

ATOLL RESEARCH BULLETIN

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No. 54

Field notes on atolls visited in the Marshalls, 1956

by

Herold J. Wiens

Issued by

THE PACIFIC SCIENCE BOARD

National Academy of Sciences--National Research Council

Washington, D. C.

September 15, 1957

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Since the spring of 1955 I have been engaged in a study for the Pacific Science Board of the National Academy of Sciences-National Research Council in which I am attempting to analyze, synthesize and generalize to the extent of my capacity certain scholarly data and other published information about coral atolls and reef islands in the tropical Pacific. These data pertain to the physical environment and general ecology of such atolls and islands, to man's situation and role in them, and to the inter-relationships between man and his physical and biological environment on them. In the summer of 1954 I was the geographer on the Pacific Science Board expedition to Kapingamarangi in the Eastern Carolines and briefly visited 5 other atolls and an uninhabited reef island in this region. With the goal of gaining better insight and perspective on the aspects of coral atolls and reef islands in different precipitation zones, I pursued further field studies in the summer of 1956, visiting briefly or for longer periods eleven different atolls and two single reef islands in the Marshalls. Although pre-planning of itineraries proved to be rather futile, it turned out that I was able to visit representative atolls and islands in the dry northern, intermediate humid and wet southern parts of both the eastern and the western chains of the Marshalls.

The notes presented here generally were typed up with little change from field notes written while on the atolls described or immediately after departure from them. They should be viewed only as field notes, therefore, and not as systematic studies of any sort. All types of information striking my attention were jotted down. Most were from direct observations; others were derived from informants. The amount of time spent upon any atoll differed from that spent on others, and I had no control over my transportation schedules. Traveling was done by small 50-70 ft. schooners for the most part, although two or three trips were made by air. On some atolls there was time only for one to several hours of ground examination during daylight. On others, several days were available, although owing to heavy continuous rains on such atolls as Arno and Ebon, not all the time in such longer stays could be used to advantage. The distribution of the islets along scores of miles of reefs, the changing state of the tide interrupting travel between islets, the lack of local transportation, and the fact that visiting schooners stop only at one or two of the scattered bits of land combined with the briefness of the stops in limiting my observations. These limitations account for the fragmentary character of these observations and for their unequal amount and quality.

The reader is begged indulgence for these deficiencies. The notes are offered in spite of them if for nothing else than that some of these atolls are seldom visited, and little is known of them. I gratefully acknowledge the aid and cooperation of the United States Naval authorities on Kwajelein and of the District Administration of the Trust Territory at Majuro and

(Sonneratia caseolaris), jong (Bruguiera conjugata), and ecok (Rhizophora mucronata); the latter has an oblong shaped leaf; photos of all three types were taken. One Hernandia sonora seen was one foot in diameter. Merlap (Canavalia microcarpa) of a light purple color was observed. The islet as a whole impressed one with the abundance of pandanus and tall breadfruit trees. At the tip near Airik the coconut trees are in sandy soil and tend to have a chlorotic color and are low. However, a well with water tasting fresh occurs only 30 feet from the lagoon shore, with surface water (at the tidal stage observed) of four feet below the surface of the ground. Seagrape bushes and a variety of croton bushes are common decorative shrubs along the sides of the road traversing the islet. Other common trees are Hibiscus, Plumeria, Calophyllum and Barringtonia.

Residences observed on Buoj and Airik appear better than in most Marshallese settlements, about on a par with those of Likiep and Ebon. The magistrate here is Jorninea; Luta is headman of Buoj and Leiran is headman of Airik. Both Marmoru and Maida speak English well. Albert, a Gilbertese married to a local Marshallese Catholic is a Protestant who is building a store to compete with Mico. He speaks excellent English. A neat, clean medical clinic with two rooms stands a couple of houses from the home of Maida Kabua who is a descendant of the Kabua kings whose graves are situated across the road from Maida's house in Buoj. Maida said that serious diseases or accidents rarely occur; skin infections, eye infection, and colds are the commoner afflictions. The new Protestant Church almost completed and subsequently dedicated in early August 1956 was designed by a Marshallese carpenter trained in his profession by the Japanese during their period of occupation. He has displayed a good deal of imagination in decoration, if his color schemes are a bit garish in their primary colors.

Bikajla Islet across from Buoj shows an extraordinary development of coral boulders lying loosely, and apparently permeable to salt water for about 250 feet inland from the ocean-side. In the outer parts dense growths of Morinda citrifolia and Guettarda lie in almost rainforest gloom, with liana-like vines of a Wedelia-type weed falling from their crowns and hanging leafless in the perpetual shadows. Farther inland Bruguiera conjugata provides dense shade, intermingled with some Pandanus, its gnarled, humped-up roots covered with a hairy green coat of algae or lichen. The land forms a low trough here. Asplenium nidus and Nephrolepis acuta grow on the trunks and old stumps of coconut and other trees. Throughout the seaward 200 feet or so pandanus jungle predominates. Few coconut trees occur until, toward the interior, a rise on the lagoon-side of the trough and fresh-water-holding soil have allowed a dense growth of young coconut sprouts among older trees. The islet looks as if no man had disturbed things for decades.

A brief stop was made at Bikar Islet on the north end of the atoll. Here only one or two residences were inhabited. The south end of Bikar appeared to be a relatively new addition of sand with numerous pioneer plants. Strong wave erosion on the lagoon shore has almost destroyed the rock-lined road built during Japanese or German times, having undercut 10-20 feet of the lagoon shore land. Orange colored algae cover the reef rock extending into the lagoon side of the inter-islet channel on the south side of the islet.

## Ailuk Atoll

Ailuk Islet is the main residential islet, but is rather small, not more than 1500 feet long nor any wider. No unusual topographic features were observed. There are no very large islets on Ailuk Atoll.

Breadfruit trees were numerous and mostly 40 feet tall or lower, although several were up to 60 feet tall with trunks more than 3 feet in diameter, indicating that the storm of 1951 probably had not been so damaging as it was at Utirik. Generally the vegetation under the coconut trees was similar to that at Utirik and Mejit, with arrowroot very prevalent everywhere. Many taro pits were seen in the interior, but in several only small parts were planted to taro. Most of the pits had been abandoned to weeds.

On the north channel side of the islet Pemphis is the main bush, while Scaevola becomes more common on the ocean side beaches. Numerous bushes of ulej (Clerodendrum inerme) grew in the vicinity of the taro pits.

Numerous large sailing outriggers sailed in to the waters of the lagoon (village) from the relatively large islet at the opposite end of the lagoon.

On the oceanside someone had written just before sundown in the wet sand a long line of words carefully inscribed in Marshallese followed by the English sentence: "Please remember me always, Nathan," apparently intending the inscription to be washed away by the next high tide and so having the message conveyed to the heart of the loved one.

## Arno Atoll

Ine Islet has an unusually high sand ridge on the lagoon side and in the northern part of Ine village. A fine wide sand beach of moderate firmness for walking is found most of the length of Ine on the lagoon side. The seaward side of Ine has a high level coral boulder rampart over 100 feet wide sloping gently toward the low center of the islet which is well cleared of undergrowth. Some taro pits are in use for taro, but others have been abandoned. Much breadfruit is produced from the numerous trees, and there appears to be an abundance of banana and pandanus trees. The village houses are for the most part rather poorly constructed and maintained. The village school is in a dilapidated condition which is inexcusable; walls rotted away and tin roof full of large holes; the floor wet with water and littered with debris. A dedication plaque surmounted with an Air Force Wings insignia indicates the building was constructed or completed December 3, 1944, when the C.O. of the area was Lt. Col. C. V. Burnett, stationed at Majuro.

Kojboy (Kij-Bwe) Islet near one of the passes provides a sheltered anchorage for ships wishing to anchor just inside the pass. It has a fine sand beach facing the lagoon, with a coarse boulder and cobbled beach on the windward side above a solid rock bench rising two feet above the reef flat. This bench has been well smoothed by the grinding of sand and gravel worked back and forth by waves. Inward from the beach coarse coral boulders loosely

piled and blackened by algae reach 30-100 feet toward the middle of the islet. On this, Scaevola is most prevalent, followed by Pandanus and Guetarda. On the end of the islet facing the pass, the coral boulders reach inward to greater depth in a series of ramparts.

This type of islet structure is typical of many observed throughout the Marshalls as well as at Kapingamarangi in the Carolines. It leads me to believe that the coarse coral blocks on the seaward side, up to one or two feet in diameter and loosely piled, must have been deposited at one time in a single major storm. The modern beach fronting this layer of blocks at Kojboy, for instance comprises mostly smaller gravel, well rounded and polished and piled in a ridge or sometimes in two or more ridges above the solid rock bench and forming the beach proper. At other islets where wave action has eaten inward upon the islet, such coarse coral boulders, little worn and rounded by wave action, have been observed to be underlain by well worn and rounded gravels and finer materials.

Along the end of Kojboy Islet facing the pass, the swift current and tidal pounding have left no sand accumulation as often is the case at points facing shallow inter-islet channels which are dry at low tide. The beach accumulation forming the lagoonward-turning point of the islet here comprises coarse cobbles and gravels overgrown with a scattered growth of Scaevola.

In the interior of Kojboy, the ground under the coconut palms has been kept cleared except for low shrubs, ferns and grasses. One or two families have residence houses here, but the taro pit in the center is not used for taro, but has been abandoned to weed growth.

Like the other islets observed, Arno Islet has a similar coarse cobble beach on the seaward side, with a fine sandy beach on the lagoon side. On the eastern end where the island becomes attenuated and connects with a very narrow (50-80 feet wide) islet east of it, the connection is a sand ridge apparently broken at times when storm waves or spring high tides bring water sweeping across it. Small boats can land readily on the south or seaward side when winds are not strong from the southeast.

Arno Islet has comparatively great width for atoll land areas, and the interior of the wide portion has become overgrown. Weed tree species or coconut jungles are virtually impenetrable in small sections. Numerous former taro pits in the central portion have been abandoned to become pandanus swamps. Domestic pigs have been allowed to run wild and find many coverts and thickets in which to hide. Large numbers of breadfruit trees grow on the island, together with plentiful pandanus and banana trees. Residences are widely separated for the most part.

### Ebon Atoll

Ebon Islet is the largest and widest islet on the reef and compares with Arno Islet on Arno Atoll in width but is much longer; the northwestern five miles or so is mostly narrow, 50-150 feet in the middle part and widening to about 500 feet in the northeastern tip. The seaward beach is a very firm,

sand to gravelly sand beach for much of its length, possibly with hard rock underlying it. Except for the village area in the wide part of the islet, the lagoon side northeastward is not sandy but has a rocky to gravelly beach with extensive rock flats exposed at low tide. The reef flat on the ocean side is rather smooth with few loose rocks and boulders. Erosional remnants of former islet bedrock are revealed in the northeast central sector of the islet by a series of jaggedly eroded rock platforms 10 to 20 feet wide and up to 30-40 feet long. These are spaced in a line of half a mile or more flanking the lagoon rock flat about 100-400 feet off the present lagoon shore and above tide water. They lead me to believe that once the islet here was up to 500 feet wide instead of the present 100-feet. The erosion that has taken place has been largely on the lagoon side where the present hard rock flat now stands. In the extreme northeast part of the lagoon, an amazingly flat limestone reef bare at low water is almost smooth enough for roller skating. The jagged remnants above the reef flat support a good growth of Pemphis acidula, with roots anchored in erosional pockets containing some sand and holding fresh water after rains. These remnants rise  $4\frac{1}{2}$  feet above the surface of the reef flat. These erosional remnants are similar to eroded bedrock in other areas, in the sharp and jagged character of the surface, which type of surface appears to occur most often where rain water dissolution rather than wave action is the disintegrating factor involved.

A pace measurement of Ebon Islet at the new church, in a line running from ocean side to lagoon side, showed a width of 600 feet. The wide part must be four or five times this width. A 50-60 foot strip bordering the ocean side stands as a relatively high beach rampart from which the land slopes inward toward a central trough which in places reaches within a foot of the fresh-water-lens surface, as revealed in dug wells and in taro pits. Roads 6 feet wide border the residential and wide part of the islet, 50 feet from the ocean beach and 150 feet from the lagoon beach.

Vegetationally, Ebon Islet is one of the richest seen in the Marshalls. Here are the most numerous lime, banana, breadfruit, and papaya trees as well as numerous pandanus trees. Most of the islet is kept well cleared of undergrowth, so that coconuts may be gathered easily. In the central parts of the wide section, however, vegetation has been left to grow unchecked, with a dense cover of all types of characteristic atoll trees in almost jungle-like masses amidst which are nearly concealed taro pits which are poorly maintained, overcrowded with ferns and grasses and unlike the neatly weeded taro beds of Mokil, Pingelap and Kapingamarangi in the Eastern Carolines. This greater carelessness may be due to the fact that men in the Marshalls have the job of farming whereas in the other areas women do the taro-pit work and own the taro patches; at least this is the case in Kapingamarangi. Morinda, Hibiscus and even Guetarda crowd the central portions of the islet together with Pandanus and occasional breadfruit trees. In this central overgrown section, however, coconut trees are dead and decapitated or old and in poor condition and are few and scattered. I was informed that coconut trees did not grow well here.

Possibly this condition may be related to the existence here of too high a concentration of phosphate; for the Japanese dug and exported a phosphate rock from here, some piles of which remain heaped-up next to the lagoonside road from the war period. The neglect of this interior area also may be related to the richness of food production on the islet and the relative sparseness of population for so large an area. Certainly the houses and yards show an evidence of care and prosperity not seen elsewhere in the Marshalls except at Ailinglaplap, or possibly at Likiep.

On the northeast part of the islet where the width reaches about 500 feet, coconut trees are tall and crowded, but the undergrowth is kept down to low weeds and ferns of which there are plenty. The weeds here are Vigna marina and Wedelia biflora, with some Guettarda and Pandanus here and there. The ground often is almost bare of weeds where a cobbly surface prevails. Even in some of the narrower parts, scarcely 50-60 feet wide, some breadfruit trees grow, possibly because the alignment of the islet here with the wind direction reduces the ingress of salt spray.

The amazing ability of coconut trees to gain a footing in the most barren situations is revealed by the five adult palms, plus a small pandanus and one young coconut tree growing on Nakor Islet separated by a channel from the northeastern end of Ebon Islet. Nakor comprises a small sand patch 10 feet by 20 feet on top of bare rock washed by salt water at high tide. Apparently the sand cover of 1-2 feet depth plus pockets holding fresh water in the rock after rainfall supplies the moisture needed by the plants.

On the southwest end of Ebon Islet just beyond the last residence house a tongue of sand stretches in an arch toward the lagoon. On this, pioneer seedlings include Calophyllum, Messerschmidia, Scaevola, Pandanus, coconut, Wedelia, Cassytha, and several grasses.

Breadfruit trees on Ebon for the most part are of a low variety and not exceeding about 60 feet height. A specimen of kirak or kurak (Inocarpus fagiferus?) observed was about 60 feet tall and had somewhat yellowed leaves.

Southwest of Ebon Islet are two islets close together connected by a ridge of sand where spring high tide probably washes through. The one nearest Ebon Islet is Enearmi, meaning "island of people", about 600 feet wide and somewhat longer. The other islet is narrower and about the same length. About half of the former on the ocean side which is lee to the wind is covered with loose coral blocks providing an unstable foothold. Apparently the ground underneath comprises materials holding a fresh water lens however, since the area is richly productive both of coconuts and of tall large breadfruit trees with trunks up to five feet diameter. Black humus was observed in parts where the surface was cleared of coral blocks. The ground is heaped everywhere with piles of moulding coconut husks and fallen fronds and is poorly cleared. The leeward half facing the pass in to the atoll is high with boulders, and slopes to a low elevation toward the center. The coral blocks give the impression of having been pushed inland, possibly during a single typhoon, and their rough shapes contrast with the smoother sand and wave washed cobbles and

gravels forming the modern beach. Everywhere Asplenium nidus and Nephrolepis grow upon the ground, stumps and coconut trees. Morinda citrifolia is a common understory tree. A small plant observed was called rebijreka (probably Peperomia in this habitat) meaning "to hold to the rock."

The reef flat oceanward has a bumpy looking surface with imbedded clams about three inches in diameter. Apparently owing to rather strong winds and waves during the previous night, large quantities of branching antler corals from the lagoon had been washed up onto the shallow parts of the reef flat in the inter-islet channels southwest of Ebon Islet and adjacent to the ship pass, there to die and rot. Tide pools with only an inch or two of water at low tide contained several types of corals, including one with light blue tips and clustered branch effect, a massive dark-blue, flat, fingered type, and the massive brain coral and "micro-atolls" with all but the outer ring dead, usually of an orange purplish color in the live fringe.

Culturally speaking religion plays an important part here as elsewhere in the Marshalls, most of the population of about 800 being Protestant. There are two Protestant churches, one a wooden structure with tin roof and the other, a mile down the other end of the settlement to the southwest, a thatched roof building. Adjacent to the latter is a large new concrete church being built (has been under construction for three years, but lack of concrete blocks stalled completion) which is to be finished for the centennial in 1957 of the entry of Christianity to Ebon and the Marshalls. In the religious homes Protestant families have prayers and hymns at evening and before breakfast, while on Sunday church services in the morning from 10-12 (the first hour for general church, the second for Sunday School) and Christian Endeavor in the afternoon fill the time. No work is done. Special services also are held at the first of the month, and there are prayer meetings during the week, usually on Wednesday.

The two houses of the magistrate's family and relatives each had a phonograph with records of religious, hillbilly, Japanese and cowboy songs. The magistrate informed me that there were four or five battery-operated radio receivers on the Islet which got news and music from Majuro and Kwajalein broadcasting stations. He was informed of the arrival of our schooner before it was sighted. A pool "hall" for billiards is the most popular resort of the atoll sports, and this is a common feature on other Marshall atolls as well, some having more than one billiard table. The job of children here is to pick up all leaves of breadfruit and other trees in the residential yard every morning and remove them or pile them up away from the yard, as observed at Kapingamarangi: in contrast to the latter atoll where women do all the cooking, and associated activities, I saw a man grating coconuts, sitting in a cookhouse with the women. Raw fish here as elsewhere in the Marshalls is often eaten as soon as caught, and the internal organs appear to be especially prized. Children catching small fish bite open the stomachs and eat the flesh, prying into the innards with fingers and licking them as an American child would clean a cake-mixing bowl.

A curious decorative emblem observed set in embossed concrete over the new church windows is a star inside a crescent, but with no known relation to a Moslem origin.



Unfortunately, less care is exercised toward the public school building and desks, chairs and books. The latter were scattered about hither and yon, amid other debris, and a few books lay open on the damp floor of concrete including three copies of a book entitled: "The Wonderful World of Science" about third grade level, and three copies of a song book entitled "New Music Horizons."

The old pastor here is by name Tokeak, two of the deacons are Jokiarik and Langwor. The latter is the adopted father of Nashon the 21 year-old magistrate who speaks a fair English and who entertained me hospitably for four days at his father's house.

Walter Milne, representing his brother, James Milne, who owns the schooner Raete on which I traveled, traveled himself with the schooner, but hired a Marshallese for captain. Walter who had been put up by Ebon people when his house was demolished by bombing or shelling during World War II, paid off his longstanding obligations socially by throwing a big party for his wartime hosts on the schooner, sailing around in the lagoon and feeding his hosts and friends there; this being the express purpose of the trip to Ebon. He also brought them numerous presents.

On the schooner I observed several pillows used by the Marshallese with pillow cases embroidered with such slogans as "God bless you, my dear," "May all your dreams come true," and "Sleep with God's love."

#### Jaluit Atoll

Jabwor is that section of the series of connected former islets known as Jaluit that lies at the extreme northern end of the series and adjacent to one of the deep water passes, north of which, about a quarter of a mile distant, lies Enibor, another series of connected islets. The connection in each case is a sea-wall-protected causeway constructed by the Japanese to link the concrete forts and bunkers and gun emplacements. A handcart railroad is said to have run along the causeway. At numerous points the remains of forts, bunkers and heavy guns as well as shell cases, still stand. The seawall is generally about a foot thick, of reinforced concrete, broken by storm waves in places. The causeway sectors of the long islets resulting from the connections are often not more than 15-25 feet wide, with only Pandanus, Pemphis acidula and Messerschmidia as well as Scaevola tree growth, although various vines and weeds overgrow much of the ground. Many introduced decorative trees are found on Jabwor itself, which is the widest part of the islet of Jaluit. Few coconut palms remain here, although some young trees now five or six years old have been planted. The main growths since the end of the war have been Pandanus and numerous weeds. Many concrete platforms mark the location of former Japanese houses destroyed by bombs and shells during World War II; some are being utilized for new construction foundations for the Trust Territory's agricultural station at the tip of the islet adjacent to the pass, and for the settlement of laborers and the Protestant and Catholic missions and schools now being built up. Here is a good anchorage and a concrete pier in somewhat dilapidated condition. The southern part of the

settlement has an area set aside for the Kili people to use as a base for fishing and for warehouse and communication purposes.

Immediately south of the Kili sector the islet narrows to about 20 feet width and continues southwestward in varying and generally narrow widths until another former islet of some width is reached about three miles away. Here is a former pier and two 300-foot (?) high steel towers, one on the lagoon side and one on the seaside built by the Japanese for communications. The seaside tower is badly rusted through and unusable; the lagoonside tower is comparatively intact, and I climbed the ladder to the top for photos. The remains of large buildings lie adjacent to the towers, their concrete walls are still standing and possibly usable, if roofed over. Breadfruit trees in some number occur here as well as a dense growth of other trees. Little if any attempt has been made to clear the undergrowth that has sprouted up here since the end of the war.

Northward and across the channel from Jabwor, the islet of Enibor quickly narrows after an initial width allowing breadfruit tree growth and continues in 20-50 feet width for many miles interrupted now and again by gun emplacements and corroded guns and fallen-in-bunkers of concrete and coral rock. Over all these grow a "jungle" of atoll trees, shrubs and vines. Numerous crabs and an occasional brown rat rustled in the ground debris while lovely white fairy terns, white-capped grey noddy and now and then a reef heron flew overhead. The coconut trees growing here are all young. Much Pandanus has covered the area, with Messerschmidia and Scaevola prevalent on the seaward side, as well as occasional Pemphis acidula; Guettarda is more prevalent on the lagoonside or the interior. At one point on the seaward side were several large boulders torn from the reef edge and measuring about 6 feet cubed, having been pushed by storm waves to within 20 feet of the beach edge and 150 feet from the reef edge.

Imroj Islet next to an eastern deep pass of the atoll has a reported 300 people. The settlement looks rather shabby, but the islet appears productive. A striking amount of pandanus, bananas, and some lime trees grow on it. Breadfruit trees are low but numerous. Many squash or pumpkin vines were seen in blossom and appeared to be flourishing. On the northern end is a salt water basin fed by underground tidal flow in which mangrove thrives. A large but dilapidated Protestant church is a prominent landmark. Some Catholic converts also live here, including Jobjabot who sailed as crew member of Father Donohue's St. Joseph during my trip. The magistrate was absent, and a man named Karen took it upon himself to show me the courtesies of the place.

### Kili Island

This lagoonless island is surrounded by a reef of rather narrow dimensions especially restricted on the leeward side. It is backed on this side by a sand beach in the southwest sector where small boat landings can be made through a 20-foot-wide channel at low tide. At high tide such landings are made with care directly on the rocky and bouldery shore. A high bouldery and rocky beach occupies most of the rest of the shoreline except a stretch

fronting the north end of the islet where sand again occurs. Salt water enters through coarse boulders into a brackish pond on the leeward side surrounded by a growth of Pemphis acidula which here also grows on the boulder rampart running inward from the beach. A fresh water swamp now planted partly in taro occupies the central part of the islet in back of the village proper. The highest point of land is occupied by the neatly thatched little church. The wooden houses furnished by the American authorities are not in very good condition and are ugly shacks at worst.

The islet has a high vegetation and is endowed with abundant rainfall as indicated by the damp soil and moulding piles of husks. It reminded me of Ringtoru Islet in Kapingamarangi, with a flourishing growth of Asplenium nidus and Nephrolepis hirsutula standing up to six feet high in the northern end where coconut trees also have been allowed to grow and sprout crowded together far too densely for good production. Small delicate mushrooms were observed, similar to those seen at Likiep and Jaluit. Moss covers the paths as at Nukuoro Atoll. The taro swamp, however, is badly tended, and overgrown with 2-3 feet tall grass and ferns. Much of the swamp is still unplanted and lying in waste and weeds.

In the swamp there was a large growth of a woody stemmed weed called mer (Jussiaea suffruticosa) by my guide. It has small yellow four-petaled flowers.

On the sandy leeward beach-ridge grows several kōno trees (Cordia subcordata) one of which is 6 feet in diameter one foot from the ground, but branches thereafter into limbs of about one foot diameter each. A Morinda citrifolia was seen with a trunk diameter of about one foot.

Some of the Kili people complain about not enough food and not enough variety of food, but there appear to be numerous breadfruit and a fair number of banana trees as well as coconut trees and some pandanus. Some 10,000 taro plants were brought in for them to plant, but the people are unused to its culture and apparently do not particularly like to work in the taro fields. They ate up the taro, often without replanting the tops, so that the stock is much reduced. While 210 or so people in 1956 may be rather too many for so small an area, food production from the land probably is greater than that from their erstwhile Bikini homeland, although they miss the rich lagoon fishing area. They appear not to be working too hard at improving their plant production, however.

Fishing is either on the narrow reef at high tide, or in the open ocean where it is restricted to the leeward side not far from shore. Five or six outriggers were used in line fishing and a dozen men and boys were standing on the reef at high tide using goggles and spears for fish and mollusks. Before our schooner left about a dozen fish 7-9 inches long were bought or exchanged by our schooner's owner from the Kili people. The Kili store was the best stocked seen on the outlying atolls during our trip, although this does not indicate the buying power of the Kili people.

## Kwajelein Atoll

The islets visited on Kwajelein had been violently disturbed by war activities and the vegetation was thus quite abnormal. The islets visited included five north of Kwajelein, of which Ebeje (commonly known as Ebeye owing to American usage) is the only one with a settlement, except for the one family living on South Loe Islet next northward of Ebeye. Northward of South Loe are North Loe, Bijinkur, and Eboj. Most of the latter three are under 100 feet wide, although Eboj is quite long. Scaevola is the dominant vegetation throughout Eboj, although Ipomoea pes-caprae forms a creeper mat in large areas. A few scattered Messerschmidia and a few Pandanus occur, with a few coconut trees here and there. Triumfetta procumbens also was prevalent in places and flourished better in the shade of Scaevola than in the hot sun adjacent, or, at least, showed larger leaves of greener hue, although having fewer blossoms in the shade.

North Loe was overrun with Wedelia biflora and Vigna marina in much the same way that Ebeje is. A few Guettarda trees occur and Messerschmidia is rather common here. Pemphis was not seen here, but my informant said that it was common on the small uninhabited islets of the atoll. Its hard-wearing wood is used for husking sticks, for making canoe keels, and in the olden days, for spears.

Kwajelein Islet is just a large airfield with a military settlement and facilities. The Navy has a daily ferry service between Ebeye and Kwajelein Islets to take the Marshallese employees back and forth. Ebeye is a village of over a thousand Marshallese from many atolls who work for the Navy for their existence for the most part. On the islet is a Coast Guard Loran station (this operates a radio guiding system for ships), the Kwajalein Island Trading Company (Kitco), the Marshalls Import and Export Company (Mieco), a few small stores with pool tables, and the offices and residences of the Trust Territory Administrator. The latter is in the process of constructing new quarters but in the meantime lives in an old "temporary" housing unit left over from the war period. However, the Coast Guard sells them electric power for light, deep freeze and refrigerator, and they have a running water system derived from an elevated tank into which water is pumped from a concrete cistern collecting rainwater. Four or five small rooms in a building next to theirs serve as hostel accommodation for visitors.

Ebeye is depressing from a vegetation standpoint. Aside from a couple of small clumps of coconuts and a scattering of Messerschmidia, most of the vegetation comprises a half dozen varieties of weeds.

## Likiep Atoll

The two chief residential islets lie at opposite ends of the long lagoon some twenty miles apart. Of these the most important by far is Likiep Islet and village on the east end. There also are a few residents in the other larger islets scattered along the reef. The shape of Likiep Islet is like that of a fishhook without the barb, the sharply curved part being in the eastern end, so that an excellent sheltered harbor is formed with sandy bottom

that is deep enough to accommodate the larger vessels that visit the atoll. The village is around this section of the harbor. At the end of the hook sand has been accumulating consistently, for a long period, and extending the shore line into the lagoon. A pier situated here now has its face 20-30 feet from the deep water that formerly was alongside, so a new pier extension has been built into the lagoon. Capelle DeBrum, one of the two leading men of the atoll, stated that so far as he had observed, no noticeable erosion of a serious sort had made inroads upon the land area of the islet from the oceanside.

The islet is not more than 300-500 feet wide being narrowest in the western end. Scaevola and Messerschmidia and some Pemphis cover the entire seaward strip for a depth of 20-50 feet. This has been left as a shelter belt intentionally to afford the coconut trees protection from the salt spray. The lagoon-side has been entirely cleared of weed species, and coconut trees grow right up to the edge of the beach. Breadfruit trees are abundant on the village end where the breadth of the islet is greatest. None appear more than 40-50 feet high and they are much branched close to the ground. The rest of the island is generally well planted to well spaced coconut trees, with occasional Pandanus and more rarely Calophyllum as an understory, although the latter are left as shade trees on the beach next to the village. The ground-cover is mostly grasses, some foot-high succulent weeds, entangled in some areas with Cassytha filiformis, the whole topped by a rather dense growth of arrowroot used here for food as elsewhere in the northern Marshalls after the breadfruit season, together with the pandanus which then comes into production more abundantly.

A striking topographical feature on Likiep Islet are the many large depressions on the western half of the islet, some round, some elongated, but with no special directional alignment. They reach down approximately to the surface of ground water. Several have been planted to taro, but some have coconut trees growing in them. An old man of 70 when asked about them said that he had heard that they had been caused by storms in ancient times, but he did not know how they originated. This appeared to be the opinion of other older men who did not believe they were dug for taro pits although some have been used for this. Today there is only a small amount of taro grown at Likiep. My opinion is that they were man-made taro pits dug before memory of the present people.

Major storms have come from the southwest and northwest. The last major storm was in 1918 when some 5,000 coconut trees were knocked over, but it was not a severe storm. There was no serious land erosion, although in several places on the lagoon side, accretion of land has taken place owing to sand accumulation. Water supply generally is plentiful, although occasional low periods occur when no rain falls in 3-4 months.

A localized growth of Wedelia biflora occurs on two sides of the path near the middle of the islet. Numerous patches of sandbur grass also bordered the path. The general aspect of the coconut plantation is very clean; all leaves and husks are piled up and burned. This injures some of the coconut tree trunks.

There are three varieties of breadfruit, moderately high yielding, with the producing season being from May to August; some production occurs in February.

The pandanus seasons are January to May and August to December, i.e., from August to May, thus taking the people through the period when breadfruit is not in season. Arrowroot (Tacca) is not planted but grows abundantly by itself. Food supplies are lowest in September.

Most of the coconut trees here date back to German planting by the ancestors of the present land-owners; a few were planted during the Japanese times. Two varieties of taro-plants grow here: Iraj (Cyrtosperma chamissonis) a large variety, and kotak (Colocasia esculenta) the true taro. Each family has a pig or two and a few chickens. Marbele (Ipomoea tuba) a vine, is fed to pigs. It has a white morning-glory type flower. Plumeria and Bougainvillea have been introduced as ornamentals. The outside fiber of Triumfetta procumbens is used for handicraft weaving, Pemphis wood for furniture and canoe keels, Morinda fruit for pig feed, and Calophyllum for boat keels and other parts having hard wear.

Some 3 or 4 poisonous varieties of fish, which everyone recognizes, occur in the lagoon or on the reef. Capelle reported that on Majuro a type of fish which had regularly been eaten for years had, about two years ago, suddenly become poisonous.

The wooden house with the tin roof is preferred here, particularly because it is used for water catchment and provides water much cleaner than that washed down from thatch with the latter's accumulation of insects, skinks, lizards, etc. Wood had been easy to get from salvage and scrap at Kwajelein after the war, but is now growing scarce. For a time it had been free for anyone to take.

Likiep has no large breadfruit trees suitable for canoe dugouts; formerly canoes were made from driftlogs, but in recent years driftlogs have grown quite scarce (possibly owing to change in lumbering or rafting operations in the northwest of the U. S.). During German times there had still been some sea-going canoes, but western type boats were built and used for inter-atoll travel. Now canoes are all too small for this, and they also are rather few in number. During Japanese times, a large steamer visited the atolls once every two months, while smaller schooners made trips to each atoll once a month or oftener. Likiep has two locally owned schooners that operate between here and Kwajelein or Majuro. Transportation for Likiep, thus, is not a serious problem.

In June 1956 some 518 people were resident upon the atoll, most of them on Likiep Islet. About two-thirds of the local population is Protestant, and perhaps one-third is Catholic. The former have a large but unpretentious church whose pastor is Koneaea. The Catholic church is new, with a new rectory, nuns' house and school, all in bright aluminum and neatly laid out. The resident American priest is presently Father McCarthy whose schooner ran

on the reef at Kwajelein not long ago because the pilot and passengers were all asleep. His engine was rescued, but the hull was abandoned. Likiep is the center for Catholic girls' education in the Marshalls.

Before German times Likiep was temporarily uninhabited, but was visited by Wotje people from time to time for fishing, turtle and bird catching or for wood supplies. In the 1870's four men, an American, an Englishman, a German and a Portuguese combined their resources and bought the atoll from the Wotje chief who owned it. Actually, by tribal custom he did not have the right to alienate the land. A few years later, the American and Englishman sold out to the remaining partners and the atoll became the property of the Capelle and DeBrum families whose descendants remain the owners. It was not until then that coconut plantations were laid out, the owners hiring laborers from other atolls to come to Likiep to work for them. The latter eventually settled permanently as laboring families on the atoll and lost their outside connections as far as land rights elsewhere were concerned. Now these laboring families have been resident some 70 years and have nowhere else to go. They have no legal rights to local land, however, and work the plantations on a share-crop basis for the land-owners. The latter consist of the two clans, the Capelle with eight families, and the DeBrum with nine families. The original owners intermarried with Marshallese and subsequently with each other.

Capelle DeBrum is now recognized as head of the combined clans, while Melander DeBrum, his brother, is next in rank, and the two are at the top of the social and political hierarchy. Only one of the landowning families, Raymond DeBrum, is Protestant, the rest being Catholic, while most of the laboring families are Protestant. The economic conflict that has occurred between the landed and the landless is thus sharpened by religious division. Some of the landless recently have tried to make claim for property rights in land but have been unsuccessful. Dissatisfaction with earlier agreements for crop division recently brought on discontinuance of copra making work by many of the laborers, apparently supported by Raymond DeBrum, but the present arrangement of a 50-50 split of copra proceeds appears to have satisfied most of the laborers. Perhaps 25 per cent of them still are disgruntled and are not too active in producing copra.

A serious pest affecting breadfruit has been recently noticed (about a year or so ago). It turns breadfruit blackish-brown, spreading from an infected spot to the entire fruit which then becomes rotten. It was noticed first on one tree at the south end of the village, but this summer infestation was noted on several other trees, including one at the other end of the village. Small fruit flies fluttered about the rotten or diseased fruit, but these may be attracted by the spoiled fruit rather than by the disease carrier. Capelle expressed worry that their spread to all the trees would ruin this important food source for Likiep.

Lodo Islet is a quarter of a mile northward across the channel from Likiep village. Its aspect is similar to the plantation area of Likiep Islet. It is well cleared of undergrowth up to the shelter belt on the oceanside where a considerable growth of Wedelia biflora occurs. Attempts

have been made to burn it. In other areas the ground cover is much thinner than on Likiep Islet, reflecting a drier soil. Grass intertwined with Cassythia filiformis makes a thin mat. Six or seven houses are scattered along the lagoon side on the wider east end of the islet. Maas Hone, who recently completed his first year at the University of Hawaii, is the alab or head landowner of the islet, succeeding his father who died this spring.

On the west end of Lodo in the inter-islet channel the beach rock rises out of deep water in a coral cliff. A great slab had broken off due to erosion and undermining.

On walking along the lagoon shore with me, Maas noticed dense schools of small fish, sardine-like and 7-8 inches long. He got a throw net and, trailing the schools from shore, made a catch of about 150 fish after about 40 minutes and half a dozen throws of the net.

Maas informed me that there was at least one islet of small size along the reef that was covered with a tree whose description points to Pisonia. It was an islet with many nesting birds. In traveling westward close to the lagoonside on the schooner, I observed an islet with vegetation that appeared to correspond to that of Pisonia. Many birds circled over it.

Liglaa Islet at the opposite end of the lagoon from Likiep Islet has its lagoon beach facing the prevailing wind. Vessels visiting this place sail out through the adjacent pass and anchor off the oceanside reef in the lee of the wind. After Likiep Islet, Liglaa has the largest number of residents. Actually, it comprises two islets close together separated by a few yards of channel. The larger one of the two, with a lagoonside beach is called Imejwa; the smaller is Maat. It took me about three hours of steady walking to encircle Imejwa. A remarkable and high sand beach with a crest 12 feet above high tide slants at a 30-40 degree angle to the water. From the crest there is a slightly sloping backshore which sometimes turns into a number of low dunes reaching inward 75-100 feet from the southeast end of the islet around to and along the east side.

The seaward side to the lee of the wind has a pronounced beachrock development in several well-marked strata sloping at 15-25 degrees dip. The channel to the north of the islet has what appeared to be raised bedrock in spectacular formations. They probably represent the remnants of islets formerly covered with soil now destroyed by storm action.

Along the sandy beach crest of the lagoon side and on the southeast end Scaevola is the dominant cover, with Cassythia throttling much of it. By contrast the northwest channel side and the ocean side find Pemphis forming a spray-burned and impenetrable shelter belt. The crowns of some of these show distinct alignments controlled by wind and spray.

The westward coast of the islet has sharply eroded bedrock standing several feet above the main reef flat. At the reef's edge here the lithothamnion ridges have a beautiful pink color, but this disappears in the leeward part of the reef.



The southeast sections of the islet are park-like and well-cleared. However, everywhere thousands of coconuts litter the ground, many well sprouted with half a year's growth, indicating the neglect that the laborers' dispute with the landowners has brought about. At the northwest sectors of the islet, neglect has permitted a rank growth of sprouting coconut trees 6-10 feet high, intermingled with Pandanus trees. The ground is heavily littered with leaf and debris among the young growth, so in places one finds the thickets impenetrable.

### Majuro Atoll

Majuro is quite a large atoll, about 30 miles or so long - with numerous islets - including a large one, Majuro Islet about 4 square miles in area.

Uluga at the opposite end of the atoll from Majuro and where the Trust Territory District Administration is centered is unrepresentative but still exemplifies an essential part of the Marshalls' economic and social transformation and acculturation processes. Here an airfield with weekly connections by Trust Territory plane and occasional Navy plane, a motor road system, trucks and jeeps, wharf and terminal warehouses for ocean freighters, electric lights, hospital with medical and dental services, and more and better commodities at Kitco and Mico, as well as a commissary with all essential foodstuffs, and a regularly paid staff, with money and things to be purchased, all occur. Here is the seat of overall government as well as the center of inter-island political relations and the site of the Marshallese Congress.

War damage to vegetation is apparent in the lack of well planted coconut plantations and in the overgrowth of weeds. Part of this is due to the fact that some land has been retained by the Trust Territory Administration, but is not being immediately used by it. Only when one gets away from this center does the vegetation situation become more normal in the sense of native plantations, as in the case of Enegu Islet, about three islets east of the pass, on the north reef. However, even here the situation appears affected by the nearness to the administration center of wage-paid labor, where cash is abundant enough so that urgency in working copra may not be pressing. Or, possibly, the owner of a large section of this islet lives far across the lagoon and seldom gets to Enegu to work his copra. The eastern two-thirds of the islet are overgrown with weeds and have sprouted coconuts strewn over the ground, the stage of growth of the latter indicating many months, possibly a year, of neglect, with sprouted nuts having fronds up to five feet or more in height.

On the west end of Enegu, a residential owner lived in an area newly planted with neatly rows of coconut trees about three years old. Immediately after the war or during the war, the area had been cleared for use by the Coast Guard according to my informant. This explained the uncrowded vegetation and new coconut plantations in straight rows as advised by the American agricultural aide.

Bananas and papayas are plentiful on this atoll, as is breadfruit. Taro is mostly lacking, however, and the people prefer to buy rice and flour as staple substitutes.

#### Malloelap Atoll

Airik and adjacent Makaru Islets on this atoll were visited by the writer in a Navy plane that landed in the lagoon. The former is the main residential islet of the atoll. The other islets in the atoll were heavily damaged by the war, as they were used by the Japanese for an air base and numerous installations and buildings with concrete platforms that have obstructed the replanting of the area with coconut or other fruitful trees. Wrecked planes and equipment and buried ammunition, unexploded shells and mines still cause the people to be fearful about clearing land and cultivating. Only recently a shell exploded without being touched or moved, and six ammo dumps or shells and a mine were exploded by a Navy demolition team sent there in July of this year. Such areas are overgrown with weeds and weed trees of many years growth, so that clearing them will involve much labor.

Airik Islet or Village appeared to be plentifully planted with productive breadfruit, pandanus and coconut. The breadfruit trees, however, are low, under 40 feet, as at Likiep. The islet is wide, about 1200 feet in sectors near the northern end. About 200 feet of this width on the ocean side, however, has been left as a shelter belt in which a rare pure strand of Barringtonia was observed, a stand about 150 feet across, a rather unusual feature on atolls. No taro pits are planted to taro, but old pits contain banana plants. No Pemphis or Suriana were seen on the ocean side, Scaevola being the predominant shelter belt tree, plus a few Pandanus and Guettarda and another shrub resembling Scaevola.

On Makaru Islet only the lagoonward third appeared to be cleared and with coconut uncrowded by weed trees, the oceanward two-thirds being a jungle of undergrowth including numerous young coconut sprouts surrounding the adult palms.

As seen from the airplane pink algae appear to cover the windward seaward reef-edge.

#### Mejit Island

Mejit is a relatively large island as islets on reefs go. It has two sections once separated by a narrow channel, but no separate names were attached to them. The larger section which has the greatest breadth was known as the "main island," the other section was merely called "that island" or "the other part." The channel appears to have been no more than 100 feet wide or less at the ocean side, broadening to 400 feet or more towards the lagoon side. There also appeared to have been an inlet or tongue of the "lagoon" into "that island." on the lagoon side which now constitutes a salt lake with a marshy fringe. The formation of this appears to have occurred during Japanese occupation times when the channel gradually filled in with

sand pushed in by the tide from the "lagoon side," so that now there is a broad sandy connection between the two parts, making the whole a single island surrounded by a reef. On the leeward side of the island is a narrow shallow "lagoon" hardly more than 150 yards wide and stretching along much of the leeward side. At low tide, it takes only about ten minutes to walk from the village along the almost exposed reef to the ocean edge of the reef.

The leeward beach is of fine sand and unusually high, appearing 15-20 feet from low water to beach crest. The southwest beach also is sandy but much lower. The vegetated area here runs inward from the beach crest in a sandy strip 250 feet wide; then the land suddenly rises 5-6 feet in elevation in a line roughly SE to NW.

The vegetation reflects the low rainfall and is similar to that found on the islets of Likiep, Utirik, and Ailuk. Breadfruit trees are low, but appear to do well and are productive. There are numerous papaya trees and some banana trees. The undergrowth below the coconut trees characteristically is a mixture of various grasses and rather dense stands of arrowroot (Tacca), with few weed-tree or bush species, although Pandanus trees are numerous. The aspect is park-like, and it is easy to walk in any direction across the island. On the east-southeast side a gradual rise occurs about 200 feet from the beach ridge. Ipomoea tuba, a morning-glory type vine, without flowers at the time of observation, forms a dense ground cover in places in the interior. Scaevola and Messerschmidia form a shelter belt on the ocean side here, followed on the inward part by a zone of Pandanus 20-30 feet wide. Inward from the east beach Cassipoupa filiformis forms a dense ground cover together with Lepturus and other grasses for a width inland of over 250 feet. Roads 6-7 feet wide, bordered with a line of coral stones, extend through the village and around the main islet, as well as through sections of the adjoining "that island." Many of these roads are overgrown with low weeds and grasses, however. 600 feet inland from the east shore Ipomoea tuba so covers the ground to a height of several feet as to constitute a serious impediment to walking. Here also are found some Morinda bushes of small size. Another 100 feet westward and inward and not far from the village are numerous taro pits, some well weeded and with a water-filled "drainage" ditch around the edge of the pit; others abandoned and not in use for taro. Breadfruit trees on the banks of these pits are scrawny and small, with trunks of under 1-2 feet diameter and with the main trunks generally broken off and rotten after reaching a height of 20-30 feet. Pandanus trees are also rather low, but are numerous on the half of the islet occupied by the village.

The old channel and part of the inlet that now has become filled with sand have been planted during the last two to five years with coconut trees, most of which are doing rather poorly, appearing chlorotic. The lagoonward or, rather, leeward part of "that island" also has a soil of nearly pure sand on which the coconut trees are low, chlorotic and often dead. In sections of the filled-in channel now planted with coconut trees, there still remain numerous clumps of Pemphis acidula to show that this once stood in salt water. Doubtless underlying the sand around the Pemphis there is solid rock commonly found associated with this tree or bush. Bruguiera type mangrove trees line the edges of the salt pond and are backed by Pemphis. Only this one species of mangrove was noticed.

One species of bush which was very common in parts of the interior was a low growing type called ulej by the inhabitants (Clerodendrum inerme). It has a white flower forming an incomplete circle of petals somewhat like those of the Scaevola. A similar plant, also called ulej (Pseuderanthemum carruthersii), is sometimes used for hedges around residence lots.

Flies were numerous and annoying; small swarms of them followed one even on the breezy windward side beach.

### Namu Atoll

Our schooner made a landing on the leeward lagoon shore of Mai Islet of Namu Atoll. This islet showed an obvious change to a wetter climate in comparison with Maloelap. Mai is in the southeast end of the atoll. Coconut trees here are very tall and old, and the soil appeared black with humus and fertile. Breadfruit trees grew more than 90 feet tall, one was seen to be five feet in diameter at waist level.

The interior of the islet has a low swampy trough parallel to the shore. Coconuts sprouting 12-15 feet apart resulted in some crowding. Wedelia biflora weeds were rampant over much of the land. The soil surface was bouldery, with coconut fronds left about in disorder to rot. Morinda is a common understory tree with some Guettarda. Ipomea tuba grew on parts of the windward beach. On the southeast channel beach on the windward side of Mai grew some spray-burnt shrubs resembling Scaevola called ikung (Terminalia samoensis) by my informant. The burning method of clearing the underbrush had damaged some coconut trees in this part of the islet. A small pit with swamp taro was observed, the edges planted with banana trees. Only the single leaf type of fern (Polypodium scolopendria?) seen at Likiep was observed here, no Asplenium nidus and no Nephrolepis that characterize the wetter parts of the Marshalls. Prevalent weeds were Triumfetta procumbens, and a plant called kuli (Sophora tomentosa); a glossy-leaved tree called gizet and Bruguiera conjugata (called dzong) were observed.

The lagoon beach was clear of large trees and coconut trees for a distance of 20 feet back of the beach crest, and the sand was sparsely covered with grass and seedlings of Scaevola and Messerschmidia, indicating recent sand accretion.

The characteristic habit of Pandanus of sending aerial prop roots down from even upper branches was shown by an example of such a root reaching ten feet downward from the branch.

The taro-like plant called wot (Alocasia macrorrhiza), which is not edible, grew here in large numbers under the breadfruit and coconut trees. One taro pit was seen to be overgrown with weeds, while four breadfruit trees grew on its banks, each about a foot in diameter. The pit size was only 30 by 30 feet. Pandanus is the common beach-edge shrub, but I saw no Pemphis or Suriana.

There is some beach rock exposure on the lagoon shore in the north end of Mai Islet.

Across the lagoon from Mai, our schooner anchored off the leeward ocean side of the reef. On the rock flat of the reef near the pass there stands a huge boulder that appeared 6-7 feet high and perhaps 10 by 20 feet across, that must have been torn up from the reef edge by a storm wave. Observed in passing on the leeward side of the islet was a reef whose edge was only a few yards from the shore, the boulder rampart on the islet adjacent here appeared to rise 5-6 feet higher than where the reef edge was considerably farther out from shore. In an inter-islet channel on this same leeward (westerly) side of the reef, the reef flat was mantled with large boulders 3-5 feet in diameter.

### Ronlap (Rongelap) Atoll

In conversation with me on 22 June 1956 Maynard Neas, District Administrator at Majuro, described briefly the problem presented by the people of Ronlap (Rongelap) about 100 miles east of Bikini. They were victims of the fall-out of the bomb test two years ago when some of them suffered mild burns, hair fall-out, etc. As a result the people were evacuated by Navy landing craft and removed to a small islet of 16-18 acres on Majuro atoll which was administration property. Here the United States had built them a village of wooden houses (plywood) and the community as a whole was given a subsidy of \$1100 monthly.

The number of people evacuated from Ronlap included a few families in Ronrik (Rongerik) and Ailiniae (Ailinginae), which two atolls were worked as plantations by the Ronlapese who owned them and the total was only 74 people. Their atolls lie in the dry zone of the northern Marshalls and are not very productive, especially during the winter dry season. However, there are said to be five or six square miles of land above high tide altogether, and the people subsisted all right. Their settlement in Majuro with a regular cash income, however, was somewhat of a bonanza, since they had to do little for a livelihood aside from picking a few coconuts for their immediate needs, and do a bit of fishing. A few breadfruit trees also offered some variety together with some papayas. The cash income or subsidy enabled them to buy at the trading store what they needed or wanted. This attracted very soon a large number of extended family members or relatives and friends from other atolls. Now, two years later, the total population of "Ronlapese" has grown to 175 people.

The AEC has been conducting tests for lingering radio-activity from fall-out at Ronlap and the neighboring atolls, and it appears that this is largely gone, so that the Ronlapese may be returned to their atolls soon. This involves the question of rebuilding the homes on the atolls and of transporting the people there from Majuro atoll. The AEC has promised the Ronlap people that it would construct a new village for them, wooden houses similar to or better than the ones they now occupy on Majuro, and it inquired as to how many wanted to return. The Ronlapese were also informed that the subsidy would end with their return and they would again be on their own as before the tests of the bombs took place. The answer was rather surprising, since instead of a few more than the original 74 people that might be expected to want to go back, all of the 175 people now in the settlement wanted to go there. Mr. Neas thought that possibly the great attractions

were the wooden-tin-roofed houses which, although merely small one-room affairs, nevertheless provided a drier place to live and lasted a longer time without repairs than native houses. There possibly also has developed a community esprit-de-corps which may be a factor in the desire of the whole group to move there rather than for the hangers-on to disperse to their original areas of residence. Finally, there perhaps also may be some wishful thinking that in spite of the announced intention to discontinue the subsidy, the Americans might still subsidize them in some way.

Captain P. C. Staley, Commander of the Kwajalein Air Base, informed me that the problem of furnishing transportation for these people back to Ronlap had been dumped into his lap. He had not decided yet whether he would send them back by air or boat. Mr. Neas thought that the best way would be to send one or more landing craft to take the whole community at one time, as had been done when they were removed from Ronlap.

### Utirik Atoll

Utirik Atoll has few islands, and they are not large. The residential islet of Utirik is the largest, possibly 2500 feet long by about the same depth, roughly triangular, but with almost a mile of attenuated strip of bare sand in addition westward.

There are several rather unusual features about this islet. Along the north side of the eastward bulge oceanward and running for about  $\frac{1}{4}$  mile toward the lagoon with a width up to 100 yards, is one of the largest boulder and cobble beds and ramparts I have yet seen among the atolls. Much of it is bare, the rocks and cobbles turned black and gray with algae. Most of it, however, is covered with a wide stand of Scaevola shrubs. As the shoreline turns towards the southwest, an equally unusual sand beach and backshore development takes place, with a width of about 200 feet. This also is mostly covered with Scaevola, but with occasional Messerschmidia. On the south side of the island, where it abruptly narrows, the sand beach also narrows and is bordered by a long strip of exposed beach rock inward of which the ground has been scoured out by a typhoon which occurred, according to my informant, during pre-Japanese times, possibly the one of 1905. The beach rock extends with characteristic oceanward dip for a distance of more than a mile. Inward of it a desert-like expanse of sand and gravel stretches for a width of 500 feet and narrows as the end is approached. On the lagoon-side of this patch is a second line of beach rock, this time dipping down toward the lagoon and having a fine texture which shows clearly its origin from lagoon sand. A new ridge of sand has been built up lagoonward of this to a height of 5-6 feet and is covered with grass and occasional Scaevola. The large sand patch has scattered clumps of Pemphis, Scaevola, and Messerschmidia, and in one central spot, also half a dozen coconut trees with nuts. Most of it is bare, however. Because of the lack of cobbles and boulders in this scoured-out remnant of former vegetated land area, it can be assumed, perhaps, that the storm-wind came from the direction of the lagoon. This same wind probably accounts for the large sand beach development on the south side described above. The nature of the exposure and the position of an adjoining islet to the northeast would indicate that the storm wind probably swept across this section of the islet from a westerly direction.

A ten-foot long sawed-off section of a log three feet in diameter had drifted on to the southeastern sand beach. On it were cut the names Ole, and also Ha, and there was a blue-pencilled name, Halleck. Probably the log came from the northwest coast of the United States.

In the southwest end of the islet exposed to the sweep of the north or northeast wind from across the lagoon, the results of a second storm appear. This storm occurred in 1951, and brought the fall of 10-20 per cent of the coconut trees then standing. The trees lie fallen toward the south to southwest directions. Exposure of the roots shows the depth of the main roots to be about  $2\frac{1}{2}$  feet in a smallish clump less than 3 feet in diameter, with sand as the soil constituent.

The plantation vegetation is similar to that at Mejit and Ailuk. Arrowroot (Tacca) is omnipresent and quite dense, grasses of several species together with a fair amount of Triumfetta procumbens form the ground cover. Breadfruit trees here as elsewhere in the northern Marshalls are low, mostly from 20-30 feet high, some of the young vigorous ones well rounded and forming a beautiful tree. Few had trunks over a foot in diameter. This is partly explained by the fact that perhaps many, probably most, large breadfruit trees were blown over in the 1951 storm. Some black fungus or other disease had attacked many of the leaves of some trees observed. There were some abandoned taro pits in the interior, but I was told that no taro was being grown.