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Service Type Copy non returnable
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Service 2
Service Type Loan
Media Type None

Item Details (Journal Article)
Journal Title Reports of the Great Barrier Reef Committee.
Publisher Govt. Printer.
ISSN 1328-2670
Volume / Issue VOL 1
Part Date 1925
Classmark Call Number fyp GB468.89 .G7 : 1(1925)-6(1947/1956); fys1p GB468.89 .G7 : 1(1925)-3(1931)

Article Details
Title The natural destruction of a coral reef
Article Author Hedley, C.
Pages n/a sorry 35-40
Additional Nos ANBD: 000007245509
Ref. Source Libraries Australia/bibali-r20-d502

Additional Service Details
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THE NATURAL DESTRUCTION OF A CORAL REEF.

By Charles Hedley, Scientific Director of the Great Barrier Reef Investigations.

(Plate V.)

Some exquisite pictures of coral reefs, published by Saville Kent, gave to the untravelled student his first idea of how such reefs appear in life. Among the best of these was a series illustrating the reef fringing the south-west corner of Stone Island, near the town of Bowen, in Port Denison, Queensland (lat. 20° S.; long. 148° 15' E.).

Probably many corals recorded by Brooks and Bernard from Port Denison or the Great Barrier Reef were gathered here by Saville Kent. That writer has noted the following from Stone Island:—Turbinaria cinerascens, Fungia discus, F. repanda, Goniatrea grayi, and Lophosorites cristata.

A curious presentiment prompted Saville Kent to recommend to posterity the study of this Stone Island Reef as well as of that at Thursday Island, because both were so readily accessible from a town. He suggested that photographs taken after a long interval of time precisely on the same spot and in the same direction as his own would constitute "a measured survey, and thus assist towards ascertaining the future growth."

As the next historian to deal with the topic, I have to make the mournful announcement that this famous, wonderful, and immense structure has now completely vanished. Not only has the coral all died, but every vestige of it, except the foundation, has been swept away. A ruin so complete recalls some tale of ancient, bitter warfare in which it was said that not one stone of the conquered city was left standing upon another and that the conquerers prevented any future revival by sowing their enemies' field with salt.
I was guided to the place where the reef once stood, by Mr. F. H. Rainford, an enthusiastic naturalist resident at Bowen, to whom I am indebted for my first information on the subject. He has seen the reef both in full development and the catastrophe that destroyed it. The testimony of eye-witnesses as to the exact position on which the reef once stood is supported by other evidence. Saville Kent noted landmarks and cross bearings, especially one in which the peak of Saddle-back Island rises in the centre of Gloucester Passage. Kent's Pl. V. No. 1 is taken on this bearing. A photograph published herewith (Plate V.) of the Stone Island Reef was taken by Mr. E. Strange, of Bowen, about 1890. The middle distance is the same as in the above-quoted figure, but the camera stood about 30 yards in front and was turned a little to the left. Here Middle Island appears on the left and the lofty peaks of Gloucester Island on the central and right horizon.

Most investigators who at one time have inspected a reef in healthy growth at another time probably have crossed, but without observing it, the site where such a reef had once stood. It was
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ere the reef once stood, by a naturalist resident at Bowen. Information on the subject, elopement and the catastrophe is supported by other evidence, especially one in which a rise in the centre of the reef is taken on this bearing. (Plate V.) of the Stone age, of Bowen, about 1890, the above-quoted figure, but real and not a little on the left and the lofty and right horizon.

We have inspected a reef in Sydney have crossed, but without one had once stood. It was
my unique good fortune not only to inspect the razed foundation but to do so with a full knowledge of the reef that formerly stood there. By this happy chance a chapter, hitherto unrelated, can now be written of coral reef ecology.

I spent an afternoon, during a low spring tide, in wading over the place where this reef had been. No coral blocks now remain upstanding; all have been planed away by the waves as if some huge razor had shaved off the coral growth down to low tide level. Where a great coral mass, such as those prominent in the photograph, had once stood, there now appears a block like a great paving stone set in a rough road. This flat stone shows in section the radiations of the coral branching from the core. Between the paving stones are pools of coral sand, and the inequalities between these for hundreds of yards amount to no more than a few inches in height.

With one exception animal life was curiously scarce. The dominant form now in possession of the flat is a species of Chama, a shell like an oyster but of a reddish-brown colour, a little larger than a walnut, one valve a cup, the other a flat lid, set tilted on edge and distributed at the rate of several to the square yard. A Chama-studded flat like this was described by Professor Taylor and myself from Cairns Reef. Perhaps further experience may show such flats to be characteristic of planed-down reefs.

After some hours' search through this scene of desolation I found two small lumps of Porites mayori alive, and no other living coral. But some comparatively fresh coral thrown up along high-tide mark suggests that in deeper water, off the edge of the reef, the coral is now recovering. Such soft corals as Lobophyton and Sarcophyton were conspicuously absent. Except Chama, the mollusca were poorly represented. I found two or three small clams, Tridacna crocea, alive, and several others dead. The echinodermata were represented by a few scattered Holothuria. The crustacea were almost confined to small gregarious hermit crabs carrying small shells. At low and high tide I noticed a few barnacles.

A small gregarious brick-red sponge $\frac{1}{2}$ in. in diameter appeared to be perforating the dead coral.

In contrast with this depauperated fauna the algae were unusually abundant, both as to species and individuals. As a
rule algae are infrequent and inconspicuous on a coral reef. A large
collection of these seaweeds were gathered and handed to
Mr. Cyril White, Government Botanist, who hopes to supply a
report on them later.

The seaweeds and coral are antithetical to each other, the
weeds making the ground foul for coral by leaving to the corals
no clean gritty surface to perch upon, so that the coral will be
unable to regain this site while the weeds are in possession of it.
But the cycle will run its course; when the algal complex now in
possession dies down the corals will resume their heritage, as one
crop follows another.

An explanation which was given to me by Mr. Rainford, and
which I fully accept, of this destruction is as follows,—During
the cyclone of 1918 so heavy a fall of rain happened that a thick
layer of fresh water floated far out on the surface of the sea.
When the low tide fell, this surface water sank till the whole reef
was immersed in it. Then every living thing that had dwelt there
—corals, worms, shell-fish, and crabs, died immediately.
Putrefaction from these enlarged the zone of destruction. This
slaughter reached as deep as 10 ft. below mean tide level.

Mr. Rainford related that round a beacon in front of the
beach at Bowen there existed, before the cyclone, a half-acre patch
of coral, chiefly stagshorn, just covered at the lowest spring tide.
Not only was all this mass of coral killed in 1918, but the reef
rapidly disintegrated, and for many months the opposite beach
was strewn with fragments of the dead coral. Now all the coral
round the beacon has disappeared, and the water is much deeper.

My informant remarked that the area of destruction extended
as far as Armit Island, 20 miles away, and that in 1921 he found
the coral on Holbourne Island dead.

I am indebted to the kindness of Mr. G. G. Bond, Meteorologist
for Queensland, for some interesting particulars of this storm.
The hurricane of 1918, now named the Mackay Cyclone, was
remarkable both for the magnitude of the area it covered and
the maintenance of its intensity for an unusually long period. It
reached its height late on the 19th and early on the 20th January,
1918, when the barometer fell below the notating scale, as the
centre of disturbance moved westward and crossed the Australian
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THE NATURAL DESTRUCTION OF A CORAL REEF.

Coast a short distance north of Mackay. An extraordinary rainfall followed. During the 22nd, 23rd, and 24th of January 55 in. fell at Mackay, and the total for January reached 85 in.

This storm swept Bowen with reduced force, yet on the 22nd, 23rd, and 24th, 19 in. was recorded there. After the storm passed, a northerly wind drove the water from the flooded Don River down on Stone Island. Railway bridges over the Don and the Burdekin were carried away. It was reported that a passing steamer drew up bucketfuls of fresh water from the sea at a distance of 8 miles from the land.

The Mackay Cyclone was immediately followed by a second storm, a milder type of cyclonic disturbance, which also brought torrential rain. On the 27th, 28th, and 29th of January, Bowen received 15 in.; so that in the eight days of 22nd to 29th January a total of 35-7 in. fell at Bowen. It is reported that a little to the north the rainfall was still greater.

On the surface of the sea rain water a yard in depth had fallen; in addition to this the swollen rivers poured out a huge volume.

The full moon occurred on 27th January, and the ensuing spring tide was a low one. Mr. D. Fison, of the Port Office, Brisbane, kindly informs me that the range of the tides at Bowen, as registered by the local pilot, was as follows:—On 25th and 26th January, 8 ft., and on 27th January, 7 ft. 6 in.

It will be obvious that the oceanic and off-shore reefs would be exempt from this particular casualty. To be drowned in fresh water is a fate reserved for the inshore reefs reached by torrential rain and swollen rivers which change the surface of the sea from salt to fresh.

Glancing at this phenomenon from a long distance, there is a suggestion of recurrence. Probably the reef whose destruction is here related was the growth of centuries. Thus the destruction is a record, not clearly decipherable, of weather cycles, indicating that the conditions of rainfall and tide have not recurred here for hundreds of years.

Probably, if literature was carefully combed, many cases like the subject of this paper might be found recorded. So far I have only noticed the following instance:—At the entrance to Port
Dorey, Western New Guinea, Quoy and Gaimard observed two coral reefs which had been killed long before, but which had commenced to revive and which yielded them a few isolated corals, including the new *Goniopora pedunculata*. They suggest that the coral reef had been destroyed by the heavy rainfall of the north-west monsoon.

A similar but not exactly parallel instance was observed at Cocos Island, and has been fully reviewed by Wood-Jones. In 1876 a spring of dark malodorous water broke out and spread over the south-east of the lagoon, completely destroying the coral there. After a lapse of thirty years the coral had only partially recovered its hold on the denuded area, for which the rivalry of the algae is to some extent responsible.

REFERENCES.


5. Corals and Atolls, 1913, p. 192.