Training Report
on
Cultural Heritage Protection

The Training Course for Researchers in Charge of Cultural Heritage Protection in Asia and the Pacific Region 2004

1 February – 4 March 2005, Nara

Cultural Heritage Protection Cooperation Office,
Asia/Pacific Cultural Centre for UNESCO (ACCU)

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Preface

Since it was established in Nara in 1999 with the cooperation of the Agency for Cultural Affairs, Nara Prefecture and Nara City, Cultural Heritage Protection Cooperation Office, Asia/Pacific Cultural Centre for UNESCO (ACCU) has instigated training courses on the investigation and protection of cultural heritage. These training courses are of two types: group courses of about one month for some 15 participants and individual training on particular topics for one or two participants. The present course was of the second type.

This time we welcomed our first trainee from the Federated States of Micronesia. Micronesia is a country comprising more than 600 islands distributed over a wide area from east to west in the Caroline archipelago in the Pacific. This geographical context of scattered Pacific islands means that the present status of cultural heritage in Micronesia is not sufficiently understood. Moreover, the scarcity of specialist involved in the protection and investigation of cultural heritage means that in most cases foreign teams are invited to conduct work.

The scarcity of specialist involved in heritage protection in Micronesia means that each individual is expected to conduct a broad range of tasks. For this purpose we arranged a broad-based course centered on archaeology with training on excavation methods, artifact analysis, recording and publication, as well as folklore and ethnological approaches relevant to archaeological work. We hope that the results of the training course will be put to good use after the participant returns to Micronesia.

Finally, we wish to thank Nara Medical University, Tenri University, Nara University of Education, the National Museum of Ethnology, Kansai Gaidai College, and the Archaeological Institute of Kashihara, Nara Prefecture for their assistance with this training course.

USHIKAWA Yoshiyuki
Director
Cultural Heritage Protection Cooperation Office,
Asia/Pacific Cultural Centre for UNESCO (ACCU)

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1. General Information

Training Course on
Cultural Heritage Protection in the Asia-Pacific Region
(1 February－4 March 2005, Nara)

1. Organizers

Organizers: The Asia/Pacific Cultural Centre for UNESCO (ACCU)
National Research Institute for Cultural Properties.
In cooperation with: Nara Medical University, Nara University of Education
Sponsored by: Japan's Agency for Cultural Affairs.

2. Background

Cultural Heritage Protection Cooperation Office, Asia/Pacific Cultural Centre for UNESCO (hereinafter referred to as the ACCU Nara Office) was established in August 1999. The activities of the ACCU Nara Office cover training for experts, provision of information, and networking for the protection of tangible, immovable cultural heritage.

The Training Course for Researchers in charge of Cultural Heritage Protection in Asia and the Pacific is one of the many programmes that the ACCU Nara Office undertakes every year. Each year two or three experts from the Asia-Pacific region are invited to Nara to engage in training at appropriate institutions/organizations under the coordination of the ACCU Nara Office.

The Federated States of Micronesia was explored and recognized by the Spanish in the 16th century. It was granted independence in 1986 after having gone through the occupation and mandatory rule by Japan in the beginning of the 20th century, and the era of trusteeship by the United States following World War II. This lengthy colonial rule resulted in the destruction of traditional cultural practices as well as many tangible and intangible cultural heritages that are usually handed down to succeeding generations.

The Federated States of Micronesia includes four states with the entire area belonging to the Caroline Islands consisting of over 600 small islands in the Pacific Ocean distributed widely from east to west. The wave of modernization has rippled across these islands, with the further destruction of cultural heritage on and under the ground, and underwater due to various development projects. At the same time, these advances in development have created opportunities for the discovery of many heritage places.

However, in terms of cultural heritage protection, the value and presence of cultural heritage itself has not been fully comprehended because of the geographical circumstances of the country that is a nation comprised of remote islands isolated in the Pacific Ocean. Moreover, since there are few personnel to conduct the protection and investigation of heritage resources, the country often relies on foreign research teams. Therefore, the training of personnel necessary for cultural heritage protection is an urgent issue.

3. Date and Venues

Date : Tuesday 1 February to Friday 4 March 2005

Venues: Cultural Heritage Protection Cooperation Office, ACCU (ACCU Nara Office); National Research Institute for Cultural Properties, Nara; Nara Medical University; Nara University of Education; Kansai Gaidai College

4. Objective of the Training Course

In the Federated States of Micronesia, as in many oral cultures around the world, there is no history of writing, thus, cultural heritage as it is presently known has been transmitted orally through storytelling, dance and religious events. Consequently, in finding and documenting unknown heritage, methods of archeological investigation play a significant role. The aims of this training project allow the opportunity to master advanced technologies currently used to investigate heritage resources, to obtain results from their use, and to contribute to cultural heritage protection in the Federated States of Micronesia.

Regarding the selection of candidates, the most important factor is that they should be in a position to immediately and widely disseminate their results. In the present situation, where there are very few personnel engaged in the protection cultural heritage, each participant is expected to act in a proactive manner covering an extensive region, and thus, exerting a significant influence in their primary region of study. Therefore, fostering the development of personnel belonging to government organizations may be a shortcut to achieve certain results in the short term.

5. Training Curriculum

The training curriculum consists of three primary foci:

- Introduction to the Methodologies of Archaeological Site Investigation
- Survey recording methods in Archaeological Site Investigation
  i.e. Summary survey, Topographic survey, GPS use, Site data integration
- Observation, Identification and Analysis of Remains
  Human Bones, Animal Bones, Pollen analysis, Soil analysis

6. Participants

Yvonne Chong Neth

Archaeological Staff, Historic Preservation Office, Federated States of Micronesia

Others (Past achievement to accept trainees)

Since 2000 when the above-mentioned invitation programme started, 13 trainees from 7 countries have been accepted. It is the first time to invite trainees from FSM.

7. Certificate

Each trainee will be awarded a certificate upon the completion of the course.

8. Language

The working language of the course will be English.

9. Expenses

Expenses for participants for the training course shall be borne by ACCU and comprise the following:

(1) Travel expenses:

Participants shall be provided an economy-class return air ticket between the international airport nearest to her residence and Kansai International Airport, and domestic transportation costs / to and from the airports and between the training venues in Japan.

(2) Living expenses:

Participants shall be provided a daily subsistence allowance during the training course, beginning from January 31 (Monday) to 6 March (Sunday), 2005. Arrangements for accommodations will be made by the ACCU Nara Office.

10. Correspondence

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2. Programme Schedule

Day			Lecture	Venue
	31	Mon.	**Arrival**	
February	1	Tue.	Orientation	ACCU
	2	Wed.	Introduction to Archaeology	ACCU
	3	Thu.	Introduction to Environmental Archaeology	NRICPN
	4	Fri.	Analysis of Animal Bones Ⅰ	NRICPN
	5	Sat.		
	6	Sun.		
	7	Mon.	Analysis of Animal Bones Ⅱ	NRICPN
	8	Tue.	Analysis of Human Bones	NMU
	9	Wed.	Method of DNA Analysis	NMU
	10	Thu.	Folklore Research in Micronesia	NME
	11	Fri.		
	12	Sat.		
	13	Sun.		
	14	Mon.	Introduction to Pollen Analysis and Work Shop Ⅰ	NUE
	15	Tue.	Introduction to Pollen Analysis and Work Shop Ⅱ	NUE
	16	Wed.	Introduction to Pollen Analysis and Work Shop Ⅲ	NUE
	17	Thu.	Introduction to Soil Analysis and Work Shop	NUE
	18	Fri.	Introduction to Museum Studies and Data Management	NME
	19	Sat.		
	20	Sun.		
	21	Mon.	Observation and Recording of Pottery Ⅰ	NRICPN
	22	Tue.	Observation and Recording of Pottery Ⅱ	NRICPN
	23	Wed.	Observation and Recording of Pottery Ⅲ	NRICPN
	24	Thu.	Archaeological Research in Micronesia Ⅰ	KGC
	25	Fri.	Archaeological Research in Micronesia Ⅱ	KGC
	26	Sat.		
	27	Sun.		
	28	Mon.	Survey Measuring Methods Ⅰ	NRICPN
March	1	Tue.	Survey Measuring Methods Ⅱ	NRICPN
	2	Wed.	Survey Measuring Methods Ⅲ	NRICPN
	3	Thu.	Survey Measuring Methods Ⅳ	ACCU
	4	Fri.	Report Writing, Closing	ACCU
	5	Sat.		
	6	Sun.	**Departure**	

NRICPN: National Research Institute for Cultural Properties, Nara **NMU**: Nara Medical University
NUE: National University of Education **NME**: National Museum of Ethnology **KGC**: Kansai Gaidai College

Summary of Lectures and Workshops

<u>February 1, (Tue.)</u>

Orientation

- General explanation of the training course objectives.
- Interview: current situation and future needs in FSM.
- Visit to the National Research Institute for Cultural Properties, Nara (NRICPN).
  - Zooarchaeology laboratory (Dr. Matsui Akira).
  - Dendrochronology laboratory (Dr. Mitsutani Takumi).
  - Conservation science laboratory.
  - Artifact management room: primarily for pottery/ceramics.
- Workshop and lecture with Prof. Kataoka Osamu, a specialist in Micronesian archaeology.

Dendrochronology laboratory (with the director, Dr. Mitsutani, right).

Lecture on environmental archaeology with Dr. Matsui.

<u>February 2, (Wed.)</u>

- Visit to UNESCO World Heritage Sites in Nara
  - Horyuji Temple
  - Kasuga Grand Shrine
- Introduction to Japanese history and arts
  - Nara National Museum: special exhibition of Itsukushima Jinja Shrine: UNESCO World Heritage site in Hiroshima Prefecture.
  - Buddhist art from the protohistoric and medieval periods.

Osteometrics: taking measurements of animal bones.

<u>February 3, (Thu.)</u>

Introduction to Environmental Archaeology

〈Dr. Matsui, *NRICPN*〉

- Zooarchaeology and Faunal Analysis: How to classify animal bones, and examine traces of cultural or natural modifications and damage.
- How to identify and classify animal bones, and conduct archaeofaunal analysis.

Classifying animal bones excavated from a shell midden.

Identifying bones from the fish skeleton.

Lecture by Prof. Yamada on Human Osteology

DNA extraction process instructed by Prof. Ishitani.

Collection Management was explained with items from Micronesia at the Tenri Sankokan Museum.

February 4, (Fri.)

Analysis of Animal Bones Ⅰ

〈Dr. Miyaji, *NRICPN*〉

- Workshop: classification of animal bones from the Miyashita Shell Midden, Nagasaki Pref.

February 7, (Mon.)

Analysis of Animal Bones Ⅱ

〈Mr. Diab, *ACCU* and Research Associate at *NRICPN*〉

- Lecture: characteristics of the fish skeleton and taxonomy.
- Drawing and osteometrics: learning the morphology (structure) of fish bone elements.
- Basics of Mollusc identification and classification.
- Workshop: fish bone and mollusc identification from archaeological sites, cataloguing faunal remains in a computer database.

February 8, (Tue.)

Human Osteology: Analysis of Human Bones

〈Prof. Yamada, *Nara Medical University*〉

- How to identify sex, age and racial traits from human bones.
  - Characteristics of the skull and pelvis.
- How to measure the skull and evaluate the results, specifically, racial differences.
- Examination of bones from Kofun period (circa 1500 B.P.) sites from Ehime Pref.

February 9, (Wed.)

Methods of DNA Analysis

〈Dr. Ishitani, *Nara Medical University*〉

- Lecture and analysis of DNA.
- Workshop: how to extract DNA from blood.

February 10, (Thu.)

Folklore Research in Micronesia

〈Dr. Yasui, *Tenri University*〉

- Presentation by Dr. Yasui regarding her research on: "Traditional Healing and Medicine Childbirth Today in the Pacific".
- How to conduct interviews for folklore research.
- Visit to the Tenri Sanko-kan: viewed collections from Micronesia and exchanged information.
- How to manage ethnographic and archival collections: the use of filing cards and records.

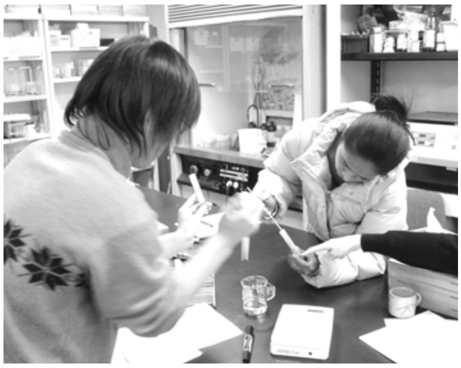
Prof. Nagatomo lecturing about the thermoluminescence dating method

February 14, (Mon.)

Introduction to Pollen Analysis and Workshop Ⅰ

〈Dr. Kanehara, *Nara University of Education*〉

- Lecture: introduction to pollen analysis
  - Examples of pollen analyses from archaeological sites and their results were shown through a Power Point presentation.
- Workshop: pollen analysis extraction procedure, and preparations for screening.
  - Microscopic observation and identification of diatoms from freshwater and saltwater.
- Visit to Prof. Nagatomo's laboratory
  - Short lecture on the thermoluminescence dating method and introduction to the equipment used to process samples.



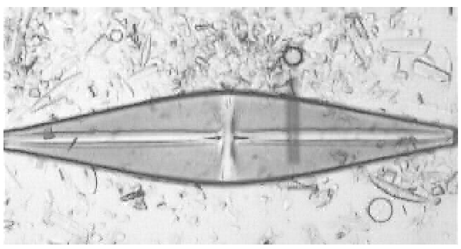
Preparations for screening

February 15, (Tue.)

Introduction to Pollen Analysis and Workshop Ⅱ

〈Dr. Kanehara and Mr. Takeno, *Nara University of Education*〉

- Continuation of the workshop from Monday (February 14).
  - Making slides of diatoms for microscopic observation.
- Lecture on how to identify diatoms and interpret palaeoenvironments based on the results.



Observing diatom with microscope. (above). An example of the diatom observed in the laboratory (below).

Lecture on how to make slides for microscopic pollen observation prior to the workshop.

Lecture on paleoparasitology by Dr. Kanehara and Ms. Kanehara.

At the storage room in the museum

Lecture by Prof. Into on ethnoarchaeological research in Micronesia.

- Presentation by Mr. Takeno: about the reconstruction of palaeoenvironments from diatoms recovered from moat depositions surrounding protohistoric tumuli.

<u>February 16, (Wed.)</u>

Introduction to Pollen Analysis and Workshop Ⅲ

〈Dr. Kanehara and Mr. Azuma, *Nara University of Education*〉

- Lecture on pollen analysis: the purposes of pollen analysis: reconstructing palaeoenvironments, palaeoclimate, and palaeodiet
- Making slides for microscopic pollen observation.

Introduction to Pollen Analysis and Workshop Ⅳ

〈Dr. Kanehara and Mr. Azuma, *Nara University of Education*, Ms. Kanehara, *Paleoenvironmental Research Institute Co. Ltd.*〉

- Workshop: pollen identification.
- Presentation about the excavation of the Kibi-zuka tumulus, on the NUE campus
  - General information about the excavation was presented initially, followed by a discussion and examination of an inlaid sword that was excavated from the tumulus.
- Visit to the Paleoenvironmental Research Institute Co. Ltd.
  - Lecture on palaeoparasitology by Ms. Kanehara
  - Observation and identification process for seeds and wood.

<u>February 18, (Fri.)</u>

Introduction to Museum Studies and Data Management

〈Mr. Ujitani and Prof. Into, *National Museum of Ethnology*〉

- Visit to the National Museum of Ethnology, Osaka.
- Lecture by Mr. Ujitani
  - General information about the museum: role of the museum, number of collections, how to utilize the collection etc.

- Tour of the museum collections: library, storage and photo studio.
  - How the library is managed.
  - How the collections are treated after they are brought into the museum.
- Lecture by Dr. Into: ethnoarchaeological survey in the Micronesia area.
- Tour of the exhibit area of the museum.

Pottery Laboratory: examining excavated pottery; learning about artifact curation and management; refitting potsherds (using glue).

<u>February 21, (Mon.)</u>

Observation and Recording of Pottery Ⅰ

〈Mr. Kawagoe, *NRICPN*〉

- Tour of the pottery laboratory at NRICPN
- Lecture on the fundamentals of pottery:
  - How to reconstruct and refit pottery
  - What kind of information do we need to reconstruct and refit pottery vessels
- Workshop: putting together *haniwa* sherds

Potsherds awaiting refitting.

<u>February 22, (Tue.)</u>

Observation and Recording of Pottery Ⅱ

〈Mr. Takahashi, *NRICPN*〉

- Workshop: glue together and reconstruct sherds
  - Instruction on refitting potsherds and the best methods used to glue sherds together.
  - Vessel reconstruction: filling missing sherds with plaster.

<u>February 23, (Wed.)</u>

Observation and Recording of Pottery Ⅲ

〈Mr. Morikawa, *NRICPN*〉

- Workshop: artifact recording.
  - How to record or draw artifacts: polished stone axes and chipped stone tools were used as an example.
  - The wet-rubbing method was introduced. This is used for recording sherd patterns, roof tiles, petrography, etc.

Lectured by Mr. Takahashi, gluing together and finished reconstruction of the lower part of the *haniwa*

Lecture by Prof. Kataoka on Micronesian archaeology.

Identifying excavated fish bones from Micronesia.

February 24, (Thu.)

Archaeological Research in Micronesia Ⅰ

〈Prof. Kataoka, *Kansai Gaidai College*〉

- Lecture on Archaeological Research in Micronesia.
  - Geography of the glacial period.
  - Immigration of people and characteristics of plants and animals.
  - Archaeological research at the prehistoric village of Nan Madol: lecture with videotape.
  - What kind of information can we get from fish bones found at archaeological sites.

  (Diagram from the lecture notes shown below)

February 25, (Fri.)

Archaeological Research in Micronesia Ⅱ

〈Prof. Kataoka, *Kansai Gaidai College*〉

- Lecture on Archaeological Research in Micronesia with slides.
- Identification of fish bones from Micronesia.

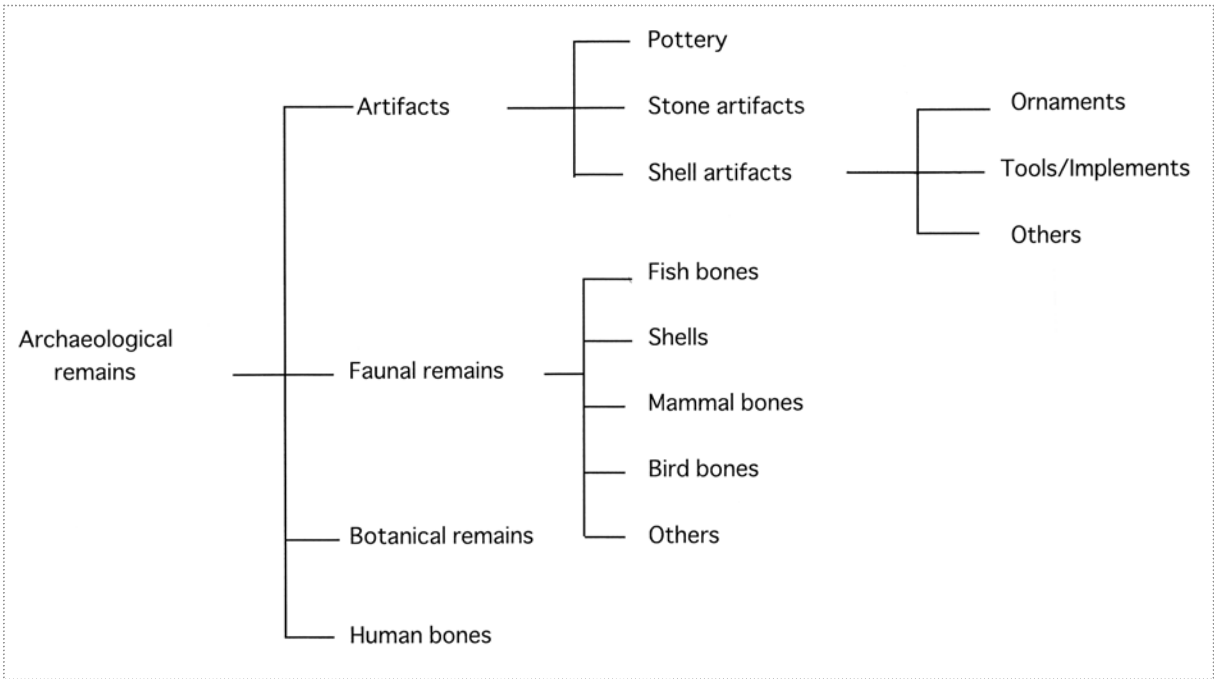


Diagram from the lecture by Prof. Kataoka, showing classification of archaeological remains in Micronesia.

<u>February 28, (Mon.)</u>

Survey Measuring Methods Ⅰ

〈Mr. Nishimura, *ACCU*〉

- Lecture on introduction to surveying methods.
- Workshop: leveling survey/
  - How to handle the level.
  - Transferring data point values to the target area.
  - Determining elevation from the plane table survey points.

<u>March 1, (Tue.)</u>

Survey Measuring Methods Ⅱ

〈Mr. Nishimura, *ACCU*〉

- Lecture on leveling and archaeological prospection.
  - How to calculate and obtain results from the measurement figure.
  - What is “archaeological prospection”?
  - General information on archaeological prospection: earth resistivity, magnetometry, and ground penetrating radar (GPR).
- Workshop: plane table surveying
  - How to set the plane table.
  - Traverse survey for determining control points.
  - Detail of plane table survey drawing.

<u>March 2, (Wed.)</u>

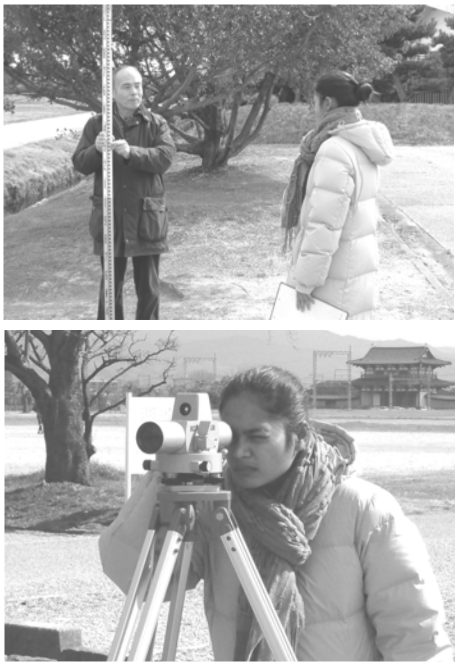
Survey Measuring Methods Ⅲ

- Workshop: Plane table surveying method
  - Detail mapping and complete the map.
  - Contour-line mapping.
  - Compass survey
  - How to adjust the result.

<u>March 3, (Thu.)</u>

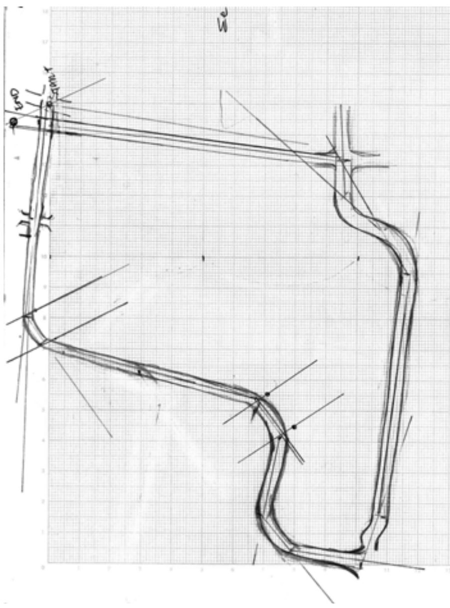
Survey Measuring Methods Ⅳ

- Visited following institutes and sites.
  - Archaeological Institute of Kashihara to see the 3D Scanner used for drawing and recording artifacts.



Workshop: leveling survey

Workshop: Plane table surveying method



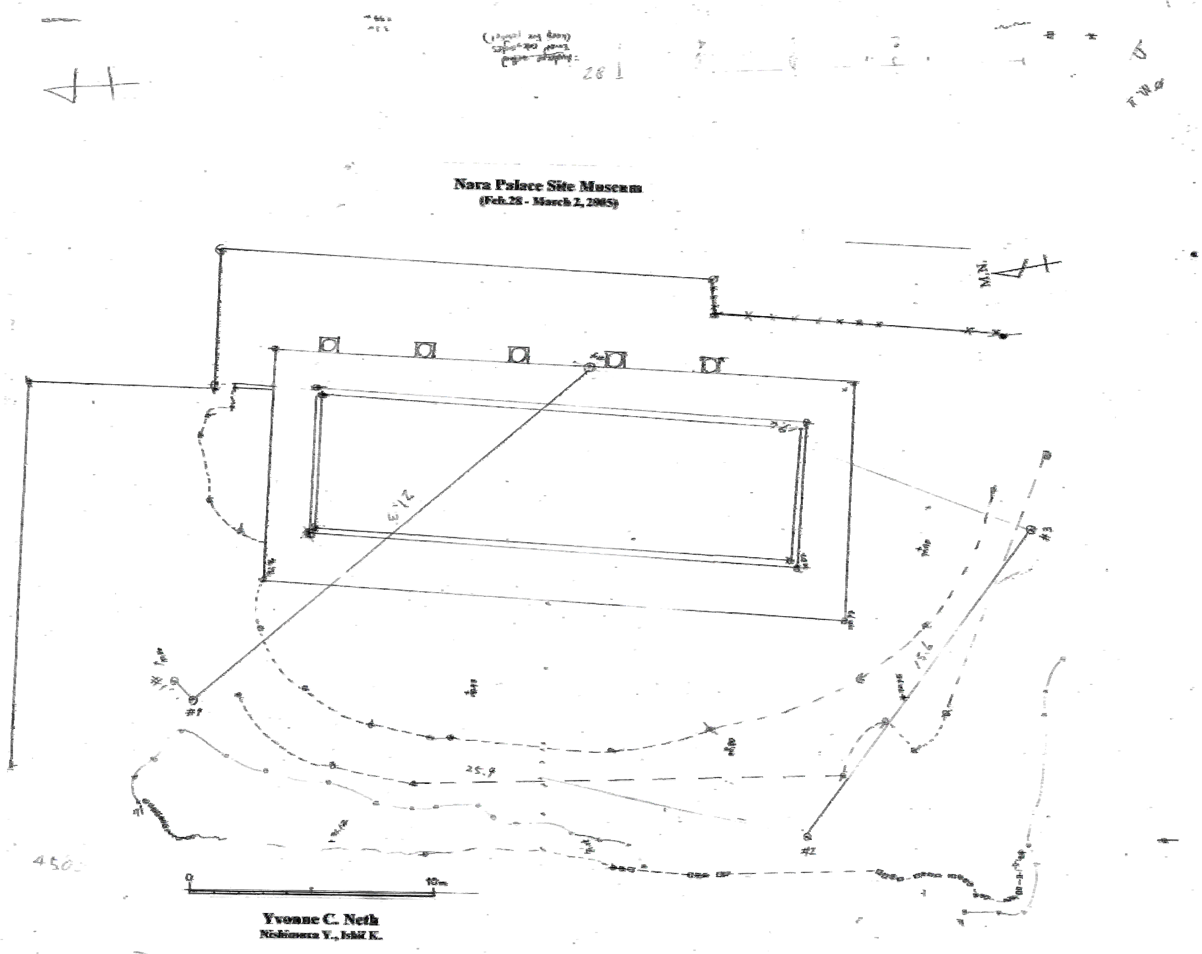
A map drawn with compass survey method by the participant.

At the Niko-ji *haiji* temple site (upper) and the Sakafune-ishi site, in Asuka Village

- Museum, Archaeological Institute of Kashihara.
- Niko-ji *haiji* temple Site, Katsuragi: Visited the excavating site and learned how the excavation was managed practically.
- Visited *Ishibutai* tumulus, *Kame-ishi* stone, other historical stone objects and archaeological sites in Asuka region to see how sites are utilized and opened to public.

<u>March 4, (Fri.)</u>

Closing ceremony at ACCU.



A map drawn with plane table method by the participant.

Country Report

Yvonne C. NETH
Historic Preservation Office

Personal past and present work done here in Micronesia may not deem myself as a professional, however, observations and probing questions have revealed the all-too-obvious fact that the need for archaeologists is great. It is imperative that Micronesia find such a resource, for it serves as a means to preserve the history of our islands, the defining and teaching factor of our cultures.

The present situation of archaeology resides in the tiny facilities of the Historic Preservation Offices (HPOs). Guidance falls to their banner, "Preserve and conserve the tangible and intangible cultural and historical resources of the Federated States of Micronesia." For the whole of the Federated States of Micronesia (FSM), there is but a single trained archaeologist, Dr. Rufino Mauricio. He is the Historic Preservation Officer for the FSM National Government. In a report written by Dr. Mauricio himself, 29 October 2004, he describes the responsibilities of the HPOs. They are as follows:

"The FSM National HPO is responsible for microfilming government documents, setting up an indexing system for microfilmed materials and assisting the public with information search into the large collection of the Trust Territory Archival Records. In addition, the FSM National HPO oversees the work of four State HPOs (SHPOs). He provides coordination, advisory and technical assistance to the SHPOs in matters pertaining to the management of the Historic Preservation Fund grant and in matters pertaining to Survey and Inventory of Sites, Site Development, Site Registration and Review and Compliance. Each SHPO and the FSM National HPO have specific activities within the following program areas: administration, planning, review board development, public education, survey and inventory of sites, site development, review

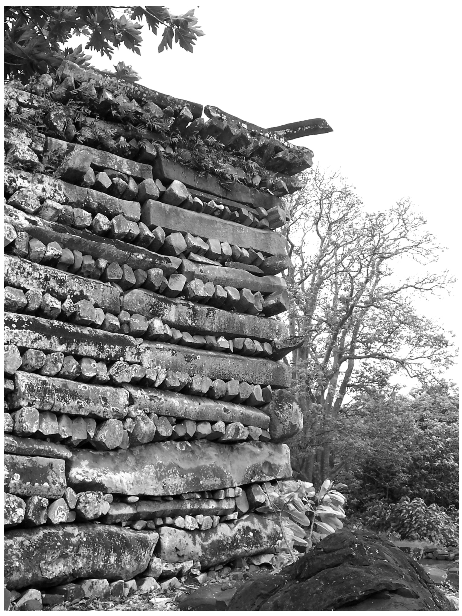


Photo 1: Corner of outer retaining wall, Nan Dauwas islet; (Photographer: Wilfred Nanpei)

and compliance, site registration, and cultural inventory or ethnography, inclusive of the former oral history program.

The SHPO's and the FSM National HPO's activities of the program areas, Survey and Inventory, Site Development, Review and Compliance, and Site Registration (nomination of sites to a registry) includes observation, recording, and analysis of the remains of flora, fauna and marine organisms, soil typology, recording of water sources, vegetation, and geological features of the land where sites are found. Archaeological surveys conducted by these offices assist in the conservation and protection of the natural resources of the nation.

Under the FSM public laws and the U.S. Historic Preservation Law, review of cultural and historical effects of the FSM National Government is required. In the presence of a government-funded or government-allowed earthmoving activity, the HPOs work with the Environmental Protection Agencies in determining the effect of such undertaking on historical and cultural resources. In all review and compliance work, the HPOs conduct surveys and, thus, collect and share, through public education programs and classroom presentations, important environmental information. This will, in turn, contribute to the conservation and protection of the nation's environment as well."

In an interview with Dr. Mauricio, he further explains that within each SHPO, there is a team of para-professionals. They are as such, because they lack the professional certification of a post-graduate diploma, but have been certified by the National Park Service in cultural resource management, inclusive of trainings in survey and site recording. That is not to say, however, that these individuals are inadequate. On the contrary, these individuals exhibit a humble knowledge of the science of archaeology and apply it so where the aforementioned responsibilities are carried out within a satisfactory extent. Yet a 'satisfactory extent' does not reflect the efficiency of a specialist. In the same October report by Dr. Mauricio, he stresses this importance in a section titled, "Strategic Goals, Outcomes, and Some Baseline Numbers." The first of these strategic goals are as follows:

"Strategic Goal 1: Improve archaeological survey activities by providing more field archaeology training and by increasing the number of archaeological resources recorded, reported and registered.

Outcome: The number of archaeological field training is increased by one or two trainings a year for at least one Field Technician from each State Historic Preservation Office (SHPO).

(Only one or two archaeological field trainings are held a year now.)

Activities: FSM National HPO to conduct at least one of the trainings in each FSM State.

Outcome: Increase the number of archaeological sites recorded reported and registered by three sites each ear. All copies of completed site forms and project reports will be duplicated and give to the Environmental Protection Agencies.

- Chuuk SHPO has 175 sites (historic and prehistoric) recorded and reported; none of these sites have been nominated to Chuuk's registry of sites.
- Kosrae SHPO has 350 sites (historic and prehistoric) recorded and reported; 78 of these sites are in-putted into databases; one of these sites has been nominated for Kosrae registry; 12 of these sites are regularly maintained for the Site Development Program.
- Yap SHPO has 90 sites recorded and reported; 17 are nominated to Yap's registry of historic places.
- Pohnpei SHPO has 360 sites recorded and reported; none of these sites have been nominated to Pohnpei State's registry of historic places.

Activities: The FSM National HPO will monitor the activities of the on-going archaeological survey in each of the FSM states and conduct two reconnaissance surveys with the staff, one monitoring trip to each SHPO per year.

Outcome: Increase the areal coverage of the reconnaissance survey areas (in square meters) in each FSM state targeting areas targeted for development, ground disturbing and areas subjected to deterioration y natural forces.

(Baseline reconnaissance survey area in each state is presently not available; baseline data for areas targeted for development and ground disturbance in each state is not available now.)"

It should be noted as well that the site registry is divided into State and National. There is a HPO board, where its members determine which site should be registered. They begin at the State level and later determine what should be deemed as a National site. Examples of National sites are the products of World War II, the aging tanks and shrines in their rustic existences. State sites differ in their definition of importance. Notable qualities can derive from religious importance (e.g. The stone ruins of Pohnpei and Kosrae), from symbolism (e.g. The Yap stone money serves as a symbol of the cooperative work and hard labor done by the people), and from a more practical reason such as economic revenue (e.g. Chuuk uses the WWII sites to increase tourism and the money it brings).

Contract archaeologists do exist, but they only work six months to two years at a time. The contract itself is valid for only two years. There are archaeologists that visit the islands every year, however, to perform their own personal research. It is required of these archaeologists to provide a copy of their proposal and reports of their work done in the FSM. Approval of their work is granted by the FSM National HPO.

Insufficient funds, environmental factors and short-handedness are obstructions that will continually present themselves. Progress then becomes a slow, dawdling walk against the swift escape of time. I believe the Historic Preservation Offices understand this. However, there is a prevailing factor they apply that reflects the banner of "Preserve and conserve" in which they work under, and that is *perseverance.* It is this factor that will elude what obstructions lay before them. Let it be an incessant search to overcome such trials, just as long as progress takes a step forward and remains mobile.

Photo 2: Bridge along the trail to Nan Madol;
(Photographer: Tania Chong)

Ⅳ Lecturers' Papers

Techniques for Identification of Artifacts

MIYAJI Atsuko
National Research Institute for Cultural Properties, Nara

Topics

1) The History of Techniques of Excavation of Small Artifacts

(1) Washing Soil

The first report of soil from an archaeological site in Japan being washed to search for small finds is in the 1911 book *Prehistoric Fishing in Japan* by Kamakichi Kishinouye. In this work, Kishinouye recounts how, when he washed fox bones from the Kuwagasaki shell midden in Iwate Prefecture in his sink at home, he noticed tiny fish bones that had been contained in the attached soil. Nakao Sakazume made the following paraphrased comments regarding methods for collecting small artifacts [Nakao Sakazume, "*Bisho ibutsu saishuho ni tsuite*", *Kaizuka* 8:36-37, 1939]: Soil containing rock shells (*Rapana thomasiana*) and moon shells (*Neverita didyma*) was brought back from a shell midden together with ash from hearths, placed in a white basin and mixed with water up to one eighth from the top. At this stage the small land snails float to the surface. If one gets close to these objects with a wet writing brush, they can be extracted by the brush through capillary action. After mixing several times until all floating objects have been removed, the water is thrown away and the soil examined. Soil is removed with the tip of the brush and anything that can be collected should be done so. It is unlikely that small fish such as sardines and dace would not have been used for food. Even if there is no method of directly identifying species at the moment, it is necessary to collect a sufficient quantity as samples for the future. Finally, Sakazume concluded that "in the near future, no doubt the day will come when such microscopic excavations will become essential."

(2) The problem of sample size

The most commonly used method for sampling shell middens, the column sample, was mainly developed in midden excavations conducted by the University of California in the first half of the 20th century. In these trials, one study concluded that 2kg of midden were needed from each layer, while another study suggested only 500g would suffice. Some researchers concerned themselves not with the quantity of soil but with the number of analyses. Binford approached sampling methods in archaeology from head on, noting that the problem was what researchers used in their analyses. He argued that while it was sufficient to define two types of pottery from a sample of 100 pots, 15 types were not sufficient. In general, examples involving artifacts need at least a sample of one hundred in order to conduct quantitative analyses. Just as there is a great variety of sites and features, sample size also needs to be considered with respect to the aims of the analysis.

(3) Applications of flotation

At the large excavations beginning in the late 1940s at Jarmo in Iraq and the Tehuacan Valley in Mexico, the use of water flotation to separate light objects that float in water and the use of dry screening of excavated soil to check sampling errors became common. In these arid areas flotation could be carried out using regular water in buckets and led to the effective separation of many plant seeds.

In Japan, after Kishinouye, for a long time no research attempted a quantitative analysis of the composition of shell midden deposits. An attempt at a quantitative comparison of shellfish from shell layers was made by Ichiro Yawata at the Yamazaki midden in Chiba Prefecture. Examining the shell deposits at the three excavation areas—those dug by the Department of Anthropology, Tokyo University (I), the Shizengaku Kenkyukai (III), and the intervening area II—Yawata used sections of the shell layers that contained relatively few other objects, counted all the collected shells, worked out their percentages and linked them with sea level changes [I. Yawata, "Shimofusa no kuni Yamazaki kaizuka ni tai suru ni, san no shaken," *Journal of the Anthropological Society of Nippon* 42(12), 1927; reprinted in *Yawata Ichiro Chosakushu*, Vol. 2, pp. 244-249, Tokyo: Yuzankaku, 1979].

The first use of a screen to collect small finds seems to have been at the Hebigiri Cave in Chiba Prefecture. From the deposits in A trench outside the cave, 40cm^3 blocks of soil were collected from Layers 3 and 4 and screening produced large quantities of Japanese pilchard (*Sardinops melanostic*) (160 vertebrae from Layer 3, 311 from Layer 4), anchovy (*Engraullis japonica*) (296 vertebrae from Layer 3, 1145 from layer 4), and chub mackerel (*Scomber japonicus*) (53 vertebrae from Layer 3, 44 from Layer 4). Estimates were also made of actual fish size using measurable elements of moray (*Gymnothorax kidako*), black sea bream (*Acanthopagrus schlegeli*) and read sea bream (*Pagrus major*) [Hiromasa Kaneko and Tetsu Wada, Tateyama Hebigiri Dokutsu no Kokogakuteki Chosa. *Waseda Daigaku Kokogaku Kenkyushitsu Hokoku 6*, 1958].

The British archaeologist Sebastian Payne was the first to clarify the correlation between screen mesh size and sampling error. He compared finds of obsidian from four sites, looking at (1) materials collected at the time of excavation, (2) materials collected during washing, and (3) compared the number and weight of finds found before screening. As a result, he found that where screening was not used the number of obsidian artifacts that were found ranged from 0 to more than 27%, while in terms of weight the range was from 0 to 82%. Payne emphasized the dangers of statistical analyses on assemblages collected without screening [S. Payne, "Partial recovery and sample bias: the results of some sieving experiments," in *Papers in Economic Prehistory*, pp. 49-64. Cambridge University Press, 1972].

In Japan, during the excavation of the Kamitakatsu shell midden in Ibaraki Prefecture, Kimio Suzuki and his colleagues noticed that the midden contained a large number of small fish bones and reported that with the use of screening they could collect small fish bones that were not visible to the naked eye [K. Shimizu, K. Suzuki and H. Fujimura et al., "Kaizuka ni okeru dobutsu izontai no saishu hoho to sono mondaiten", abstract of paper presented at the 39th meeting of the Japanese Archaeological Association, 1973]. These authors emphasized that existing excavations where only large bones were collected by hand had probably overlooked small animal and fish bones. Some years prior to this, Takeru Akazawa had taken three representative fish found in shell middens in the Kanto and Tohoku regions—red sea bream, black sea bream and sea bass—and measured the palate which tends to be the best preserved part of the head. Comparing his results with modern fish, Akazawa had argued that the shell midden people had concentrated on capturing large specimens [T. Akazawa, "Jomon kaizukasan gyorui no taicho sosei narabi ni sono senshi gyoryogakuteki imi," *Journal of the Anthropological Society of Nippon* 77:154-178, 1969]. Suzuki et al., however, argued that because none of the excavations used by Akazawa had employed screening, smaller fish had probably been overlooked. During their excavations at the Miyano shell midden in Iwate Prefecture, Suzuki and Komiya used screening to demonstrate that the Jomon people had actually caught small red sea bream, black sea bream and sea bass [Kimio Suzuki and Hajime Komiya, "Kaizukasan gyorui no taicho sosei fukugen ni okeru hyohon saishuho no eikyo ni tsuite," *Daiyonki Kenkyu* 16(2):71-75, 1977]. Moreover, at excavations at the Shomyoji shell midden in Yokohama, Suzuki and Komiya used the same screen method to compare fish body lengths based on samples without sampling error. As a result it was shown that, whereas the red sea bream at Miyano were said to be bigger than at Shomyodai and that red sea bream under 30cm long were not present at Miyano, fish under 30cm occupied the major part of the red sea bream assemblage at Shomyodai. This difference clearly reflects fishing behavior in the Kanto and Tohoku regions in the Late Jomon [K. Suzuki, *Kaizuka no Kokogaku*, Tokyo University Press, 1989].

During their excavations at the Tagara shell midden, Miyagi Prefectural Board of Education also screened soil after artifacts had been excavated by hand in order to investigate what proportion of artifacts had been overlooked with the naked eye [Miyagi Prefectural Board of Education, eds., *Tagara Kaizuka*, 1986]. According to this report, 291 stone arrowheads were carefully collected by hand but with screening this number increased to 1413. Naturally it was the smaller arrowheads that tended to be overlooked and it was shown that comparisons of arrowhead weight and size with assemblages from sites where screening had not been employed were without meaning.

(4) Dry Screening

In dry screening, soil from the excavation is placed in a square screen and the soil passed through, leaving artifacts on the surface which can then be collected. This method is effective for shell middens, cave sites, and for sandy and silty soils. The smaller the screen mesh, the fewer artifacts are overlooked but at the same time the more pebbles and other debris remain on the screen making the sorting process harder. Generally speaking, 10mm and 5mm screens are the most effective here. Most pottery sherds, stone tools and mammal bones can be collected with a 10mm mesh, but stone chips, fish bones and damaged fragments of bone and stone tools need a 5mm mesh. Shell midden strata are usually divided into pure shell layers (here defined as more than about 9/10 shell), mixed soil-shell layers (more than about 2/3 are shell) and mixed shell-soil layers (using the naked eye less than 2/3 shell). When digging pure shell layers by hand it is also easy to overlook large artifacts hidden by shells. As noted already, it is essential to use large screens for all of these shell and mixed shell and soil layers.

Peat, gleyed deoxidized clay and sand form the main deposits at wetland sites. None of these soils are suited for dry screening. As found at the Korekawa Nakai site, "special peat layers" are sometimes found with the remains of foods consumed by humans [Isamu Kono, "Aomori-ken San-no-He Korekawa-son Nakai sekki jidai iseki chosa gaiyo", *Shizengaku Zasshi* 2(4):237-254, 1930]. In the case of such artificial deposits it is necessary to estimate the quantity of nut shells contained therein and if the quantity of soil is not that great, then the whole deposit should be removed for sampling. Where quantities are large, the Museum of London manual recommends 75 liters as a basic soil sample [C. Spence, ed., *Archaeological Site Manual*. Museum of London, 1990.].

Depending on the objectives of the analysis, it is necessary to change the amount of soil sampled in order to obtain at least 100 examples of the artifacts concerned. In the case of seeds, however, current European standards recommend a combined total of at least 500 crop and weed seeds [J. Greig, *Handbooks for Archaeologists, No. 4: Archaeobotany*. Strasbourg: European Science Foundation, 1989, p. 46].

(5) Wet Screening

①The advantages of wet screening

Wet screening refers to a method by which soil is placed on the screen and water then sprayed from above, which forces small sand particles through the mesh leaving any artifacts to be collected from the screen. In the case of shell midden deposits, circular screens with a diameter of 20cm are often used; these have meshes of 9.52, 4, 2, 1 and 0.5mm and are made by Iida Manufacturing Co. Ltd. and other companies. Equipment especially designed for water separation is also commercially available from the Daiichi Gosei Co. Ltd. with mesh sizes of 5, 2.5 and 1mm. If the quantity of soil is not that large, however, then ordinary screens are sufficient. Plant remains are often poorly preserved, and when they are very small they are often damaged and difficult to separate using dry screening. The use of water makes it easier to clearly separate artifacts and soil, and differential flotation also helps in separating lighter objects such as seeds which float and heavier objects like bones that do not. Small artifacts obtained in this way are important materials for reconstructing past diets and determining the nature of archaeological features.

(6) Flotation

①Objectives and general methods

Flotation refers to methods whereby soil is added to water or another liquid and the lighter finds float to the surface to be collected by the archaeologist. Soil is usually placed in a tub of water and then agitated until light seeds and carbonized materials can be collected. In the case of dry, sandy soils found in arid regions or dry caves, small artifacts are easily separated from the soil matrix, but with clayey soils like those in Japan the soil needs considerable agitation before small plant and insect remains will float to the surface. When the quantity of soil is small, it is added to a liquid with a high specific gravity and then plant and insect remains are collected (usually liquid zinc chloride with a specific gravity of two, but because this is an organic chemical compound it cannot be poured down the drain after use and disposal poses problems). This same method is used by palynologists to separate pollen from soil in test tubes. Beetles and other insects can be collected by placing the soil into warm water with kerosene or dissolved paraffin wax. All of these methods pose problems of disposal; they are effective for treating small quantities of soil but difficult for amounts over 100cc.

A 10mm screen is sufficient for collecting nuts and large seeds but 0.5mm or 0.3mm screens are needed where small seeds like millets or grasses are expected. A simple kitchen or tea strainer can be convenient here. Gauze is also easily obtained, but without a frame care is needed that small artifacts do not slip off the gauze and artifacts can also become clogged in the mesh and time-consuming to collect.

② Flotation of about 10 liters of soil

A 5 liter stainless steel beaker with a single spout is the most useful here. Where a beaker is hard to obtain, a bucket will serve but without a pouring spout it is difficult to control finds floating on the surface.

(a) Fill the beaker with water and then add two or three trowels of soil (500cc – 1000cc) and stir. If the soil is clayey, it can be presoaked in water from the previous day and kitchen mixers or beaters are effective for stirring the soil.

(b) Floating finds are first removed with a tea strainer or similar device and then separated in a case filled with water.

(c) Place a hose in the beaker and add water. The current from the hose can be used to float lighter artifacts to the surface. A net or strainer and a 20cm diameter 0.3 or 0.5mm mesh screen should be placed to catch water that overflows.

(d) The screening is completed when the number of floating artifacts becomes small and impurities disappear. Stone tools, potsherds, bones and other artifacts may, however, be contained in the grit that falls to the bottom of the beaker and this should either be placed in a separate case and the artifacts collected or else wet screened as discussed below.

(e) The seeds collected in the screen can, like wooden artifacts, be subject to shrinking, cracking and other damage during drying and they should be kept in a tightly sealed container until they can be identified.

③ Flotation using a Chip purifier

Soil from latrines which contains large quantities of seeds, insects and so forth requires a Chip purifier used in scientific experiments. Tap water pumped in at the bottom of the machine causes a current and the soil is agitated by the blade attached to the top. The light fraction flows with the water through the hole at the side, though larger objects can be collected directly with a strainer. In my experience, about a liter of soil can be floated in about 15 minutes.

(7) Other Wet Screening Methods

① Effective wet screening of large quantities of soil

If large quantities of soil need to be screened for valuable artifacts, then use of an electric sieve is effective. With the electric sieve made by the Dalton Company, soil is inserted through the funnel at the top and is passed through 10, 4, 2 and 1mm screens while receiving vibrations that cause radial eddies; finds are then collected with pebbles and debris according to the size of each screen. This is suitable for shell midden layers or bead-making sites where the soil is not clayey and where there are small but important artifacts.

In the case of clayey soils, soaking in water for several days makes processing easier. With actual clay, however, even this is often not enough. Where large quantities of very heavy soil need to be water screened, an electric cement mixer is effective. This method was used by the Museum of London when excavating alluvial deposits from the River Thames. Sites formed on alluvial deposits of large rivers are often comprised of many layers of heavy clay soils. With limited time and resources, this type of machine is probably necessary to maintain the same standards as at other sites.

If 50-100 liters of clayey soil are placed in the mixer drum and rotated, the blades inside break up the soil and make it easier to dissolve in water. The use of concrete mixers and electric sieves are thus effective ways to collect small finds from heavy soils.

② **The problem of sample size**

If, for example, you are interested in determining the ratio of shell types in a shell layer, there will be cases where it is sufficient to screen 1000cc of soil from each stratum through a 1mm screen, whereas in other cases 10,000cc will not be enough to get the full number of individual species. To obtain numbers for boar and deer, all the soil from the excavation needs to be passed through a 10mm or 5mm screen, but that might not be enough to get reliable data. In contrast, while studying pollen, parasite eggs and other microfossils it is usually sufficient to have 500cc or the equivalent of a 35mm film case from each layer. For this reason, when taking soil samples from a site the archaeologist needs to think about what sort of analyses will be conducted at the site and thus what sample sizes, screen size, and so forth will be necessary.

2) The Significance of Compiling a Pictorial Review of Animal Skeletons

Zoo-archaeology has developed as a part of environmental archaeology. There are an increasing number of people in the field of archaeology who are interested in animal remains. This development is no doubt partly due to the diversification of the field of archaeology, which has promoted a focus on the informational value of shellfish and animal bones that are amenable to the direct discussion of ancient eating habits and livelihoods. In the past, animal remains were lumped together with natural stones and plant remains and referred to as "natural artifacts," considered to be material for studies in the field of natural science and outside the realm of archaeological research. Today, however, their importance as artifacts that reflect the culture of humans in a major way is gaining recognition. Nevertheless, in order to identify the species and body parts of animal remains that are unearthed from archaeological sites, it is necessary to have on hand the skeletal specimens of a full range of modern animals and to become thoroughly versed in complicated anatomical terminology, most of which is either in Latin or English. In addition, there have been no facilities that have skeletal specimens of modern animals made available for archaeological researchers to use, a situation that has forced those who aspire to become zooarchaeologists into collecting skeletal specimens on their own. Furthermore, if one wishes to come into contact with research at the forefront of zooarchaeology, there is a need to pay attention to literature written in English at the very minimum. These factors make for a road that is wildly convoluted and despairingly long. Even though on the one hand, the demand for zooarchaeology has increased, on the other hand nothing has changed in terms of the difficulty of studying the discipline. Even if one were to teach oneself, the first obstacle is the absence of any decent introductory handbooks on animal osteology. At the National Research Institute for Cultural Properties, Nara, we have always incorporated lectures on zooarchaeology in our Environmental Archaeology training programs. We are now drawing on our experience to compile a series of pictorial reviews of animal osteology, designed for archaeological researchers with convenience of use in mind.

3) Names of major bones

"Environmental Archaeology 2 and 3: Pictorial Review of Small and Medium-Sized Mammalian Osteology," contains life-size illustrations of the dog (*Canis familiaris*), the wild boar (Japanese wild boar, *Sus scrofa leucomystax*) and Fish.

4) Identified archaeological remains

Material

- Miyashita shell-midden (Late Jomon period)
- Harunotsuji (Early Yayoi period)

Bibliography

Chaplin, Raymond E. 1971 *The study of animal bones from archaeological sites*. Seminar Press, London. 170 pp.

Driesch, Angela Von Den 1976 *A guide to the measurement of animal bones from archaeological sites*. Peabody Museum Bulletin No. 1, Harvard University 137 pp.

Gilbert, B. Miles 1980 *Mammalian osteology*. B. Miles Gilbert, Publisher, Wyoming. 428 pp.

Goto, Masatoshi and Ohtaishi, Noriyuki ed. 1986 *Ha no Hikaku Kaibougaku* (The Comparative Anatomy of Teeth). Ishiyaku Publishers, Inc., Tokyo. 266 pp.

Grant, Annie 1982 *The use of tooth wear as a guide to the age of domestic ungulates. Ageing and sexing animal bones from archaeological sites*. BAR British Series 109, pp. 91 – 108.

Hachiya, Noboru and Ohtaishi, Noriyuki 1994 *Kokkaku Hyohon Sakuseiho* (Method for the Preparation of Skeletal Specimens). Hokkaido University Press, Sapporo. 129 pp.

Hidaka, Toshitaka ed. 1996 *Nihon Dobutsu Daihyakka, Honyurui 1 & Honyurui 2* (Encyclopedia of Animals in Japan, Mammals 1 & Mammals 2). Heibonsha Limited Publishers, Tokyo. 156 pp., 155 pp.

Hillson, Simon 1992 *Mammal bones and teeth. An introductory guide to methods of identification*. Institute of Archaeology, University College London. 64 pp.

Hongo, Hitomi; Ishiguro, Naotaka; Watanabe, Takuma; Shigehara, Nobuo; Anezaki, Tomoko; Vu The Long; Dang Vu Binh; Nguyen Trong Tien; and Nguyen Huu Nam 2002 Variation in mitochondrial DNA of Vietnamese pigs: Relationships with Asian domestic pigs and Ryukyu wild boars. *Zoological Science*, 19, Zoological Society of Japan. pp. 1329 – 1335.

Kawada, Shimpei and Daigo, Masayuki 1970 *Kachiku Hikaku Kaibougaku I* (Comparative Anatomy of Livestock I). Buneido Publishing Co., Tokyo. 365 pp.

Matsui, Akira ed. 1991 *Kankyou Koukogaku 1: Iseki Dojo no Senbetsuho* (Environmental Archaeology 1: Method for the Classification of Soil in Archaeological Sites). Buried Cultural Properties News, 95, National Research Institute for Cultural Properties, Nara. 16 pp.

Matsui, Akira ed. 2002 *Kankyou Koukogaku 2: Chu Kogata Honyurui Kokkaku Zufu* (Environmental Archaeology 2: Pictorial Review of Small and Medium-Sized Mammalian Skeletons). Buried Cultural Properties News, 108, National Research Institute for Cultural Properties, Nara. 16 pp.

Mochizuki, Kimiko ed., Evans, H. E. and Christensen, G. C. ed. 1985 *Inu no Kaibougaku* (The Anatomy of the Dog). Gakusosha, Ltd., Tokyo. 923 pp.

Ohtaishi, Noriyuki 1980 Iseki Shutsudo Nihonjika no Kagakukotsu ni yoru Seibetsu, Nenrei, Shibou Kisetsu Sateihou (Method of Utilizing the Mandible for Assessing the Sex, Age, and Season of Death of Japanese Sika Deer Unearthed from Archaeological Sites). *Koukogaku to Shizen Kagaku* (Archaeology and Natural Science), No. 13, pp. 51 – 74.

Schmid, Elisabeth 1972 *Atlas of Animal Bones. For Prehistorians, Archaeologists and Quanternary Geologists*. Elsevier Publishing Company. 159 pp.

Shogakukan 1999 *Super Nipponica: Dainippon Hyakka Zensho* (Complete Encyclopedia of Japan) CD-ROM.

Yamada, Eichi translation 1977 *Zukai Kaibougaku Jiten* (Illustrated Anatomical Cyclopedia). Igaku Shoin, Ltd., Tokyo. 489 pp.

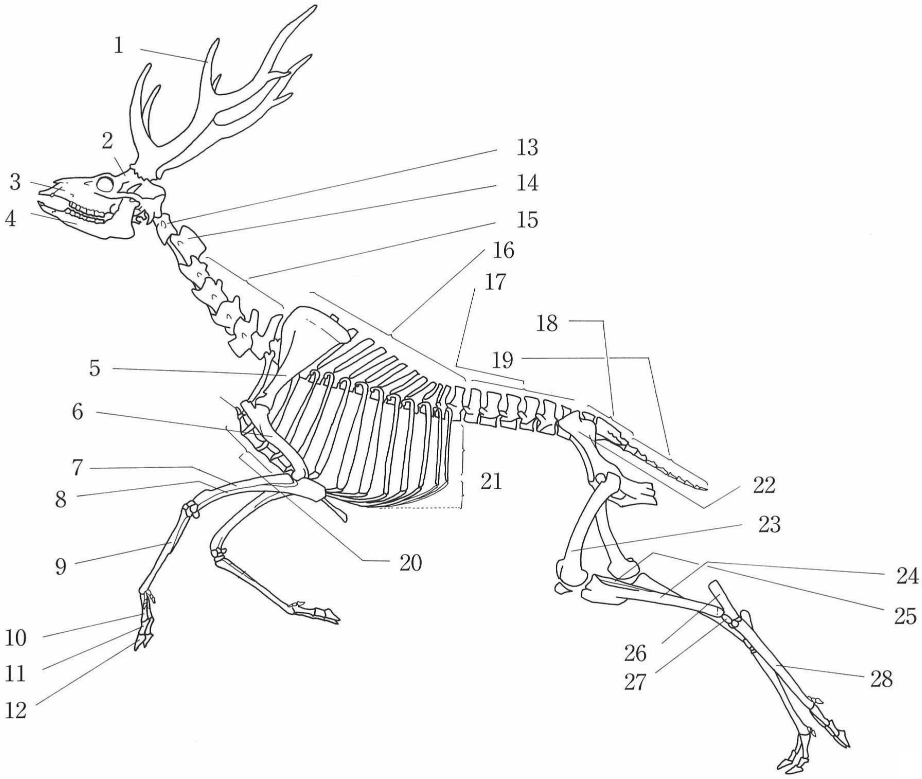


Figure 1: Names of Major Skeletal Parts (Illustration: Japanese Sika Deer)

List of Measurements by Animal Species

Units: mm

Name	Body part measured	Japanese Sika deer	Wild boar	Japanese black bear	Japanese serow
Cranium	Total length of cranium (GL)	290.3	294.9	257.1	209.7
	Greatest breadth of cranium (ZB)	132.7	136.2	170.8	91.3
Mandible	Total length of mandible (Id-Goc)	186.0	241.7	179.2	166.3
	Height of mandibular ramus (Cr-Gov)	101.0	106.7	86.9	86.1
Scapula	Greatest length (HS)	161.5	191.5	132.7	160.8
	Greatest breadth of distal extremity (GLP)	39.5	33.9	39.1	35.1
Humerus	Greatest length (GL)	180.6	196.0	204.5	196.4
	Greatest breadth of proximal extremity (Bp)	46.3	50.0	40.0	43.2
	Greatest breadth of distal extremity (Bd)	38.5	41.7	55.6	39.4
	Breadth of trochlea (BT)	37.4	29.9	37.1	37.0
Radius	Greatest length (GL)	187.0	142.3	179.3	182.2
	Greatest breadth of proximal extremity (Bp)	35.7	27.6	23.7	37.1
	Greatest breadth of distal extremity (Bd)	32.4	32.0	32.0	33.6
Ulna	Greatest length (GL)	229.6	198.1	209.4	226.4
	Breadth (DPA)	32.6	36.1	26.9	27.5
Metacarpal	Greatest length (GL)	186.8	64.1 (63.3)	—	136.6
	Greatest breadth of proximal extremity (Bp)	25.1	20.2 (15.0)	—	30.6
	Greatest breadth of distal extremity (Bd)	27.4	16.4 (15.3)	—	35.2
Pelvis	Length of pelvis (GL)	217.8	221.7	182.1	216.4
	Greatest breadth of acetabulum (LA)	32.4	31.8	31.4	31.6
Femur	Greatest length (GL)	223.6	209.9	215.1	219.1
	Greatest breadth of proximal extremity (Bp)	55.0	52.7	53.4	47.3
	Greatest breadth of distal extremity (Bd)	49.9	45.5	44.9	45.1
Tibia	Greatest length (GL)	265.3	188.7	178.4	254.8
	Greatest breadth of proximal extremity (Bp)	50.4	48.3	46.4	49.1
	Greatest breadth of distal extremity (Bd)	33.7	27.6	34.4	34.1
Fibula	Greatest length (GL)	-	174.7	158.7	—
Metatarsal	Greatest length (GL)	214.8	69.6 (76.3)	—	146.8
	Greatest breadth of proximal extremity (Bp)	24.2	14.8 (13.5)	—	25.5
	Greatest breadth of distal extremity (Bd)	26.7	15.3 (15.9)	—	32.9
Talus	Greatest breadth of lateral (GLl)	35.8	40.2	26.3	36.6
	Greatest breadth of medial (GLm)	34.4	35.3	—	34.7
	Greatest breadth of distal extremity (Bd)	23.4	23.8	—	19.4
Calcaneus	Greatest length (GL)	80.8	75.4	45.9	65.6
	Greatest breadth (GB)	25.4	22.6	31.3	24.1

1. Antler
2. Cranium
3. Maxilla
4. Mandible
5. Scapula
6. Humerus
7. Radius
8. Ulna
9. Metacarpal
10. Proximal Phalanges (1st)
11. Middle Phalanges (2nd)
12. Distal Phalanges (3rd)
13. Atlas
14. Axis
15. Cervical Vertebrae
16. Thoracic Vertebrae
17. Lumbar Vertebrae
18. Sacrum
19. Caudal Vertebrae
20. Sternum
21. Ribs
22. Innominates (Pelvis)
23. Femur
24. Tibia
25. Fibula
26. Calcaneum
27. Astragulus
28. Metatarsal

Environmental Change as Seen from Seashell Remains Unearthed from the Nan Madol Ruins --Pohnpei Island, Micronesia

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Introduction

The Nan Madol Ruins, the largest in Micronesia, amazed the first Westerners to visit Pohnpei Island in the 1800's, which they, in turn, called the "Venice of the Pacific". The islanders do not have a written language and have conveyed the story of Nan Madol to the present by word of mouth. It was this oral history that the first Westerners to the island recorded in their travel logs and ethnographies. In recent years, archeology has made considerable advances in the Pacific. Many excavations are underway with the objective of preserving cultural properties, and these activities are producing more and more artifacts. Using artifacts, recounted stories and ethnographies, attempts have been made to answer some of the many questions concerning Nan Madol such as how these mammoth ruins came to be. This presentation looks into environmental changes, identified through analyses of excavated seashells, that accompanied Nan Madol's construction.

The Location and Environment of Pohnpei Island

Pohnpei Island is located at 6°58' north and 158°13' east in the Eastern Caroline Islands of Micronesia (Fig.1). It is the third largest volcanic island in Micronesia behind Guam and

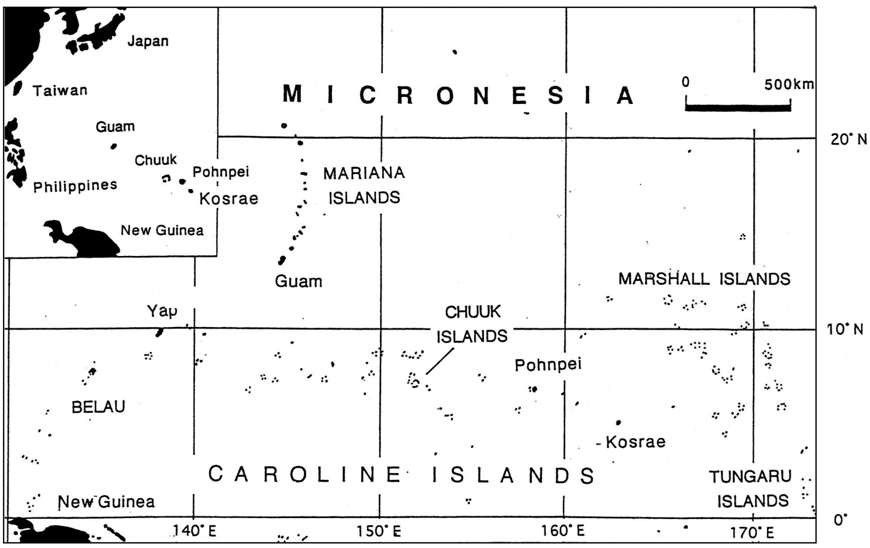

Fig.1: Map of Micronesia (Kataoka 1998)

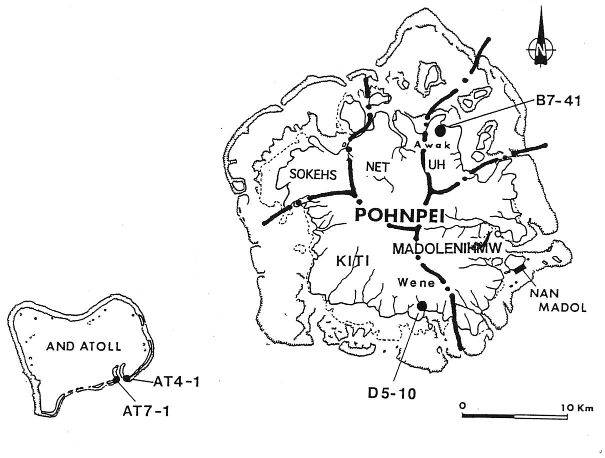

Fig.2: Map of Pohnpei Island and And Atoll (Kataoka 1998)

Babeldado Island (belonging to Palau). The 790 m peak of Mt. Nahnalaud is the second highest after Agrihan Island of the Northern Mariana Islands. Moreover, there are11 peaks over600 m high. Located east of the andesite line, the main island is formed of basalt. The main island is 334.2 km^2 in area and almost round in shape with a maximum diameter of 23 km. Inland, the island is characterized by thick forests and rugged terrain. There are 42 rivers that wind through mountains, which themselves reach to the shore, and spill into the fringing reef.. There is very little flat land as 81% of the island is mountainous and 14% mangrove swamp. The climate is characterized by heavy rainfall, high temperatures and high humidity. From December to May, the Trade Winds blow in from the northeast or east.

Most of the coastline is enclosed in mangrove swamps. The only beachfront is around Temwen Island in the southeast. With the exception of Temwen Island, the island is almost completely surrounded by barrier reefs and lagoons with channels between them in 20 locations. Some 23 small volcanoes are found in the lagoons (Fig.2).

The Nan Madol Ruins

The Nan Madol Ruins are located atop a reef flat in the southeast foothills of Temwen Island, which is located southeast of Pohnpei. Unlike other coastal areas, there are no lagoons around the ruins; a long reef flat that runs from the northeast to the southeast connects it to the open sea (Fig. 3). This huge complex, measuring 1.5 x 0.5 km in size, consists of over 100 man-made islets. Traditionally, it is divided into Upper Nan Madol (Madol Poe) where priests lived, and Lower Nan Madol (Madol Pa) which was the ceremonial and political seat of the Sau Deleur Dynasty (Fig. 4).

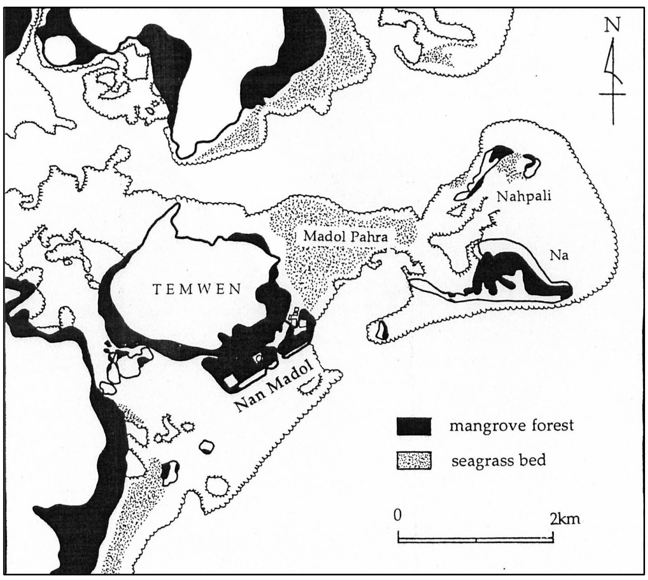

Fig.3: Nan Madol and its surroundings (Kataoka 1996)

The man-made islets were generally constructed by building a foundation of large basalt boulders

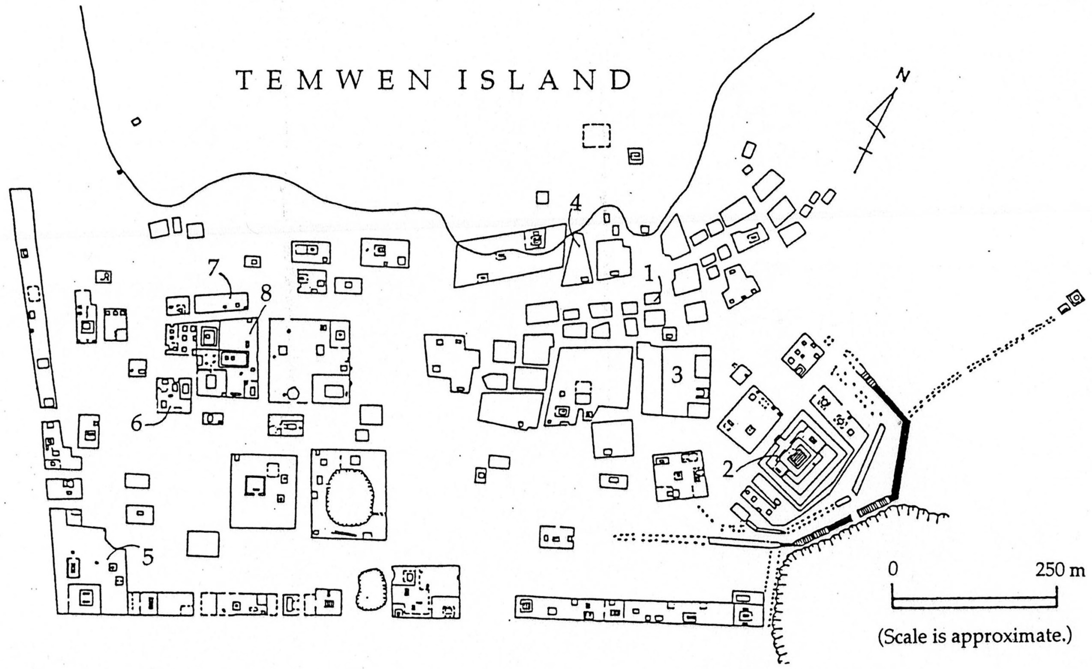

Fig.4: Plan of Nan Madol Site (Kataoka 1996)

estimated to weigh about 50 tons and 1 ~ 5 ton basalt prisms on the reef flat, and assembling a perimeter wall in a basalt prism. The basalt prism perimeter wall of Nan Douwas reaches 8 m in height. The islets are basically rectangular in shape and range in area from 370 to 12 700 m^2; the largest islet of Lower Nan Madol, Pahn Kadira, is 110 x 115 m. The internal areas within the perimeter walls of the islets are built with large quantities of heaped coral and covered with earth to level the area, but the heaped coral is exposed on some of the man-made islets. Oral history states that the coral used to build Nan Madol was taken from three spots: the nearby area, Lukop to the north and Ipwal to the south. Years of coral excavation in the area around Nan Madol has left a vast barren sandy bottom zone called *pohnpikalap*.

Analysis of Seashells

Trenches were dug in 12 locations on 8 of the Nan Madol islets. 57,469 seashells weighing approximately 360 kg were identified, possessing a minimum of 44,526 individuals. Of the gastropods, that accounted for 86.7% of all individuals, 47 classes and 96 species were identified in 34 families, whereas with the bivalves, that accounted for 13.3% of all individuals, 20 classes and 19 species were identified in 17 families. This presentation is approximately minimum of 30,290 individuals that were unearthed from the age-dated strata.

A. Change and Differential Representation in Excavated Quantities of Seashells

In terms of percentages, unlike later periods, there was a significant difference in the types of seashells identified. Examples of some species not found in the deposits at the Dauahdpeidak site (DPK, 69 AD), the oldest era at the Nan Madol Ruins, included *Strombus gibberulus* of the *Strombidae* family (18.7% of total shells) and *Tellina palatam* of the *Tellinidae* family (13.5% of total shells). What this indicates is that abundant resources could be gathered from various areas exploited by the first inhabitants. Between 657 and 760 AD, large quantities of *Strombus gibberulus* (42.8%) were gathered, that together with *Anadara antiquata* (11.3%) and *Lambis lambis* (6.8%) accounted for 60.9% of all shells. The muddy bottom zone and sandy bottom seaweed bed that extended from these habitats to the mangrove forests were important gathering grounds at that time, and furthermore, the importance of *Strombus gibberulus* continued to increase through to 1300 AD. A decrease to 31.5% in 1400 AD, though it was still the maximum, was believed to be the result of overharvesting. An increase seen from 1650 AD onward was presumably due to the abandonment of Nan Madol in the 1500's, which gave *Strombus gibberulus* populations a chance to recover (65.6%) by the time the man-made islets were used again. From 1800 onward, the number of identified specimens increases to 67.1% of the total mollusk specimens.

B. From the Environmental Changes

As a comparatively large quantity of *Tellina serrata* were collected by the former site occupants, the species' population decreased in number from 69 AD. This indicates that the first inhabitants in the shallow sea area near Temwen Island did their gathering in the silt bottom along the coast, the ecological habitat of *Tellina serrata*. The subsequent decline in population indicates that the inhabitants started building man-made islands close to Temwen Island which was a suitable habitat for the *Tellina palatam*. By the time that Nan Madol was completed, the silt zone habitat of the *Tellina palatam* had been reduced to 0.8% in 1650 AD, and to 0.3% around the turn of the 20^{th} century.

The building of man-made islets gradually expanded from Temwen Island towards the sea. It is presumed that, alongside this expansion, the mangrove forests got bigger and a muddy bottom zone formed in the nearby area. The muddy zone of the mangrove forests provided an excellent habitat for *Anadara antiquata* of the *Arcidae* family and *Gafrarium pectinatum* of the *Veneridae* family. Also, the vast seaweed beds that adjoined the mangrove forests were a good habitat for *Strombus gibberulus* and *Lambis lambis*. The environmental changes associated with the construction of Nan Madol can be understood from the fact that these shells were gathered in increasing number from 600 AD onward.

The *Nerita polita* (8.7%) and *Nerita undata* (3.1%) of the *Neritidae* family declined greatly between 650 and 750 AD. This is presumably because the lagoon and coral flat that served as the habitat of these shellfishes were used for the construction of Nan Madol. The reduction in coral around the Nan Madol site is also explained by the decrease in fish bones of the *Scaridae* family, which have a close ecological relationship with coral and were found in abundance in excavations of the early period, to 29.8% in 750 AD. Moreover, the increase in the *Lutjanidae*, *Carangidae* and *Acanthuridae* families suggests the coral was transformed into a barren flat.

On the other hand, the increase in *Nerita polita* from 900 to 1000 AD is believed the result of an artificial habitat suitable for the species being created in the tidal zones by the heaped coral and basalt used to build the islets. From 650 to 750 AD, the increase in *Strombus gibberulus* (42.8%), *Anadara antiquata* (11.3%), *Cypraea spp.* family (*Cypraea tigris*: 7.4%), *Lambis lambis* (6.8%) and the *Naticidae* family (4.1%) tells us that the seaweed bed that follows the mangrove forests was their primary habitat as well as an important gathering ground. Also, the increase in *Asaphis violascens* indicates an increased use of mangrove swamps. From the Wasau period (500 AD) to the Usendau period (800 AD), construction of the man-made islets spread far and wide. During this period, the land adjoining Temwen Island became occupied by people who used the muddy bottom zone and seaweed beds as major shellfish gathering grounds.

Conclusion

The chronological changes in the percentage of uncovered shellfish are believed to be caused by (1) over-gathering from continuous fishing, (2) environmental changes, (3) changes in gathering grounds, (4) evolving gathering techniques, and (5) changes in personal preferences. Within that, in the case of Nan Madol Ruins, because large quantities of coral were used to build the man-made islets on the reef flat over a period of about 1,500 years, it is believed that the surrounding environment changed greatly as a result. As told by locals, there is an extremely high possibility that coral was taken from areas adjoining Nan Madol. The resulting reduction of vast areas of the coral flats into barren sea affected the types of shellfish that locals fed on as well as their gathering activities. Gathering became impossible in previous gathering grounds because of further human occupation. Locals were forced to change gathering grounds and thus moved their main gathering grounds farther offshore from Temwen Island as the man-made islands expanded.

Kataoka Osamu (1998), Study on Food Shellfish of Prehistoric Pohnpei, Federated States of Micronesia, *Journal of Inquiry and Research No.68*, Kansai Gaidai University, Osaka, Japan, pp:403

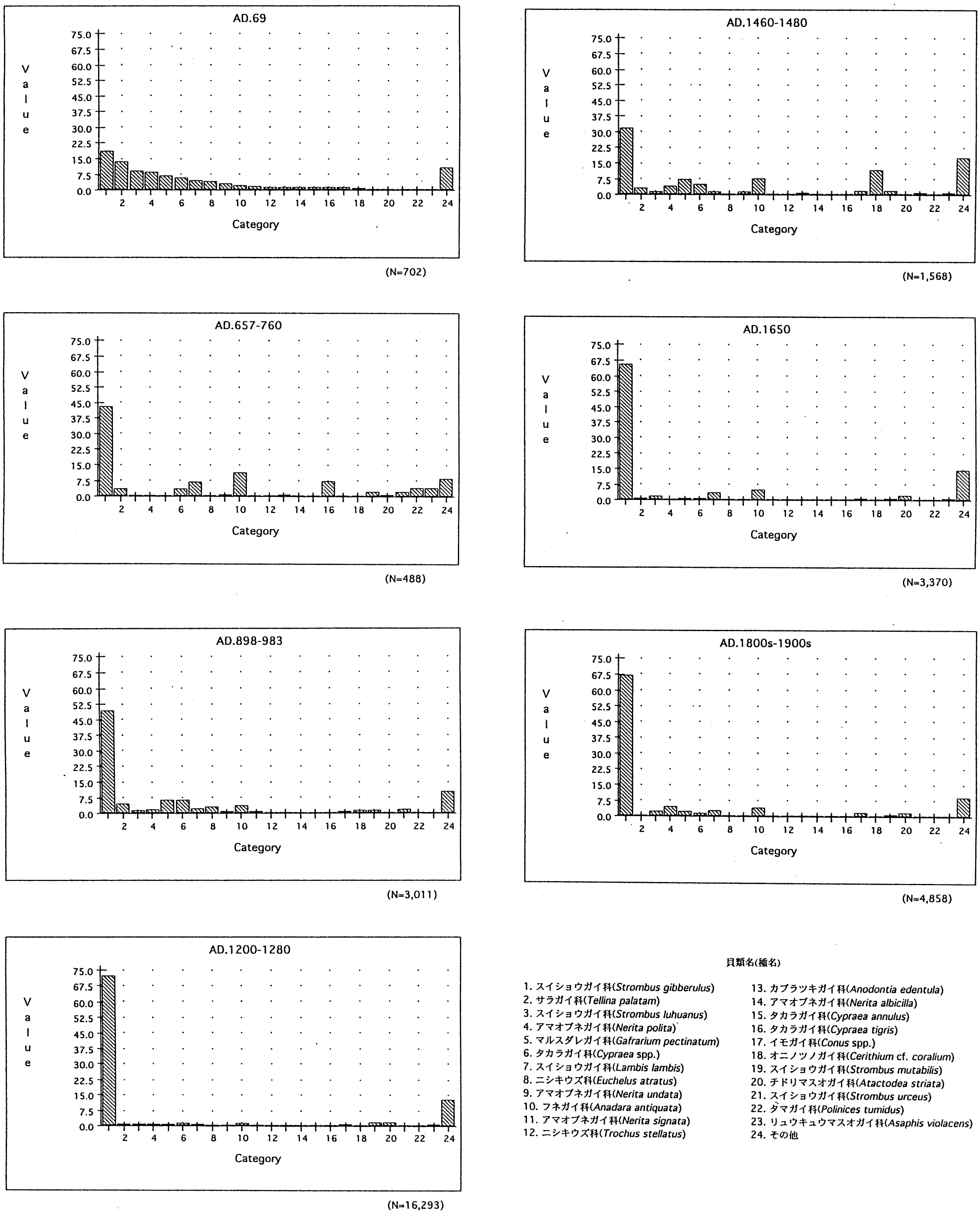

Fig.5: Shell remains unearthed from the Nan Madol Site

Final Evaluation Report

Yvonne C. NETH

Week One:

The Conservation Laboratory introduced many new technological advances, in terms of machinery and solution treatments, to items of wood, pottery, metal and soil. Usage of such treatments in Micronesia may be as follows:

1. Resin treatments executed on wooden objects may be utilized in the island of Yap, where aging ceremonial meetinghouses still stand. There are paintings on the faces of these meetinghouses that emit a message to the community. In utilizing the resin treatment, these messages can continue to provide guidance to the present and future communities, and to function as a vessel of education on Yap's cultural heritage.

2. The soil treatment, extracting stratigraphical information onto a plastic sheet, is brilliant. The information can be transferred outside the excavation site literally, instead of relying on the old practices of drawing and pictures. With continual conservation treatment, the sample becomes a comparative sample, a resource in the study of history in Micronesia. What can come out of this, is the discovery of the changing size of the island, due to climatic and environmental conditions; e.g. where a beach once was situated 200 years before today, and now has become a fertile taro patch plantation.

3. If any metal conservation were to be executed, the objects used would be products of World War I and II, and the exploration and colonization periods by the Spanish, German, Japanese and the United States of America. There are many evidence of foreign origins scattered all over Micronesia; from the enormous canons hidden in the jungle of Sokehs mountain to the petite measurement of a Japanese skull, attached to the rusted floor of a giant ship by yellow-white coral, on the reefs of Chuuk lagoon.

4. Finally, potter conservation would entail further analysis into the development of economy in Micronesia. Methodology and decorative patterns involved in pottery making can be compared to neighboring locations. A theory of migrational patterns between peoples, for the means of trading or newfound habitats can be derived from the examination of pottery artifacts. If a theory currently exists, then further support to it can be established from these studies.

Animal bone analysis at Nabunken utilized the bones of the deer as our main subject tool. After a review of the major osteological terminology for the anatomical areas of the bone, we concentrated on the present animal species that remain prevalent in Micronesia: dog, pig, chicken, turtle, eels and fish. This better understanding of the osteology of these animals will further expedite the identification process of excavated artifacts.

Week Two:

Micronesian lifestyle encompasses a maritime livelihood, simply because of our environment. Therefore, concentrating on fish and shell analysis is extremely important, for these two items are found the most in any given archaeological site in Micronesia. The existence of pig, dog and chicken were later products of migrational influence. Earlier analysis of prehistory would demand knowledge of fish and shell anatomy.

Professor Yasui at Tenri University involved herself in the studies of ethnography. I understand the importance of this field. All of Micronesia is governed to a great extent by culture. Our traditions are not passed on in written form, but orally. Because of this and the changing of ideas with foreign countries, inclusive of our adaptation to foreign conveniences and teaching courses in English, the definition of cultural norms are being altered. Therefore, ethnography would serve as a survival skill in the preservation of our cultural values.

Week Three:

In theory, the analysis of pollen and diatoms could help determine the migration of flora material from other neighboring locations, by utilizing evidence from each stratigraphic layer of soil. Indeed, Micronesian flora is less unique and quite predictable than other countries -- coconuts and bananas would be the generalized idea. The importance of this theory is to not only prove the beginning of certain dietary substance intake but the beginning of migration itself, a migration that denotes the origins of Micronesian civilization and its very genetic ancestral makeup. In practicality, this vision is blurred and far-fetched. I do not believe any comparative sources are available, and as such, any results drawn may not stand firm in the scientific community.

I found Parasitology quite interesting. The research facility belonging to Dr. Kanehera distinguished which toilets belonged to Japanese and which to Foreigners. The Foreigners' common diet consisted of beef and pork, while Japanese concentrated on aquamarine animals. The presence and quantity of parasites deriving from each toilet differed in their origins, beef/pork or aquamarine. Hence, a theory was imposed as the toilets with beef/pork parasites belonging to the Foreigners, and the other of aquamarine nature belonging to the Japanese. The same concept may be applied to Micronesians and foreign colonizers. Considering the "primitive" nature of medicinal remedies against foreign diseases, the existence of parasites can entail health and perhaps mortality issues. However, I do not know the survival rate of such parasites in the environmental conditions of the Micronesian islands. Still, it is important to take this concept of Parasitology into consideration.

An opportunity presented itself at the National Museum of Ethnology. According to an administrative officer, NME offers aid to foreign countries, in the form of training of museum staff in the proper management and function of a museum -- even a museum that has not been erected yet. Several museums exist in Micronesia. However, they are not visited regularly, which in turn becomes a factor that affects the need for proper maintenance. Another factor is budget allowances. Now, I have learned inadvertently during my first week here in Japan, that the government of Japan enforces Junior High school students to visit cultural heritage sites; this serving as exposure and appreciation for one's country's heritage and history. I believe this applies to museum maintenance because the building can serve as a vessel for the very same educational exposure, considering the fact that our cultural heritage sites are not all registered and enforced by the government as mandatory places to visit. In effect, budget allowances would increase and become standardized; this ensuring further maintenance and functioning of our museums.

Week Four:

Observation and recording of pottery involved sorting, identifying the purpose of the pottery, and its restoration. According to my understanding, pottery artifacts are not as prevalent in Micronesia, in comparison to other islands, such as those of Polynesia. However, this does not understate their importance in our historical record. If and when pottery is found, the process of sorting, identifying purpose and restoring such artifacts is imperative. I have gained the fundamental understanding of this process through this training program.

Drawing artifacts to scale is a skill I would insist upon all HPO members in Micronesia. Proper recording of information ensures the survival of important data. Staff members will become more knowledgeable and able to draw theories of how our ancestors once lived.

Wet rubbing can be applied on the pietroglyphs in Pohnpei. If any impressions on excavated pottery served as decorations, this technique can serve as a recording tool for such findings. Its effectiveness is enhanced in its ability to survive 200-300 years; this quality can ensure a lasting comparative sample.

Dr. Kataoka emphasized the alliance of ethnology and archaeology in understanding evidence from an excavation site. Certain species of fish existing in a site may entail a specific cultural rule. In his case, Dr. Kataoka found that fish could be divided in Micronesia as ones labeled "prestigious" and others "common." Types of fish offered to an individual followed accordingly to his rank. This ethnographic data further clarified the role of the persons who once lived in the excavated site in question. In addition, ethnographic data could indicate a potential archaeological site before an excavation is performed. This would assist in planning and research into a site, while a sense of control over budget allowances is established. Hence, increasing the productivity and efficiency of an archaeological survey. More importantly, the importance of ethno-archaeology extensively improves one's understanding of the "bigger picture" involved in archaeological excavations – What happened here?

Week Five:

It goes without question that survey measuring methods are applicable in Micronesia. A goal of critical importance to the Historic Preservation Office is to discover and register as many cultural heritage sites as possible. Survey measuring methodology is a required step to the completion of this goal. The techniques can be taught with ease, for it does not involve much machinery or mental work. If I trained a handful of individuals with what I learned with Mr. Nishimura, the collection of cultural heritage sites into a registry will increase rapidly.

Conclusion:

Micronesia has had its islands probed at and traversed for a scientific explanation of its past by foreigners for centuries. Field reports, books, and antique journals draw up figures, graphs, theories, and testimonies — all representations of a nation made up of tiny volcanic and coral islands that continue to remain baffling to the mind. Within the enigmatic blueprint of desolated stone cities, of buried artifacts and painted mosaics on the aging wood of meeting houses, lies the persisting force of an infrastructure of powerful cultural elements. This fact alone clarifies the need for the natives of such a nation to move into the conservation sciences; for an "emic" view of culture can better explain and understand the inner-workings of one's history than imposing foreign theories. It is imperative that we as Micronesians move quickly before all we know of "what was" becomes a degenerative process, before fading into memory soon evolves into nonexistence.

On a personal note, I have great respect and much appreciation for the many professionals I have had the honor of interacting with. I have every intention of applying my newfound knowledge in my country; nothing gained here in Japan will fall futile in any way. Invested in me is a responsibility that cannot be readily dismissed, and for that this training program has extensively prepared me more to take on this responsibility. In addition, I have enjoyed such optimal level of hospitality, and I thank ACCU for this memorable experience in Japan.

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