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Illustrations.[1]

Figs. 18, 19, 20, and 21 were provided by the courtesy of Dirk Spennemann.

[1] If not otherwise indicated photographs were taken by Carmen C.H. Petrosian-Husa, ethnographer of the Historic Preservation Office of the Marshall Island during the 2004 field survey and are © of the Historic Preservation Office of the Marshall Island.

Forward.

The following preliminary report is the result of a field research conducted between January 6-13, 2004 at Arno Atoll, Republic of the Marshall Islands and of some background research. Due to problems with weather and organization the actual research could not be conducted and this report is far from complete, but represents only the beginning of the 'Arno Atoll Survey Project', which will continue during the year 2004. According to schedule the final report will be presented in September 2004.

The research was conducted by the anthropologist of the Historic Preservation Office of the Republic of the Marshall Islands. The projects were all sponsored by the Republic of the Marshall Island's Historic Preservation Office and funded by the Historic Preservation Fund, National Park Service, Department of the Interior.

Our thanks go to our colleagues at the National Park Service, Paula Falk Creech, Mark Rudo, and David Look for their assistance and guidance. We could not have performed the survey without the assistance of many individuals at the Alele Museum, on Arno Atoll and in Majuro:

Bernice Joash, director of the Alele Museum, organized the fieldtrip and translated for the ethnograpaher,
MIMRA (Marshall Islands Marine Resource Authority) provided transportation and housing,
Clotomar Anni was our guide and chauffeur on Arno Atoll,
Hilmar Jormelu, Jimel Jarwin, and Lekdlik - our informants,
Mr. Nakamura, from MIMRA on Arno Atoll made our stay comfortable,
Junior Aini, proofread the sections in the Marshallese language,
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Frank R. Thomas as well as Clary Makroror from the Historic Preservation Office of the Republic of the Marshall Islands who assisted in logistics and library research.

Our further thanks go to the Minister of Internal Affairs and the Chairman of the Advisory Council for Historic Preservation, the Hon. Rien Morris, as well as to the Secretary of Internal Affairs and Historic Preservation Officer, Mr. Lenest Lanki. Finally our deepest thanks go to the people of Arno Atoll.

The research and this publication have been financed entirely with federal funds from the Historic Preservation Fund grant program in partnership with the National Park Service, Department of Interior. However the contents and opinions do not necessarily reflect the views or policies of the Department of Interior nor does the mention of trade names or commercial products constitute endorsement or recommendation by the Department of Interior.

Carmen C. H. Petrosian-Husa
Majuro Atoll, Marshall Islands
March 2004

I. INTRODUCTION.

1.1 Project Objectives.

The purpose of the survey was twofold. The first was to identify, record and evaluate the historic, prehistoric, and traditional sites located on the atoll in accordance with the survey and inventory program area of the Historic Preservation Office (HPO). The second was to educate the inhabitants of the atoll on the importance of protecting and preserving the sites that the team identified. As such the Historic Preservation Office made every effort to include the local population, their elected officials, and traditional chiefs and landowners in every step of the research. Local informants and guides were used throughout the research.

1.2. Evaluation of Research Design and Methods Used.

A) Non Intrusive Reconnaissance Survey.

The research conducted was a non intrusive" reconnaissance survey. The team did not remove any artefacts and/or food remains. The sites were identified with the help of local guides through a walking survey. The sites as well as the survey were documented on digital photographs. Informal interviews were conducted during the research *in situ*. The informants were asked for their consent in order to be mentioned in this report. All field notes and photographs of the survey on Arno Atoll are housed in the Historic Preservation Office, Majuro Atoll, Republic of the Marshall Islands.

Evaluation was classified according to the Republic of the Marshall Islands' site significance levels established by the RMI Historic Preservation legislation in 1992, determining the definition of significance based on the fact whether the site is determined to be prehistoric, historic or traditional. All traditional sites are determined as significant. Prehistoric or historic sites can be evaluated as being "very significant", "significant", "less significant", "insignificant", or "undetermined significant" [RMI Historic Preservation Legislation, regulations Governing Land Modification Activities, Section 6.]

A prehistoric site was considered "very significant" if it met at least one of the Marshall Islands' formal criteria:

(i) the resource is the only one of its kind known in the atoll concerned; or

(ii) the resource is part of an ensemble of sites, even if the individual sites as such would not be considered to be very significant; or

(iii) the resource is rich in cultural artifacts and undisturbed by construction activities; or

(iv) the resource is particularly well preserved; or

(v) the resource is connected with oral traditions important beyond the limits of the individual atoll on which the source is located.

A prehistoric site was considered "significant" if it met at least one of the Marshall Islands' formal criteria:

(i) the resource is the only one of its kind known on the islet concerned; or
(ii) the resource is rich in cultural artifacts and undisturbed by construction activities; or
(iii) the resource is well preserved; or
(v) the resource is connected with oral traditions.

A historic site was considered "very significant" if it met at least one of the Marshall Islands' formal criteria:

(i) the resource is the only one of its kind known in the Republic; or
(ii) the resource is part of an ensemble of sites, even if the individual sites as such would not be considered to be very significant; or
(iii) the resource is considered to be a prime example of the workmanship of a particular architect, builder or craftsman; or
(iv) the resource is rich in cultural artifacts and undisturbed by construction activities; or
(v) the resource is particularly well preserved and shows little or no alterations to the original appearance of the structure; or
(vi) the resource is connected with historic events or persons or oral traditions important beyond the limits of the individual atoll on which the source is located.

A historic site was considered " significant" if it met at least one of the Marshall Islands' formal criteria:

(i) the resource is the only one of its kind known in the atoll concerned; or
(ii) the resource is considered to be a good example of the workmanship of a particular architect, builder or craftsman; or
(iii) the resource is rich in cultural artifacts and relatively undisturbed by construction activities; or
(iv) the resource is well preserved and shows only limited alterations to the appearance of the original structure; or
(v) the resource is connected with historic events or persons or oral traditions important for the individual atoll on which the source is located.

The aim of the anthropological survey is to covered all sites, recorded by former archaeological teams, as well as others, significant events, and characteristics of this particular atoll. This survey can be used to establish eligibility for inclusion in the RMI National Register. Future researchers can use this information in assessing which sites are deemed significant enough to warrant further research, analysis, interpretation and/or protection and restoration. The survey followed the standards and guidelines of the grantor, the United States Department of Interior National Park Service Historic Preservation Fund.

B) Nomenclature.

In assigning sites, the system used in the Marshall Islands includes three two-letter abbreviations and then a site number. The first abbreviation identifies the site as located in the Marshall Islands (MI), the second is the atoll, Arno (AR), the third the islet, Arno (AR). Therefore the site MI-AR-AR-001 is the first site identified on the islet Arno in Arno -Atoll.

C) Schedule and Logistics of the Fieldtrip.

Initially the Arno Survey was scheduled for the beginning of February 2004. As transportation on such a big atoll is of vital importance a cooperation with MIMRA (Marshall Islands Marine Resources Authority) was agreed upon. MIMRA would provide lodging and transportation. Due to schedule of MIMRA as well as to weather conditions in February and March the field trip was delayed again and again. A short first trip to Arno was finally made from March 23-24, 2004. The survey team stayed at the MMRA facilities.

Fig. 1. MIMRA Facilities, Arno Island, Arno Atoll.

D) Team Members and Survey Equipment.

Staff Ethnographer: Carmen C.H. Petrosian-Husa

Translator: Bernice Joash, Director of the Alele Museum, Majuro.

During the survey on Arno, the anthropological team of the Alele Museum used the following equipment:

1 Canon EOS D60,

1 28mm - 135 mm Canon zoom lens,

2 512 MB compact flash cards,

notebooks, pens, and pencils

E) Informants/Guide.

Fieldwork on Arno Atoll relied heavily on informants and guides. Our guide was Clotomar Anni, from MIMRA (Marshall Islands Marine Resources Authority). Bernice Jaosh, who was born in Tutu Islet on Arno Atoll, not only translated for the ethnographer but also provided helpful insights and guidance.

Key informants on Arno Atoll were:

Jimel Jawin	born 1936, Jikuplik Clan, living on Arno Island.
Hilmar Jormelu	Jebo Island, teacher in Jebo Village; husband of Lañtimur Bohanny Jormelu, the *lerooj* of Arno Atoll.
Lekdlik Johnson	born in 1932, Raej Clan.

Fig. 2. Jimel Jawin.

Fig. 3. Hilmar Jormelu.

Fig. 4. Guide Clotomar Anni.

They provided a never exhausting pool of knowledge to be further investigated ethnographically. Since precisely locating sites on Arno was essential the use of a guide was necessary.

F) Survey Method.

The aim of the survey was to cover the entire atoll. During the two days stay on Arno Atoll only Arno, Jebo, and Ine Islands were visited, but not surveyed. No archaeological team accompanied the ethnographer, because several archaeological surveys had been conducted in the past.

Interviews were conducted at the sites as well as after visiting sites. The interviews were conducted according to needs (accompanying site information, historical events, personal experiences, etc.) therefore no specific questionnaire was developed. Informants as well as guides received compensation for their efforts.

1.3. Limitations of Research.

The ethnographic research of an atoll is supposed to gather information concerning all recorded sites as well as information on historical events or stories not related to any site. This goal was not achieved and the present report can only be seen as a preliminary one.

Two days in the field can only be considered to give a first impression. Arno is not only a big atoll with several inhabited islands and many more uninhabited ones but has 161 archaeological recorded sites[1] (not included sites from the Japanese time and WWII). To cover all of this needs more time in the field.

1.4. Previous Research.

Due to its proximity to Majuro and its interesting history many researches have been conducted on Arno Atoll. Most of these are of a biological nature. Some archaeological surveys and testings have been conducted in Arno Atoll, as for instance Dye (1981 1987), Rosenthal (1987), Streek (1988), and in 1972 Rynkiewich wrote his thesis, *'Land Tenure Among Arno Marshallese'*.[2]

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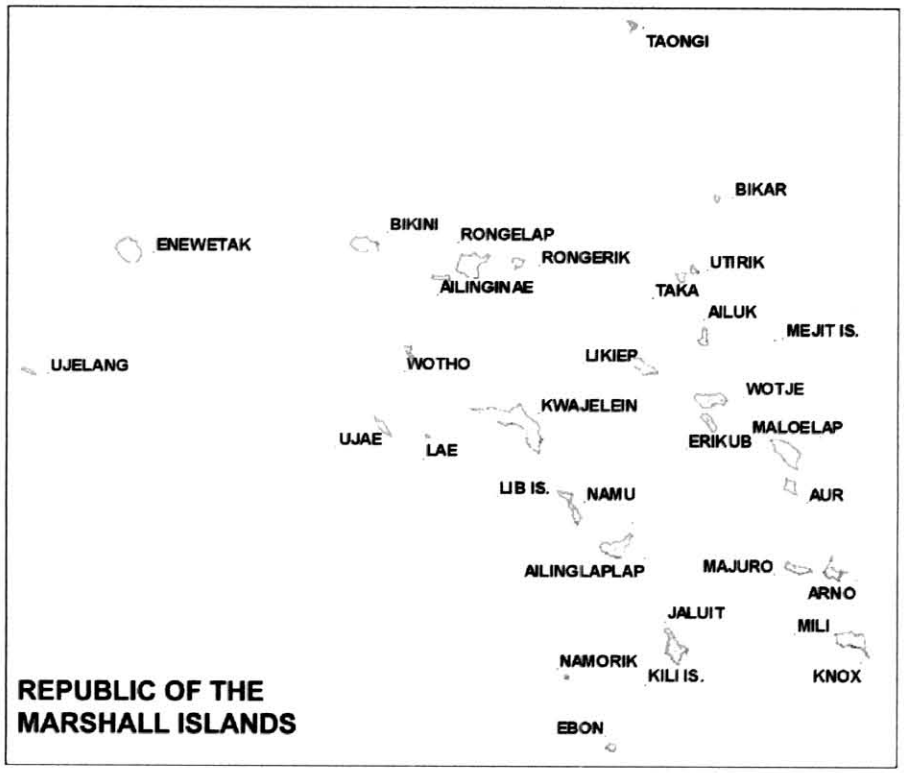
[1] Dye, 1981:18.

[2] See Bibilography p. 59

In the course of background research the handwritten field notes of the archaeological survey by C. Streek in 1988 have been used. These handwritten field notes are have been transcribed and are now in the library of the Alele Museum. Streek described 53 sites:

- Lamoka
1.2A Lwe en
1.2B Ale
1.2C Ale Lototak
1.3C Loan Warrior
1.3A Ale
1.4A Kabinbok
1.4B Jikin Tarinaieko
1.4C Stony Point
1.5A Uliej
1.5C Uliej
1.5D Uliekj in Jetnol
1.6A Paten ilo Ajeltak
1.6C Jabon Matolen Tu Rear
1.6D University of Arno
1.7C Me
1.8A Kapiroñ
2.2A Me en an Laktid
2.3A Ale
2.3B Illo Mejjen (Me)
2.3C Jikin Trainaie
2.3D Me en ilo Boken
2.4A Kabinbok
2.4B Jikin Tarinaie
2.5A Uliej
2.5C Ilkin Mwejeram
2.5D Uliej
3.2A Lwe en
3.3B Me
3.3C Alele Lipein
3.3C Kõtan Ine – Matolen
3.3D Me
3.4D Vietnam
3.5A Aneaitok
3.5B Uliej
3.5C Änekorea
3.5D Letbar
3.6B Jikin Bwilbwil
4.2A Lwe en
4.3D Me
4.5A Uliej
4.5B Uliej
4.5B Uliej Jikin Bwilbwilko
4.5C Uleij
4.5D Miej
5.1A Wod en iarin Äne eñiõñ
5.2A Me
5.3A Ale
5.5A Uliej
5.5D Uliej en ilo Weloken
8.5D Uliej en ilo Taie
10.5D Uliej en ilo Najbakä
11.5D Uliej en ilo Jemenmõñ



Map. 1. Republic of the Marshall Islands.

1.5. A Brief History of the Marshall Islands.

The people of the Marshall Islands refer to their parallel-chained archipelago as *Aeõñ Kein*, "These Atolls." According to folklore the first discoverers and settlers were a handful of wayfarers seeking an uninhabited autonomous area where they could live.[3] What little we know about early Marshallese comes from oral history and early accounts of explorers.

Marshallese autonomy was threatened when the first of eight known Spanish ships passed through the area. The first recorded sighting, probably Bokak Atoll, was made by Alonso de Salazar, commanding the *Santa Maria de la Victoria*, but no contact was made.[4] In 1529 contact was made by Alvaro de Saavedra of the *Florida* which laid anchor to take provisions at Enewetak or Bikini and stayed for eight days. He also discovered Utrõk, Taka, Ujelang, and made landings at Rongelap and Ailinginae. The Spanish flagship *Santiago* and five other ships in the expedition under Ruy Lopez de

[3] Hart, 1992.

[4] Levesque 1992a; Sharp, 1960:12.

Villalobos is credited for the western discovery of Wotje, Erikub, Maloelap, Likiep, Kwajalein, Lae, Ujae, and Arno. Landings were made on some of the islands.[5]

In 1565, Alonso de Arellano of the Legaspi expedition sighted Likiep, Kwajalein and an island thought to be Lib[6] while Legaspi himself is credited with sighting Mejit, Ailuk and Jemo. Some trading was done at Mejit.

The following year the mutineer Lope Martin commanding the *San Jeronimo* made several sightings and was eventually stranded in the Marshall Islands, probably on Ujelang. Two years later the Spanish ships, *Los Reyes* and *Todos Santos*, under Alvaro de Mendana went ashore at what is probably Ujelang. Namu was also thought to be sighted.[7]

Fifty seven years passed before another vessel is reported to pass through the Marshall Islands' chains. The Dutch ship *Eendracht* and ten other vessels of the Nassau fleet commanded by Admiral Gheen Schapenham sighted Bokak.[8] In spite of Spain's annexation of the Marshall Islands in 1686, the Spanish established no trading post, trade routes, or left any lasting influence.

In 1767 Captain Samuel Wallis of the British ship Dolphin sighted what is thought to be Rongerik and Rongelap.[9] Even though the Spanish were the first known westerners to see the Marshall Islands credit is given to Captain William Marshall, commander of the *Scarbough*, and to Thomas Gilbert, commander of the *Charlotte* for the discovery or more appropriately the rediscovery of the Marshall Islands in 1788. Marshall and Gilbert mapped these island groups and traded with the various atolls. They are the first westerners to sight Mili, Arno, Majuro, Aur, and Nadikdik.[10] They also sighted the previously discovered Wotje, Erikub, Maloelap, and Ailuk.

Captain Henry Bond aboard the British merchantman vessel *Royal Admiral*, sighted Namorik and Namu in 1792. Two years later the British ship *Walpole*, under the command of Captain Thomas Butler, sighted Enewetak. Thomas Dennet was the first westerner to sight Kili as well as reporting on Ailinglaplap, Lib, and doing some trading on Namu in 1797. Other vessels sailed through the area, including the British ship

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[5] Levesque 1992a; Sharp, 1960:28.

[6] Sharp, 1960.

[7] Levesque, 1992a.

[8] Hezel, 1979.

[9] Sharp, 1960:108; Hezel, 1979.

[10] Sharp, 1960:154.

Hunter, the British brig *Nautilus*, the ship *Ann & Hope* of Providence, *Ocean*, *Herald*, and *HMS Cornwallis*, to name a few. These ships sighted atolls and islands that had been previously reported but did not stop and trade. Jaluit was sighted by the *Rolla* in 1803 and again in 1809 by Captain Patterson of the British merchant brig *Elizabeth*, both of which landed and did some trading.[11]

The first scientific exploration of the Marshalls was conducted by a Russian, Otto von Kotzebue, in 1816-17 and 1824. It is during this time that first significant contact between Europeans and Marshallese was made. Von Kotzebue and his crew spent several months in the Ratak Islands in 1817 and 1824, specifically Wotje, Maloelap, and Aur Atolls. [12]

The account left by this expedition provides the first early ethnographic material including an interesting description of how Kotzebue was urged to help Lõmade defeat Latete, a powerful southern Ratak *Irooj*, and become *Irooj* of all Ratak. Although Kotzebue declined the offer, his influence was noted. Traditional warfare practices began to change soon after Kotzebue's first visit. Metal hatchets given as gifts were attached to wooden poles. Lõmade's troops used these new weapons to defeat the powerful *Irooj* and establish control over the Ratak Chain.[13]

Other ethnographic observations come from Lay and Hussey (1828), who survived the *Globe* mutiny at Mili Atoll, and Paulding (1831), a U.S. Navy lieutenant, who helped to retrieve Lay and Hussey. These early observers published accounts, which give us an insight to traditional personal appearance, manners, food, dwellings, and to a lesser extent, facets of political and social organization as reflected by traditional practices.

Prospects of profitable trade lured German entrepreneurs into the Marshall Islands in the latter part of the 19th Century. Subsequent contact with Europeans gradually increased as whalers concentrated their activities in the region. They were hunting to provide lamp oil to meet European and American demands. With disruptive and intolerant whalers as well as English blackbirders, both being in search of cheap labor to work the mines and plantations in the New World and Australia, encounters turned hostile. Numerous ships were attacked by the Marshallese and the crews killed; brutal

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[11] Sharp, 1960:173, 178, 183, 191; Hezel, 1979, 1983.

[12] Kotzebue, 1821; 1830; von Chamisso, [1836] 1986.

[13] Erdland, 1914; Krämer und Nevermann, 1938.

retaliation followed. The mood of contact in the first half of the 19th Century was one of confrontation.[14]

The treacherous reefs, reduced numbers of whales and the new method of distilling of kerosene from crude oil soon put the whalers out of business. The blackbirders however continued their raids until the 1870's.

In 1857 two American missionaries from the American Board of Commissioners for Foreign Missions, Congregationalists from the New England area, succeeded in setting up operations on Ebon (where as recently as 1852 a ship from San Francisco had been attacked and the entire crew killed).[15] The Marshallese *Irooj* opposed the missionaries and the establishment of new congregations throughout the 1860s because it eroded their power. This loss of power was somewhat alleviated by the establishment of permanent trading stations, as the demand for copra rapidly increased. The chiefly power base gradually shifted from control over the land to control over the trade between the Marshallese and the foreigners.[16] Ebon remained the mission center, from which occasional trips were made throughout the southern atolls, until in 1880, when the station was moved to Kosrae in the eastern Carolines.

Changes in the Marshallese way of life had been rapid and extensive. The dominant contact with the outside world had been through missionaries sent or trained by the American Board. Yet virtually no ethnographic description is to be found among the voluminous records kept by the missionaries. Instead they were "not only indifferent, but supremely scornful of the religious beliefs [of the Marshallese]. They tried to extinguish them completely and to destroy every trace of them.[17] The ethnography summarized by the Germans, Erdland (1914) and Krämer and Nevermann (1938), coincided with major structural changes in the Marshallese way of life. Writing in about 1905, the German ethnographer and priest Erdland commented, "the present generation no longer has any exact knowledge of the inner coherence of the ancient traditions.[18]

Other factors also influenced these changes. The copra trade dates from about 1860 in the Marshall Islands and American, Australian and German firms often had

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[14] Hezel, 1979, 1983; Dye, 1987.

[15] Hezel, 1979.

[16] Dye, 1987.

[17] Knappe, 1888.

[18] Erdland, 1914:307.

resident traders on the various atolls. Beachcombers added to the resident white population , often filling the role of trader as well.

In 1885 the Marshall Islands became a protectorate of Germany, as the Marshall Islands were not under the sovereignty of any civilized state".[19] During the German era, which lasted until 1914, the atolls were visited regularly, by traders, missionaries, and administrative officials. Administration of the area was carried out by the German trading company, Jaluit *Gesellschaft*. This firm which resulted from a merger of companies active in the area, Robertson and Hernsheim, and *Deutsche Handels - und Plantagengesellschaft* (D.H.P.G.) (formerly *Johann Godefroy und Sohn*), had exclusive trading rights in the Marshalls. Despite complaints about this monopoly by the Australian firm Burns Philip and Co., the new Zealand company, Henderson and MacFarlane, and others, the German government continued to act on the advice of the Jaluit *Gesellschaft* until 1902 when it assumed direct administration of Micronesia.[20]

Fig.5. German 'Reichsadler'.

This form of administration, with primarily an economic focus, had little impact on the health and educational level of the Marshallese. In this regard, the missionaries were of greater importance. Select groups of Marshallese were educated in the German language to serve as interpreters and the services of a doctor were available on occasion. Copra was the main product of the Marshalls and production was stimulated by taxes assessed through the traditional leaders as well as through the availability of Western goods. This form of indirect rule strengthened the traditional political organization of the Marshallese, while the German administration dealt mostly with conflicts between foreigners and the *Irooj*.[21]

Warfare between the island *Irooj* was eliminated, an act which froze the relative social positions of the *Irooj* and their *jowi* (clan) and created a condition of inflexibility in the social system; in addition it allowed increased trading and missionary activity and

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[19] Pauwels, 1936.

[20] Hezel, 1983.

[21] Hiery, 1995.

thus contributed to more rapid cultural change.[22] German ethnographers were active in this period and it is largely through their efforts, especially in the many volumes published on Micronesia by the German Südsee-Expedition of 1908-1910 that much is known of the traditional way of life.[23]

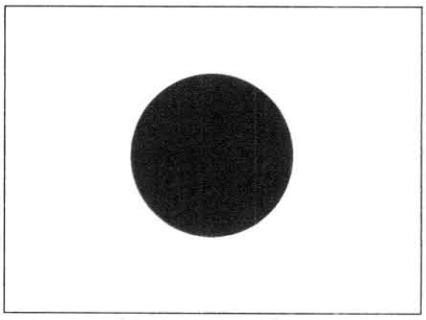

Fig.6. Japanese flag.

In 1914 at the beginning of World War I, the Marshall Islands were taken from Germany by Japan. They shifted to a system of direct rule through a set of community officials and greatly expanded the administrative staff. Traders of other nationalities were excluded and the Japanese attempted to expand copra production. Protestant and Catholic missionary activity was allowed to continue unhampered, and in the general the Marshallese appear to have gotten on well with the Japanese.[24] The Japanese did conduct ethnographic research, however most of this material has not yet been translated into English.

The Japanese military, through the South Seas Defense Corps, governed the Marshalls until 1918. From 1918 until 1920, a combined civilian and military government was in charge. In 1920 Japan was awarded Micronesia as a Class 'C' mandate by the League of Nations (although they continued to submit annual reports through 1937). After 1933, the Japanese considered the Marshalls and the rest of Micronesian mandate, an integral part of the Japanese Empire.[25]

During the Japanese era, the administration had several goals; the economic development of Micronesia, the use of the islands as an immigrant settlement for Japan's rapidly increasing population, the Japánization of the islanders through education, language training, and enforced cultural change, and eventually, the use of the islands for military bases in anticipation of World War II.[26]

For the Marshallese improvement in health and sanitation were minimal. The "availability of adequate medical care was directly related to one's ability to pay" and

---

[22] Spoehr, 1949.

[23] Krämer and Nevermann, 1938, Ratak - Ralik, is a result of this expedition.

[24] Spoehr, 1949.

[25] Peattie, 1988.

[26] Peattie, 1988.

despite a sliding fee scale, "the poorer and generally unhealthier native received less care".[27]

Education was also segregated and of differential quality. Ethnic Japanese were offered a school system identical to the one in Japan, while the Marshallese received three years of primary education consisting mostly of Japanese language instruction and ethics classes, with an additional two years for the more promising students.[28]

The Japanese administration also attempted to make a number of changes in the Marshallese social and political organization. They appointed non-*Irooj* Marshallese leaders, which was contrary to the existing political structure, thus weakening the position of the traditional leader.[29] The Japanese also attempted to change the Marshallese social organization of matrilineality to conform to the Japanese system of patrilineality, more like their own system, with little success.

In the early 1930s, Japan began to construct fortifications on Kwajalein, Enewetak, Jaluit, Wotje, Mili, and Maloelap. Marshallese were conscripted to labor on these buildings and were resettled.[30] World War II started in 1941. In 1944, U.S. forces concentrated on gaining supremacy in the Pacific. Kwajalein, Majuro, and Enewetak were captured within one month. All of the other atolls except Wotje, Maloelap, Mili, and Jaluit were checked for Japanese in the next two months. In those bypassed atolls, the Marshallese escaped or were removed under cover of night and resettled temporarily on Majuro, Arno, or Aur atolls.[31] The U.S. fortified Enewetak and Kwajalein atolls as military bases.

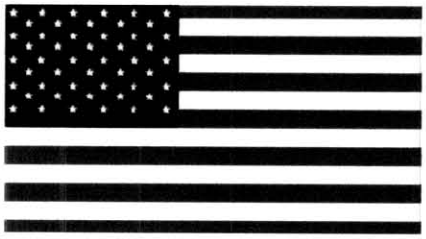

Fig. 7. American flag.

After World War II, the United States took over trusteeship of the Marshall Islands. In this time extensive ethnographic research was conducted in the Marshall Islands. Beginning with Spoehr's work on village life in Majuro (1949), ethnographers have concentrated on community studies. The primary sources are Mason (1947, 1954) whose focus is economic organization; Kiste (1967, 1974) who deals with resettlement issues, Davenport (1952, 1953), and Chambers (1969, 1972) who concentrates on oral traditions.

---

[27] Shuster, 1978.

[28] Hezel, 1995.

[29] Bryan, 1972.

[30] Peattie, 1988.

[31] Smith, 1955.

During this period, from June 30. 1946, to August 18. 1958, the United States also conducted 67 underwater surface and atmospheric tests of atomic and thermonuclear weapons in the Marshall Islands. [32]

	Date	Site	Type	Yield (kt.)	Operation	Test
1.	6/30/46	Bikini	Airdrop	21.00	Crossroads	Able
2.	7/24/46	Bikini	Underwater	21.00	Crossroads	Baker
3.	4/14/48	Enewetak	Tower	37.00	Sandstone	Xray
4.	4/30/48	Enewetak	Tower	49.00	Sandstone	Yoke
5.	5/14/48	Enewetak	Tower	18.00	Sandstone	Zebra
6.	4/7/51	Enewetak	Tower	81.00	Greenhouse	Dog
7.	4/20/51	Enewetak	Tower	47.00	Greenhouse	easy
8.	5/8/51	Enewetak	Tower	225.00	Greenhouse	George
9.	5/24/51	Enewetak	Tower	45.50	Greenhouse	Item
10.	10/31/52	Enewetak	Surface	10,400.00	Ivy	Mike
11.	11/15/52	Enewetak	Air Drop	500.00	Ivy	King
12	3/1/54	Bikini	Surface	15,000.00	Castle	Bravo
13.	3/26/54	Bikini	Barge	11,000.00	Castle	Romeo
14.	4/6/54	Bikini	Surface	110.00	Castle	Koon
15.	4/25/54	Bikini	Barge	6,900.00	Castle	Union
16.	5/4/54	Bikini	Barge	13,500.00	Castle	Yankee
17.	5/13/54	Enewetak	Barge	1,690.00	Castle	Nectar
18.	5/2/56	Bikini	Air Drop	3,800.00	Redwing	Cheroke
19.	5/4/56	Bikini	Surface	40.00	Redwing	Lacrosse
20.	5/27/56	Enewetak	Surface	3,500.00	Redwing	Zuni
21.	5/27/56	Bikini	Tower	0.19	Redwing	Yuma
22.	5/30/56	Enewetak	Tower	14.90	Redwing	Erie
23.	6/6/56	Enewetak	Surface	13.70	Redwing	Seminole
24.	6/11/56	Bikini	Barge	365.00	Redwing	Flathead
25.	6/11/56	Enewetak	Tower	8.00	Redwing	Blackfoot
26.	6/13/56	Enewetak	Tower	1.49	Redwing	Kickpoo
27.	6/16/56	Enewetak	Air Drop	1.70	Redwing	Osage
28.	6/21/56	Enewetak	Tower	15.20	Redwing	Inca
29.	6/25/56	Bikini	Barge	1,100.00	Redwing	Dakota
30.	7/2/56	Enewetak	Tower	360.00	Redwing	Mohawk
31.	7/8/56	Enewetak	Barge	1,850.00	Redwing	Apache
32.	7/10/56	Bikini	Barge	4,500.00	Redwing	Navajo
33.	7/20/56	Bikini	Barge	5,000.00	Redwing	Tewa
34.	7/21/56	Enewetak	Barge	250.00	Redwing	Huron
35.	4/28/58	Nr Enewetak	Ballon	1.70	Hardtacki	Yucca
36.	5/5/58	Enewetak	Surface	18.00	Hardtacki	Cactus
37.	5/11/58	Bikini	Barge	1,360.00	Hardtacki	Fir
38.	5/11/58	Enewetak	Barge	81.00	Hardtacki	Butternut

[32] U.S. Department of Energy, United States Nuclear Tests, Nuclear Claims Tribunal.

39.	5/12/58	Enewetak	Surface	1,370.00	Hardtacki	Koa
40.	5/16/58	Enewetak	Underwater	9.00	Hardtacki	Wahoo
41.	5/20/58	Enewetak	Barge	5.90	Hardtacki	Holly
42.	5/21/58	Bikini	Barge	25.10	Hardtacki	Nutmeg
43.	5/26/58	Enewetak	Barge	330.00	Hardtacki	Yellowwd
44.	5/26/58	Enewetak	Barge	57.00	Hardtacki	Magnolia
45.	5/30/58	Enewetak	Barge	11.60	Hardtacki	Tobacco
46.	5/31/58	Bikini	Barge	92.00	Hardtacki	Sycamore
47.	6/2/58	Enewetak	Barge	15.00	Hardtacki	Rose
48.	6/8/58	Enewetak	Underwater	8.00	Hardtacki	Umbrella
49.	6/10/58	Bikini	Barge	213.00	Hardtacki	Maple
50.	6/14/58	Bikini	Barge	319.00	Hardtacki	Aspen
51.	6/14/58	Enewetak	Barge	1,450.00	Hardtacki	Walnut
52.	6/18/58	Enewetak	Barge	11.00	Hardtacki	Linden
53.	6/27/58	Bikini	Barge	412.00	Hardtacki	Redwood
54.	6/27/58	Enewetak	Barge	880.00	Hardtacki	Elder
55.	6/28/58	Enewetak	Barge	8,900.00	Hardtacki	Oak
56.	6/29/58	Bikini	Barge	14.00	Hardtacki	Hickory
57.	7/1/58	Enewetak	Barge	5.20	Hardtacki	Sequoia
58.	7/2/58	Bikini	Barge	220.000	Hardtacki	Cedar
59.	7/5/58	Enewetak	Barge	397.00	Hardtacki	Dogwood
60.	7/12/58	Bikini	Barge	9,300.00	Hardtacki	Poplar
61.	7/14/58	Enewetak	Barge	Low	Hardtacki	Scaevola
62.	7/1/58	Enewetak	Barge	255.00	Hardtacki	Pisonia
63.	7/22/58	Bikini	Barge	65.00	Hardtacki	Juniper
64.	7/22/58	Enewetak	Barge	202.00	Hardtacki	Olive
65.	7/26/58	Enewetak	Barge	2,000.00	Hardtacki	Pine
66.	8/6/58	Enewetak	Surface	Fizz	Hardtacki	Quince
67.	8/18/58	Enewetak	Surface	0.02	Hardtacki	Fig

Table 1. List of atomic tests in the Marshall Islands.

The most powerful of those tests was the "Bravo" shot, a 15 megaton device detonated on March 1, 1954, at Bikini atoll. That test alone was equivalent to 1,000 Hiroshima bombs. While the Bravo test is well known, it should be acknowledged that 17 other tests in the Marshall Islands were in the megaton range and the total yield of the 67 tests was 108 megatons, the equivalent of more than 7,000 Hiroshima bombs. From 1945 to 1988, the U.S. conducted a total of 930 known nuclear tests with a combined yield estimated to be 174 megatons. Approximately 137 megatons of that total was detonated in the atmosphere. In other words, while the number of tests conducted in the Marshall Islands represents only about 14% of all U.S. tests, the yield of the tests in the Marshalls comprised nearly 80% of the atmospheric total detonated by the U.S.[33]

[33] http://nuclearhistory.tripod.com/testing.html.

Numerous Marshallese have suffered from cancers, leukemia and other life-threatening diseases directly connected to nuclear radiation poisoning.

Testing of intercontinental missiles continues at Kwajalein, the target lagoon for missiles launched from Vandenberg Air Force Base in California. Under the terms of the Revised Compact of Free Association the United States will retain rights to the Kwajalein atoll until 2066.[34]

Today, as a result of American testing, about twenty percent of the land of the Marshall Islands is unavailable to the people, because of toxic radioactive wastes due to the nuclear testing, and because of continued use, principally at Kwajalein, by the United States.[35]

[34] http://www.umc-gbcs.org/getinvolved/viewarticle.php?csa_articleId=205.

[35] http://www.umc-gbcs.org/getinvolved/viewarticle.php?csa_articleId=205.

1.6. Important Historical Events for Arno Atoll.

Names under which the atoll is known in old sources:

Arno
Arnho
Daniel I.
Daniel- and Pedders Islands[36]
High (islet)
Pedders I.
Peddlar (mispelling)

US. Navy Codenames used during WWII and during the nuclear testing period:

Lobworn
Losworm
Separate

ca. 2000 BC - 500 BC The first Micronesian navigators arrive in the Marshalls, calling the atolls *Aeõñ Kein Ad* (our islands). Dates and origins of the settlers are still uncertain. Relatively little is known about the prehistory of the people They are thought, like other Pacific Islanders, to have originated in Southeast Asia and to have established themselves on their scattered islands centuries before European voyagers reached this area. Early accounts depict Marshallese society as having much in common with other Micronesian islands, such as the Carolines. Chieftainship was strong and material culture, given the paucity of natural resources, was relatively advanced. Early Marshallese were regarded as superb canoe builders and sailors.

1494 The treaty of Tordesillas cedes ownership of all Micronesia to Spain.

1527 Three ships under Alavaro de Saavedra, sent from Mexico to seek news in the Moluccas of the Magellan and Loaisa expeditions, are sent to the area of the Marshalls (Sharp 1960:18, Levesque 1992).

1529 The Spanish flagship *Santiago* and five other ships in the expedition under Ruy Lopez de Villalobos is credited for the western discovery of Wotje, Erikub, Maloelap, Likiep, Kwajalein,

[36] Gilbert 1788.

	Lae, Ujae, and Arno. Landings were made on some of the islands.[37]
1788	The *Scarborough* (Captain John Marshall) and *Charlotte* (Captain Thomas Gilbert) sight Mili, Arno, Majuro, Aur, Maloelap, Erikub, and Wotje Atolls while proceeding to China from Botany Bay.[38] The name Marshall Islands is later applied to the group as a whole by Russian hydrogapher A. J. Krusenstern.
1788	Arno, separated from Majuro by the Fordyce Channel, named in 1788 by Gilbert. Gilbert considered Arno two islands, which he named Daniel and Pedder. Tanner was the first to clear up the mistake.[39]
1800s	Wotje, Utrõk, Mejit, Maloelap are allied with Aur and *Irooj* Lõmade against Arno, Majuro, etc.[40] Lõmade inherited his position as *Irooj* from his great-great grandmother Litarau matrilineally through Legerinoa, Leom, and Limidjoa.[41]
1817	Kotzebue met up with *Iroojlaplap* Lõmade and was told he was about 30 years old; he was a native of Arno who had gained his power by murdering all of the *Irooj* of Aur, Maloelap, and Uterõk.[42] The Ratak Islands that did not belong to Lomadde (Majuro, Arno, and Mili) belonged at that time to the *Irooj* Latete, against whom Lõmade was waging war.[43]
1817	Lõmade, the *Iroojlaplap* over Aur, Maloelap, and Wotje desired to attack his ennemies of Arno, and Mili under Latete. Captain von Kotzebue gave him some lances and grappling hooks, for which he received in turn six bundles of preserved pandanus. The new weapons put an end to the war in six days. Of the several hundred persons engaged only five had fallen.[44]
1820s	American whalers seeking food and water begin visiting the Marshall Islands. Some of these occasionally leave men on shore who become beachcombers and, later, traders.[45]

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[37] Levesque, 1992a; Sharp, 1960:28.

[38] Sharp, 1960:154.

[39] Krämer und Nevermann, 1938:70, citing Meinicke.

[40] von Chamisso, [1836] 1986.

[41] Krämer and Nevermann, 1938.

[42] Von Chamisso, [1836] 1986.

[43] Krämer und Nevermann, 1938.

[44] Finsch, 1893.

[45] Hezel, 1983.

1823	*Iroojlaplap* Lõmade Juen, of the clan Rimwejoor, conquered all the islands of the Ratak Chain and ultimately conquered Kwajalein, Lae, Ujae, Arno, Rongelap, Bikini, Enewetak, and Ujelang in the Ralik Chain.[46]
1840	Kaibõke had become the second-highest chief of the southern Ralik after he married the daughter of the paramount chief. Kaibõke was feared on account of his attacks on foreign ships.[47]
1842	Kaibõke Lobadeo of Ebon assumes power as the *Iroojlaplap* of the Southern part of the Ralik chain.[48]
1851	70 people of Ebon (including Kaibõke's brother) are killed when an American whale ship fires at their canoes in revenge for a trader's murder. Kaibõke swears to kill all whites in revenge for his brother's murder by the whalers.[49]
1852 Jan. 1.	British man-of-war, *HMS Serpent* under Commander L.U. Hammet, landed at Arno where officers exchanged biscuits for coconuts.[50]
1857	Rev. Hiram Bingham Jr. of the American Board of Commissioners for Foreign Missions (ABCFM) creates a missionary outpost on Ebon. Kaibõke supports their work.[51]
1860s	American and Hawaiian Protestant missionaries arrive, sent by the Hawaiian Evangelical Association, an auxiliary of the American Board of Commissioners for Foreign Missions. About this time J.C. Godefrroy und Sohn, of Samoa, establishes trading stations on Mili, Aur, Jaluit, Ebon and Namdik. A few years later, two other German companies, Hernsheim &Co. and A. Capelle &Co., are also in business there. Copra is their principal interest.[52]
1863	Kaibõke dies of typhoid fever.[53]
1870	After Kabõke's death, Kabua (Lebon) a *leadakkad* of Rongelap, becomes *Irooj* when he marries Lomokoa, the widow of the Kaibõke of Ebon.[54]

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[46] Krämer und Nevermann, 1938; RMI Ministery of Education, 1996.

[47] Krämer und Nevermann, 1938.

[48] Krämer und Nevermann, 1938, RMI Ministry of Education, 1996.

[49] Erdland, 1914.

[50] http://www.micsem.org/pubs/articles/historical/forships/marshalls.htm.

[51] Hezel, 1983.

[52] Hezel, 1983.

[53] Krämer und Nevermann 1938.

[54] Erdland, 1914; Krämer und Nevermann, 1938.

1876	Loeak and Kabua fight about who should be *Iroojlaplap*. Loeak chases Kabua from Ebon.[55]
1878	Germany enters into a treaty with inhabitants of the Ralik chain, granting special trade privileges. Kabua (Lebon) presents himself to the German government as the *Iroojlaplap*. Kabua, Lagajimi, Nelu, Loeak, and Launa, all sign the treaty.[56]
1880	Loeak goes to Jaluit from Ebon to challenge Kabua in battle. After a bloodless fight, Loeak returns to Ebon.[57]
1885	Under meditation of Pope Leo XIII, the German government annexes the Marshall Islands.
1885	Loeak is the chief in the southern Ralik. Murjil, Irooj of Aur controls northern Ratak. In northern Ralik and southern Ratak, individual atolls are in most instances ruled by independent local *Irooj*.[58]
1886	By agreement with Great Britain the Marshall Islands became a German protectorate.
1887	Germans form the Jaluit Company (Jaluit *Gesellschaft*), an entity entrusted with governance of the Marshalls. It buys out two foreign competitors based in San Francisco and Aukland. However, Burns, Philip & Co. of Sydney, which has been trading in the group for some years, continues to do so and remains until World War I.[59]
1899	Flooding of several atolls occurred, most likely as the result of a typhoon. On Arno a piece of land with some 100 coconut palms on it was washed away.[60]
1900	A typhoon struck the southern Marshalls.[61]
1910	Kabua dies.[62]
1910	The German Station Director approached Leit to purchase 5 atolls (Bikini, Rongerik, Rongelap, Ailinginae and Arno) for 18.600 German Mark, but Leit refused to sell.[63]

[55] Krämer und Nevermann, 1938.
[56] Krämer und Nevermann, 1938.
[57] Krämer und Nevermann, 1938.
[58] Krämer und Nevermann, 1938.
[59] Hezel, 1995.
[60] Spennemann and Marschner, 1994.
[61] Spennemann and Marschner, 1994.
[62] Krämer und Nevermann, 1938.
[63] Walsh, 2003:175-176.

1914	The Marshall Islands are taken over from Germany by Japan.
1920	The Marshall Islands are mandated to Japan by the League of Nations, together with the other occupied islands. The group is administered as a separate district. The Marshallese are given little voice in their own government. Copra has to be exported to Japan at a price fixed by the Japanese.[64]
1921	The Japanese take over the copra industry from the Germans, replacing the Jaluit *Gesellschaft* with the *Nanyo Boeki Kaisha.*[65]
1934	Japan withdraws from the League of Nations, but retains possession of the Marshall Islands Fortification of the islands begins as Japan prepares for war. The Japanese military begins building airstrips, power plants, and bunkers.[66]
1939	World War II begins in Europe.
1945	End of World War II grants effective control of the Marshalls to the U.S.
1946 February	The U.S. established the Pacific Nuclear Proving Grounds in the Marshalls beginning with Bikini Atoll and in
1946 December	Enewetok was also included.[67]
1946	Operation Crossroads is launched with "Able" (June, 30) and "Baker" (July, 24) nuclear tests at Bikini; both are Hiroshima-size atomic tests.
1947	The Marshall Islands become part of the United States Trust Territory of the Pacific Islands (TTPI) following three years of American military administration.
1948	Operation Sandstone was conducted at the Pacific Proving Grounds.[68]
1951	US Department of the Interior assumes responsibility within the US government for the Trust Territory of the Pacific Islands (TTPI) from the Department of the Navy.
1951	Operation Greenhouse was conducted at the Pacific Proving Grounds.[69]
1952	The first hydrogen device - Operation Ivy - under the US testing program in the Marshalls is fired on Enewetak on March 1st.[70]

[64] Hezel, 1995.

[65] Peattie, 1988.

[66] Peattie, 1988.

[67] http://nuclearhistory.tripod.com/testing.html.

[68] http://nuclearhistory.tripod.com/testing.html.

[69] http://nuclearhistory.tripod.com/testing.html.

1954 March 1. US nuclear testing program detonates Bravo, the most powerful hydrogen bomb ever tested by the U.S., on Bikini atoll. Radiation from the test forces evacuation of Marshallese and U.S. Military personnel on Rongelap, Rongerik, Utirõk, and Ailinginae.[71]

Fig. 8. Detonation of Bravo.

1954 March 2. In a flyover 0.001 R/hr are measured at Arno Atoll.[72]

1955 Operation Wigwam was conducted at the Pacific Proving Grounds.

1958 Operation Hardtack I was conducted at the Pacific Proving Grounds.[73]

1961 Peace Corps is founded and the first volunteers are dispatched to the Marshall Islands.

1963 August The signing of the Limited Test Ban meant the end of atmospheric testing and therefore the end of testing in the Marshall Islands.[74]

1965 The Congress of Micronesia is formed, with representatives from all the Trust Territory of the Pacific Islands. It is created by the

[70] Deines at al., 1990.

[71] Deines at al., 1990.

[72] http://nuclearhistory.tripod.com/testing.html.

[73] http://nuclearhistory.tripod.com/testing.html.

[74] http://nuclearhistory.tripod.com/testing.html.

U.S. administration in preparation for greater self governance by Micronesians.

1979 Amata Kabua is selected as the first president of the Marshall Islands.

1979 The government of the Marshall Islands is officially established and the country becomes self governing.

1980 The Airline of the Marshall Islands (AMI) begins operation, serving eight locations; Enewetak, Bikini, Kwajalein, Mili, Likiep, Maloelap, Wotje, and Majuro.

1982 Official name changed to the Republic of the Marshall Islands (RMI).

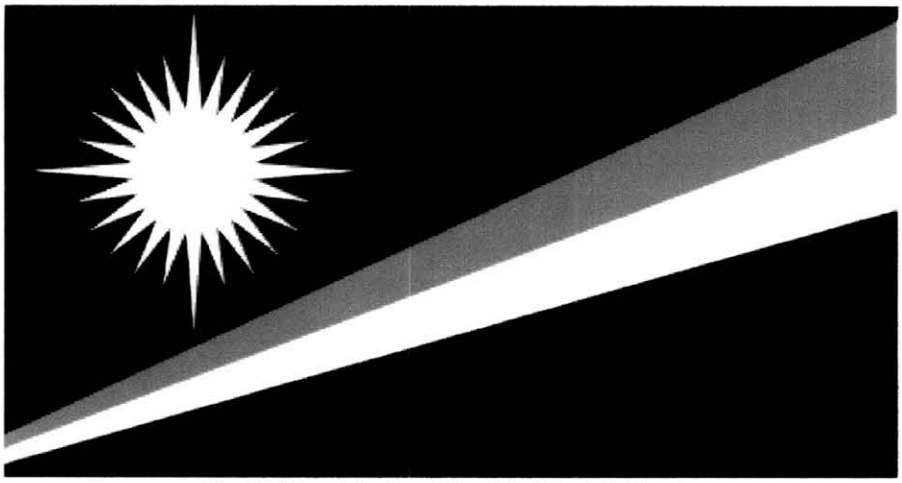

Fig. 9. Flag of the Republic of the Marshall Islands.

1983 Amata Kabua selected a second time as president.

1983 Voters in the RMI approve the Compact of Free Association with the United States.

1986 U.S. Congress approves the Compact, resulting in its entry into force. The Compact grants the RMI its sovereignty and provides for aid and U.S. defense of the islands in exchange for continued U.S. military use of the missile testing range at Kwajalein Atoll.

1986-1996 152 Peace Corps volunteers were stationed in the Marshall Islands[75]

1987 In third election, Amata Kabua is elected as president.

[75] Personal correspondence with A. J. Wickenheiser, Peace Corps Office.

1988	The Nuclear Claims Tribunal to address personal injury and property claims resulting from the nuclear testing in the Marshall Islands and provided for in the Compact of Free Association was begun.[76]
1990s	Settlement of compensation claims as a result of the U.S. nuclear testing in the Marshalls still proceeds, and is associated with various agreements being made as part of the Compact of Free Association package. There are also outstanding court cases. Almost 5000 islands had sought compensation from Nuclear Claims Tribunal and, up to September 1993, some 380 had been granted compensation totaling about $ 14 million; only a quarter of which had been paid.[77]
1990	U.N. Security Council terminates the RMI's trusteeship status.
1991	In fourth election Amata Kabua is elected as president.
1991	RMI joins the United Nations.
1994	The U.S. Department of Energy begins releasing thousand of previously classified nuclear test era documents, many of which confirm the wider extent of the fallout contamination in the Marshall Islands.
1994 December	A five-year study of 432 islands in the Marshall Islands shows that 15 atolls and single islands -almost half of this nation were dusted by radioactive fallout from the U.S. nuclear weapons tests of the 1950s.[78]
1995 February	Marshall Islands officials testify before President Clinton's Advisory Committee on Human Radiation Experiments in Washington, D.C. stating that fallout exposed many more than the four atolls acknowledged by the U.S. government, and that islanders were purposefully resettled on contaminated islands so the U.S. could study the long-term effects of radiation.[79]
1996	In fifth election Amata Kabua is elected as president.
1996	Amata Kabua dies.
1997	Imata Kabua is selected to finish the late Amata Kabua's term.

[76] http://nuclearhistory.tripod.com/testing.html.

[77] Deines at al., 1990.

[78] http://resourcescommittee.house.gov/106cong/fullcomm/99may11/debrumt.htm.

[79] http://resourcescommittee.house.gov/106cong/fullcomm/99may11/debrumt.htm.

Arno Atoll - Cumulative Doses by Event and Location (Finite Dose to Next Event)--mr						
Bravo	Romeo	Koon	Union	Yankee	Nectar	Total
60	200	300	8	25	1.3	594
Days between events.						
26	11	19	9	9	10	

Table 2. Arno Atoll, radio active doses.[80]

2000	In sixth election Kessai Hesa Note is elected as president.
2001	First Compact of Free Association expires.
2003	Second Compact of Free Association comes into effect.
2003	In seventh election Kessai Hesa Note is elected as president.

[80] Congressional Record: May 12, 1999 (House), Page H3063-H3065. http://www.fas.org/sgp/news/1999/02/faleo.html.

II. ENVIRONMENTAL SETTINGS.

2.1. Physiographic and Biological Setting.

Located in the central Pacific between 4° and 14° north latitude and 160° and 173° east longitude, the Republic of the Marshall Islands consists of 29 low lying coral atolls and five coral islands (Map 1). Twenty-two of the atolls and four of the islands are presently inhabited. The atolls and islands are situated in two almost parallel chain-like formations. The eastern group is the Ratak (Sunrise) Chain and the western is the Ralik (Sunset) Chain, which together extend about 700 miles (1,130 km) north to south and approximately 800 miles (1290 km) east to west. Surrounded by ocean, the Republic is more than 2,000 miles (3,230 km) from the nearest trading centers, Honolulu and Tokyo. Its nearest neighbors are Kiribati to the south and the Federated States of Micronesia to the west.

There are approximately 1,2025 islets spread across an area of over 750,000 square miles (1.2 million square km). With a total land area of over 70 square miles (110 square km), a mean height of 7 feet (2 meters) above sea level, and soils that are nutrient poor, the nations agricultural base is limited. The marine resource base, however, is extensive. The combined lagoon area totals 4,037 square miles (6,511 square km). Coral reefs fringe the atolls and serve as the only defense against the ocean surge. The clearance of the reef in the sections that are covered by water is usually no more than a couple of feet.[1]

Generally speaking, an atoll consists of a series of low lying islets and submerged reefs arranged about a central lagoon, which mixes with the open ocean via one or more channels and/or shallow passes. In the Marshall Islands, the islets composing an atoll usually form an oval shape around a central lagoon of 150 feet (45 m) average depth. The surrounding ocean depth plunges to over 5,000 feet (1,525 m) within two miles (3 km), and to 10,000feet (3,050 m) within ten miles (16 km) of the typical atoll.[2]

Dye[3] suggests a probable development history for the Marshall Islands; he states that approximately 70 million years ago the volcanic cores of the Marshall Island atolls erupted forming new volcanic islands. The islands, slowly subsiding but standing above

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[1] Permanent Mission of the Republic of the Marshall Islands to the United Nations, 1992.

[2] Fosberg 1990; Wiens 1962.

[3] Dye, 1987.

sea level, were colonized by species of reef-building corals, and the process o reef flat construction began approximately 40 million years ago.

Underwater ocean maps show that there is also an abundance of underwater seamounts, some of which reach almost to the surface, such as Keats Bank east of Mili Atoll. Most of these guyots are aligned along the same axes as the Ralik and Ratak Chains, so that these underwater features as a whole have recently been termed Ralik and Ratak Ridge.[4]

All atolls and islands in the Marshall Islands have *joorãne*, land signs, as well as *joormeto*, sea signs, which indicate a location on an island or on the ocean, as well as the relationship between the land signs or the land itself and the sea sign. Erdland[5] describes this Marshallese marker system:

> The configuration of these beings, which are on their respective atolls either lifeless objects, birds or fish, which I am going to present might look at first sight as a simple list. Of course some of the names might be without meaning now, because the history of the respective person does no longer live in the memory of the seafaerers. Though many of them allow us a deep glimpse into the beliefs of the Marshall islanders and further on they represent a part of the unwritten history of the islanders. Because these names have a special value for the localization of myths and fairy tales. Some of them are mentioned in the legends therefore they can be considered historic to a certain degree. ... It is remarkable that some of these *äkejab* localized on land have children on sea, ... These children of the *äkejab* are birds or fish or other lifeless drifting objects which stay at a certain distance to the atolls ....

Due to the persistence of these signs they served the old navigators as points of orientation, so that they know – besides the waves, and other indicators – were the atoll is located to which the respective bird or fish belongs. In order to imprint these sea signs into the memory of the young navigators, the old ones have composed sayings or rhymes, which show a close connection between the sea sign and the land.

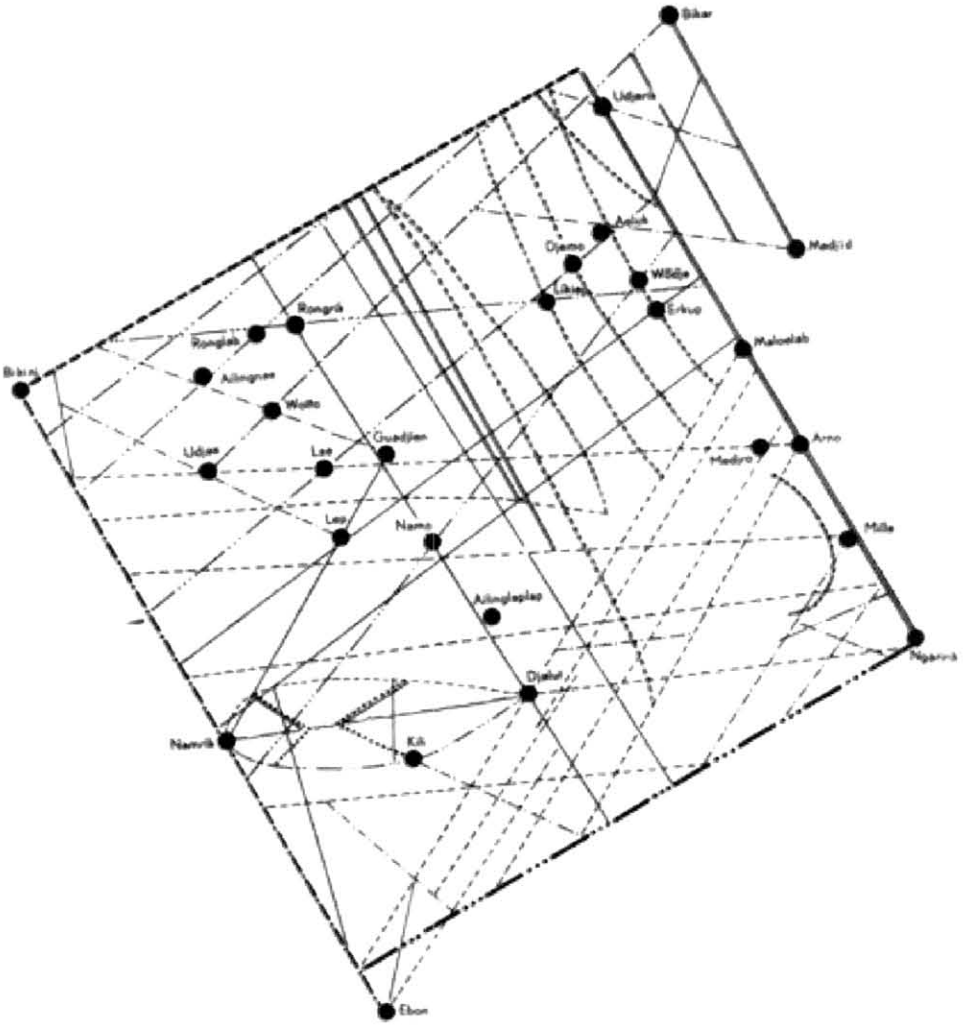
Long before the Atolls of the Marshall Islands have been discovered and charted by European and American ships, Marshallese had already put their archipelago, atolls and waterways 'on the map' indicating them in Marshallese stick charts.

> ...., sea charts are made of straight and curved small mid rips of palm fronds. Small white sea shells (Cypraea or Melampus) indicate the islands The maps do not indicate the exact geographical position of the islands but give information about the

[4] Spennemann, 1993.

[5] Erdland, 1914:346-347.

condition of the sea between the islands, in particular the condition of the surf besides of other matters of significance for the course. There is no regulated system for the sea charts and one school does not know the teachings of the other. Thus a sea chart can only be interpreted correctly by its maker ....[6]



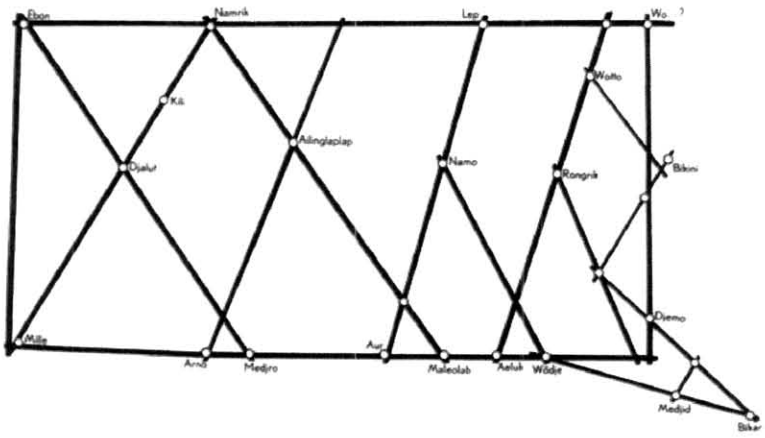
Map 2. *Meto*, Stick chart of the Marshall Islands.

According to Krämer the name Arno is composed of *ar* the beach and *no* the wave[7] and means "Lagoon Beach With Strong Surf'. Citing different sources he describes the atoll like this:[8]

[6] Krämer und Nevermann, 1938:221.

[7] Krämer und Nevermann, 1938:27.

[8] Krämer und Nevermann, 1938:69-73.



Map 3. *Meto*, Stick chart including Arno.

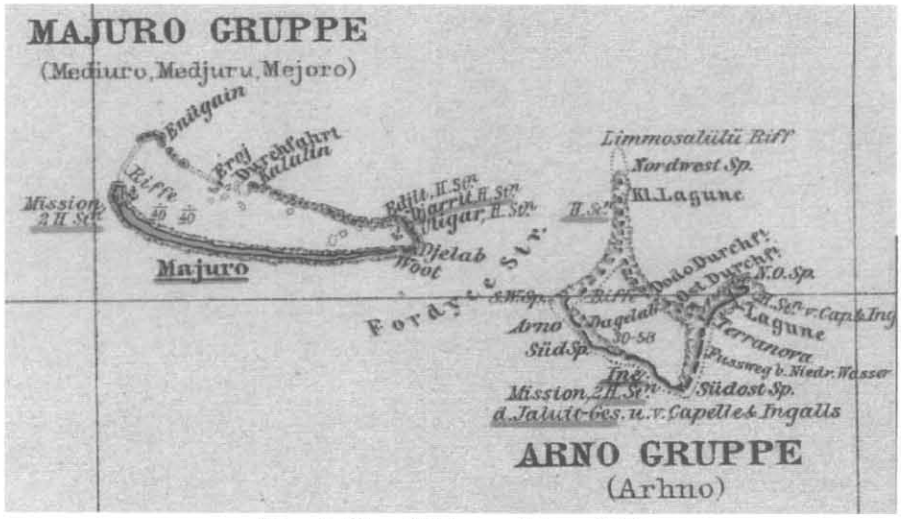
Arno ... is only eight nautical miles east from Medjro and forms with it the community of Metöerikrik, 1,600 inhabitants. ... it was mentioned that Arno, like Namuonito, is peculiar in having a second lagoon; in fact there are two. The inner water is diamond-shaped, with one point to the north, the other to the east. These two points each have a cape seven to eight nautical miles long, so wide that they have individual lagoons. ...

Arno is famous through its kin group *ri* Arno which is in first place in Medjro and Maloelap. The Radak King is said to descend from this house. Lamdjenailik is a large rock in the lagoon (*lam*), where the spirit of the same name dwells. He protects Arno and the king and makes the large lagoon sea.

The 1905 Typhoon ... piled up accumulation on the east point, which as on Djalut, caused small secondary lagoons to be formed; at the end of 1905 they were only one meter above high water and were already planted with coconuts by the natives (Jeschke, 1906). North of the atoll, three and a half nautical miles away, depth of 36 meters (Jeschke). East of the atoll, there is a reef Wourenlal, 'reef of the bottom', fishing ground. Boston mission here the, the Catholics settled in 1906.

Meinicke: Arno, separated from Medjro by the Fordyce Channel, named in 1788 by Gilbert. Gilbert considered Arno two islands, which he named Daniel and Pedder. Tanner was the first to clear up the mistake.

S.-H.: 43 nautical miles north of Mille, has the largest land area of the Ratak Chain and is 55 nautical miles in circumference. Lagoon up to 58 meters deep. Islands about two meters high, tops of trees 6-20 meters. Main village on the southern islands.



Map. 4. Map of Majuro and Arno, 1897

Then Krämer gives a virtual tour of Arno and Bikaridj Atolls in the north:[9]

South to southeast point	Ine five nautical miles long, two chiefs, two trading stations and one missionary station, many pigs here (brought from Djalut). On the south shore, on the open sea, on the lee side , a stony *Huk*. 500-800 meters (see story El. 1914:235, Jäbo and Eiocio Island), Ine Buoti, 'anchorage', for small ships. Jeschke: two chiefs here, Ujelang and Leiban.
	Narrangansett entrance? Shown on the map, but not mentioned in S.-H. and not on the Japanese map.
	1 curved island over 4 nautical miles long.
South coast	2 small islands.
	1 island 2 nautical miles long.
West point	An angular island, almost 2 nautical miles long , according to Rötger (A. d. Hydrogr. , 1885:152), Arno Island anchorage, 52 meters deep, stony.
Northeast side	9 small islands about 3 nautical miles from the north cape.

[9] Krämer und Nevermann, 1938:71.

North point

The north cape, the end of the chain of 14 islands (see Agassiz pl. 180, footnote 3), which begins at the Dodo entrance midway along the northeast side; 8 belong to it, the other 6 are on the reef of the cape and they end in a forked island, see below, Bigaritsch, Japanese Pikarezi. The extensions of the two fork tines of the island each have 3-4 islands, so that there is a secondary lagoon at high water, 1,5 nautical miles long and .75 nautical miles wide. The north point of the cape is a coral bank 2.5 nautical miles long.

Northeast side

7-11 meters of water lies off this side.

→ Dodo entrance (Japan: Doudou, 40 meters), best, 1 small island lies inside.

2 small islands.

→ Boat passage (not on the Japanese map).

2 small islands.

→ Tagelib passage 7 meters (9 meters in the middle?) Japan 25 meters, inside the island Enirikku divides the large entrance in two.

1 small island and Tagelib , called 'high islands' because of the trees.

1 small island

→ East Passage, 3 meters (on the Japanese map only a dotted line).

Reef, 1.2 nautical miles.

East cape:

North side reef with about 25 small islands.

South side an island about 10 nautical miles long which, curving to the east, forms the north east point, midway it is bent so much to the north that two lagoons are formed , 3

and 4 nautical miles long and 1 nautical mile wide* with depths up to 40 meters; the island 10 nautical miles long is called Langar at the west end on the map Terranova , according to Jeschke (Knappe: Langar)and is up to 7 meters high and 500 meters wide.

*Footnote: The more westerly of the two is connected to the large lagoon; the eastern one is separated from it and has a small inlet toward the north. This is quite clear on the Japanese map: the eastern lagoon is 4,900 meters long and 300 meters wide north to south); the long southern island is broken the two lagoons join; it end a little farther to the east; Rakarur Island in the north east.

East side — Reef 5 nautical miles long with 4 islands, shown as one island on the Japanese map; the last island ends at the south east point near Ine; on the Japanese map there is a reef 3.5 km long with approximately 8 very small islands.

The island Bikaridj (see Edao, p. 350) is in the north cape, according to Jeschkle, the islands is called Bigaritsch.

Gilange (Epic line 57) remains questionable; perhaps Langar?

The island Dagelal with high *galgal* trees , Fisnch p. 121.

Sacred things: Arno Island has a sea eel, *ladjebonegiul*, which brings good weather, on the shore of Ine a Stone, *legalik*, to which offerings are made during the flying fish season, and a stone, *laberadjat*, which grants longevity. On Langar, an *uot* tree, good for catching flying fish. Near Arno a deep hole *ladjulemalang*, a sandy place, *lamedjenairik*, *eleling*, a *binebin* tree, *lalodelang* a reef.

Shoal: 25 nautical miles northwest of the east cape the Japanese map of October 22nd shows a shoal of 635 meters, surrounded by depth of 1,000-2,000meters and even 3,000-4,000 meters. These cannot be known to the natives.

The natives of Arno state that there is a reef 30 nautical miles to the east; in 1904 it was reported by the schooner 'Neptune', the H.M.S. Condor looked for it in vain, however.

2.2 Climate.

The climate of the Marshall Islands is predominantly a trade-wind climate with the trade winds prevailing throughout the year. Minor storms of the easterly wave type are quite common from March to April and October to November. The islands are not generally considered to be in the Typhoon belt, but because they are low with small land masses they are easily subject to flooding during storms. Tropical storms are rare but do occur. The first typhoon recorded for the Marshall Islands happened in the 1840s. It devastated Likiep Atoll and cost the lives of the greatest part of the population. The first typhoon recorded for the Marshall Islands happened in the 1840s. It devastated Likiep Atoll and cost the lives of the greatest part of the population.

In 1905 another devastating typhoon struck the southern Marshall Island:[10]

Typhoons do not occur on Jaluit'. Words to that effect were frequently uttered by traders and skippers working for German firms in the Marshall Islands and faithfully reported by travel writers and ethnographers. Indeed, in the short time German and other traders had been working in the Marshalls, the effect of typhoons had been comparatively small. Some events had occurred, but none memorable enough.

All of this changed on June 30th, 1905. A typhoon struck the southern Marshalls, devastating Mile, Nadikdik and Jaluit and severely affecting Arno and Majuro. Over 227 Marshallese lost their lives on that day. In subsequent months approximately another 90 people died of starvation as a result of destroyed food stocks.

List of typhoons that hit or affected Arno:[11]

Date	Typhoon	
1899		On Arno a piece of land with some 100 coconuts was washed away during a typhoon.
1900		A typhoon struck the southern Marshall Islands.
1905, 30. June		Severe Typhoon struck the southern Marshall Islands (Mile, Nadikdik, Jaluit, Majuro, Arno, Ujelang, Kili, Aur, Ailinglaplap).
1918		Majuro and Arno hit by a Typhoon.
1982, 25-28. Nov.	Pamela	Jabwat,Kwajalein,Lib,Namu, Majuro, Arno are hit.
1992, 7.-9. Jan.	Axel	The southern Marshalls were struck, Jaluit, Mile, Arno and Majuro were inundated.

Table 3. List of Typhoons that hit Arno Atoll.

[10] Spennemann, 2000: http:/life.csu.edu.au/marshall/html/climate/Typhoon1905.html.

[11] Spennemann and Marschner, 1994.

The only atoll for which complete weather data exists is Majuro, where the U.S. National Oceanic and Atmospheric weather station is located. Due to its proximity we can consider these data also valid for Arno Atoll. Annual rainfall varies considerably from north to south; the southern atolls receiving 120-170 inches (300-400 cm), and the northern atolls receiving 40-70 inches (100-175 cm).[12] The highest rainfall generally occurs during the *añõn rak* season, also known as breadfruit season (June to October). Precipitation is generally of the shower type; however continuous rain is not uncommon. During the *añõn ean* season, also known as the pandanus season (January to March), the rainfall decreases with February noted to be the driest month of the year.

Year	Rainfall
1990s mean	129.
1980s mean	125.
1970s mean	135.
1960s mean	137.
2001	124.3
2000	135.4

Table 3. Annual rainfall for Majuro.[13]

One of the outstanding features of the climate is the extremely consistent temperature regime. Daily temperatures for both northern and southern atolls fluctuate between the high seventies and mid eighties with no seasonal variation. The range between the coolest and the warmest months averages less than one degree Farenheit. Nighttime temperatures are generally 2-4 degrees warmer than the average daily minimum temperatures, which usually occur during heavy showers in the daytime.

In spite of this the weather is always hot and humid with an average temperature of 81° degrees Farenheit all year round.[14] Arno Atoll lies in the south of the Marshall islands where the weather the climate is wetter than in the northern atolls.

2.3. Vegetation.

There is no record of the original vegetation of the Marshall Islands. The precise date when plants first occurred in the Marshall Island atolls is still debated.[15] It is possible that 44 species of plants, including various herbaceous species, shrubs, and trees

[12] NOAA, 1989.

[13] Economic Policy, Planing and Statistics Office, 2003:8.

[14] Permanent Mission of the Republic of the Marshall Islands to the United Nations, 1992.

[15] Dye, 1987.

drifted to the southern Marshalls before the arrival of man.[16] The early inhabitants probably altered the vegetation of the atolls by introducing new species. During the twentieth century coconut plantations, developed by German, Japanese and American administrations replaced most of the original vegetation of many atolls.[17] Today as much as 60 per cent of the nation's land area is covered with coconut (*Cocos nucifera*).[18]

Many areas not dedicated to coconut plantations have been put to other uses such as cultivation of taro and other plants. Species that have been introduced are reliant on the presence of humans for propagation.[19]

Fig. 10. Beach vegetation, Arno Island, Arno Atoll.

The vegetation that grows in the Marshall Islands include mixed broadleaf forest composed of a small number of tree species (*Tournefortia argentea, Guettarda speciosa, Pisonia grandis, Pandanus tectoris, Allophylus timoriensis, Cordia subcordata , hernandia Sonora*); a few shrubs (*Scaevola serica, Suruana maritama, Pemphis acidula, Tournefortia*); and a layer of ground cover consisting of several species (*Lepturus repens, Thuarea involuta, Fimbristylis cymosa, Polypodium scoloprendria*). Several mono specific forests occur in the Marshall Islands (*Neisosperma, Pisonis grandis, Turnefortia argentea*).[20] Shrubs such as *Pemphis acidula, Suriana maritama,* and *Scaevola sericea*

[16] Hatheway, 1953.
[17] Fosberg, 1990.
[18] OPS,1991.
[19] Fosberg, 1990.
[20] Fosberg, 1990.

typically grow along shorelines while herbaceous plants occur mainly under forests. Limited strands of mangroves (*Bruguiera*) occur on larger islands of the wet southern atolls[21] and are found in swampy areas containing brackish. Several of the cultivated plants (*Musa, Cocos nucifera, Artocarpus altilus, Cytrosperma chamisonnis, Pandanus tectoris*) are commonly found on the inhabited islets of the Marshalls. These various plants serve as windbreakers, slat spray repellents, food, and are used by Marshallese for plaiting and medicinal purposes.

Fig. 11. View of the interior of Kinejon Island.

On most of the islets there is a strip of natural shrub forest along the seaward coast that serves as a windbreak. This mainly consists of mixed broad leaf forest and shrub with Scaevola on its outer edge.[22] There are 81 species of vascular land plants and many exotic plants not found on other atolls.[23]

2.4. Sea Level Changes.

Due to being so low in elevation, the recent sea level rise caused by global warming or "greenhouse effect" is a critical threat to the Marshall Islands. The rising of the sea during the last two decades has devastated the low -lying atolls economically and culturally. It is estimated that the normal trend for sea level rise has been approximately 1.3 inch to 3 inch increase over the span of 100 years. However, it is figured that within

[21] Stemmerman, 1981.

[22] Fosberg 1990.

[23] National Biodiversity Report, 2000.

the next 50 years there will be a 1.7 inch increase alone. As predicted by scientists (global warming red alert), the islands of the Marshalls are among the Pacific nations that will be affected by the rising of the sea level within the next fifteen to twenty years. Under normal conditions, coral and the other components of the coral reef can maintain a healthy landmass. At present, visibly eroded scrublands are along the coastline and most of the vegetation growing in this area will soon be washed away by the incoming tides. Any archaeological sites that are located within this area will vanish and their significant historical value will be lost to the tides.

For many years the Marshall Islands Government has been concerned with the issue of global change. As the Marshall Islands lie in open ocean and are very close to sea level, the vulnerability to waves and storm surges is, at the best of times, precarious. Although the islands, have by no means been completely free from weather extremes, they are more frequently referred to in folklore as *'jolet jen anij'* (gift from the god), the sense that the Marshall islands are a god given sanctuary, away from the harshness of the other areas, is therefore a notion that is part of the sociocultural identity of the people. When any variation of the weather hits the Marshall Islands, the effects can be severe. When typhoon Paka passed through Ailinglaplap in late 1997, food crops were severely hard hit and outside food had to be brought in. El Niño induced drought brought consequences that caused the entire Marshall Islands to be declared disaster areas, and emergency water making equipment and food supplies were shipped in from outside.

Given the physics of wave formation and the increasing frequency and severity of storms, the Marshall Islands will likely be at even greater risk of total inundation. The relative safety that the islands have historically provided is now in jeopardy. The impacts are not limited to the Marshalls and its immediate neighbors. The Marshall islands are often referred to as the "front line state" with regard to the climate change issues. It is important to realize that once the potentially catastrophic effects begin to appear, it is likely too late to prevent further warming that will threaten virtually all of the world's coastal regions.[24]

Fig. 12. View over the lagoon of Arno Atoll.

[24] Permanent Mission of the Republic of the Marshall islands to the United Nations.

III. LAND TENURE

Marshallese society is generally matrilineal and is composed of a number of matrilineal clans (*jowi*). The most important descent group is the lineage (*bwij*). The *bwij* is the matrilineal system in which all land rights are passed down through the mother's side. Therefore the whole group is descended, mother to daughter, from a common ancestor or *jowi* (clan). There were at least forty-four clans spread over the atolls and and though no one remembers how members of a *jowi* were related by blood, members consider themselves related. The lineage head (*alap*), usually the eldest male of the senior line of the lineage, is steward of the lineage land holdings.

With slightly less than 70 square miles of land in the entire archipelago and prime settlement areas being extremely limited, land has long been the most highly prized possession in the Marshall islands and control of land is the central theme of Marshallese culture. The basic land division of the Marshall Islands, *wãto*, is a strip of land that runs from the lagoon to the ocean side of an island. One or more *wãto* are held and administered by a matrilineage line. Title is divided and shared by several levels of the society. In the pre-Christian era, the Marshallese social system distinguished between two major classes: *irooj* (chiefs) and *kajoor* (commoners). The *irooj* hold title over an island or atoll. Among the *irooj* the *iroojlaplap* (paramount chief) were the ones with the most power while the *iroojiddik* of the lesser chiefs, shared the power and many of the privileges, but to a limited degree. Today the term *kajoor* is not used so often as the class has been divided into the *alap* (land managers) and the *rijerbal* (workers). The alap organizes and directs lineage activities and allots lands for use to different descent lines within the lineage. The *alap* and the *rijerbal* (workers) make up the subjects of the *kajoor* (commoners) and render services to the *Irooj* in exchange for the use of land. The *Irooj* managed the land in a way that not only provided themselves with food but also provided for the *kajur* (*alap* and *rijerbal*) The *kajur* in return cultivated the land, harvested the water surrounding the atoll, and performed *ekkan* (tributes to the *Irooj*. The procedure is a cycle that has been repeating itself for hundreds of years. The common members of a lineage have land rights, although the *alap* and the *rijerbal* change land ownership. The *Iroojlaplap* is the only individual with permanent land rights, unless defeated in war.

Historically one *Iroojlaplap* (paramount chief) was able to extend his control over most of the Ralik Chain (except Enewetak and Ujelang). Periodically the *Irooj* visited these islands to collect tribute. The Ralik Chain was subsequently divided into two districts, one including Namu and the north islands, the other Jabat, Ailinglaplap, and the

islands south. Although all of these islands were owned by the *Iroojlaplap* he rarely visited those further north than Kwajalein and Ujae, because they were isolated and somewhat impoverished.[1] Within the northern atolls, stratification was less elaborate, in comparison to those in the south.

Ratak was likewise structured but far less centralized. The whole chain was never integrated under a single *Iroojlaplap,* although the *Iroojlaplap* of Maloelap was able to put the islands to the north (except for Mejit) under his rule. Majuro and Arno broke away from this union, however, and again became independent political entities. The Ralik and Maloelap associations were unstable and varied in size as local lesser *irooj* tested the strength of their islands against that of the *Iroojlaplap.* This trend towards instability encouraged the *Iroojlaplap* to move his residence from island to island to make his control evident to the local lesser *irooj.*

Today traditional rights of land tenure are unequivocally preserved in the Constitution, and the traditional requirements of consensus decision making, in which all persons with land rights to a certain *wãto* must agree, on questions of land transfer is retained.

The traditional land tenure system confounds Western-style efforts of historic preservation. Public or government land is non existent and private landowners are accustomed to exercising ultimate control over land use and access, and are therefore unaccepting of regulations which might restrict the usage of their property.[2]

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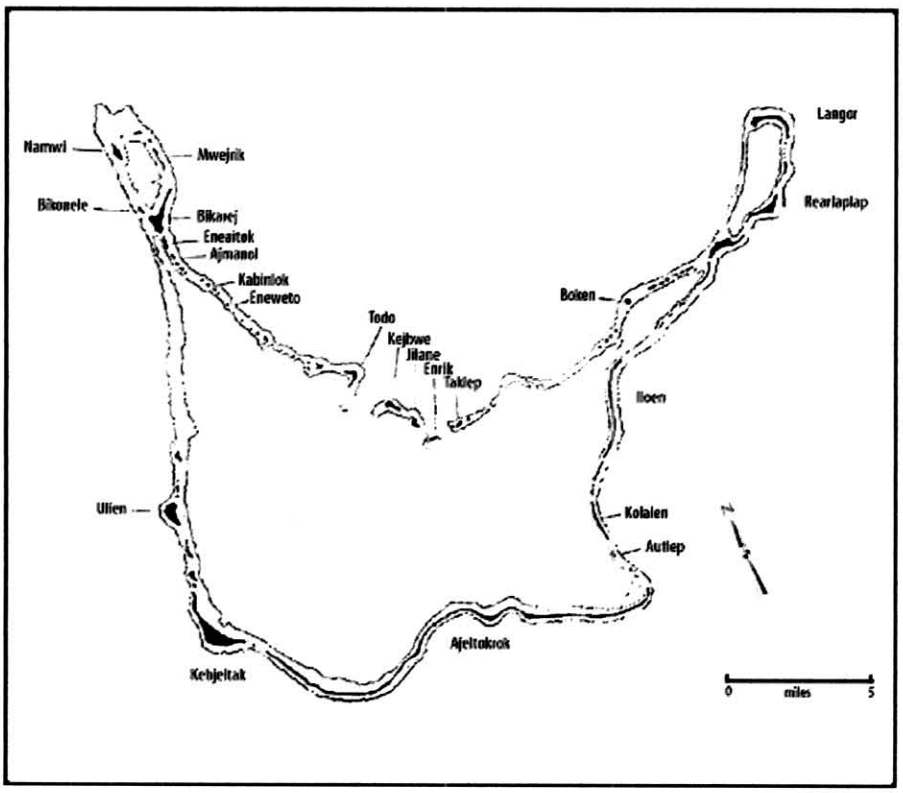
[1] Alkire, 1977.

[2] Williamson, 2001.

IV. FIELD INVESTIGATION.



Map. 5. Arno Atoll.

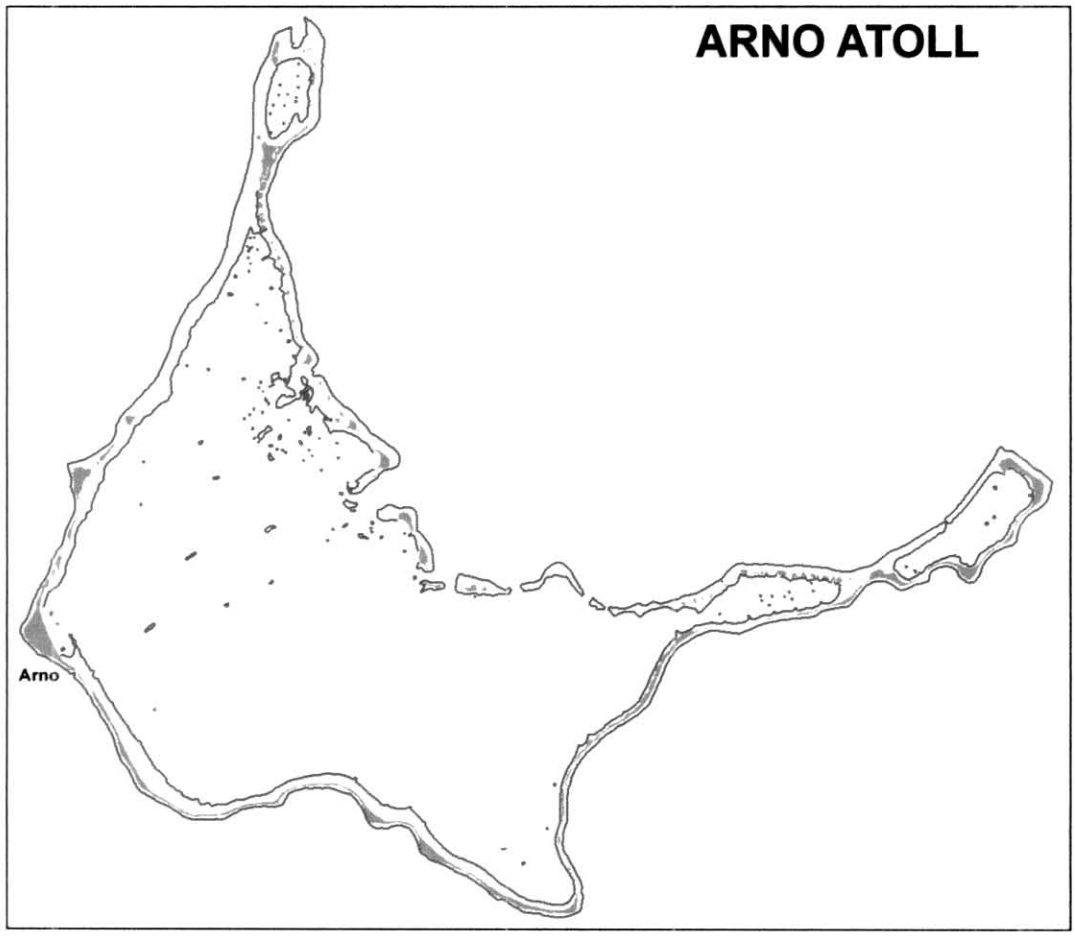
4.1 Background Information.

Arno Atoll lies in the Ratak Chain, on the eastern side of the Marshall Islands, about 10 miles away from Majuro Atoll. Boat travel between the two atolls is frequent and weekly flights also link them.

In 1972 Rykiewich recorded the following facts about Arno.[1]

> Arno Atoll has 133 islets, which comprise about five miles of land area. Resources are considerably enhanced by 16 square miles of surface reefs and by 130 square miles of enclosed lagoons. There are five passes one major and 4 minor along the northeast reef, and one minor pass along the northwest reef.

[1] Rykiewich, 1972:26.



Map. 6. Arno Atoll.

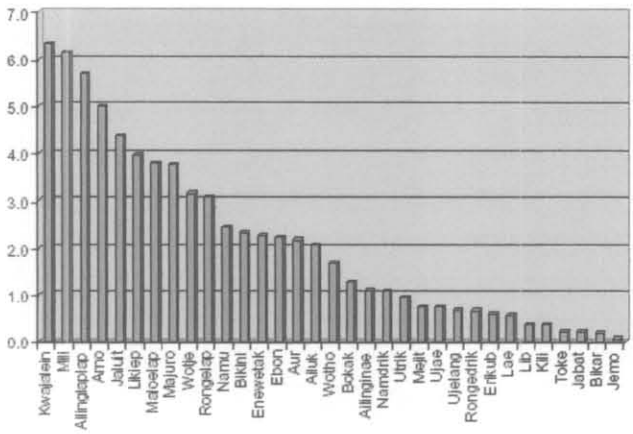
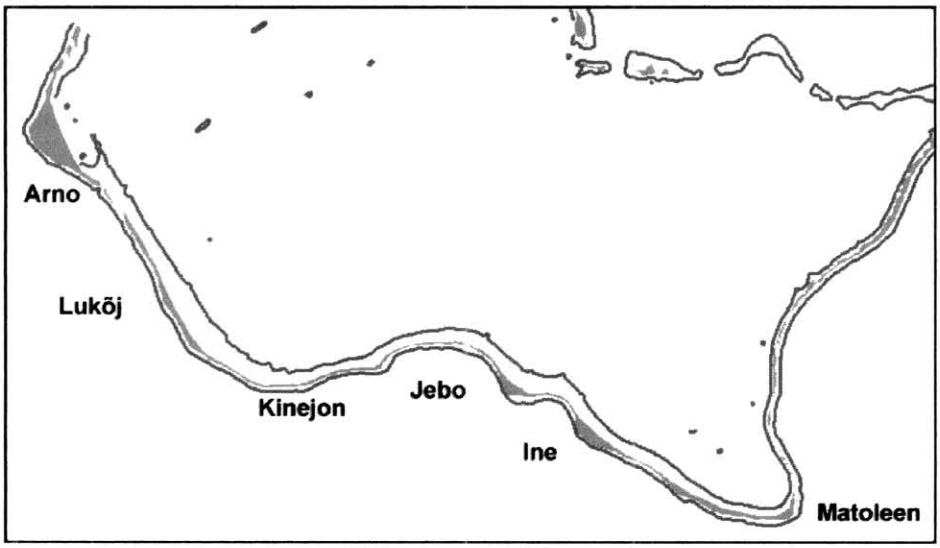


Table 4. Land area of atolls and islands.

But according to the 2002 Census Arno Atoll is situated at 6 58' - 7 18' Latitude (North) and 171 33' - 171 57' Longitude (East) and has only 103 islands, 130.8 square miles lagoon area, and 5 square miles land area. In 1999, 2,069 people lived on the atoll. Thus, Arno is one of the big atolls of the Marshall Islands according to landmass.

Currently more than twenty islands of Arno Atoll are inhabited. In the past probably more were inhabited.



Map. 7. Southern part of Arno Atoll.

4.2. Recorded sites.

During the brief stay on Arno Atoll the survey team traveled the so-called historic road from Arno over Lukõj, Kinejon, Jepo, Ine to Matoleen and back. Today this road is the main means of transport between these islands. It consists of a single track. From Jabõn-Kiwul passage at the northern end of Arno Island the road winds through villages and coconut groves, past schools, churches, some isolated compounds, and across the former airstrip on Kinejon Island all the way to the passage at the southeastern end of Matoleen Island.

> The road said to have been built during the Japanese administration of the atoll ran from Arno Islet to Matolen Islet. It was marked by upright coral-cobble curbstones and was surfaced with clean lagoon sand. Portions of this road are now found near the lagoon shore; those in Kinejon are particularly well preserved.[2]

Fig. 13. On the Japanese road.

Fig. 14. Japanese road, crossing the airstrip.

Along this road two sites were recorded and documented. On Jebo Island our tight time schedule the site was not mapped (GPS).

Fig. 15. Crash site of American B-24D "Liberator".

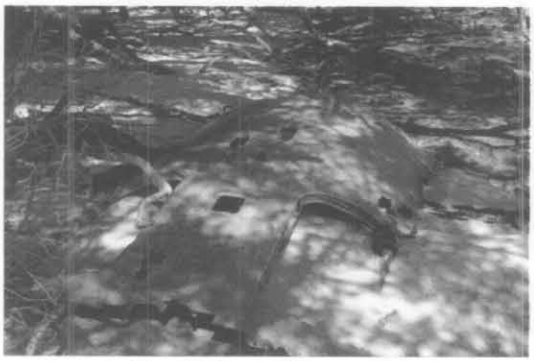


Fig. 16. Part of the cockpit.

Fig. 17. Part of the B-24D "Liberator" in the lagoon.

Spennemann recorded the following information about this plane:[3]

The wreckage of a B-24D "Liberator", a Consolidated San Diego-built B-24D, block 145 (B-24D-145-CO), Serial number #42-41205) (nickname "*St. Quentin Quail*") rests on the lagoon side of Jab'u, Arno Atoll, Republic of the Marshall Islands. The plane, part of the of the 98th Bomb Squadron, 11th Bomb Group, flying under the command of Capt. Morse, crashed on 2 January 1944, as a result of damage incurred during an attack on the Japanese airbase of Taroa on Maloelap Atoll.Another B-24 of the same squadron, the *Homesick Angel*, also returning from Taroa reported the landing, took

[2] Dye, 1981:51.

[3] Spennemann, 1994, 1995, http:/life.csu.edu.au/marshall/html/B24/B24_Arno.html.

photos (see below) and dropped emergency rations. Apparently the bomber crews had been briefed that Arno Atoll was a safe place to land in case of an emergency, but when a "Dumbo" plane, a Navy PBY flying boat went into the lagoon early next morning at dawn and reported that there was no trace of the crew. It was believed that were captured and taken away.

Figs. 18. and .19. Photographs of the B-24 wreck at Jebo taken immediately after crash by officers on board of the B-24 'Homesick Angel'.

Two of the crew members died during or as a result of the crash and were buried on Arno. Eight of the crew members survived and were housed and fed by the Marshallese on Arno Atoll from January 3 to January 16, 1944, on which date a Japanese patrol boat arrived from Taroa and captured them. The airmen were taken to Maloelap Atoll where they remained until January 20, 1944.

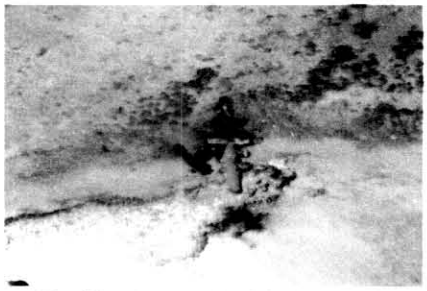


Fig. 20. Photograph of the Arno B-24 wreck taken on January 28, 1944 by a PBY.

The last we know of the airmen is that they were on a Japanese vessel entering Kwajalein lagoon on January 22, 1944, when the vessel was attacked by U.S. bombers. One airman was killed during this attack. The remaining seven perished without a trace on Kwajalein between then and the U.S. conquest of that atoll on February 3rd.

The perished crew comprised of: Lt. Roger W.Morse, Pilot; Lt. Herbert S. Evans, Co-Pilot; Lt. Robert H. Wirostek, Navigator; Lt. William F. Carpen, Bombardier; Sgt. Marion L. Farmer, Flight Engineer; TSgt. John W. Horman, Radio-operator; SSgt. I.L.Stowe, Gunner; SSgt. Paul H. VanBuskin, Gunner; SSgt. Henry R. Wyka, Gunner; and Pvt. Robert T. McTwigan, Gunner.

The two crew members buried on Arno (Henry R. Wyka and Marion L. Farmer) were exhumed after the U.S. landings on Majuro on 31 January 1944 and re-interred at the war cemetery on Garra Island ("Demon Island"). After the war they were removed and interred at their final resting places in the U.S.A.

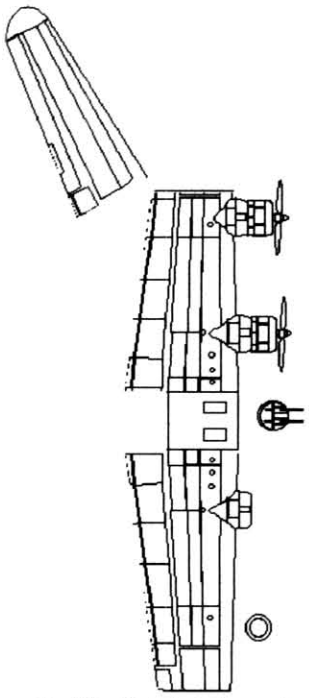


Fig. 21. Sketch of the crashed plane.

The plane wreck rests in the intertidal zone off a beach rock spur off Jab'u Island in 1 to 1.5m of water at low tide, some 30-40m from the present high-tide mark. Extant are the port wing, a large part of the starboard wing, the central fuselage section between the wings, and all four engines. Only one propeller was seen, although the others may well rest buried in the sand, somewhere to the rear of the plane, ripped off during the crash landing. The tip section of the port wing from the port No.2 engine onwards is snapped off and twisted backwards. The bottom of the lagoon shows a few isolated pieces of aluminum, among them the ring of the central Martin turret. No pieces of the pilots cockpit or the entire rear fuselage including rear ailerons could be located.

From the pattern of the wreckage and debris it is clear that the plane landed at the beach in an eastward direction, against the prevailing trade winds, and that it came to an abrupt halt at the beach rock spur, which may well have been partially submerged at the time.

The aluminum is on the whole in good condition and it can be expected that as long as no untoward actions happen, the plane will be around for some time. The plane, resting on the reef, has been utilized by the Arno people in the 1940s and 1950s as a resource for aluminum to manufacture coconut-grater blades, husking-stick points and other artifacts for daily use.

For more information regarding this site see 'Transcript of Interviews' p. 53.

Fig. 22. Site of the former *me*, weir.

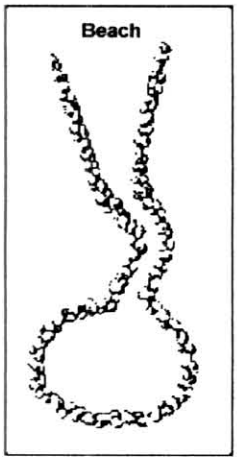


Fig. 23. *me*, weir.

The second site that was recorded was a former *me*, a weir. This fish trap was not well maintained and obviously had not been in use for quite some time. No mapping was done. Fig. 23 shows an ideal *me*, sketched by Krämer.

During the drive on the road, some remains of former fortifications could be seen, as well as foundations of former Japanese buildings. But again the time frame did not allow any further investigation. Undoubtedly there are many more sites still unrecorded.

4.3. Transcript of Interviews.[4]

During the two day stay in Arno Atoll three interviews have been conducted. Two of them (Jimel Jawin and Lekdlik) were organized immediately after arrival on the atoll, thus they are not site specific interviews. The third interview, with Hilmar Jormelu, was conducted after the wreckage of the plane had been documented.

All informants were very cooperative and willing to help the survey team. With all of them further interviews are planned either in Arno or in Majuro.

[4] See p. 47.

A) Interview with Jimel Jawin on Arno, Arno Atoll on March 23, 2004

Informant was born Nov. 6, 1936, Jikuplik Clan.

MIMRA clam station: is situated on a land fill, where formerly was a passage. This *ripako* passage is connected with a story from the *ripako*.

There was a man called LOJOLIK. He always came here to bring his copra. He made the copra on his land but came here to sell it. But the *alap* did not want this. This made the man angry and he caused a wave that washed away this part of the island and formed a passage.

Later on the passage was filled again in order to make the road all the way from the tip of Arno island to Ine island.

Ripako: the *ripako* come originally from Arno Atoll, but today you can find *ripako* all over the Marshall Islands, on all the Atolls and Islands. *Ripako* people can stop waves and create waves (see above).

The story of the stopped typhoon in the 70 happened in Majuro. The *ripako* have a reputation for being able to stop a typhoon. But only a few people of the *ripako* can do that not everyone. The pass it on.

They cannot eat *pako* and when they catch a shark then they have to release it. If they would eat *pako,* it would be like they eat their own flesh and blood. The other people can eat shark.

DILA is a man from Ainirik Island. When he traveled he used waves to get around the islands of the atoll. Thus people say he traveled by wave.

***Pako* - shark:** *Pako* is fished with intestines or anything bloody. Where there are many fish there are also the sharks. Today no more wooden hooks are used to fish for sharks, but big metal hooks.

There is a right way to cut *pako*. This is very important because when the *pako* is cut well then he does not have this distinctive urine smell. It is important to remove the intestines and also the bones have to be removed.

The right way to cut the *pako* is: Fist you cut the dorsal fin, then the flippers, then the tail, and then the head. Then it is time to remove the intestines and to do this you cut from the anus like this (see picture). The skin of the *pako* is used like sandpaper. The teeth were used for weapons and according to Krämer the bladder as a membrane for the Marshallese drum. Today the fins are sold for the Chinese market.

Jibukilik Clan: This is a clan that has to do with the chiefs. They are the ones that have to do with the chiefs they serve them like personal servants and this is also the reason why they can walk next to them. Because otherwise they could not move around freely among the chiefs. When the *irooj* dies they are the ones that are told to dig the grave.

Ura Clan: these were the people who were killed when a chief died because they were supposed to accompany the chief.

Former times: In former times people were helping each other, the helped to thatch the houses. You would exchange food with your neighbors. Everybody would help everybody. All work together. It would be announced in church when you had to do communal work.

Churches: In Arno Arno there is a church of the Assembly of God and a Bahai Church. Sasser's father was the one who brought the Assembly of God church to Arno. The Protestants are in Jebo, Ine and Matoleen. Informant is a Bahai. He became a member in 1967. He likes it because all pray to the same god and the church has a organized program. There are less members than in the Assembly of God church.

Burial: In former times people were buried at sea, in the lagoon there is a designated area where the burial would take place.
What is the name of this place?
Where is it located in the lagoon?
Was it used only by Arno people or did all the islands use the same spot?

***Me* - stone weirs:** There are and were *me* in the lagoon as well as on the ocean side. But most of them are in the lagoon. There are still today some at Japo and Ine. The *ribubu* decide where the weir is going to be built. There are me for the *irooj* and me for everyone. Generally speaking the *me* belongs to the *wãto*. A *me* brings a lot of fish, When there are fish in the me it will be announced and everyone can go there and it. *Me* need a lot of work, have to be maintained.

***Ribubu*:** There are people who do divination and there are people who do white and magic and there are people who do black magic. Some of the *me* were only for the *irooj*, others were for everyone.

***Aḷeḷe*:** *Alele* is done on Arno and there are designated places. But you can also normally fish there if you want. In the old days the chief made the decision when to hold an *aḷeḷe*, today anybody can decide it. It could be decided for instance when you see a swarm of small fish, or when a big delegation comes then you prepare for an *aḷeḷe*. Then the *alap* calls for the *aḷeḷe*. Then the *mweo* is made from rope and coconut fronds and a net is prepared.

After the *aḷeḷe* the rope can be kept when it is still god, the fronds are left on the beach. The catch is distributed, some goes to the guests and some is distributed among the participants.

With an *aḷeḷe* you can catch all kind of reef fish, one thousand and more. On Arno the informants does not remember when the last *aḷeḷe* was held, but in the atoll there was one in 2003.

There is also a season for *aḷeḷe?*

Fishing: *Roro ek* is calling the fish to come, it is also called *kajin ek*. Each man has his own and it is supposed to bring *woro* - luck to the fishing expedition.

Woda e, e; itom kwãñod io
Joda e, e to toom pad i-ene.

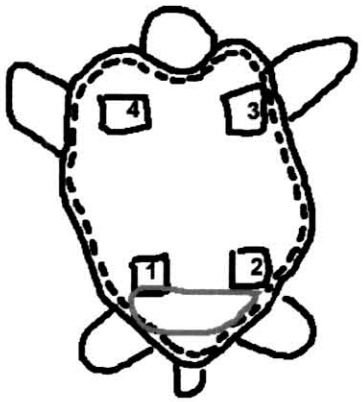
Juon ie joni, juõda e, juõda

Joni e to juõda uwe em kwãñod io.

***Ke* - Dolphin:** Informant likes to eat dolphin. To catch dolphin is called *jibuke*. A long time a go there were people who could call the dolphins.

***Wõn* - Turtle:** Turtle can be eaten all year round, there is no season for it. Actually they should not be eaten but people do nevertheless. There are two different kinds of turtles: the one that you find on the beach they do to the *irooj* and *alap,* while the one that you catch in the open ocean you can keep and eat yourself.

Every one can kill a turtle. But cutting a turtle is he tricky thing and this you have to know. Informant is one of the people who know and is a renowned turtle cutter. The people who can cut the turtle are called *ri muijmuijwuin* - the turtle cutters. The cutter does not get a special part of the turtle but his share. But the one who sights the turtle will get a special part of the turtle - the hind legs on both sides, there is a special way to take them off.



The fist step is to open a door and then the other three doors of the turtle's belly-shell. These doors do already exist and just have to be cut open. Then the belly shell is cut all around the edge and removed. Once it is open then the intestines are removed. Then the flippers are cut off and in this respect the hind flippers are cut in a special way (indicated in red). Then the head is cut and the blood is collected in a container. The guts are cleaned and put back into the belly of the turtle, which is closed with the belly shell and in such a fashion it is put into the *um.* This process is also called *um.* It takes about 3-5 hours to properly coo the turtle in its shell. After the cooking the turtle meat is sliced. Turtle meat, together with *mokwaṇ,* is specially good to eat.

***mokwaṇ* - Pandanus paste:** There are not may people on Arno who still make *mokwaṇ* and not many households do have a *beka.*

B) Interview with Lekdlik on Arno, Arno Atoll on March 23, 2004
Informant was born in 1932, Raej Clan.

Informant: Was born in Mili and then went to school in Jaluit. After the war he came to Arno. Informant had relatives in Arno.

He is a well known carver. The museum has several of his carvings such a few model *bega (*about 25 *beka* he made in the course of his life, as well as about 20 *raneke*), he also knows how to make a pandanus pounder, or cups made of coconut shells and medals for necklaces. He learned his skills by watching others and trying it himself. Informant likes to work with wood. Informant has not passed on his skills as nobody of the younger generation is interested in learning it. When he works then the younger men come and watch but do not want to learn it themselves. Even his sons never showed any interest.

***beka* - coconut crusher:** The best wood to make such a tool is

kõn̲o - Cordia subcordata
kõñe - Pemphis acidula, iron wood would be his first choice;.
lukwej - Calophyllum inophyllum
kiden - Turnefortia argentea

The tooth of the *beka* is usually made of coconut shell or a piece of metal, theoretically you can also make the *beka* out of one piece of wood.

Informant has never crushed fresh pandanus keys but knows that you can do it. You can drink this juice and also dilute it with water.

Because a *beka* is so much work it also repaired when it is broken which is usually when the tooth is gotten loose. The tooth should not be so sharp as it would cut the key, it should be sturdy and strong. Making a *beka* will take him about 2 days of work.

Nobody in Arno Island has still a *beka* in his household.

WW II: There has been no fighting in Arno during the WWII. Many people from Mili, Maloelap and Wotje came here.

There were Japanese in Arno, but no military personnel. The Japanese had businesses here, they had trading stations, sold groceries, cloth and bought copra.

Copra: All families in Arno make copra, in order to have the necessary cash to pay for the needs in their life. But today copra does not pay very well and you cannot live on the money you make with making copra. Currently the copra price is 8cents per pound. You need to husk and dry about 120 coconuts in order to fill one bag and then your earn 10 USD.

Economy: People in Arno make money with Copra, Fish and handicrafts. Handicrafts are currently the best means of income. There are also men who make handicrafts. For the handicrafts people have to collect shells and they know where to find them. Red shells are very rare [I think the informant is talking about the golden cowries].

People who have a boat go to Majuro and sell their catch there. The others come to the pier and sell it here. Fish is dried or salted.

Fishing: Ini is good place for fishing. Today you can fish wherever you want, in former times you had to go to the *alap* and get permission.

Informant has a chant for *jojo* flying fish. There are different chants for different fish and fishing methods.

Today nobody follows any taboos you can wear and do whatever you want before or while going fishing.

To be a good fisherman is based mostly on the experience and not so much on luck, but luck is also important.

People fish in Arno with line and spears. As well as nets for bait fishing.

C) Interview with Hilmar Jormelu, Jebo Island, Arno Atoll, on March 24, 2004

Informant: is married with Lañtimur Bohanny Jormelu, the *lerooj* of Arno Atoll. He is a teacher and has in his compound a study center where children are taught in the afternoon.

Crashed American plane: Just before reaching the settlement of Ine the remains of a crashed American plane can be seen in the lagoon, where both wings (still attached) are lying against some coral slabs in the lagoon. The cabin of the plane is not visible, but parts of the motor as well as of the propeller can be seen.

On the shore, just where the vegetation starts part of the cabin is laying half buried in the sand. And a little bit further on, already in the water but still clearly visible and probably more exposed at low tide a part that has a ladder like look.

Informant was child during the war but remembers hearing the story of the plane. It was probably shot at in Maloelap and ran out of gas. It crash landed in the lagoon against the corals. Two of the crew died. One body was stuck in the plane and could not be brought out. The waves washed it out two days later. The other crew members were taken to Ine by Marshallese (one of them was the father of the informant) and the Japanese police. One week later a ship came and picked the Americans up. People do not know what happened to them but it is assumed that they were killed.

One of the dead bodies was buried on the shore. Some years later the bones were collected and brought to the States.

Japanese Time: During the Japanese colonial time the Japanese in Arno were traders. They were stationed in Ine and the foundations of their houses are still there.

Japanese Hotel: for Japanese tourists in Jebo. It is a two storey house and the biggest building in the settlement.

Arno Atoll: The atoll consists of 4 sections. The one called *ajeltõkrõk* consists of Ine, Jebo, Matoleen, and Kinajoñ islands.

School: Jebo has no real school. Some of the kids go to school, which is a building with a thatched roof and no real walls. The other kids are taught in church, which is opposite of the school building.

Churches: There are two churches in Jebo, the Assembly of God and the Protestant church.

V. SUMMERY AND CONCLUSION.

As mentioned in the introduction, the objectives of the present project were very clear and focused on site survey and inventory and education. The present work at the HPO is focusing on anthropological and archaeological surveys of all the atolls within the republic in order to produce a complete site inventory and National Register.

Part I of this report discussed the project's research design, scope of work, and methodology. It also contains the history of the Marshall Islands and Arno Atoll.

Part II describes the environmental setting of Arno. Typhoons can drastically alter landscape of the low-lying atolls in the Pacific. Sea level changes pose additional threats to atoll environment. It is predicted that the global warming trend will have a tremendous impact on atoll communities within the next century. Information provided on vegetation and soil types provide clues to the likelihood of areas primarily used for agriculture.

Part III discussed land tenure and subsistence strategies. This is important for evaluating the significance of sites concerning their standing in time and space. How certain areas may provide a better chance of recovering subsurface material in future extensive excavations.

Part IV reported the results of the field research. It must be noted that, given the limited time in the field, this inventory is incomplete. A more intensive survey still needs to be conducted.

5.1. Significance of Sites.

No significance of sites was established. Streek made some recommendations in his field notes, concerning recommendation of certain sites to be included into the National Register:

1.3C, Loan Warrior, Ine Island.
1.6A, Paten ilo Ajeltak, Bikarej Island.
1.8A, Ledrik ran ruo im Mao eo nejier, Tutu Island.
2.3D, Me en ilo Boken, Boken Island.
2.4A, Kabinbok, Bokatarinae Island.
4.2A, Lwe en, Bikarej Island.
4.5A, Uliej in Irooj Tobo, Bikarej Island.
5.2A, Me en an Lijeltuwa, Bikarej Island.

5.2. Research Plan for an Anthropological Survey of Arno Atoll.

Despite of all the existing research, which has been conducted on Arno Atoll, an anthropological survey is recommended because many researches are of biological nature where anthropological points are often not more than a footnote. The archaeological or anthropological work that has been conducted dates from the 60s and 70s of the last century. Thus, in order to gain a picture of recent developments of Arno Atoll and to complement some of the older data a field survey of the Historic Preservation Office of the Republic of the Marshall Islands is recommended.

During the initial visit to Arno Atoll it was established that many of the older people reside in Majuro and can be interviewed there. Nevertheless, for several reasons a first hand experience of location and sites is of importance for the ethnographer in order

- to understand Arno Atoll's topography and biological setting,
- to ask the right questions,
- to take GPS measuring of sites (none of the previous surveys had recorded GPS data), and
- to document sites from Japanese colonial time and WWII (this has not been done in the past), and
- to record and document changes of already recorded sites.

Therefore it is planned

- to return to Arno Atoll,
- to survey all inhabited islands (these are currently: Arno, Kinejon, Jebo, Matoleen, Mwian, Taklap, Jilan, Enidrik, Jarkul, Bikarej, Keimman, Kilomman, Ulian, Eneeidrik, Enedoul, Malel, Kelange, Tutu, Tinak, and Loñar) as well as sites related to important oral traditions,
- to collect GPS measurements of all sites recorded during this survey,
- to put an emphasis on Loñar Island and its oral tradition,
- to record information concerning the Japanese colonial time, and
- to record WW II information and sites.
-

Considering the size of the atoll, the amount of work, and the other scheduled surveys within the Republic of the Marshall Islands this will need considerable time to achieve.

The following tentative schedule has been planned:

Due to already set fieldtrip schedules, surveys in Arno Atoll will take place over 6 weekend trips every two weeks. Thus, it should be possible to cover all sites. The final report will be submitted on September 31, 2004.

VI. GLOSSARY.

Marshallese	Old Sources	English
A		
aelõñ kein		these islands
aelõñ kein ad		our islands
Ajeltõkrõk		name of a section of Arno Atoll consisting of the islands Ine, Jebo, Matoleen, and Kinajoñ.
	äkejab Erdland, 1914:346-347.	idol
aḷeḷe		special fishing technique
alap		lineage head
	ar Krämer+Nevermann, 1938:27	beach
B		
beka		pandanus crusher
bubu		divination
bwij		lineage
E		
ek		fish
ekkan		tribute to the chief
I		
irooj		chief
iroojiddik		lesser chief
iroojlaplap		paramount chief
J		
Jibukilik		clan name
jibüke		to catch dolphins
jojo		flying fish
jolet jen anij		gift from the gods
joorãne		land sign
joormeto		sea sign
jowi		clan
K		
kajin		language
kajin ek		fish language
kajoor		commoner
kajur		lineage heads and workers
kiden		Turnefortia argentea
kõñe		Pemphis acidula, iron wood
kõṇo		Cordia subcordata

L		
lam		lagoon
leadakkad		higher ranking commoner
lerooj		female chief.
lukwej		Calophyllum inophyllum
M		
me	me Krämer und Nevermann, 1938: 122.	weir, stone fish trap.
meto	meto Krämer und Nevermann, 1938: 223.	Marshallese stick chart.
mokwan		preserved pandanus paste
mweo		moving dragnet
N		
	no Krämer und Nevermann, 1938: 27	wave, surf
P		
pako		shark
R		
raneke		coconut scraper
Raej		clan name
Ralik Chain		sunrise chain
Ratak Chain		sunset chain
ri		people, who …
ribubu		people, who have the skills to make a divination
rijerbal		worker
ri muijmuijwõn		people who can cut a turtle in a special way
ripako		shark people, clan name
roro		chant
roro ek		to call the fish
U		
um		earth oven
	uot Krämer und Nevermann, 1938:71.	
Ura		clan name
W		
wãto		land parcel
woro		luck
wõn		turtle
wot		Alocasia Macrorrhiza

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