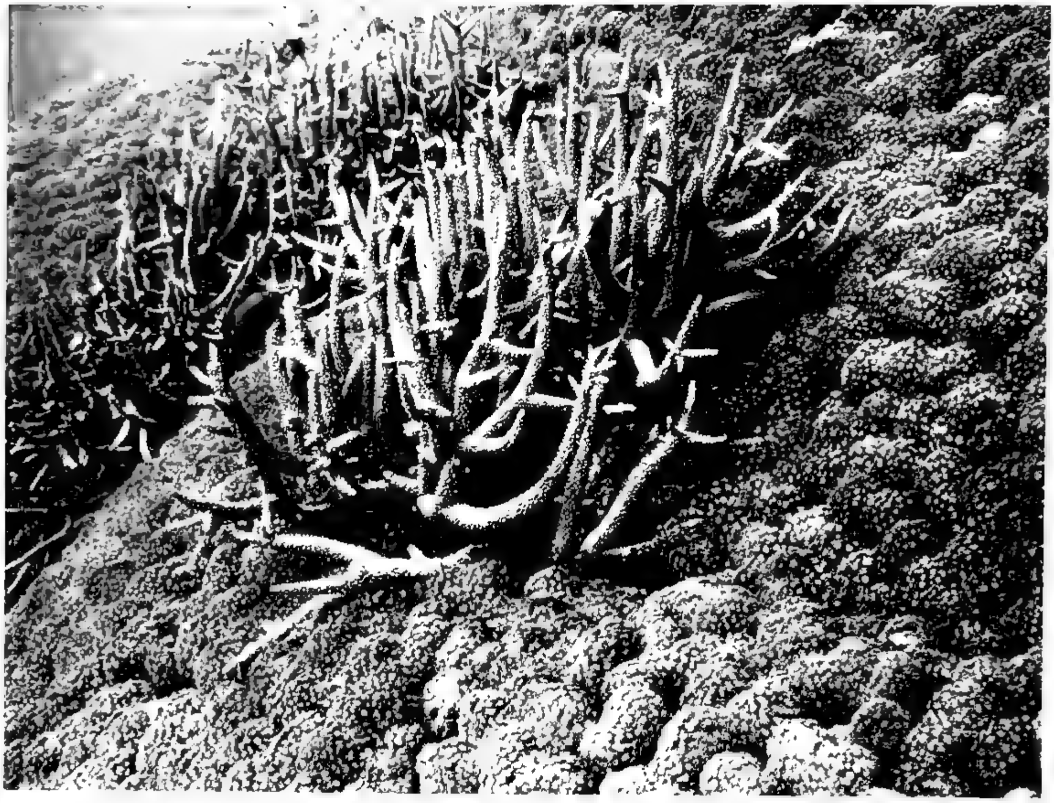


Fig 118 *Goniopora djiboutiensis* at the Swain Reefs, collecting station 67 (photo: T Done).

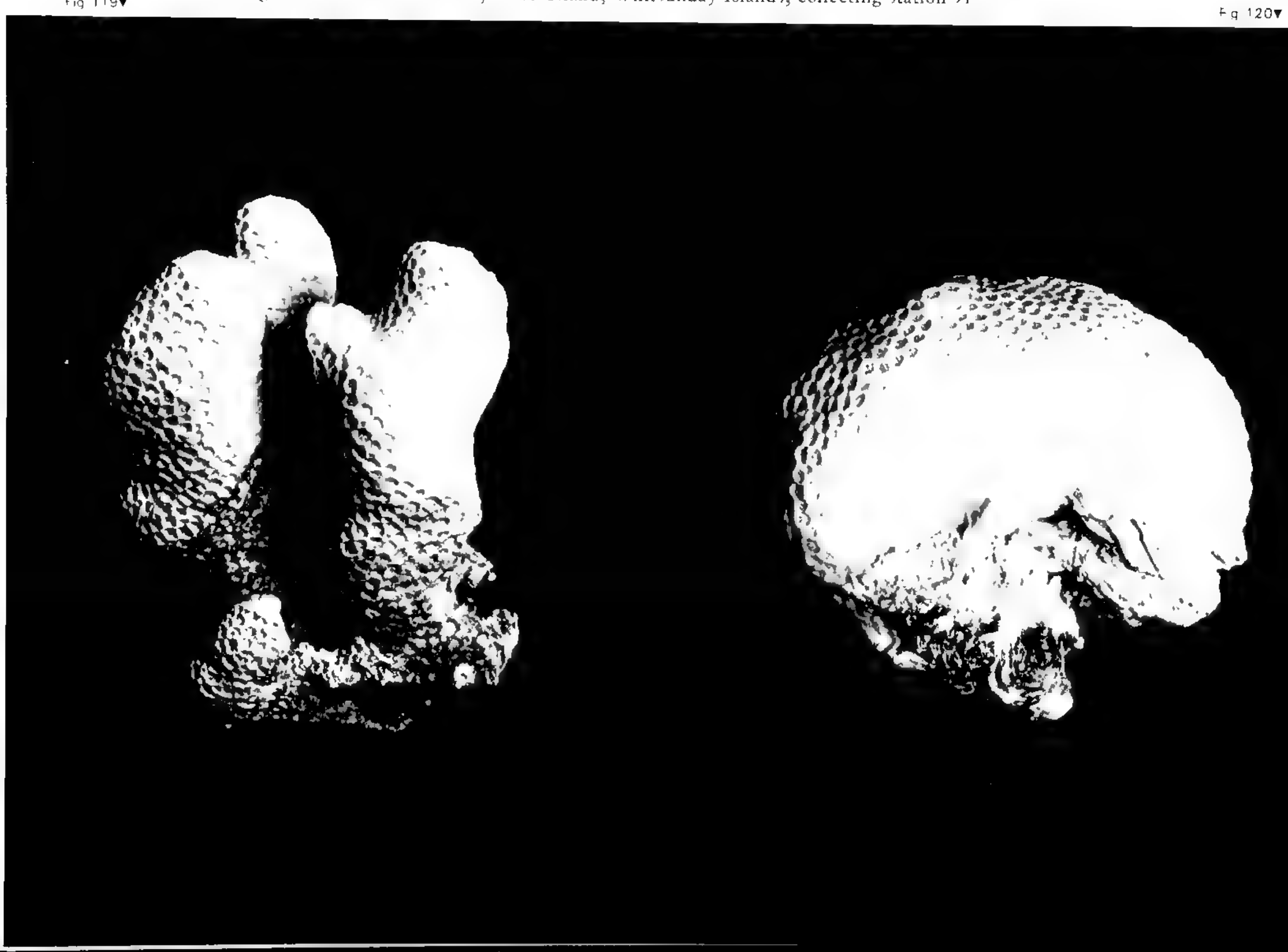
Figs 119, 120 *Goniopora djiboutiensis* × 0.5

Fig 119 From Pandora Reef, collecting station 172.

Fig. 120 From Nara Inlet, Hook Island, Whitsunday Islands, collecting station 97

Fig 119▼

Fig 120▼

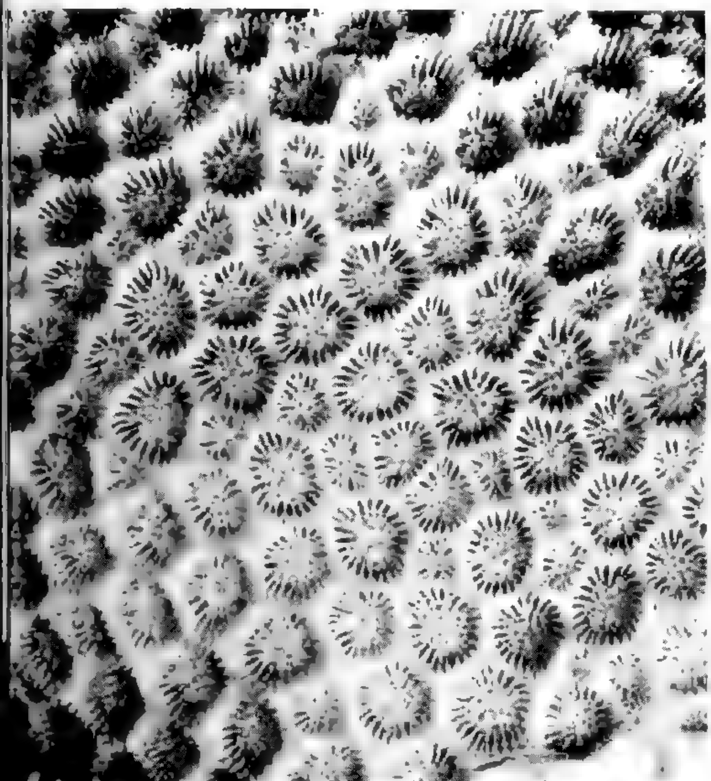


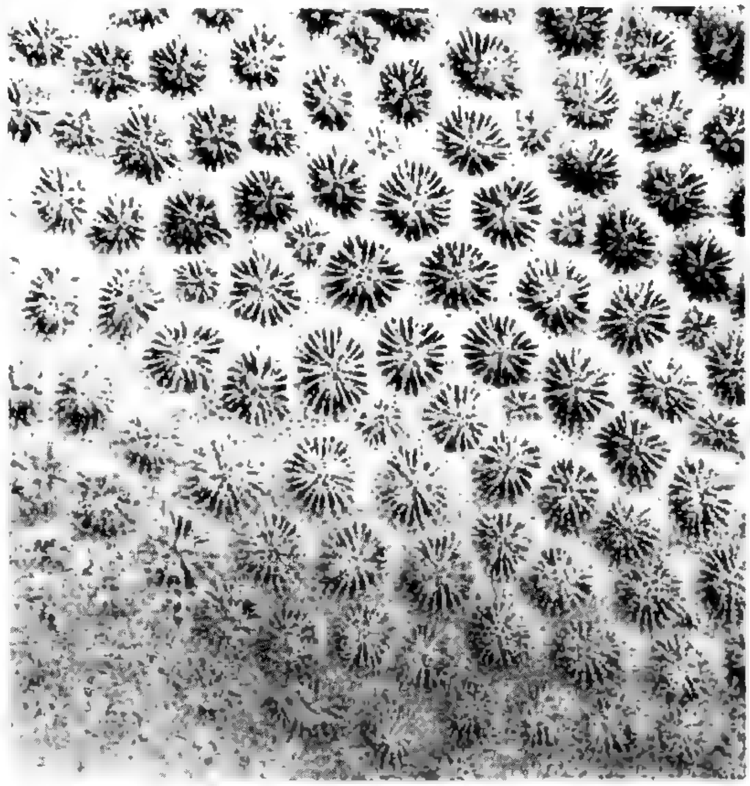
thickness near branch bases. They are clearly composed of a lattice of trabeculae with synapticular cross-members.

Living colonies (Figs. 283–288) are pale or dark brown or green and are readily distinguished by polyps having large prominent oral cones, which may be the same colour as the tentacles but which are usually white. Some columns may have very pale polyps due to the expulsion of zooxanthellae, in contrast with other columns of the same colony (Fig. 283).

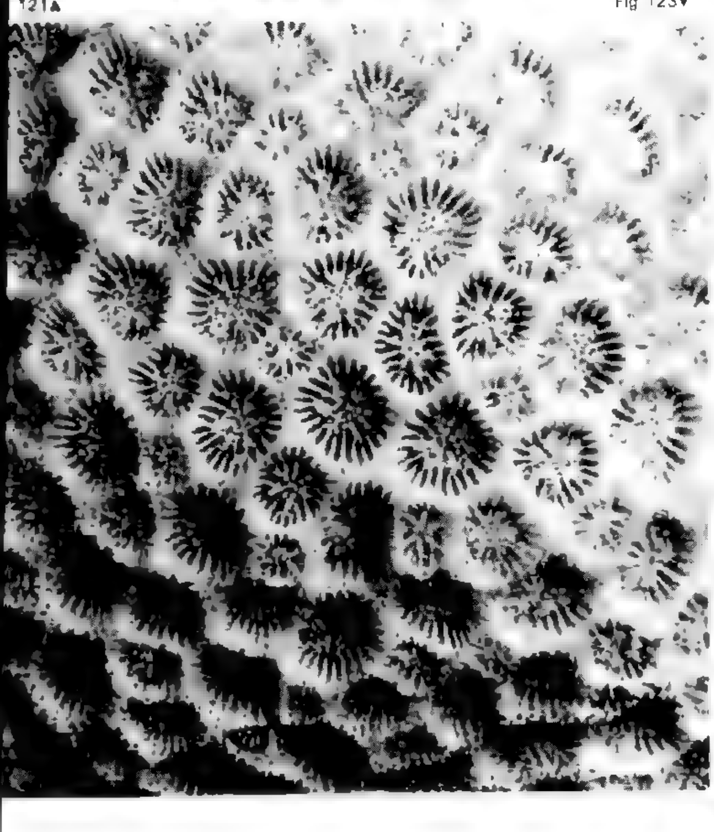
Figs. 121–124 *Goniopora djiboutiensis* (× 5)

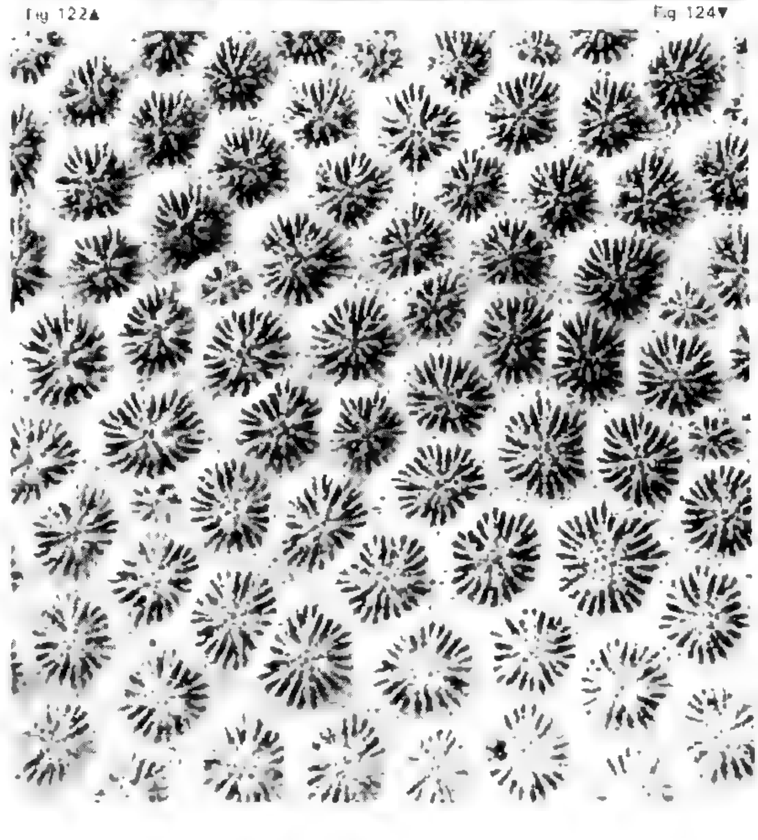
Fig. 121 From Pandora Reef, collecting station 172, same corallum as Fig. 119.
Fig. 122 From Nara Inlet, Hook Island, Whitsunday Islands, same corallum as Fig. 120.
Fig. 123 From Lizard Island.
Fig. 124 From Pioneer Bay, Orpheus Island, Palm Islands, collecting station 45





121▲ Fig 123▼ Fig 122▲ Fig 124▼





Skeletal variations and affinities

The series of coralla attributed to this species is very heterogeneous and shows affinities with *G. lobata*, *G. stokesi* and *G. somaliensis*. It is distinguished from *G. lobata* by the presence of shallower corallites with large columellae and correspondingly shorter septa. However, these differences are less marked around the base of some *G. lobata* coralla. It is distinguished from *G. stokesi* by having shallow corallites, dome-shaped columellae and very regular septa. *Goniopora somaliensis* has smaller corallites, a generally encrusting growth form, and finer septa.

Because of the variable nature of the septa and columellae both within and between coralla, *G. djiboutiensis* coralla may be difficult to recognise, but *in situ* its large oral cone makes it distinctive.

Distribution

Widely distributed from the western Indian Ocean to the Great Barrier Reef, Fiji and, probably, the Marshall Islands.

Goniopora stokesi Edwards & Haime, 1851

Synonymy

Goniopora stokesi Edward & Haime, 1851; Edwards & Haime (1860); Ortmann (1888); Bedot (1907); Gravier (1907, 1911); Faustino (1927); Gardiner & Waugh (1939); Nemenzo (1955); Rosen & Taylor (1969); Scheer & Pillai (1974).

'*Goniopora* Java Sea 1' Bernard (1903).

'*Goniopora* Maldives 4' Bernard (1903).

Alveopora irregularis Crossland, 1952.

This species is well illustrated by Bernard (1903), who notes (p. 75) that his Java Sea and Maldives specimens 'are of the same type'. The species is also well illustrated by Rosen & Taylor (1969) and Scheer & Pillai (1974).

Crossland's (1952) *Alveopora irregularis*, a single specimen, is a thin-walled corallum of this species, identical to specimens of the present series in reproductive phase (see below).

Material studied

Big Mary Reef, Thursday Island, Palm Islands (4 specimens), **Chesterfield Atoll, Whitsunday Islands, Bushy Island-Redbill Reef** (2 specimens), **Swain Reefs, Heron Island, Fitzroy Reef** (2 specimens).

These localities include collecting stations 38, 42, 53, 55, 58, 68, 94, 116, 169, 187, 189, 197, 215.

Characters

The shape of colonies varies greatly according to the nature of the substrate on which they grow. Colonies on soft sand or mud substrates are usually small (< 10cm diameter) and hemispherical and are frequently free living. Colonies on solid substrates are massive or are short, thick columns.

The structure of the corallites and the appearance of the living colonies both vary greatly according to the state of asexual reproduction which this species periodically undergoes. During reproduction the coenosarc becomes inflated and separates from the surface of the skeleton by up to 30mm. The large, fleshy polyps are frequently extended up to 80mm in

Fig. 125 *Goniopora stokesi* from Iris Point, Orpheus Island, Palm Islands, collecting station 55 showing a branch end and satellite coralla removed from the coenosarc (× 0.6).

Fig. 126 *Goniopora stokesi* from the Swain Reefs, collecting station 68 (× 0.9).

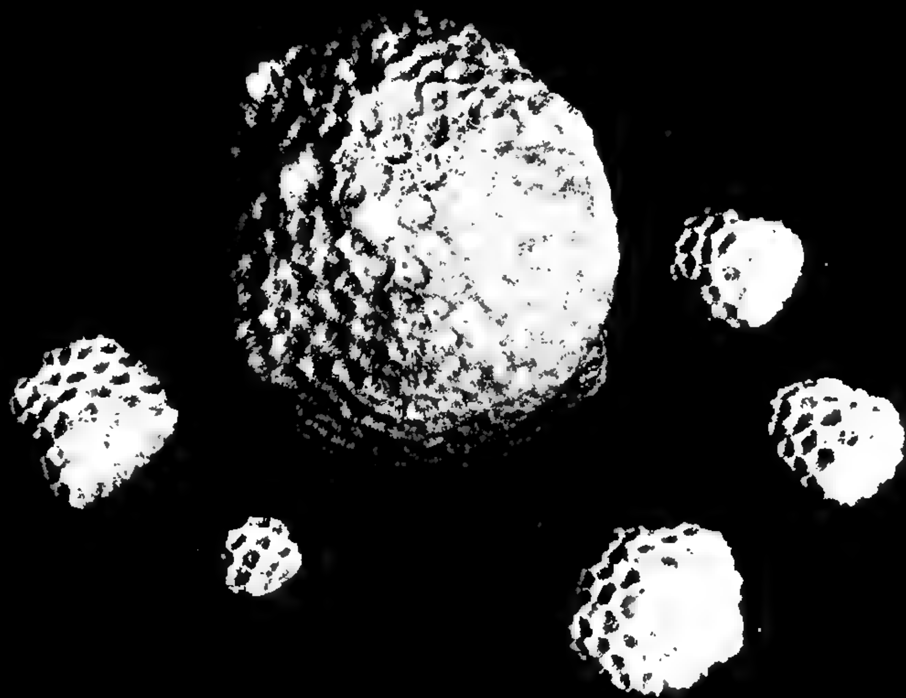
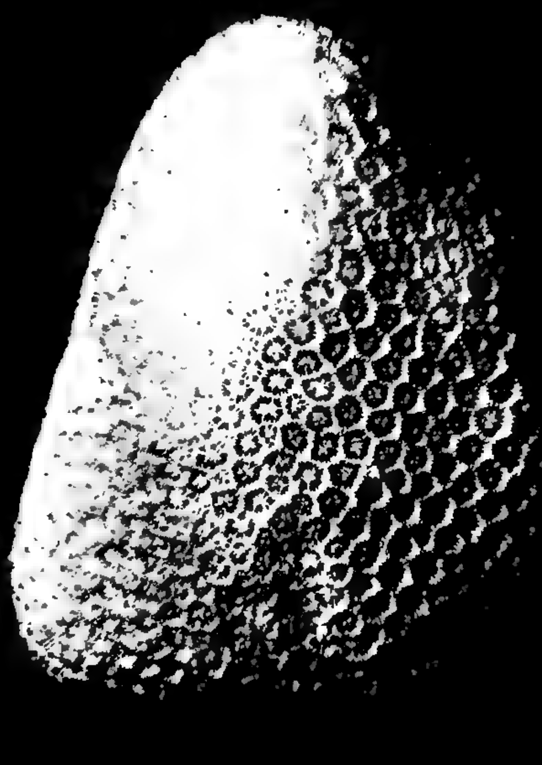


Fig. 125▲

Fig. 126▼



length and there is usually a mixture of polyp sizes, the smallest being a few mm long with only a few short tentacles. Under such conditions, undifferentiated granules of coenosteum develop in the coenosarc. With further calcification, these granules develop into complete corallites which bud further corallites until satellite colonies are formed, still within the coenosarc of the parent colony. These satellite colonies were described by Scheer (1959, 1960), who termed them 'Ableger', as well as by Rosen and Taylor (1969), who termed them 'polyp-balls'. They are illustrated by Rosen & Taylor (1969) and Scheer & Pillai (1974), and are clearly a reproductive strategy, allowing settlement on soft substrates after break-up of the original coenosarc.

When this reproductive process occurs, the corallites of the parent colony become extremely irregular. They have very thin, almost *Alveopora*-like walls, with calices of variable size (2–6mm diameter and 1–4mm deep), mixed together. The floors of the calices are mostly covered by the columellae which are spongy. The septa, which vary in number from 1–24 according to the size of the calices, are very irregular in shape. They are short, highly perforate and are usually irregularly fused. The gonioporoid pattern of fusion is barely detectable.

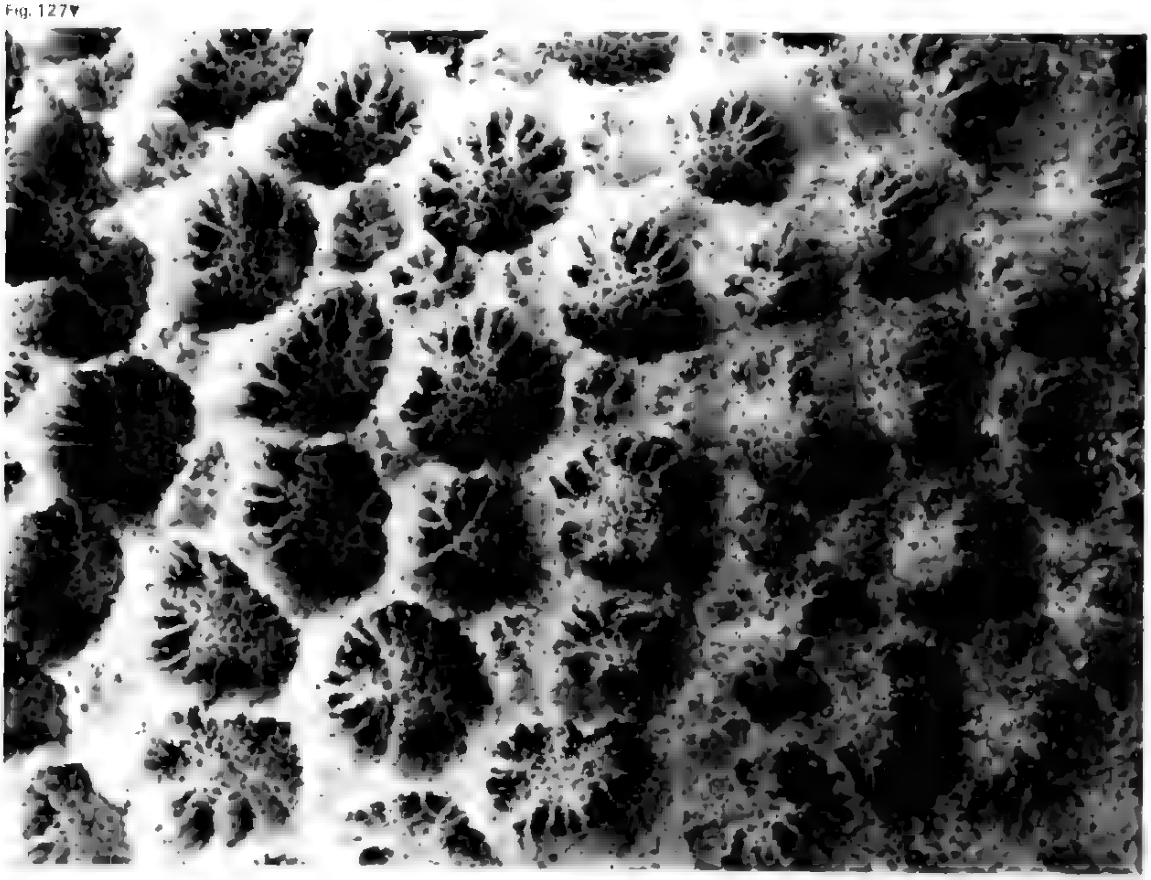
Colonies not undergoing reproduction have much more regular corallites. Calices may be up to 6mm diameter and 5mm deep. Walls are approximately 2mm thick and are usually only slightly perforate. The columellae are $\frac{1}{2}$–$\frac{1}{4}$ the calice diameter and the length of the septa varies accordingly. Septa are 24 in number and have the gonioporoid pattern of fusion clearly developed. All septa are finely dentated. There is usually no evidence of a paliform crown except in shallow corallites near the base of columns where the columella complex may have six pali-like ridges formed at the fusion of three or more septa. Most non-massive coralla, especially those which are free-living, have a well-developed epitheca.

Living colonies are uniform brown or green in colour.

Affinities

Goniopora stokesi is closest to *G. lobata*, *G. djiboutiensis* and *G. columna*, all of which have corallites of similar size. It is usually readily distinguished from *G. lobata* by the latter's very weak development of columellae, thicker walls and larger septa. It is usually distin-

Fig. 127▼



guished from *G. djiboutiensis* and *G. columna* by the characters summarised on p. 70 and p. 80 respectively.

Distribution

Widely distributed throughout the tropical Indo-Pacific from East Africa at least as far east as the Philippines, Indonesia and the Great Barrier Reef.

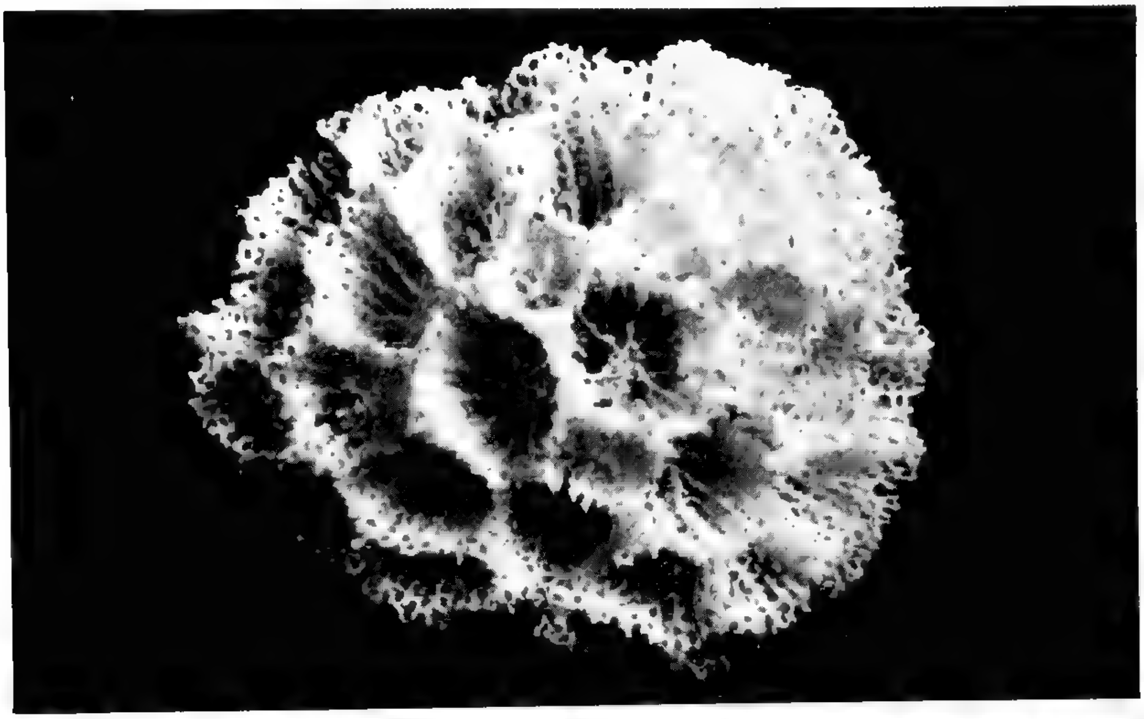
Figs. 127–130 *Goniopora stokesi* (× 5)

Figs. 127, 128 From Iris Point, Orpheus Island, Palm Islands, same coralla as Fig. 125 showing the branch end and the largest satellite coralla respectively.

Fig. 129 From Esk Island, Palm Islands, collecting station 42.

Fig. 130 From the Swain Reefs, same corallum as Fig. 126.

Fig 128▼



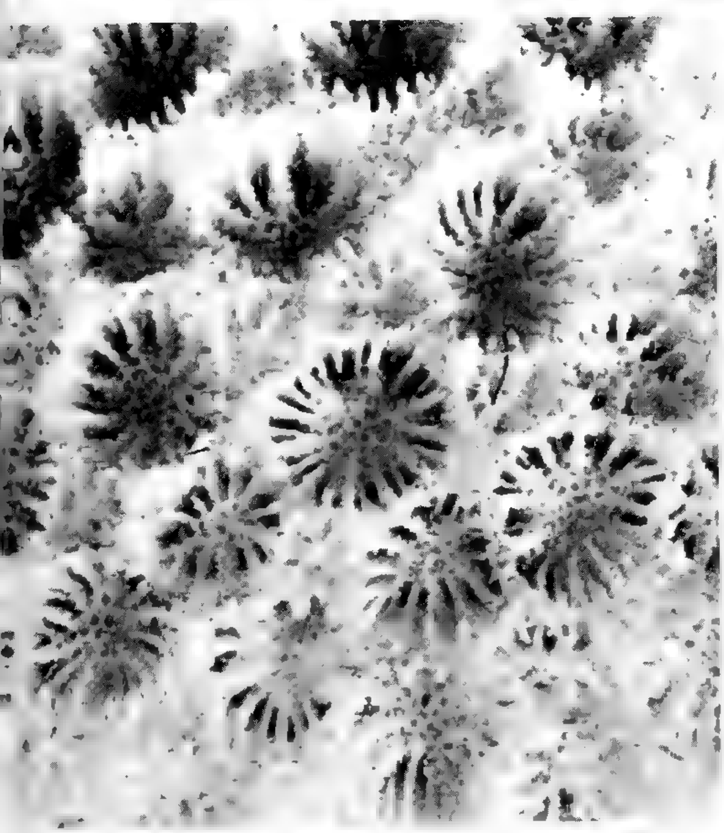


Fig 129▲

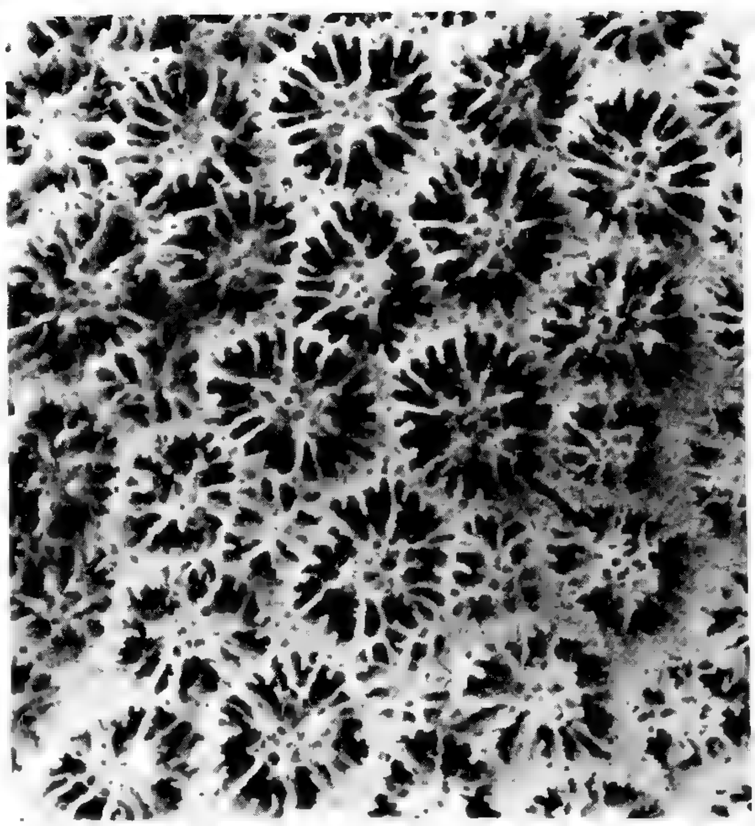


Fig 130▲

Goniopora lobata Edwards & Haime, 1860

Synonymy

Goniopora lobata Edwards & Haime, 1860; Duncan (1889); Bernard (1903); Bedot (1907); Vaughan (1907a, 1918); Hoffmeister (1925); Crossland (1948, 1952); Wells (1955); Stephenson & Wells (1955); Searle (1956).

?*Goniopora hirsuta* Crossland, 1952.

?*Goniopora traceyi* Wells, 1954.

Goniopora columna Dana; *sensu* Scheer & Pillai (1974).

Type specimen number 497 from the Paris Museum has corallites 2.5–3.5mm diameter, smaller than those usually found in Great Barrier Reef specimens, although there are some specimens in the present series that are close to the type.

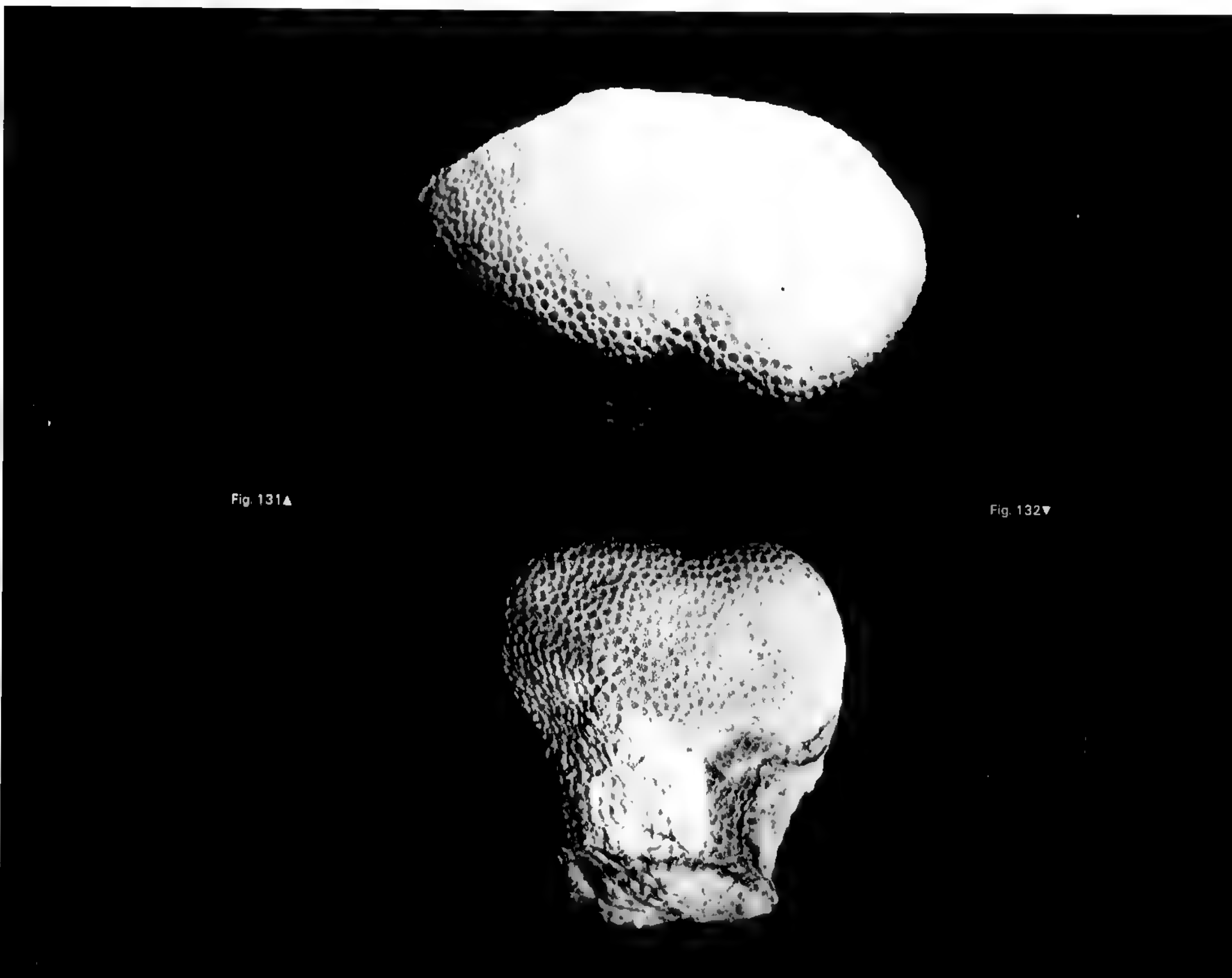
The holotype of *Goniopora traceyi* is close to the type of *G. lobata* and is also very close to specimens in the present series.

Many specimens of Bernard (1903) belong to *G. lobata*. One of these, '*Goniopora* Maldives 2', has corallites near the top of the corallum almost identical with type of *G. lobata*, while those down the sides (as described by Bernard, p. 87) have a range of size and structure covering much of the variability of the species.

Goniopora hirsuta Crossland, 1952 is probably this species. The type specimen is very small and has few distinctive characters except its 'hirsute' appearance.

Opinions of various authors about the validity of *G. lobata* as opposed to *G. columna* and *G. planulata* are discussed below (p. 77).

Figs. 131, 132 *Goniopora lobata* (× 0.45)
Fig. 131 From the Chesterfield Atoll.
Fig. 132 From Fitzroy Island, collecting station 197.



Material studied

Yorke Island (3 specimens), **Arden Island** (2 specimens), **Murray Islands** (2 specimens), **Turtle Islands** (2 specimens), **Tijou Reef** (2 specimens), **Jewell Reef** (2 specimens), **Houghton Island, Lizard Island, Hope Island** (3 specimens), **Low Isles** (4 specimens), **Lihou Reefs** (2 specimens), **Britomart Reef** (3 specimens), **Palm Islands** (45 specimens), **Pandora Reef** (9 specimens), **Magnetic Island** (3 specimens), **Marion Reef** (2 specimens), **Chesterfield Atoll** (18 specimens), **Whitsunday Islands** (7 specimens), **Pompey Reef, Bushy Island-Redbill Reef, Swain Reefs** (4 specimens), **Heron Island, Fitzroy Reef, Musgrave Reef** (5 specimens).

These localities include collecting stations 2, 13, 30, 31, 34, 38, 42, 43, 45, 55, 59, 69, 70, 97, 98, 102, 116, 165, 166, 167, 168, 170, 171, 172, 174, 178, 183, 191, 193, 194, 195, 202, 205, 210, 212, 215.

Previous records from Eastern Australia

Solitary Islands, Veron *et al.* (1974); **Moreton Bay**, Wells (1955b), Lovell (1975); **Bushy-Redbill Reef**, Wallace & Lovell (1977); **Low Isles**, Crossland (1952), Stephenson & Wells (1955).

Characters

Coralla are hemispherical or form columns commonly up to 15cm thick. Corallites are rounded or polygonal, calices are 3–5mm diameter. They have 24 septa that may be in 3 cycles of 6, 6, 12, or two orders of 12, 12, or be of irregular lengths. They are usually fused in the gonioporoid pattern. All septa are granulated and dentate. Pali are not developed, although inner dentations may look like pali. Columellae are usually small, consisting of a few twisted dentations, but may be up to $\frac{1}{2}$ the calice diameter in width. Walls are composed primarily of septa linked with synapticulae which leave regular circular pores. Septa of adjacent corallites are usually not adjoined; the gap between them sometimes leaves a groove along the tops of walls.

Living colonies have very large polyps, commonly brown, yellow or green in colour (Figs. 289–292).

Skeletal variation

Coralla from shallow, turbid water, protected from strong wave action, show the most pronounced characteristics of the species. The growth form is usually massive-columnar, the columns being large with hemispherical ends. They divide if space permits, so that whole colonies are dome-shaped with polyps of adjacent columns in contact. Lower parts of large columns are usually dead. Corallites of such coralla have characteristically small columellae. Septa are in 3 cycles, with the first two sloping towards the corallite centre. The third cycle is short and plunges down the wall.

Coralla from outer reef slopes are submassive and seldom form columns. Columellae commonly reach half the calice diameter. Septa are usually in 2 alternating orders and initially plunge steeply down the corallite wall.

Intermediate environments result in skeletal structures intermediate between these two extremes. Different coralla from the same biotope usually have very similar skeletal structures, but those from different biotopes over the wide range of environments in which *G. lobata* occurs, show such wide variability that this species is frequently difficult to recognise.

Affinities

Goniopora lobata is initially distinguished from *G. columna* by differences in growth form, which tend to be massive and columnar respectively. *Goniopora lobata* is further distinguished by having small columellae and relatively long, well-defined septa.

Goniopora lobata is distinguished from *G. stokesi* by the latter's deep calices, broad columellae, and thin, prominent walls.

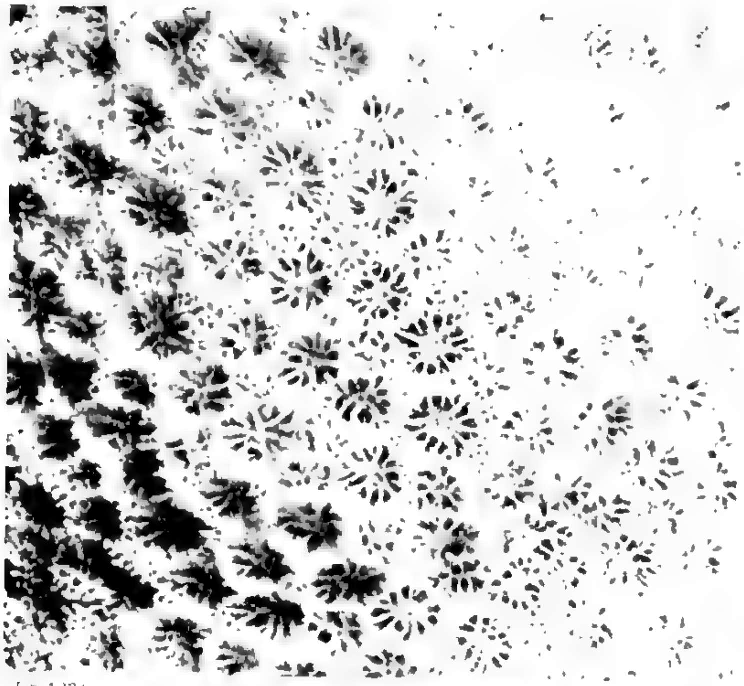


Fig 133▲

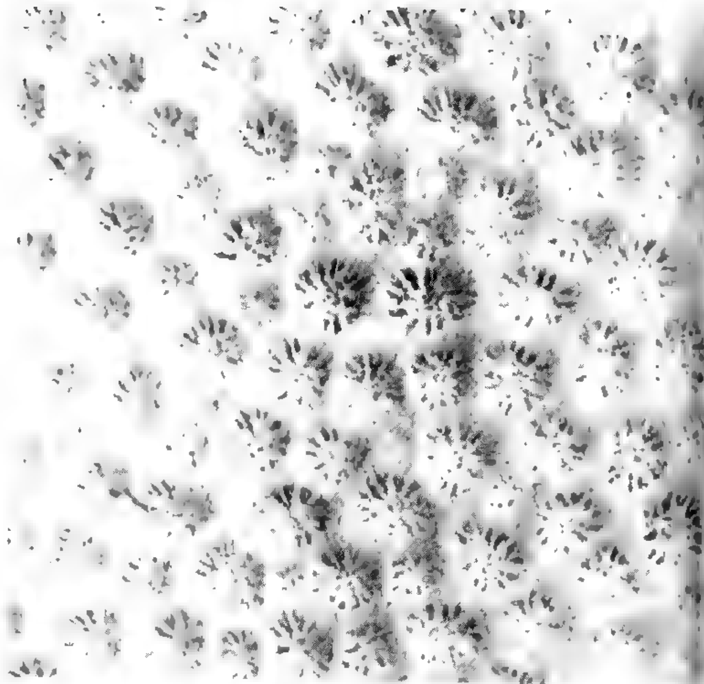


Fig 134▲

Fig 135▼

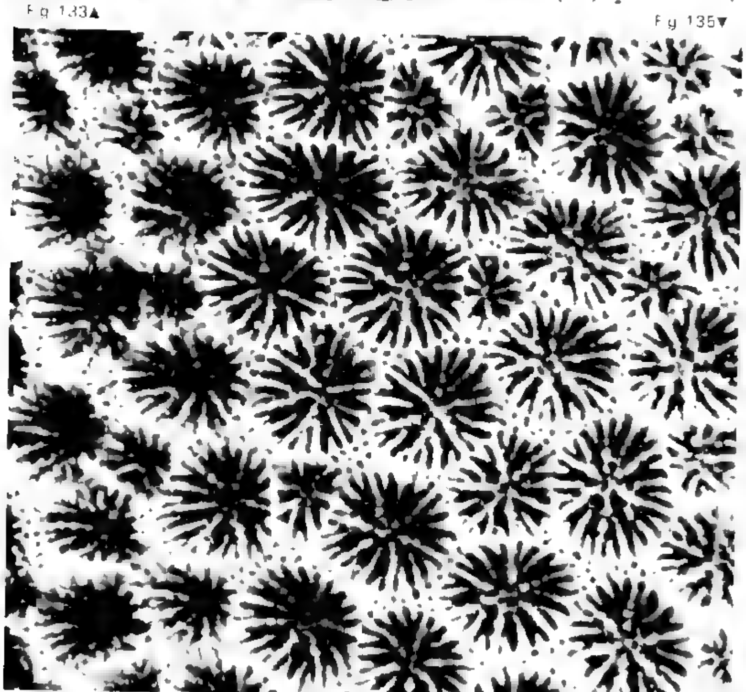


Fig 136▼

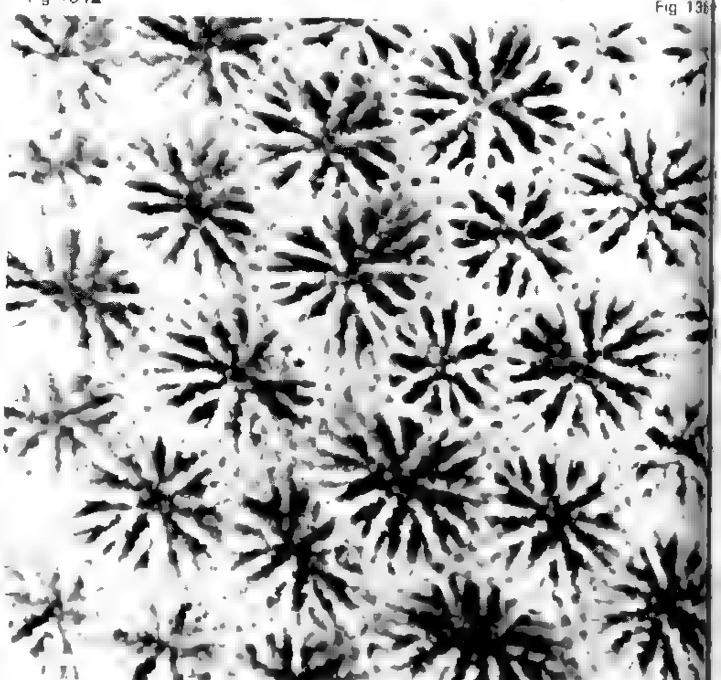


Fig 137▼

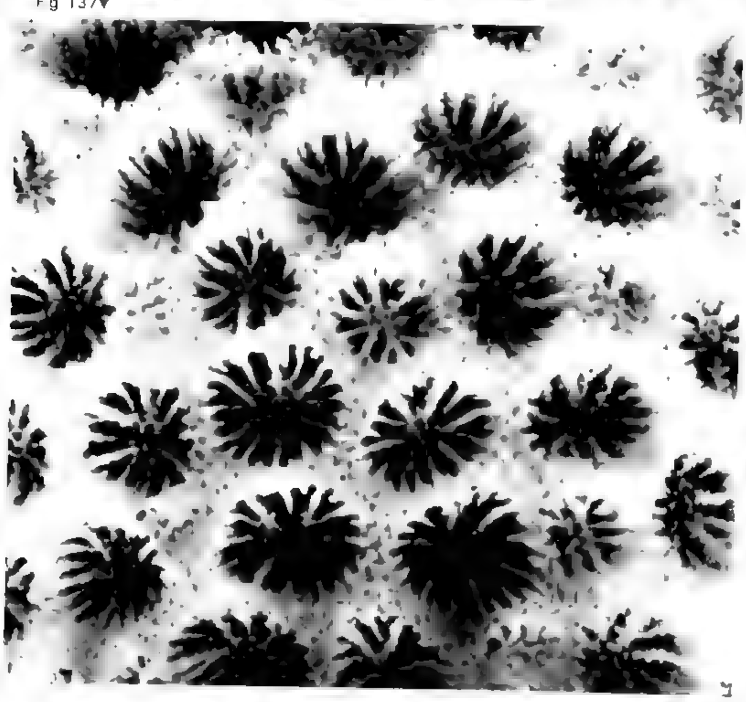
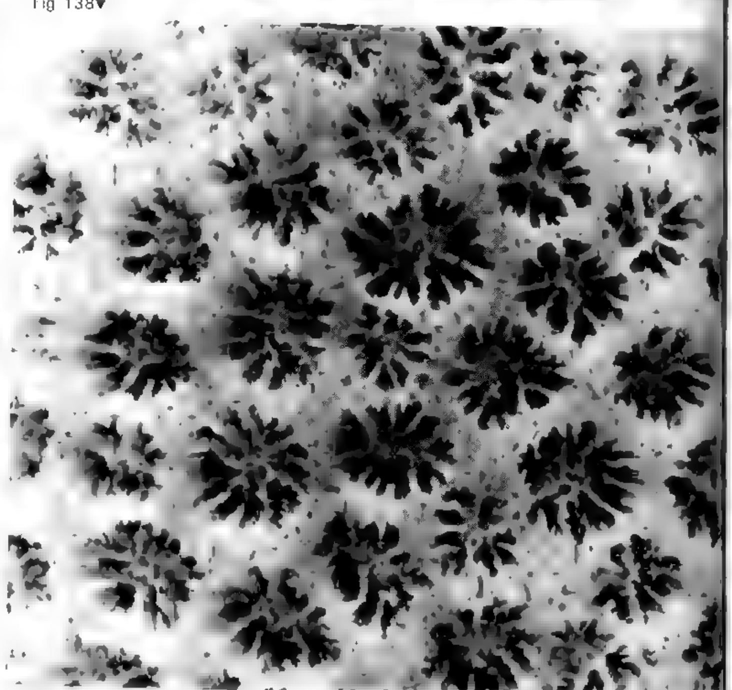


Fig 138▼



Distribution

Widely distributed throughout the tropical Indo-Pacific from Eastern Africa to Fiji and Samoa.

Goniopora columna Dana, 1846

Synonymy

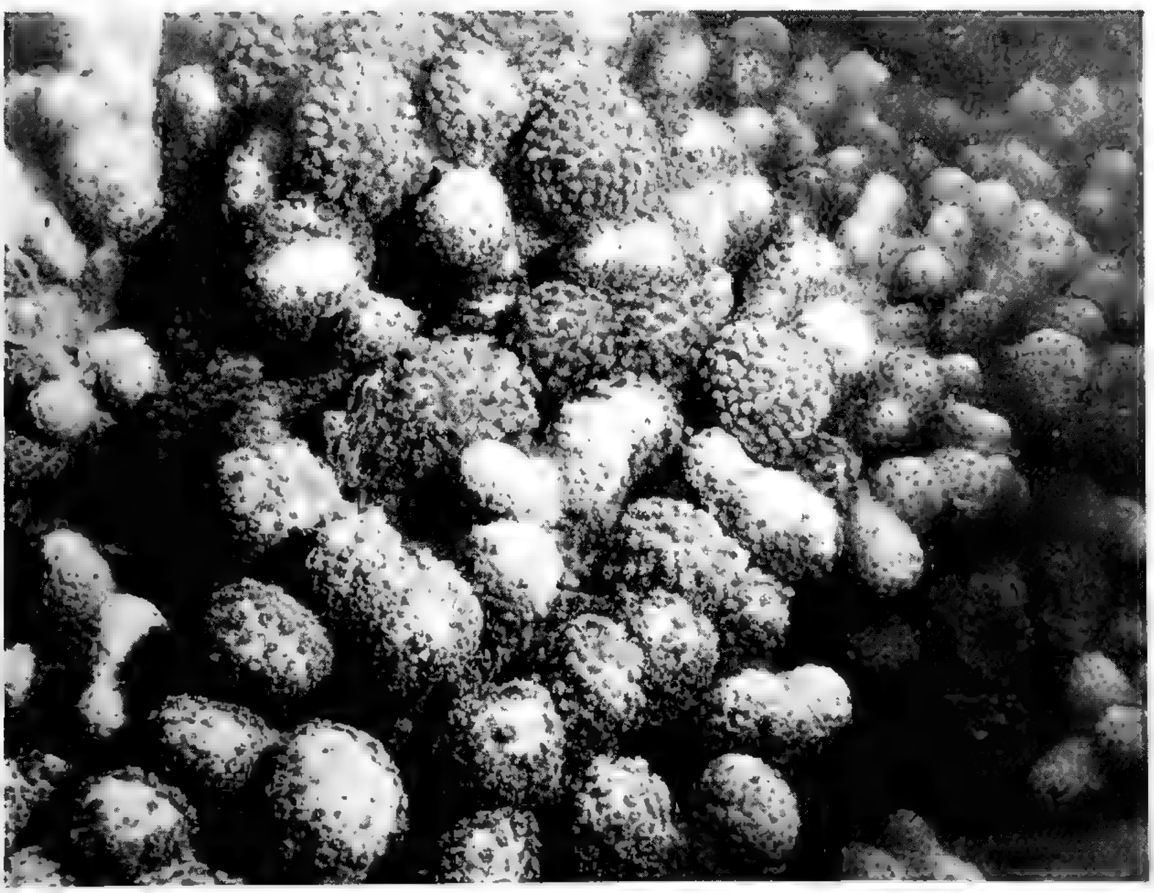
Goniopora columna Dana, 1846; Duncan (1889); Crossland (1938); Umbgrove (1939); Nemenzo (1955); Searle (1956).

Dana's type specimen from Fiji (Fig. 142) is primarily characterised by its very fine septa, which gradually merge with a diffuse columella. Klunzinger (1879) considered *G. columna* to be synonymous with *G. planulata* Ehrenberg from the Red Sea as well as *G. lobata*. Umbgrove (1939) separated *G. planulata* and *G. columna*, an opinion supported by Scheer & Pillai (1974). Crossland (1952) combined Klunzinger's *G. planulata* with *G. columna* and separated *G. lobata* from it. However, the type specimen of *G. planulata* appears to be lost, and Ehrenberg's description of it is unrecognisable.

Figs. 133–138 *Goniopora lobata* (× 5)

Fig. 133 Type specimen from the Red Sea.
Fig. 134 From the Chesterfield Atoll, same corallum as Fig. 131.
Fig. 135 From Fitzroy Island, same corallum as Fig. 132.
Fig. 136 From Low Isles, collecting station 166.
Fig. 137 From Fantome Island, Palm Islands, collecting station 34.
Fig. 138 From Darnley Island, collecting station 31.

Fig. 139 *Goniopora columna* at the Swain Reefs (photo: L. Zell)



Material studied

Big Mary Reef (3 specimens), **Arden Island, Murray Islands, Turtle Islands, Wye Reef, Lizard Island** (2 specimens), **Hope Island** (3 specimens), **Low Isles, Palm Islands** (24 specimens), **Pandora Reef** (7 specimens), **Broadhurst Reef** (2 specimens), **Chesterfield Atoll, Whitsunday Islands** (2 specimens), **Bushy Island-Redbill Reef, Palmaise Reef, Fitzroy Reef** (2 specimens).

These localities include collecting stations 28, 42, 45, 55, 57, 59, 89, 102, 165, 170, 171, 172, 178, 183, 187, 197, 198.

Previous records from Eastern Australia

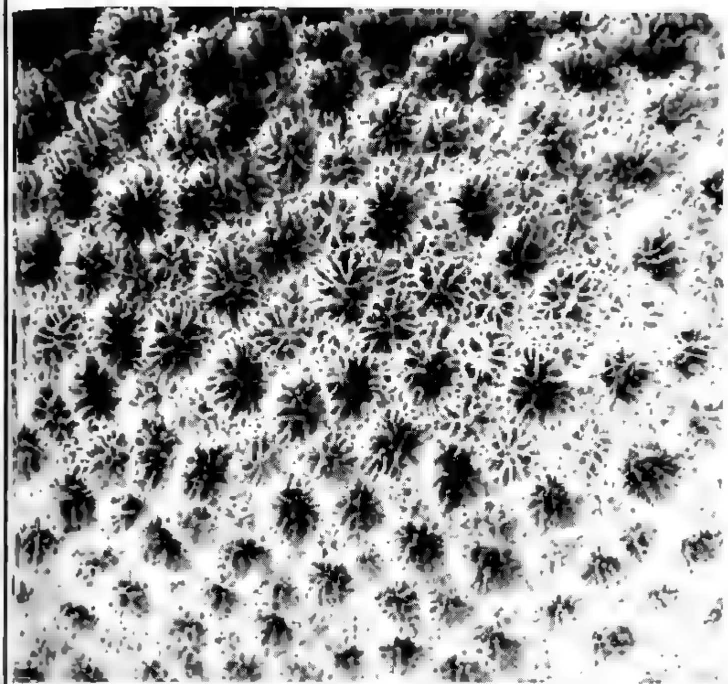
Not previously recorded.

Figs. 140, 141 *Goniopora columna* (×0.6)
Fig. 140 From Iris Point, Orpheus Island, Palm Islands, collecting station 55.
Fig 141 From Hope Island.

Figs. 142 147 *Goniopora columna* (×5)
Fig. 142 Type specimen from Fiji.
Fig. 143 From Iris Point, Orpheus Island, Palm Islands, same corallum as Fig. 140.
Figs. 144, 145 Same corallum from the Turtle Islands, collecting station 165, showing corallites at the base and top of the corallum respectively.
Fig. 146 From Iris Point, Orpheus Island, Palm Islands, collecting station 55.
Fig. 147 From Dewar Island, Murray Islands, collecting station 28.

Fig. 140▲

Fig. 141▼



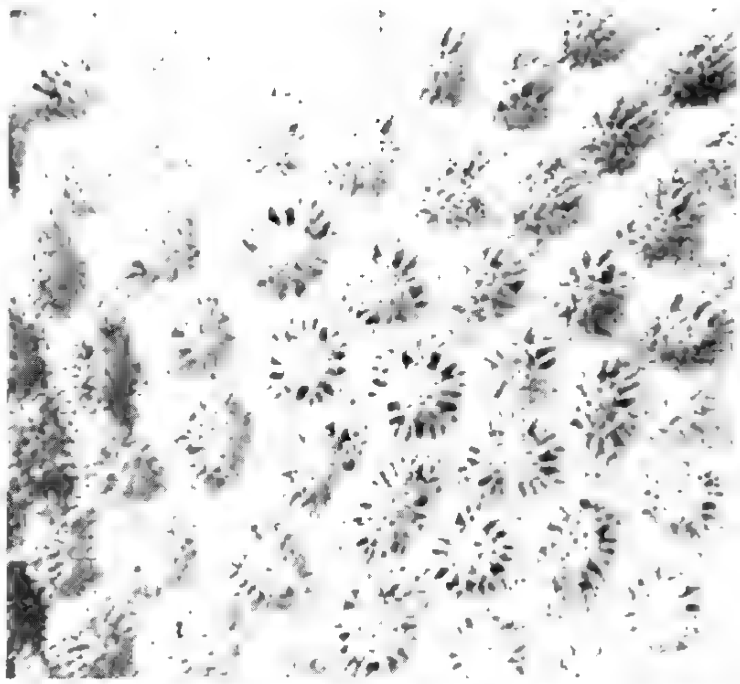
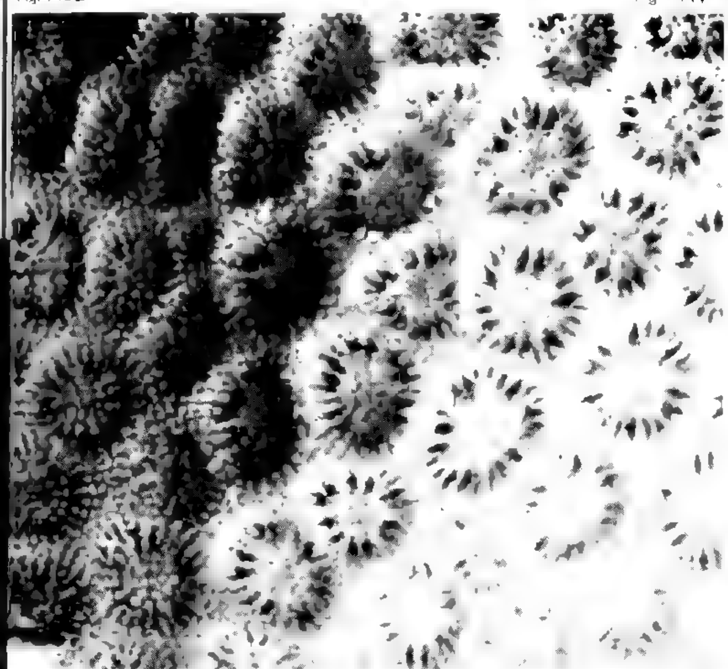


Fig. 142▲ Fig. 144▼ Fig. 143▲ Fig. 145▼



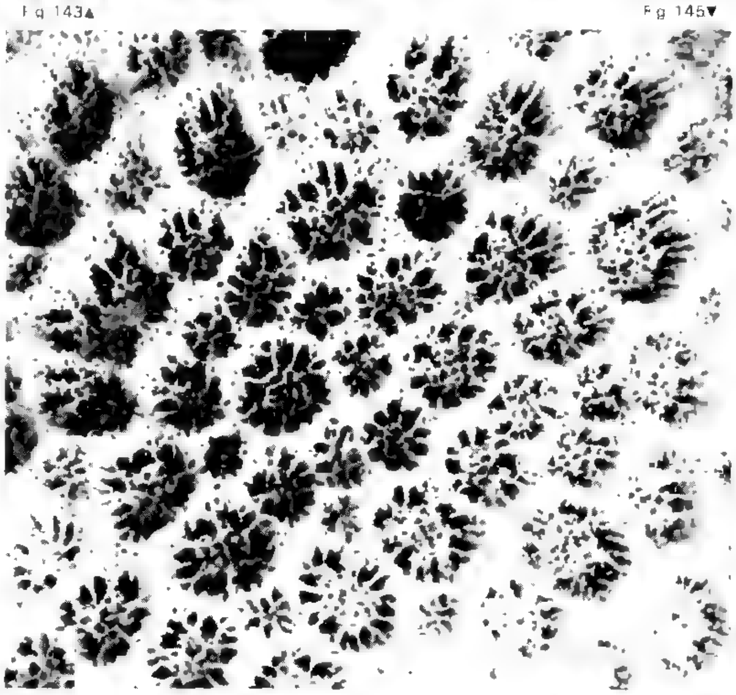
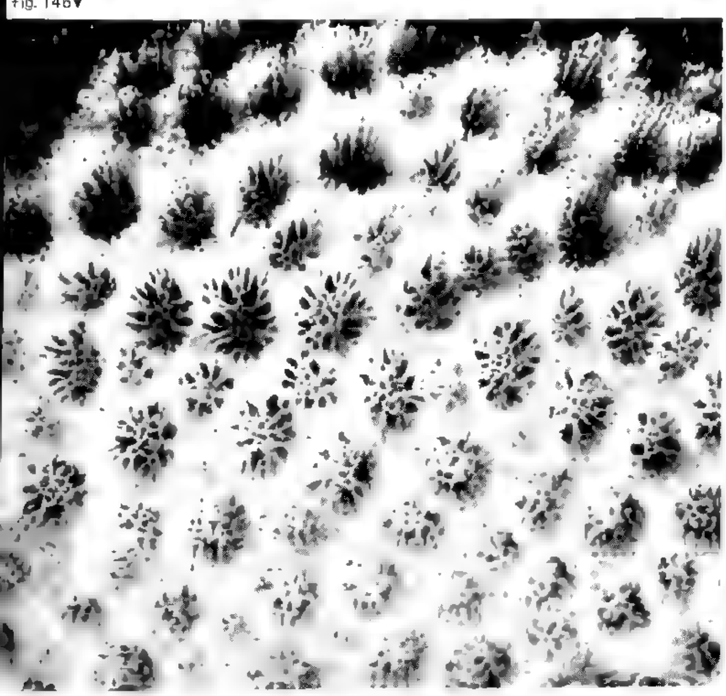
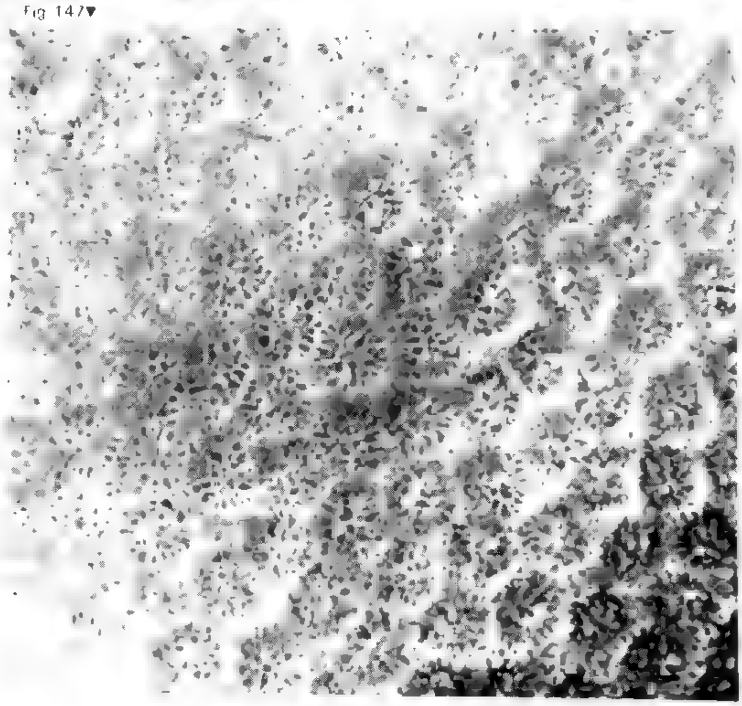


Fig. 146▼ Fig. 147▼





Characters

All coralla of the present series consist of short columns with rounded tops. Columns are usually oval in transverse section and divide in the plane of the greater diameter. Corallites are uniform in size, calices are 3.5–4.5mm diameter. Septa are very fine and highly perforate and irregular, although the gonioporoid pattern of fusion is sometimes clear. All 24 septa can usually be distinguished; sometimes the 6 primary septa are distinguished from the others. The development of pali varies greatly, although they are usually inconspicuous or absent. Columellae are diffuse, occupying $\frac{1}{2}$–$\frac{1}{4}$ the calice diameter. Corallite walls are also highly perforate, although they are normally up to 1.5mm thick. They consist of vertical trabecular plates and an irregular pattern of synapticulae. Most columns have a well-developed epitheca.

Living colonies have very large, fleshy polyps. These are uniform in colour, usually brown, green or yellow. Some have a pink mouth. Contracted polyps frequently have a different colour from extended ones. In areas where this species is abundant, the polyps on different columns may vary greatly in their degree of extension and have correspondingly different colours.

Skeletal variation

As with most *Goniopora*, different corallites of the same corallum may vary greatly (Figs. 144, 145). Corallites near the base of columns are usually shallow, well calcified, have broad columellae and well-defined septa. Those near the top of columns have the very fine, irregular septa and the diffuse columellae that characterise the species.

Affinities

Goniopora columna is closest to *G. stokesi*. It is distinguished from it by having shallower calices, thicker walls and less well-defined columellae. However, both species have broad columellae and highly perforate septa and generally similar growth forms and may thus be difficult to distinguish, especially when *G. stokesi* is in a non-reproductive phase (see p. 72). *Goniopora columna* and *G. lobata* are also very similar (see p. 75) and can seldom be distinguished *in situ*.

Distribution

Widely distributed throughout the tropical Indo-Pacific from the Red Sea to Fiji.

Goniopora somaliensis Vaughan, 1907

Synonymy

Goniopora somaliensis Vaughan, 1907b.

Material studied

Yorke Island (3 specimens), **Little Mary Reef, Murray Islands** (4 specimens), **Triangle Reef** (3 specimens), **Sir Charles Hardy Islands** (2 specimens), **Houghton Island** (2 specimens), **Lizard Island, Willis Islet** (2 specimens), **Low Isles, Magdelaine Cay, Lihou Reefs** (6 specimens), **Britomart Reef** (2 specimens), **Palm Islands** (9 specimens), **Pandora Reef** (4 specimens), **Broadhurst Reef, Bowden Reef, Chesterfield Atoll** (19 specimens), **Whitsunday Islands** (3 specimens), **Swain Reefs**.

These localities include collecting stations 13, 16, 28, 30, 34, 35, 38, 55, 57, 59, 78, 97, 100, 101, 140, 157, 165, 166, 167, 172, 179, 181, 185, 187, 199, 200, 202, 210, 211, 212, 213, 215.

Previous records from Eastern Australia

Not previously recorded.

Fig. 148 *Goniopora somaliensis* from the Chesterfield Atoll (× 0.45).

Characters

Coralla are thin and encrusting or are large thick plates. Corallites are shallow, giving coralla a smooth surface. Calices are polygonal, 2.8–4.0mm diameter. Septa are in two alternating orders with a partial gonioporoid pattern of fusion. Most first order septa reach the columella while second order septa are short, with either free or fused vertical inner margins. The pali are usually prominent and there are usually additional pali-like dentations, all of which are thick and knob-like. Remaining septal dentations are usually large and are arranged in 2 or 3 concentric rows. Walls are thick and are composed of septa and septal dentations linked by synapticulae. The columellae are plate-like, being composed of fused septal dentations which are horizontally flattened.

Living colonies are usually grey. Polyps are short and cylindrical with short pointed tentacles, a pale oral disc and a pink mouth (Figs. 297–299).

Skeletal variation

As illustrated, some coralla have a cellular appearance with sharply defined walls and a distinct crown of pali. Others resemble the holotype in having shallow superficial corallites with indistinct walls and little or no development of pali.

Affinities

Large colonies are easily recognised, as this is the only east Australian *Goniopora* which forms large flat plates. Even small encrusting coralla are readily recognised, as corallites are shallower than any other species with a similar corallite size.

Distribution

Previously recorded only from East Africa.

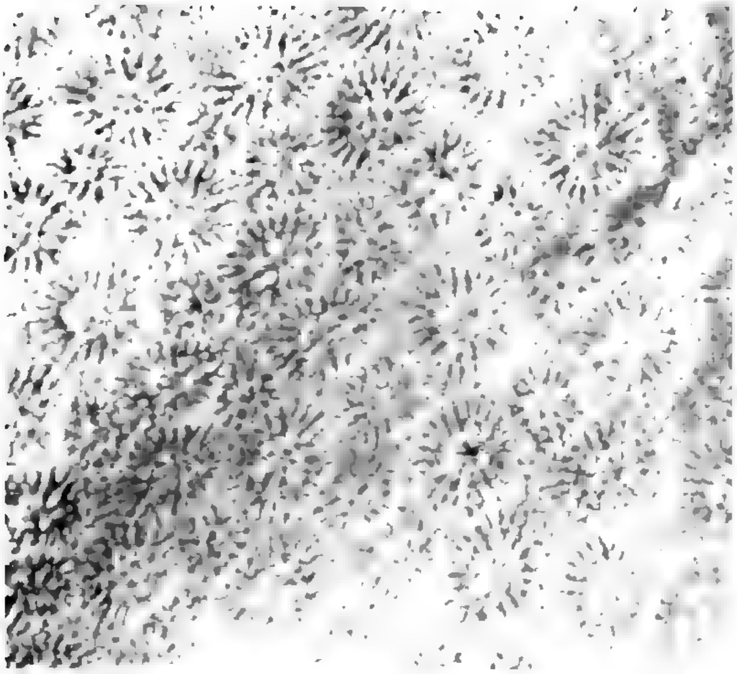


Fig 149▲

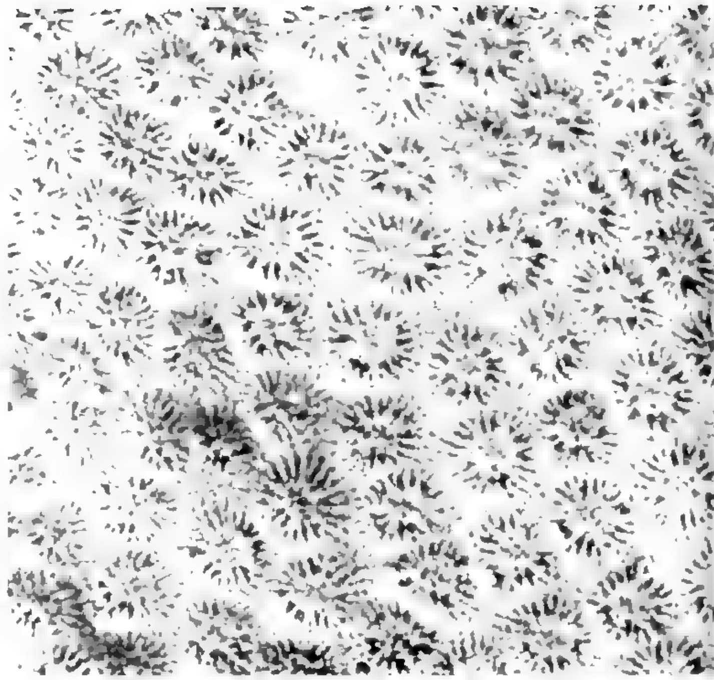


Fig 150▲

Fig 151▼

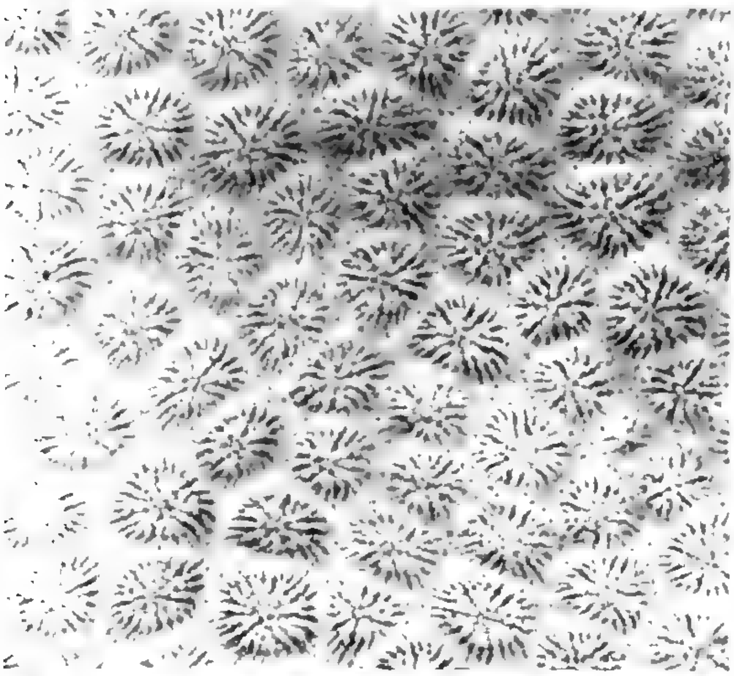


Fig 152▼

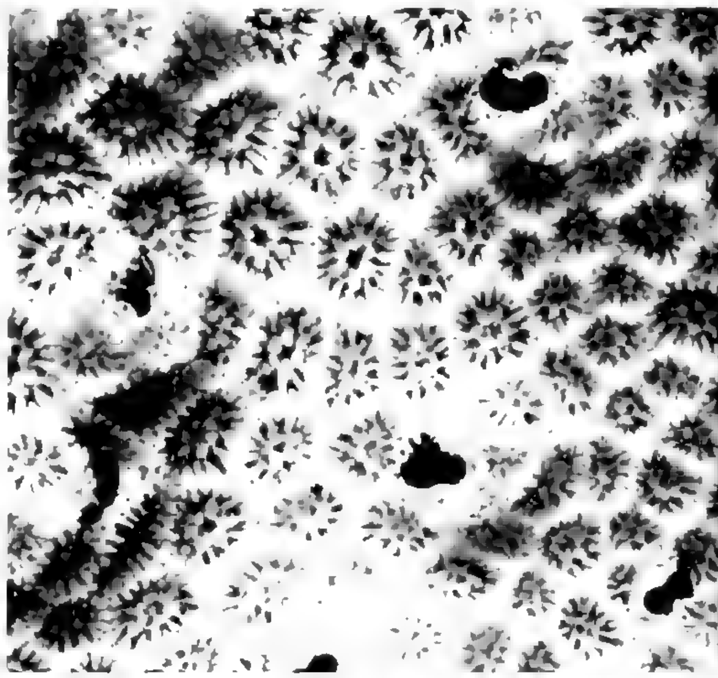


Fig 153▼

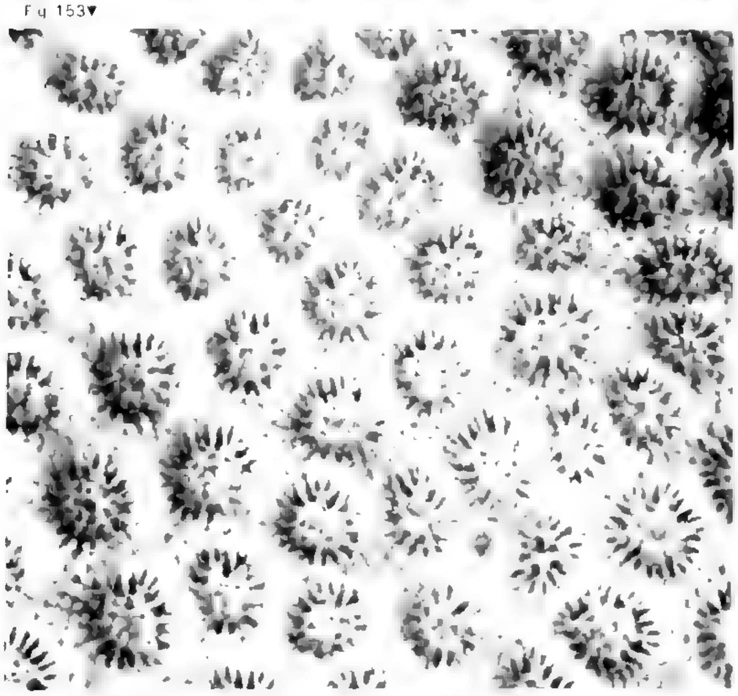


Fig 154▼

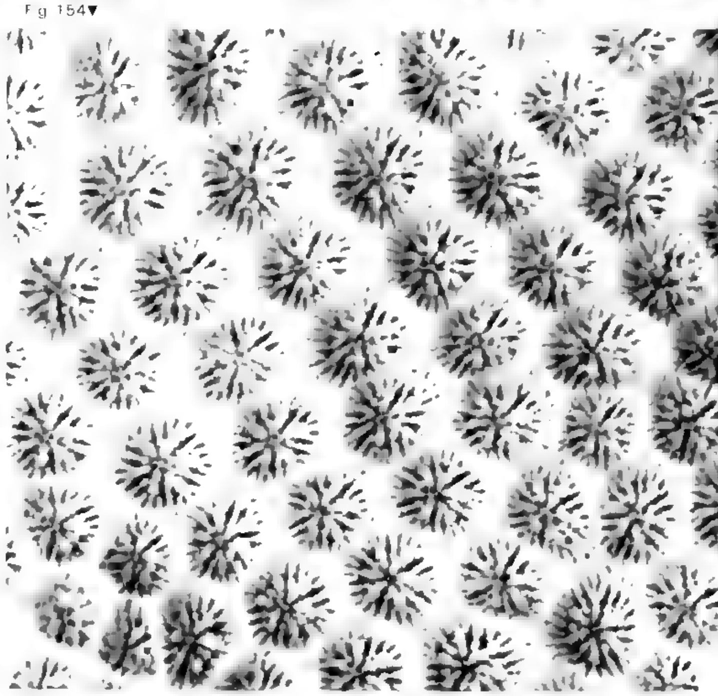


Fig. 155 *Goniopora tenuidens* from Keeper Reef (× 0.5)

Goniopora tenuidens Quelch, 1886

Synonymy

Rhodaraea tenuidens Quelch, 1886; Bedot (1907).

Goniopora tenuidens (Quelch); Vaughan (1918); Faustino (1927); Umbgrove (1940); Stephenson & Wells (1955); Ma (1959); Utinomi (1965); Chevalier (1968); Scheer & Pillai (1974).

'*Goniopora* Moluccas 1' Bernard (1903).

This is one of the most readily identified *Goniopora* from photographs, with all published illustrations of it showing close resemblance to Quelch's type or having still more prominent pali than the type.

Figs. 149–154 *Goniopora somaliensis* (× 5)

Fig. 149 Type specimen from Somalia.
Fig. 150 From Big Mary Reef, collecting station 187.
Fig. 151 From Bennett Island, Chesterfield Atoll, collecting station 215.
Fig. 152 From South-east Cape, Great Palm Island, collecting station 38.
Fig. 153 From Wyer Island, Murray Islands, collecting station 30.
Fig. 154 From the Chesterfield Atoll, same corallum as Fig. 148.

Material studied

Darnley Island (8 specimens), **Murray Islands** (6 specimens), **Sue Island** (2 specimens), **Thursday Island** (2 specimens), **Great Detached Reef** (4 specimens), **Wye Reef** (2 specimens), **Tijou Reef** (6 specimens), **Bewick Island** (3 specimens), **Lizard Island** (5 specimens), **Hope Island** (11 specimens), **Willis Islet** (3 specimens), **Low Isles** (7 specimens), **Magdelaine Cay** (9 specimens), **Britomart Reef** (7 specimens), **Bowl Reef** (3 specimens), **Palm Islands** (110 specimens), **Keeper Reef** (3 specimens), **Chesterfield Atoll** (22 specimens), **Whitsunday Islands** (16 specimens), **Pompey Reef** (2 specimens), **Bushy Island-Redbill Reef** (11 specimens), **Fitzroy Reef** (10 specimens), **Llewellyn Reef** (2 specimens), **Lady Musgrave Reef** (2 specimens).

These localities include collecting stations 1, 2, 6, 8, 12, 18, 27, 28, 31, 34, 36, 37, 38, 41, 42, 43, 45, 46, 48, 53, 55, 57, 60, 70, 73, 89, 94, 97, 98, 101, 102, 163, 167, 169, 170, 182, 190, 192, 194, 195, 196, 197, 199, 200, 210, 215.

Previous records from Eastern Australia

North-west Island, Hedley (1925); **Bushy-Redbill Reef**, Wallace & Lovell (1977); **Batt Reef**, Yonge (1930); **Low Isles**, Yonge (1940); Crossland (1952); Stephenson & Wells (1955); **Murray Island**, Vaughan (1918); Mayor (1918).

Characters

Coralla are massive, hemispherical or spherical. Calices are rounded or polygonal, 2.5–3.1mm diameter, except for immature corallites which are often irregularly distributed on convex surfaces where budding is common. Septa are in 3 well-defined cycles. First cycle septa have no pali; they may also be fused with the columella, or else have free inner margins plunging deep within the corallite. Second cycle septa are very prominent, having very large pali which are thicker than the other septa and which are fused with the columella. Third cycle septa are always very short. All septa are regularly dentate, the dentations usually being arranged in rows down the corallite walls. Columellae are always small, consisting of a few irregularly fused dentations from the second, or first and second, septal cycles. Corallite walls are primarily composed of septa which are evenly exsert and have highly granulated tips. Septa are linked by cross-bars of synapticulae leaving a regular lace-work of rounded pores.

Living colonies in lagoons (where this species is very common) (Fig. 300) are uniform in colour, different colonies having different colours, commonly bright blue, green or brown, sometimes with blue or white tips to the tentacles. Colonies from deeper reef slopes are usually dull brown in colour. Polyps are evenly extended with terete tentacles of even length (Figs. 301–303).

Skeletal variation

Goniopora tenuidens commonly occurs as small, sub-spherical colonies in lagoons and other shallow-water biotopes exposed to strong illumination. Such colonies have the most pronounced pali and the thickest septa and walls. Coralla from deeper or more turbid biotopes have reduced pali and first cycle septa have free inner margins.

Figs. 156–161 *Goniopora tenuidens* (× 5)

Fig. 156 From Keeper Reef, same corallum as Fig. 155.
Fig. 157 From Great Detached Reef.
Fig. 158 From Elk Cliff, Great Palm Island, collecting station 37.
Fig. 159 From Sue Island, collecting station 182.
Fig. 160 From Bushy Island-Redbill Reef, collecting station 73.
Fig. 161 From Great Detached Reef, collecting station 1.

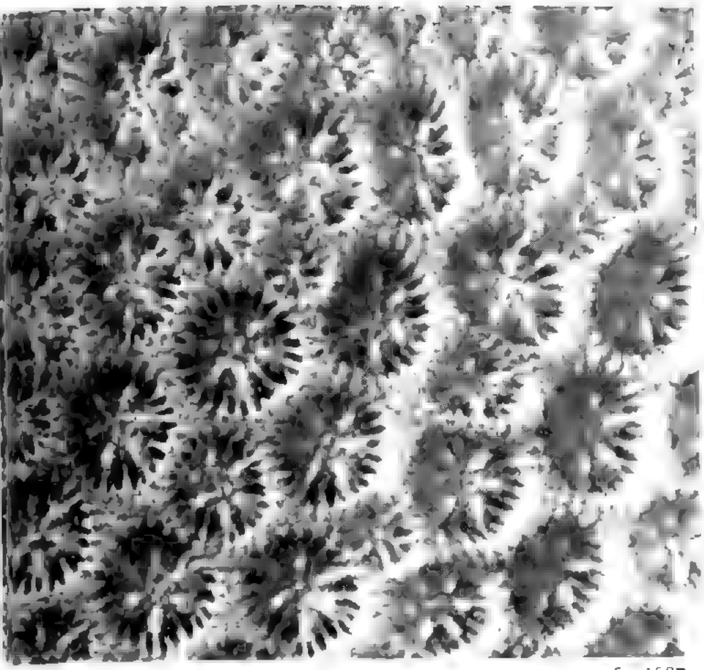


Fig 156▲

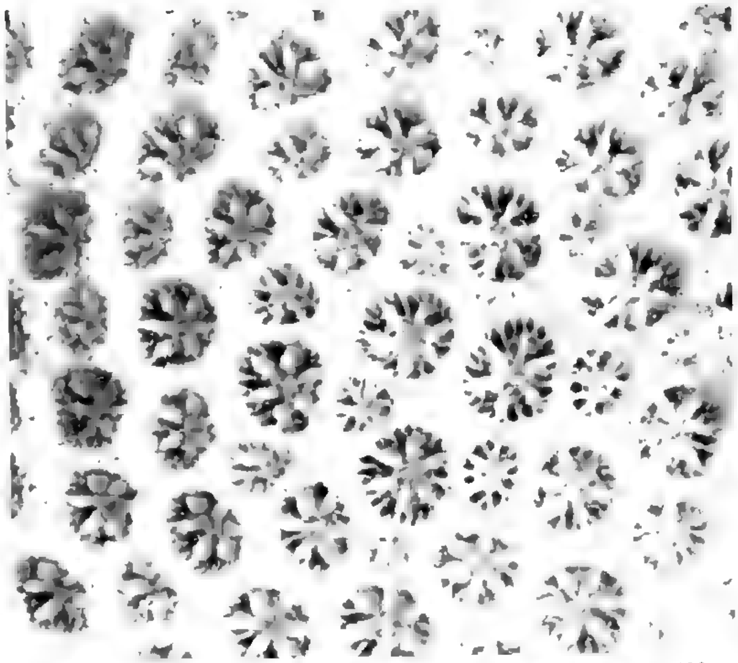


Fig 157▲

Fig 158▼

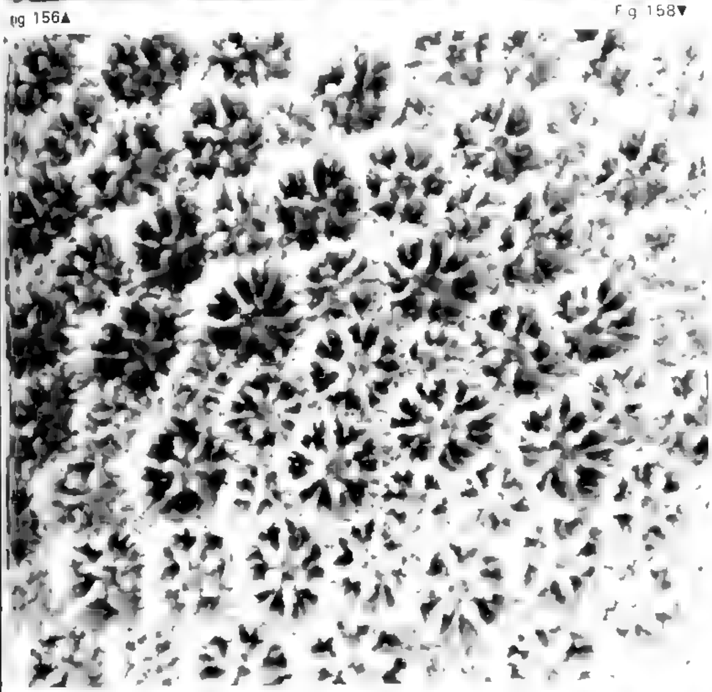


Fig 159▼

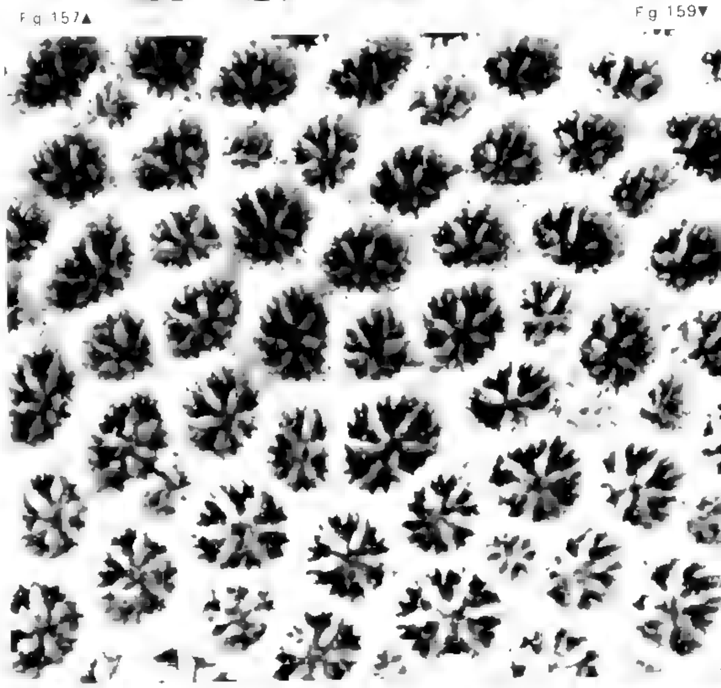


Fig 160▼

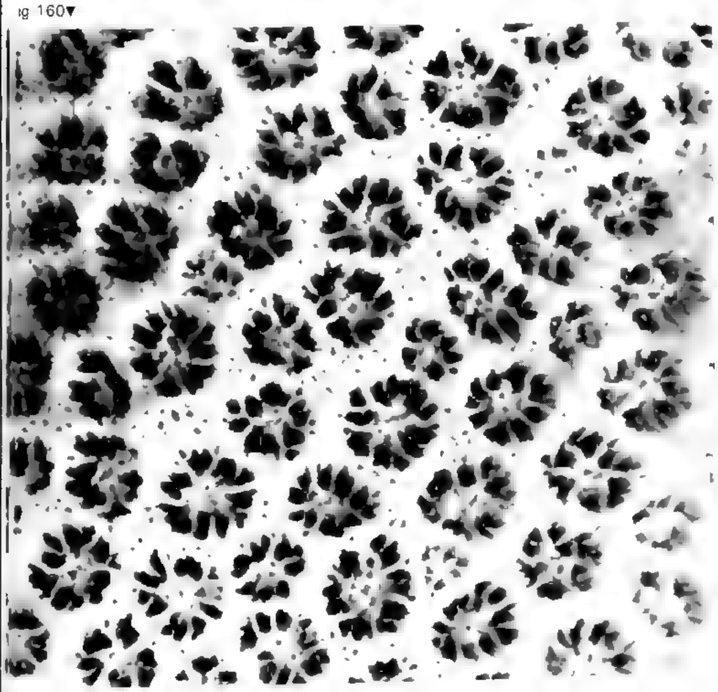
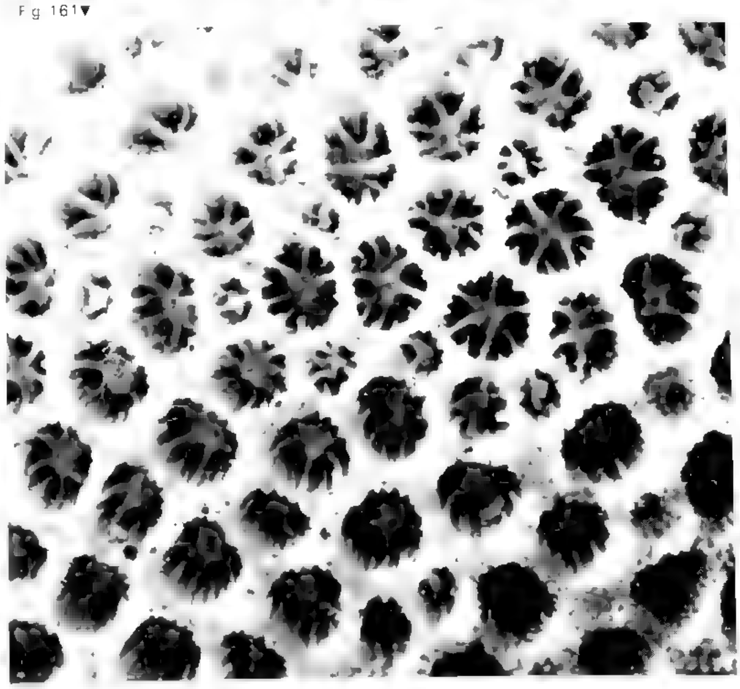


Fig 161▼



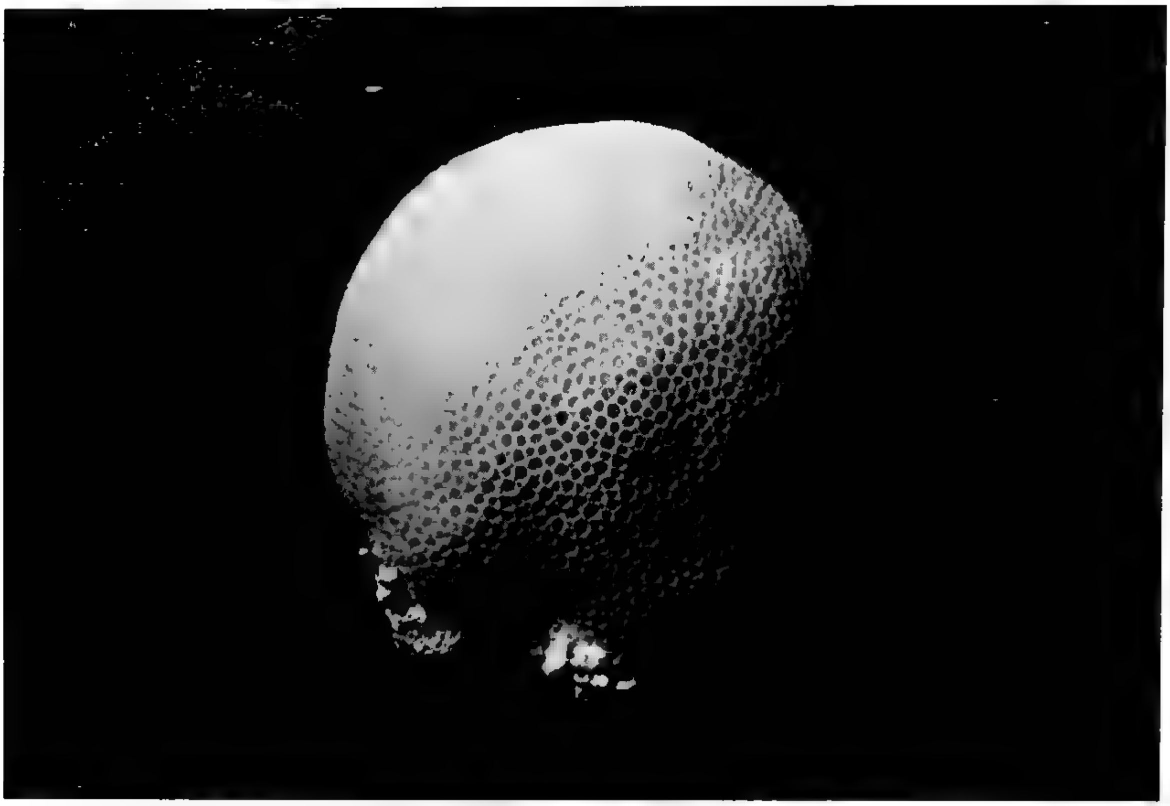


Fig. 162 *Goniopora minor* from Magdelaine Cay, collecting station 200 (× 0.6).

Affinities

Goniopora tenuidens is closest to *G. norfolkensis,* which is distinguished by the absence of pali and by the shape of the septa, which do not plunge steeply down the corallite wall but which slope towards the columellae. It is also close to *G. minor* (see p. 88).

Distribution

Widely distributed in the western Pacific from the South China Sea, Philippines, Indonesia, New Caledonia to the Great Barrier Reef and west to the Nicobar Islands.

Goniopora minor Crossland, 1952

Synonymy

Goniopora pedunculata Quoy & Gaimard; Edwards & Haime (1848); Quelch (1886); Faustino (1927); Nemenzo (1955).

Goniopora minor Crossland, 1952; Nemenzo (1955); Stephenson & Wells (1955); Ma (1959).

'*Goniopora* Great Barrier Reef 2, 3, 5, 10, 11' Bernard (1903).

Crossland (1952, p. 233) named this species from Bernard's (1903) 'Great Barrier Reef 5', an unfortunate choice as Bernard's specimen 1902–9–9–4 is close to the type of *G. tenuidens,* which can be readily confused with *G. minor* (see below). However, Crossland selected his own holotype which clearly has the characters of the present species.

Figs. 163–168 *Goniopora minor* (× 5)
Figs. 163, 164 From Low Isles, collecting station 166.
Fig. 165 From Britomart Reef, collecting station 167.
Fig. 166 From Magdelaine Cay, collecting station 200.
Fig. 167 From Tijou Reef, collecting station 2.
Fig. 168 From Happy Bay, Long Island, Whitsunday Islands, collecting station 102.

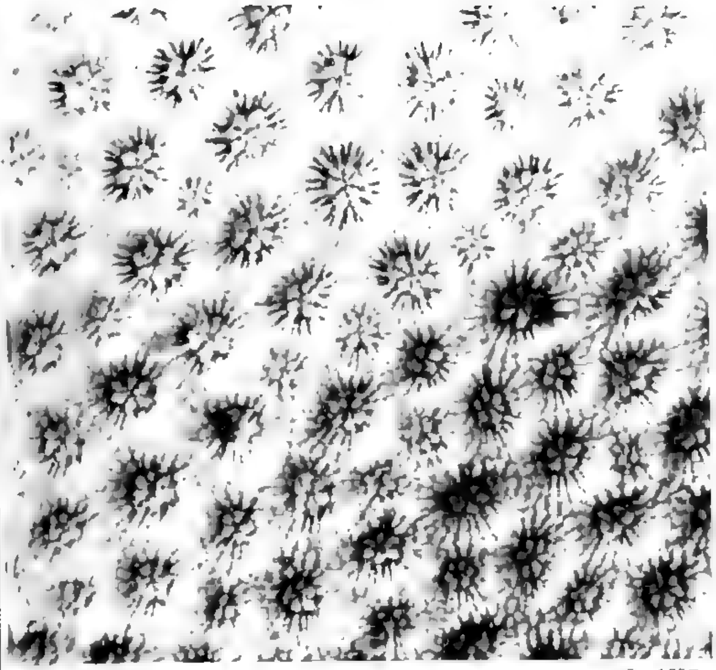


Fig 163▲

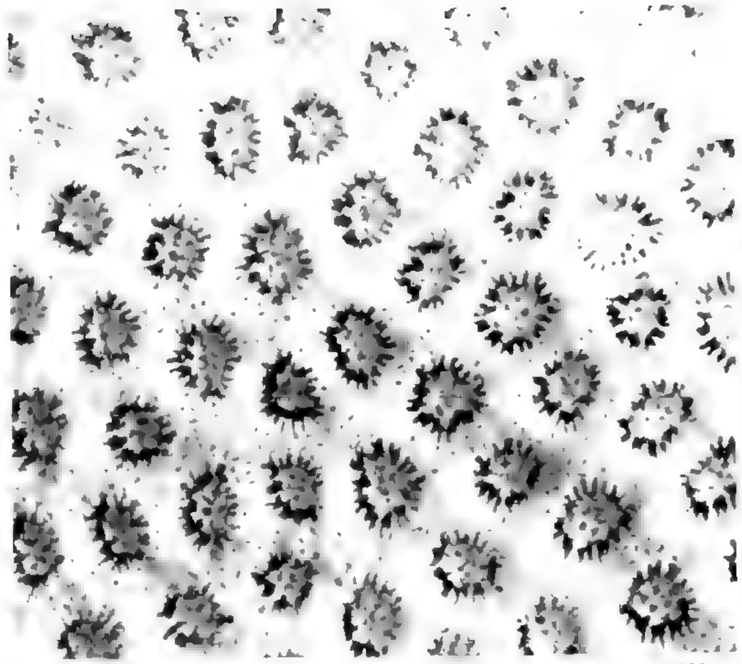


Fig 164▲

Fig 165▼

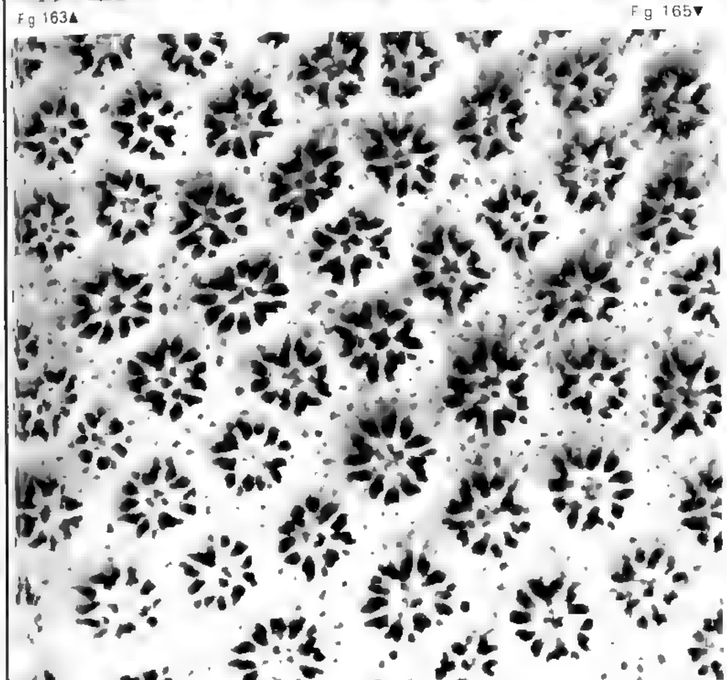


Fig 166▼

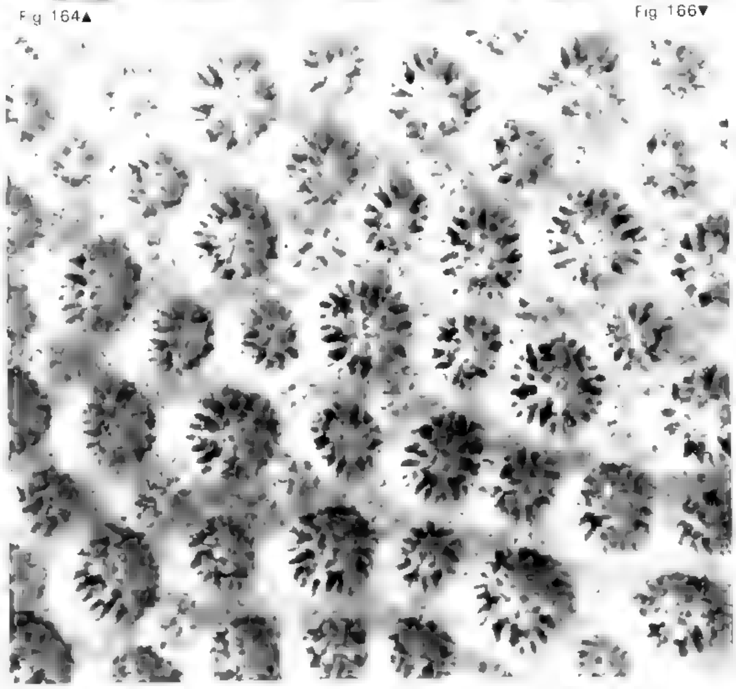


Fig 167▼

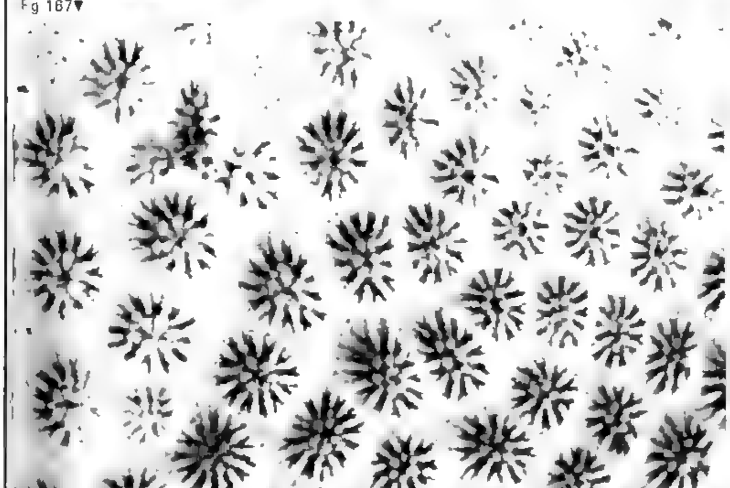
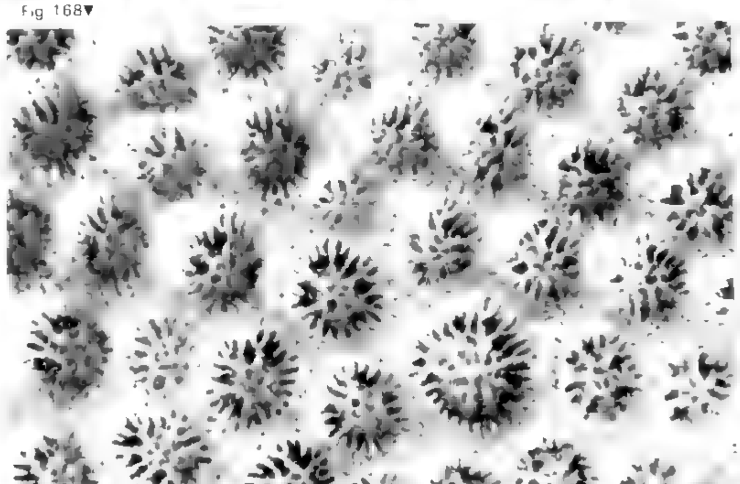


Fig 168▼



Goniopora malaccensis Brüggemann, 1878 (Bernard's (1903) '*Goniopora* Singapore 3') is close to this species and may prove to be a senior synonym. However, it has thinner walls, less well-developed columellae and less well-developed pali than any specimen in the present series.

Goniopora pedunculata Quoy & Gaimard, 1833 from New Guinea may also be this species, although the type specimen appears to be lost and the species cannot be recognised with certainty from Quoy & Gaimard's description. Edwards & Haime's (1848) description of *G. pedunculata* is based on specimen 175b in the Paris Museum; this is not the holotype (see Bernard, 1903, pp. 36–7), but it is certainly the present species.

Material studied

Yorke Island (13 specimens), **Little Mary Reef, Arden Island** (6 specimens), **Sue Island** (2 specimens), **North-west Island** (2 specimens), **Turtle Islands** (5 specimens), **Great Detached Reef** (8 specimens), **Martha Ridgway** (2 specimens), **Tijou Reef** (6 specimens), **Corbett Reef** (2 specimens), **Yonge Reef** (2 specimens), **Lizard Island** (3 specimens), **Hope Island** (4 specimens), **Willis Islet** (2 specimens), **Low Isles** (21 specimens), **Magdelaine Cay** (5 specimens), **Lihou Reefs** (4 specimens), **Britomart Reef** (6 specimens), **Palm Islands** (19 specimens), **Keeper Reef, Darley Reef** (2 specimens), **Chesterfield Atoll** (18 specimens), **Whitsunday Islands** (7 specimens), **Pompey Reef** (2 specimens), **Fitzroy Reef** (2 specimens), **Lady Musgrave Reef** (10 specimens).

These localities include collecting stations 1, 2, 5, 8, 9, 12, 13, 14, 17, 31, 38, 41, 45, 55, 57, 59, 60, 97, 102, 103, 159, 164, 165, 166, 167, 183, 185, 187, 189, 191, 193, 194, 195, 199, 200, 210, 215, 218.

Previous records from Eastern Australia

Low Isles, Crossland (1952); Stephenson & Wells (1955); 'Great Barrier Reef' (as '*Goniopora* Great Barrier 5'), Bernard (1903).

Characters

Coralla are encrusting to massive, usually forming hemispherical heads. Corallites are 2.5–4mm diameter with walls up to 1.9mm thick. Calices are mostly circular in outline and 1.9–3.0mm diameter. Septa are in 3 cycles, the first 2 always being sub-equal, the third varying from slightly smaller to almost absent. There are 6 well-developed pali which form a neat crown. The pali and the septa are very heavily granulated, making them thick, so that the inner margins of the first and second cycle septa are fused with the pali and the pali are fused with each other. The septa are also dentated, the dentation having elaborated tips. Columellae are weakly developed, consisting of a few anastomosed septal dentations at most. The walls are porous in lightly calcified coralla. The septa of adjacent corallites may be fused or may be separated by a groove along the top of the walls.

Living colonies are a variety of browns or greens in colour, usually with a distinctively coloured oral disc and pale tips to the polyp tentacles (Figs. 304, 305).

Affinities

Goniopora minor is closest to *G. tenuidens* and *G. norfolkensis* which have a similar growth form and corallites of similar size. It is distinguished from both by the relatively thick walls of the corallites and heavily granulated septal structures. Septa and pali are thus very thick, with adjacent pali in contact, forming a crown. The pali of *G. tenuidens* are not in contact, while they are not developed at all in *G. norfolkensis. Goniopora fruticosa, G. palmensis* and *G. eclipsensis* are readily distinguished from *G. minor* by their growth form. All have corallites of similar size, making them difficult to separate by corallite characters (see pp. 99 and 102).

Distribution

Recorded only from the South China Sea, the Philippines and the Great Barrier Reef.

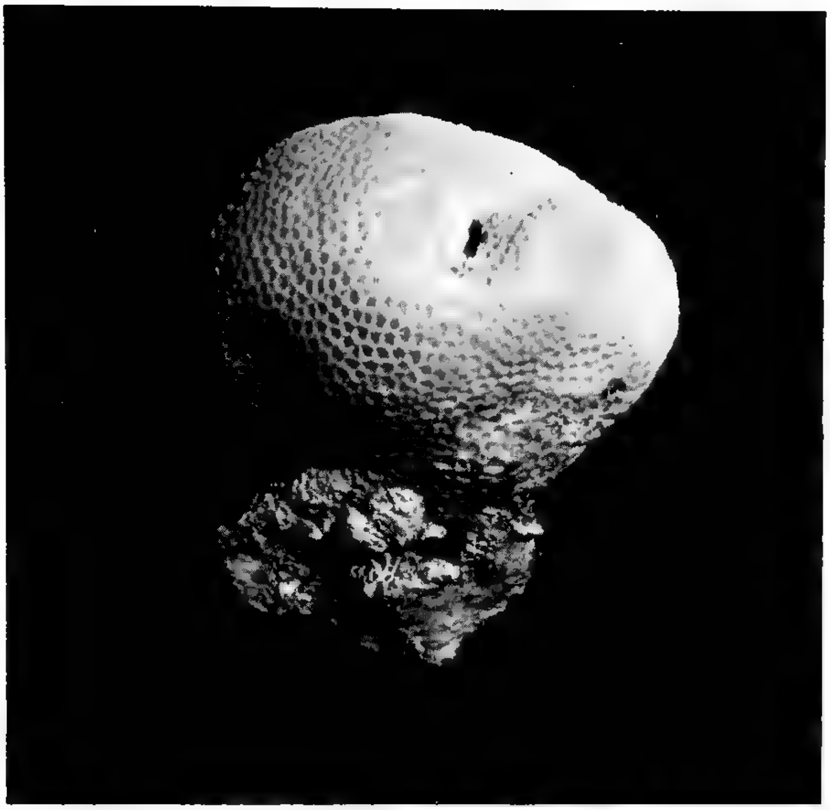


Fig. 169 Holotype of *Goniopora norfolkensis* from Iris Point, Orpheus Island, Palm Islands, collecting station 55.

Goniopora norfolkensis n.sp.

Synonymy

Goniopora sp., Veron (1981).

Material studied

Houghton Island, Lizard Island, Hope Island, Lihou Reefs (2 specimens), **Britomart Reef** (3 specimens), **Palm Islands** (8 specimens), **Chesterfield Atoll, Bushy Island-Redbill Reef, Heron Island** (3 specimens), **Fitzroy Reef** (3 specimens), **Llewellyn Reef** (2 specimens), **Lady Musgrave Reef** (8 specimens), **Norfolk Island**.

These localities include collecting stations 36, 40, 43, 45, 55, 59, 60, 168, 169, 188, 191, 193, 194, 196, 202, 210.

Characters

Coralla are massive, hemispherical or spherical. Corallites are rounded or polygonal, with calices 2.2–3.4mm diameter except for immature corallites which are often irregularly distributed on convex surfaces where budding is common. Septa are in 3 well-defined cycles. The first 2 cycles are sub-equal or $\frac{2}{3}$R and $\frac{1}{3}$R in length, and both slope evenly towards the columella. The first, or sometimes both cycles fuse with the columella. There are no pali. Third cycle septa are always very short. All septa are regularly dentate. The columellae are always small, consisting of a few irregularly fused dentations from the first or first and second septal cycles. Corallite walls are primarily composed of septa which are evenly exsert and have highly granulated tips. Septa are linked by cross-bars of synapticulae, leaving regularly spaced, rounded pores.

Goniopora norfolkensis is an uncommon species and has seldom been recognised in the field. Polyps are short and tentacles form a thick, uniform carpet. Tentacles are clearly arranged in two orders. They are dark coloured with pale blunt tips (Figs. 306, 307).

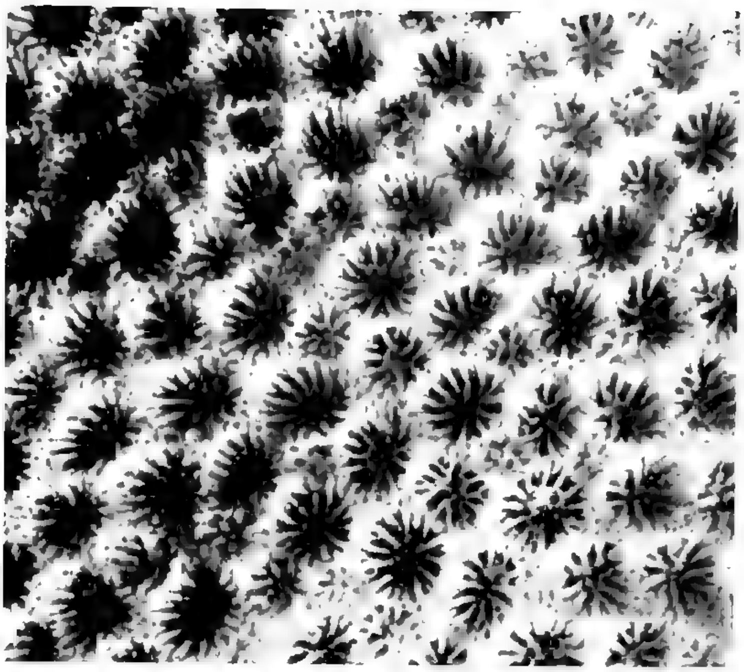


Fig 170▲

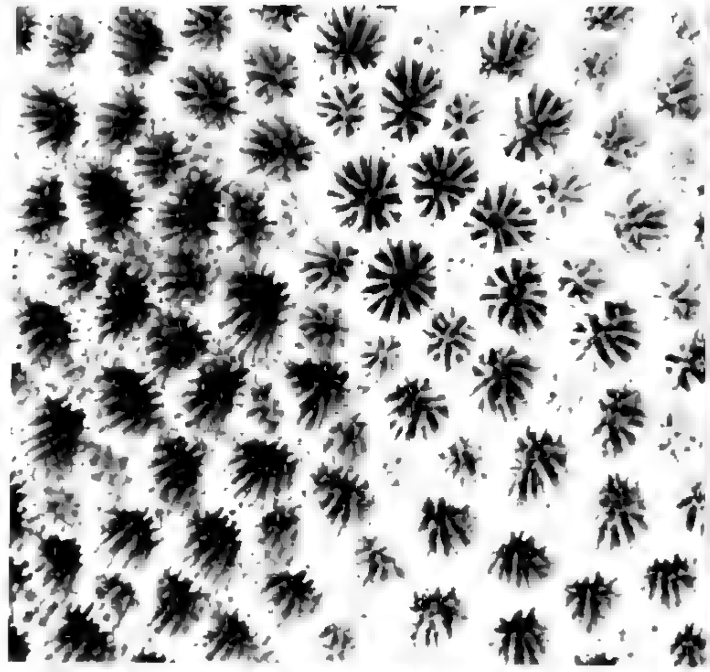


Fig 171▲

Fig 172▼

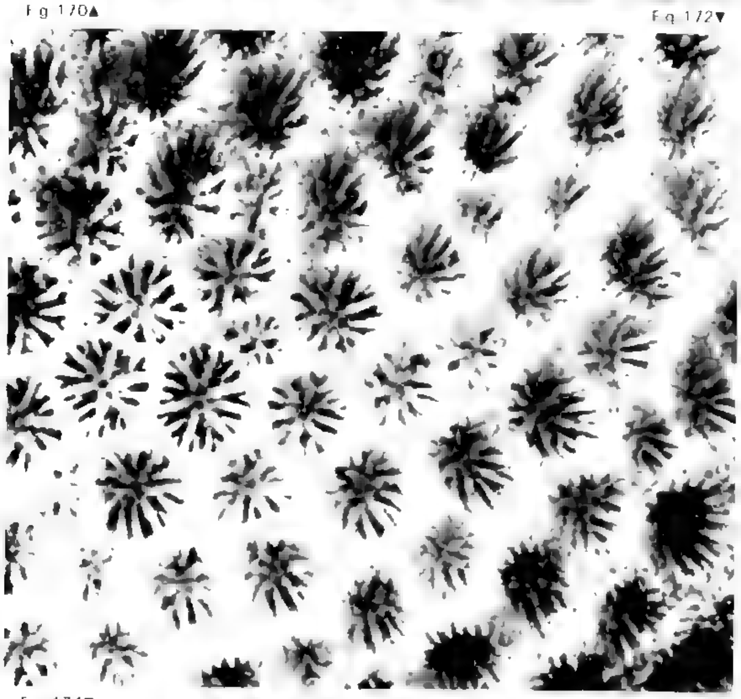


Fig 17.

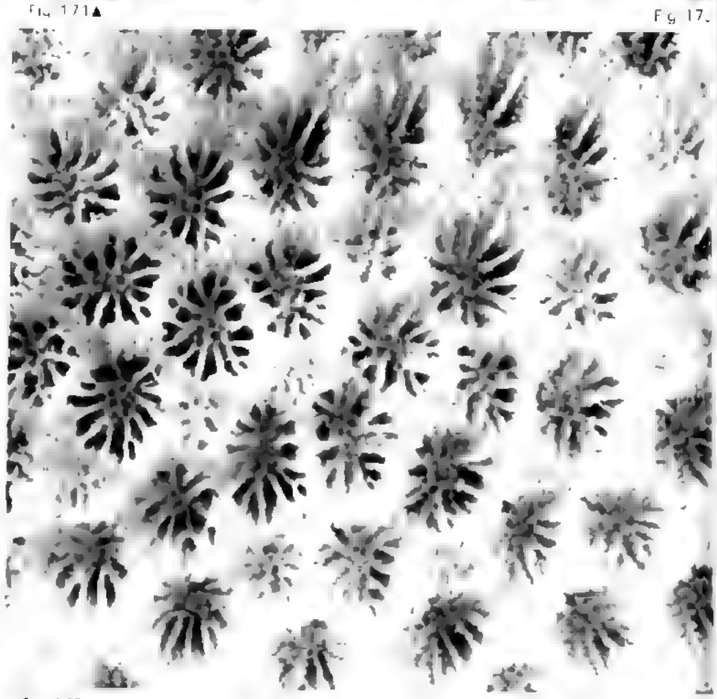


Fig 174▼

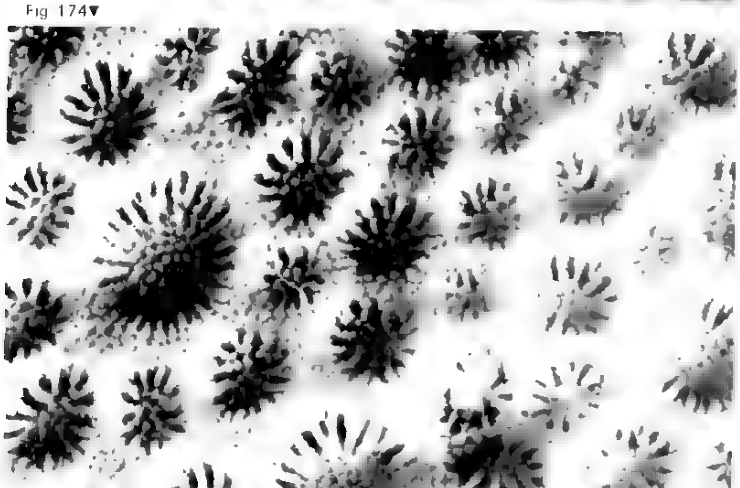


Fig 175▼

Skeletal variation

Despite the wide geographic and environmental range from which the present series has been collected, it shows little variation. Coralla from relatively deep or turbid water have thinner septa, with only those of the first cycle reaching the columella.

Affinities

Goniopora norfolkensis has corallites of similar size to *G. minor* and *G. tenuidens*, and all have a similar massive growth form. It differs in having no pali and in having a very regular septal configuration and is thus readily distinguished from these species.

Of non-east Australian species, *G. norfolkensis* is closest to *G. burgosi* Nemenzo, 1955, which has corallites of similar size and similarly poorly developed columellae. However, the septal configuration of *G. burgosi* is unlike that of this species (Nemenzo, 1955, p. 52).

Etymology

Named after Norfolk Island where this species was first collected.

Holotype

Dimensions: The maximum dimension is 113mm, the minimum 45mm, excluding attached substrate.
Locality: Iris Point, Orpheus Island, Palm Islands, collecting station 55.
Depth: 22–25m
Collector: J. E. N. Veron
Holotype: British Museum (Natural History)

Paratypes

Australian Institute of Marine Science
Queensland Museum, Australia

Distribution

Known from the Great Barrier Reef, Norfolk Island and Hong Kong.

Goniopora pandoraensis n.sp.

Material studied

Turtle Islands (4 specimens), **Palm Islands** (10 specimens), **Pandora Reef** (3 specimens), **Gould Reef, Whitsunday Islands, Swain Reefs**.

These localities include collecting stations 59, 69, 97, 113, 165, 171, 172, 178.

Characters

All colonies of the present series consist of short branched columns with rounded tops. Columns are usually oval in transverse section and divide in the plane of greater diameter. Living corallites only occur on column ends.

Corallites are uniform in size, calices are 2.7–3.1mm diameter. They vary greatly in structure according to their position on the corallum. Those on the sides of column ends have thick walls with 1 or 2 exsert septal dentations. Septa are thick, strongly dentate and plunge steeply within the calice. They are in 2 orders; those of the first order extend to the columella and alternate with those of the second order which remain short. There are 6

Figs. 170–175 *Goniopora norfolkensis* (×5)
Figs. 170–173 From Iris Point, Orpheus Island, Palm Islands, Figs. 170, 171 same corallum as Fig. 169 (holotype), Figs. 172, 173, paratypes.
Fig. 174 From Heron Island, collecting station 188.
Fig. 175 From Norfolk Island.

large, very prominent pali, connected by a thick palar synapticular ring. Columellae are small and usually consist of a solid or nearly solid flat plate. Corallites near the column ends become thin-walled and cellular in appearance and all skeletal elements are fine. The columellae are a diffuse tangle, the pali hair-like, and the palar synapticular ring very weakly developed. All septa are thin, are irregular in length and have the gonioporoid pattern of fusion.

Living colonies are very distinctive (Figs. 308–314). Polyps are dark grey-brown except for their mouths and tentacle tips which are white. Some branches of large colonies have uniformly white polyps (presumably through expulsion of zooxanthellae) which are smaller than the coloured ones. These different coloured branches are frequently intermixed, giving the superficial appearance of two intermixed species.

Figs. 176, 177 *Goniopora pandoraensis* (× 0.6)

Figs. 176, 177 From Eclipse Island, Palm Islands, collecting station 59, Fig. 176 holotype, Fig. 177 paratype.

Figs. 178–183 *Goniopora pandoraensis* (× 5)

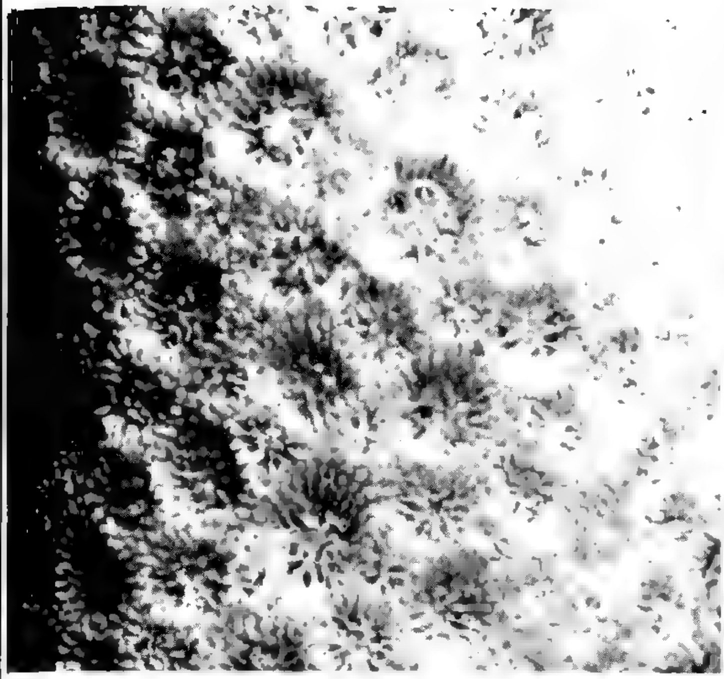
Figs. 178, 179 From Eclipse Island, Palm Islands, same corallum as Fig. 176 (holotype) showing corallites near a branch base and top respectively.

Figs. 180, 181 From Eclipse Island, Palm Islands, collecting station 59, (paratypes) Fig. 180 same corallum as Fig. 177.

Figs. 182, 183 Same corallum, from Pandora Reef, collecting station 171, showing corallites near a branch base and tip respectively.

Fig. 176▲

Fig. 177▼



ig 178▲

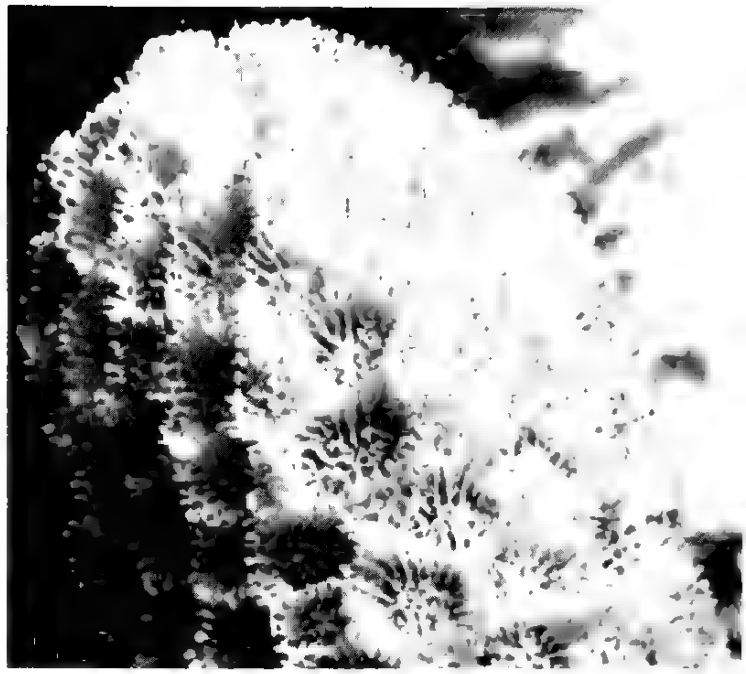


Fig 179▲

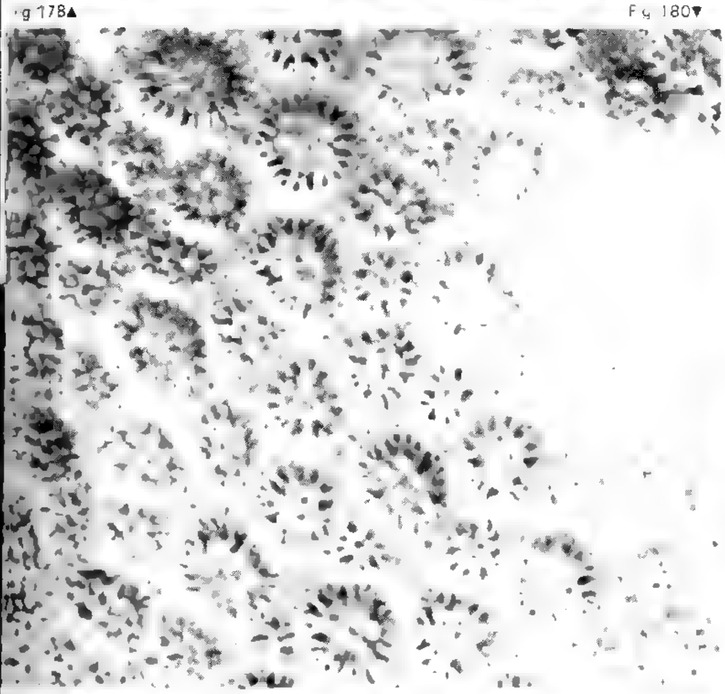


Fig 180▼

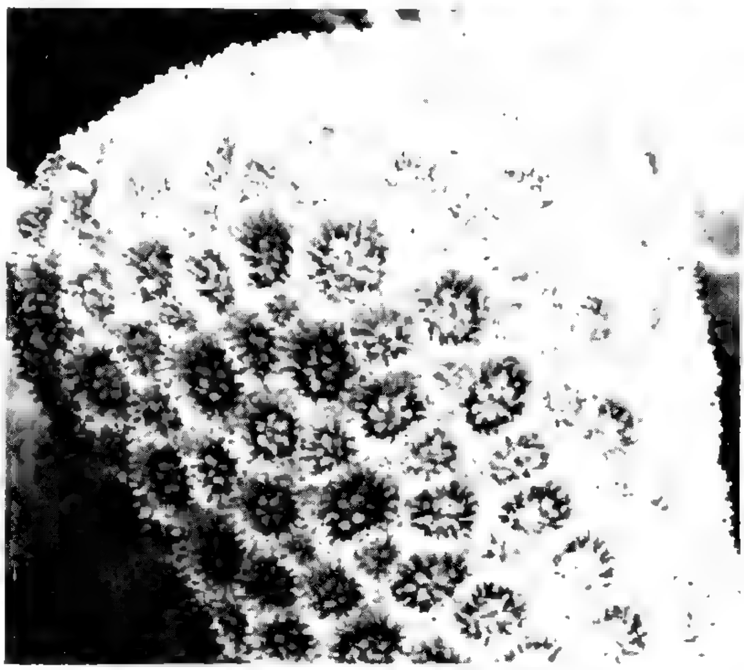


Fig 181▼

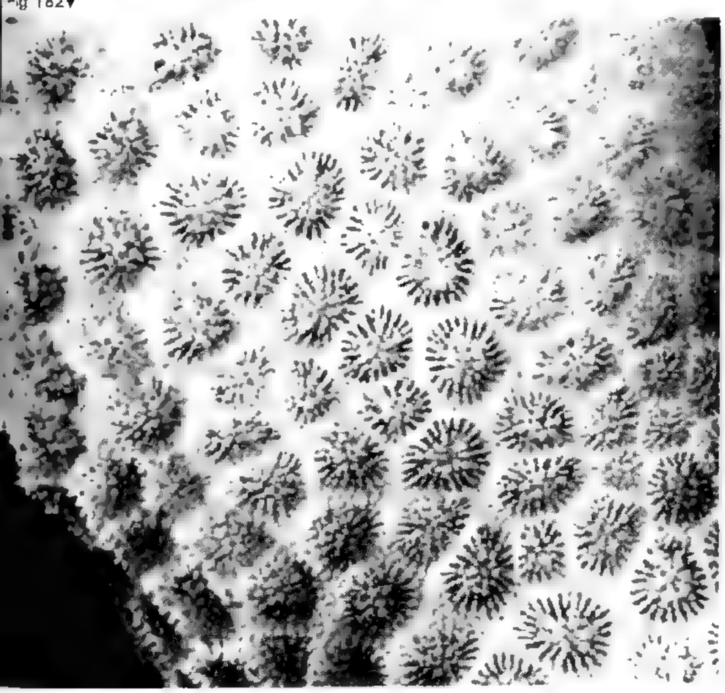


Fig 182▼

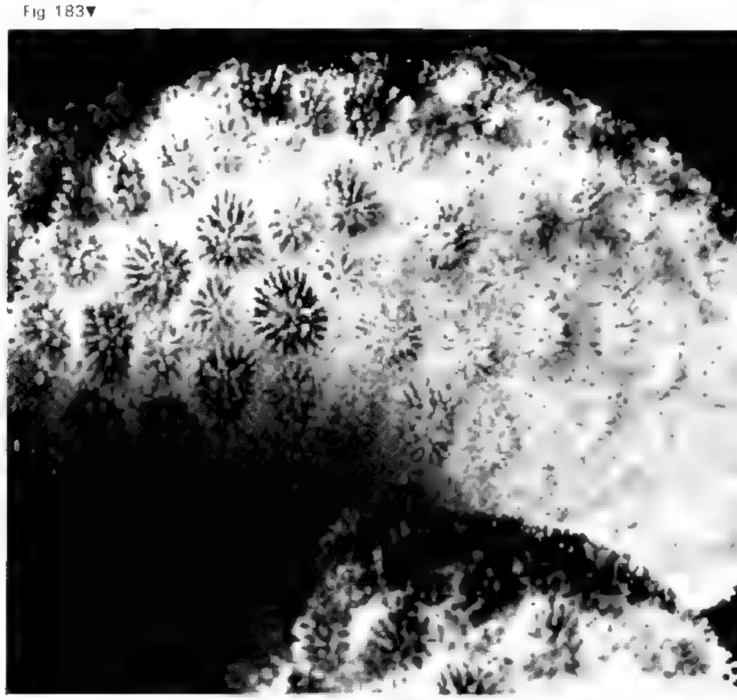


Fig 183▼

Skeletal variation

The present small series is very uniform, the wide variation of corallite structures described above frequently being found on the same branch. Septa may be thick and arranged in 2 distinct orders, or thin and irregular in length and confused with the columella tangle. The columellae may be small fused plates or diffuse and >$\frac{1}{2}$ the calice diameter. Pali may be large and distinct, or small, scarcely separable from the septal dentations.

Affinities

Goniopora pandoraensis has a growth form similar to *G. eclipsensis* and *G. columna*, with both column and corallite size being intermediate between these species. Corallites are closest to those of *G. eclipsensis*, the only distinguishing character being the greater variability in development of the pali and columella. *In situ*, they are very readily distinguished by their polyp shape, size and colouration (Fig. 308). Similarly, *G. columna* has distinctive polyps (Fig. 313), but also has distinctively larger corallites with less development of pali.

Etymology

Named after Pandora Reef, where this species is abundant.

Holotype (Figs. 176, 178, 179)

Dimensions: The corallum consists of branching columns, is 18cm long, with corallites only on the branch tip.
Locality: Eclipse Island, Palm Islands.
Depth: 8m.
Collector: J. E. N. Veron
Holotype: British Museum (Natural History)

Paratypes

Australian Institute of Marine Science
Queensland Museum, Australia

Distribution

Known only from the Great Barrier Reef.

Goniopora eclipsensis n.sp.

Material studied

Eclipse Island (6 specimens), **Pandora Reef** (3 specimens).
These localities include collecting stations 59, 172.

Previous records from Eastern Australia

Not previously recorded.

Characters

Colonies are columnar or branching. Branches are cylindrical, <30mm diameter, becoming flattened when dividing. They are up to 30cm long, but have living corallites only on their ends. A broad band of epitheca usually occurs below the living corallites and may overgrow them.

Corallites are rounded, calices are 2–2.5mm diameter. They have thick walls consisting of thick, exsert septa, which are continuous between adjacent corallites. All septa are strongly dentate with the upper margin of the wall consisting of rows of dentations, one from each corallite, and sometimes a central row. Dentations are usually flattened concentrically and all have serrated edges and granulated sides. Septa plunge steeply in well excavated corallites, or slope gently in superficial ones. In the latter case, a *G. stutchburyi*-

like goniopororoid pattern of fusion is sometimes seen and usually these septa are of irregular lengths and are strongly dentated. Pali may be indistinguishable from the dentations, but are usually prominent and pillar-like. Up to 5 are usually present although this varies, even between adjacent corallites. Columellae are rarely pillar-like; usually they consist of a fused tangle of pali and inner septal margins. Polyps are uniform brown in colour. The tips of the tentacles are paler than their bases, and are pointed (Figs. 315–317).

Affinities

Goniopora eclipsensis is primarily distinguished from other *Goniopora* with small corallites by its columnar or branched-columnar growth form. Corallites show similarities with those of *G. fruticosa*, *G. palmensis*, *G. pandoraensis* and *G. columna*. They differ from those of *G. fruticosa* and *G. palmensis* in being smaller and more heavily calcified, although

Figs. 184, 185 *Goniopora eclipsensis* from Eclipse Island, Palm Islands, collecting station 59, Fig. 184 holotype, Fig. 185 paratype (× 0.4 and × 0.9 respectively).

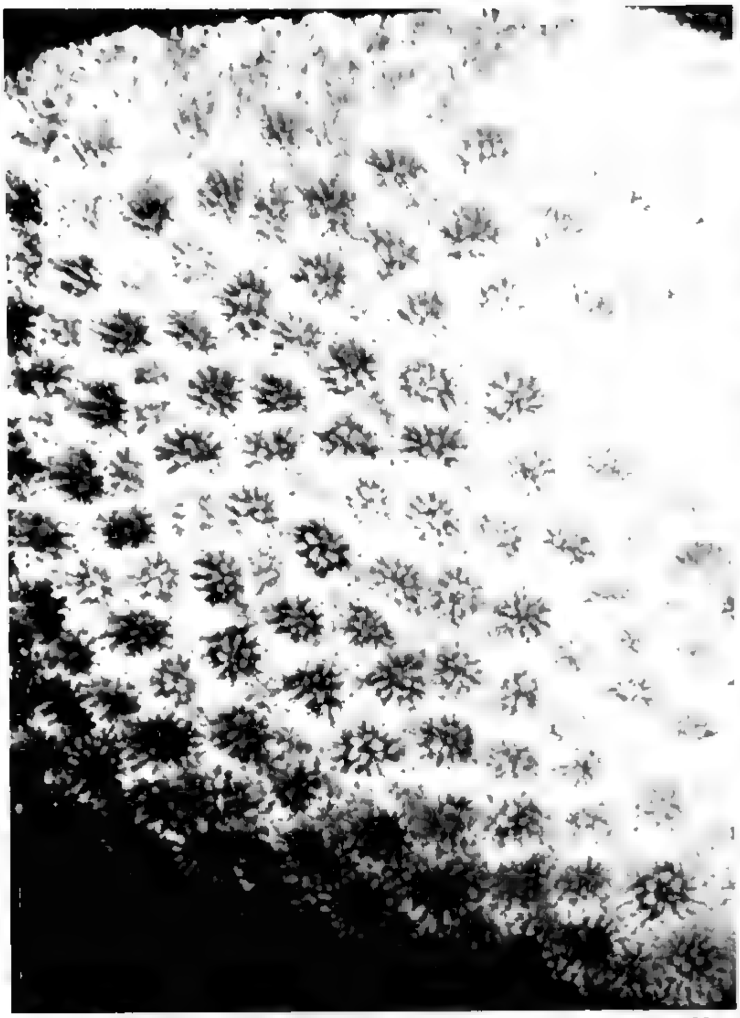


Fig 186▲

Fig 188▼

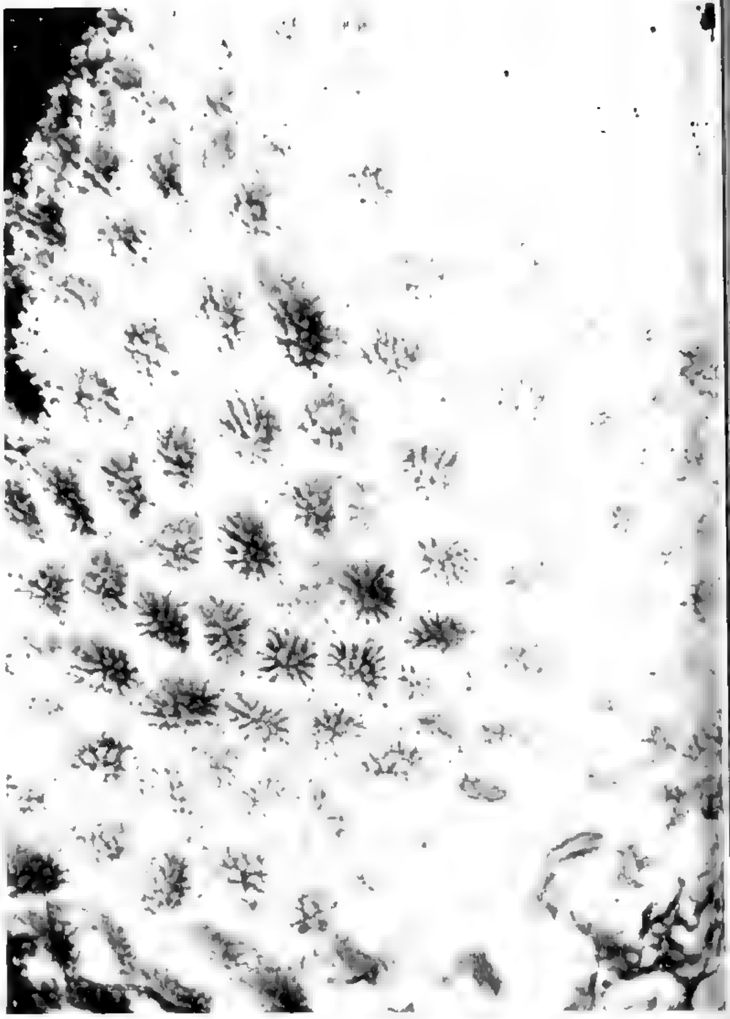
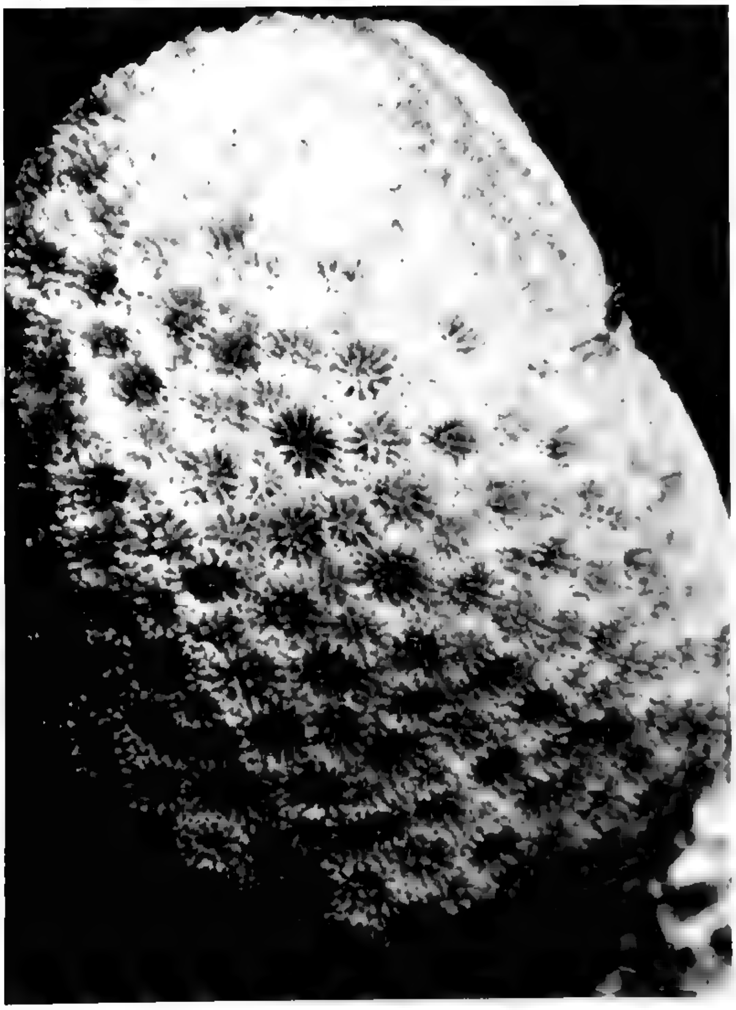
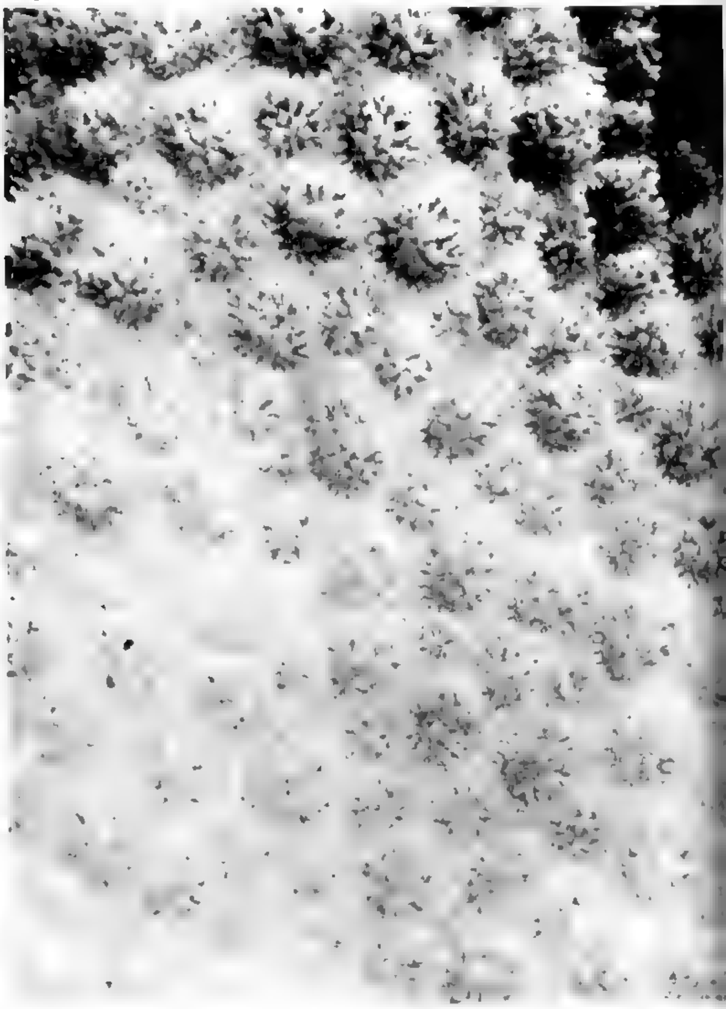


Fig 187▲

Fig 189▼





this difference is only reliable in coralla from similar biotopes. Otherwise, these species can only be distinguished by their differing growth forms, *G. fruticosa* being primarily encrusting with small branches and *G. palmensis* being digitate with thin, more frequently dividing branches. *Goniopora columna* has a similar growth form but has larger branches and larger corallites. *Goniopora pandoraensis* usually has larger pali and also has distinctive polyps (see p. 94 and Fig. 316).

Etymology

Named after Eclipse Island where this species was first recognised.

Holotype (Figs. 184, 186)

Dimensions: The corallum is branching, 25.5cm long, with corallites only on the branch tips.

Locality: Eclipse Island, Palm Islands.

Depth: 8m.

Collector: J. E. N. Veron.

Holotype: British Museum (Natural History).

Paratypes

Australian Institute of Marine Science
Queensland Museum, Australia

Distribution

Known only from the Great Barrier Reef.

Figs. 186–189 *Goniopora eclipsensis* from Eclipse Island, Palm Islands, collecting station 59, Fig. 186, same corallum as Fig. 184 (holotype), Figs. 187, 188 same corallum showing corallites on a branch side and tip respectively, Fig. 189 (paratype (× 5)).

Fig. 190 *Goniopora eclipsensis* from Pandora Reef (photo: T. Done)

Fig. 191◄

Fig. 192▲

Fig. 193►

Fig. 194▲

Goniopora palmensis n.sp.

Synonymy

?'*Goniopora* Mauritius 1', Bernard (1903).

Material studied

Turtle Islands (2 specimens), **Palm Islands** (3 specimens), **Pandora Reef** (4 specimens), **Whitsunday Islands, Swain Reefs.**

These localities include collecting stations 45, 55, 69, 102, 165, 171, 172, 178.

Previous records from Eastern Australia

Not previously recorded.

Characters

Colonies are sub-massive, digitate or branching. Branches are usually <30mm diameter, short, terete, with rounded ends or sometimes tapered. They are seldom anastomosed.

Calices are 2.2–3.0mm diameter. They are rounded, thick-walled and generally uniform over the whole corallum surface. Septa are in 2 orders of 12 each, or 3 cycles of 6, 6, 12, and have an irregular gonioporoid pattern of fusion. Third cycle (second order) septa are always very short, consisting of little more than trabecular pillars in the wall. These alternate with the other 12 septa which may be of similar lengths or be differentiated into 2 cycles of 6 each. Pali are usually 6 in number, although additional irregular pali are not uncommon. They are fused with the palar synapticular ring which is always thick. All septa are granulated. Columellae may be small to $\frac{1}{2}$R. In the latter case, the palar synapticular ring and columella are sufficiently fused to form an almost solid floor to the corallites. Walls are primarily composed of septa which are evenly exsert with pointed granulated tips.

Living colonies are usually brown, green or cream in colour. Polyps have a large oral cone and short pointed tentacles which have pale, often white tips (Figs. 319–322).

Affinities

Goniopora palmensis is very close to *G. fruticosa* and cannot be reliably separated from it by corallite characters except by the corallite walls which are more exsert and thinner in *G. fruticosa.* The two species have differing growth forms, *G. fruticosa* tending to be more encrusting and having thinner, more anastomosing branches. *In situ* these species are very distinct, having polyps of different colour and shape.

Goniopora palmensis is also close to *G. eclipsensis* which is distinguished by its columnar growth form, smaller corallites and thicker calicular structures. The uniform brown polyps of *G. eclipsensis,* with their relatively long tentacles, helps distinguish this species *in situ.*

Sub-massive coralla of *G. palmensis* can be distinguished from *G. minor* by the latter's more prominent pali and thicker walls, but these differences are unreliable.

Etymology

Named after the Palm Islands, where this species is especially abundant.

Holotype (Figs. 192, 196, 197)

Dimensions: The corallum is digitate, 19.5cm long, 14.5cm high.

Locality: South Pioneer Bay, Orpheus Island, Palm Islands.

Depth: 12m.

Collector: J. E. N. Veron

Holotype: British Museum (Natural History)

Figs. 191–194 *Goniopora palmensis* (× 0.5)

Fig. 191 From Happy Bay, Long Island, Whitsunday Islands, collecting station 102.
Fig. 192 From Pioneer Bay, Orpheus Island, Palm Islands, collecting station 91 (holotype).
Fig. 193 From Iris Point, Orpheus Island, Palm Islands, collecting station 55 (paratype).
Fig. 194 From the Swain Reefs, collecting station 69 (paratype).

Distribution

Recorded only from the Great Barrier Reef and possibly Mauritius.

Figs. 195–198 *Goniopora palmensis* (× 5)
Fig. 195 From Happy Bay, Long Island, Whitsunday Islands, same corallum as Fig. 191.
Figs. 196, 197 From Pioneer Bay, Orpheus Island, Palm Islands, same coralla as Fig. 192 (holotype).
Fig. 198 From the Swain Reefs, same corallum as Fig. 194 (paratype).

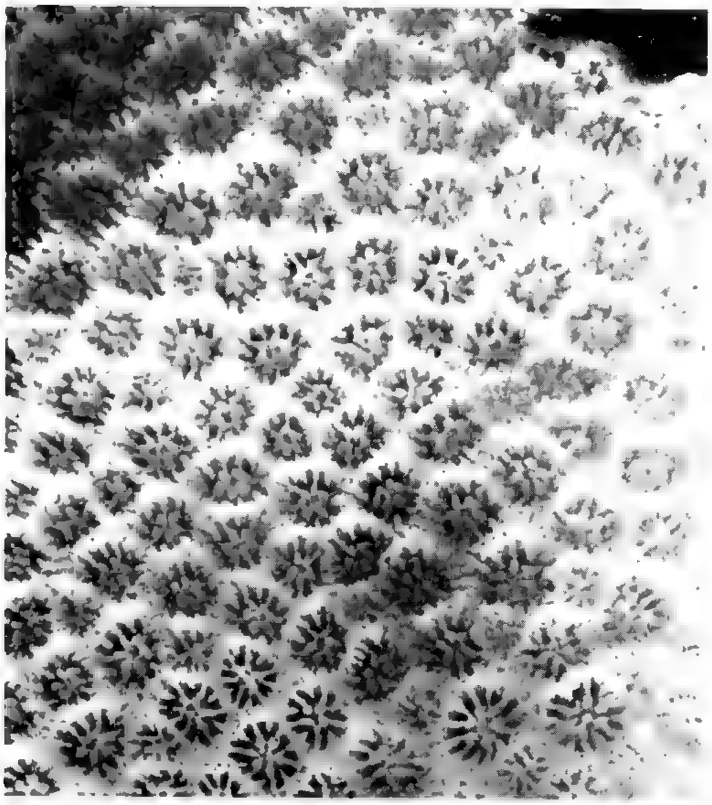


Fig 195▲

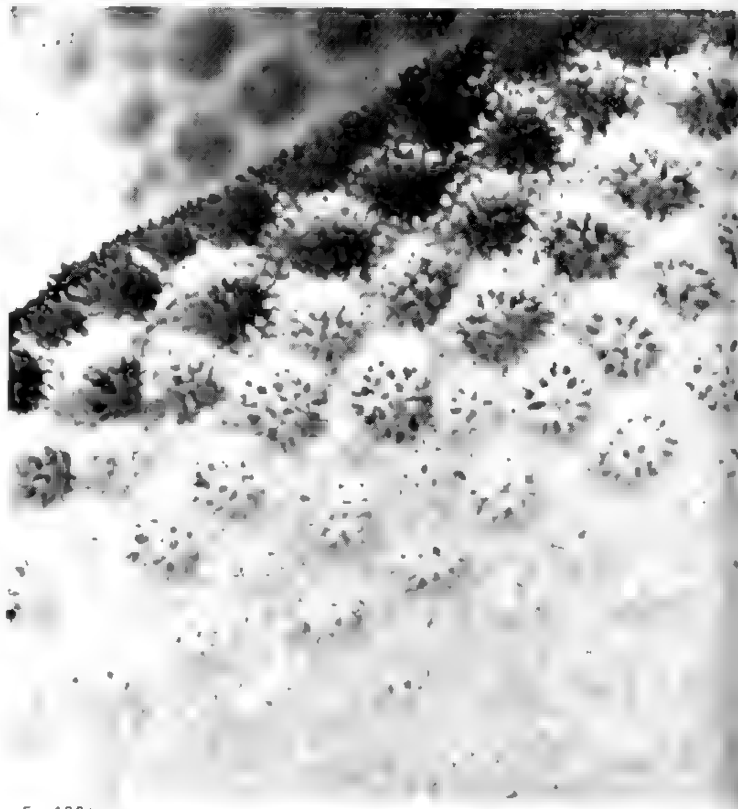


Fig 196▲

Fig 197▼

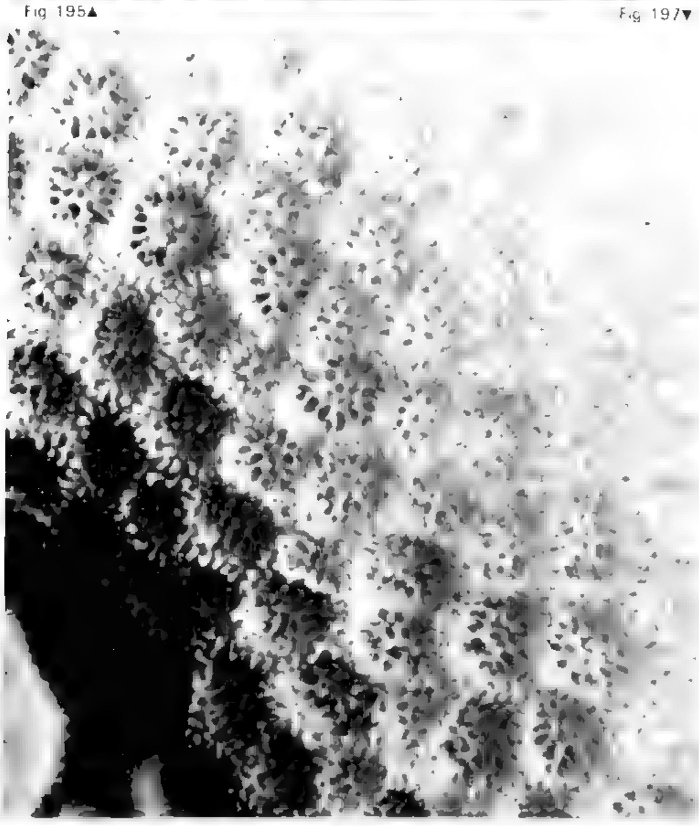


Fig 198▼

Goniopora fruticosa Saville-Kent, 1893

Synonymy

Goniopora fruticosa Saville-Kent, 1893; Bernard (1903); Searle (1956).

'*Goniopora* Great Barrier Reef 12' Bernard (1903).

?*Alveopora polyformis* Zou, 1980.

Alveopora polyformis Zou from the Xisha Islands is very close to Fig. 204 and is similar to the type specimen of *G. fruticosa*, but has slightly smaller corallites.

Fig. 199▲

Fig. 200▲

Fig. 201▲

Material studied

Yorke Island (7 specimens), **Little Mary Reef, Arden Island** (2 specimens), **Murray Islands** (2 specimens), **Turtle Islands** (3 specimens), **Great Detached Reef, Sir Charles Hardy Islands, Tijou Reef** (2 specimens), **Bewick Island** (2 specimens), **Howick Island** (2 specimens), **Houghton Island** (3 specimens), **Lizard Island** (3 specimens), **Low Isles** (6 specimens), **Britomart Reef** (6 specimens), **Palm Island** (89 specimens), **Pandora Reef** (5 specimens), **Broadhurst Reef, Gould Reef** (4 specimens), **Whitsunday Islands** (21 specimens), **Swain Reefs** (15 specimens).

These localities include collecting stations 1, 6, 12, 13, 16, 18, 30, 33, 34, 35, 41, 42, 43, 45, 55, 57, 59, 69, 79, 91, 97, 98, 101, 102, 113, 165, 166, 167, 171, 172, 174, 175, 178, 179, 183, 185.

Previous records from Eastern Australia

Warrior Reef; Saville-Kent (1893), and as '*Goniopora* Great Barrier Reef 12', Bernard (1903) (same specimen).

Characters

Coralla are encrusting, sub-massive or digitate, usually with combinations of these growth forms. Digitate branches are <15mm thick (except near their bases) and are highly anastomosed.

Calices are 2.0–2.5mm diameter, rounded or polygonal, and are uniform over the corallum surface except towards branch tips. Their walls are thin, consisting of an *Alveopora*-like lattice of trabeculae and synapticulae. Septa are in two alternating orders. First order septa reach the columella, second order septa may consist of trabecular pillars only, or be fused to first order septa in a gonioporoid pattern. All septa are strongly granulated and dentate, the uppermost dentations being adjacent to those of the adjacent corallite, forming 2 rows of dentations along the upper corallite wall. The 6 pali formed are of irregular shape and size. All pali are linked by a palar synapticular ring and all are fused with the columella. In many coralla, the inner septal margins, pali, and columella form a fused tangle.

Living colonies are very distinctive (Figs. 323–325). Polyps have fine tapering tentacles which are always dark brown, in contrast to the oral disc which is white. Saville-Kent (1893) notes a similar colouration in specimens he observed in Torres Strait.

Affinities

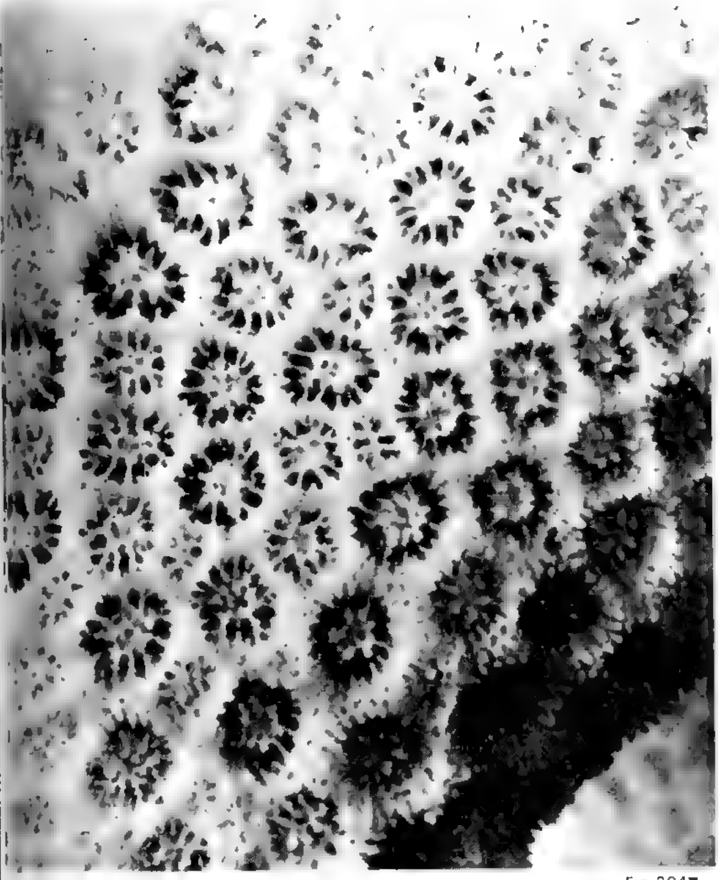
Goniopora fruticosa has a distinctive range of growth forms, generally unlike that of any other east Australian species. Corallites are similar to those of *A. eclipsensis* but are usually larger and have finer septal structures (see p. 95). Corallites are also very similar to those of *G. palmensis* which has thicker corallite walls, a greater degree of septal differentiation and more prominent pali (see p. 99). Corallites may also be similar to those of *G. minor* (see p. 88).

Distribution

Recorded from the Great Barrier Reef and Malaysia and questionably from the South China Sea.

Figs. 199–201 *Goniopora fruticosa* (× 0.45)
Fig. 199 From Yorke Island, collecting station 13.
Fig. 200 From Bullumbooroo Bay, Great Palm Island, collecting station 35.
Fig. 201 From Iris Point, Orpheus Island, Palm Islands, collecting station 55.

Figs. 202–205 *Goniopora fruticosa* (× 5)
Figs. 202, 203 From Yorke Island, same corallum as Fig. 199.
Fig. 204 From Bullumbooroo Bay, Great Palm Island, same corallum as Fig. 200.
Fig. 205 From Iris Point, Orpheus Island, Palm Islands, same corallum as Fig. 201.



ig 202▲

Fig 204▼

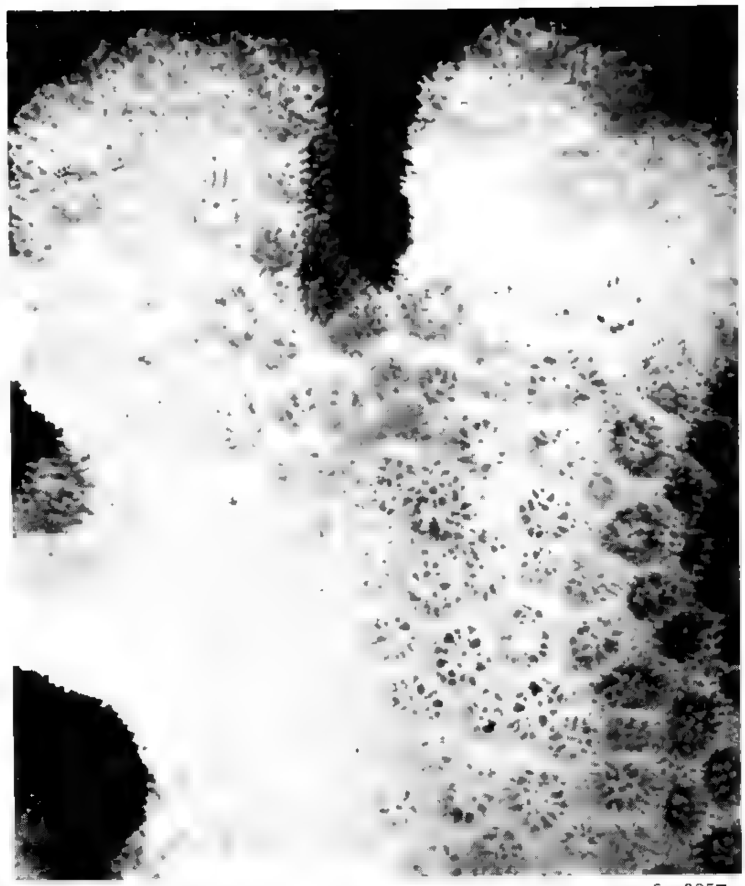
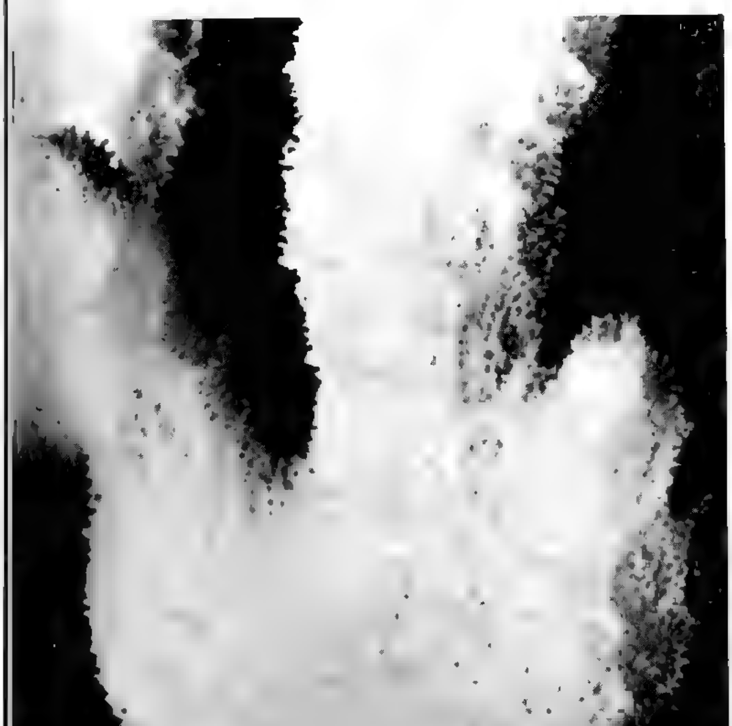
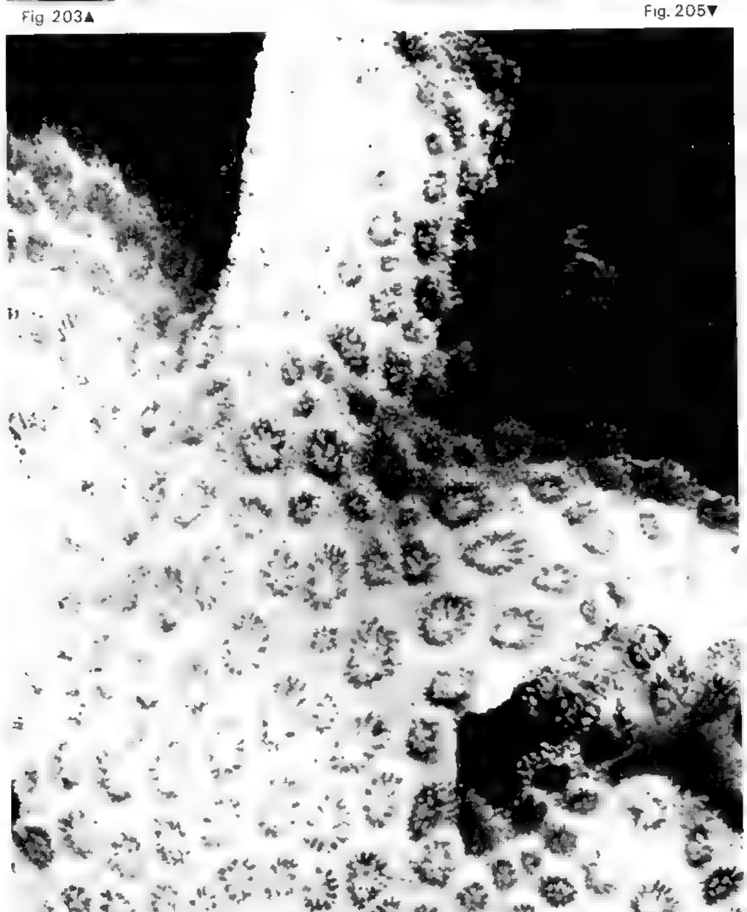


Fig 203▲

Fig. 205▼





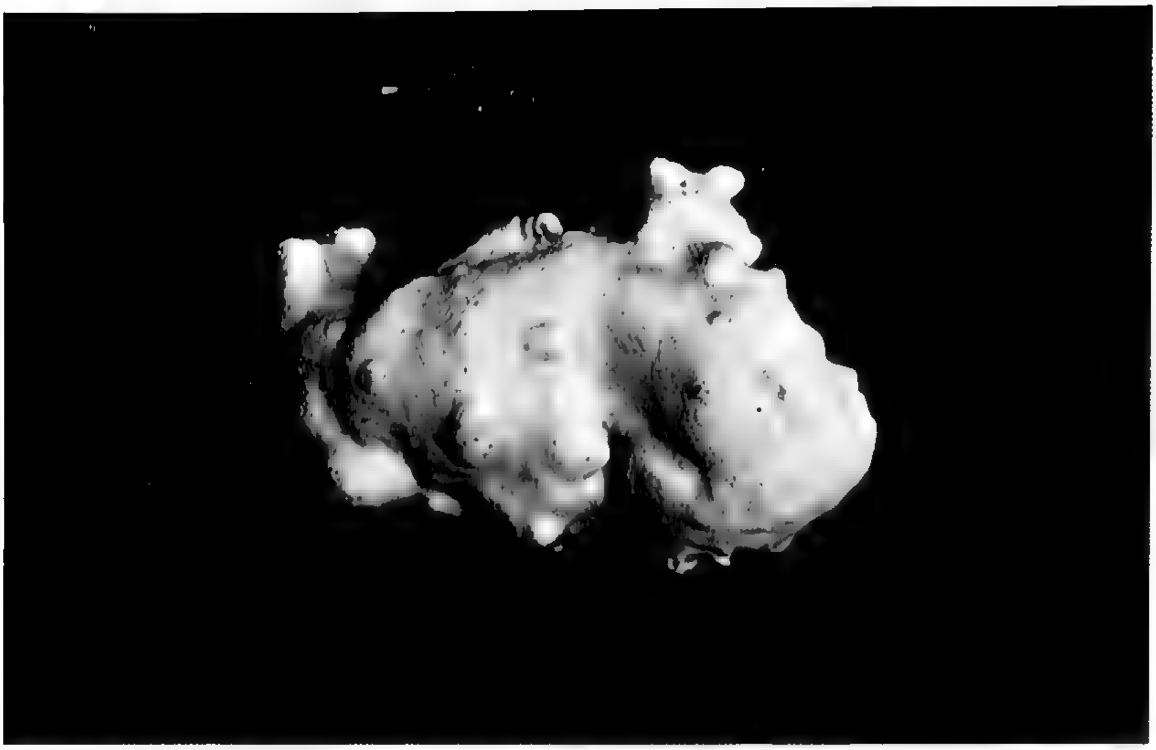


Fig. 206 *Goniopora stutchburyi* from Fantome Island, Palm Islands, collecting station 34.

Goniopora stutchburyi Wells, 1955

Synonymy

Goniopora stutchburyi Wells, 1955b; Searle (1956); Veron (1981).

Goniopora nigra Pillai, 1967.

Goniopora wotouensis Zou & Song, 1975.

'*Goniopora* North-west Australia 2' Bernard (1903).

'*Goniopora* North-west Australia 7' Bernard (1906).

'*Goniopora* Great Barrier Reef 13 and 14' Bernard (1906).

'*Goniopora* Torres Strait 1' Bernard (1906).

As Pillai notes, his *G. nigra* is the same as '*Goniopora* Great Barrier Reef 14' of Bernard (1906), which is not listed by Wells (1955) in his synonymy but which is very similar to Bernard's (1906) '*Goniopora* Great Barrier Reef 13' from Moreton Bay, the type locality of *G. stutchburyi*.

Goniopora wotouensis Zou & Song (1975) from southern China is closest to Bernard's '*Goniopora* North-west Australia 7' and is similar to Fig. 212 as well as to specimens collected from nearby Hong Kong.

Material studied

Warrior Reef (2 specimens), **Warrior Island** (2 specimens), **Murray Islands** (6 specimens), **Houghton Island** (2 specimens), **Magdelaine Cay, Palm Islands** (15 specimens), **Magnetic Island** (4 specimens), **Whitsunday Islands** (12 specimens), **Swain Reefs** (5 specimens), **Palmaise Reef, Heron Island**.

These localities include collecting stations 16, 26, 30, 34, 35, 56, 59, 69, 78, 85, 97, 120, 121, 174, 198, 200.

Previous records from Eastern Australia

Moreton Bay, Wells (1955), Lovell (1975); Great Barrier Reef (as 'Great Barrier Reef 13 and 14'), Bernard (1906); Torres Strait (as 'Torres Strait 1'), Bernard (1906).

Characters

Coralla are sub-massive to encrusting, always with a smooth, flat, undulating or nodular surface. Corallites are rounded or polygonal and have very shallow, flat bottomed calices 1.6–2.9mm diameter. Depending on size, corallites have 17–30 septa which are not arranged in cycles or orders. All septa are of uniform width and are tightly compacted, with gaps between them being only half the septal width (approximately 0.15mm). As this remains constant, septa fuse in groups of 2–6, usually with one outer septum of each group reaching the calice centre. These long septa are usually evenly curved, as fusions with other septa occur on one side only. This pattern may be identical to Bernard's pattern (Fig. 117) or a further elaboration of it. Septa have thick granulations on their sides and margins. In some coralla, septa are regularly dentated, the dentations having the appearance of up to 7 concentric circles of granules or groups of granules. Sometimes septa are fused at regular intervals with the points of fusion also having a concentric appearance. Columellae vary greatly in different coralla. They may consist of a few elaborated, granulated, fused septal spines, or may be up to $\frac{1}{2}$ the calice diameter and have a dense spongy matrix. Corallite walls are usually ill-defined and are composed of an irregular aggregation of loosely anastomosed granules, being the outer margins of septa, with spongy coenosteum.

Living colonies have short, wide polyps with 24 short, tapering tentacles extended during the day (Figs. 326, 327). In some colonies, the polyps have tentacles of similar size; in others, 6 tentacles are much larger than the others; thus there are two orders of tentacles, the larger ones separated by 3 small ones. Polyps are usually pale brown or cream, sometimes with pale blue mouths.

Skeletal variation

The dominating skeletal characteristics of *G. stutchburyi* (very shallow calices filled with tightly compacted septa) give all coralla a similar general appearance. Wide variation is, however, seen in the degree of development of the columella, the number of septa and the degree to which septa are dentated. Large columellae tend to be associated with relatively wide corallites with numerous septa. Only a small part of the total variability is seen in any one corallum. The present series does not indicate any consistent correlation between skeletal variations and environment other than that larger corallites are associated with deeper or protected environments.

Affinities

Goniopora stutchburyi does not closely resemble any other east Australian species except *G. somaliensis* Vaughan which also has shallow corallites. These species are readily distinguished by *G. somaliensis* having larger corallites and much less compacted septa which do not fuse in the manner of *G. stutchburyi*.

Distribution

Known from India, the South China Sea, Malaysia and the east and west coasts of Australia.

Figs. 207–212 *Goniopora stutchburyi* (× 5)

Fig. 207 From Fantome Island, Palm Islands, same corallum as Fig. 206.
Figs. 208, 209 From Nara Inlet, Hook Island, Whitsunday Islands, collecting station 97.
Fig. 210 From the Swain Reefs, collecting station 69.
Fig. 211 From Palmaise Reef, collecting station 198.
Fig. 212 From Bullumbooroo Bay, Great Palm Island, collecting station 35.

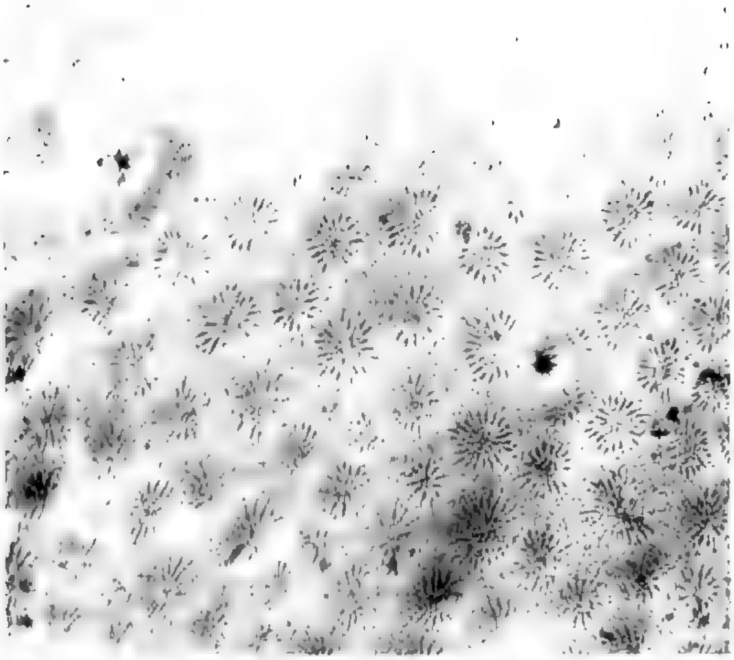
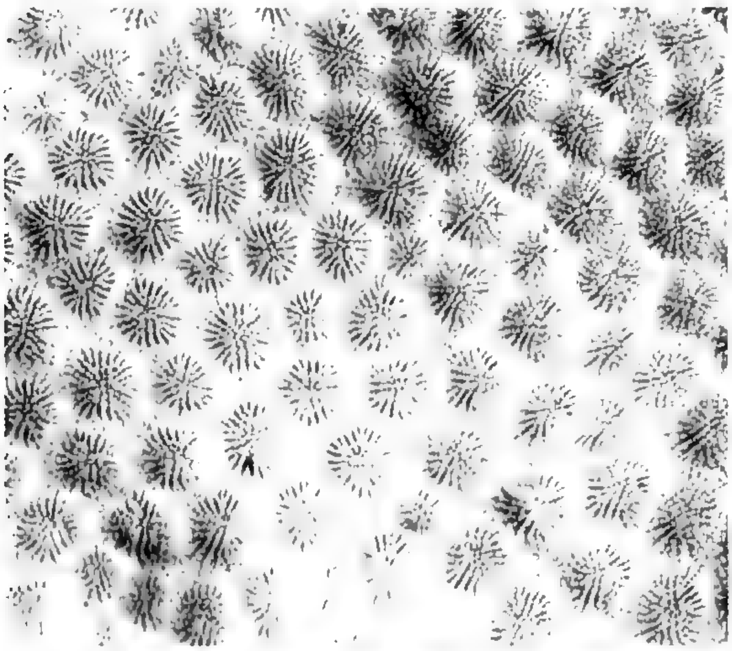


Fig. 207▲

Fig. 209▼



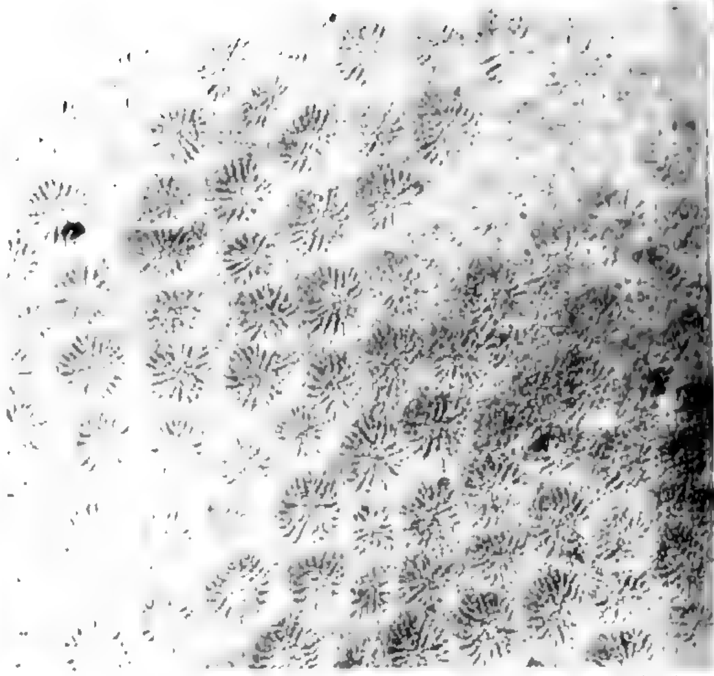


Fig. 208▲

Fig. 210▼

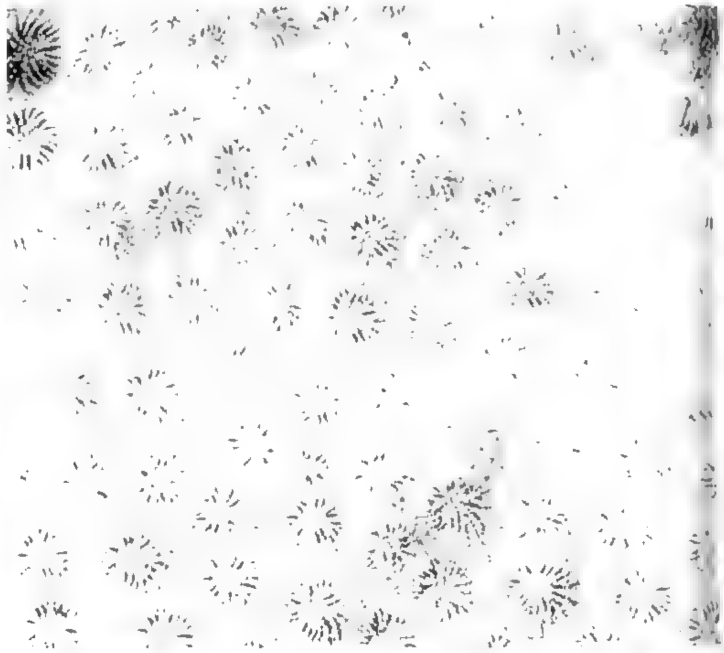


Fig. 211▼

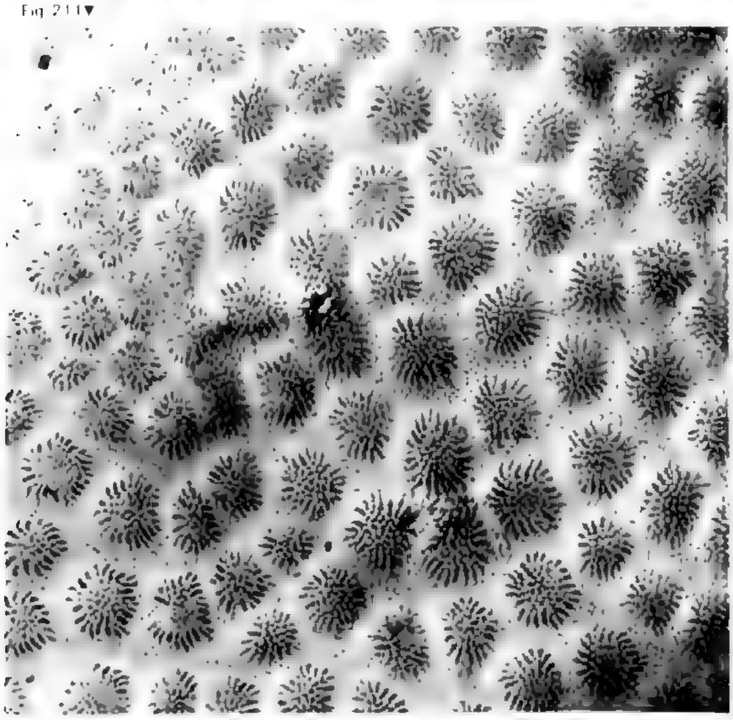
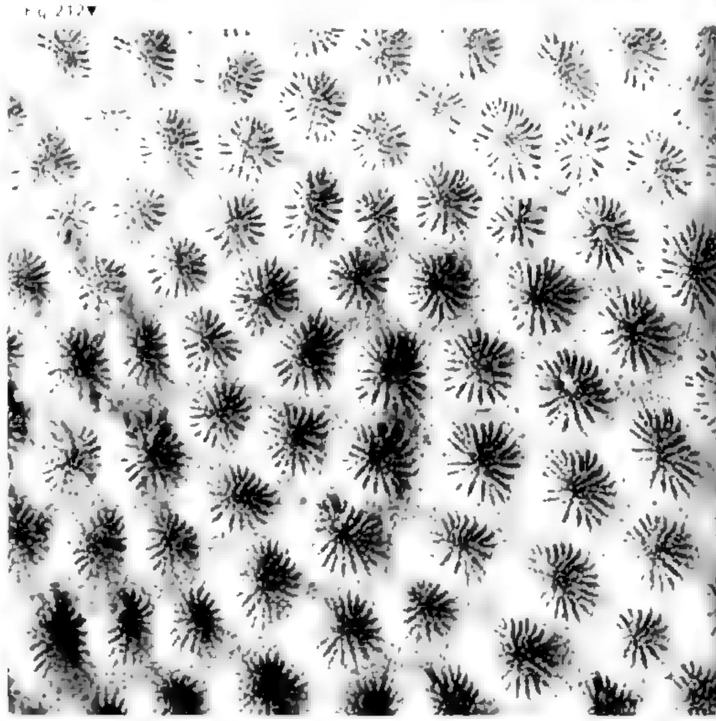


Fig. 212▼



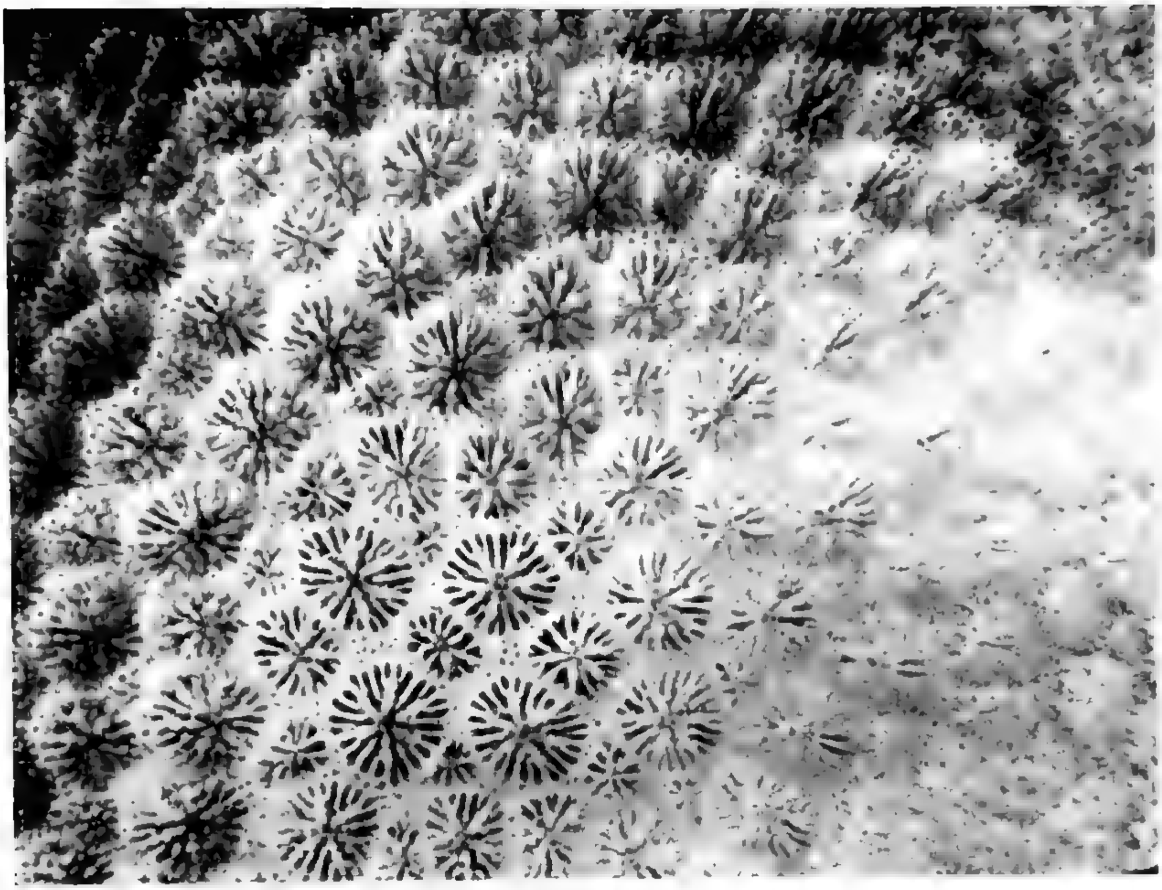


Fig. 213 *Goniopora* sp. 1 from Jewell Reef (× 5).

Goniopora sp. 1

Character

Only two specimens of this species, from Jewell and Marion Reefs, have been collected. The corallum is sub-massive, the corallites are shallow, rounded to polygonal, calices are 3.5–4mm diameter. The walls are thin and highly perforated. Septa are in three orders which very clearly follow the gonioporoid pattern of fusion. There are 6 plate-like pali. All septa are perforated and have synapticular projections on their sides. The inner margins of pali are fused with the palar synapticular ring. There is no development of columellae other than a few fused dentations.

The appearance of the living colony is not known.

Affinities

This specimen does not resemble any described species, nor any that have been figured in the literature. It will be described as a new species if further specimens can be obtained for study.

Goniopora sp. 2

Material studied

Big Mary Reef (2 specimens), **Jewell Reef, Marion Reef, Chesterfield Atoll.**

These localities include collecting station 187, 205, 215.

Characters

This small series of specimens may represent a separate species. The coralla are massive with polygonal to rounded corallites with calices 3.5–4mm diameter. Their walls are very porous, consisting of septal plates linked by 1 or 2 rows of synapticulae. Septa are thick, and are divisible into 3 indistinct orders. They are irregularly fused. Six pali are usually present which may be fused together to form a small columella.

The appearance of the living colony is not known.

Affinities

Some or all of these specimens may be an aberrant *G. stokesi.* Otherwise they may be an undescribed species.

Alveopora de Blainville, 1830

Type species *Madrepora daedalea* Forskål, 1775; s.d. Wells (1936).

Introduction

Alveopora is one of the larger scleractinian genera that has not been systematically revised in any way, nor have there been any detailed accounts of the morphology or affinities of *Alveopora* except for the observations of Bernard (1899, 1903).

The family Poritidae was founded by Dana (1846), who included the two genera *Porites* and *Goniopora* in it. *Alveopora* was included in his Favositidae. Edwards & Haime (1860) separated the Poritidae into two subfamilies, the Poritinae and the Montiporinae. The Poritinae included *Porites, Goniopora, Rhodaraea* (a separate group of *Goniopora* species, see p. 65) *Alveopora, Coscinaraea,* and a number of fossil genera. The Montiporinae included *Montipora* and *Psammocora.* Some true poritids, e.g. *Alveopora rubra* Quoy & Gaimard and *Porites (Synaraea) rus* Forskål were, however, placed in the second group.

Figs. 214, 215 *Goniopora* sp. 2 (× 5)
Fig. 214 From Marion Reef, collecting station 205.
Fig. 215 From Bennett Island, Chesterfield Atoll, collecting station 215.

Fig 214▼

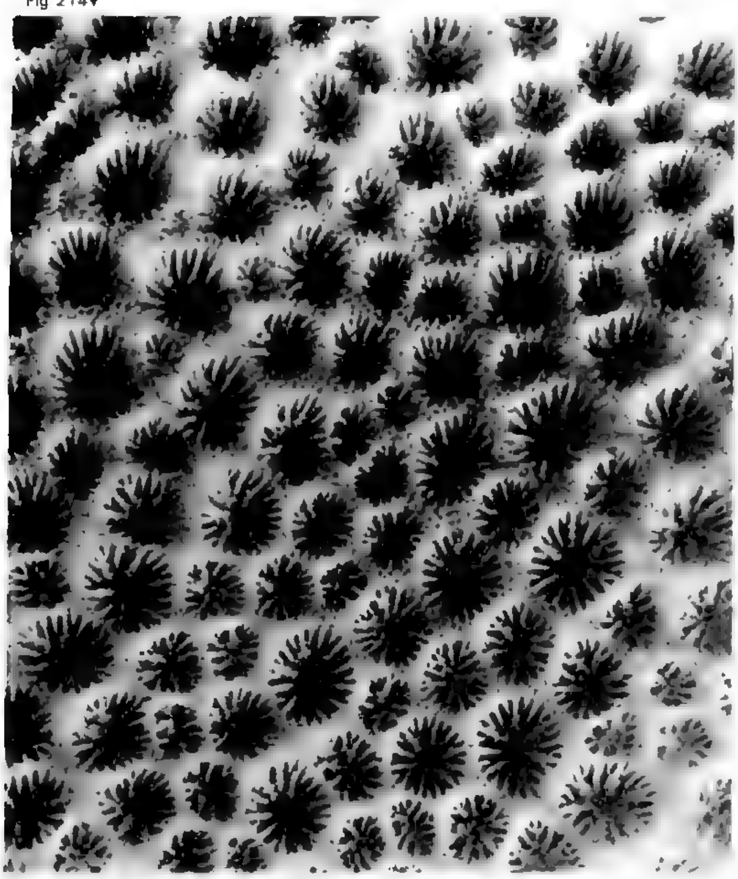
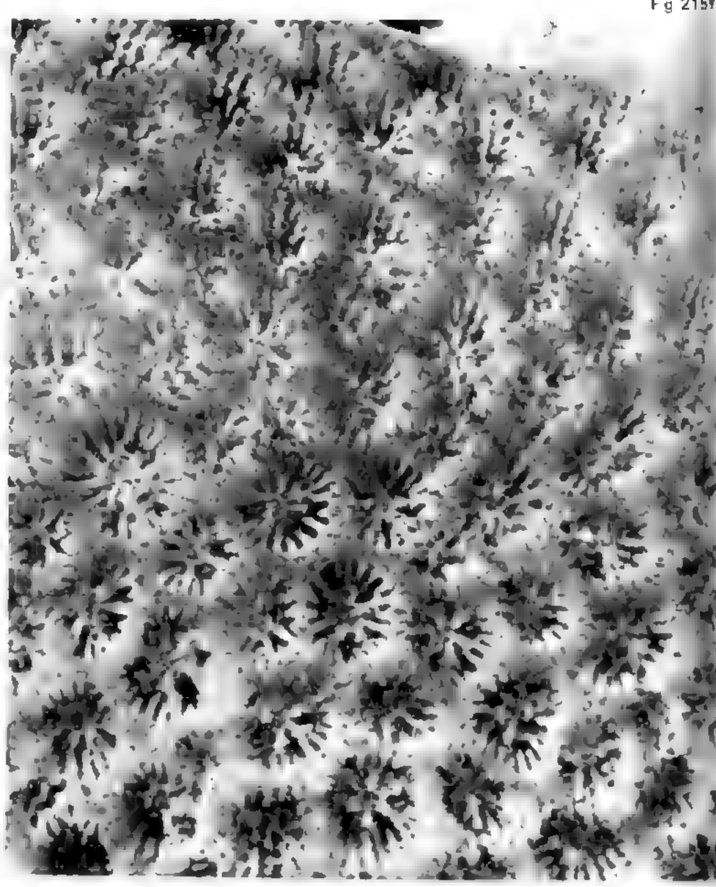


Fig 215▼



Verrill (1870) adopted three subfamilies for the Poritidae: Poritinae, Alveoporinae and Favositinae, thus partly combining the views of Dana and Edwards & Haime. Although he gave few reasons for doing so, the Montiporinae have not since been associated with the Poritidae except by Duncan (1884) who adopted a system of generic groupings similar to that of Edwards & Haime.

Studer (1878), Klunzinger (1879) and Quelch (1886) all gave *Alveopora* a similar systematic position in the Poritidae. Bernard, however, strongly asserted that *Alveopora* did not belong to the Poritidae, having affinities only with the Palaeozoic Favositidae (see p. 67). He thus believed that *Alveopora* had no affinities with the Scleractinia. Subsequent authors, including Vaughan (1907a), Hoffmeister (1925) and Thiel (1932), adopted Bernard's classification of *Alveopora* without question until Vaughan and Wells (1943) replaced *Alveopora* in the Poritidae along with *Goniopora*, *Porites*, *Synaraea* and *Napopora*. All subsequent authors have kept *Alveopora* in the Poritidae, its relationships with *Goniopora* being emphasised by ecological similarities and similarities in the structure and behaviour of the polyps (see below).

Twenty-six species of *Alveopora* are known to the authors (Table 2), 15 of which, described from last century, are not recognisable from their descriptions. Of these, the only type specimens that have been found are *A. fenestrata* (Lamarck), the types of Dana and Verrill and *A. tizardi* Bassett-Smith. Wells (pers. comm.) has seen the type of *A. intersepta* (Esper). There are thus 15 nominal species with adequate descriptions and/or type specimens. A further 16 specimens in the British Museum (Natural History) are named and marked 'type', presumably by Bernard in his initial study of the Poritidae, before he decided to remove *Alveopora* from the Poritidae and to abandon the Linnaean system of nomenclature. These specimens have no taxonomic status.

Significantly, the literature contains very few references to old names which cannot be verified. One exception is *A. daedalea* Forskål, the most commonly used of all *Alveopora* names. Wells (1936) notes that 'there is a shade of doubt whether Forskål's specimen of *M. daedalea* was really an *Alveopora* and his original specimen is missing' while Crossland (1941) notes that 'the specimen has disappeared but there is no doubt that it was an *Alveopora* . . . both Forskål's and Klunzinger's specimen are smaller than others I have collected at Ghardaqa, though the species is usually much smaller than others of the genus'. Crossland goes on to give the characters of the species which are, however, simply those of the genus. Klunzinger's specimen that he refers to is probably the very small specimen preserved in alcohol in the Berlin Museum. This specimen is not identifiable to species.

Ecology and structure

Alveopora is very seldom abundant on any reef within the Great Barrier Reef and, perhaps more than any other genus, its occurrence is unpredictable. More than most coral genera, different species of *Alveopora* occupy very different habitats; e.g. *A. catalai* is found in turbid water protected from wave action, *A. verrilliana* is found in clear water on reef slopes. Seldom are more than 2 or 3 species found in the same biotope. For this reason, and because of its general rarity, some of the species of *Alveopora* are difficult to separate. When they are separated, some are difficult to describe, because their skeletons have so few distinctive features.

All *Alveopora* have simple skeletons. Corallites have 12 trabecular pillars linked by horizontal synapticulae. These elements then form a cylinder with regular lattice-like pores. Septa are always reduced to rows of spines projecting inwards from the trabeculae. Different species may have characteristic septal patterns, but usually these are very variable. No east Australian *Alveopora* shows any sign of having either of the patterns of septal fusion found in *Porites* or *Goniopora*. This was the basis of Bernard's objection to including *Alveopora* in the Poritidae and it is a valid objection which requires further study.

The polyps of *Alveopora* are very distinctive. All east Australian *Alveopora* have 12 tentacles, and are thus readily distinguished from all *Goniopora*, which have 24 tentacles. Thus, even the big polyps of *A. catalai* and the tiny polyps of *Goniopora stutchburyi* have 12 and 24 tentacles respectively. Alveopora tentacles are usually also distinguished by having swollen tips when fully extended, whereas those of *Goniopora* are usually terete, or taper. Both genera show similar polyp behaviour. Polyps are usually extended, or partly extended, day and night. The degree of extension of individual polyps, however, varies greatly between, and within, individual colonies. All polyps retract when disturbed, the stimulus to retract being rapidly transmitted to neighbouring polyps.

Table 2 The nominal species of *Alveopora* and their type localities

	Type locality
Madrepora daedalea Forskål, 1775	Red Sea
Madrepora retepora Ellis & Solander, 1786	Not recorded
Madrepora intersepta Esper, 1795	East Indies
Pocillopora fenestrata Lamarck, 1816	'Southern Ocean'
Porites reticulata Lamarck, 1816	Not recorded
Alcyonella savignyi Audouin, 1826	Red Sea
Alveopora octoformis de Blainville, 1830	Not recorded
Alveopora peroni de Blainville, 1830	Not recorded
Alveopora viridis Quoy & Gaimard, 1833	Santa Cruz
Alveopora rubra Quoy & Gaimard, 1833	New Ireland
Alveopora spongiosa Dana, 1846	Fiji
Alveopora verrilliana Dana, 1846	Hawaii
Alveopora excelsa Verrill, 1864	Singapore
Alveopora retusa Verrill, 1864	Singapore
Favositipora deshayesii Saville-Kent, 1870	Not recorded
Alveopora tizardi Bassett-Smith, 1890	South China Sea
Alveopora allingi Hoffmeister, 1925	Samoa
Alveopora fijiensis Hoffmeister, 1932	Fiji
Alveopora regularis Thiel, 1932	Banda Sea
Alveopora mortenseni Crossland, 1952	Great Barrier Reef
Alveopora ocellata Wells, 1954	Marshall Islands
Alveopora japonica Eguchi, 1968	South China Sea
Alveopora catalai Wells, 1968	New Caledonia
Alveopora superficialis Scheer & Pillai, 1976	Maldive Archipelago
Alveopora alcalai Nemenzo, 1976	Philippines
Alveopora marionensis Veron & Pichon (this study)	Marion Reef, Coral Sea

Alveopora catalai Wells, 1968

Synonymy

Alveopora catalai, Wells, 1968.

Material studied

Big Mary Reef, Howick Island, Lizard Island, Hope Island (2 specimens), **Low Isles** (4 specimens), **Palm Islands** (28 specimens), **Gould Reef** (2 specimens), **Whitsunday Islands** (8 specimens), **Swain Reefs** (5 specimens).

These localities include collecting stations 12, 24, 41, 43, 45, 57, 59, 81, 91, 95, 97, 113, 175, 187.

Previous records from Eastern Australia

Not previously recorded.

Fig. 216 *Alveopora catalai* at the Swain Reefs *in situ* (photo: L. Zell).

Characters

Colonies are ramose, composed of gnarled branches that divide irregularly. Branches are uniform in thickness for any particular colony and average 12–55mm diameter.

'Corallites cylindrical to subpolygonal, averaging 3.5mm in diameter when fully developed, a few reaching 4.5mm, their vertical axis diverging slightly from the axis of the branch. Mature calices slightly separated from each other. Corallite wall formed by a palisade of 12 trabecular pillars linked by stout synapticulae, the projecting tips of pillars forming a prominent crown of spines. The 12 septa consist of vertical rows of trabecular spines projecting inward from the mural pillars. The tapered inner ends of the septa divide and fuse deep in the calices to form a loose, irregular axial tangle. The vertical row of spines of each septum in the inner or upper side of a mature calice is commonly strengthened by a vertical bar between each spine. Dissepiments sparse, represented by a few very delicate horizontal partitions deep in the calices. On older parts of branches the mural trabeculae become greatly thickened, often obliterating the spaces between them' (Wells, 1968).

Living corals (Figs. 216, 328) are usually pale brownish-pink when polyps are retracted. Extended polyps are usually dull green, brown or yellow in colour. Oral discs are white and tentacles may have white tips. Polyps are usually extended day and night and are frequently over 10cm long. They have 12 short tentacles (or more than 12 where regeneration after damage has occurred).

Skeletal variation

Alveopora catalai only occurs on soft substrates in deep water or in shallow turbid water protected from currents. The lower parts of most colonies are usually dead and support the living parts above soft substrates. Branch diameters are relatively uniform within colonies, with branches being thickest in the shallowest or least turbid environments.

This is one of the commonest and most conspicuous species in turbid environments and frequently forms monospecific stands >10m diameter.

Fig. 217▲

Fig. 218▲

Fig. 219◂

Affinities

The ramose growth form of *A. catalai* clearly distinguishes it from all other species, both on the Great Barrier Reef and elsewhere. The large rounded corallites resemble only those of *A. allingi*, which has an encrusting or lobed growth form.

Figs. 217–219 *Alveopora catalai*

Figs. 217, 218 From between Brisk and Falcon Islands, Palm Islands, collecting station 41 (× 0.75 and × 0.5 respectively).

Fig. 219. From Nara Inlet, Hook Island, Whitsunday Islands, collecting station 97.

Figs. 220–223 *Alveopora catalai* × 5

Figs. 220, 221 From between Brisk and Falcon Islands, same corallum as Fig. 217, showing corallites at a branch tip and base respectively.

Figs. 222, 223 From Nara Inlet, Hook Island, Whitsunday Islands, Fig. 222 same corallum as Fig. 219.

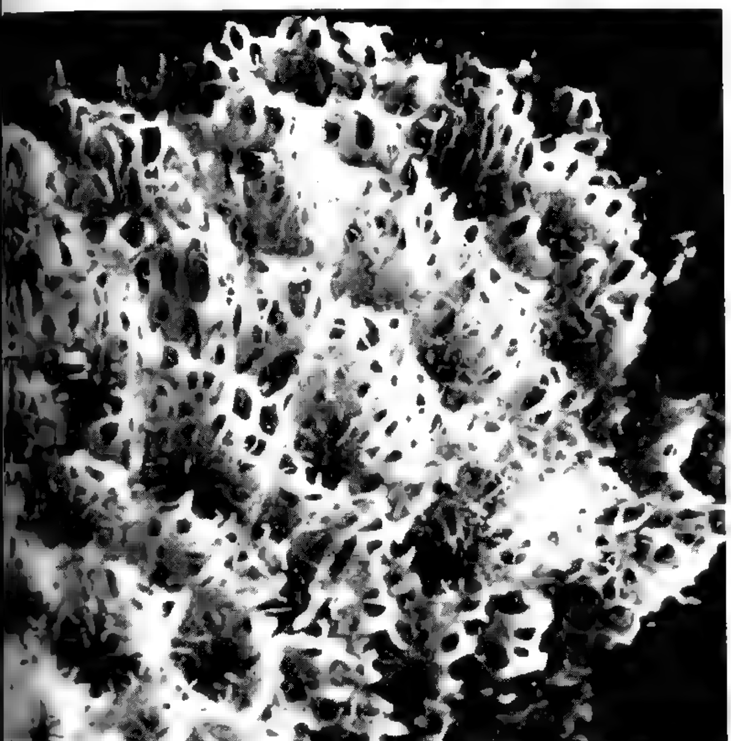


Fig 220▲

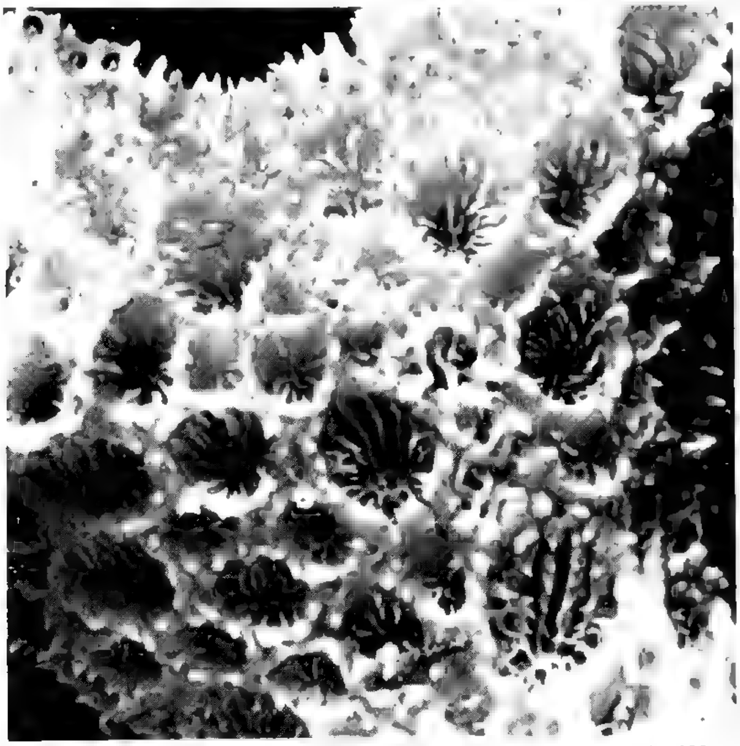
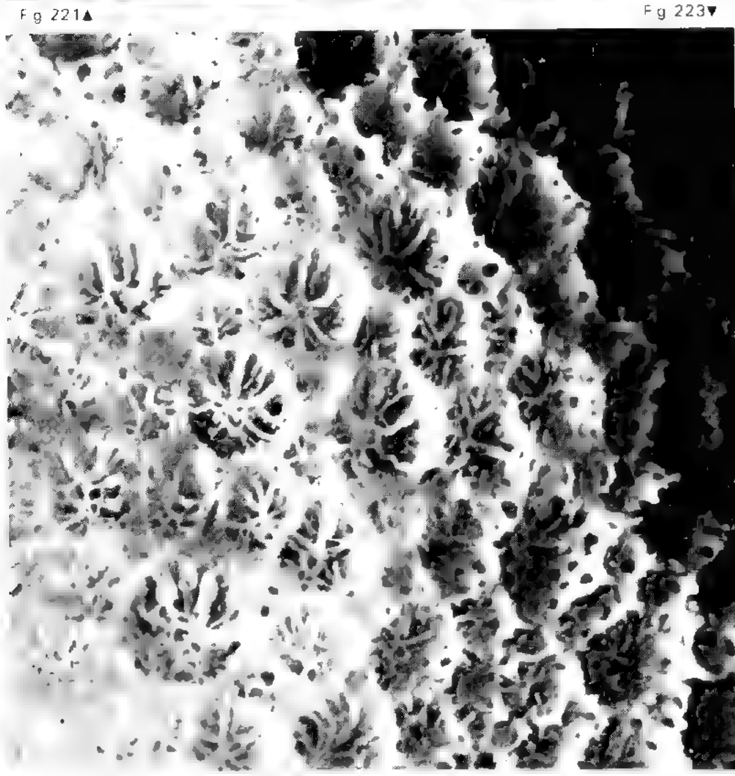


Fig 221▲

Fig 222▼

Fig 223▼



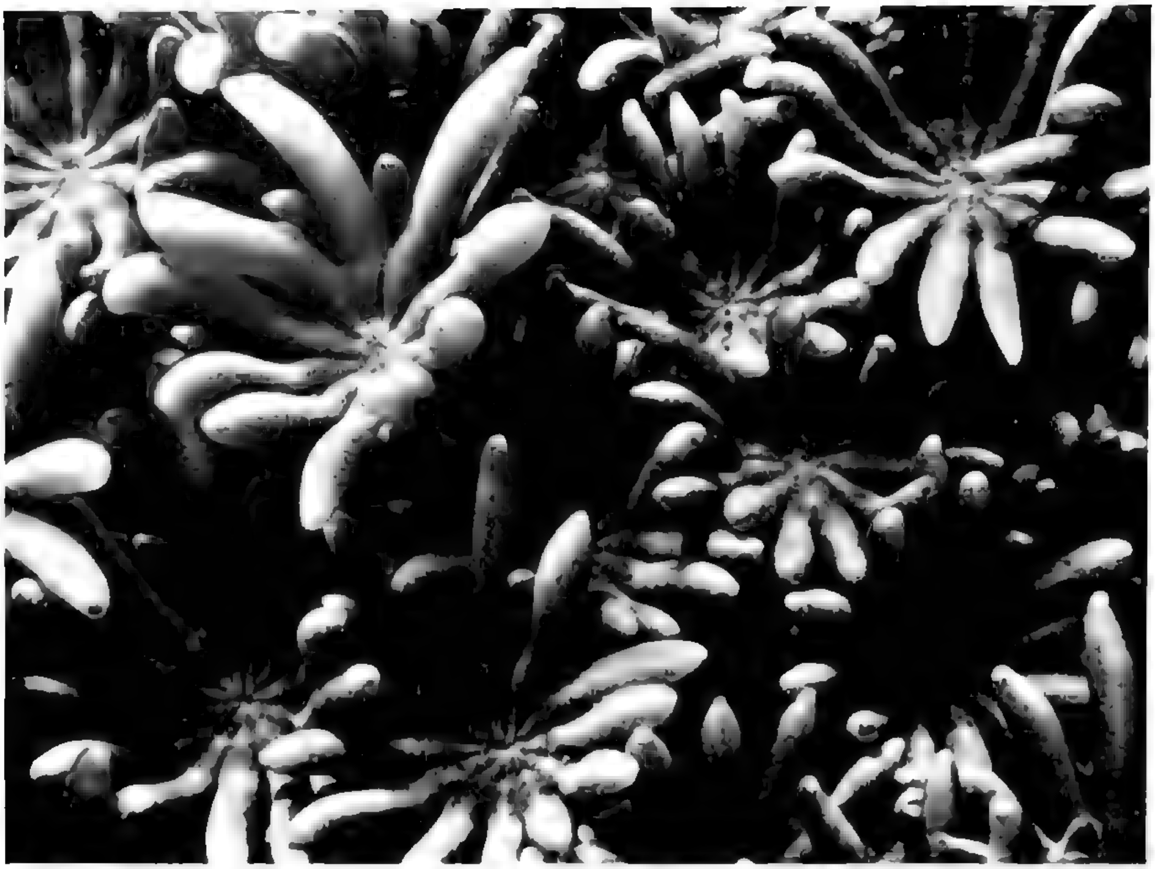


Fig. 224 *Alveopora allingi* from Lord Howe Island (photo: L. Zell).

Alveopora allingi Hoffmeister, 1925

Synonymy

Alveopora allingi Hoffmeister, 1925; Wells (1954); Pillai & Scheer (1976); Veron & Done (1979).

Alveopora mortenseni Crossland, 1952; Pillai & Scheer (1976).

The single specimens of *A. allingi* recorded by Wells (1954) and Pillai & Scheer (1976) are both in close accord with the present series and with the type specimens.

The holotype of *A. mortenseni* differs from that of *A. allingi* in having larger, more irregular, less well-calcified corallites. The septa are finer and less regular, and there is little development of columellae. Pillai and Scheer's (1976) specimens attributed to *A. mortenseni* are similar to Crossland's type. The present series, however, is very polymorphic. It contains specimens clearly identical with both type specimens (as did the collection of Pillai & Scheer, 1976), as well as specimens which are much more calcified and with a much better developed septation than either type. This range of skeletal characters is generally correlated with environmental conditions, as described below. The conclusion of this study is that the present series is a single, polymorphic species, with several ecomorphs. However, further work may show it to be two discrete species, occupying different habitats, the *mortenseni* form from deep or turbid water and the *allingi* form from shallower or less turbid water or biotopes exposed to currents.

Figs. 225–229 *Alveopora allingi*

Fig. 225 From the Whitsunday Islands (× 0.45).
Fig. 226 From Lord Howe Island (× 0.45).
Fig. 227 From Thursday Island, collecting station 54 (× 0.45).
Fig. 228 Holotype from Samoa (× 0.7).
Fig. 229 From the Palm Islands (× 1.0).

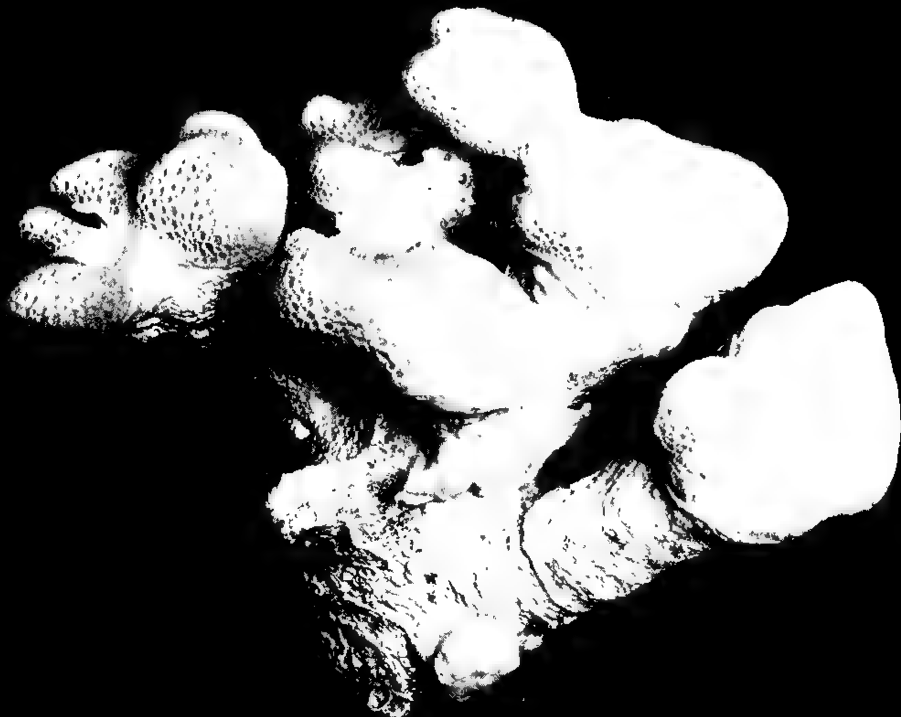


Fig. 225◄

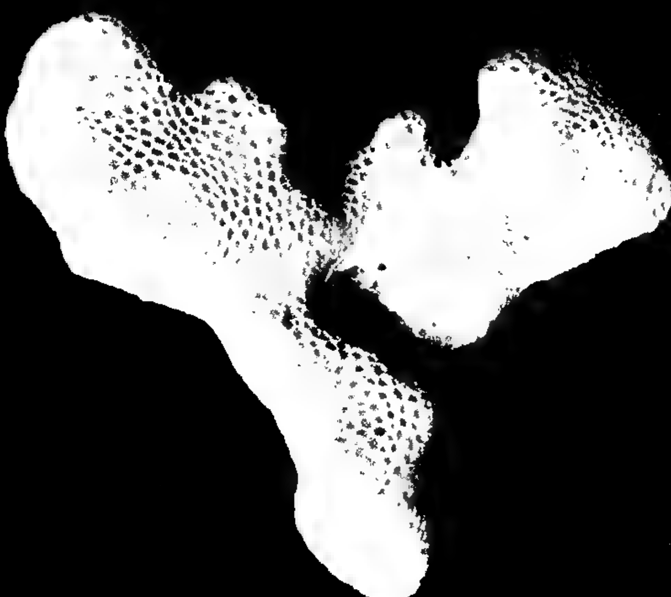


Fig. 226◄

Fig. 227◄

Fig. 228▲

Fig. 229◄

Material studied

Thursday Island (3 specimens), **Raine Island, Ribbon Reef, Hope Island** (3 specimens), **Low Isles, Magdelaine Cay, Mellish Reef, Palm Islands** (16 specimens), **Marion Reef** (11 specimens), **Chesterfield Atoll** (3 specimens), **Whitsunday Islands** (3 specimens), **Lord Howe Island**.

These localities include collecting stations 37, 38, 41, 42, 54, 57, 59, 60, 63, 94, 102, 151, 178, 200, 203, 207, 210, 211.

Previous records from Eastern Australia

Low Isles (as *A. mortenseni*), Crossland (1952); **Bushy-Redbill Reef**, Wallace & Lovell (1977); **Lord Howe Island**, Veron and Done (1979).

Characters

Coralla are encrusting, submassive or consist of short irregular lobes with rounded even surfaces. Corallites are polygonal, 3.5–4.5mm diameter. Their walls are thin and highly perforated or are sturdy, with pores accounting for as little as 30 per cent of the wall area. Septa are in two cycles and consist of straight spines, which may be connected by vertical struts, be fused in the calice centre, or have free ends. Columellae may be up to $\frac{2}{3}$ the calice diameter, or be completely absent.

Living colonies have tightly compacted polyps which have 12 tentacles, each with an expanded knob-like tip. They are usually yellow, green or brown in colour and may be over 10cm long.

Skeletal variation

As noted above, *A. allingi* is very polymorphic. It can be divided into several ecomorphs.

Alveopora allingi from deep water (Figs. 229, 233)

Coralla from deep or turbid water, such as those from the protected fringing reefs of the Palm Islands, are the least calcified of the present series. They are mostly encrusting or pillow-like. Corallite walls are highly perforated (50–60 per cent of the area being pores) and septa consist of a diffuse tangle of hair-like spines forming a diffuse columella.

Alveopora allingi from Lord Howe Island (Figs. 226, 231)

Coralla are much more calcified than the above group. Columellae are mostly wide and well defined. Septa are subequal and short, consisting of horizontal spines with vertical connecting struts.

Alveopora allingi from reef slopes (Figs. 225, 232)

Coralla consist of large irregular lobes with rounded even surfaces. Calices are polygonal to rounded, averaging 3.5mm diameter. Walls are sturdy, the trabeculae and synapticulae forming a regular palisade with pores accounting for 30–40 per cent of the area. Septa are in two well-defined cycles. First cycle septa are solidly fused in the calice centre except for their upper margins which consist of short, thick spines. Second cycle septa consist of rows of short thick spines, $<\frac{1}{4}R$, which may be partly fused to the first cycle septa deep within the corallite, below the level of fusion of the first cycle septa. There are no distinct columellae.

Affinities

Alveopora allingi does not closely resemble any other east Australian species. It has a growth form similar to that of *A. marionensis*, but has much larger corallites. The size of the corallites is similar only to those of *A. catalai*, which is readily distinguished by its growth form.

Distribution

Recorded from east Australia, Samoa, the Philippines and the Maldive Archipelago.

Figs. 230–233 *Alveopora allingi* (×5)

Fig. 230 Holotype from Samoa, same corallum as Fig. 228.
Fig. 231 From Lord Howe Island, same corallum as Fig. 226.
Fig. 232 From the Whitsunday Islands, same corallum as Fig. 225.
Fig. 233 From the Palm Islands, same corallum as Fig. 229.

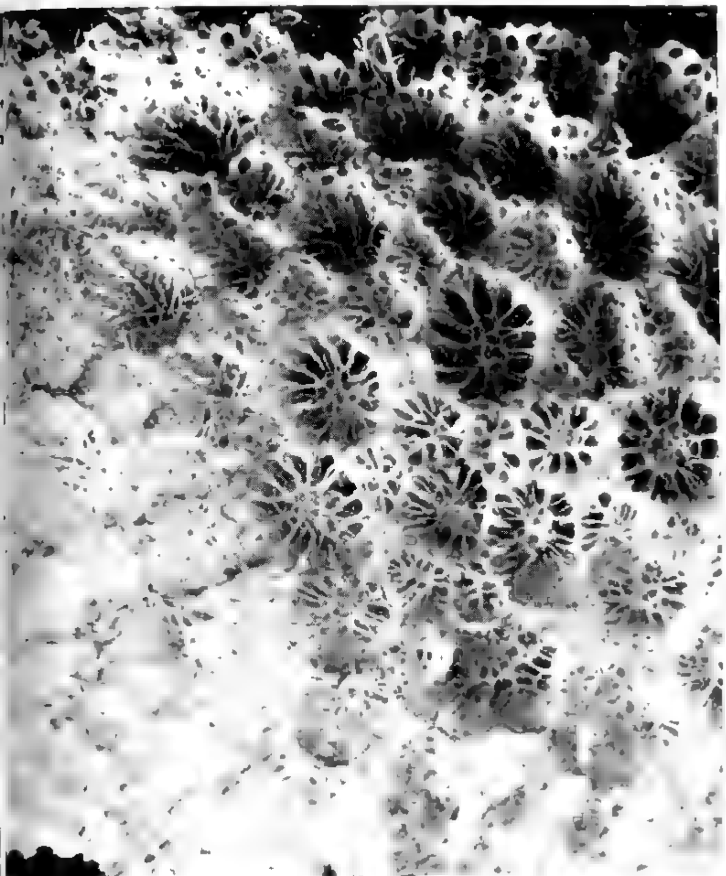


Fig. 230▲

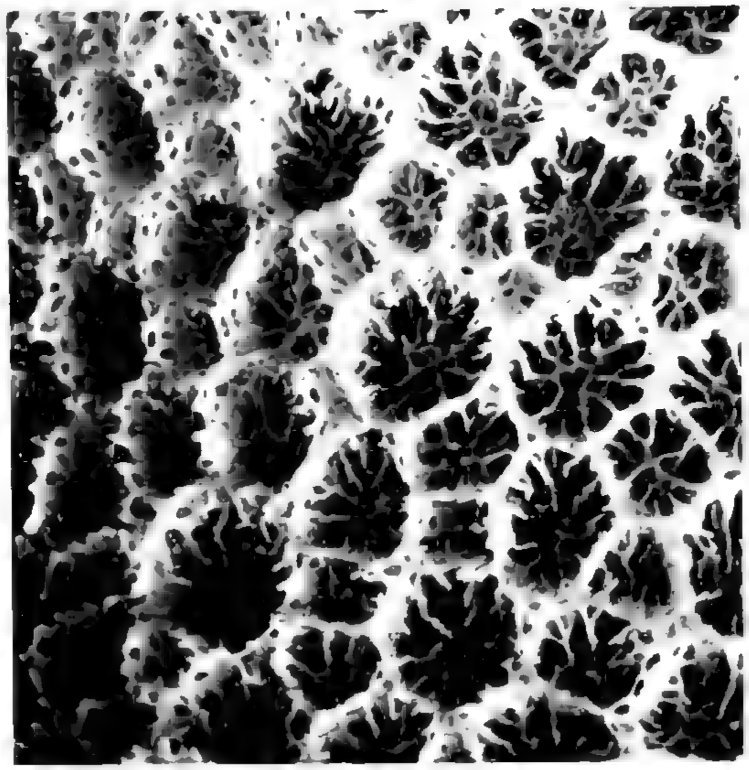


Fig. 231▲

Fig. 232▼

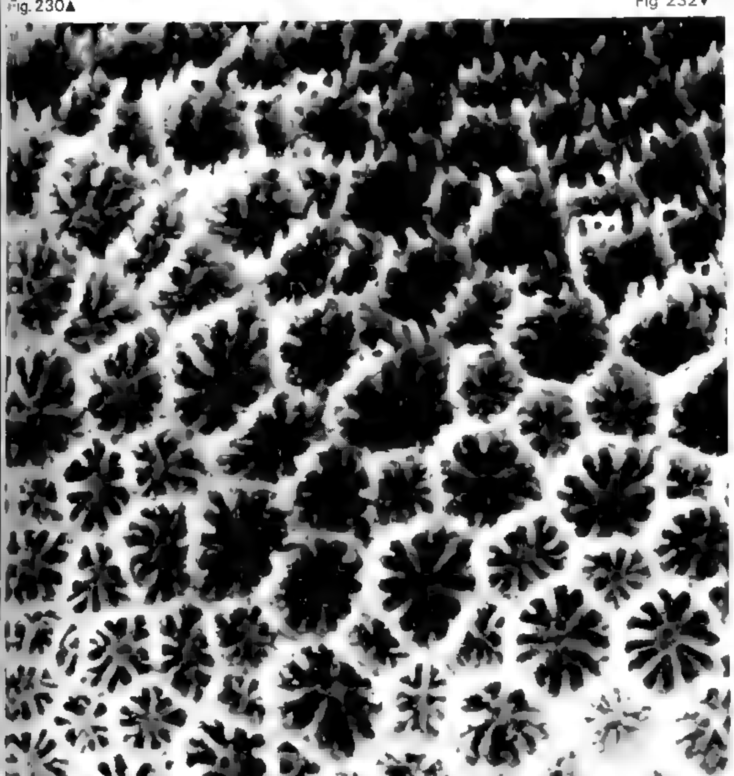
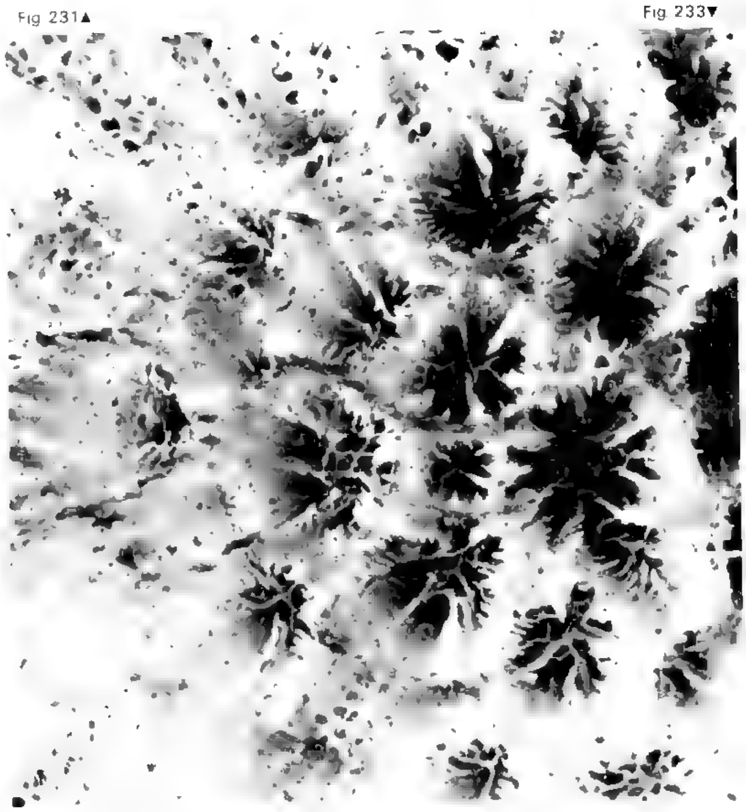


Fig. 233▼



Alveopora marionensis n.sp.

Material studied

Marion Reef (7 specimens).

This locality includes collecting stations 203, 204.

Previous records from Eastern Australia

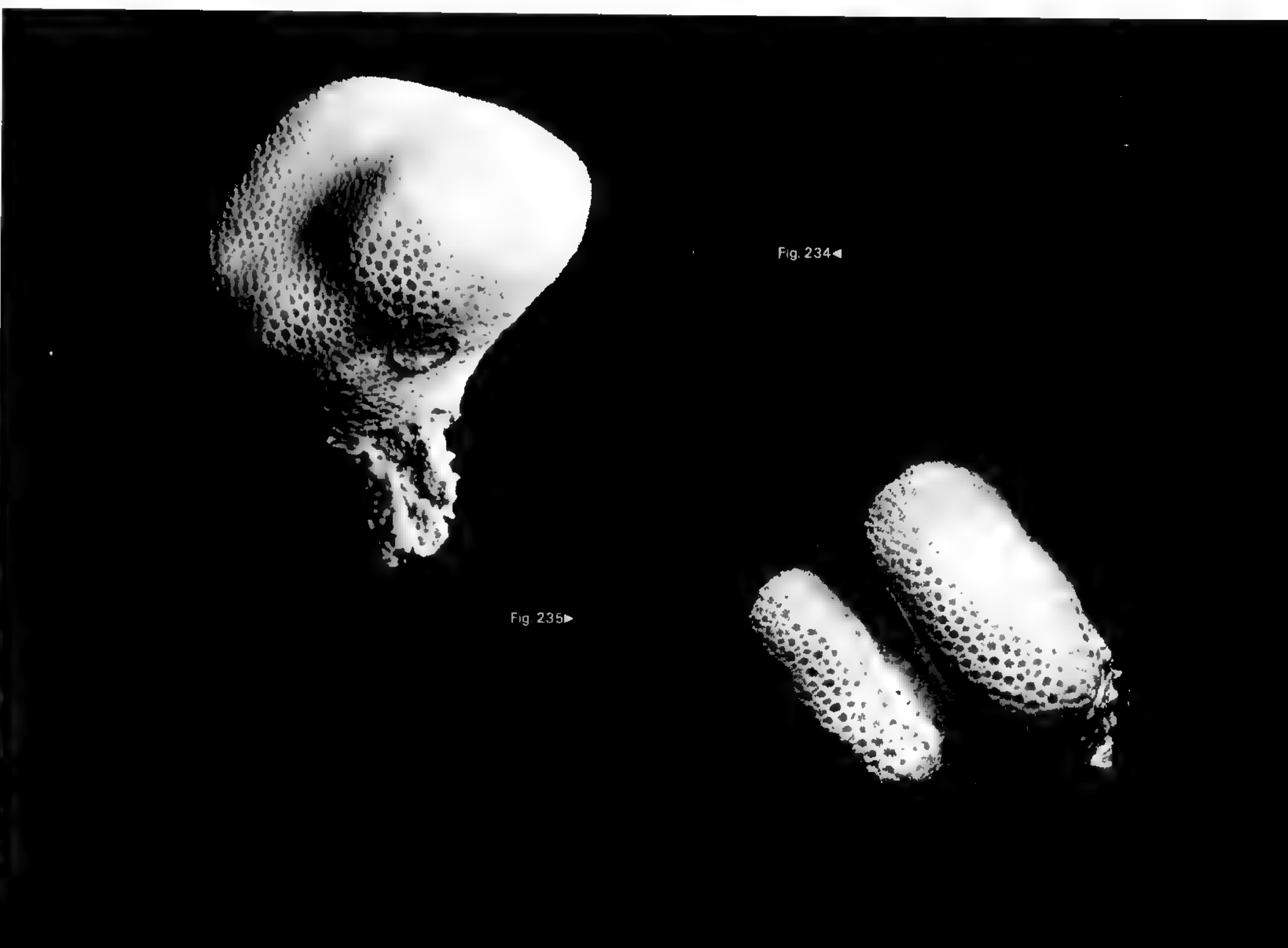
Not previously recorded.

Characters

Coralla are massive or submassive, sometimes forming thick plates. Corallites are polygonal, 2.8–3.2mm diameter. Their walls consist of a palisade of regular trabecular pillars and smaller synapticular linkages, with rounded pores accounting for 40–60 per cent of the surface area. Calices are deep and open. Septa are in two cycles. The first cycle consists of 6 rows of short spines at the corallite rim. These become fine and elongate approximately 3mm deep within the corallite, and may fuse. The second cycle is usually complete and consists of spines remaining $<\frac{1}{2}R$ along the whole length of the septum. There is almost no development of columellae other than a slight elaboration of the tips of lower septal spines.

Living colonies have polyps with short straight tentacles normally extended during the day (Figs. 330–333). All colonies from the same reef or general reef area tend to have the same colours and have a very uniform appearance. Colonies from different areas, however, may have different colours and slightly different polyp sizes and may look very different underwater. The most common colour is a uniform grey, but polyps may be pink with white tips to the tentacles or brown. At Marion Reef, the grey and pink colour morphs occur together and superficially appear to be distinct species. Skeletal characters are the same for both morphs and there is no other evidence that more than one species is involved.

Figs. 234, 235 *Alveopora marionensis* from Marion Reef, collecting station 203 (× 0.7 and × 0.9 respectively).



Skeletal variation

The present small series shows little variation between coralla, although there are substantial differences between corallites from the side as compared with the upper surfaces of coralla. The former are relatively well calcified, with thick walls and thick septal spines.

Affinities

Alveopora marionensis is very close to *A. fenestrata*, from which it is difficult to distinguish (see p. 123).

Etymology

Named after Marion Reef, where this species was studied.

Holotype (Figs. 234, 239)

Dimension: 102 × 82mm

Locality: Marion Reef

Depth: 12m

Collector: J. E. N. Veron

Holotype: British Museum (Natural History)

Paratypes

Australian Institute of Marine Science
Queensland Museum, Australia

Distribution

The only confirmed records of this species are those of the present study.

Figs. 236, 237 *Alveopora marionensis* from Marion Reef, Fig. 236 same corallum as Fig. 234, Fig. 237 from collecting station 205 (× 5).

Fig. 236▼

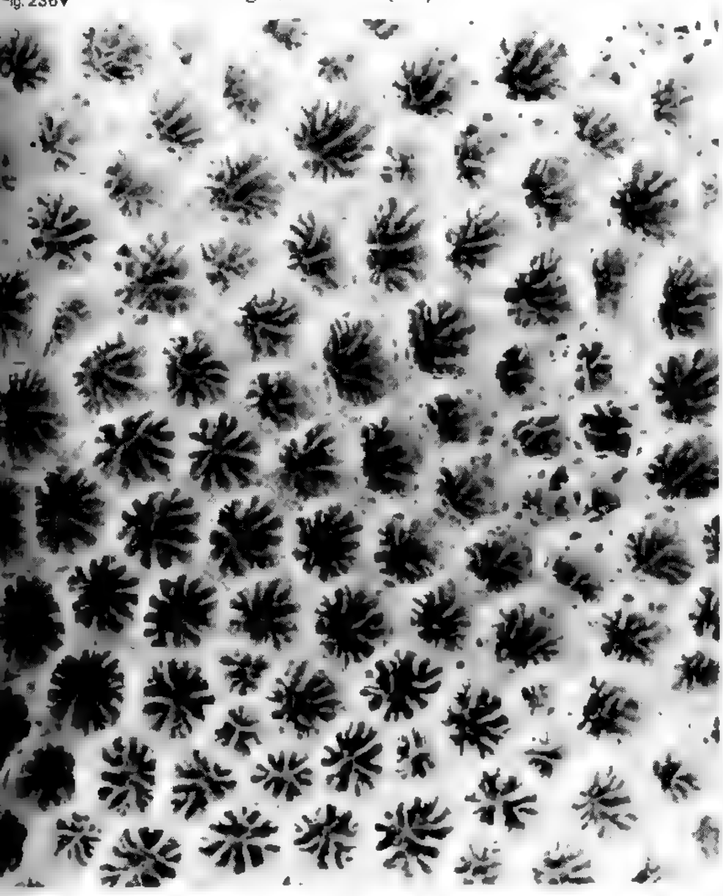
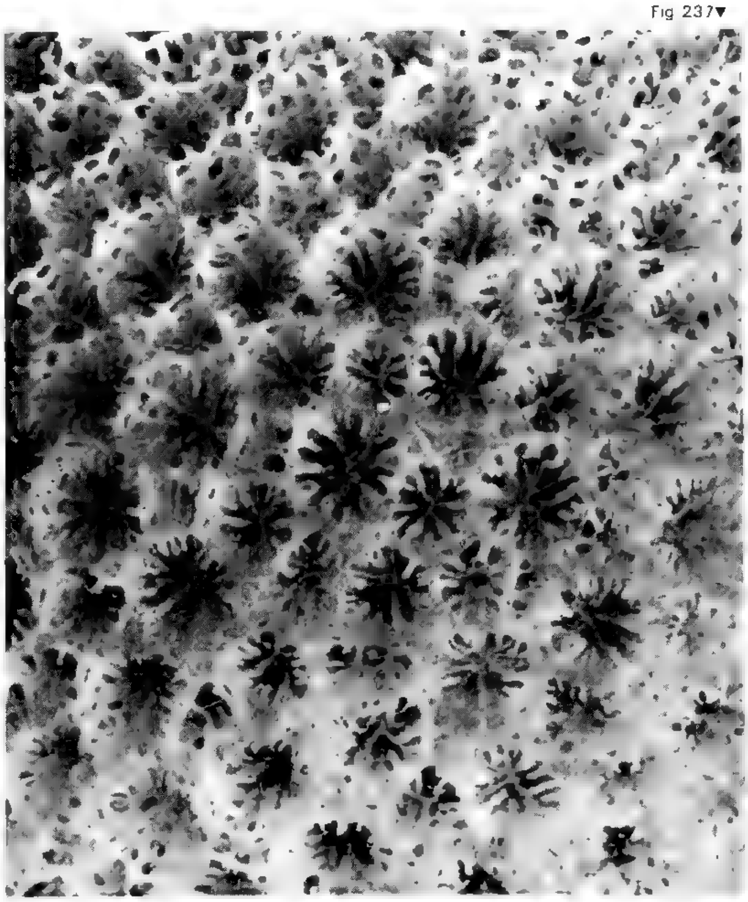


Fig 237▼



F 238▲

F 240▼

▲

F g 24

Alveopora fenestrata (Lamarck, 1816)

Synonymy

Pocillopora fenestrata Lamarck, 1816.

Alveopora retusa Verrill, 1864.

Two specimens in the Paris Museum appear to be Lamarck's types. The larger, 70mm long, is clearly identified with the present series. It has deep, cellular, hexagonal corallites averaging 2.3mm diameter. Septa are in two indistinct cycles and are composed of needle-like spines that may be irregularly fused.

Material studied

Mellish Reef, Palm Islands (5 specimens), **Broadhurst Reef, Marion Reef** (11 specimens), **Whitsunday Islands, Bushy Island-Redbill Reef, Fitzroy Reef** (2 specimens), **Lady Musgrave Reef** (2 specimens).

These localities include collecting stations 59, 91, 94, 169, 178, 193, 194, 197, 203, 205, 207.

Figs. 238–241 *Alveopora marionensis* from Marion Reef (× 20)
Figs 238, 239 Same corallum and same corallum as Fig. 234.
Figs. 240, 241 Same corallum and same corallum as Fig. 235.

Figs. 242, 243 *Alveopora fenestrata* from Marion Reef, collecting station 205 (× 1.0).

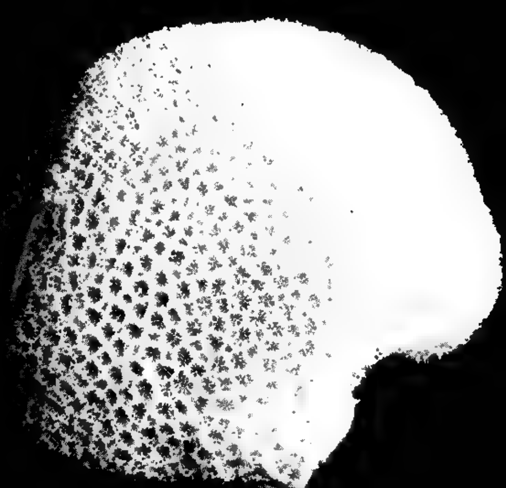
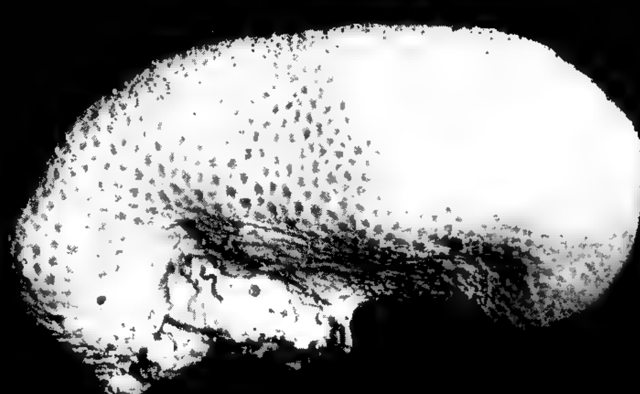


Fig. 243▼

Fig. 242▲



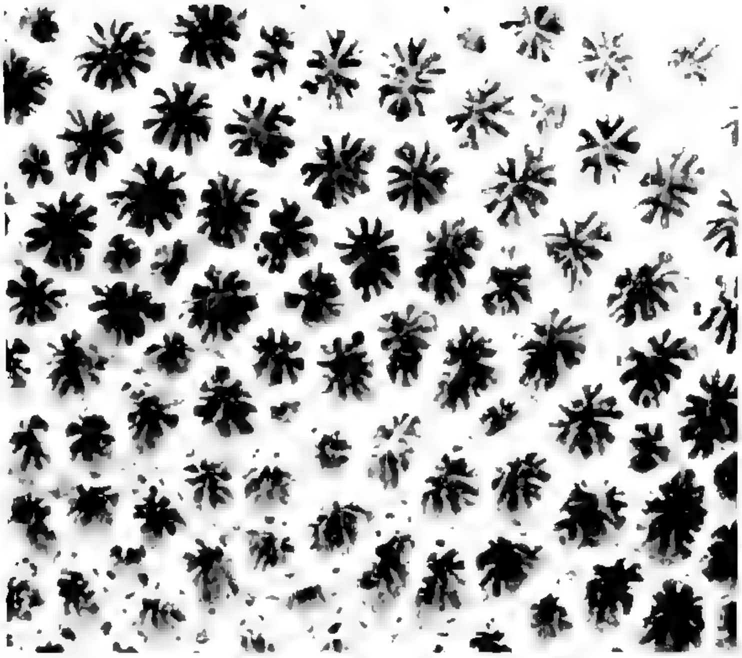


Fig 244▲

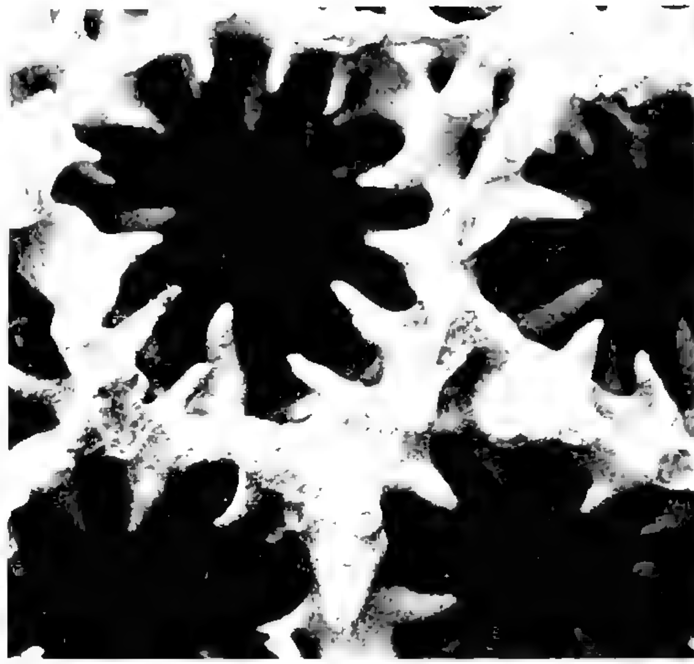
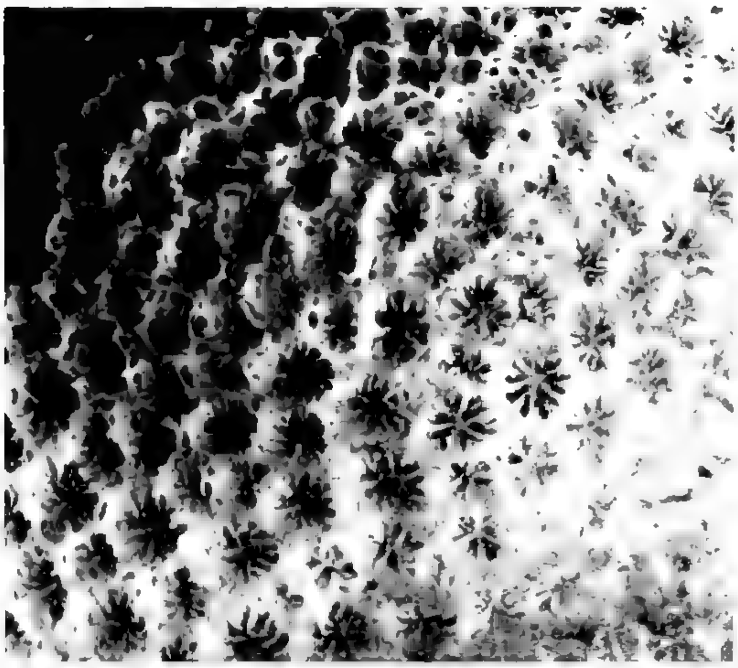


Fig 245▲

Fig 246▼



F 24

Fig 248▼

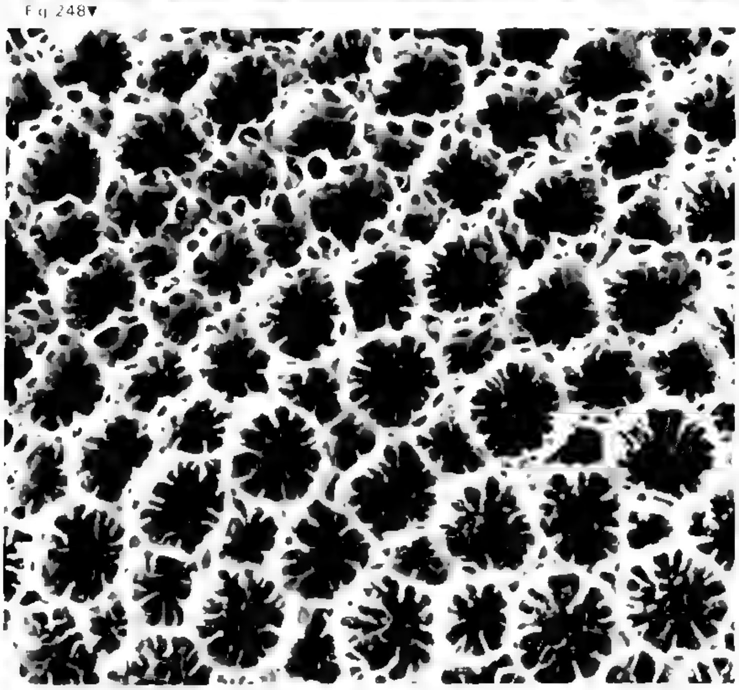
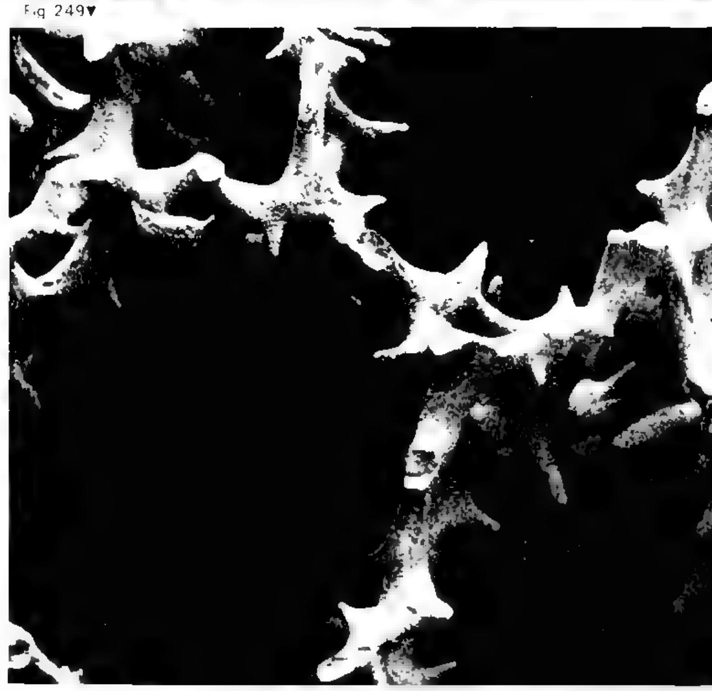


Fig 249▼



Previous records from Eastern Australia

Not previously recorded.

Characters

Coralla are hemispherical with a surface divided into irregular lobes. Corallites are 2.1–3.0mm diameter and are hexagonal in shape. They have thin walls with regular trabecular pillars and small synapticular linkages, the pores accounting for 30–50 per cent of the surface area. Septa are in 2 cycles which may be indistinct. The first cycle consists of 6 vertical rows of spines which are short at the calice rim, becoming fine and elongate approximately 3mm deep within the corallite, where they may fuse. The second cycle is usually complete and consists of spines remaining $<\frac{1}{3}$R along the whole length of the septum. There is almost no development of a columella, other than a slight elaboration of the tips of the lower septal spines.

Living colonies have polyps extended during the day. Polyps are long and have a ragged appearance, with long thin tentacles. The colour is a uniform greenish, dark brown (Figs. 334–336, 339).

Affinities

Alveopora fenestrata has a growth form intermediate between *A. marionensis* and *A. verrilliana.* Corallites are bigger than those of *A. verrilliana* (see Fig. 250) and are less well calcified. There is very little difference between the corallites of *A. fenestrata* and those of *A. marionensis* and only large coralla of these species can be distinguished. *Alveopora marionensis* has slightly larger corallites and slightly longer septa which more frequently fuse. Underwater they are readily distinguished by their differing polyp shapes and colours (see Fig. 339).

Distribution

The type locality is unknown. The only confirmed localities of this species are those of the present study.

Alveopora verrilliana Dana, 1872

Synonymy

Alveopora daedalea (Forskål); Dana, 1872.

Alveopora verrilliana Dana, 1846; Vaughan (1907a); Hoffmeister (1925); Ma (1959); *non* Nemenzo (1971).

Dana's type from Hawaii, which was described by Vaughan (1907a), is a small knob-shaped specimen, 42mm diameter, and is very similar to some of the better calcified coralla in the present series from Marion Reef.

Material studied

Lizard Island, Marion Reef (7 specimens), **Chesterfield Atoll.**

These localities include collecting station 32.

Previous records from Eastern Australia

Not previously recorded.

Characters

Coralla have short irregularly dividing, knob-like branches. Corallites are polygonal, 1.7–2.0mm diameter. Their walls are irregularly perforated and consist of 30–50 per cent

Figs. 244–249 *Alveopora fenestrata* from Marion Reef

Figs. 244, 245 Same corallum and same corallum as Fig. 242 (× 5 and × 25 respectively).
Figs. 246, 247 Same corallum and same corallum as Fig. 243 (× 5 and × 25 respectively).
Figs. 248, 249 Same corallum (× 5 and × 25 respectively).

pores. The upper edge of the walls are dentate, the dentations consisting of trabeculae and uppermost septal spines. Septa are very irregular, 2–10 in number and $\frac{1}{4}$–$1\frac{1}{4}$ R in length. The longer septa sometimes anastomose. They consist of thick tapering spines, which are seldom arranged in rows and are not arranged in cycles. There are no columellae.

Living colonies (Figs. 337–341) have polyps extended during the day. They are relatively long for the small sized calices and are a dark greenish-brown colour.

Skeletal variation

The present series consists of 9 specimens only, 7 from the same locality (Marion Reef), where this species is common. Elsewhere it appears to be rare, and the present series shows little skeletal variation.

Affinities

Alveopora verrilliana is readily recognised by its growth form, which does not resemble that of any other east Australian species. It is also readily distinguished by its corallites, which resemble only those of *A. spongiosa* from exposed environments. Even then, *A. spongiosa* seldom develops the strong septation of *A. verrilliana* and never has dentations along the upper wall.

Figs. 250, 251 *Alveopora verrilliana* from Marion Reef, Fig. 250 with a small corallum of *A. fenestrata* attached, same colony as Fig. 338 (× 0.45).

Figs. 252–255 *Alveopora verrilliana* from Marion Reef (× 25)
Figs. 252, 253 Same corallum and same corallum as Fig. 251.
Figs. 254, 255 Same corallum.

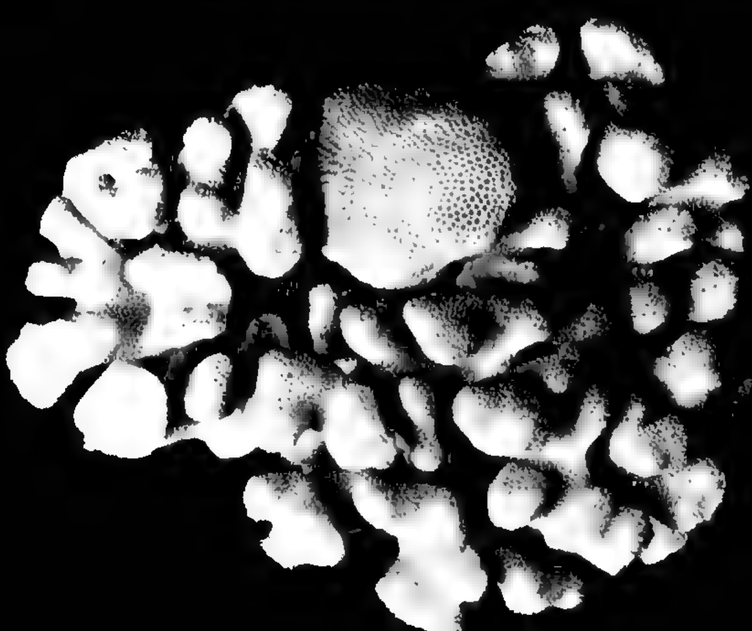


Fig. 251▼

Fig. 250▲

Fig 252▲

Fig 253▲

Fig 254▼

Fig 255▼

Alveopora spongiosa Dana, 1846

Synonymy

Alveopora spongiosa Dana, 1846.

Alveopora fijiensis Hoffmeister, 1932.

Alveopora regularis Thiel, 1932.

Alveopora regularis is described from a single very small specimen primarily characterised by two very unequal septal cycles, the first reaching almost to the calice centre. *Alveopora fijiensis* is similar, with septal spines reaching the calice centre. Both type specimens are close to the present species of *A. spongiosa* from relatively shallow water.

Material studied

Darnley Island (4 specimens), **Arden Island, Murray Islands** (3 specimens), **Dungeness Reef, Raine Island, Martha Ridgway Reef** (2 specimens), **Tijou Reef** (4 specimens), **Corbett Reef, Low Isles, Palm Islands** (20 specimens), **Pandora Reef, Chesterfield Atoll** (2 specimens), **Whitsunday Islands** (2 specimens), **Bushy Island-Redbill Reef** (2 specimens), **Swain Reefs, Fitzroy Reef** (4 specimens), **Lady Musgrave Reef** (3 specimens).

These localities include collecting stations 6, 7, 8, 12, 28, 31, 34, 37, 38, 42, 55, 57, 59, 80, 81, 90, 91, 92, 93, 95, 97, 122, 151, 154, 164, 170, 172, 183, 187, 190, 193, 195, 211.

Previous records from Eastern Australia

Lord Howe Island, Veron & Done (1979).

Characters

Well-developed colonies have the form of thick, encrusting or sub-encrusting plates or pillows with smooth, undulating surfaces. Small colonies are irregular in shape or are hemispherical nodules. All coralla have a well-developed epitheca and a soft, very porous skeleton.

Skeletal structures are similar in different coralla from the same biotope, but vary greatly in different environments. Corallites are circular to sub-polygonal, 1.9–2.6mm diameter, with walls having vertical trabecular pillars and horizontal synapticular cross-members of similar size and shape. The walls therefore have a highly perforate palisade appearance, with the pores forming 40–80 per cent of the area. Septa are very variable: they may be reduced to a few irregular tapering spines or be in two complete cycles up to R and ½R. Endothecal dissepiments are poorly formed or absent. There are no columellae.

Living colonies (Figs. 342–345) are usually very distinctive *in situ,* being relatively uniform in colour, usually dark or pale brown. Colonies exposed to strong light may sometimes be dark green or purple, while others under ledges or in caverns may be cream. In any of these colonies, the tentacles of the polyps are usually brown. Sometimes they are white, and, rarely, they are bright blue or green.

Polyps may be up to 3mm long and are normally extended during the day. They have 12 tentacles, which usually have expanded tips. Very rarely, 6 large tentacles alternate with 6 smaller ones.

Figs. 256–258 *Alveopora spongiosa*

Fig. 256 From Chesterfield Atoll (× 0.5).
Fig. 257 From Great Palm Island, collecting station 92 (× 0.8).
Fig. 258 From Orpheus Island, Palm Islands, collecting station 55 (× 0.5).

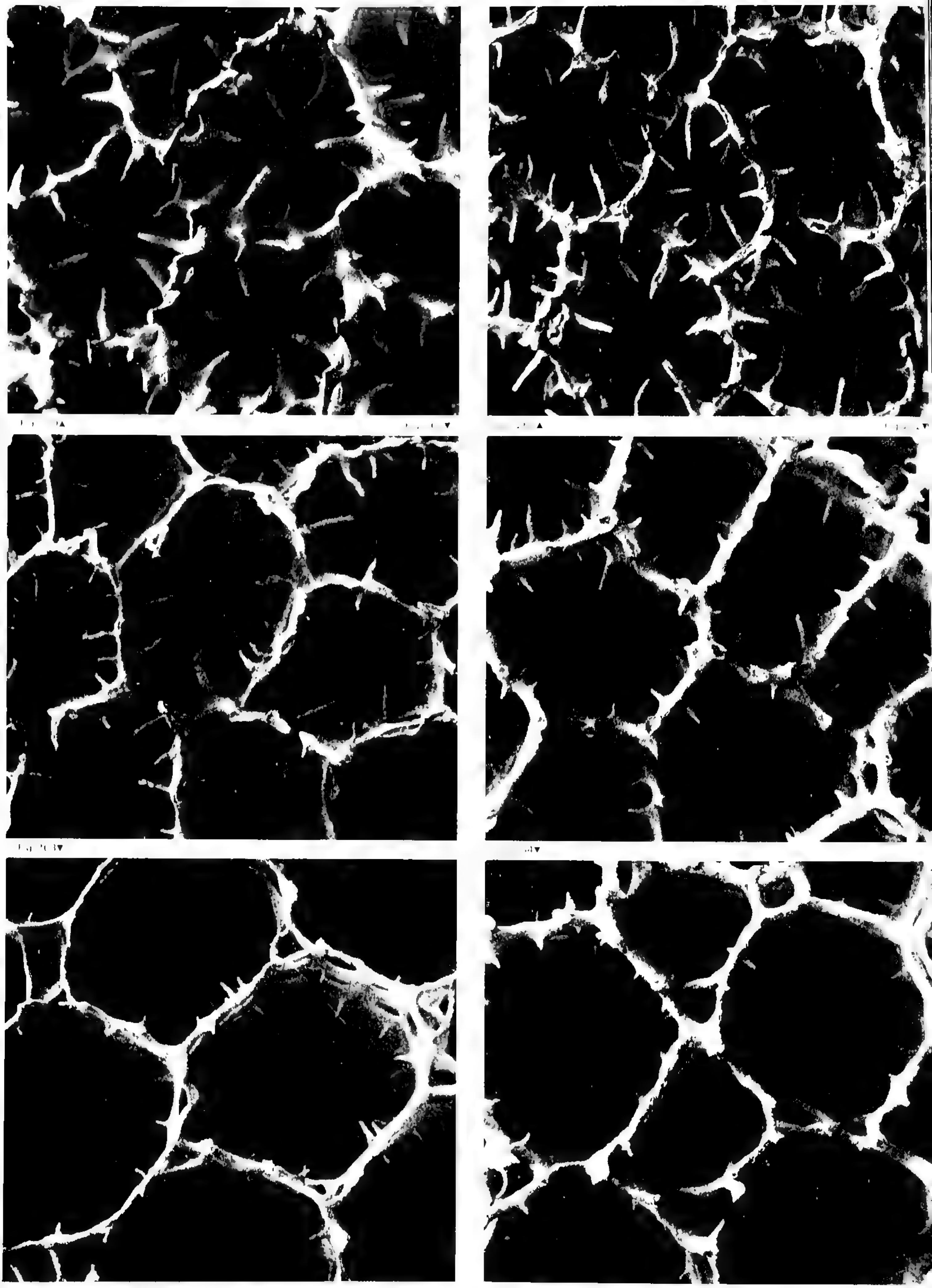
Figs. 259–264 *Alveopora spongiosa* (× 25)

Fig. 259 From Chesterfield Atoll, same corallum as Fig. 256.
Fig. 260 From Eclipse Island, collecting station 59.
Fig. 261 From Darnley Island, collecting station 31.
Fig. 262 From Great Palm Island, collecting station 92.
Figs. 263, 264 From Orpheus Island, Palm Islands, collecting station 55. Fig. 264 same corallum as Fig. 258.

Fig. 256◄

Fig. 257◄

Fig. 258◄



Skeletal variation

Alveopora spongiosa occupies a wide range of environments from deep turbid water, where coral diversity is very low, to shallow reef environments protected from strong wave action. Coralla from deep turbid water or caves have the lightest, most porous skeleton of any Indo-Pacific coral. Corallites are small, approximately 1.9mm diameter. Septa are usually reduced to a few short spines. Coralla from less protected deep water biotopes have irregular septal spines up to $\frac{1}{2}$R. Coralla from reef slopes with a moderate species diversity but still protected from wave action usually have very long, irregular, twisted septal spines, which may be fused at the corallite centre. Coralla from shallower upper reef slopes have septal spines becoming short again, but they are relatively thick and straight, and are usually arranged in two distinct cycles. Corallite diameters are usually 2.8–3.3mm.

Affinities

Of the Great Barrier Reef species, *A. spongiosa* is closest to *A. tizardi* (see p.132). Of non-Great Barrier Reef species, it most closely resembles *A. superficialis* Pillai & Scheer, 1976, which is distinguished by having smaller, shallow corallites. These (like *A. ocellata*, Wells, 1954) are circular in outline and have two cycles of fine, elongate, twisted septal spines.

Distribution

Unconfirmed records indicate this species has a wide distribution in the western Pacific. It has been previously recorded from Tahiti (type locality), Fiji (type locality of *A. fijiensis*) and the Banda Sea (type locality of *A. regularis*).

Figs. 265, 266 Same corallum of *Alveopora spongiosa* from Great Palm Island, same corallum as Fig. 262, showing the structure of the wall. Fig. 266 is a side view of broken corallites (× 25).

265▼

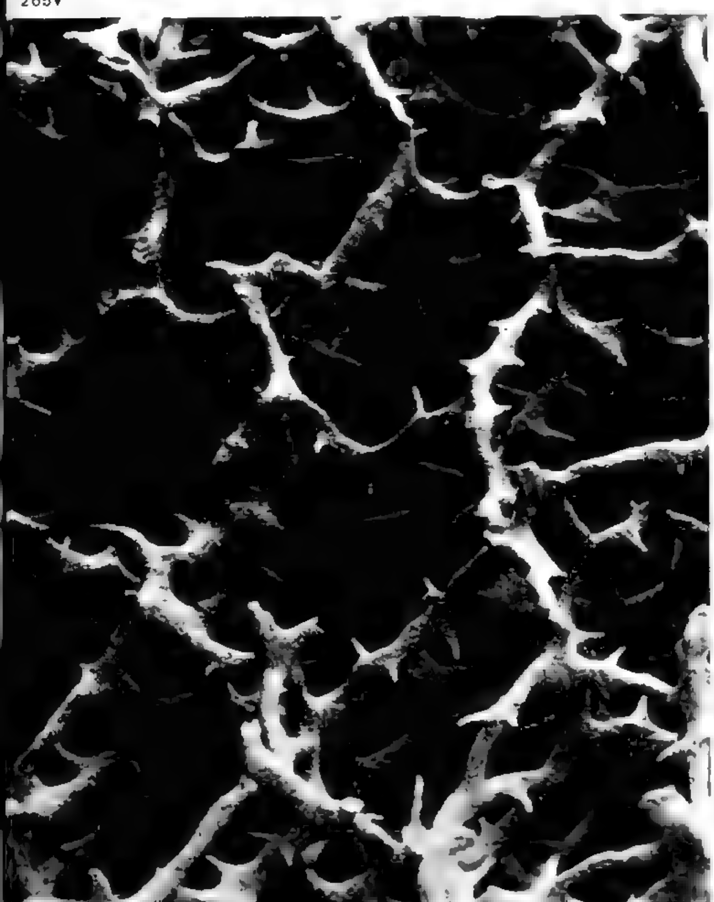
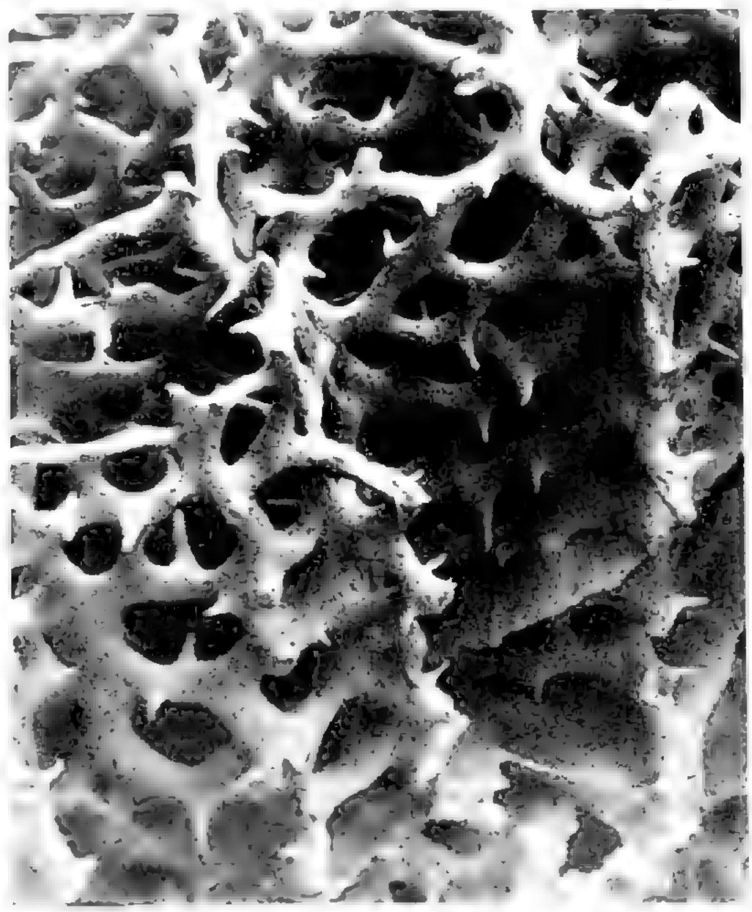


Fig 266▼



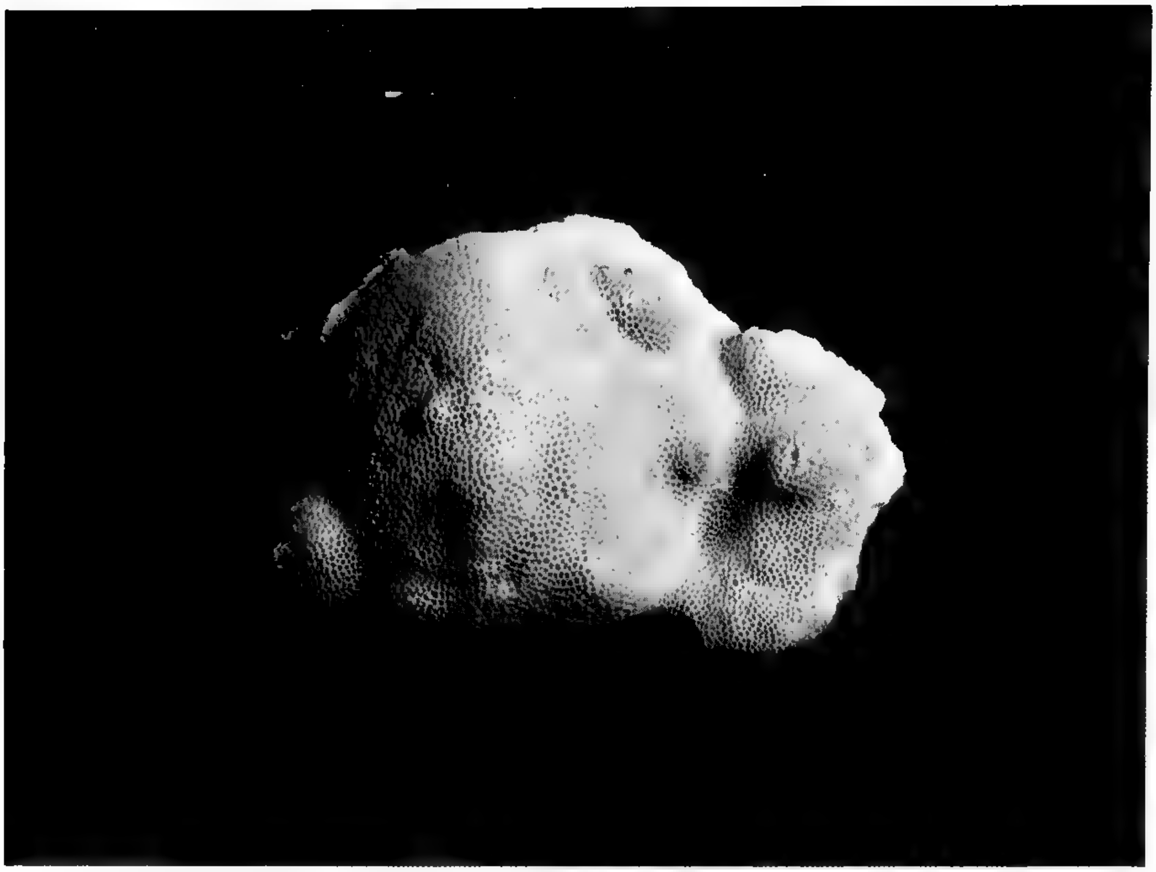


Fig. 267 *Alveopora tizardi* from Hook Island, Whitsunday Islands (× 0.42).

Alveopora tizardi Bassett-Smith, 1890

Synonymy

Alveopora tizardi Bassett-Smith, 1890.

The type specimen is an encrusting plate, 1.5cm thick. The corallites are very similar to those described below, except that the septa are slightly finer and longer.

Material studied

Tijou Reef, Palm Islands, Pandora Reef (3 specimens), **Broadhurst Reef, Swain Reefs** (5 specimens), **Fitzroy Reef.**

These localities include collecting stations 8, 59, 69, 172, 190.

Previous records from Eastern Australia

Not previously recorded.

Characters

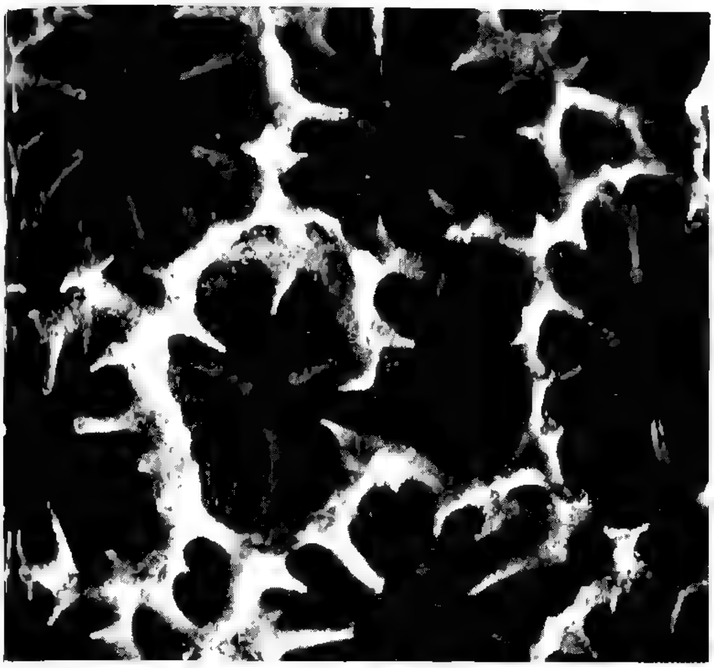
Alveopora tizardi is a rare species. All colonies observed *in situ* are submassive or are flat undulating plates. Corallites are polygonal, 1.2–1.7mm diameter. Their walls are composed of trabecular and synapticular rods, forming a network which appears to be irregular at the surface, but which forms regular vertical and horizontal components surrounding circular pores when seen in longitudinal section. First cycle septa are rows of straight spines approximately $\frac{3}{4}$R long. Second cycle septa are $<\frac{1}{4}$R, irregular, and are often incomplete. Endothecal dissepiments are well formed, at intervals of 1.5–3mm. There are no columellae.

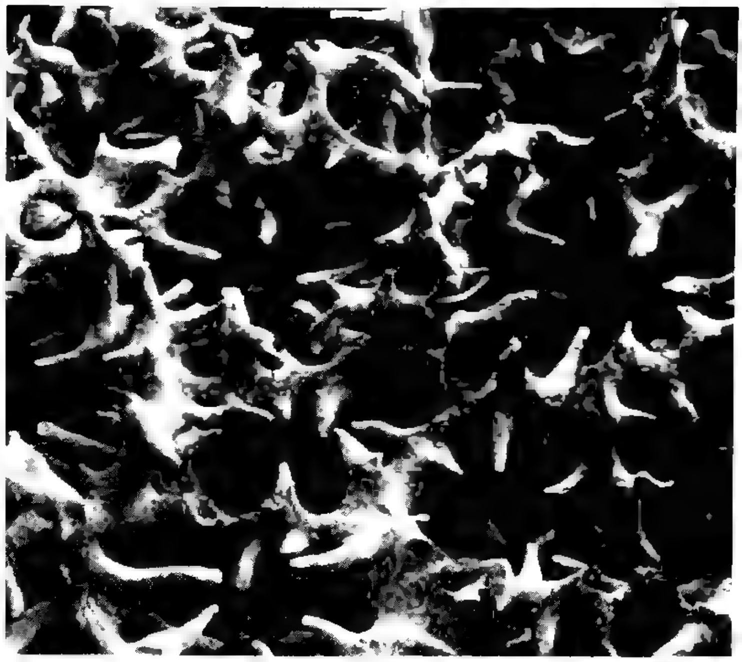
Figs. 268–273 *Alveopora tizardi* (× 25)

Figs. 268, 269 Same corallum from the Whitsunday Islands.

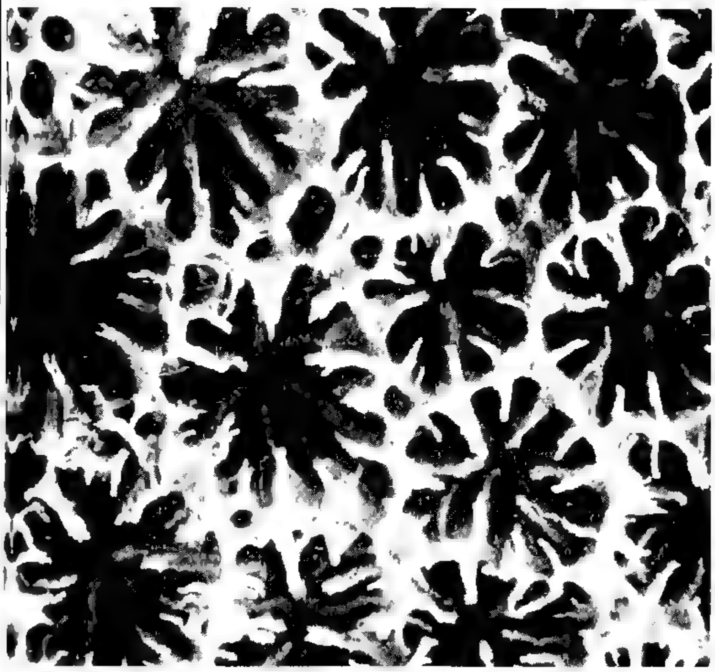
Figs. 270–272 Same corallum from Chesterfield Atoll.

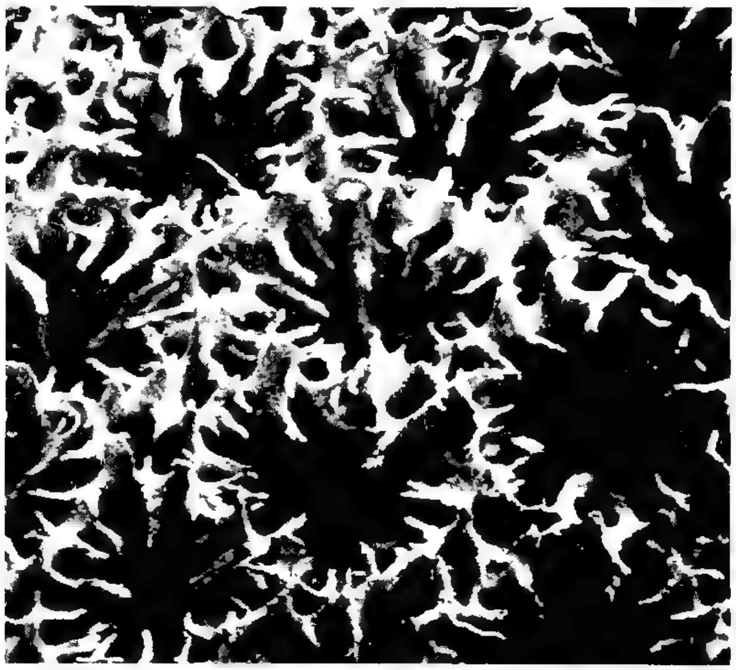
Fig. 273 From Eclipse Island, Palm Islands, collecting station 59.



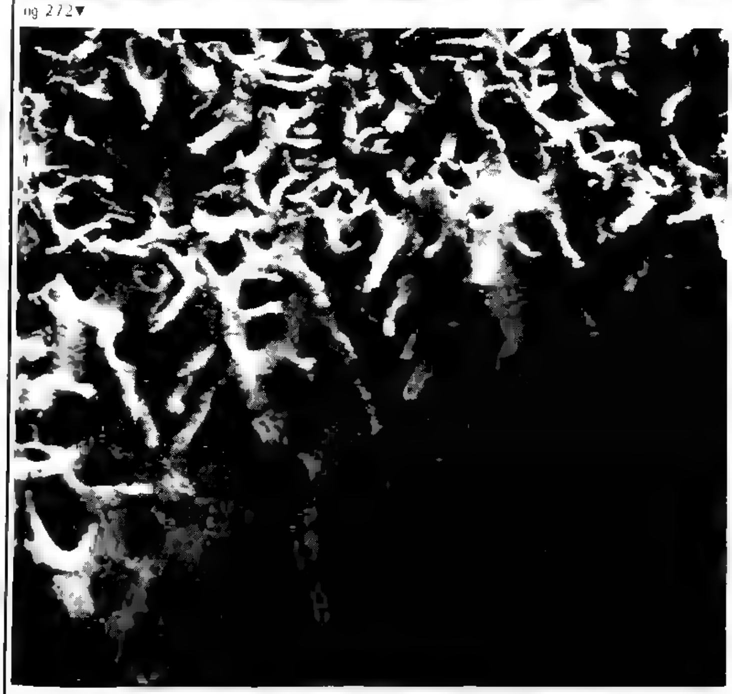


g 268▲ Fig 270▼ Fig 269▲ Fig 271▼





ng 272▼ Fig 273▼



Living colonies (Fig. 346) have short polyps of uniform length extended during the day. They have been observed only on protected fringing reefs of the Whitsunday and Palm Islands, where they are pale pinkish-brown to bright pink in colour.

Affinities

Alveopora tizardi is closest to *A. spongiosa,* from which it can be distinguished underwater by its colour and small polyps. Coralla are distinguished by having smaller corallites, with thicker walls and a more regularly developed first septal cycle. The only other described species *A. tizardi* resembles is *A. superficialis,* which has corallites of similar size, but these are circular in outline and have two cycles of distinctive elongate, twisted septal spines.

Distribution

This species has been recorded only from east Australia and Lizard Bank (South China Sea).

IV
Additions and Changes to Parts I–III

Since the field work for Part III was completed in 1978, additional field work for Parts IV and V has been undertaken along the full length of the Great Barrier Reef and also in the Coral Sea (see additional Principal Collecting Stations, pp. 3–9). In the course of this work and with further study of non-east Australian coral collections, more information has been obtained about some of the unresolved taxonomic problems of Parts I–III. Resulting additions and changes are described here in the same order.

PART I
FAMILY POCILLOPORIDAE GRAY, 1842

GENUS *POCILLOPORA* GRAY, 1842

Pocillopora meandrina Dana, 1846

Synonymy

Pocillopora meandrina Dana, 1846; Edwards & Haime (1860); Verrill (1869); Gardiner (1897); Studer (1901); Vaughan (1907a).

Pocillopora nobilis Verrill, 1864; Verrill (1869); Quelch (1886); Studer (1901).

Specimens that appear to be this species have also been called *P. meandrina nobilis* Verrill or *P. meandrina* var. *nobilis* Verrill by many authors including Hoffmeister (1929), Yabe *et al.* (1936), Wells (1954), Nemenzo (1964) and Scheer & Pillai (1974), following Vaughan (1907a). Vaughan divided *P. meandrina* into three varieties (*meandrina s.s.*, *meandrina* var. *nobilis* and *meandrina* var. *tuberosa*), noting (p. 98) that 'typical *meandrina* lies at the periphery of the species, while Verrill's *P. nobilis* is the centre'. He also noted (p. 100) that '*P. meandrina* is extremely close to *P. verrucosa*; in calicular characters they overlap. The verrucae of the latter are larger and more irregular in size, causing the corallum to have a very rough, even a ragged appearance. *P. damicornis, danae, verrucosa, meandrina,* and *elegans* form a series so indistinctly broken that one is led to suspect that they are really continuous. It is probable that *P. brevicornis* and *P. lobifera* are part of the same series'.

The present authors synonymised *P. meandrina* with *P. verrucosa* (Part I, p. 48), as Dana's type specimen was in close agreement with *P. verrucosa* from biotopes exposed to strong wave action (see ecomorph *meandrina,* Fig. 75). The two species can, however, be separated where they co-occur, especially on Coral Sea reefs where *P. meandrina* is more common than it is on the Great Barrier Reef.

Material studied

Willis Islet (3 specimens), **Mellish Reef** (8 specimens).

Previous records from Eastern Australia

Bowl Reef (as *P. verrucosa*) Veron & Pichon, 1976.

Fig. 274◄

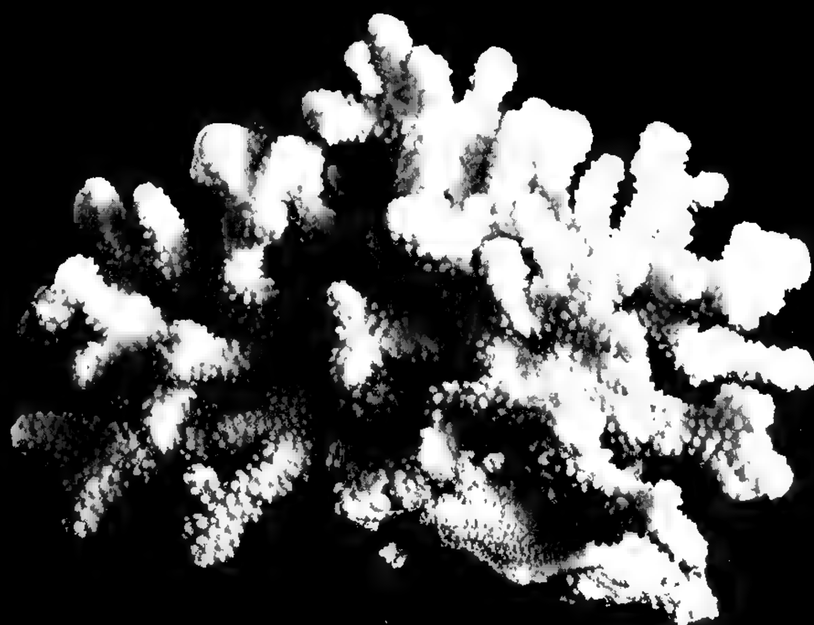


Fig. 275◄

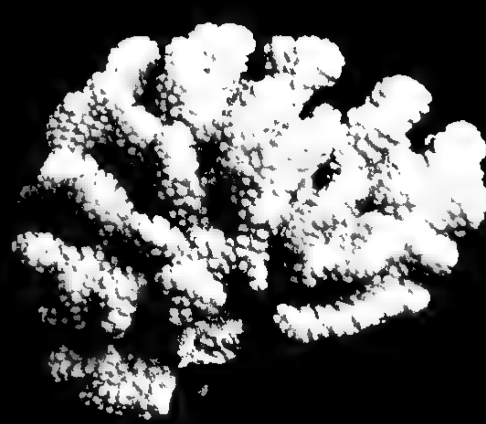


Fig. 276◄

Characters and affinities

The growth forms of *P. meandrina* are intermediate between those of *P. eydouxi* and *P. verrucosa*. Colonies are ramose, with branches tending to be flattened, evenly spaced and uniform in appearance. Branches are always verrucate, the verrucae being always smaller than those of *P. verrucosa* from the same biotope (see Fig. 274). There are no consistent differences between these species in the structure of the corallites, and even adjacent colonies of the two species usually have overlapping ranges of corallite structures. Usually, *P. meandrina* has slightly larger calices, and slightly less septal development.

Distribution

Identification difficulties make the distribution of *P. meandrina* difficult to determine, but it is probably widely distributed from the Nicobar Islands east to Tahiti and Hawaii.

Fig. 274 Attached coralla of *Pocillopora verrucosa* (left) and *Pocillopora meandrina* (right) from Enewetak Atoll, Marshall Islands. Similar intra-biotope differences in general appearance occur in the Great Barrier Reef and Coral Sea (× 0.6).

Figs. 275, 276 *Pocillopora meandrina* from South Islet, Willis Islands, collecting station 199 (× 0.85 and × 0.6 respectively).

Figs. 277, 278 *Pocillopora meandrina* from South Islet, Willis Islands, same corallum as Fig. 275, showing corallites on a branch tip and base respectively (× 5).

Fig 277▼

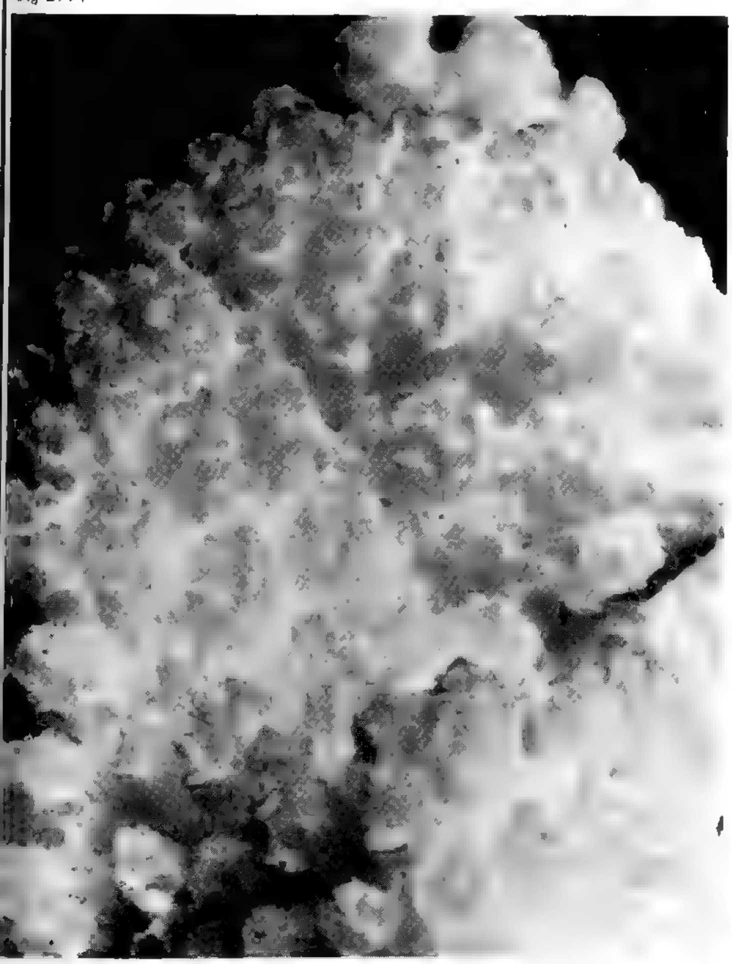


Fig 278▼

PART II
FAMILY FAVIIDAE GREGORY, 1900

GENUS BARABATTOIA YABE & SUGIYAMA, 1941

Type species *Barabattoia mirabilis* Yabe & Sugiyama, 1941.

Characters

The characters of the genus are as given by Yabe & Sugiyama: 'Corallum massive or hemispherical; corallites usually much exsert, round, intervals unequal, showing tendency of building short series in arrangement. Costae crenulated [*sic*], surfaces covered by very minute granules. Pali-like structure absent or feebly developed. Growth mono- or distomodaeal, intercalicular budding in association. Columella spongious, composed of filiform fibers of septal origin. Dissepiments well-developed, horizontal.'

The genus *Bikiniastrea* Wells, 1954 would appear to be a synonym of *Barabattoia*, as the type species of both genera can have the same characters, including a subdendroid growth form. However, *Bikiniastrea laddi* Wells, 1954 does not occur on the Great Barrier Reef, and as the authors have only examined the holotype, this question remains open.

Barabattoia amicorum (Edwards & Haime, 1850)

The '*Favia amicorum* complex' of Part II has been further studied with the aid of additional specimens from the Marshall Islands, Indonesia and the Philippines.

Most of the complex is one species, for which the name *amicorum* is applicable. The synonymy of this species is as given for the *Favia amicorum* complex, except for *Bikiniastrea laddi* Wells, which is believed to be a second species of *Barabattoia*. Illustrations of Great Barrier Reef *Barabattoia amicorum* are as in Part II, except for Figs. 41 and 44 which are of a unique specimen believed to be a third, undescribed species of *Barabattoia*. Figures 38–40 are, therefore, of *B. amicorum*.

GENUS *FAVIA* OKEN, 1815

Favia speciosa (Dana, 1846)

Synonymy

Astrea speciosa Dana, 1846.

Favia speciosa (Dana); *pars* Vaughan (1918); Yabe et al. (1936); Wells (1954); Chevalier (1971).

It is probable that this synonymy is incomplete. *Favia speciosa* is one of the most frequently used names of any *Favia*, but has been confused with *F. pallida* in most cases (see Part II, p. 36).

Material studied

Lord Howe Island (4 specimens), **Moreton Bay** (8 specimens), **Fitzroy Reef**.

Previous records from Eastern Australia

Not previously recorded except from Lord Howe Island (Veron & Done, 1979), although the name *F. speciosa* has been used for *F. pallida* by several authors, including Vaughan (1918), Crossland (1952) and Stephenson & Wells (1955).

Characters and affinities

There is very little variation in the present series. All specimens closely resemble the type specimen of the species (Part II, Fig. 45). The characters of *F. speciosa*, and those by which it is distinguished from *F. pallida*, are as outlined by Chevalier (1971) and in Part II, p. 36.

Favia maritima (Nemenzo, 1971)

Synonymy

Bikiniastrea maritima Nemenzo, 1971.

Favia sp. 1; Veron, Pichon & Wijsman-Best (1977, p. 48).

Characters

This species was described in Part II, p. 48 as *Favia* sp. 1. Further collecting has revealed that it is a valid species and that the name *maritima* is applicable to it.

Although the corallites are more exsert than usually found in *Favia*, budding is intratentacular and there are no other characters suggesting affinity with *Bikiniastrea laddi* Wells (the type species of *Bikiniastrea*) or with *Barabattoia*.

Figs. 279, 280 *Favia speciosa* from Flinders Reef near Moreton Bay (× 0.3 and × 4).

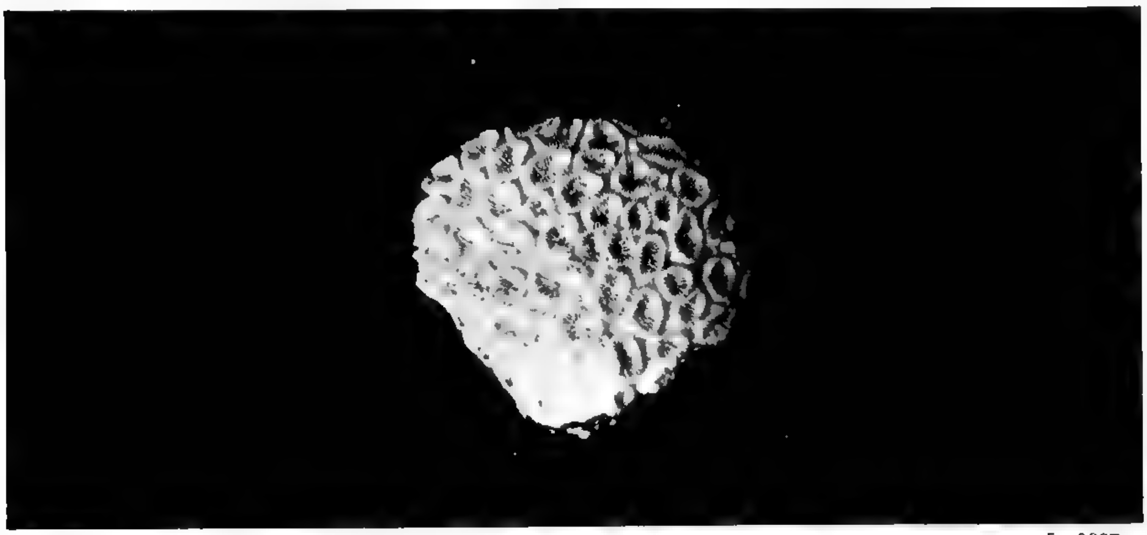
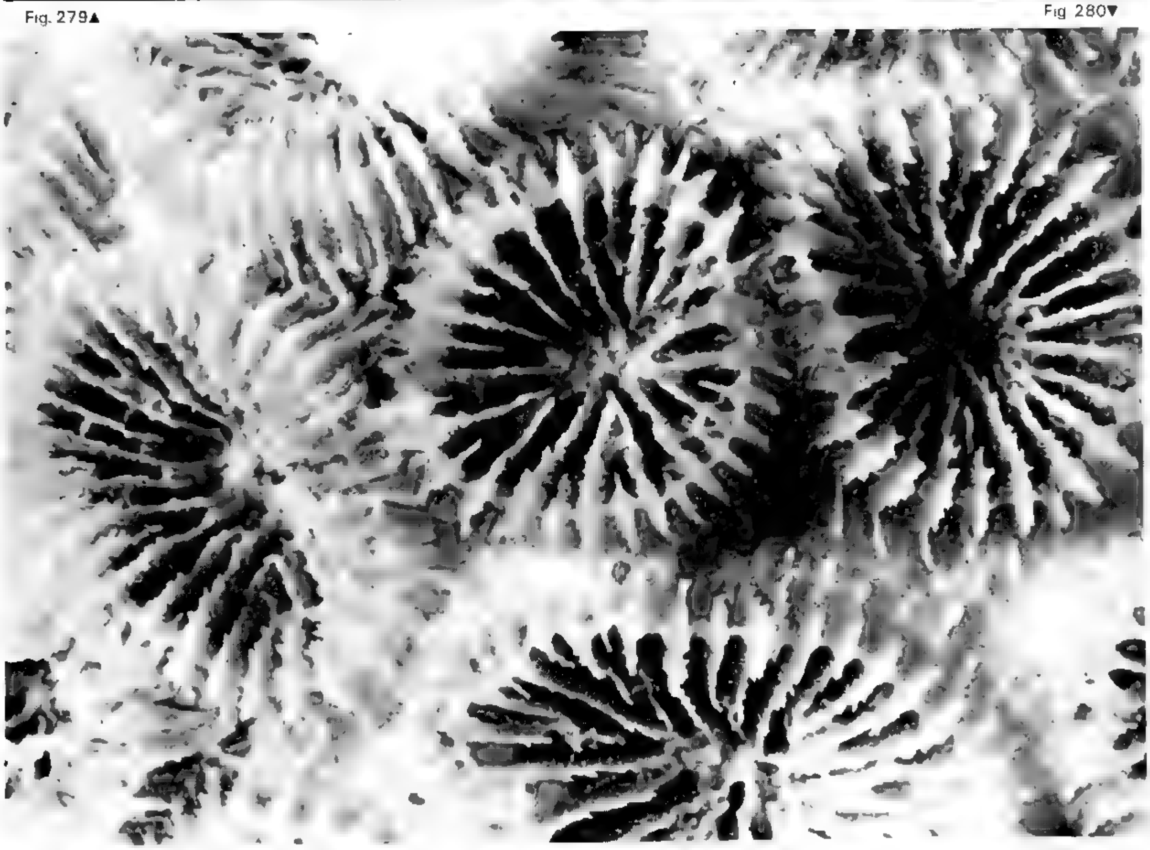


Fig. 279▲

Fig 280▼



GENUS AUSTRALOGYRA new genus

Type species *Platygyra zelli* Veron, Pichon & Wijsman-Best, 1977.

This species was described in Part II, p. 110 as *Platygyra zelli*, where it was noted that 'the ramose growth form of this species, combined with the normal lack of a columella, separates it from all other *Platygyra* and makes its generic affinities obscure. It is placed in the genus *Platygyra* because (1) where a columella is formed, it resembles those of other *Platygyra* species, (2) the septa resemble those of other *Platygyra* and (3) there are no other skeletal structures, e.g. paliform lobes, which suggest closer affinity with any other genus. Alternatively, there is a case for creating a new genus for this species, especially if another species were to be found with close affinities to it'.

With the possible exception of *Coeloria klunzingeri* Matthai (1928) from the Red Sea, which also has almost no columellae, no related species have since been found. However, further studies of non-east Australian *Platygyra* indicate that *zelli* should be separated from it. This leaves *Platygyra* as a relatively well-defined genus with *Australogyra* a close relative. As this is a monospecific genus, its characters are those of *zelli*.

Australogyra is the only genus restricted, as far as is known, to the Great Barrier Reef.

GENUS *LEPTASTREA* EDWARDS & HAIME, 1848

Leptastrea inaequalis Klunzinger, 1879.

This species was described in Part II as *Leptastrea* cf. *bottae* and one of the two type specimens was figured. It was noted (p. 155) that 'the holotype of the species differs substantially from coralla of the present series and also from most other published accounts where the name *L. bottae* is used. Retention of the name for the present species is subject to further study and is therefore provisional only'. Further study of specimens from the Gulf of Aqaba and Eilat (Pichon, in prep.) show that *L. inaequalis* and *L. bottae* are distinct species which may occur together, and that the name *L. inaequalis* is applicable to the east Australian species described in Part II. However, Wijsman-Best (1980) holds the view that these species are synonymous.

PART III

GENUS *ACANTHASTREA* EDWARDS & HAIME, 1848

Acanthastrea lordhowensis n.sp.

This species was described in Part III (Veron & Pichon, 1979, p. 264) as *Acanthastrea* sp. At that time, it was known from a single specimen only, from Lord Howe Island. No further specimens have been collected from eastern Australia, but 6 further specimens have been collected from Hong Kong (Veron, 1981), where this species is not uncommon. As its validity is now clearly established, this species is named after the island where it was first found.

Holotype

Dimensions: 21cm across

Locality: Lord Howe Island

Depth: 2m

Collector: J. E. N. Veron

Holotype: British Museum (Natural History)

GENUS *LOBOPHYLLIA* DE BLAINVILLE, 1830

Lobophyllia sp.

A fifth species of *Lobophyllia* has been recognised *in situ*, but only the two specimens illustrated have been collected. This species, which appears to occur only in Torres Strait, will be described when more is known of its skeletal variability.

The two specimens illustrated are primarily characterised by extremely coarse septa with large dentations and very large columellae. Septa are in 3 orders which are not always distinct. The largest septa are up to 3.5mm thick. Columellae are spongy, up to 13mm maximum dimension.

The only observed colour is a dark grey-green.

Figs. 281, 282 *Lobophyllia* sp. 1, both from Dewar Island, Murray Islands, collecting station 28 (× 0.6).

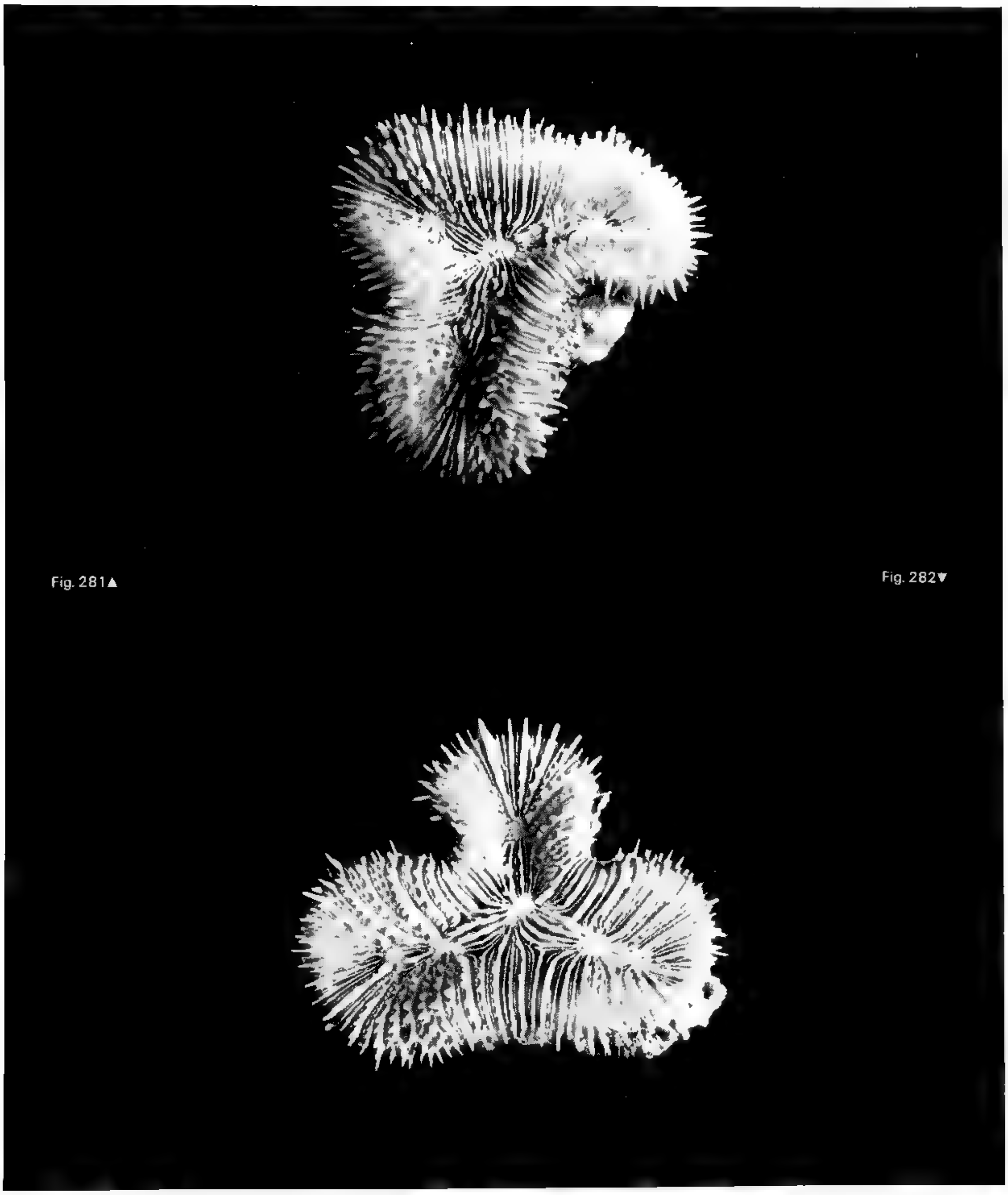


Fig. 283 *Goniopora djiboutiensis* from Eclipse Island, showing normal and pale colouration.

Fig. 284 *Goniopora djiboutiensis* from Eclipse Island, showing typical appearance of fully extended polyps.

Figs. 285–287 *Goniopora djiboutiensis* from Eclipse Island, Orpheus Island and Pandora Reef (respectively), showing colour variation (× 2.7).

Fig. 288 *Goniopora djiboutiensis* from Arden Island.

Figs. 289–292 *Goniopora lobata* from Eclipse Island (Fig. 289), Orpheus Island (Fig. 290), and Pandora Reef (Figs. 291, 292) showing variability in polyp morphology and colour (× 2.7).

Figs. 293–296 *Goniopora columna* from Eclipse Island (Fig. 293), Orpheus Island (Fig. 294) and Pandora Reef (Figs. 295, 296) showing variability in polyp morphology and colour (× 2.7).

Fig. 297 *Goniopora somaliensis* from Big Mary Reef.

Figs. 298, 299 *Goniopora somaliensis* from Orpheus Island and Pandora Reef (respectively) (× 2.7).

Fig. 300 *Goniopora tenuidens* from Bushy Island.

Fig. 301 *Goniopora tenuidens* from Broadhurst Reef.

Figs. 302, 303 *Goniopora tenuidens* from Orpheus Island (× 2.7).

Figs. 304, 305 *Goniopora minor* from Orpheus Island (× 2.7).

Figs. 306, 307 *Goniopora norfolkensis* from Orpheus and Eclipse Islands (respectively) (× 2.7).

Fig. 308 Complex of *Goniopora* species from Eclipse Island showing *G. pandoraensis* (left and below), *G. eclipsensis* (centre) and *G. djiboutiensis* with normal and pale colouration (right and top right).

Fig. 309 *Goniopora pandoraensis* (left and right) and *G. djiboutiensis* (centre) from Eclipse Island.

Fig. 310 *Goniopora pandoraensis* (left) and *G. tenuidens* (right) from Broadhurst Reef.

Fig. 311 *Goniopora pandoraensis* from Eclipse Island.

Fig. 312 *Goniopora pandoraensis* from Eclipse Island showing intermixed normal and pale colouration.

Fig. 313 *Goniopora pandoraensis* (right) and *G. columna* (left) from Orpheus Island (× 2.7).

Fig. 314 *Goniopora pandoraensis* from Pandora Reef (× 2.7).

Fig. 315 *Goniopora eclipsensis* (right) and *G. djiboutiensis* (left) from Eclipse Island.

Fig. 316 *Goniopora eclipsensis* (left) and *G. pandoraensis* (right) from Eclipse Island.

Fig. 317 *Goniopora eclipsensis* (right) and *G. columna* (left) from Pandora Reef (× 2.7).

Fig. 318 *Goniopora eclipsensis* from Pandora Reef (× 2.7).

Figs. 319–322 *Goniopora palmensis* from Pandora Reef (Figs. 319–321) and Orpheus Island (Fig. 322) (× 2.7).

Figs. 323–325 *Goniopora fruticosa* from Pandora Reef (Figs. 323, 324) and Orpheus Island (Fig. 325) (× 2.7).

Figs. 326, 327 *Goniopora stutchburyi* from Orpheus Island and Palmaise Reef (respectively) (× 2.7).

Fig. 328 *Alveopora catalai* from Eclipse Island (× 2.7).

Fig. 329 *Alveopora allingi* from Pandora Reef (× 2.7).

Figs. 330, 331 *Alveopora marionensis* from Marion Reef.

Figs. 332, 333 *Alveopora marionensis* from Orpheus and Eclipse Islands (respectively) (× 2.7).

Figs. 334, 335 *Alveopora fenestrata* from Marion and Broadhurst Reefs (respectively).

Fig. 336 *Alveopora fenestrata* from Orpheus Island (× 2.7).

Fig. 337 *Alveopora verrilliana* from Marion Reef.

Fig. 338 *Alveopora verrilliana* (left) and *A. fenestrata* (right, with polyps retracted) from Marion Reef.

Fig. 339 *Alveopora verrilliana* (left) and *A. fenestrata* (right) from Marion Reef.

Figs. 340, 341 *Alveopora verrilliana* from Orpheus and Eclipse Islands (respectively).

Figs. 342–344 *Alveopora spongiosa* from Orpheus Island, Eclipse Island and Broadhurst Reefs (respectively) showing three colour morphs.

Fig. 345 *Alveopora spongiosa* from Willis Island.

Fig. 346 *Alveopora tizardi* from Orpheus Island.

Addendum

Professor J. W. Wells has brought to my attention the fact that *Porites* Cuvier, 1798 (Tableau Elementaire de l'Histoire naturella des Animaux p. 678) precedes Link, 1807 with the following syntypes:

Madrepora fascicularis (Galaxea)

Madrepora ramea (Dendrophyllia)

Madrepora carduus (Mussa)

We can find no citation of *Porites* Cuvier, 1798 in any subsequent literature and therefore consider that *Porites* Cuvier, 1798 is a *nomen oblitum*—JENV.

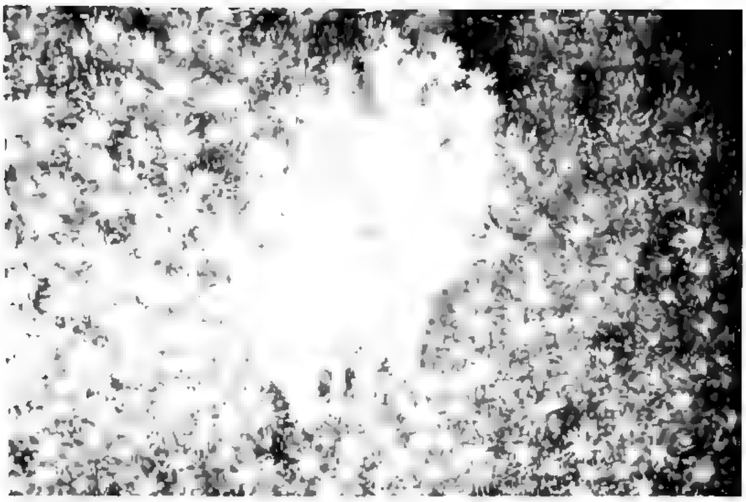


Fig. 283▲


Fig. 284▲


Fig. 285▲

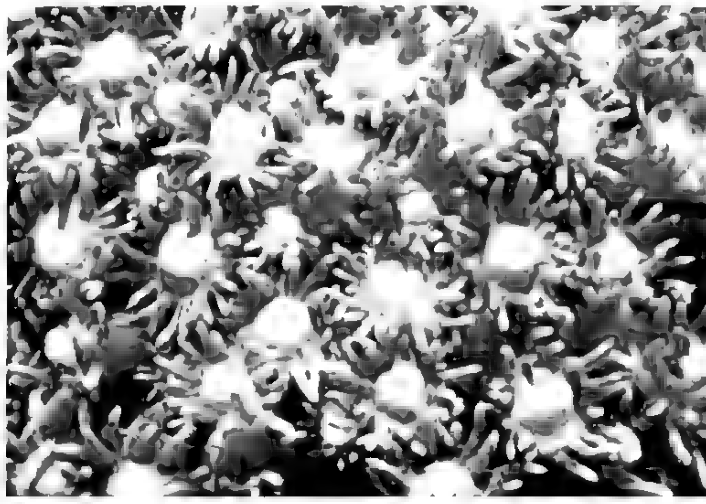


Fig. 286▲

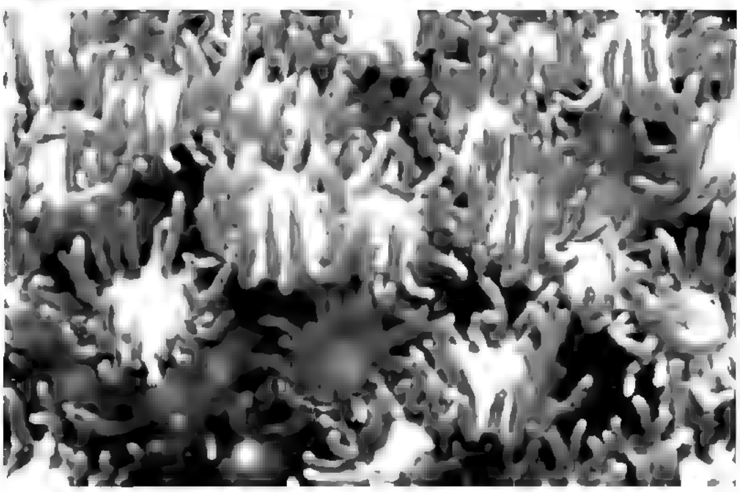


Fig. 287▲


Fig. 288▲

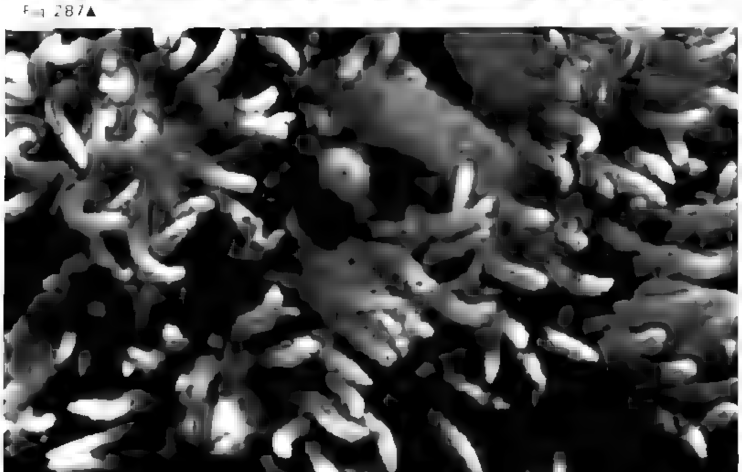


Fig. 289▲

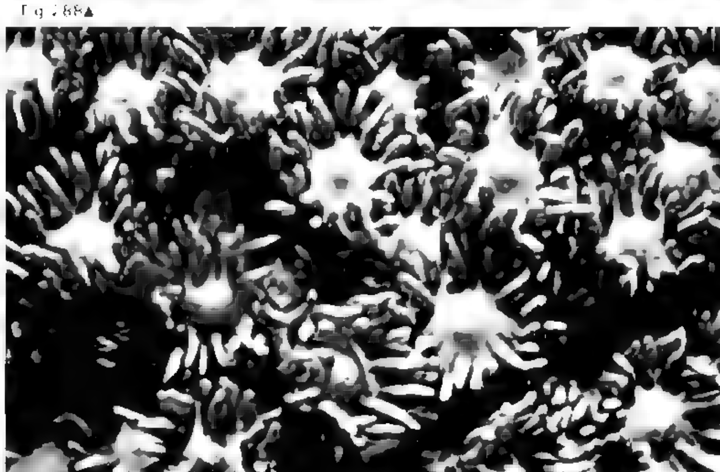


Fig. 290▲

Fig 291▲

Fig 292▲

Fig 293▲

Fig 294▲

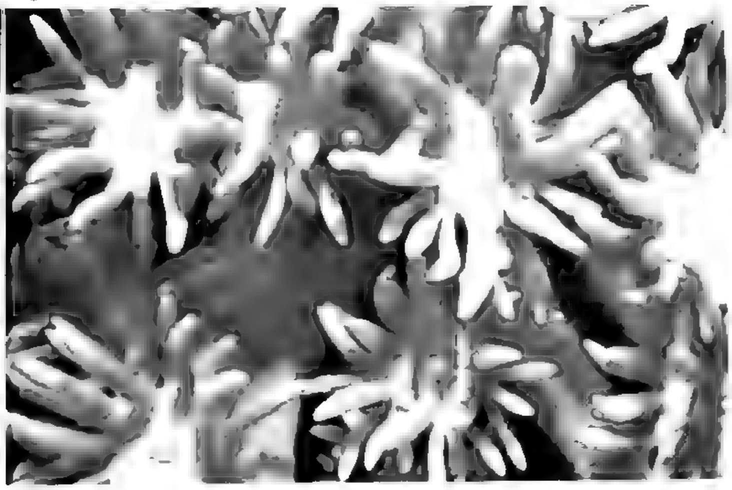


Fig 295▲

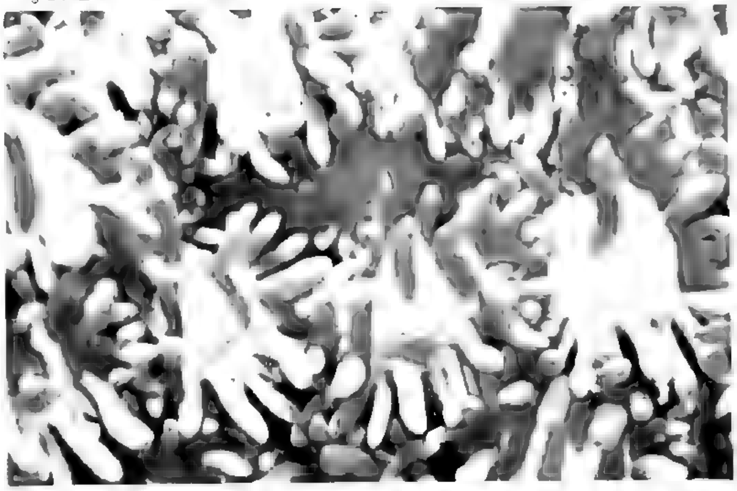


Fig 296▲

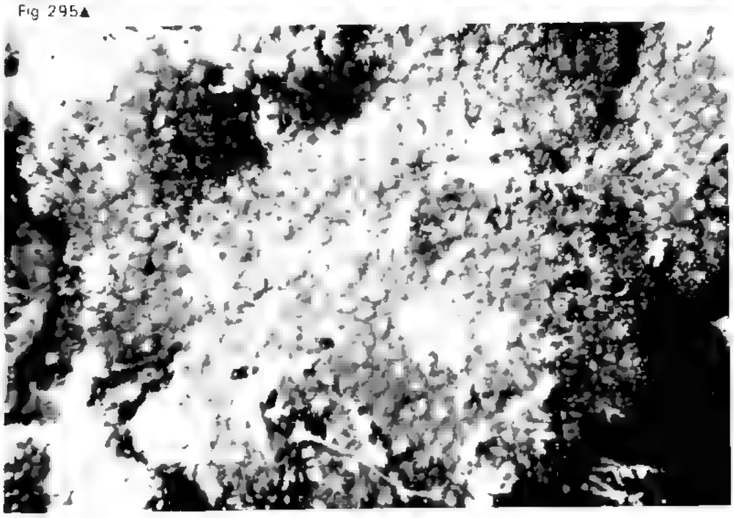


Fig 297▲

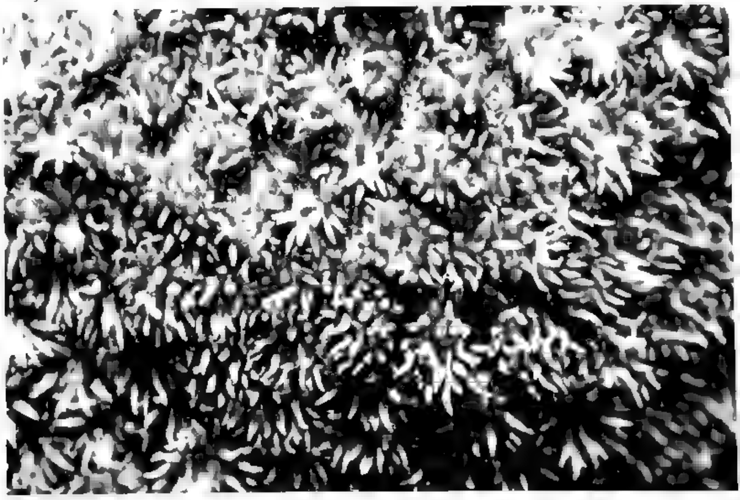
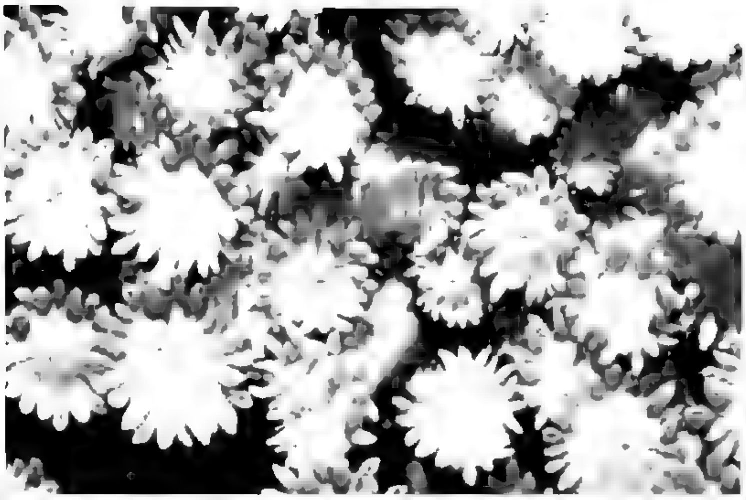


Fig 298▲



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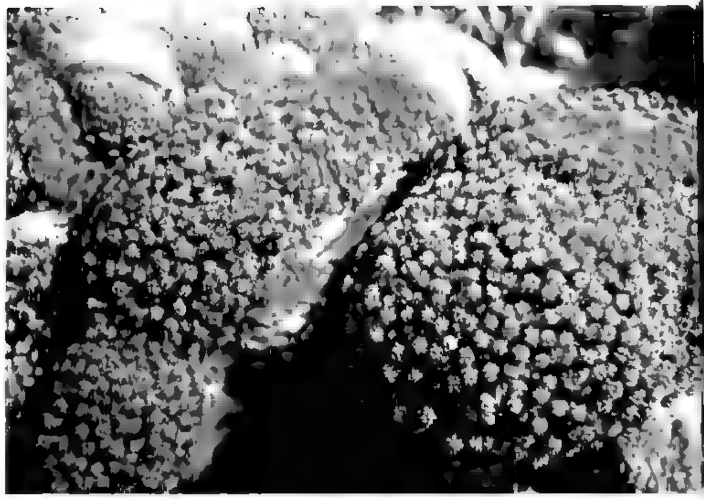

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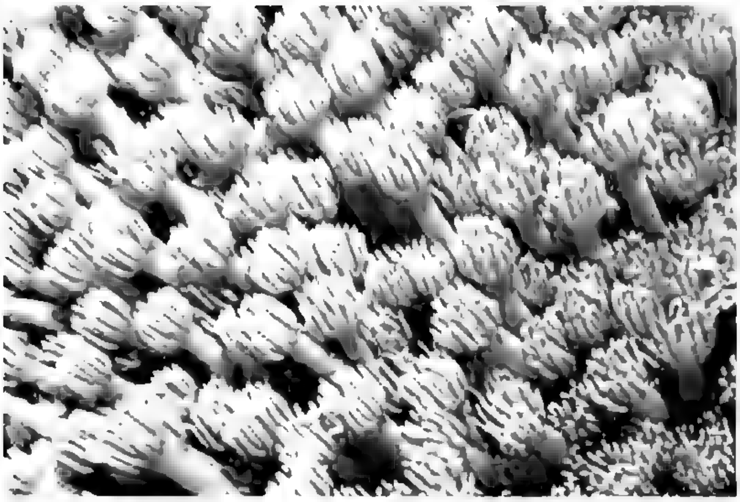
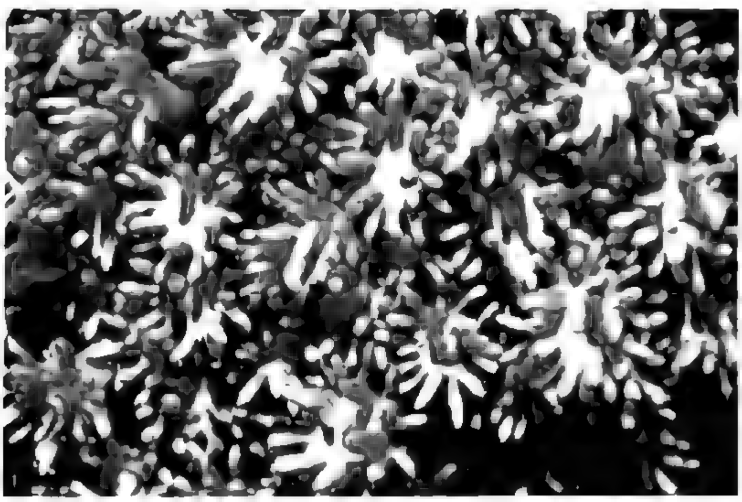


Fig. 301▲

Fig. 302▲

Fig. 303▲

Fig. 304▲



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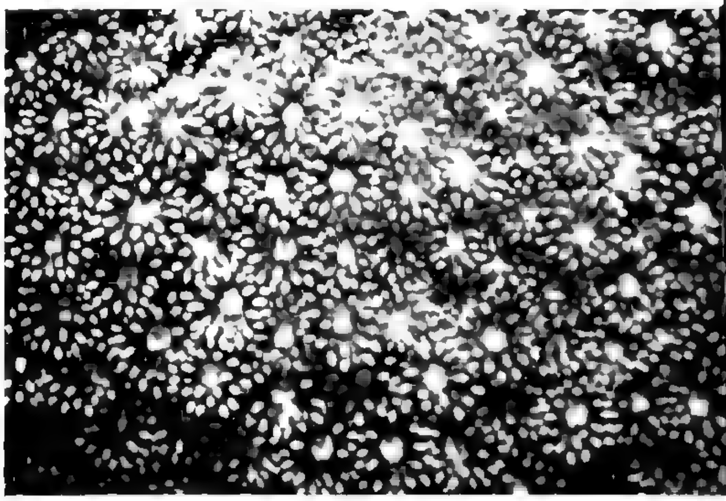


Fig. 306▲

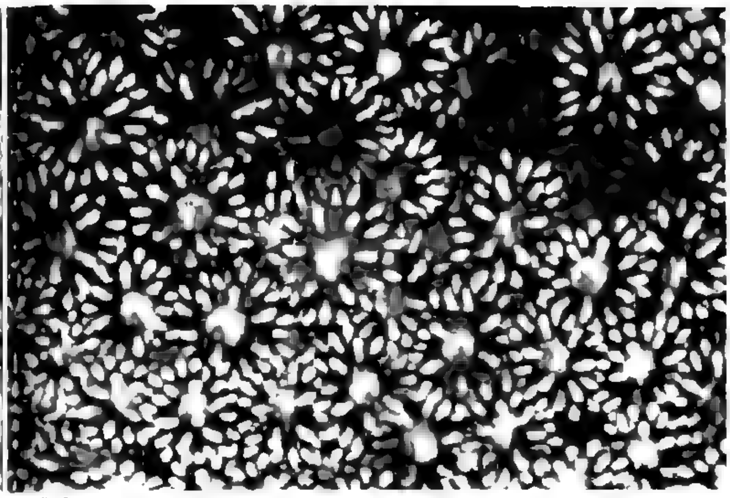
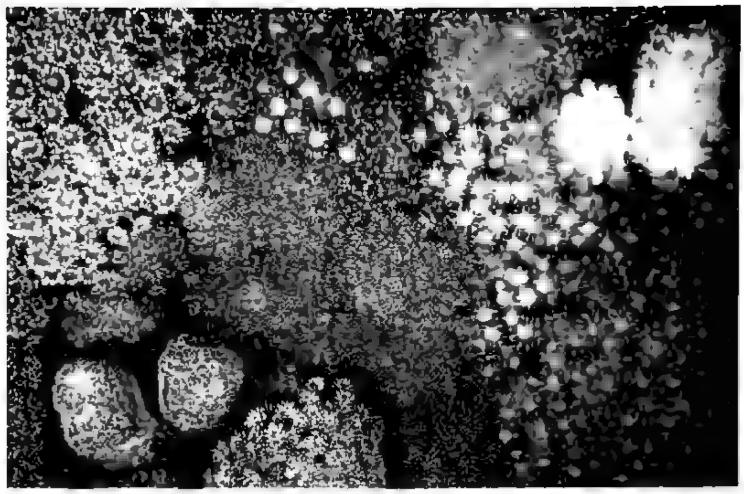


Fig 307▲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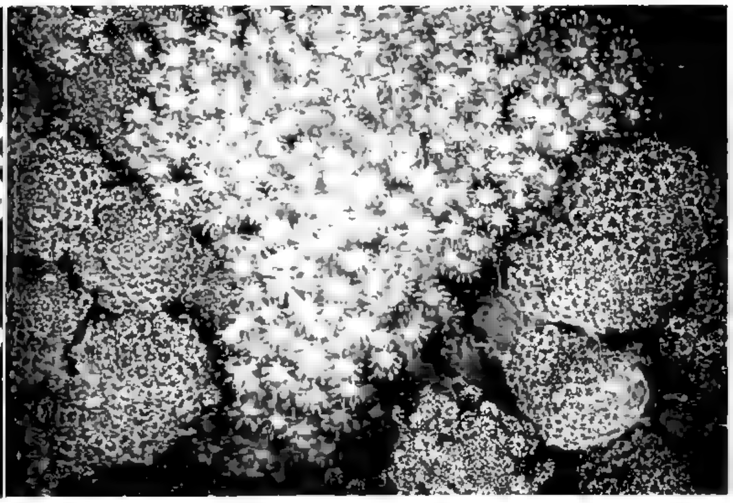
Fig 309▲


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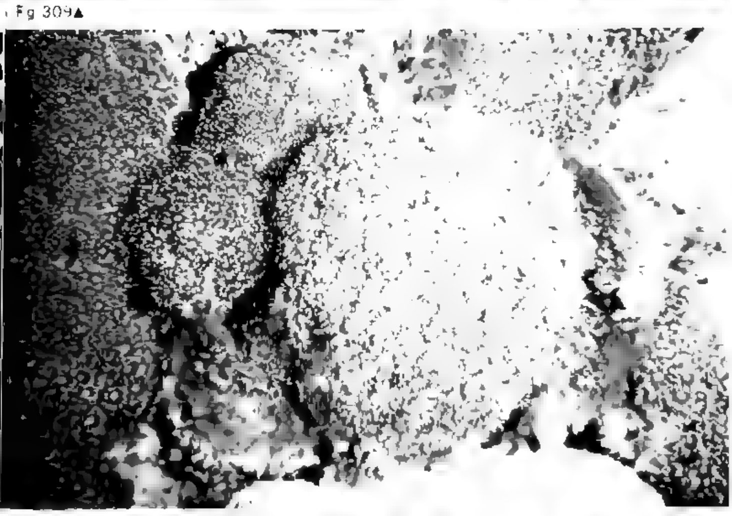


Fig 311▲

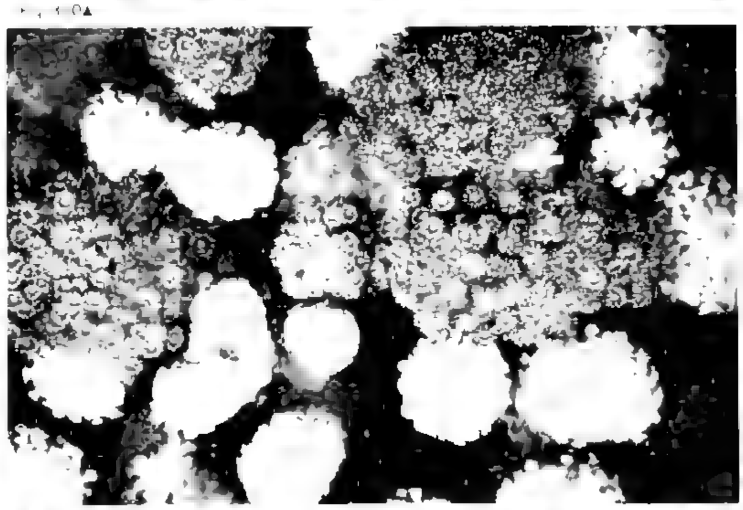


Fig 312▲

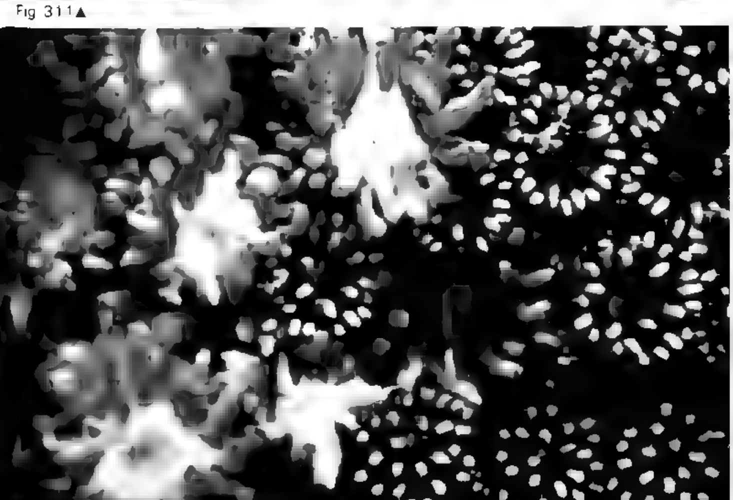


Fig 313▲


Fig 314▲

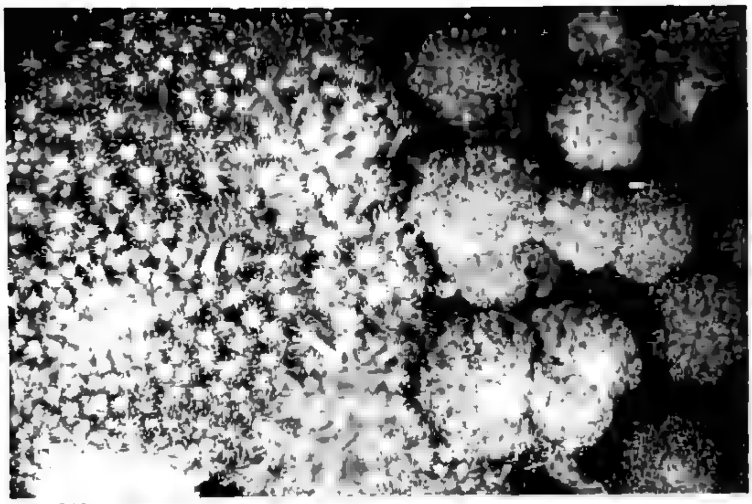


Fig 315▲

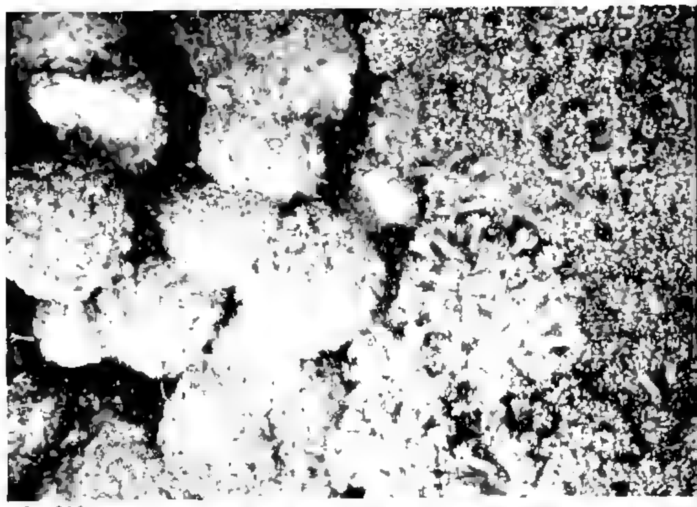


Fig 316▲

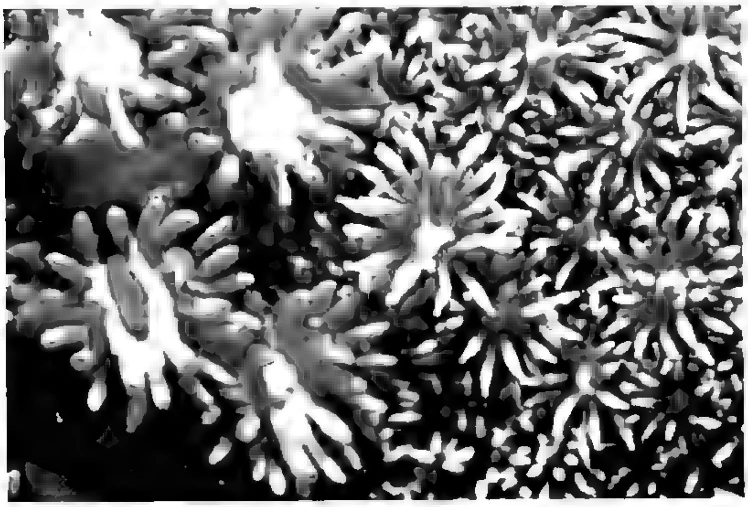


Fig 317▲

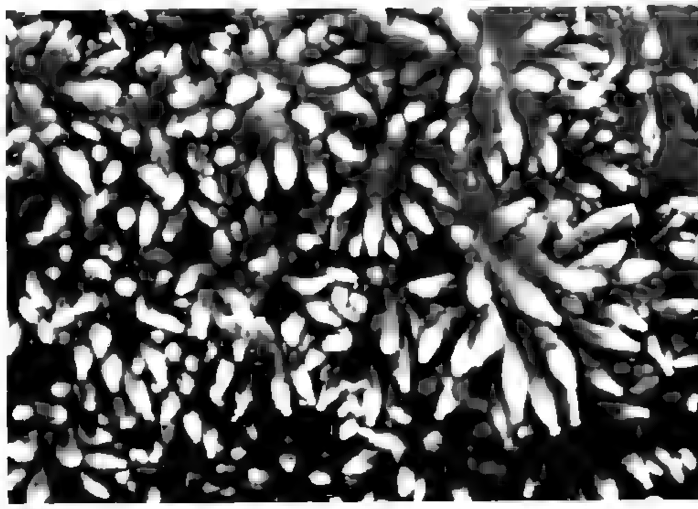


Fig 318▲

Fig 319▲

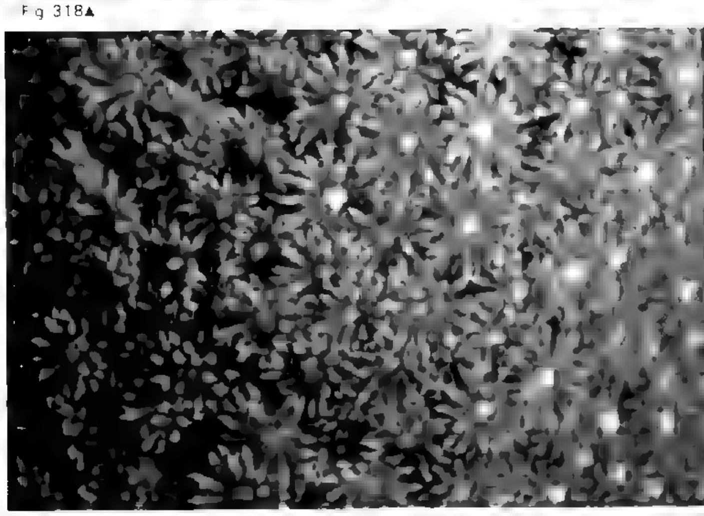


Fig 320▲

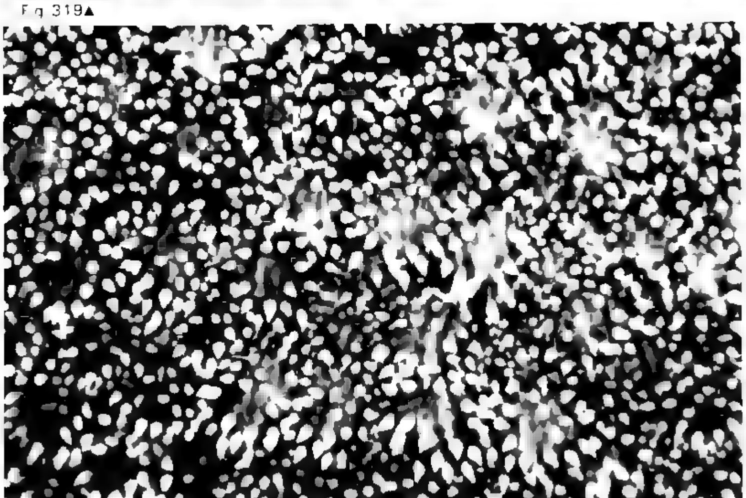


Fig 321▲

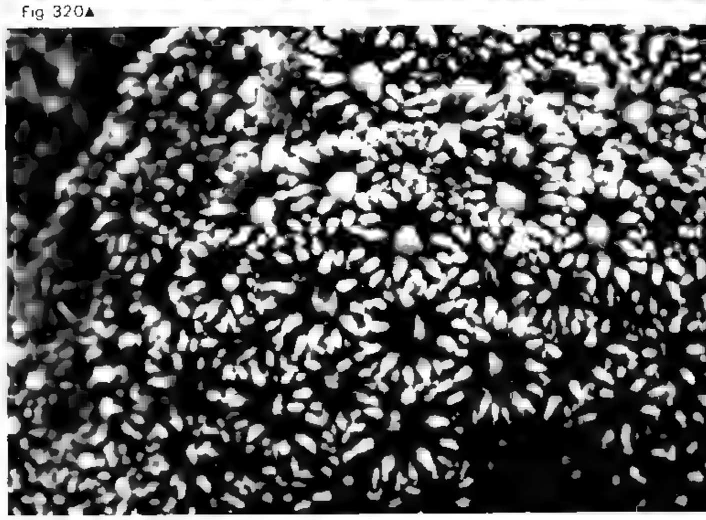
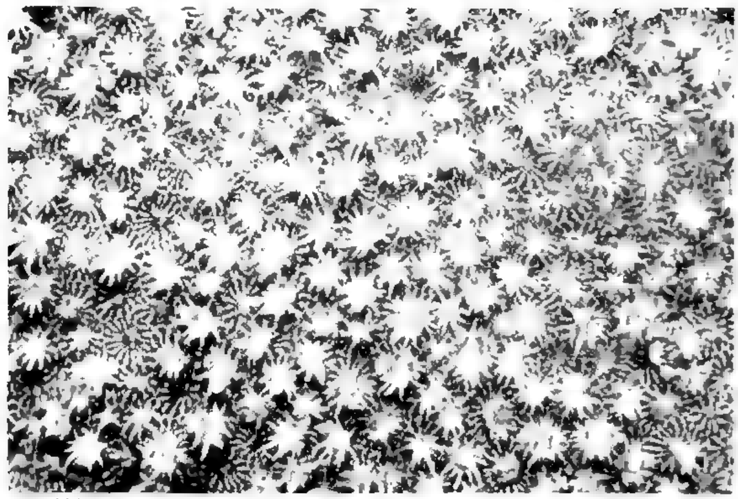


Fig 322▲


Fig 323▲


Fig 324▲


Fig 325▲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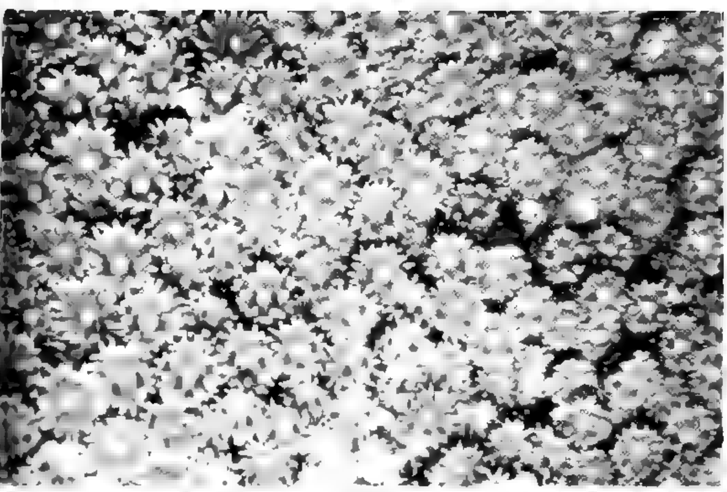


Fig 327▲


Fig 328▲

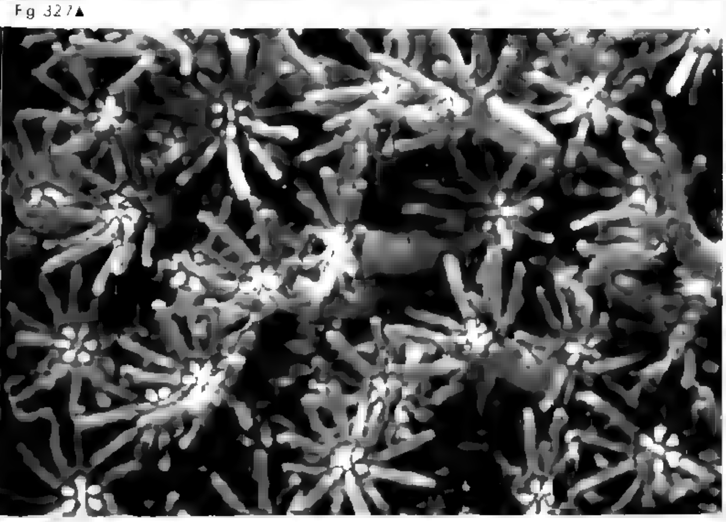
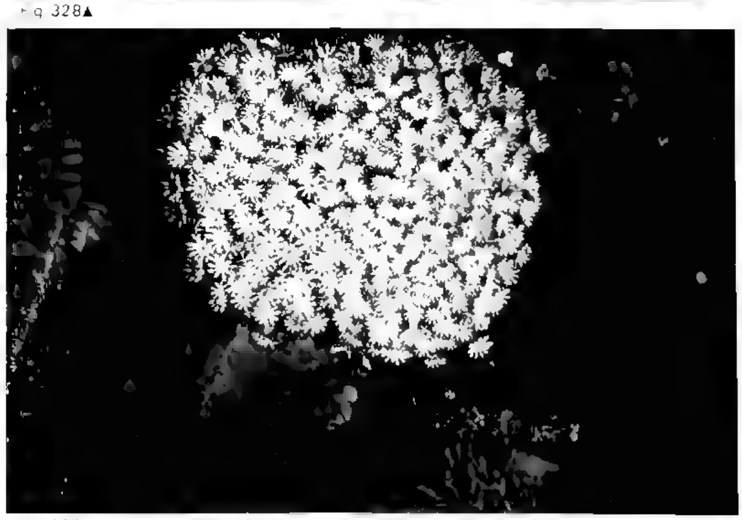


Fig 329▲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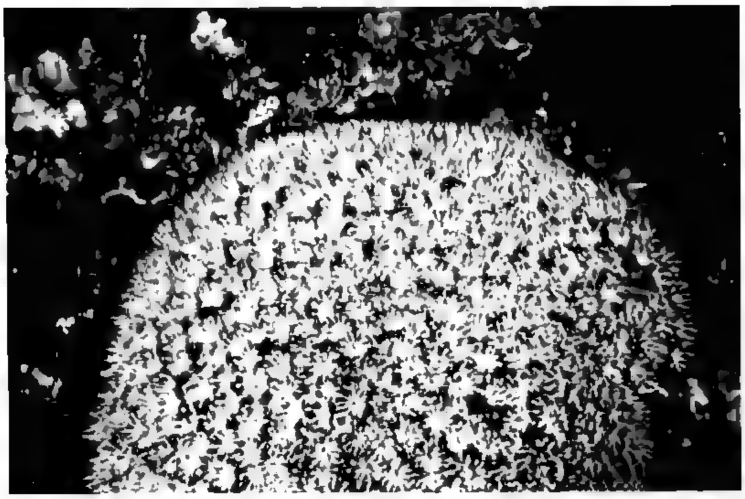
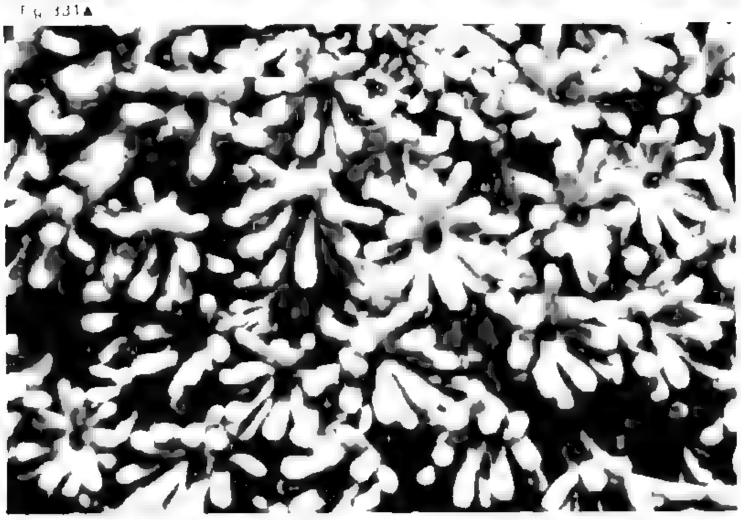


Fig. 331▲


Fig. 332▲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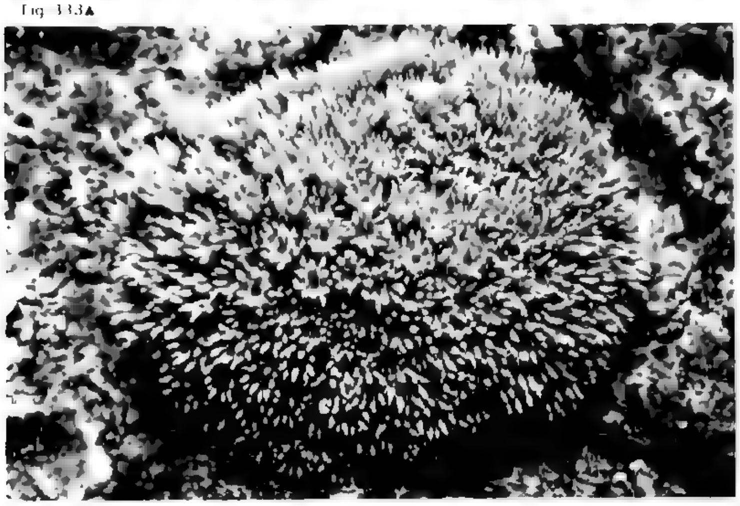
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Fig. 336▲


Fig. 337▲


Fig. 338▲


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Fig 340▲


Fig 341▲

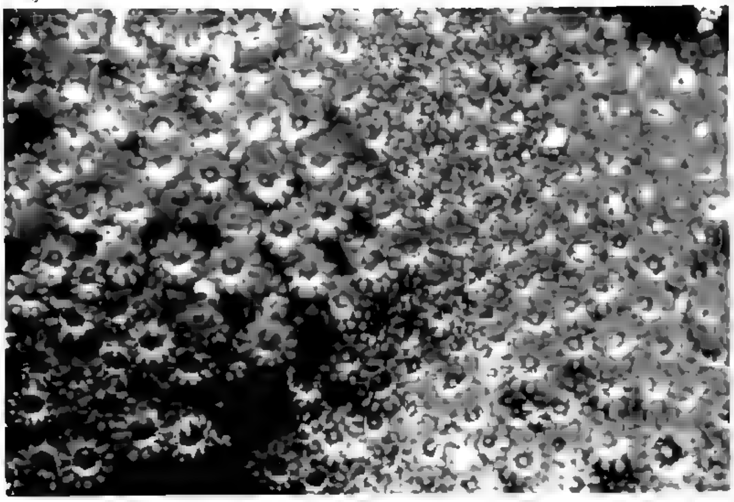
Fig 342▲

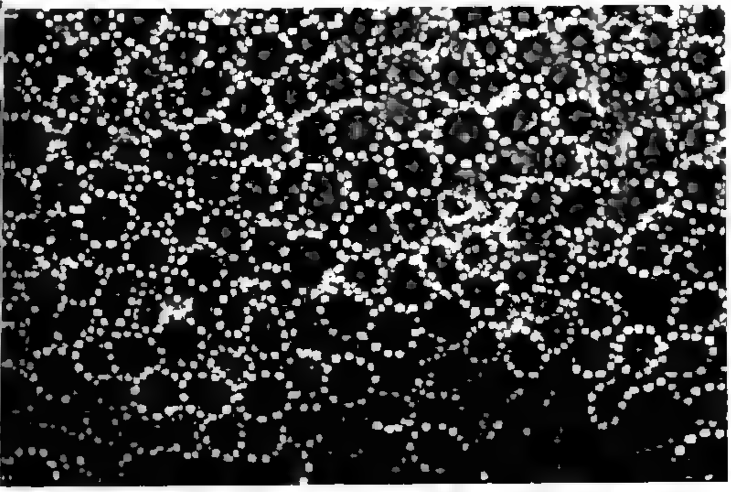
Fig 343▲

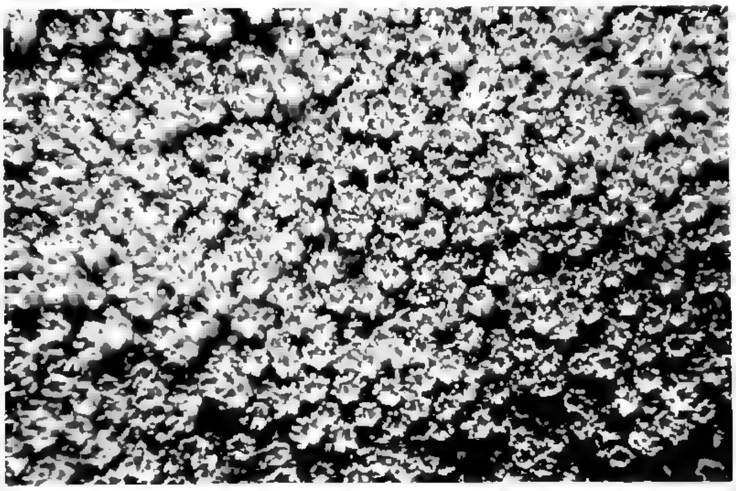
Fig 344▲

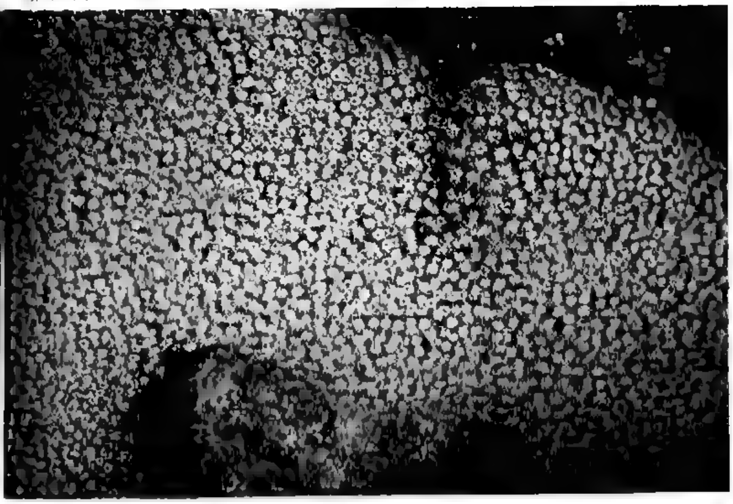
Fig 345▲


Fig 346▲

V
Acknowledgments

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