

# **ON CORAL REEFS AND ISLANDS**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649526390

On Coral Reefs and Islands by James D. Dana

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**JAMES D. DANA**

**ON CORAL REEFS  
AND ISLANDS**



ON

CORAL REEFS AND ISLANDS.

BY

JAMES D. DANA,

GEOLOGIST OF THE EXPLORING EXPEDITION AROUND THE WORLD DURING  
THE YEARS 1838—1842, C. WILKES, U. S. N., COMMANDER.

“We wandered where the dreamy palm  
Murmured above the sleeping wave ;  
And through the waters clear and calm  
Looked down into the coral cave,  
Whose echoes never had been stirred  
By breath of man or song of bird.”

THULIA, J. C. PALMER, U. S. N., EXPL. EXP.

—♦♦♦—  
FROM THE AUTHOR'S EXPLORING EXPEDITION REPORT ON GEOLOGY, WITH ADDITIONS.  
—♦♦♦—

NEW YORK:

G. P. PUTNAM & Co.

1853.

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NOTE.—By a recent letter from Rev. C. F. Winslow, we are informed that he has examined with acids the supposed coral material on Maui, referred to on p. 133, and found that it does not effervesce and is not calcareous. It is therefore no evidence of an elevation of the island.

## CORAL REEFS AND ISLANDS.

## CHAPTER I.

## STRUCTURE OF CORAL REEFS AND ISLANDS.

## I. GENERAL FEATURES OF CORAL REEFS AND ISLANDS.

THE general features of coral reefs and islands have often been delineated by travellers, and are probably almost as familiar to the reader as the scenes of the land around us. Yet a few brief remarks on this point form a necessary introduction to the more minute descriptions of structure which follow.

*Coral reefs.*—A wide platform of rock covered by the sea except at low tide, borders most of the high islands of the Pacific. It is a vast accumulation of coral, based upon the bottom in the shallow waters of the shores. This bank or table of coral rock, is of varying width, from a few hundred feet to a mile or more; and although the surface is usually nearly flat, it is often intersected by irregular boat channels, or occasionally encloses large bays, affording harbor protection to scores of ships. In very many instances the reef stands at a distance from the shores like an artificial mole, leaving a wide and deep channel between it and the land; and within this channel are other coral reefs, some in scattered patches and others attached to the shore. The inner reef in these cases, is distinguished as the *fringing* reef, and the outer as the *barrier* reef. The sea rolls in heavy surges against the outer margin of the barrier; but the still waters of a lake prevail within, affording safe navigation for the tottling canoe sometimes through the whole circuit of an island: and not unfrequently, ships may pass, as by an internal canal, from harbor to harbor around the land. The reef is covered by the sea at high tide, yet the smoother waters indicate its extent, and a line of breakers its outline. Occasionally a green island rises from the reef, and in some instances, a grove of palms stretches along the barrier for miles, where the action of the sea has raised the coral structure above the waves.



The annexed sketch conveys some idea of the peculiar features presented by a Pacific island and its encircling reefs, though in order to fill out the scene, the jagged heights and deep gorges of the island should be covered with forests and the shores with groves and native villages. The coral platform which borders the



shore is represented with its usual uneven line, its broad harbors with a narrow entrance, and to the left, an irregular ship channel running between the inner or fringing reef, and the outer or barrier. At a single place, the sea is faced by a cliff; and here, owing to the boldness of the shores and depth of waters, the reef is wanting. To the right there is only a fringing reef.

*Coral islands.*—Coral islands resemble the reefs just described, except that a lake or lagoon is encircled instead of a mountainous island. A narrow rim of coral reef, generally but a few hundred yards wide, stretches around the enclosed waters. In some parts the reef is so low that the waves are still dashing over it into the lagoon; in others it is verdant with the rich foliage of the tropics. The coral-made land when highest is seldom more than eight or ten feet above high tide.

When first seen from the deck of a vessel, only a series of dark points is descried just above the horizon. Shortly after, the points enlarge into the plumed tops of cocoa-nut trees, and a line of green, interrupted at intervals, is traced along the water's surface. Approaching still nearer, the lake and its belt of verdure are spread out before the eye, and a scene of more interest can



scarcely be imagined. The surf beating loud and heavy along the margin of the reef, presents a strange contrast to the prospect beyond,—the white coral beach, the massy foliage of the grove, and the embosomed lake with its tiny islets. The color of the lagoon water is often as blue as the ocean, although but fifteen or twenty fathoms deep; yet shades of green and yellow are intermingled, where patches of sand or coral-knolls are near the surface; and the green is a delicate apple-shade, quite unlike the ordinary muddy tint of shallow waters.

The belt of verdure, though sometimes continuous around the lagoon, is usually broken into islets separated by varying intervals

of bare reef; and through one or more of these intervals, a ship-channel occasionally opens into the lagoon. The larger coral islands are thus a string of islets along a line of reef. The king of the Maldives bears the high-sounding title of "Ibrahim Sultan King of the thirteen Atollons and Twelve Thousand Isles;" which Capt. W. F. W. Owen, R. N., remarks, is no exaggeration.

A few small coral islands are simple reefs without lagoons. In some cases they are bare banks of coral; but generally, the usual vegetation of the islands has obtained a foothold, and affords some protection against the glare of the coral sand.

With these general remarks we may enter upon the more particular consideration of the characters of reefs and islands.

## 2. CHARACTERS OF FRINGING AND BARRIER REEFS.

*a. General features.*—*Fringing* reefs have been described as those that directly adjoin the shores of an island; and the *barrier*, as the exterior reefs, separated from the fringing reef, or from the shores when there is no inner reef, by an open channel.

While there are only narrow shore-reefs to many islands, around others, a distant barrier extends like an artificial mole, sometimes ten or even fifteen miles from the land, and enclosing not only one, but at times several islands. Between the narrow fringing platform and these remote barriers, there is every possible variation as to extent and relative position. The inner channel is sometimes barely deep enough at low tide for canoes, or for long distances may be wanting entirely. Then again, it is a narrow intricate passage, obstructed by knolls or patches of coral, rendering the navigation dangerous. Again, it is for miles in length an open sea, in which ships find room to beat against a head wind with a depth of twenty, thirty, or even fifty fathoms. Yet hidden reefs make caution necessary. Patches from a few square feet to many square miles in extent are met with over the broad area enclosed by these distant barriers.

These varieties of form and position are well exemplified in a single group of islands—the Feejees; a chart of which Archipelago by the Expedition is inserted at the close of this volume.

Near the middle of the chart is the island *Goro*; its shores, excepting the western, are bordered by a fringing reef. The island *Angau*, south of *Goro*, is encircled by a coral breakwater, which on the southern and western sides runs far from the shores, and is a proper barrier reef, while on the eastern side, the same reef is attached to the coast and is a fringing reef. From these examples we perceive the close relation of barrier and fringing reefs. While a reef is sometimes quite encircling, in other instances it is interrupted or wholly wanting along certain shores; and occasionally it may be confined to a single point of an island.

Above Angau lies *Nairai*; though a smaller island than Angau the barrier reef is of greater extent, and stretches off far from the shores. To the eastward of *Nairai* are *Vatu Rera*, *Chichia*, and *Naiiau*, other examples of islands fringed around with narrow reefs. *Lakemba*, a little more to the southward, is also encircled with coral: but on the east side the reef is a distant barrier. In *Aiva*, immediately south of *Lakemba*, the same structure is exemplified; but the coral ring is singularly large for the little spots of land it encloses. The *Argo Reef*, east of *Lakemba*, is a still larger barrier, encircling two points of rock called Bacon's isles. It is actually a large lagoon island, twenty miles long, with some coral islets in the lagoon, and two of basaltic constitution, of which the largest is only a mile in diameter. *Aiva* and *Lakemba* are in fact other lagoon islands, in which the rocky islands of the interior bear a larger proportion to the whole area. The same view is further illustrated by comparing the *Argo reef* with *Nairai*, *Angau*, or *Moala*: these cases differ only in the greater or less distance of the reef from the shores and the extent of the enclosed land.

Passing to the large islands *Vanua Levu* and *Viti Levu*, we observe the same peculiarities illustrated on a much grander scale. Along the southern shores of *Viti Levu*, the coral reef lies close against the coast; and the same is seen on the east side and north extremity of *Vanua Levu*. But on the west side of these islands, this reef stretches far off from the land, and in some parts is even twenty-five miles distant, with a broad sea within. This sea, however, is obstructed by reefs, and along the shores there are proper fringing reefs.

The forms of encircling reefs depend evidently to a great extent on that of the land they enclose. That this is the case even in the *Argo reef* and such other examples as offer now but a single rock above the surface of the enclosed lagoon, we shall endeavor to make apparent, if not already so, when the cause of the forms of coral islands is under discussion. Yet it is also evident that this correspondence is not exact, for many parts of the shores, and sometimes more than half the coast, may be exposed to the sea, while other portions are protected by a wide barrier.

In recapitulation, we remark, that reefs around islands may be (1) entirely encircling; or they may be (2) confined to a larger or a smaller portion of the coast, either continuous or interrupted: they may (3) constitute throughout a distant barrier; or (4) the reef may be fringing in one part and a barrier in another; or (5) it may be fringing alone: the barrier may be (6) at great distances from the shores, with a wide sea within, or (7) it may so unite to the fringing reef that the channel between will hardly float a canoe. These points are sustained by all reef regions.