

ATOLL RESEARCH BULLETIN

NO. 418

SHALLOW-WATER SCLERACTINIAN CORALS FROM KERMADEC ISLANDS

BY

VLADIMIR N. KOSMYNIN

**ISSUED BY
NATIONAL MUSEUM OF NATURAL HISTORY
SMITHSONIAN INSTITUTION
WASHINGTON, D.C., U.S.A.
AUGUST 1994**

SHALLOW-WATER SCLERACTINIAN CORALS FROM KERMADEC ISLANDS

BY

VLADIMIR N. KOSMYNIN

INTRODUCTION

Shallow-water scleractinian corals were collected in the Kermadecs (South-West Pacific) in April-May of 1990 during the 18th cruise of the USSR Academy of Sciences' R/V "Akademik Alexandr Nesmeyanov", which sailed from Vladivostok to the Western Pacific. The objective of this expedition was to study the influence of volcanic gas and hydrothermal activity on sublittoral communities. Dredging operations were performed on the slopes of Kermadecs: underwater observations were made near Curtis Island and corals were collected at several points near Raoul Island and nearby islets using SCUBA (fig. 1).

Despite numerous previous visits to the Kermadec Islands by research vessels, very little information has been reported on the scleractinian fauna. The presence of corals in bottom communities in this area was mentioned by Nelson and Adams (1984) and coral communities were noted when Shiel et al. (1986) described the sublittoral zonation, but neither publication provided a list of species. The last publication dealt directly with corals from the Kermadec Islands was that of Vaughan (1917). This paper was based on the material collected early this century by R.W.B. Oliver, former director of the New Zealand National Museum of Natural History, who described the Kermadecs in several publications. Material from this collection are deposited in the Museum of New Zealand (MNZ) in Wellington and at National Museum of Natural History (NMNH) in Washington. Some additional Kermadec corals collected and kept in the New Zealand National Museum were identified by D.F. Squires. Soviet expeditions also worked there, but their results are not yet published.

A SHORT DESCRIPTION OF SITES OF CORAL COLLECTING

Near Raoul Island two sublittoral areas were studied: one north of Blue Lake and another in the southern part of Denham Bay. Meyers and Napier Islets were also studied and corals were collected (Figure 1).

North of Blue Lake at the depth of 10-15 m the foreshore is characterized by a gently sloping floor. The floor shows an alternation of areas covered by ripple sands with separate boulders and patches of boulder pavement, among which some boulders that are 1-2 m high. Unlike the barren ripple sands, bottom communities on large boulders are rich and include fleshy algae as well as calcareous geniculated *Corallina* on upper surfaces and encrusting *Lithothamnium* under overhangings, and many sea urchins that include at least two species. Corals are abundant there and are mostly encrusting forms of *Hydnophora*, *Goniastrea* and *Montastrea* 50-60 mm in size on top surfaces of boulders, and *Dendrophyllia* under overhangings (Tabl. 1). Life is less diverse on the

Moscow State University, Geographical Faculty, 119899 Moscow, Russia

surface of boulder pavement in comparison to that found on large boulders probably because of sand abrasion.

The foreshore in the southern part of Denham Bay is considerably different from that described above. It is steeper and at a distance of 50-70 m from the shoreline the depth is 15-20 m. The slope is composed of large basalt blocks, each several cubic meters. They are arranged on the slope either in dense groups or scattered individuals. Coarse-grained sand and gravel are accumulated between boulders.

These boulders support rich flora and fauna on their tops, whereas at the base, where light is weaker and sand-gravel erosion is stronger, the boulders are poorly inhabited. Along with macrophytes, these rich communities contain a considerable number of corals, primarily colonies of *Turbinaria bifrons*, which form large flat coralla up to 1.5 m in diameter. There are also abundant encrusting colonies of *Goniastrea australiensis* with a corallum size up to 20 cm, and smaller coralla of *Montipora*, *Leptoseris* and *Cyphastrea*. These corals cover no more than 10-20% of the surface even at the top of boulders. The maximum number of corals appears to occur at depths of 13-15 m and decrease rapidly up the slope, probably because of the increasing abrasive effect of the resuspended sediments.

The richest coral communities were discovered on the western side of the Meyers islets opposite a channel separating them. Here at depth of 22-24m there is a terrace that looks like a wave cut platform. It may be in fact a submerged coast-line. On the surface of the terrace there are thin lenses of coarse-grained sand and gravel, as well as individual colonies of *Turbinaria radicalis* with coralla up to 0.5m in diameter. Rocks of different height occur on the surface of the terrace, some of them reach a depth of 10-12 m, while others extend up to almost the surface. The rocks contain very rich communities in which corals play an important role sometimes covering up to 25% of the surface. Life forms of corals are mainly encrusting such as *Goniastrea*, *Leptoseris* and *Montipora*, or massive or columnar such as *Hydnophora exesa*. Branching forms are represented by sparse small colonies of *Pocillopora damicornis*, which inhabit the tops of boulders. *Turbinaria radicalis* and *Turbinaria bifrons* form the largest colonies and are more noticeable than other corals. *Hydnophora exesa* form the second largest colonies, with coralla up to 40 cm in diameter.

On vertical cliffs there are frequent *Dendrophyllia* sp. together with gorgonian corals. The latter grow abundantly at a depth of more than 25 m, and up the slope on more gently sloping areas there are abundant alcyonarian corals. In the communities at the depths of less than 25 m other sedentary animals are numerous along with the corals, including sponges, tunicates, hydroids, sea lilies, sea urchins and the notorious sea-star *Acanthaster planci*. Similar communities were noted also near Napier island.

The Kermadec Islands are also characterised by abundant deep water scleractinian corals at the depth of 375-1000 m. In particular, a large quantity of fragments of *Goniocorella dumosa* (Alcock,1902) were dredged from the depth of 1000 m by trawl at 30°28'0"S 178°37'2"W, as well as corals such as *Madrepora vitiae* Squires & Keyes,1967 and *Flabellum gracile* (Studer,1877).

DISCUSSION

The deep water scleractinian corals mentioned above are related to the fauna from New Zealand, whereas the shallow water Kermadec corals are linked with the Tonga and Fiji Islands to the north and the Norfolk Islands on the west. There is a certain affinity of the latter with the Great Barrier Reef of Australia through the Norfolk and Lord Howe Islands but the diversity is considerably lower. Further studies will undoubtedly increase the list of corals for the Kermadec Islands. Some fossil corals were also noted by Vaughan (1917): *Leptoria phrygia* (Ellis & Solander,1786; USNM 93896), *Alveopora* sp. (USNM 93898), *Acropora* sp.(sample I failed to find in USNM) and *Cynarina*

lacrymalis (Milne Edwards & Haime, 1848) (USNM 93899), which may quite possibly be alive on Kermadecs.

The low diversity of reef-building coral species off the Kermadecs is probably due to several reasons. I tend to agree with Schiel et al. (1986) that it is not a result of competition for space with other organisms, in particular algae. Among the main factors are the relative isolation of the islands, their young age and recent activity of volcanic processes as well as wave erosion (abrasion). The development of coral reefs near Raoul Island is limited not only by low water temperatures but more by relief and coastal geomorphic processes. Quick wave erosion of volcanic shores and mobility of floor substrates limit the possibilities for establishment of reef building corals. The coral fauna adjacent to Raoul Island small islets is richer than the coral fauna of Raoul Island itself. The precipitous rocky foreshores of small islets almost lack sediments. For corals it is more suitable to settle and grow there than on the relatively gentle slopes of Raoul Island where the mobile coarse bottom sediments limit coral growth.

The water temperatures near the Raoul Island are not optimal for reef corals but does not fall to the lethal winter limit of 15°C for the majority of hermatypic corals. The summer temperatures, which are about 24°C, is close to normal for coral reproduction.

The establishment/recruitment of new species of corals on Kermadec Islands is quite possible. It can happen not only by the distribution of planula by but also by rafting, for example, by fragments of pumice-stone carried by currents from northern volcanic islands. The discovery of fossil colony fragments of such species as *Acropora* and *Alveopora* (Vaughan, 1917) indicate that some species could have established in this area but the conditions are not favorable for survival of new populations. In particular, their survival is considerably limited by abrasion and mobility of sediment material, and by volcanic activity.

ACKNOWLEDGMENTS

The author is grateful for the support provided to me: by Dr. Vitaly Tarasov, the head of the expedition on the "Academik Alexandr Nesmeyanov"; Dr. Alan Baker, the director of MNZ, Wellington; other colleagues of the MNZ for the opportunity to work with their collection; Dr. Paul Gillespie (Cawthron Institute, Nelson, NZ) for computer search of data on the corals from the Kermadec Islands; Dr. Ian Macintyre and Mr. Chad Walter (NMNH) for reviewing of manuscript. I would like to thank especially Dr. Stephen Cairns for reviewing of the article and for advice on work with the NMNH coral collection.

LITERATURE

- Nelson W.A.; Adams N.M. 1984: Marine algae of the Kermadec Islands. National Museum of New Zealand occasional series 10: 1-29.
- Schiel D.R., Kingsford M.J., Choat J.H. 1986: Depth distribution and abundance of benthic organisms and fishes at the subtropical Kermadec Islands. New Zealand Journal of Marine and Freshwater research. Vol. 20: 521-535.
- Vaughan T.W. 1917: Some corals from Kermadec Islands. Trans. N.Z. Inst., vol.49: 275- 279.

Table 1. The list of shallow water scleractinian corals from Kermadec Islands.

Species name	North coast Raoul	Denham Bay	Napier Islet	Meyers Islets
<i>Hydnophora exesa</i> (Pallas,1766)	1-10-4,5,6,7,9		2-22-1,2,6,11,13	4-5(15)-7,8
<i>Goniastrea favulus</i> (Dana,1848)*				
<i>Goniastrea australiensis</i> (Milne Edwards & Haime,1857)	1-10-4,7,17, 18,19,23	3-14-4,8,11, 13,14,17,18	2-22-3,15	4-5(15)-1,2,15,19
<i>Leptoseris mycetoseroides</i> Wells,1954		3-14-7,15,16,24		
<i>Leptoseris hawaiensis</i> Vaughan,1907		3-14-4	2-22-10,12	4-5(15)-10
<i>Cyphastrea serailia</i> (Forskal,1775)		3-14-5,6,9,12	2-22-3	4-5(15)-13
<i>Montastrea curta</i> (Dana,1846)	1-10-3,8		2-22-4,9	4-5(15)-3
<i>Montipora cf. millepora</i> Crossland,1952		3-14-22	2-22-8	4-5(15)-12
<i>Montipora cf. spumosa</i> (Lamarck,1816)**				
<i>Pocillopora damicornis</i> (Linnaeus,1758)				4-5-30,31,32
<i>Plesiastrea versipora</i> (Lamarck,1816)**				
<i>Turbinaria radicalis</i> Bernard,1896	1-10-22	3-14-20		4-5(15)-4,5,6,17
<i>Turbinaria bifrons</i> Bruggemann,1877		3-14-10	2-22-5	4-5(15)-14
<i>Dendrophyllia</i> sp.	1-10-24	3-14-1	2-22-14	4-5(15)-16

* according to Shiel et al.,1986.

** according to Vaughan,1917. Comments to some of these species see in text.

1-10-3 - Paleontological Museum of Moscow recent scleractinian corals collection number. First number is the site of collecting (the same as on the chart, fig.1); second number is depth of collecting (if 5(15) - it means range 5-15 meters); third is number of sample from this site. Duplicates of these specimens with the same indexation were transmitted to MNZ in Wellington.

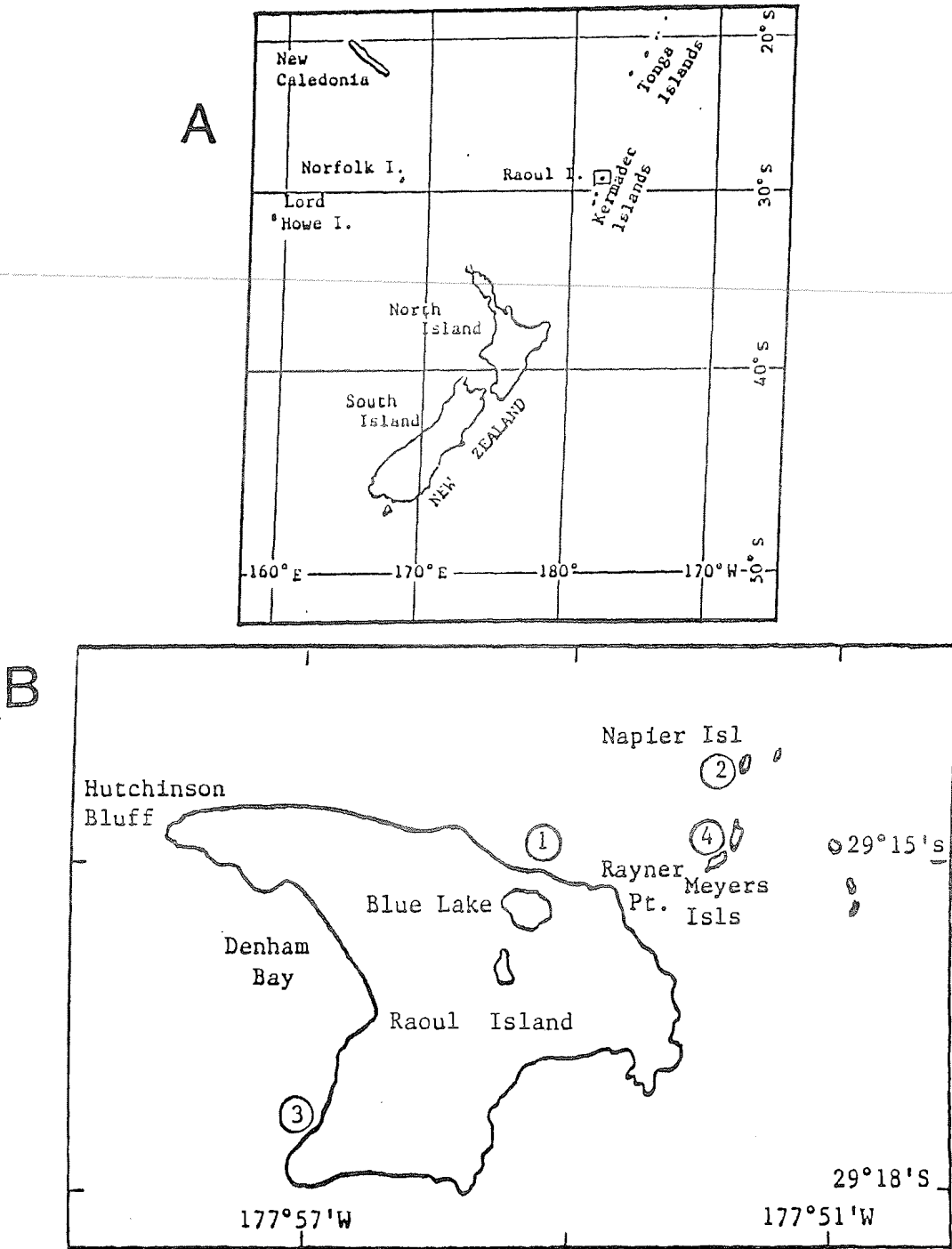


Figure 1.
 A. The location of the Kermadec Islands, north of New Zealand.
 B. Enlarged map of Raoul Island in the Kermadecs showing smaller islets, with sites of coral collecting (1 - 4).