ART. XXVIII.—*Remarks upon the Atoll of Ebon, in Micronesia;* by E. T. DOANE.

WE will begin our remarks upon the Atoll of Ebon by referring in a general way, first, to that section of Micronesia which embraces it, known as the *Marshall Islands.* The name is that given by *Krusenstern* in honor of Capt. Marshall who made the first discoveries there in company with Capt. Gilbert. The discoveries date back seventy-two years; the first island was seen in 1788, the last being discovered only in 1824.

The whole group lies within the longitudes 166° and 172° east, and 4° 39′ and 12° north latitude. Of the atolls of the group, some are large, measuring forty, fifty, and sixty miles in circumference, while others are mere bank-reefs, two or three miles in circumference. Of the large islands, we may mention *Jaluit* or Bonham's *Rimski Korsakoff*, or *Rong-rik* and *Rong-lab*,

and *Mille* or the Mulgrave Islands. Of the mere bank-reefs, we may mention *Kili* or *Hunter's* and *Lib* or *Princess* Island. And we would here remark, perhaps no group of the Pacific presents a more tangled mass in the nomenclature of its islands, than does the Marshall Islands, and especially the Ralik range. Some of the terms we have given above may perplex the reader as he attempts to trace them out on ordinary charts.

The Marshall Islands are divided by a deep sea about one hundred and fifty miles wide—into two chains—the Eastern or *Radak*, and the western or *Ralik*. Their general bearing is N.W and S.E. The Eastern chain possesses thirteen atolls and the western sixteen. The general features of these atolls are similar to those of most coral islands. They are low—the reef-rock in none probably measuring more than ten or twelve inches in elevation. In form, however, there is much diversity. *Mille* or Mulgrave island is nearly a parallelogram—*Majuro* or Arrowsmith is oval; *Ebon* circular—while *Jaluith* or Bonham's Island and *Arlinglab-lab* or *Elmore* Islands, and many others, are without any definite forms.

The atolls vary in fertility. Those south of 8° north latitude possess, from all native accounts, the most fertile islets and the most available soil. Their fertility may be accounted for from the fact, that more rain falls upon them. They are more affected by the equatorial belt of "constant precipitation" which is ever oscillating backwards and forwards over them. Dead leaves and wood rapidly decay.

It is an interesting fact, anomalous to the general features of coral islands, vide Dana's Coral Is. p. 24—that the *leeward side* of these islands possesses the largest body of land. Indeed the windward side of many of these islands is entirely destitute of land—or possesses it only in small islets. On *Mille* or *Mulgrave* Islands and *Majuro*, *Arrowsmith*, *Jaluith*, *Bonham's* Islands and *Ebon* islands which the writer has visited, this is emphatically true. The windward side of *Majuro* is possessed only of small islets, while the leeward side is one continuous strip of land, twenty-five miles long. *Jaluith* is much like this; perhaps, however, it has not so continuous a piece of land on the leeward side—though there is here the most fertile soil. On *Ebon* this is likewise true.

An explanation of this fact may perhaps be found, in the strong winds—the "N.E. trades" sweeping with all their force for one half the year over these reefs. These strong winds and the heavy sea they raise, tend to sweep off the material which might accumulate there; and bearing some portion on across the lagoon to the leeward side is there lodged, and helps forward most rapidly the accumulation of the "beach formation."

The fact has been stated, that the northern atolls of the Mar-

shall islands are rather subsiding than otherwise; vide Dana's Coral Is., p. 134. It may be asked, is this not rather apparent than real? May not the small amount of wooded land found there—for this is the basis of the statement—be owing rather to the heavy seas and winds which there prevail? The natives ever speak of the heavy winds of that latitude, 12° N. Islands have been desolated by them. We feel disposed to offer this as a solution of the fact.

Another fact, we would state as common to the whole group —is the existence of large ship channels on almost every side of the lagoon. *Mille* possesses four large ones—three of them, and one, the largest of all, on the windward side. *Jaluith* has its reef pierced by as many—and much in the same position. While *Majuro* has its channel on the windward side only, and *Ebon* on the leeward, we cannot speak of more from personal observation—though the natives say the other islands possess many channels and in much the same position of those above mentioned.

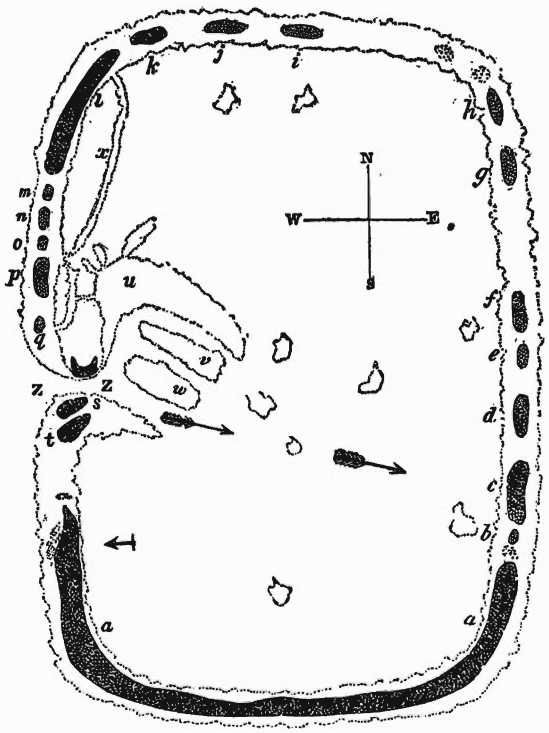
With these remarks upon the general features of the Marshall islands, we proceed to remark upon the atoll of Ebon.

The position of this atoll is 4° 39′ north latitude, 168° 49′ 30″ east longitude. This is the position, from the anchorage of the ship "Morning Star" in the Lagoon. The atoll is the most southern one of the *Ralik* range. It was discovered May 25th, 1824, by Capt. George Ray who named it Boston Island. In 1834 Capt. Covel thought it a new discovery, when it took his name, by which it is often called. The atoll is nearly circular and measures some twenty or twenty-five miles in circumference Except the passage on the west side of the reef, there is no other, not even a boat passage, in the whole circumference of the atoll. The reef however, at full tide, can be crossed by native craft. There is a tradition that once a passage existed, of sufficient capacity to admit ships, on the N.E. side, and that it was destroyed however by some powerful spirit, in his rage, and the present passage opened.

The natives possess also an interesting tradition concerning the existence of *a high island as having once occupied the most of the lagoon.* It is said the tall hills, covered with bread-fruit and cocoanut, reared themselves where now the flats in the lagoon exist. It is said also that what must then have been the barrier reef possessed land, which is now Ebon islet. The present passage is twelve or fourteen fathoms deep, and at the inflowing and outflowing of the tide has necessarily a very strong current, being the only outlet for the whole lagoon—when the waters are lower than the reef. As it flows in, against a strong wind, its presence may be traced quite across the lagoon, from the ripple of the waters and the white caps. The reef-flats near the passage in the lagoon are being covered with sand and other

coral debris—the nucleus of some future islet. The small coral patches in the lagoon are all covered with a few inches of water at low tide.

Ebon is the largest islet on the reef, as shown on the accompanying sketch—and gives name to the whole atoll. Its length from point to point is about eight miles. A singular feature is found upon it, a ledge of coral conglomerate. The map by the sign ↤ presents its position. On the north end of the islet it projects itself free from all soil or sand; and its course as marked, can easily be traced by its repeated outcropping. The land which lies on the sea side is of considerably more recent formation than that on the lagoon side. The difference is very perceptible. The ledge or embankment was formed, no doubt,



a, Ebon; *b*, Dile; *c*, Eniaithok; *d*, Kermkumlab; *e*, Eri Mon; *f*, Remrol; *g*, Koie; *h*, Minlak; *i*, Enear; *j*, Enikaiori; *k*, Riri; *l*, Toko; *m*, Bikri; *n*, Bivilil; *o*, Aneming; *p*, Enilu; *q*, Iu; *s*, Jurith; *t*, Eni-armith; *u*, Worai-thok-thok; *v*, The Komil; *w*, Morelab.

mainly from the wash of the lagoon. This is seen from its lamination sloping that way. It undoubtedly served an important purpose in catching and holding the finer materials thrown up from the lagoon.

At the S.W. bend of the islet the surface is quite uneven,—hills and vales in miniature form and size show themselves. They are formed no doubt by the drift of the sand—blown up into little hillocks. From its elbow round to the N.E. point the islet possesses but little soil. It is however covered with a quite heavy growth of bushes and trees, all possessing a very rich and deep green color—and this is indeed characteristic of the foliage of the whole island. It has none of that sickly yellow, half nourished hue, which we find upon many coral islands—those especially of the Kingsmill group. On Ebon all the growth is beautiful. There is soil and rain enough to nourish well the tropical vegetation.

I have not been able to obtain an exact classification of the plants of this atoll. More than fifty distinct species, however, will be found. We will mention some which enter chiefly into the support of native life. The Artocarpus is represented by some eight or ten varieties, one, the *A. integrifolia*—and the rest *A. incisa*. The *Pandanus odoratissimus* is represented by some twenty varieties. Its fruit enters largely into the native food. It is prepared in large rolls enclosed with its own leaf,—and may be kept for years. The cocoanut (*Cocos nucifera*) is represented by some ten varieties distinguished only by the nut. Two varieties of tarro (*Arum esculentum*) is quite plentifully grown. It is raised in large beds prepared somewhat for it. These beds differ from those found on the Kingsmill islands. They are not as there, excavations carefully worked out and good soil prepared and worked in. They seem in a measure to be natural excavations, perhaps the sunken hollows between hillocks. These hollows with some little preparation would answer the purpose:—at least their origin at this day is unknown. If a native be asked concerning them, he invariably refers them to the work of spirits. Around the margin of these arum patches, are grown bananas in quite plentiful crops. And the larger islets have just sufficient to raise oranges and figs, which the missionaries are now growing.

This atoll is the home for a few varieties of birds. But in this feature of the island, the contrast is as wide between the "low coral" island and the "high volcanic" one—as between their natural features. The high islands of Micronesia are largely supplied with the feathery tribe,—but this atoll can claim only a very few birds—and with two or three exceptions these are all water fowl. There are a few Columbidæ, *Carpophaga oceanica*, which manage to elude the keen search of the natives. These birds are occasionally heard cooing away in the tops of some quite isolated bread-fruit tree. A Cuculus gives forth occasionally its sharp whistle—and these, with the addition of another land bird whose species I have not been able to learn —are all the feathery songsters this atoll can claim.

The shores of the reef at low tide, and the bare rocks, are a little enlivened by the brown and white Heron. Small flocks of snipe (*Scolopax*) gather on the sand bars—or single individuals are running along the beach picking up food. An occasional plover (*Charadrius*) is to be seen. Sea swallows (*Sterna stolida* and *Sterna minuta*) are skimming the waters of the lagoon, or resting on the beach. A Booby (*Lula*) now and then is seen sailing over the island. His home is unknown to the natives. His want of caution is clearly seen in the easy way a native will ascend a tree in which the bird is roosting and with a slip-noose capture him. An interesting explanation of the origin of the single variety of the *Cuculus* is given by the natives—so skillful has this bird been in concealing its birth-place. As the natives find it only full grown they say that it is born and nourished in the clouds and falls to the earth of full size.

At least five species of reptiles are found on the atoll. Four are of the Lacertinidæ—and one, Geckotidæ. The Gecko readily domesticates himself, and lives upon the house flies and gnats he finds. The Lacertinidæ find their homes on trees and bushes.

The varieties of insects are interestingly numerous. It might seem as though these atolls, so comparatively recent in their origin would be but feebly represented by any varieties of animal life. But the entomologist will find here not an uninteresting field of study. The most common kind of insect is the parasite *Pediculus*, disgustingly numerous in the heads of natives; a large size Libellula, dragon fly, is quite numerous, and a few of the diurnal and nocturnal Lepidoptera are found. Of ants and mosquitoes and flies there are large swarms. Of the *culex* there is probably a new kind, which might be called *diurnal* culex. They are very small and almost as numerous as those more commonly seen at night. Of Scolopendra—Centipedes—there are many to be found and of rather formidable size—though we rarely hear of their biting any one.

There are several varieties of Spiders. The scorpion, though found on the atoll is small and harmless.

The Crustacea are numerous on land and in the water. We seem to have a great abundance of the Paguridæ—hermit crabs. I have thought they were more numerous on these coral islands than on the volcanic ones.

The Mollusca too are abundant. Some rare specimens are found. The orange cowry is common to some of the Lagoons. Zoophytes also are numerous, as would be supposed in these waters. A valuable and quite abundant sponge is also found in some of the lagoons and the Marshall islands.

It will be noticed, on the reef of this atoll, that besides the islet of *Ebon* there are nineteen others. All of them are much smaller than Ebon, though for their size they are equally fertile. Some of them seem to be veritable fairy-lands—so soft is the

green grass which covers them—and the deep shade of the interlaced bushes and majestically tall bread-fruit trees, throwing out their long sweeping arms like the monarch oak—

—"Who has ruled in the green wood long."

In the growth of some of these islets, we have perhaps some interesting facts connected with the rate of growth of islets or coral reefs. *Bikri* is an islet containing not more than an acre of land. A few Pandanus self-sown from seed washed there by the waters of the lagoon or sea, have taken root. And there are a few bushes,—a variety which I have noticed as growing only on the frontier soil of an islet—soil which is but little more than sand. From the leaves of these bushes and Pandanus, soil is very slowly forming. But *the present age* of the islet is, as stated by a native, who saw it when only a *sand bank* washed by the tides—some *thirty-five years*. He remembers it when a boy as only a sand bank. Now it has a *little* soil and *few bushes*. The islet *Nanming* he describes as once only a sand bank. It is now about the same size and condition as *Bikri*. These facts are not stated of course as definite for determining the rate of growth of coral *islets*—for into such a calculation many other circumstances might enter, such as the position of the reef for catching and holding the washed-up matter, &c. But we may learn from the facts here given, that the growth of land, like the growth of the reef-rock, *is very slow*.

Near the southern extremity of Toko (opposite *x* on the map) some *thirty-five* years since, there was a passage sufficiently large to let a proa pass over the reef between what was then *two islets*. Now that passage has been filled up, and large bushes grow there. The only tree of any size is the cocoanut and Pandanus, which have been planted. This fact we would state as illustrative of two points—one bearing on the fact we have just referred to—the rate of growth of an islet—and the other, that large islets are made by stringing as it were, together several small ones. It may be questioned whether a large islet, say some two or three miles long, is one continuous production; it was rather formed by several smaller islets becoming attached and the whole in time becoming one large islet. This fact I think can be clearly proved to have been the case with the growth of the islet of Ebon. There are several spots which may be indicated as the *welding* points of small islets. These places are usually narrower, and less overgrown with bushes and trees, and possess a thinner soil than other parts of the whole islet. Then again there are places which are *expanded*, just as if they had been the central nucleii of the islets. These are heavily wooded—have large bread-fruit trees and other trees of apparently an old age, growing upon them. We have reason to believe that all the islets of this atoll will in time be thus united, and thus the

whole reef possess, so far as it goes, one unbroken chaplet of vegetation.

We are now deeply interested in watching the formation of *sand banks* at one or two points. As yet they are shifting about —as the winds and seas prevail for a given time from any quarter; they are as yet covered by high tides. One of these sand banks is between *Eni-armeth* and the northern point of *Ebon.* We may not live to see it, but we believe that this sand bank will yet become *fixed*—will enlarge itself—catch some floating seeds and appropriate them and then there will be another green islet on the reef. This will again expand itself and become the connecting link of Ebon and Eni-armath—thus completing the length of the green band of this Ebon islet on its northern extremity.

Ebon Atoll, Marshall Island, Micronesia, Aug. 16th, 1860.