Supplement 1 1979

MICRONESICA

Journal of the University of Guam

DEVOTED TO THE NATURAL SCIENCES OF MICRONESIA AND RELATED AREAS

ARCHAEOLOGICAL TEST EXCAVATIONS PALAU ISLANDS

1968–1969

Douglas Osborne

MICRONESICA

Journal of the University of Guam
DEVOTED TO THE NATURAL SCIENCES IN MICRONESIA

Founded by Benjamin C. Stone in 1964
Published twice a year

Actual date of issue
June 20, 1979

MICRONESICA is a forum for original research in the fields of physical and social anthropology, archaeology, linguistics, and ethnology; systematic and ecological botany and zoology, marine sciences, and related disciplines concerned primarily with Micronesia and adjacent regions.

UNIVERSITY OF GUAM

Box EK, Agana Guam, U.S.A.

Subscription Prices
Individual $ 8.00 per year
Institutional $12.00 per year

ARCHAEOLOGICAL TEST EXCAVATIONS PALAU ISLANDS

1968 – 1969

Douglas Osborne

Department of Anthropology, California State University
Long Beach, California 90840

In Loving Memory of
Ellen Elisabeth Osborne
and
Sumang, the Yachad of Ngerahamai
Neither of whom could wait to see
the published results

MICRONESICA

Journal of the University of Guam

Supplement 1 Agana, GUAM 1979

CONTENTS

EDITORIAL NOTE

This is a Supplementary issue of MICRONESICA, additional to our regular series. The narrative style and length of the manuscript are not representative of manuscripts that are accepted by MICRONESICA. However, archaeological authorities advised us that this manuscript is a major contribution to the prehistory of Micronesia and provides much needed data on the western Caroline Islands. Financial support for publication of this manuscript is provided, in part, by National Science Foundation Grant No. BNS78-08830, awarded to the author.

The Editor

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

The following pages of this introductory statement will present a history of the expedition in as much detail as is pertinent. Included herein will be references to and acknowledgments of the many persons or institutions that have played a part in forwarding the archaeological program. Here also will be discussed the approach, method and reasons that guided our field and laboratory activities.

The major thrust of the occupation of the Pacific islands, i.e., that which resulted in the peopling of Melanesia, Polynesia and parts of eastern Micronesia, is now accepted, I am sure correctly, to have come out of southeast Asia-Indonesia and to have worked its way thence along and through the archipelagos that we now call Melanesia. Movements south, at an earlier date, led man into Australia-Tasmania. Pressures and voyages, still well before the time of Christ, led another kind of man into western and then eastern Polynesia. This, truly, must be the major part of the story of human exploration and utilization of the Pacific. But it is not the whole tale and while it must be the more important in terms of human history because it is so massive, it may not be of greater anthropological import than the spread of man and culture to western Micronesia out of the adjacent large islands to the south, southwest and west.

The Palau Islands are the nearest large Micronesian group to the Philippines. There are tiny inhabited islands (Sonsorol, Tobi, Merir and Pul) south of Palau, nearer Malaysia and Melanesia. Merir and Pul (Pulo Ana) have archaeological sites on them that cry for attention.

In 1953–1954 my wife Carolyn, our two small daughters Frieda and Ellen and I spent the winter, spring and part of the summer in the Palau Islands. During this time we accumulated the data which resulted in the publication of the archaeological survey of the Palaus (Osborne 1966).

No other archaeologists had attacked the problems of Palau prehistory, and since my wife and I retained a strong interest in the area and the study of its past, I prepared a request to the National Science Foundation for the financial support of a year of field work there. The proposal went to Washingron in the fall of 1967 and on April 3, 1968 I received a letter from Richard W. Lieban, NSF Program Director for Anthropology, advising me that the proposal had been approved as project GS-1963 for $47,800.

From the start, the Palau field work was planned as, primarily, a family affair. Carolyn Osborne appeared on the proposal as unsalaried associate investigator. Hers was the task of organizing and accomplishing the laboratory processing and recording. In the Palaus, this meant training and participating in analysis of the sherds (which were 99.99% of the artifacts found), recording the results on the forms set up (so that computer cards could be punched from them), and organizing, managing and participating in the darkroom work in the same way as was necessary at the sherd tables.

Frieda, our older daughter, was the expedition typist and secretary, botanical collector and darkroom assistant. She also expanded a hobby that had long infected the household and at the end of several months of intensive study, felt herself able to attend to the identification of all archaeological shells. She has continued in this field. Ellen's interests in ceramics led her to work in sherd analysis—a decision that often tormented her when the bags of sherds began coming in from the excavations. She also took over the work of making silhouettes of the rim forms for the charts (for example, Figs. 32–37) using a formagauge, black construction paper and scissors, and she cataloged and maintained the photographic files. Both girls had scuba equipment and much collecting and photography of marine life was accomplished.

The proposal included a salary and transportation for a student assistant. It was my hope

that I could initiate a young anthropologist into the techniques and tactics of Pacific studies, at least as I knew them. Mr. Jan Stevens applied for the position of field assistant and he and his wife Sheila, also a beginning graduate student, asked that she be taken as an assistant at no salary but that her transportation be paid. This seemed like a good opportunity to train more than one student and to lighten and distribute the work to be done in field and laboratory.

The decision was made early to travel to Guam by freighter because such a method would save on shipment of supplies: a large amount could go as baggage, and it would give us time to study and plan. Academic duties kept my daughters and myself and the Stevens busy until mid-June. Both during the school year and later we plunged into the task of accumulating the necessary instrumentation, getting forms printed, buying tools and purchasing and packing the necessities of living. We made a number of trips to the State Educational Surplus where we were fortunate in securing tools, surveying equipment, camera and photographic supplies and even some household supplies suitable for island life.

A number of gifts and loans of needed items from persons in no way connected with the project saved our budget considerably. James Miles, M. D. of Denver, Robert Weed, M. D. of Napa, Edward Siudmak and Richard Hoefer donated medical supplies. Rose Bornstein placed a Zeiss transit-level at our permanent disposal and Everett Lambert lent a farm level. On the academic level, Keith Dixon and George Mead assisted us in formulating our methods for recording the ceramic attributes. We made some changes in the forms later, while in the field, but the basic approach remained.

We purchased a boat, boat trailer and outboard motor locally, cleaned and painted the boat and packed it with our light gear. The Maintenance Division on the campus decked it with plywood to check pilfering, successfully. A pickup was also purchased and the Division built a large truck box which, with the cab, was also laden when we shipped it. The truck lasted us to the end of the work, limping badly the last few weeks; the secondhand outboard and boat were worn out in mid-year and were sold locally and newer equipment purchased in the islands. Although our transportation needs were met I would have done better to have purchased a new outboard in the States, shipped it over and purchased a boat on the islands. It would have been impossible at that time to have ordered and secured delivery on a new Japanese pickup in the islands, in the short time between April and August when we arrived there. With a little more lead time such an arrangement could be made; it would be preferable.

On 19 July the six of us, having packed and seen our equipment on the San Pedro docks, met in San Francisco to board the Pacific Far East Lines AMERICA BEAR for the long trip to Guam. Captain Schwab, master, and all of the crew were thoughtful hosts. Our group was the only passengers and we were spoiled; the food was excellent and the Captain's before dinner hospitality was the stuff of which memories are made. We docked in Guam after 13 days at sea. Here we were assisted between heavy showers, by Emilie G. Johnston and Robert Hahn. Mrs. Johnston is an amateur archaeologist and historian who has been and is contributing to the preservation of the Guamanian heritage. Mr. Hahn is Pacific Far East Lines agent on Guam and also a dedicated student of Guam's past. Both had been of great help to Fred Reinman, then of the Chicago Museum of Natural History, in his recently accomplished archaeological surveys and excavations on the island, and Reinman's letters of introduction to them gained us two good friends and no end of help when we needed it.

On the 9th of August we took the Air Micronesia flight from Guam to the Palaus. There within a few days we were to move into the laboratory appartment at the Trust Territory Entomology Laboratory and conservation complex developed and directed by Robert Owen. Our boxes and the automobile and boat came in shortly and by the 28th we were ready to start our first extended field work. We were able to spend several days, between mid- and late August, driving around Koror, reassessing the sites and refamiliarizing ourselves and familiarizing the Stevens with the area.

A major problem during the earlier few days was the lack of a Palauan assistant. Such a person was in my budget. We needed a man who spoke passable English, knew the islands, knew boating and though not necessarily, had rather high social standing. It was our hope that Sumang, who assisted us through the first Palau trip, and liberally fulfilled all of the requirements, could work with us again. For a number of reasons this was not feasible and, with his and others' help, we searched anxiously for several days. I finally suggested that Francis Toribiong, a nephew of Sumang's might be able to fill the position. He went to work for the project on 1 September and remained with us until the following June. We soon came to depend on him and though young and inexperienced, he did very well indeed.

Fortunately for us Bonina Towai had been working as housekeeper at the laboratory apartment for the persons who preceded us. She continued with housekeeping, and helped with sherd washing, with Palauan nomenclature of shells and plants, and a host of other things. She is an excellent Palauan cook and a good Japanese one. Under her tutelage our daughters became discerning betel nut chewers. Not a day passed that some bit of useful knowledge, some suggestions or some material assistance did not come our way from local people.

The strategy that has been formulated and followed for the pursuit of arehaeological knowledge concerning man in western Micronesia is simple. Alternatives exist but it seemed preferable to examine the same area that we had surveyed in the mid-1950's. The resultant survey then dictated the second step, that of test excavating in several different kinds or ages of sites in differing environments. A successful campaign, made up of a number of small excavations could hopefully wring the best from several sites and yield the basic stuff of Palauan culture history. A synthesis of data should serve to test, correct and modify the published hypothetical reconstruction which was derived from survey data and native historical legend (Osborne 1966: 460–465). However, there are still areas in the Palaus and some with archaeological promise, that have not been combed.

The sites chosen for sampling, the second phase of study of Palauan prehistory, have been the ones which original survey data indicated. It was certainly too much to expect that theyhad entombed within them the very best deposits for the purpose of assisting in outlining Palau prehistory. The choices were made first on the basis of the sherd collections of the survey. Collections which suggested occupations of depth, based on the then admittedly tentative conclusions resulting from our first testing and analysis, were judged as demanding site investigations. These demands were modified or reinforced by such variables as kind of site, outstanding characteristics, geographic position, and other environmental associations. Finally, practical considerations such as availability of the site by land or water, presence of a local source of labor and even the progress of the campaign as a whole, dictated not so much the choice of a locale for excavation but the amount of time and effort which was devoted to several excavations.

I am not a ritualist. Thus, while there are admitted values to be gained from the choice of dig locations or of extensive surface collecting at random, this procedure was not followed. Variances of plant cover, soil, erosion and slope, surface sherd concentrations, past probable use (often hypothetical) were all judged more important than random control. The variables stated, and others, had significance in the past or signified past happenings, and we believed ourselves sufficiently discerning to select the best places for testing. No doubt such a desision rests to a certain extent on personal ego and bias. It would be, or might have been of interest and perhaps of value to have set up a random selection of the same amount of excavation that we did accomplish on one of the sites and after analysis, compared the results' of the digging of random and considered selections. I am not aware that this has been done.

Preliminary testing was usually accomplished by vertically wedge shaped test pits dug for the sole purpose of exposing deposit and stratigraphy. More formal test squares or trenches were laid out following the data known, adduced, and accumulated by the informal tests. A

grid system, using a centerline and right and left lines was our basic control but no single excavation was large enough to have created the need for developed or overall grid control. Initial formal excavations were controlled by half-foot levels, measured from the surface or a set datum. Stratigraphic excavation followed the original exposure if it were feasible. Every effort was made to map each site where excavation was accomplished. The job was partly done for some, well done for most. The Palau sites that we worked are sufficiently different from one another and from inhabited areas elsewhere so that descriptive data are unusually important.

Excavations will be described from south to north. Thus the sites that we excavated on the platform and reef-remnant ("rock" or limestone) islands will be described first. Those on volcanic soil will be last. The different kinds of soils and patterns of living that obtained in the two different physiographic areas within the Palau Islands are striking. Yet the basic aspects of life were, as far as we can discern archaeologically, much the same.

The calendar of excavations is available piecemeal in the descriptive discussion of each site worked. It is given here in toto. An examination of the field time, as opposed to total time, will show the usual imbalance: laboratory work is far more time consuming than field work. The sites and islands appear on Figure 1.

Site Koror 3: 26 August-9 September, 1968, 11 working days.
Koror 5: 23 September-1 October, 1968, 7 working days.
Babeldaob 18: 9–23 October, 1968 and 14 to 20 April, 1969, 20 working days.
Babeldaob 19: 15–25 October, 1968, 9 working days.
Babeldaob 10: 29 January—13 February, 1969, 20 working days.
Babeldaob 37: December, 1968 and January, 1969, 24 working days.
Babeldaob 40: 10—28 February, 1969, 17 working days.
Angaur 19: 1—12 May, 1969, 8 working days.
Pelilieu 1: 2—15 May, 1969, 8 working days.
Aulong 1: 11—23 March, 1969, 10 working days.
Ngerkeklau 1: 2 working days, November 1968.
Koror 25: 1 working day, December 1968.

This totals 137 days in which excavations were actually open and either Stervens or I or both were supervising a field crew. It does not count the weekends in the field in which we cataloged, brought notes up to date, sketched in maps or explored. To the 137 days should be added 13 days during which Frieda and Ellen excavated at Aulong 1 and Babeldaob 18, 12 days which Carolyn Osborne worked on B18 and B40, Pelilieu 1 and Koror 3. Sheila Stevens worked 18 days in the field at Koror 3 and 5 and Babeldaob 19. This equals 180 field days for American personnel on the digs. Francis Toribiong was in the field 98 days, which raises us to 278 field days. The entire project supervisory and technical crew including Toribiong worked 1132 man days. Thus field work made up about 25% and laboratory (including darkroom), packing, writing and maintenance, about 75% of our time overseas. The sherd analysis, 13,868 sherds broken and examined with a hand lens and the 1310 black and white negatives developed and printed and 40 rolls of color film processed were the major tasks. All records were made in duplicate, including the photographic records. One copy was mailed to the Department of Anthropology at the University for storage where Laurie Simms, department secretary, took it under her wing, and the other was shipped home when we left the islands. Fortunately there were no accidents and both copies survived.

Sheila Stevens left the project in mid-December 1968 and repaid the project the cost of her passage home. She had worked out the approximate expense entailed by the trip out.

Two weeks of my work were lost in a quick trip to Sri Lanka under a research development award. I had hoped to set up an archaeological study of the obviously Hoabhinian-related Balangoda culture of Sri Lanka, using the Foreign Currency funds then available. Unfortunately the project could not be funded but the experience was a valuable one.

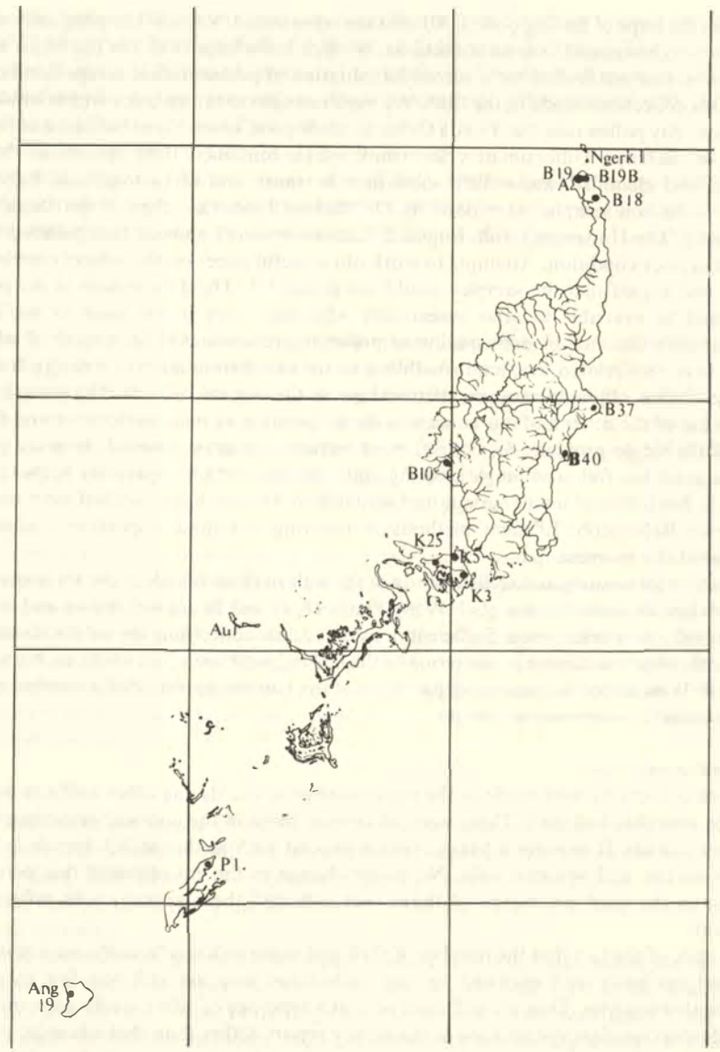


Fig. 1. Palau Islands (excluding Kayangel): base map, site tests.

Assistance from visiting scientists and scientifically-oriented persons was, as it usually is, repaid in some measure by us. We have tried to pass on some of the help and encouragement that the Owens gave to us, and at the same time help them increase scientific work on the islands. We, of course, benefited.

Soil study

Soil sampling was done at suitable intervals, either measured or as determined by soil

change in the hope of finding pollen. All sites are represented. Vertical sampling only was done; there were no horizontal or areal collections. We lack knowledge of any of the major aspects of observation that are needed for a successful initiation of pollen studies except floral checklists and pollen collections made in the field. We were not able to set up traps which would sample the present day pollen rain, but Frieda Osborne made good-to-excellent botanical collections at several of the sites. Unfortunately the trunk which contained these specimens, herbarium mounted and identified, was soaked some time in transit and was a total loss. Palynological studies of the soil samples were done by Dr. Robert J. Morley, then of the Department of Geography, The University, Hull, England. Laboratory work showed that pollen grains were few and in poor condition. Attempts to work out a useful paper on the subject convinced both Morley and myself that the samples would not support it. The data remain in my possession and would be available to other researchers who may work in the same or similar areas. Unfortunately this lack or poor quality of pollen in archaeological sites, most of which were terrace or terrace related, creates a roadblock to the easy formulation of a design for research on the problems of jungle-savanna relationships on the vlocanic islands. The growth of one at the expense of the other and our concern with the position of man, agriculture and fire are all parts of the single problem. Of course, most terraces are grass covered. It is my belief that savanna grass has followed jungle clearing and, with fire, which apparently helps rather than hinders it, has followed man's agricultural activities and finally has smoothed them out in much of interior Babeldaob. Efficient methods of carrying out these important studies are not apparent at the moment.

There is fortunately an excellent study of the soils of these islands in the MILITARY GEOLOGY OF THE PALAU ISLANDS (Corwin et al. 1956). Plates 18, 19 and 30 are well drawn and colored soil maps, keyed into a description. Sufficient descriptive data concerning the local soils and digging conditions, plus a statement in the terms of the soil engineer are given under each site heading. Robert E. Winchell of the geology deparrment at the University identified a number of items of dubious mineral composition for us.

Shell and animal bone

Shell collections were made in the same manner as sherds and other artifacts were taken, from the sites that had shell. These were, of course, those in the non-acid environments of the limestone islands. It requires a heavy midden deposit such as that at K3, trench 2, to protect shells from the acid volcanic soils. No major change in the environment that produced the shells or in the food preference of those that collected them appear to be reflected in the collections.

In spite of the fact that the number of shell and stone artifacts from Palauan sites has been increased markedly and enriched by our collections they are still too few to support a sophisticated analysis. They are sufficient so that a typology of adzes is offered, a modification of the descriptive class system used in the survey report. Other than that advance, we can give no more than descriptive summations and the comments that appear in the conclusions.

Masuoki Horikoshi, malacologist of the University of Tokyo, visited the islands with a group of his graduate students. We worked with him and went on reef and beach searching expeditions with his group. He, in turn, assisted with identifications and worked with Frieda who was carrying the burden of our shell identifications. Leo Hertlein, then curator of Invertebrate Paleontology at the California Academy of Sciences, identified some problem shell fragments from our archaeological sites.

Mr. Gene Helfman and Mr. Carl Salcedo, both Peace Corps Volunteers on the islands, were headquartered at the Entomology Laboratory. The former was studying the coconut crab; the latter, local ethnobotany. Again there was mutual assistance of value to all of us in the field and laboratory.

The collections of fish bones, primarily from Koror 3 and Aulong 1, were sent from the islands to T. Abe of the Tokaiku Fisheries Research Laboratory in Tokyo. They were studied by Hiromasa Kaneko of Waseda University (Appendix 6). Charles A. Repenning identified a whale tooth from the Aulong excavations. He is a vertebrate paleontologist with the United States Geological Survey, Menlo Park office.

A most interesting find was that of pig bones in levels 3 and 4, wall test of Aulong 1. These were examined by Frank C. Whitmore, Jr. of the USGS, US National Museum. He found two races of domesticated pig in the bones from the site. A rib from the same provenience has been identified by Barbara Lawrence of the Museum of Comparative Zoology, Harvard, as almost surely goat.

Stone

Artifacts of stone, other than the megalithic remains, usually architectural or monumental, are exceedingly rare. Consequently the description of the portable artifacts and a brief commentary outgrowth is all that seems reasonable. In general the stone items fit into or approximate the same descriptive or typological categories as do the shell tools. The most interesting exceptions are a few stone adze blades not found by the expedition but in the Owen collection, which are surely not Palauan in origin (Appendix 3).

Human bone

The removal of burials from Palauan sites is now known to require more time, equipment and training of the workers, than we were able to manage. Our techniques and equipment were simple and conventional. Sites on Angaur, Pelilieu and Aulong will yield burials and the bones will be acceptable for metrical and other forms of analysis if proper techniques of drying and preserving are used in the field. The osteology of our bones appears as Appendix 5. Our information gives no hope for the recovery of osseous (including turtle shell) or shell material in an acceptable state of preservation from any of the sites on the volcanic islands unless unusual edaphic conditions occur.

Pottery

Examination of the rarer artifacts of shell and stone followed rather straightforward and simple systems. This contrasts with the more involved approach used to record and study the sherds. We were fully aware as we prepared for our work in the Palaus, that the major contribution that we could make on the method or the methodological level would be in the study of the ceramics.

We were also aware, from our earlier study, that the sherds of Palau would not fall readily into conventional wares, or types and varieties, such as have been used in the southwestern United States and Mexico. Most of the fragments found in or on the sites lacked those aspects of surface treatment that are the prime megascopic clues for any sorting scheme. We discussed the continued use of the classification device used in the survey (Osborne 1966: Chapter 3) and one of us, Carolyn, was sure that it could he used with success. We eventually decided, with some trepidation, to study our sherds via an attribute analysis. Each sherd would thus be treated as an entity, worthy of and receiving detailed individual examination and recording. There could be no lumping or massing of groups of sherds in any way. This method, depending on Rouse's classic study (1939) is becoming in its many possible variations, more and more used by analysts.

Eighteen major attributes, each with a number of subattributes were selected on the basis of the survey data, a reexamination of one of our 1953–1954 sherd collections borrowed from the Washington State Museum, Seattle, and our memories. The overall 18 headings were divided into the subheadings or detail-attributes. These varied from 14 under rim forms to two

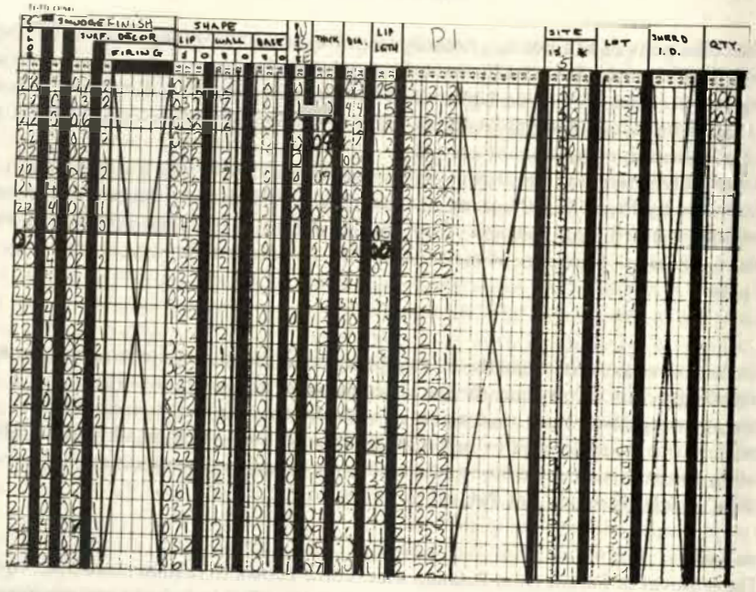


Fig. 2*a*

under temper size. In all cases we recorded 0 if the attribute could not be determined. Figure 2*a* is a reproduction of one of our laboratory record sheets (sherds from site P1). Figure 2*b* and *c* (rims) are the keys as we used them in the field. The following are some comments on the categories.

Columns 1–2. Surface color was recorded unless totally negated by numbers 1–6 in column 7 (surface change). Sherds so smudged or eroded that original color could not be seen were recorded as 0. The overwhelming majority of the sherds are "red". There was no feasible or economic way to record that the redware and buff of B37 are not the same as the redware of Koror 3, or the buff of either B19 or B18, but lies somewhere in between. None of the other pottery (clay or firing?) is as red as that found on Koror. The thin buffware of B18 that comes as close to being another "ware" as found in Palau, is statistically recorded the same as the buff from other sites (although a run of thickness correlated with color would surely have isolated it).

Column 4, surface finish, is probably one of the great levelers in the similarity analysis. We do not think recording here would be necessary for all sherds—note could be made of exceptions. Surface finish was indeterminate in correlation with notations in column 7.

Column 6, surface decoration, is the only one in which 0 signified "none" rather than the usual indeterminate. In this case, if decoration were indeterminate it would have to be because of surface change (column 7, 1–6) and we felt such a category not necessary.

Column 7, surface change, recorded the ultimate change in the pot or potsherd. About a quarter of the way through, we realized that we needed a firm negative in column 7. This did not really occur until we got into the tremendously altered sherds in the Babeldaob series in which sherds with no surface change were such a rarity that we felt them worthy of note. Here we needed the 0 to cover the mixed change of heavy smudging and breakup of the surface by "erosion" either during use or in the ground. Smudging as we used it throughout was usually

Column 1
Exterior color
0 indeterminate
1 grey float
2 red float
3 white float
4 red slip
5 grey slip
6 white slip
7 rose
8 buff

Column 2
Interior color
0 indeterminate
1 grey float
2 red float
3 white float
4 red slip
5 grey slip
6 white slip
7 rose
8 buff

Column 4
Surface finish
0 indeterminate
1 smoothed exterior-rough interior
2 rough exterior-smoothed interior
3 rough exterior and interior
4 smoothed exterior and interior
5 polished exterior
6 polished interior

Column 6
Surface decoration
0 none
1 incised
2 filled
3 painted
4 incised and painted
5 mat or basketry impressed
6 stamped
7 miscellaneous
8 indented

Column 7
Surface change
0 indeterminate
1 smudged exterior
2 smudged interior
3 smudged both
4 exterior surface eroded
5 interior surface eroded
6 both surfaces eroded
7 no surface change

Column 9
Firing
0 indeterminate
1 well fired
2 poorly fired

Columns 16-17
Rim shape
00 indeterminate
01 straight
02 incurving A
03 incurving B
04 incurving C
05 backcurve
06 lip equal to flange
07 lip greater than flange
08 flange with no inner lip
09 mushroom type
10 exterior neck band
11 interior neck band
12 interior lip
13 thickened rim
14 thinned rim

Column 18
Lip proper
0 indeterminate
1 rounded
2 flat
3 thickened
4 pointed
5 channeled

Column 21
Wall shape
0 indeterminate
1 straight
2 incurving
3 backcurving
4 shouldered
5 saucer-shaped mouth=widest diameter

Column 25
Base
0 indeterminate
1 flat
2 rounded

Column 28
Possible use
0 indeterminate
1 cooking pot
2 water vessel
3 lamp
4 jar-storage

Columns 30-31
Thickness in mm.

Columns 33-34
Diameter in cm.

Columns 36-37
Lip width in mm.

Column 39
Paste
0 indeterminate
1 extra fine
2 fine
3 medium
4 coarse
5 extra coarse

Column 41
Temper - material
0 indeterminate
1 sand
2 sherd
3 both

Column 42
Temper- size of particles
0 indeterminate
1 coarse
2 fine

Column 43
Temper - quantity
0 indeterminate
1 heavily tempered
2 medium quantity
3 lightly tempered

Column 54
Island number (coded)

Columns 55-56
Site number

Columns 60-61
Catalog number

Column 69
Excavation unit level or stratum

Column 70
Subdivision of above.

Fig. 2*b*

coupled with a recording of 1 in column 28 (use) but there were instances of light smudging which did not seem to justify calling a vessel primarily a "cooking" pot. Here again, the initial Koror 3 series of sherds were in great contrast to those that came from northern Babeldaob. As a result of this, although recorded the same, smudging and use are different—Koror 3 sherds lighly smudged, B18 and B19 sherds smudged all the way through to the point of pot breakage from cooking itself.

Column 9, firing. We used the presence of a grey-to-black interior layer in a sherd as an indication of poor firing—that is, a center section that never was completely oxidized by firing temperature. This was indiscernable in the smudged sherds that were black completely through. Consequently, the pottery that we know must have been well fired to have sustained prolonged cooking use is recorded as indeterminate, and the attribute does not have the usefulness that it should have.

The rim, lip, bowl shape series posed a problem to the analysts at the beginning and C. Osborne spent some time with the rims when we returned to standardize the analyses made during the initial period. Each analyst placed each rim on a flat surface to determine the

Fig. 2*c*

Fig. 2. Laboratory analysis of sherds for computer use. *a*, recorded sherd attributes, sample page from Pl; *b*, key to attributes; *c* code for rim and lip forms.

position of the lip which is the true top of the vessel; it has to be flat (or nearly so) unless the vessel had a scalloped top—a decision we were spared. The lip itself was recorded (see Fig. 2*c*). Although we started with only two choices, rounded or flat, we added thickened for an immediate broadening of the lip (as if the lip had been scraped or pressed in final preparation), pointed, and channeled as these forms appeared. We should probably not have added thickened as it caused confusion, but it was used very sparingly. The rim is the form of closure of the vessel—the last shaped section. Any of the rims can have any of the lip forms. Only large rim or body sherds give clues to body shape. Any rim form could be attached to any body shape with one exception—the backcurving jar had a rim of the same type. It is obvious that a body sherd from a backcurving jar that did not include a portion of the rim would probably have been recorded as an incurving bowl sherd. We have specimens of all types in the Palaus although the closed shapes are not common.

The rim charts show the rims as a continuum. There is a steady increase in turning inward at the rim from the 02, through the 03, into the 12 series. Rim 04 merges in its greatest manifestation into the mildest of the 07 series. The test that we tried to use in evaluation was whether the flange was sufficient to aid in lifting the pot—if so, it was designated 07. There is also some merging of the 05 form and the 08 (flange with no inner lip) which we had not anticipated in view of the true backcurving rims from some sites. The 13 series was differentiated from the 02 in that the thickened rims were deemed to have an even expansion on both exterior and interior of the vessel.

Column 28, use, is probably not necessary. Smudging denoted cooking use amply, and it

was not until we began site correlation and handling of the computer data that we realized that the heavy, unsmudged rim sherds of the largest diametered bowls probably came from vessels that were used for water catchment. Some are so massive that they must have been stationary. Very few were recorded on the forms as 2.

There are a number of difficulties in this scheme or design. I think that we knew and recognized most of them, if not at the first, then indeed shortly thereafter. Even with all the categories (and there are probably too many) we had sherds that are "different" and each analyst developed a series of asterisks and symbols to cover them. We have tried to mention these peculiarities in the text—certainly they would have been lost in the multiplicity of attributes statistically. There is a discussion of some of these in Appendix 1.

Furthermore many of the decisions required on the detail—attributes were or could be subjective. This, we know, is by no means a new problem or one limited to our area. But we felt it more keenly while carrying out this analysis than we have elsewhere. We discovered while determining diameters of pots (columns 33–34) that a piece of rim would often be difficult to match to a proper circle on our chart and different analysts or the same worker at different times would vary in the final determination. Was a rim fragment too short to match to a curve? Did it come from an oval vessel? We attempted to control subjectivity throughout by a constant reference to wall charts, to marked sherd samples, and above all to C. Osborne who as laboratory chief had organized the study and controlled the data better than any other. We believed that if we must be subjective, it were best that we narrow the focus to one person's subjectivity. This worked fairly well because the operation was small. There were never, except during the early experimental period, more than four sherd analysts at work at once and usually it was half that number. Nevertheless we found error and variance as we reconciled the rim charts and record sheets before and during the period that the latter were going to the key punch machines. C. Osborne spent the better part of a month in checking and corrective work and a number of IBM cards had to be repunched.

We were thus manipulating 83 detail-attributes under 18 headings or signifying our inability to do so with an 0. Three of the attributes are measurements. Four of the headings with 12 details required hand lens work, and three called for calipers or a scale.

Perhaps the most impressive aspect of this kind of analysis, to us in the laboratory on Koror and after, was the sheer grinding work that it entailed. It was impossible for a worker to do much more than 100 sherds in a full working day: 70 was a good day's work when added to other tasks that called for attention. In addition to the analysis, the rims were separated, cataloged in India ink, and set aside for silhouettes to be taken. Body sherds were often kept for radiocarbon determinations. We would be less than frank if it were not admitted that we did often yearn for the precomputer days in which we could have mass sorted into some kinds of types or wares. It would have been much faster. An afterthought that has plagued is that we should have kept time records on the sherd handling and the costs that were entailed by the preparation and the work involved in getting our sherd attributes onto paper so that they could be fed into a computer. We did not, but the following estimate is rather close and would err on the side of conservatism. Actual analysis required 220 days; sorting, mending, cataloging and bagging sherds another 45; the rim silhouettes done with a formagauge, and organizing and pasting them onto the charts another 24 days. Punching the IBM cards required 13 days and final proofing of all of these data 21 days. This adds to 323 laboratory days required by our system of analysis and recording for 13,868 sherds. Thus, only 43 sherds could be totally processed per day of work by our personnel, using our methods. More staff time was spent on this analytical work than was spent in the field: 137 supervisory days. The washing of the sherds was done by Palauan women hired for the purpose, under the supervision of Bonina Towai. Some of the labor of mending, cataloging and bagging was also done by our several Palauan assistants.

It became patent when the laboratory work on the sherds from our first site (K3) was well in process during the latter part of our training period, that the analysis of every sherd from every excavation would either be impossible or would require a drastic curtailment of the number or size of the excavations. The latter was all but unthinkable. The project had been built around a minimum of sites and tests because of the limitations of funds and time. There was no budget for sherd analysis after the return from the field. We were finding on Koror that the tail was wagging the dog, and the only feasible change demanded that the tail be docked. We decided to process a minimum of 100 sherds, if they were available, from each level or stratum of each separate excavation unit. The maximum was to run over that number, from the larger units, but these large collections were not represented, ultimately, by more than 200 sherds. All were washed as they came in from the field and the rims, bases, and any decorated or modeled sherds, which were very few, were set aside. These, as the first major orders selected, often made up the entire analyzed group from an excavation unit. If there were less than 100 rims and bases the remaining sherds were massed into two piles, the thick heavy pieces and the light and thin ones and a random equalizing selection was made from each group to round out the sample. The selection of the rims obviously insured that we analyzed those sherds that had the greatest number of attributes. It is our fond hope that it do not do violence to the data that came from the ground. Selected parts of the sherd collections, the analysis sherds and the punched IBM cards derived from them, and the printouts are available through the Department of Anthropology, California State University, Long Beach to anyone interested in either reexamining the analysis or in attempting to derive from it further data.

An attempt was made, and this took time, to reconstruct vessels or parts of vessels from the sherds. Usually this involved glueing only two or three sherds together but on occasion we found enough to put together a sizable fragment of a pot. Of these large reconstructed sherds, involving ten cm or more of pot circumference and ten cm or more of depth we have approximately the following: 10 from Ang19, 3 from P1, 5 from Aul, 10 from K3, 0 from K5, 0 from K25, 4 from B10, 2 from B40, 4 from B37, 24 from B18, 0 from B19A, 1 from B19B. There was the hope and expectation that we could, with our large sherds, work out data on vessel size and shape for the individuals, that would be close to reality. We were aware of a hitch in this plan. Keate (1788: 311) says "They made also vessels of a kind of earthenware, of a reddish brown colour, mostly of an oval shape." The extrapolation of the curve of a sherd to an oval of the general nature of the original oval, if such it were, has been commented upon.

These difficulties have restrained us from developing and presenting outlines of the forms of a number of vessels represented by most of our sherds. Those which we trust appear under the discussion of the ceramics of the sites of origin.

A series of 33 sherds were sent to 2 experts for petrological comments and analysis. Twelve sherds were thin-sectioned and examined by William R. Dickinson of the Department of Geology, Stanford University. He had, in 1965, done the same for four sherds from the 1954 survey. Six sherds were thin sectioned and discussed by David L. Weide, then of the Department of Geology, University of California, Los Angeles. Mr. Weide's comments differ because the questions transmitted with the sherds, differed from those asked of Dickinson. I was more specific with the latter, more general with the former; as might be expected Weide's comments were general and more ranging. These discussions appear in Appendix 1.

The Bai

Before we left the States a letter from Hera Owen had informed us that a *Bai*, a man's clubhouse or more broadly and in a more modern context, a community house, was to be built by the Palau Museum Committee with funds granted from the Trust Territory through the Palau Community Action Agency. Mrs. Owen stated that the work was to be done in the traditional manner and that the structure would be a wholly Palauan one from sleepers to

rooftree. She suggested that an anthropological record would be of value and pointed out that it was doubtful if another such structure would be built by the rapidly acculturating Palauan people. We agreed enthusiastically and, assuming that the *Bai* were to be built on Koror inasmuch as it was to be located there, felt that there would be no great difficulty in keeping ethnographic observations apace with construction.

On arrival we found to our surprise and some consternation that the *Bai* was being prefabricated, except for the thatched roof, in the major village of Ngeremetengel, Ngeremlengui municipality, about one-third of the way up the coast of Babeldaob. This is 40 minutes to an hour or two by boat from Koror, depending on weather, water, boat and tide. Thus a subproject that presented small difficulties at first suddenly became a problem in logistics. Gearing the trips to Ngeremlengui with the absences from Koror demanded for excavation, and the laboratory work, became a real task. Visits were not as frequent as they should have been and our records could not be satisfactory to us. Nevertheless we managed to record the major share of the construction activity and to be present when the prefabricated structure was set up, attend ceremonial feasts and the like. When the *Bai* parts came down in the spring of 1969 from Ngeremlengui to Koror to be erected we were able to better our coverage and someone of us visited the work daily. The building of the roof, the making of the thatch and the actual roofing was done by a group of men from Ngerechelong, subcontracted as it were. Many of the men were old friends; some had worked for me on the excavations of Bairulchau (Babeldaob 18).

The structure was completed, all roofed and the final ceremonial festivities took place in June. Our record consists of 1622 black and white and color photographs, some 610 m (2000 ft) of color motion picture film and the notes. We are not, because of the necessarily disjointed coverage of the basic construction of the *Bai* at Ngeremlengui, able to present our data as a full ethnographic study of the construction of a Palauan clubhouse. We do have sufficient data, however, so that we believe that we can complete a valuable publication, even though it cannot be a truly anthropological study. We are grateful to and indebted to the people of Ngeremetengel and Ngerechelong who helped us, explained to us, fed us and posed for our photographs thoughtfully and intelligently.

It is more than probable that this *Bai* is the last that will be built on the islands. I can recall that Mr. Owen and I argued at length in 1954 with the chief of Pelilieu, whose people wanted a new community house, that it should be built in the traditional manner, or at least in a modified traditional. We lost, and most towns in Palau now have frame buildings which function somewhat as the old club houses did. There are only two old ones left: at Airai in southeastern Babeldaob and on Kayangel. The Palau Museum Committee, its chairman Judge Morei, Mrs. Owen and the Trust Territory officials are to be congratulated for organizing and financing the building of this *Bai* before the old knowledge and interest died away.

People and things

It was during the latter part of the building on Babeldaob that our old outboard engine ceased functioning. Mr. Owen lent us his boat and boatman for several trips and helped at other times with land transportation when the pickup was garaged, gave us supplies, the need for which we had not anticipated and, above all and at all times, was helpful with advice and suggestions. His and Mrs. Owen's knowledge and understanding made our program in the islands more efficient and successful than it could otherwise have been, as their help has done for many, many other scientific efforts there.

Although Mr. J. B. Mackenzie, the District Administrator, was transferred before we had completed our studies, he and his administration provided us with help in many ways, some tangible; but more importantly he extended the real help that official approval and goodwill can be to strangers at work in a not strange but still unfamiliar land.

The return

Our field budget and programming were set for one year. We completed field work in mid-May and all laboratory work except the analysis of the sherds from Pelileiu 1. These were sorted, counted and shipped home for analysis. In addition to this, sherds for carbon 14 dating, all rim sherds, and of course all other artifacts were brought back. A catalog description of all artifacts had been completed and duplicated so that a loss in transit would not be a total one. Tools and equipment, boat, engine, automobile were sold in the islands. Only the instruments and other items for which we saw future need were shipped home. Shells, coral and other locally made collections were shipped back. The more fragile items required extensive and careful packing. Unfortunately, several of the boxes were exposed to rain at some time on the return trip and there was some decay and mildew loss of susceptible objects. Our greatest and completely irreplaceable loss was the botanical collection made by Frieda on several of the archaeological sites and elsewhere. As a result reference to them must be omitted from this study.

We boarded the Air Micronesia flight to Guam on 11 July but stopped off at Yap and stayed until 14 July. Here we rented an automobile and Sherman and Judith Lingenfelter of the State University of New York, Brockport, took time from their busy schedule to show us around their island. It was most instructive. Lingenfelter was completing his doctoral work and his field is social anthropology. He has a keen eye for all aspects of life on Yap and was able to point out many aspects of Yap prehistory that have not been studied.

We were on Guam on the 14th of July and spent five days before sailing in revisiting old haunts on the island. We are indebted to Frank Taitano, Juan Onadera, Emilie Johnston and Col. E. R. Ray, USAF, stationed on Guam for showing us recent changes in Guam and the archaeological developments of the last years. We also met members of the scientific community at the University of Guam. L. G. Eldredge of the Zoology Department later suggested that I write John Flenley regarding the palynological samples.

We sailed from Guam on the 20th of July. The ship was the INDIA BEAR, PFEL, but the master was our old friend Captain Schwab. The trip home was another enjoyable voyage. We landed at the Alameda docks, Oakland, and shortly thereafter drove to southern California.

The next year, 1969–1970, was largely occupied in addition to academic duties, by the writing of the summary report of the Wetherill Mesa Project for the National Park Service. Palauan writing and other intensive work had to be shelved or take second place. We were however able to complete the analysis of the Pelilieu 1 sherds.

Laboratory analysis

Thirty-seven samples were taken to the UCLA Isotopes Laboratory of carbon 14 dating. Rainer Berger kindly accepted this rather large amount. There are 24 sherd samples, 12 of charcoal and one of shell in the collection.

The institution of which I am a part, California State University, Long Beach, cooperated fully with the project. From the initial support of the request to the National Science Foundation, through the processes of bookkeeping and disbursement, the University has helped forward field work and writing in every possible way. Mrs. Arleigh Jimenez of the Long Beach, California State College Foundation, and Mrs. Gladys Crandall who keeps the books have managed to keep overseas and at home accounts straight. Darwin Mayfield, Research coordinator, gave valuable help during preliminary and final stages of the project.

The photographic section of our Audio-Visual department made final enlargements of selected negatives for illustrations. The xerox division of the MT/ST secretarial services duplicated maps and sherd charts and typed preliminary drafts.

The Faculty Research Committee saw fit to grant me a research leave for the spring semester of 1971, during which time most of the descriptive writing was accomplished.

During the fall and early spring semester (1970–71) the IBM cards were punched from the analysis sheets, one card- one sherd. Meanwhile the rim profile charts were being checked; this caused some change in carding and it was mid-May before all corrections, deletions and preliminary work had been done so that cards could be taken to the computer room. There Bruce Hanks and his corps did their best to follow our directions toward a coherent and meaningful analysis of the pottery. Barrie Wall later took over the task of programming. Whatever success we may have had with out machine computers has depended basically on Mrs. Wall's work.

Laboratory measurements were uniformly metric. Those measurements taken in the field were in feet and tenths; our rods and tapes were the usual surveyor's equipment. The editor changed all of the latter to metric in spite of a protest, in correspondence, and a statement from him that he would not "alter the manuscript". We have to assume that the unnecessary and often awkward changes are correct and have not checked his calculations.

CHAPTER 1

Angaur 19

Angaur 19, Ngelong, described originally in the Palau survey report (Osborne 1966: 342–348) was test excavated by Stevens from 1 to 12 May, 1969. He used a crew of five; 288 man hours of labor at a cost of $115.20 completed the test. During this period we rented a house belonging to the principal of the school and Stevens took his meals with a neighboring Palauan family. Work was limited to two flat areas within the maze of limestone outcrops and pinnacles near the southern boundary of the site. It was not feasible or even possible without expending greater time and effort than the task merited, to make other than a planimetric sketch map (Fig. 3). The Angaur 19 area extends north of this southern mapped portion for at least 91 m and east of it for about 46 m. Our rather concentrated section is bounded on the east by a low area which was at one time a major taro swamp. The western limiting factor is a limestone ridge, flat on top in places. Northern and southern limits are marked by a decrease in surface evidence of occupation, primarily sherds. The soils (Corwin et al. 1956: pl. 19) are lithosols, smooth stony land and limestone outcrops (soils 10 and 11); shallow silty loam and loamy sand over limestone. The limestone outcrops, phosphate particles and light midden are also characteristic.

As might be expected there have been changes in the local cultural geography since the mid-1950's. I had assumed that I could refresh my mind by reading the pertinent pages of my survey report and then lead Stevens and my two daughters, who went with us to do botanical and shell collecting, directly to the site. I was considerably embarrassed to find that the trails which I remembered could not be found and I became hopelessly entangled in the jungle. The reason for this was not far to seek. In 1955 phosphate mining on Angaur ceased. In that year, the contracts with the Japanese Phosphate Mining Company were not renewed because the mining operations were destroying the island. The end of the activity had the desired effect, insofar as the return to natural conditions is concerned. Roads, trails and other cultural and natural features are rapidly being choked and covered by the brushy jungle. In most places this process is now in the early phases of the various plant successions through which the growth must progress toward more stable communities.

The end of the mining has had the opposite effect on Angaur cultural development, if by that term we mean activity and intensity. Many people have left Angaur; those who remain are not pleased with the situation in spite of the fact that they are economically better off than many other Palauans. They and others of Angaur origin derive an income from their share of the funds from the phosphate mining, wisely held in trust by the Trust Territory for them. It is indeed unfortunate that a middle of the road arrangement could not have been worked out. Cultural contact and stimulus is needed and desired by the people of this island as strongly as they once wished to preserve their taro swamps from the mining machinery. Unfortunately they use the taro patches minimally now. There are not as many mouths to feed and the cans of food from the stores are easily opened.

In any event, I soon swallowed my pride, got help from an older local man and we were on the site. In order to update the directions to the site I offer the following: the would-be visitor should bear in mind that plant growth may soon change these. Start at the boat basin on the west coast, walk north on the coast road about 550 m. A trail used by land-crab collectors leads off to the right (east) following an old road bed. Some 265 m inland is the site. One travels

through dense jungle, over a small rise between large coralline limestone outcrops and down into the sherd areas. I am sure that the site and the digging there were altogether about as difficult as tropical forest archaeology can be, short of disaster.

The pinnacles, some of them easily 18 m high, and the dogtoothed outcrops together form a maze of sharp slippery terrain. This aspect of land form is typical of phosphate islands. Apparently the climatic regime when the birds used these islands was such that solution erosion was maximal. The guano deposits have covered the rough needle-studded topography on many phosphate islands but the latter have been exposed by the mining. It is doubtful if the Angaur northwest area of extreme roughness was ever blanketed by guano. Yet there is a shallow cultural deposit there and the BB size oolites formed a major share of the soil which was excavated. Like dry sand, or perhaps even more unstable, it would not hold a wall. Controlled excavation was not possible.

The period of excavation was unusually warm and moist and the density of the jungle cut off the cooling sea winds. Mosquitos were out in force. Angaur alone of the islands of the Palau group supports several bands of Indonesian macaques, introduced long ago. The creatures are destructive to farm and gardens and only males are allowed on other islands. Stevens lost a bundle of cloth sherd bags and perhaps other minor things to these primates.

Ngelong was either a refuge area or a small village organized defensively and used sparingly. Evidences of long term occupation are absent or perhaps eluded us. The execrable terrain, an intriguing jungled moonscape, was made even more difficult for the intruder by the heavy stands of *belbi* (a species of *Dioscorea*). This wild yam is a prolific vine with the most sharply malicious recurving thorns of the "wait-a-minute" kind. Even an open thicket of this plant is impenetrable without a long machete. It is a "war-vine", a plant that was used

Fig. 3. Planimetric sketch of Angaur 19.

defensively. This Palauan barbed wire still grows in quantity at Pelilieu 1, a site which like Ngelong, exploited a military potential.

Within the irregular outcrops and pinnacles are a number of more open comparatively flat areas. Two of these, the northern (designated Second flat in Fig. 3) at least twice as large as the southern (First flat) were examined by 1.5 by 1.5 m test pits placed in what appeared to be the areas with deepest deposits. These adequately probed what is probably the major part of the southern Ngelong archaeological potential. We could not relocate the places that I thought (1966: 343) to have been walled crevices. They are still there, well hidden by the greenery. The northern section of Ngelong should be explored in the same way although, if the site were primarily defensive, the more open north may not have seen as much use. A last area for future work would be the cavelets in the outcrops and pinnacles. I did not want work done in these because of the strong possibility of finding stored Japanese ammunition—for the Japanese had used Angaur 19 as a refuge area also. I could be on this excavation only briefly and there was no one else available at the time to excavate or handle long buried explosives. It is possible that there are older deposits in these small rockshelters, but I am not sanguine.

The excavations penetrated into a fourth 15 cm level of the land crab churned oolitic deposits. Although the upper few centimeters were generally darker soil, and carried a somewhat heavier organic load than the lower levels, and the pockets of soil on the limestone bedrock were obviously strongly residual, there was general continuity between these extremes and no variances or inclusions worthy of an illustration appeared. Burrowing land crabs and other small fossorial creatures have kept the shallow rock-floored pockets of deposit from developing stratigraphic character.

Five test pits (T1–5, Fig. 3) were excavated in the southern flat section and 8 (T21–29, Fig. 3) in the northern. No artifacts other than sherds came from the excavations. Sixty-six tools of shell, bone and coral were all surface finds.

Artifacts

It has seemed both efficient and clear to present the rarer artifacts via tabulation (Table 1). Weight appears only if the item is whole or essentially so. Gaps in the measurements will indicate the character of the breakage. Other objects of which there may be a series available will be described as a population, and salient or pertinent characteristics stressed.

Adzes These are the only artifacts that were found in sufficient quantity so that a typological study could be attempted. I assume that a typology should be culturally indicative, reflect variances in function, be basically ethnographic. It is obvious that differences in material, poorly comprehended patterns of erosion or decay and the unknown usages associated with these objects all throw roadblocks which decrease the possibility of success of an approach which is both mechanical and interpretive.

It would seem that the classes of adze blades descibed previously (Osborne 1966: 451 seq) may in the main now be dignified as types. Changes from the cited discussion will be made and substantiated.

TERMINOLOGY: In general, we employ the descriptive terms first used by Buck et al. 1930. Herein the bottom, or that usually flattened surface of the adze blade that rests on the bed of the hafting is known as the back. The front, then, is the upper surface of the hafted blade. The bit is formed by the bevel or bevels. If the ground bevel that forms the cutting edge stems from or is on the back, it is a back bevel. If from the front it is a front bevel. Equal bevels are unusual. If they occur the blade may have seen axe-like use or have been an axe.

The poll is the rear or proximal part of the blade: it transmitted the blows to the hafting. Bits have a right and a left determined by their positions hafted and in use. However, when viewed bit-on (Buck et al. 1930), the right side of the bit will be on the viewer's left. Bevel angles

Table 1. Angaur 19 artifacts, unusual specimens

Cat. No.	Object	Illus.	Material	Length × width × thickness (mm)	Weight (grams)	Cross-section (transverse) Comments
52/Ang 19	abrader or bark beater	Fig. 9*a*	coral limestone	75 × 50 × 28	162	plano-convex. Heavy hard stone, well finished.
54/	gorget	Fig. 9*g*	*Tridacna* shell	broken × 50 × 10	frag.	concavo-convex. Conical hole from interior; radial rib of shell; unique object.
55/	knife		*Conus* shell *C. pardus* (?)	46 × 33 × 4	10	concavo-convex. Common knife outer whorl of shell.
58/	bead?	Fig. 9*e*	*Conus* ?	diam. 21 × 7	3	trianguloid; top of cone shell; hole at apex.
53/	bone disc	Fig. 9*h*	probably marine mammal	diam. 58 × 5	13	rectanguloid. Cancellous bone on one side, solid on other. Shows no use.
93/	boatshape	Fig. 9*f*	andesite	51 × 11 × 10	9	plano-convex; well finished, probably decorative inset.
59/	disc		sherd	34 × 10; hole 6 mm	12	rectanguloid; hole straight sided, off center. Edges of sherd finished.
60/	knife and scraper	Fig. 9*c*	*Anadara maculosa* shell	57 × 36 × 16	14	concavo-convex; Umbo perforated for cord.
61/	same	Fig. 9*b*	same	67 × 45 × 21	23	concavo-convex.
50/	trumpet	Fig. 8*c*	*Charonia tritones*	263 × 125 × 80 broken		unmodified; mouth hole in penultimate or next whorl.
51/	trumpet	Fig. 8*g*	*Bursa bufo* shell	184 × 95 × 90		mouth hole in 4th whorl from spire.
85/	decorated sherd	Fig. 10*a*	redware, coarse sherd temper	90 × 55 × 13		red bands ca. 10 mm wide cross sherd; 5 on ext. 4 on int. surface.
86/	sherd	Fig. 10*b*	greyware, medium, sherd temper	97 × 85 × 8		concavo-convex. Two holes pierce thickened rim for suspension; probably lamp.
95/	sherd	Fig. 10*c*	greyware, coarse, sand and sherd temper	85 × 60 × 27		quandrangular; heavy and thick, base sherd?; biconically perforated hole, 12 mm diam. test pit 21 level 3

are measured in the following ways: the back bevel with a protracter from the extended line of the back to the cutting edge (Fig. 4*a*). Front bevels are taken from the plane of the back or the plane of the back bevel if there are two bevels, around the cutting edge to the plane of the front bevel (Fig. 4*b*). Length measurements are total, width and thickness are taken at or near the origin of the bevels.

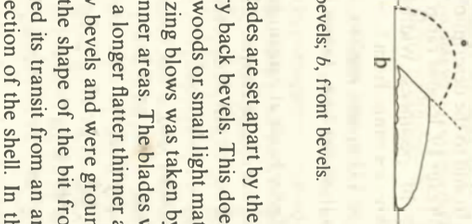


Fig. 4. Bevel angles of adzes: *a*, back bevels; *b*, front bevels.

TYPE 1 (originally Class 1): *Terebra* and *Mitra* adze blades are set apart by the selected genera. They are small, light and relatively fragile and all carry back bevels. This does not mean that their use is interpreted as having been restricted to soft woods or small light materials. The shell is tough and strong but it is light and the thrust of adzing blows was taken by the outer shell which was rarely more than 2 to 3 mm thick in the thinner areas. The blades with lower angle bevels tend to show more breaks. A lower angle means a longer flatter thinner and more fragile bit. Presumably most *Terebra* blades started with low bevels and were ground or sharpened back as the bits broke or wore. This would change the shape of the bit from an oval to a rounder outline as the place of the cutting edge changed its transit from an angle close to the length of the shell to one which approached a cross section of the shell. In the latter event a much stronger, though less sharp bit developed. The cutting edge thus became less axe-like and more adze-like as its angle increased.

The process of manufacture can be seen in Figure 5. A selected shell was pounded and crumbled along one aspect of its surface, probably with a dulled adze. This action was carried close to the columella. The next step was accomplished by grinding the prepared surface flat. This became the back of the adze and it was later fitted to the bed of the handle. After, or perhaps during the grinding of the back, the bevel was also ground, presumably although not surely at a low angle. The spire was knocked off and the blunted spire became the poll of the blade.

The curving bits of these blades suggest that they were the light gouges of the old Palauans. Heavy curved adze blades, gouges made of *Tridacna* shell, have been found in Micronesia although the only ones that I am familiar with are from Tobi. I have not found them in Palau. If they are not absent in Palau then they must have been rare indeed and the *Terebra* and *Mitra* blades must have served the purpose.

An adze blade with a curving bit, commonly called a gouge, does not find its only or its greatest use in gouging out interiors of vessels or canoes. A curved bit is an absolute necessity for hewing. A straight bitted adze, when hewing with the grain of wood, has a strong tendency to split the timber. A curved blade, because all its cutting edge does not lie in one plane, will never split.

Nineteen of the artifacts were found, all on the surface of Angaur 19 (catalog numbers 1–16/, 57/ (*Mitra*, Fig. 5*g*), 62/, 63/Ang19). Lengths range from 60 to 130 mm, median is 79, mode 78 to 82, average 85 mm; measurements taken on 12 specimens. Widths (at origin of bevel) range from 21 to 38 mm; median 27, mode 27–29, average 30; 19 specimens. Thickness (of the blade at the origin of the bevel) ranged from 10 to 18 mm, median 15, mode 15–16, average 15; 14 specimens. Weight ranged from 9 to 24 grams, median 23, average 23; 8 specimens. Angle of bevel (taken with the plane of the back) range 18° to 55°, median 40, mode 40–45, average 38; 15 specimens. The weight is certainly markedly lower than it was originally:

erosion, largely solution, has made these artifacts lighter and more fragile.

TYPE 2 (originally Class 6): Beaked adze blades of *Tridacna* seem relatively numerous: 10 were found (17, 19–26, 28/Ang19; Fig. 6). Of these, two have badly broken bits. I am not aware of the use and distribution of these objects in other parts of our area although I have seen the type from Malaysia in the National Museum in Singapore.

I have little to add to the description published in 1966 (page 457) except the data from the collections. At Angaur 19, lengths range from 50 to 112 mm, median is 82, mode 76, average 83; measurement on 10 specimens. Widths range from 25 to 41 mm, median 34, mode 34; 13 specimens. Thicknesses range from 9 to 33 mm, median 25, average 22; 13 specimens. Weight ranged from 24 to 153 grams, median 78, average 85; 10 specimens. Angle of the main bevel which originates from the back, ranges from 33° to 38°, median is 33, mode 33, average 34; 8 specimens.

This type of adze blade at Angaur is short, thick and stout. The bevel is low and is far more consistent than is that of the *Terebra-Mitra* blades. Many of them retain a portion of the deep ligamental groove on one side or the other of the roughly triangular cross sections (Fig. 6*a*, Fig. 7*a*). It can be readily understood that these tools do not cut or shave as conventional axe or adze blades, but rather they gouge a roughly V cross sectioned groove into the material being worked. The strain on the bit is heavy.

Bit shapes vary from the ideal asymmetrical three-sided pyramidal with the back bevel being the largest side or bevel (Fig. 6*a* and *b*) through a progressive deemphasis of the side bevels, which together form the front of the blades, until the front has become a smooth curve and a new type has been approached or initiated. The bits illustrate this range. All items were surface collected.

TYPE 3: This type was a part of my Class 3 (Osborne 1966: 453 and fig. 115, *9*). It continues the trend of change mentioned in the description of Type 2; the bits move from a beaked or pointed shape, formed by flat grinding on both sides of the front, to a smooth curve as the front itself assumes a curve. Similarities in the beaked adzes in the general outlines of the short to medium heavy duty shapes are obvious. So is the gouge shaped bit, which must have functioned the same as did a *Terebra* adze, although the latter would seem to have been less sharp and certainly much lighter. Figure 6, *d* (65/Ang19) illustrates the proportions and form of bit, back and front. Like *Terebra* blades the bit bevel originates from the back.

There are only 4 Type 3 adzes in the Angaur collection (numbers 27/, 32/, 64/, 65/). I cannot suggest any special function for them, such as seemed most reasonable for the beaked blades. Lengths range from 54 to 93 mm, median 72, mode 70–75, average 73; 4 specimens. Widths range from 24 to 44 mm; median 33, mode 33–34, average 34; 4 specimens. Thickness ranges from 10 to 28 mm, average 21; 4 specimens. Weight ranges from 17 to 120 grams, average is 75; 4 specimens. Angle of the bevel ranges from 22° to 36°, median 30, mode 30–31, average 30; 4 specimens.

The size, weight, form and the use of the *Tridacna* shell hinge area for these adzes all indicate a basic similarity in use and probably hafting procedures. Only the single bevel bit, arising from the back, shows that they were a less specialized tool than the beaked corner cutters and groovers. The specimens are all from the surface. Figure 6*f* is an andesite fragment. It fits type 3 better than any other but its condition and the rarity of stone adze blades prevents their typological assessment.

TYPE 4: These adzes are my old Class 4 (1966: 455). Only 3 came from Angaur and one is incomplete. There is no doubt that the interior of the shell is always the back of the blade; it was placed against the bed of the handle; the upper surface of the blade, the front, is the exterior of the relatively light *Tridacna* of which these were made. These objects are nicely finished, triangular in outline, roughly quadrangular in cross section. The bits are double beveled, but the major bevel twice to thrice as deep as the minor one, stems from the front (Fig. 7*e*). That bevel coming from the back is small and appears to be as important an aspect of shaping the tool as it was in sharpening the edge (Fig. 7*d*). The same characteristic is emphasized on specimens of Type 5, following. Inasmuch as the shells selected for these artifacts were concave, ground facets appear on the ends of the backs on several pieces.

Lengths are 50 and 65 mm, the third broken blade was much larger. Widths are 34 and 41 mm, thicknesses are 9, 10 and 12 mm. Weights are 24 and 32 grams. Angle of the bevel is 148° and 133°. This adze type is small, light, well made. Of the 3 specimens that we have from Angaur (29/, 30/, and 34/ broken), one is slightly curved. This characteristic, together with a short bottom bevel, links this type with the next. All were surface finds.

TYPE 5: This is Class 5 of Osborne (1966: 456) and is well described in the earlier report. Briefly, these blades are cut from the walls of light to medium *Tridacna* shells and retain strongly the curve of the shell. This curve of the interior, the back of the blade, presupposes a curved bed to achieve the secure fit of the blade to the handle. I know of no ethnographic specimens of this kind of hafting. The edge is double beveled, the major bevel usually exterior, on the front of the blade and the minor one on the back. Commonly the grinding of the back bevel appears to have been done with both the bit and poll in contact with the grinding surface. A bevel is thus formed on the back of the poll. Shapes are trianguloid with the usual irregularly rounded poll. Of the 4 specimens that I have, 37/Ang19, of *Tridacna maxima* is unfinished or the bit is broken away: 66/ also of *T. maxima* is a blank: 33/ has lost about half of the bit via a corner break and 40/ is represented by the bit end only. It is finely finished and may be a separate subtype. Again, this is surface material. Lengths, assuming that 37/ is unfinished, are 75, 110 and 123 mm, average 103. Widths are 35, 52, 60, 63 mm, average 52. Thicknesses are 8, 9, 11 and 11 mm, average 10. Weights are 38, 127, 145 grams, average 103. Angles of the front bevel with the plane of the back are 145°, 152°, average 148.

These large light adze blades were probably commonly used in planing and large shaping tasks. None could be illustrated properly from this site.

TYPE 6: These blades have no previously given class designation. There are 5 from Angaur (31/, 35/, 36/, 39/, and 56/Ang19; Fig. 7*b* and *c*). Two, however, are too fragmentary to assist in the description and all are so badly weathered that they are unsatisfactory for the purpose. They are long, with rounded bits and polls, made of *Tridacna gigas*. Cross sections are oval, planoconvex and subquadrangular. The heavy erosion that these tools have sustained suggests great age. Measured data should be considered approximate only. These are also surface pieces.

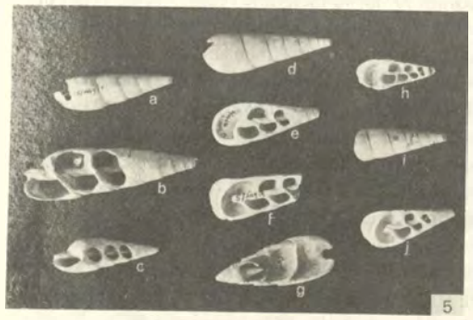
Lengths are 100 (31/), 112 (36/) and 108 mm (35/), average 107 mm. Widths are 35, 39, 51 mm, average 42. Thicknesses are 12, 11, 20 mm, average 14. Weights are 85, 125, 241 grams, average 150. Bits are rather thin and appear to have been rounded. There is an increase in thickness toward the poll where both the back and front appear to bulge. Little can be said concerning the bevels and bits, except that the bits are rounded, perhaps an aspect of erosion. One (31/) appears to have about equal back and front bevels; another (35/) to have back bevel only, while 36/ yields no data.

TYPE 7: This type occurs only once in the Angaur collection (Fig. 8*a*). There are only two representatives of this type. The other is 7/Aul. In forming a type with only two representatives we are saying that we have a complex of physical attributes each of which contributes to an operating unit. Some of these attributes like the feel and balance of the adze blade at the end of a handle of such-and-such length and such-and-such average diameter cannot possibly be assessed with our present resources. All of this judging of the attributes is a subjective thing at best.

OTHER TYPES: I do not now believe that the four unusual adzes described following are worthy of full typological consideration. The blade of 44/Ang19 is large, heavy, chunky. It is made of *Tridacna* but well enough finished so that shell characteristics have been removed. The back is the interior of the shell. It is moderately flattened and smoothed. The front is convex, poll

rounded, the object loaf-shaped. The single bevel is on the front. Altogether, the blade is much like those of Type 3 except that it is shorter, heavier, more rounded and has a front bevel. It thus cut differently and performed a different adze function. Length is 160 mm, width 75, and it is 35 mm thick behind the bevel. Weight is 728 grams. The front bevel angle is approximately 140°. Poll and bit are battered—the piece saw its final use as a hammer.

Artifact 43/Ang19 (Fig. 6*e*) is triangular, has a rounded poll and curved bit, an oval cross section and most unusually, the bevels that form the bit are equal, making this a true shell celt. It could have been used as an axe, although I rather doubt that it was. Measurements are 79 by 37 by 18 mm, weight is 75 grams. It is not possible to distinguish back from front and indeed if



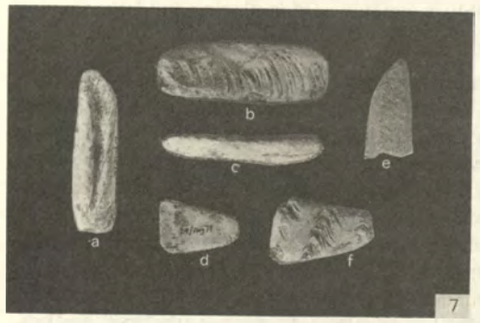


Fig. 5. *Terebra* and *Mitra* adze blades, Angaur 19. *a* (15/Ang 19), and *b* (13/) showing early stages of manufacture; *c* (14/) likewise incomplete; *d* (1/) back and *e* (2/) front view of low angle bit; *f* (5/) with broken poll; *g* (57/) *Mitra* shell; *h* (8/), *i* (4/) and *j* (62/) with high angle bevels. Length of *d*, 9.8 cm.

Fig. 6. Shell adze bits and celt, Angaur 19. *a* (25/Ang 19, *b* (17/), *c* (26/), *f* (28/), type 2 beaked adzes; *d* (65/), type 3 adze; *e* (43/) is possibly a celt or axe. Bit width of *d*, 3.5 cm.

Fig. 7. Shell and stone adze blades, Angaur 19. *a* (21/), Type 2; *b* (36/) and *c* (31/), Type 6; *d* (29/) and *e* (30/) are Type 4; *f* (42/) is andesite, probably Type 3. Length of *b*, 11.2 cm.

Fig. 8. Adze blade, trumpets and food pounders, Angaur 19. *a* (44/Ang 19), Type 7 adze blade); *b* (45/), *d* (46/), *e* (47/) and *f* (48/), coral food pounders; *c* (51/) and *g* (50/), shell trumpets; *h* (49/), tridacna shell pounder. Length of *a*, 16 cm.

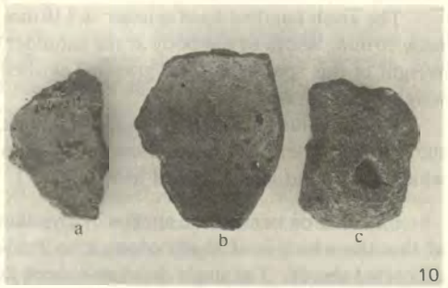


Fig. 9. Small artifacts, Angaur 19. *a* (52/Ang 19), abrader or bark beater; *b* (61/) and *c* (60/), *Anadara* shell knives; *d* (59/), perforated sherd disc; *e* (58/), cone shell bead; *f* (93/), "boatstone"; *g* (54/), gorget, perforated; *h* (53/), bone disc. Length of *f*, 5.1 cm.

Fig. 10. Unusual sherds. *a* (85/Ang 19), with red bands; *b* (86/), pierced below raised scallop of the rim; *c* (95/), heavy base (?) sherd, perforated. Measurements in Table 1.

this symmetrical object were used as an axe, this terminology would not be applicable. If the bevels are measured in the usual way then the first is 20° from an arbitrarily chosen back and the second is 150°.

The third tool (18/) is fragmentary. It is a heavy tapering nearly round section of *T. gigas* shell that is drawn to a small oval bit much like those of Type 3 except that this bit is contracting whereas those of Type 3 are expanding. Width is 41 mm, thickness 31 mm and the bevel is 31° from the plane of the back whence it originates. This piece may be simply a variant of Type 3.

The fourth piece (Fig. 7*f*) is the bit end of a sturdy stone adze of fine andesite. It is roughly quadrangular, with slightly curving front and back. The bevel originates from the back, is lightly curving downward, with the concavity of the curve toward the plane of the back. Width is 46, thickness 27 mm and the angle of the bevel is 33°. It is unfortunate that it is broken. It is an import; there are no igneous formations on Angaur. Andesite as fine as this would, I believe, be found on Babeldaob.

HAMMERS OR MAULS: These appear to be often no more than adze blades that have been dulled, and are not considered worth resharpening or refurbishing. The two from Angaur are either the poll ends of heavy large adze blades, or the battered blade ends, or were actually made as hammers. Because both are fragmentary little more can be said. One (41/) is rounded in crosssection, 45 by 35 mm, the other (38/) is plano convex, 50 by 33 mm. Both were fashioned of the heavy dense shell of *T. gigas*.

FOOD MASHERS: These really short pestles are a common artifact at this site; 5 were found. The smallest is made from the hinge section of *T. gigas*. All 4 of the others are of dense and heavy coral limestone. Three are typical conical pestles (Fig. 8*d*, *e*, *f*) but 45/ (Fig. 8*b*) is peculiar in that it has a short heavy body and a knob handle. Size distributions for the 3 conical pestles are: lengths, 140, 145, 163 mm, average 149 mm; widths 63, 64, 70 mm, average 66; thicknesses, 49, 56, 63 mm, average 56; weights, 481, (46/), 580 (48/), 944 (47/), average 668 grams. All three have a faint groove pecked and ground around the shaft of the pestle about one third of the way up from the crushing foot. This suggests hafting as a hammer, but I am doubtful of the idea; 46/ and 48/ have a worn and

slanting work surface. Probably all were taro pounders.

The knob handled food crusher is 110 mm long overall; the body is 78 and the knob 22, neck 10 mm. Width of the body at the shoulder is 80 mm, greatest width at the knob is 54 mm. Weight of this specimen is 733 grams. The shell taro pounder (Fig. 8*b*) is 80 by 42 by 38 mm, weight is 200 grams.

The remaining artifacts are individual finds, or are represented by two pieces only. As with the artifacts described above, those in the tabulation were all surface finds except 93/Ang19, which was found in the second level of pit 21.

UNUSUAL OR DECORATED SHERDS: The data on these appear in Table 1. Only 3 were found at this site which is in sharp contrast to Pelilieu 1 and Aulong 1 sites which yielded many decorated sherds. The single decorated sherd (85/) is not distinguished. Simple red striping is not complex and the ware is not fine. The rim perforated sherd is possibly from a lamp; lamps were apparently nearly always suspended, and the diameter of the pot as indicated by the fragment is about 12 cm, an approximate size for a lamp. The heavy thick possible bottom sherd, perforated, is a mystery to us insofar as use is concerned. The hole is too large for a lashing repair and this type of mend would not occur on the bottom of a pot. I cannot explain the piece except as a part of a ceramic artifact of unknown use.

Burials

Fragments of seven burials were found during the testing in the second flat area. The location of five appear on the site map, Figure 3. All were in very poor condition; land crab burrowing was heavy and was no doubt a prime destructive disturbance. All burials were or appear to be primary and none had associations although sherds and fragmentary artifacts were found in grave fill. The dead seem to have been buried in small pits but the character of the soil and of the disturbance prevented surety in this regard.

All cultural and physical data that are available appear in the tables, Appendix 5. The most photogenic burial was number 5; it is illustrated in Figure 11.

Fig. 11. Burial 5, Angaur 19. Trowel to north.

Ceramic Analysis

Angaur 19 ceramics and those of other sites may best be described through a series of comments on the organization of the data from the computer sheets. These data appear, as taken from the printout, in Table 33. Hence I shall spare the reader the percentages and frequencies here and strive to present a brief overview. The numerical information for any combination may be worked out from the tabulation. Attributes and their numerical designations are shown in Figure 2*b*.

The small number of sherds (417) from Ang19 come from three excavation units: first and second flats and pit 25, each having four 15 cm levels in depth. Exterior color is virtually limited to red, analyzed as a float, with buff and white less frequently occurring. There is no seriation of the percentages; no manifest variation with depth. Interior color is essentially the same. Pit 25 sherds are up to 100% red float; those of first flat vary as high as 86%. Again there is no evidence of change. Surface finishes are usually smoothed; rough finish on one or both surfaces is uncommon. Of course, these two attributes are the extremes of a continuum reflecting the attention to finish given by the potters. Surface change, that patterning of attributes which reflects the use and natural wear that the pots received, is more informative. First flat and pit 25 showed an increase in smudged interiors (2) from the surface through level 4 and a decrease of smudging on both surfaces in the reverse. Surface decoration is completely lacking.

Erosion was variable. These attributes (4, 5, 6) subsume a scrambled mixture of causes and cannot be considered important unless the results of an analysis are stark and clear. Well fired sherds are more numerous than poorly fired. Rims were few and data from this important set of attributes cannot be diagnostic at this site. Straight rims were used throughout; incurving 02 and 04 are strongest in the upper levels while 03 is emphasized in the lower two. The backcurve, always rare, is also strongest in the bottom pair of levels. Two backcurve rims from level 1, pit 25, are very like those illustrated from Aulong 1 (Fig. 58) wall test, stratum IV. This is of interest and a bit disconcerting as this lower stratum of the wall test is considered old, and Angaur 19, level 1, is not.

Lip forms are more strongly rounded in the lower levels of first and second flats but this simple form is not preferred in pit 25 lower levels. On the contrary it is 100% at the top. The trends are not consistent within the site. Wall forms exhibit no good sequences although incurving and backcurving are slightly stronger in the lower levels. No bases were recognized during analysis. Use as cooking ware, based on smudging or the secondary application of heat, is consistently 100% or nearly so, when recorded. No change with depth is noted. Pastes are mostly medium; fine and coarse occur weakly. No vertical sequence is present.

Tempering material percentages show an increase of sherd alone from bottom levels to top although pit 25 is in only partial agreement. Sand, or the combination, obviously varies in the opposite way. These are paired attributes or alleles, Sand temper alone is rare. Angaur totally lacks volcanic deposits but all analyzed sand tempering is volcanic. Calcareous coral sand was not used as tempering. Hence some of the tempering material and probably the clay or finished pottery had to be imported. Variations in trade add another dimension to the several variables which must be reflected in our simple statistics. Size of tempering particles is generally coarse; fine is perhaps half as common. There is disagreement among the three excavation units as to serial variation with depth, as there was also in the tempering material group. Cultural change is not evident. Temper quantity, usually an easy attribute to detect and judge, is most strongly medium. Heavily tempered sherds are next and lightly tempered least numerous.

Interior diameters (in cm) of the pots were taken from curves of the rim pieces that were large enough. No rim sherds suitable for diameter measurements came from the excavations but the general surface yielded a collection. The larger of these, a number of them partial restorations using several fragments, appear in Figure 12 wherein extrapolated reconstructions

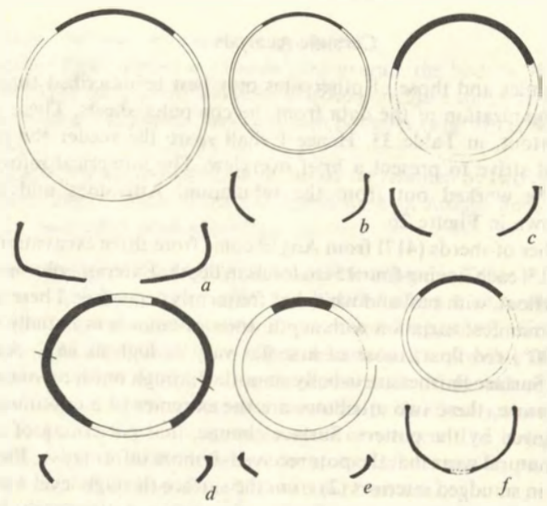


Fig. 12. Bowl shapes and sizes, Angaur 19. Dark section on circumference indicates rim section present; width equals lip width. Diameter of *a*, 60cm.
a. 67/Ang19. Rim 4 (incurving with slight exterior flange); Coarse paste, coarse sherd temper, medium quantity. Surface.
b. 69/. Rim 4; medium paste, fine sherd temper, medium quantity. Surface.
c. 83/. Rim 4; medium paste, fine sherd temper, medium quantity. Surface.
d. 68/. Rim 7, although this bowl actually ranged from 7 (flanged) to 11 (interior lip with lack of flange); fine paste, fine sherd temper, light quantity. Surface.
e. 72/. Rim 7; fine paste, fine sherd temper, medium quantity. Surface.
f. 84/. Rim 13; medium paste, fine sherd temper, medium quantity. Surface.

of rim and body shapes are presented.

I interpret the site as one which has seen essentially a late occupation and has been disturbed. Alternatively, it is possible that the primary deposits were laid down in such an erratic manner that the results are much the same as disturbance. A secondary possibility exists, that the occupation is an old one but that disturbance or inconsistent use of the area has obscured any pattern of development if such existed. Certainly the character and the latter day refuge and defense possibilities of Ngelong were exploited for short periods in an almost hit or miss, here and there sort of way. The shallow unstable soils and the quantity of surface that is sharp and irregular coral limestone adds to the acceptability of this interpretation.

CHAPTER 2

Pelilieu 1

On May 1, my daughters and I left Angaur (where Stevens was in the field) aboard the Angaur-owned REGINA II, for Pelilieu. We landed at the Orange Beach dock area, still littered with the rusted remnants of war, hired a car to go to a temporarily vacant school teacher's house that the Trust Territory office had permitted us to use and quickly got ourselves settled. The next day I reexamined the unusual P1 site. Again I found that my memory had reversed directions—a cause of some minor confusion. The P1 site (Fig. 13) is a huge food-shell midden running roughly north along the west slope of Rois Ngchemiangel and across the present road on the east slope of the northerly continuation of the ridge (Osborne 1966: fig. 101). All in all there must be some 13,530 square m of shell midden varying in depth from 1.5 m to 15cm. The average depth would be .76 to 91 m. There are, if our calculations are not overly crude, more than two billion of the small but tasty *Gibberulus gibberulus gibbosus* (Strombidae) shells in this extensive midden.

Above this white massing of shells rises the Rois (mount) a rounded cliffy coralline limestone knob with thickly jungled slopes some 90 m high. As commented in Osborne (1966 : 359) the area shows extensive war use. The mapping that I recommended after the first visit would be most difficult now. Jungle and brushy woods now cover areas that were open in 1954. Extensive mapping was not attempted and indeed (perhaps influenced by the obvious difficulties) I decided that it was not as important as I had believed during the survey. I did climb the Rois this time and had opportunity to observe that the small platform and walls which I could discern on its flanks only barely, were not remnants of intensive use and extensive building, nor were they readily assignable to any period. Japanese defenses, recent garden walls and archaeological remains are sometimes difficult to separate. Food shells were noted half to two-thirds of the way up the Rois on east, north and south sides. The best possible or probable platforms are on the west side above the shell midden. They are small, and appear to have been places of refuge or working areas rather than of daily dwelling. They exist on what were natural steps or level spots that have been modified. I found it impossible, or it would have been most difficult to descend the west side. The ascent there must have been aided by ladders or climbing poles.

The southeast and eastern part of the Rois was defended by at least two walls. The first is now very close to the edge of the mangrove and was probably unusually near the strand line when it was built. A gate exists which may be a late (Japanese) addition. It is simply a break in the wall about .9 m wide. Fragments of another wall were noted 8 to 9 m inland from the wall at the water's edge. There are also platform remnants, one of which appeared to have been wedge shaped, probably because of later cannibalism of the coral limestone chunks for other uses. The whole area along the south slopes of the Rois, next to the mangrove, is covered with the densest second growth jungle, liberally sown with the wild yam *Belbi* vine (*Dioscorea*) whose sharp recurved thorns sink into the skin and clothing and caused me many moments of profane hesitation. In addition, the area is one frequented by marine crocodiles. I was armed only with a Guam bolo and had no desire to linger. There can be no doubt however, that this was one of the P1 dwelling areas. Its archaeological examination would require extensive clearing and a large project aimed at a full exploration of all parts of the site.

The shell midden deposit on the south side of the road is a curving-sided triangle

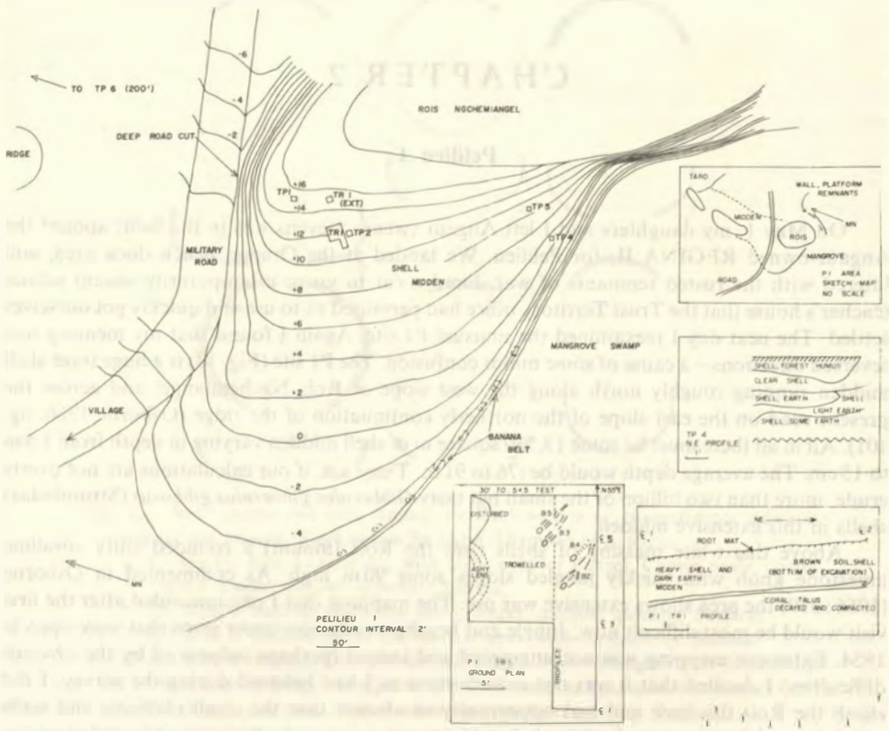


Fig. 13. Pelilieu 1 map, profiles, ground plan of excavations.

blanketing the surface from the sides of the Rois to the edge of the surrounding mangrove where a thin belt of bananas is now planted. The north side of the triangle is the military road but this recent construction has simply bisected the sheet of shell which lay around the Rois, though heaviest on the south, and then extended across the area of the present road (where it must have been at its deepest) and then along the east side of the continuing Amiangel hills (Fig. 14). The soils are lithosols, smooth stony land and limestone outcrops, shallow silty loam and loamy sand over limestone (Soils 10 and 11, Corwin et al. 1956: pl. 19).

Bomb craters, evidences of recent gardening and the road work are the major and important aspects of disturbance. The present vegetation on the midden is the result of several partial clearings for agricultural use during and since the war. The vegetation of the whole area was altered as a defense measure during the war, or was largely cleared during battle. There was a Japanese gun emplacement on the very top of the Rois; it took a direct hit.

The general reexploration of the site, photography, the mapping and the plotting of positions of small tests, occupied the rainy weekend. Excavation began on the fifth of May with five men, Francis Toribiong and myself. Five 1.5 by 1.5 m test pits were finished by early afternoon of the first day. A sixth later tested the depth of the midden on the north side of the road.

Depths of the pits varied from number 1 at 1.4 m near and above the road at the northwest edge of the Rois, to number 3, .25 m deep at the south central part of the midden on the edge of

Fig. 14. Rois Ngchemiangel and site Pelilieu 1 from east of the site to the southwest.

Fig. 15. North wall of Trench 1, Pelilieu 1, showing heavy shell midden, largely *Gibberulus gibberulus*.

the mangrove-banana belt. The deepest midden lay close to the Rois or in the central part of the midden sheet, generally northwest of the hill. Profiles, however, showed almost no true stratigraphy. There are vague lenses, lines of rich humic earth which fade and disappear quickly, but the total impression of a vertical exposure of this midden is massive shell, with some areas showing a bit more earth or ash than others (Fig. 15). The upper 15 cm is darkened with recent organic deposition and the root mat, and lightened by the bleached shell. The lowest 15 cm, or slightly more, is shell embedded in a lightly yellowed "C" soil lying immediately above and on the coral limestone-block regolith (Fig. 13, inset.).

Although the deepest shell midden lay around and near test pit 1, this area could not be chosen for further digging because of the road disturbance and bomb cratering. Good deposits exist there; the shell penetrated by test pit 1 was disturbed only superficially, but they would have to be searched out via a trenching system. The test pit 2 midden, therefore, was chosen and a 1.5 by 9.1 m (5 by 30 foot) trench was laid out near the test. Trench 1 pointed toward the adjacent north end slope of the Rois at an azimuth of N55°E. Later a 1.5 by 1.5 m (5 by 5 foot) square was excavated 9.1 m (30 feet) beyond the end of the trench. Here the midden was slightly more shallow, apparently as it lay on the rising talus of the outer slopes of the Rois (Fig. 13 and trench 1 inset).

Most of the Pelilieu 1 artifacts are shell. Because of this, the last days of excavation, May 8 and 9, were spent in trowelling the north face of 4.6 m of trench 1. Depth records were kept on each artifact found but horizontal locations were not recorded. It was felt that the lack of any structure in the midden made this unnecessary. In general, the excavation of a vertical face is poor technique. It is doubly so in a situation such as this shell midden where there was little stability and small falls and slipping occurred constantly. However, the men were regularly cautioned to dig carefully and keep alert and I believe that my depth locations are good. They are certainly as valid as I could have got from level excavation in the loose shells.

Charcoal is almost absent in the midden and shell samples were saved for dating. A vertical shell count was made by Francis Toribiong. A column, 30 cm square horizontally was marked off down the wall of test pit 1 where the deepest midden occurred. Working by 15 cm levels, Toribiong counted all *Gibberulus* shells in each level (30 by 30 by 15 cm) and bagged all shells of other kinds. These few were identified by Frieda Osborne (Table 2). The counts of the *Gibberulus* were the basis for calculations of the numbers of shells in the midden.

Trench 1 and the six test pits were filled on the afternoon of the 9th and the men paid off. The excavations required 24 man days of crew labor and cost $86.40 (exclusive of staff). Over thirty-four cubic meters of earth were moved, 136 artifacts found and 57 field specimens of sherds (all sherds from the same level in one number), bone, shell and coral were recorded.

In addition to the vertical examination of the shell population, Frieda Osborne conducted a rapid surface examination of the site and recorded the following species in addition to those identified from the test pit: *Barbatia* sp., *Codakia, Conus litteratus, Cypraea tigris, Atactodea striatus* (Palauan name *esechol*), *Ficus* or *Tonna, Hippopus, Lambis chiragra.*

Table 2. Identified shells, Pelilieu 1, Test Pit 1

Shell	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Level 9
Turbo (operculum)						1	3		
Cerithium	2		1		2	2	23	28	22
Strombus luhuanus	3	5	1	4	5	8	8	4	9
Gibberulus gibberulus gibbosus	2682	2300	2159	2181	2495	2373	2591	1543	2294
Lambis lambis							3		
Polinices	13	5	7	8	13	19	21	15	8
Cypraea							2		
Cymatium			2	1	8				1
Gutturnium							1		
Phos hirasei	2			1		4	4		3
Zeuxis			4				3	2	1
Conus		2	2		7	4	4	3	3
Terebra			1		2		1		
Acteon			1		1				
Pythia pantherina (land snail)	1						1		
Anadara scapha			2				1		
Vasticardium		2	1						
Fragum		1	6	1	3	7	16	11	8
Dosinia (?)	12	32	6	8	5	3	16	8	4
Gafrarium	1							1	
Atactodea	52	35	47	34	61	16	5		1
Unidentified pelecypods	4	2	6	5	5				

I cannot substantiate any conclusions of import from the shell counts of Table 2 or the surface check, insofar as cultural change is concerned. There is variation in all columns, including the enormous counts of the *Gibberulus* (Fig. 47*a*). This is a reflection of the amount of soil or other shells in any volume. In general, the shells were fragmented and very tightly packed. The fragmentation indicates that the same shell could have been counted twice, although only a recognizable piece of any shell was counted. The myriads of shell splinters were not.

I estimated that there are 13,530 square meters of shell midden included within Pelilieu 1. Using this figure, and an average of the *Gibberulus* counts by level, we may estimate the number of these shells to be about 2,038,400,000. Two billion plus is not readily comprehensible; when stated in terms of people and food it becomes more so: if a person eats 50 *Gibberulus* a day (2 meals of 25 shell-fish each), and there are 20 families of 5 persons each feeding in this manner throughout the year than this population of 100 could accumulate the *Gibberulus* part of the midden in 1117 years. Perhaps if we had as good an estimate for all shells and used it in the same manner we could add a few more years and arrive at a round figure of 1200 years.

Gibberulus are good food, but one can only be appalled at the thought of 1200 years of *Gibberulus* consumption.

Burials

As in Angaur, the 10 Pelilieu burials were in very poor condition; the bones were fragmentary, soft and fragile. I had seen bits of human bone on the surface of the midden while reconnoitering and mapping before excavation. These were dry and sun hardened and we entertained high hopes of finding good skeletal material. The reverse was true. The burials are there but I lacked the time and facilities to work them out. This should be done using hardeners in situ and paleontological techniques. After struggling almost fruitlessly with several skeletons, I realized that I was doing more harm than good and avoided further attempts. There can be no doubt that there is abundant skeletal material awaiting prepared excavation at P1. The same is surely true of Aulong 1 and Angaur 19.

I do not understand why bony materials in a shell midden were not in fair to excellent condition. The environment is, as far as I can comprehend it, totally calcareous. Of course, there is abundant drainage of ground water and the skeletons generally lay at the base of the shell deposit, .6 to .9 m surface depth, in total or partial contact with the residual soil on the

Fig. 16. Burial 5, Pelilieu 1, in the heavy shell midden.

coral limestone of which Pelilieu is built. This may have made the difference but I am unable to explain the chemistry of it. The shells are by no means as deteriorated as are the bones. On the other hand it is true that shell is a noncompact shifting medium. Much of the breakage can presumably be attributed to this mechanical fact.

All burials were presumably primary; there were remnants of more than one individual in three of the "burials" plus one lot of miscellaneous bone. We interpret this as indicating disturbance of an earlier grave by a later. A spoon (68/P1) made of *Spondylus* shell and a cone shell knife (166/P1) are credited to Burial 4 as associations. However, the lack of evidence of a true grave pit dug into the shell midden (as was true of all burials) and the lack of further pattern of burial associations, cast doubt on these associations.

Data and discussion of these fragmentary remains appear in Appendix 5. Burial 5, the prize of the lot, is shown in Figure 16; the burial layout in Figure 13, inset trench 1.

Artifacts

The site was a prolific yielder of artifacts, ceramic and otherwise. It is certainly the best site now known for intensive study in the Palauan southern "rock islands"—the coralline limestone reef remnant and platform islands. We have no radiocarbon dates from Pelilieu 1 but I believe it to be an occupation generally later than the Aulong 1 site. It will not yield as early material, nor would we expect it to yield as much information of environmental interest. Aulong should give us information on the concordance if any, between beach building and cultural development if it is totally exploited. However, P1 will surely contribute strongly to our understanding of the later centuries of aboriginal culture in the reef islands.

Adzes

TYPE 1: As at Angaur, a large number (27) of Type 1 *Terebra* adze blades were found (Fig. 17). There were none of *Mitra* shell. Lengths range from 58 to 95 mm (unfortunately the largest item was broken); median is 82 or 83, mode 88 to 92, average 81; measurements taken on 16 specimens. Widths range from 15 to 41 mm median 30, mode 30–31, average 29; 26 speciemsn. Thicknesses range from 13 to 38 mm median 17, mode 17, average 18; 26 specimens. Weights range from 12 to 67 grams, median is 22, mode 20 to 23, average 29; 16 specimens. Angle of bevel ranged from 20° to 78°, median is 54, mode 55, average 51; 22 specimens. Catalog numbers are 3/, 4, 6, 17, 18, 30, 31, 33, 34, 46, 47, 61–64, 72, 73, 75, 89, 99, 106, 109, 113, 115, 116, 119, 125/P1.

Fig. 17. Type 1 *Terebra* adze blades, Pelilieu 1. Increasing angle of bit from left to right: 106/P1, 30° bit angle; 4/; 33, 42°; 116/, 50°; 64/; 46/; 109/, 55°; 18/, 60°; 119/; 113/, 66°; 47/, 70°. Length of 4/ is 83 mm.

Both the Angaur 19 and Pelilieu 1 series are short but they are in satisfactory statistical agreement, as far as I am concerned, until we come to the angle of the bevel. Length, width, thickness and weight could reflect the general *Terebra* population of the local waters and indicate that there was little selectivity in gathering them or that the required large, medium and small Type 1 adzes were about the same in both villages. However, one cannot fence with the bevel: 38° average at the southern island and 51° at Pelilieu. I interpret this as indicating that Ngelong men preferred the *Terebra-Mitra* for cutting and shaving, whereas those of Ngchemiangel chopped and gouged with theirs.

There is no evidence of difference between the Type 1 blades that came from deeper in the midden and those from the upper levels. There are 12 blades with a bevel angle average of 49° recorded from the surface and to a level of −30 cm surface depth. There are 8 from −30 cm to as deep as −90 cm although the average depth of sterile subsoil is −76 cm. Their average bevel is 53°. I cannot accept this difference of 4° as significant. The error possible in measuring these irregular bevels could be almost that.

TYPE 2: These blades were fewer on Pelilieu 1 than on Angaur 19. Only 5 were found in spite of the greater amount of excavation and the more open nature of the surface of the site. All were found in excavations. Catalog numbers are 1/ (Fig. 18 *f*), 38, 39, 43, and 74/P1. They were found from the surface into level 4. Lengths range from 75 to 98 mm median 85, mode 75, average 83; 5 specimens. Widths range from 32 to 42 mm median 38, mode 32–33, average 37; 5 specimens. Thickness ranges from 20 to 36 mm, median is 28, mode 20 to 21, average 27; 5 specimens. Weights range from 96 to 174 grams, average 138; 4 specimens. Angles of the bevel range from 38° to 58°, median 45, average 46; 5 specimens.

Fig. 18. Sherd, shell and stone objects, Pelilieu 1. *a*, worked sherd (60/P1); *b*, poll end of andesite pestle or pounder (22/); *c*, aragonite piece (122/); *d*, bit portion of type 5 adze (108/); *e*, stone flake (97/); *f*, type 2 adze blade (1/); *g* unusual adze (95/); *h*, *i*, type 4 adze blades (40/, 110/); *h* is much weathered. Length of *f*, 98 mm.

A comparison with Angaur 19 beaked adzes discloses minor variations between the lengths, widths and thicknesses of the two series except that the Pelilieu items are slightly the larger. This is clearly manifest when weights are compared. The average weight is 85 grams at Angaur 19; it is 138 at P1. The angle of the main bevel is also greater at P1; it averaged 34° on the southern island and 46° at Pelilieu. This is the same situation, although not the same fraction of angle as was noted between the *Terebra* series of each site.

TYPE 3: The five Type 3 adze blades from Pelilieu all indicate that this form has seen heavy duty. Only one is intact (88/P1) and it is asymmetrical; the right side of the blade is heavier and thicker, due to the placement of the groove part of the original shell. Others (2/, 35/, 87/, 92/P1) have been broken and the bits shattered. Lengths, widths and weights are therefore estimated for all except the whole piece; the measurements are all close, though not exact. Lengths range from 90 to 125 mm median 97, mode 95–97, average 105; 5 specimens. Widths range from 42 to 51 mm average 47; 4 specimens. Thicknesses range from 27 to 35 mm median 29, mode 27 to 29, average 30; 5 specimens. Weights are 110, 150 and 316 grams; average 192; 3 specimens. Bevel angles range from 27° to 33, median and mode 31–32°, average 31; 4 specimens.

These specimens are larger, primarily longer, than the Angaur Type 3 blades. Bevel angles are essentially the same. These blades occurred on the surface and in the second and third levels. They were therefore in use during most, and probably all of the life of Pelilieu 1.

TYPE 4: The triangular front-beveled adzes, are the most like the modern steel adze blade. There are only 5: 40/(Fig. 18*h*), 98/, 100/, 110/ (Fig. 18*i*), 123/P1. Lengths range from 53 to 70 mm, median 63, mode 53, average 61; 5 specimens. Widths range from 25 to 58 mm, median 50, mode 50 to 52, average 47; 5 specimens. Thicknesses range from 10 to 17 mm, median 10, mode 10, average 12; 5 specimens. Weights range from 22 to 115 grams, median 47, mode 44 to 47, average 56; 5 specimens. Angles of the bevel range from 126 to 138°, median 130, mode 126 to 130, average 131°; 5 specimens.

Again a comparison does not appear valid. Angaur produced only two Type 4 blades. The Pelilieu series is larger and so are the averages. This fact depends on specimen 110/P1 which is the uppermost figure in all ranges. It is also peculiar in that it has a definite back bevel, 12 to 18° depending on the nature of the haft (bed) to back fitting. In a larger series it would become a subtype. All of these pieces except 40/P1 came from level 1; it was a level 4 piece.

TYPE 5: This is represented by two broken specimens, polls, (5/ and 15/P1) and by one bit (42/P1). The latter was a large blade. Width is 61 mm and thickness 13 mm. These pieces came from levels 5, 2 and 4 respectively.

OTHER TYPES: A broken blade (108/P1, Fig. 18*d*) does not conform to my typology, if I am judging correctly which surface is back and which is front. This cannot always be done with security. It is usually the back that has been most modified in order to fit the bed of the hafting. In this case there is one flat surface but the bevel springs from this as with a Type 3 blade. The remnant is, however of the flat form which suggests a Type 4 or perhaps 5, both of which carry the bevel on the front. The piece must remain in limbo for the present. It originated in level 3. In addition to this there are fragments of 3 more blades, (20/, 37/, 55/P1) which also cannot be assigned typologically. No Type 6 adze blades were segregated from the Pelilieu collection. A last unusual object is certainly an adze blade. It was made for a special purpose, probably carving of some sort (95/P1, Fig. 18 *g*). Although we cannot be sure, the shell appears to be part of the parietal callus of *Cassis cornuta* (L) and to come from the area of folded contact of the outer whorl and the callus. Size is 80 mm long by 30 wide, 10 thick. It is not possible to be sure which surface is back or front. The bevel is 38° if it is a back bevel; 142° if it develops from the front. Weight is 23 grams.

ADZE BLADE BLANKS: These are pieces of shell that have been percussion chipped or battered to a size and shape from which grinding, or perhaps careful pecking, may begin. Two, 36/ (Fig. 19*b*) and 114/P1, are from surface and level 1 respectively. The former is 75 by 51 by 16 mm and weighs 108 grams; the latter is 74 by 57 by 34 mm and weighs 179 grams. Such items could have been intended for use as hammers, either hafted or unhafted, and the next group of artifacts suggests that they may have been, although they lack one attribute of the hand held

shell hammers or drifts, the thumb-finger indentation grips.

HAND HAMMERS OR SHELL DRIFTS: These were unknown to me in Palau until 8/, 32/ (Fig. 19*a*), 54/ were discovered. The artifacts were thought to be choppers, adze blanks, or hammers until the determining factor became visible when the artifacts were cleaned. Artifact 8/ has a passable thumb or finger indentation on one face, centrally placed; 32/ definitely has one and 54/ has the little grips conveniently and centrally located on both faces or surfaces. Stone hammers of this kind were found on other sites and the artifact is common, at least in stone, in early periods in southeast Asia. Lengths, in the order of listing of the three pieces are 92, 106, and 105 mm; widths are 58, 68 and 64 mm; thicknesses are 26, 27 and 27 mm; weights are 205, 216 and 198 grams. These pieces are from levels 3, 2 and 4 respectively.

ELONGATE SHELL HAMMERS: Four were found (21/, 57/, 71/, 107/; Fig. 20*a, c, f, g*) all eroded, battered, vaguely adze blade like things that could have been blades, or blanks, before they were reduced to use in hammering or grinding as small pestles or pounders. All show end use, generally extensive (Table 3).

Fig. 19. Shell tools, Pelilieu 1. *a*, hand hammer (32/P1); *b*, adze blank (36/).

Fig. 20. Shell and stone hammers and pestles, Pelilieu 1. See Table 3 for analysis.

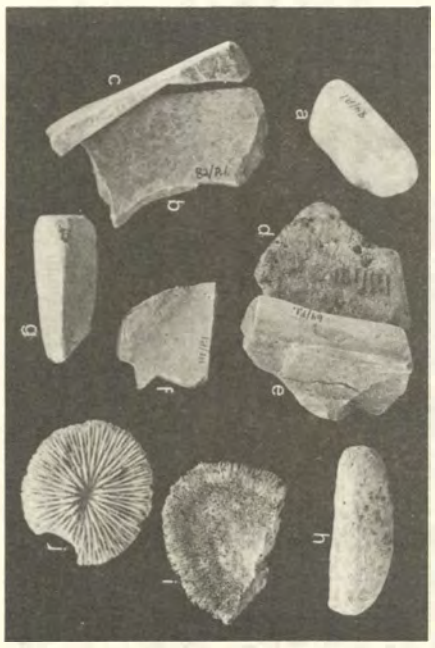


Fig. 21. A braders, files, whetstones and possible dish fragments, Pelilieu 1. See Table 4 for analysis.

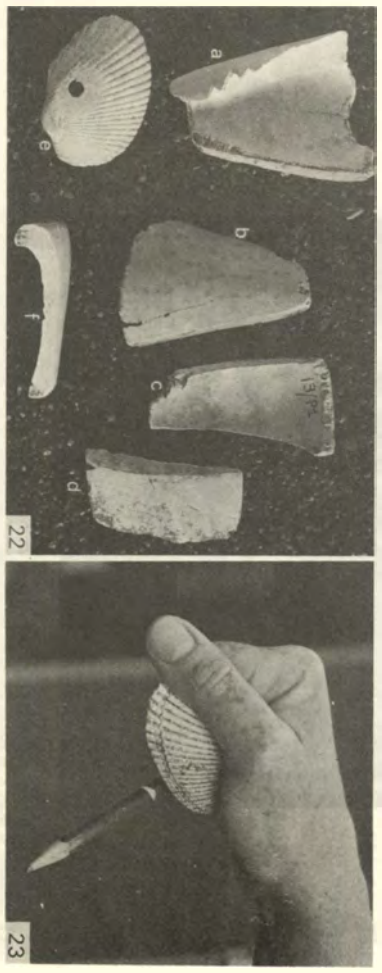


Fig. 22. Shell knives, Pelilieu 1. See Table 5 for analysis.

Fig. 23. Use of *Anadara* knife in cutting, based on ethnographic information.

Figs. 24, 25. Holding and use of *Conus* knife in cutting, postulated.

Table 3. Hammers, pestles, food pounders, Pelilieu 1.

Catalog No.	Name of object	Fig.	Material	Length × width × thickness (mm)	Weight (grams)	Cross section		Comments; origin
						lengthwise	transverse	
71/P1	hammer	20*g*	*Tridacna*	126 × 51 × 38	366	loaf-shaped	plano-convex	level 2
57/	hammer or pestle	20*f*	*Tridacna*	101 × 41 × 39	240	wedge	quadrangular	possibly used as wedge; level 2
107/	hammer or pestle	20*c*	*Tridacna*	81 × 32 × 27	96	conical	rounded	heavily eroded; level 8, test pit 2
21/	hammer or pestle	20*a*	*Tridacna*	72 × 40 × 24	115	truncated conical	double convex	level 2
24/	hammer	20*e*	andesite	74 × 58 × 60	338	spheroid		level 3
117/	hammer	20*b*	andesite	52 × 46 × 43	129	spheroid		level 8, test pit 2
118/	long hammer	20*d*	andesite	138 × 63 × 42	424	rectanguloid	trapezoidal	level 8, test pit 2
120/	pestle or food pounder		coral limestone	— × 52 × 51			rounded	single trunk of fossil coral; level 4
22/	proximal end, pestle	18*b*	fine andesite	greatest diam. 39			rounded	level unknown
19/	proximal end, pestle		*Tridacna*	greatest diam. 82			rounded	very large item; disturbed area

Table 4. Abraders, Pelilieu 1.

Catalog No.	Name of object	Fig. 21	Material	Length × width × thickness (mm)	Weight (grams)	Cross section		Comments, origin
						lengthwise	transverse	
130/P1	polisher abrader	*h*	fossil coral	85 × 38 × 30	64	loaf-shaped	plano-convex	level 3
131/	abrader	*d*	scoria	80 × 64 × 22	34	rectanguloid	rectanguloid	level 2
25/	abrader	*c*	volcanic sandstone	62 × 36 × 11		rectanguloid	rectanguloid	broken; one edge faceted; level 5
49/	abrader	*g*	volcanic sandstone	72 × 28 × 28	84	rectanguloid	triangular	grinding facets; level 4–5
69/	abrader	*e*	volcanic sandstone	88 × 53 × 32	228	rectanguloid	rectanguloid	one edge was grinding face level 5
82/	abrader	*b*	volcanic sandstone	93 × 47 × 22	141	rectanguloid	rectanguloid	grinding area on flat face; slight dishing; level 4
84/	abrader	*a*	volcanic sandstone	68 × 34 × 10	30	plano-convex	plano-convex	overall use; level 4
103/	abrader		volcanic sandstone	62 × 42 × 24		irregular	irregular	broken; smoothing on exterior; level 4
112/	abrader		volcanic sandstone	71 × — × —		fragmentary splinter		level 2
7/	file abrader	*i*	fungia coral	— × 76 × 23		plano-convex	plano-convex	broken; level 5
81/	file abrader		fungia coral	— × 80 × 20		plano-convex	plano-convex	broken; level 5
133/	file	*j*	fungia	74 × 67 × 14	54	plano-convex	plano-convex	level 5

Table 5. Shell knives, Pelilieu 1

Catalog No.	Fig. 22	Lengthxwidth × thickness (mm)	Weight (grams)	Comments: origin
Anadara knives				
9/	*e*	51 × 35 × 13	10	single valve; perforation ground through umbo.
76/		74 × 43 × 23	30	single valve; perforation broken through
Conus knives				
11/		fragment		elongate fragment, fine solution lines on exterior; level 4
13/	*c*	62 × 32 × 4	13	pronounced hook of cutting edge at base of shell; level 4
16/		62 × — × 4		fragment; level 4
29/		fragment		much altered by solution lines parallel around circumference of shell interior
41/	*f*	57 × 31 × 4	11	narrow, sharp; level 5
44/		48 × 34 × 3	9	solution lines on interior around and with length of shell; and on exterior around shell; level 4
45/		57 × 47 × 4	28	large shiny piece; edge broken; level 5
51/	*b*	62 × 39 × 4	21	fresh appearing; well ground and finished on ends. level 4
52/		56 × 27 × 4	12	exceptionally narrow; level 3
65/		64 × 30 × 4	15	well ground; level 4
66/		56 × 27 × 4	15	much eroded; solution lines on exterior around shell; level 4
166/		56 × 31 × 3	15	possible association with Burial 4; level 5
10/	*a*	59 × 46 × 4	32	sharp curl of body whorl, anterior (siphon) end of *C. pardus* or *C. litteratus*. Inner part chipped to form 4 teeth. Probable grating or scoring tool. level 4.
Tridacna knife				
126/	*d*	51 × 30 × 5	12	rather flat knife used and sharpened in same manner as those of cone shells; level 3.

Table 6. Miscellaneous artifacts, Pelilieu 1.

Catalog No.	Name of object	Fig.	Material	Length × Width × thickness (mm)	Weight (grams)	Cross section		Comments; origin
						Lengthwise	Transverse	
50/	piercer, awl	26*e*	shell	123 × 12 × 10	15	elongate pointed	oval	Anterior spine of a large Lambis, probably *chiragra*; level 4
67/	fish lure?	*c*	shell	(73) × (33) × 12		dish	plano-convex	broken; edges shattered; made of nacrous shell, either ornament or "bonito lure"; level 2
105/	fish lure?	*f*	shell	(63) × (23) × 5		dish	plano-convex	as above; broken remnant of conical perforation at small end; level 2
12/	chisel	*h*	shell	— × 11 × 4		dish	quadrangular	chisel or tiny adze blade, double bevel broken; of *Conus* shell. level 5
94/	chisel	*d*	shell	— × 12 × 5		dish	quadrangular	double bevel, broken. *Conus pardus* level 2
53/	rectangle	*g*	shell	67 × 23 × 4	13	rectanguloid dished		*Conus* sp.; spoon? counter or gaming piece? level 4
93/	bracelet section	*b*	shell	33 × 27 × 2 as is		concavo-convex	concavo-convex	probably *Conus*; curving section has 2 holes; single bevel at one end and had 2 at other. Probably repair of single piece cone bracelet. level 1
128/	bracelet section	*a*	shell	32 × 6 × 4 as is		concavo-convex	triangular	probably *Trochus* level 4
79/, 86/	fragments		turtle plastron	largest piece 60 × 40 × 8		double plane		parts of tablet shaped object of plastron. levels 2, 4
132/	trumpet		shell	badly broken				*Charonia tritonis*; mouth hole in first whorl above body, penultimate whorl, surface
14/	spoon	27*c*	Olive shell	78 × 35 × 13	11	spoon bowl shaped		outer whorl of a large shell. level 4
28/	spoon	*b*	Olive shell	70 × 30 × 4 as is	14	spoon bowl shape		outer whorl of large shell. level 4
68/	spoon	*a*, 28*a*	*Spondylus*	95 × 65 × 18	34	spoon bowl shape		see text comments. level 3
111/	dish	21*f*	volcanic sandstone	50 × 48 × 11 as is		dish shaped		See text comments. level 3
121/	quartz	28*b*	quartz vein fragment	104 × 65 × 50	345	irregular wedge shaped		Part of large intrusive igneous deposit; shows evidence of solution. Derived from sea cave on volcanic island. level 4
97/	flake	18*e*	quartzite	46 × 41 × 16	29			cobble flake (teshoa); platform and bulb vaguely visible; a purposefully struck flake. level 4
122/	unknown	*c*	aragonite	35 × 26 × 13	36	concave-convex	concave-convex	Natural solution cave peculiarity. See text comment. level 3
60/	end-notched sherd	*a*	pottery	50 × 30 × 7	16	rectanguloid		Resembles in shape the end-notched cobble sinkers of northwestern United States. Possibly sinkers for light nets, level 4.
77/	same		pottery	46 × 34 × 12	26	rectanguloid		level 2, same comments
78/	same		pottery	45 × 35 × 11	21	rectanguloid		level 2, same
162/	same	30*c*	pottery	55 × 40 × 12	38	rectanguloid		level 3, same
59/	same	*b*	pottery	55 × 33 × 12	32	oval		level 4, same
102/	drilled rim sherd		pottery	50 × 25 × 12		weidge-shaped		large thickened rim. Coarse sherd tempered red ware. unusual biconical drilling from lip to interior of rim.

STONE HAMMERS: Only 3 were found. Two are typical roughly spheroidal hammerstones of andesite. The third is an elongated 4-sided "prism" of andesite (Fig. 20*d*). The latter shows use on both ends, the spheroids are worn in various places on the surface (Fig. 20*b, e*).

FOOD POUNDERS: There are three probable food pounders, all broken. It may be accidental that P1 did not yield as many or as consistent a series of these artifacts as did Angaur 19. The small piece remaining of 22/P1 (Fig. 18*b*) of hard fine andesite demonstrates that stone was worked as well as shell. It is unfortunate that this artifact cannot be better known. The same, proximal, end of a huge shell pounder must have come from a truly enormous artifact (Table 5).

ABRADERS: There are nine tools used for grinding or polishing. One of scoria and one of fossil coral (coralline limestone) are not suitable for cutting shell although they will polish it. The others act as a sand or emery of rather different grades, and will cut shell. These latter would commonly be called whetstones. Three pieces of fungia coral are rather surely files or abraders, probably used primarily for woodwork. The cutting edges are well worn. All of these objects have seen wear and breaking. Probably the only qualifications required of them other than the grit, was that they be a convenient hand size (see Table 4 and Fig. 21).

SHELL KNIVES: Knives of the same two kinds (Table 5) that were found on Angaur were also found on Pelilieu. There are only two *Anadara* knives (Fig. 22*e*) but there are 13 of cone shells and one of *Tridacna* (Fig. 22*d*). In addition there is a cone shell object made of this same outer whorl of the shell as are the knives, at the base end. The inner, thinner edge of this fragment has several notches as if the item were used as a scoring or grating device (Fig. 22*a*).

The edges of the knives probably all began with the lip of the outer turn of the shell, which is wonderfully sharp in nature, although the tools could have been taken from any larger outer part of the body whorl of the *Conus*. Use requires resharpening which is done by grinding across the piece to get a flat single bevel with the cutting edge on the inside of the shell fragment. There is often, but not always, a hook or flare of the knife blade from that part of the shell near the broad, flat apex of the cone which must reflect the manner in which the knife was held and used and sharpened. Width measurements were made at the widest point which is usually across the hook. Several of the knives are unusually narrow (Fig. 20*f*, 41/P1; 52/). This may reflect someone's preference or later breakage or wear.

The markings of the cones are thinly visible on the exterior. These fade with erosion and solution and the character and intensity of the patterns change making it difficult to deliver a taxonomically exact identification. Most of the knives are made of the large *Lithoconus pardus* (Roding) perhaps more properly *Conus pardus*, although *C. litteratus* and *Virgoconus* may also have been used. It would seem that the selectivity would have been toward the large and strong *C. pardus* and that shell is the first choice of identification for most of these artifacts. Lengths of the knives range from 48 to 64 mm, median 57, mode 56–57, and 62, average 57: 12 specimens. Widths range from 27 to 47 mm, median 31, mode 30 to 32, average 34: 11 specimens. Thicknesses range from 3 to 5 mm, median 4, mode 4, average 4: 12 specimens. Weights range from 9 to 32 grams, median 13, mode 11 to 12, average 16: 11 specimens.

The chipped grater (10/P1, Fig. 22*a*) was included in the above. Altogether these tools form a tight group. The method of their use is not known ethnographically as far as we are aware but we believe the grips shown in Figures 23 through 25 are correct and that these knives could have done tasks that varied from scaling and cleaning fish to paring breadfruit.

OTHER ARTIFACTS: The remaining artifacts will be described in Table 6. There are several

Fig. 26. Pelilieu 1 tools and ornaments. See Table 6 for analysis. *a*, *b*, bracelet fragments; *c*, *f*, fish lures?; *d*, *h*, possible chisels; *e*, awl; *g*, shell rectangle.

Fig. 27. Pelilieu 1 shell spoons (Table 6).

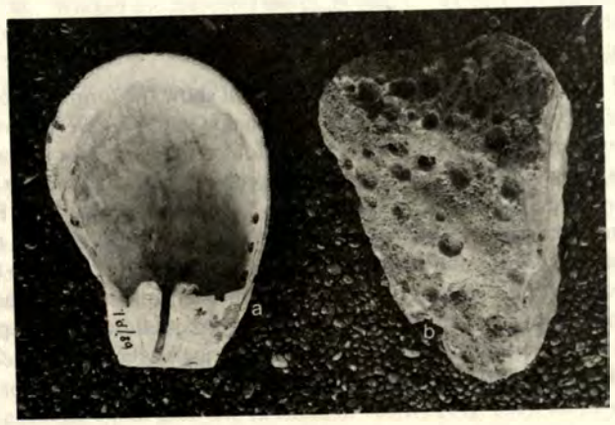


Fig. 28. Pelilieu 1 shell spoon and quartzite (Table 6).

interesting objects of shell. It is indeed unfortunate that the shiny objects (Fig. 26*c*, *f*) which I believe to have been fish lures are as fragmentary as they are. Lures were used with turtle shell hooks in the ethnographic period (Krämer 1926: 79). Both chisels (?) are broken at the poll ends, as if they had been struck there— a circumstance that reinforces the diagnosis (Fig. 26*d*, *h*). The shell bracelet of trianguloid cross section is an ancient style of bracelet in Asia and Oceania (Fig. 26*a*). It is the same in cross section as were the glass bracelets that became the prime valuables of these people. Spoons suggest the common use of liquid foods such as fermented breadfruits or fish soups. The olive shell ones are simple objects and must have been held in the hand. The *Spondylus* spoon (Fig. 27*a* and 28*a*) possibly associated with burial 4, is a more intricate object. Burial 4 unfortunately yielded fragments of three individuals, an adult and two children. The shell is the right valve; it has been smoothed exteriorly and the protruding umbo and part of the hinge cut or ground away leaving a major part of the hinge shelf with the resilifer opened (Moore et al. 1952: 422, fig. 10–14). The area under the shelf and the interior wall of the beak end of the shell formed a socket into which a handle must have been fitted. Five conical holes are drilled from the handle end of the spoon on each dorsal margin. These are about 10 mm apart and extend 46 mm up the shell on each margin. Presumably they were lashing holes for the handle and one can visualize an extension of the handle, probably wood, on the interior of each side of the spoon. Two false starts with the drill show on one side. Apparently it had a sharp leading point about 1.5 mm in diameter and then a cutting edge 2.5 mm in diameter. Or two drills of approximately those sizes were used, one to begin and the other to complete each hole. Altogether the object must have been an attractive and useful large spoon or small ladle. It has not been possible to identify this shell beyond the generic level but there is no doubt that it is a *Spondylus*.

The two pieces of volcanic sandstone that appear to be fragments of two stone dishes or platters (23/ and 111/P1; Fig. 21*f*) cannot be positively placed in this category. They may be whetstones that have responded with a dishlike form to some peculiar pattern of use but there are none of the usual stigmata of grinding or sharpening use. Interior and exterior are well finished. Both are broken; the peculiar stepped or angled edges with which the volcanic sandstone breaks, appear on both pieces. If they are vessels of some kind, they were shallow with low outslanting rims.

The aragonite piece (122/P1, Fig. 18*c*) was called *daob* (money) by the workmen who found it. The term is not of ethnographic significance, however; it is used rather freely for peculiar items that might have value of some kind.

Ceramics

Sherds illustrating the manufacturing process

There are six of these illustrated (Fig. 29 and 30*a*). All show the formation of the rim on the last coil or fillet of the vessel and welded into it. One sherd (168/, Fig. 29*c*) shows the use of a small packing fillet over which the wall of the vessel was folded to the exterior and welded to the wall—or the "packing" may indeed be the vessel wall proper, over which an auxiliary coil of clay was folded and packed to make a thickened rim. Two other sherds (167/, Fig. 29*a* and 165/, Fig. 30*a*) illustrate an imperfect rim formation method. A rim fillet appears to have been placed on the expanded rim of the still unfinished pot to form the exterior flange (07) without solid welding and compaction. This section was easily broken off; most of the flange has become detached probably during use. Many flanged sherds show this type of separation and subsequent wear and use-smoothing of the broken edge. Interior lip (12) rims (Fig. 29*d*, *e*) show a simple fold to the interior of the vessel and smoothing.

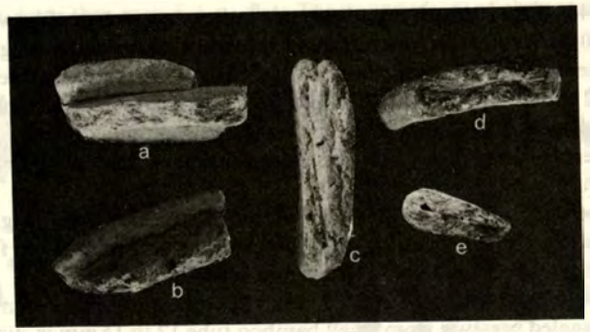


Fig. 29. Pelilieu I sherds showing some processes of forming rims. *a* (167/P1) exterior of flanged rim sherd in which the flange (at top) was not well joined to the bowl; *b* (170/) back curving rim showing a simple fold on exterior of jar; fingernail indentations secure it. *c* (168/) folding and welding over an interior packing. *d* and *e* (171/, 169/) interior lip rims showing simple fold to interior of vessel.

Fig. 30. Worked and decorated sherds, Pelilieu I. *a* (165/P1) a rim sherd from which the exterior flange has been broken because of incomplete welding at time of manufacture. *b* (59/) and *c* (162/) notched sherds, see Table 6 for description. *d* through *m*, decorated sherds (see text). Length of *b*, 55 mm.

Decorated sherds

All but two of the 13 decorated sherds are rim pieces: all are red or grey ware. It must be pointed out that the analyzed sherd samples from a site do not always contain all of the decorated sherds from that site. Because of their rarity, these were sorted from all sherd collections for special handling, including those which were subsequently discarded from the computer analysis treatment.

None of the sherds are painted: all are surface textured in a gross manner on the exterior by slash, stab and drag, punching, indenting, while the clay was still moist. Figure 30 illustrates the various techniques. The following descriptive notes accompany the figure.

Simple circumferential grooving (2 sherds): 160/P1 (Fig. 30*e*), an 02 rim, on exterior 2 cm below the lip. 163/, on exterior, a non-rim sherd.

Diagonal slash (3 sherds): 58/P1 (Fig. 30*h*), 12 rim with diagonal slashes on exterior (top) of lip. A wood or bamboo tool was used—the striations are visible at the bottom of the slashes with a handlens. 146/ (Fig. 30*k*), 12 rim, diagonal slashes on exterior of bowl below the rim; heavily eroded. 160/ had some diagonal slashing below the circumferential groove.

X-marks (1 sherd): 140/P1 (Fig. 30*g*), 07 rim. Stab and drag technique.

Indentations (2 sherds): 141/P1, 145/ (Fig. 30*f*), 07 rim with indentations below rim as if made with wedge-shaped or round pointed stick, partially smoothed over.

Punched (1 sherd): 143/P1 (Fig. 30*j*), an irregular line of small punches slants up to the right below the rim.

Notching (4 sherds): 164/P1, 154/ (Fig. 30*d*), 147/ (Fig. 30*m*), 145/ (Fig. 30*f*). Made by pressing notches diagonally, or by cutting out (147/) an external lip of 07 rim forms. Distances between notches vary from 25 mm on 154/ to 5 mm on 147/.

Comma indentations (1 sherd): 161/P1 (Fig. 30*i*), 12 rim with comma or crescentic pattern created by angled pressure from small bamboo tube 12 to 15 mm in diameter on top of the lip; 10 mm apart, and one 3 cm below the lip on the exterior.

Cut notches (1 sherd): 144/P1 (Fig. 30*l*) diagonal notches cut or filed on the lip of 02 rim.

Ceramic analysis

The computer printouts of the analyzed sherds from trench 1 were (as were all other site printouts) rearranged to bring the information on each attribute from each level into the appropriate surface-to-depth sequence. From this site we analyzed 994 sherds. The greatest depth of trench 1 approached 90 cm, the sixth 15 cm level was incomplete over much of the excavated surface. The following sketch summarizes the data presented in Table 33.

Exterior colors, where recordable, are all red float or grey float. The grey is 25% in level 1 but becomes far rarer in the remaining five levels. This marked color change may well reflect the many natural processes at work on or near the surface or in the root mat. Interior color appears almost exactly the same. Surface finish exhibits a similar situation. There is a difference between the percentages of the earthy first level and the main body of the shell deposit, the five lower levels. Smoothing on both surfaces approaches totality in the first level and decreases, but still dominates, below that. Sherds in the lower levels are rougher, primarily on the interior. Surface decoration is minimal; it is lacking in the top level. Comment has been made that the decorated sherds described were usually not all contained in the analyzed sample but were culled also from other samples.

Surface change is minor and erratic, as far as we can discern. The category of no surface change is strongest. Well-fired pottery is emphatically dominant; there was no or little change in this attribute. Rim forms from this site are disappointingly vague in any statements of order or ordered change. Straight and incurving 02 rims are twice as strong in the upper half of the deposit as they are in the lower. Incurving 03 is less so. Backcurve is slightly more important in the lower three levels. Lip equal to flange and lip greater than flange are codominant there, a situation that opposes that of the Aulong wall test. The spectacular interior lip rim is clearly important in the three lower levels. Thickened and thinned rims seem more at home in the upper deposit, presumably the latest times. Reference should be made to the rim charts, Figures 31–36.

Rims, which we believe to be of prime use in analysis, primarily because each embodies a number of subattributes of measurement and shape, do not match as might have been expected between Pelilieu 1 and Aulong 1. The measurements of lip width at P1 show a predominance of wider lip forms (07, 12) in some levels. However, these do not accurately reflect the amount of interior closure, since the exterior flange of 07 is included in lip width

measurement. The heavy use of the broad interior lip (12) in lower levels (especially 4, 5) is striking.

Lips proper are either rounded or flat. The rounded are slightly stronger in the older

Figs. 31—36.

Rim forms trench 1, Pelilieu 1. Lip of vessel at top; only complete rims are illustrated. Exterior of vessel is at the right, interior to the left. The longest sherds which give some indication of bowl shape are at the left of each rim form section.

Fig. 31. Pelilieu 1, trench 1, level 1 rim forms.

period; flat and a few pointed and channeled appear in the more variable later levels. Walls are commonly incurving; this attribute is especially dominant in the upper levels while straight is at its strongest in the lower three, though subdominant. Backcurving is more often seen in the lower levels.

An examination was made of the Pelilieu 1 sherd data in an attempt to determine use. The primary criterion was smudging of surface or paste. The exercise yielded information which is pertinent. The P1 collection is certainly the best of all for this purpose. There were many rims, the sherds were large and had not suffered the peculiar decay that seems to be associated with the acid soils of the volcanic islands. A volcanic island sherd collection will be examined in the same way (Chapter 6). Reference should be made to Figures 31 to 36 (rim profiles) and 37 (bowl profiles). In Table 7, small pots are those up to 20 cm in mouth diameter; medium 20 to 40, large 40 to 60, extra large above 60 cm. As is usual a 00 is indeterminate—diameter could not be measured or estimated. Total A is that of all rim forms for which evidences of cooking use could be recorded. Total B includes all rims by form. The percentage column offers the

Fig. 32. Pelilieu 1 trench 1 level 2 rim forms.

relationship between the figures in the size category and the 00 with Total A. The unmeasured quantity is understandably great and it is not without significance; 58% of all rims could not be estimated as to mouth diameter. Our working sample for size is thus less than half. Most significant is the fact that there are nearly the same number of vessels in the medium (20 to 40 cm diameter) as in the large (40 to 60 cm). The latter are truly large cooking pots. Rims 01 to 04, 13 and 14 (all the simple rims) do not follow the general plan. They were the most popular cooking pots of all. There were 148 of these judged as having cooking use (Total A) and 329 in all (Total B); thus 44.9% of pots with simple rims showed cooking use. The same ratio for

Fig. 33. Pelilieu 1 trench 1 level 3 rim forms.

flanged pots is 26.8% but the interior lipped forms rise to 40.4%. In the large and extra large categories however, we have flanged rims in the lead (12 out of 47) with 25.5%; interior lip at 20.6% and the simpler rim group at 19.6%. Thus the simple rim groups include most cooking pots but the flanged and interior lip rims occur predominantly on the largest cooking pots made. Both the 07 and the 12 rims, slanting inward as they do, effectively close the orifice diameter in relationship to the pot diameter. This closure would act somewhat as does a cover

Fig. 34. Pelilieu 1 trench 1 level 4 rim forms.

on a kettle or saucepan, to retain heat. These rim forms on large vessels were likely enough used in boiling down coconut toddy to sugar, extracting coconut and paranarium nut oil, and the like. On the other hand, the closing rims would also slow evaporation and prevent water sloshing. They may therefore, also be water catchment and storage pots. We see them therefore as the local version of industrial cooker, while small and medium pots were used by family kitchens. There is also the fact that an increase in rim size acts as a pot reinforcement. This is especially true for the 02–03, 07 and 13 rims. The interior lip rims obviously had one fault—a glance at the rim charts shows this weakness at the angle where the rim joined the wall.

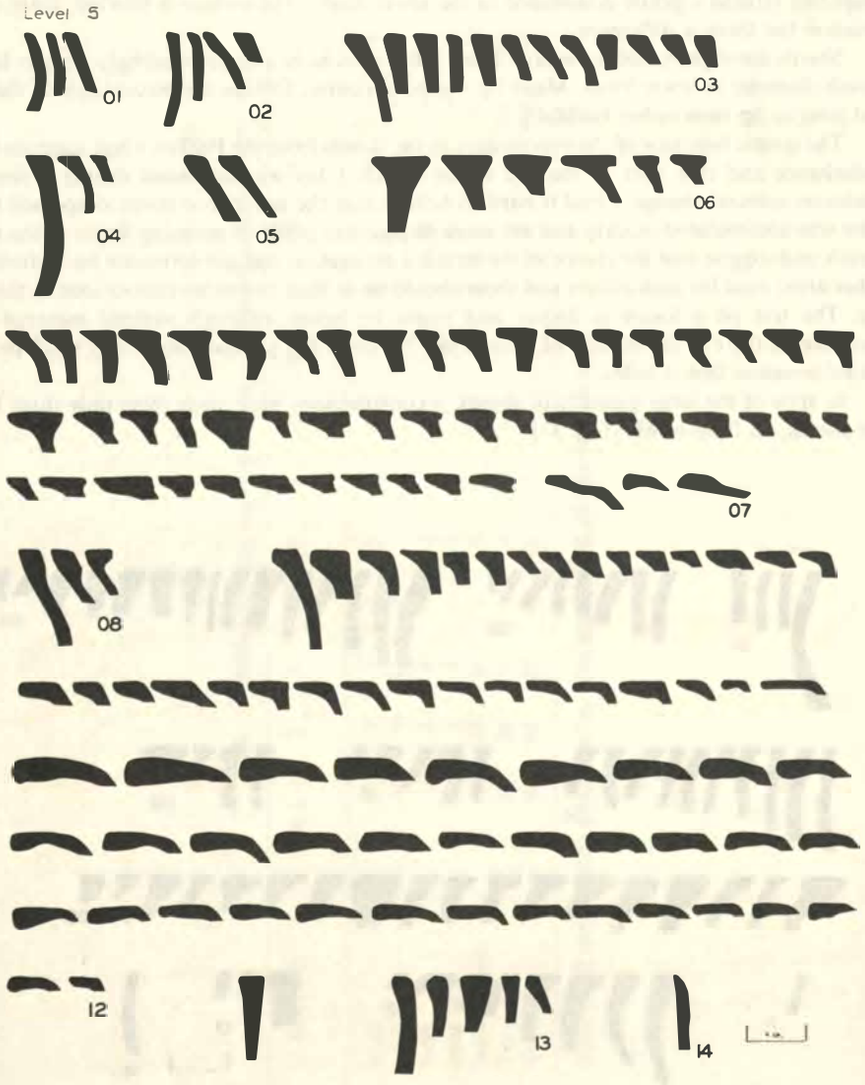


Fig. 35. Pelilieu 1 trench 1 level 5 rim forms.

It is interesting and must be significant that the percentage of all pots judged cooking wares (Total A 339 to Total B 845) is 40.1%. This is equal to the same ratio for the interior lip rims—40.4%.

Paste distributions are not emphatic in the suggestion of cultural change. Extra fine has a weak but similar distribution throughout. Fine is slightly more common in the depths; medium has an even distribution and extra coarse is stronger superficially. Insofar as cultural change suggestions are concerned, tempering material is even more reticent. Sand and sherd are about equal although sand has a slight edge in the upper deposit. Sand and sherd together is slightly preferred in later times. Tempering particle size varies somewhat; later sherds have slightly coarser temper. Temper quantity is heaviest in the lower levels, medium in the latest. Light tempering returns a gentle dominance to the lower levels. The picture is blurred; there is no seriation but there is difference.

Sherds are slightly thicker in later levels while pots have a correspondingly slightly larger mouth diameter in lower levels. Mean lip width, of course, follows the percentages of flanged and interior lip rims rather faithfully.

The erratic behavior of the percentages in the sherds from the Pelilieu 1 test suggests both disturbance and that part of the site where trench 1 lay was deposited during a time of minimum cultural change. I find it hard to believe that the nearly one meter deep shell layer there was accumulated quickly and am more disposed to point an accusing finger at the three burials and suggest that the choice of the trench 1 excavation was not fortunate for a stratitest. Other areas exist for such efforts and there should be at least two more excavations at this big site. The test pit 6 locale is deeper and might be better although skeletal material was encountered there in the bottom of the test pit. Pelilieu 1 has yielded only a very small part of the information that it holds.

In spite of the large quantity of sherds, reconstructions were made from only three large rim sherds, all from bowls (Fig. 37).

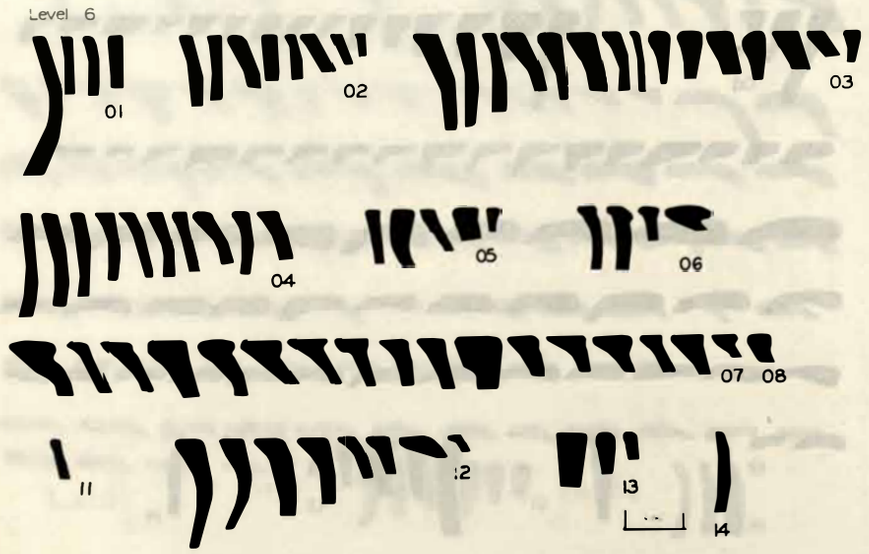


Fig. 36. Pelilieu 1 trench 1 level 6 rim forms.

Table 7. Pelilieu 1 sherds showing cooking use (smudging) by rim type; all levels.

Bowl size	Rim 1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total rims	Percentage
small	1	3	1	0	0	0	0	0	0	1	0	2	0	0	8	2
medium	4	7	13	9	3	1	9	0	1	1	1	6	1	3	59	17
large	5	4	9	4	1	0	10	4	0	2	0	13	1	0	53	16
extra large	0	1	4	0	1	1	2	0	1	0	0	9	0	1	20	6
indeterminate	19	14	27	6	9	6	26	3	0	1	1	76	8	3	199	58
Total A	29	29	54	19	14	8	47	7	2	5	2	106	10	7	339	
Total B	59	62	122	42	26	21	175	15	6	8	3	262	26	18	845	

Total A, all rims showing evidence of cooking use; total B, all rims of each type.

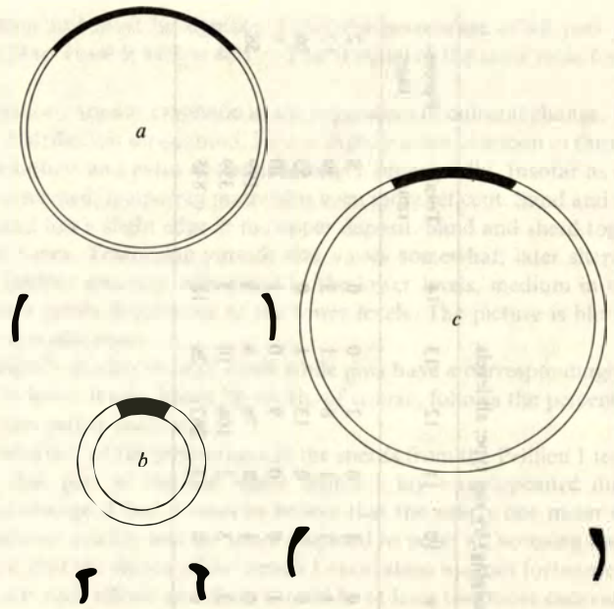


Fig. 37. Bowl shapes and sizes, Pelilieu 1. Dark section on circumference indicates rim section present; width equals lip width. Diameter of *a*, 45cm.
a. part of 136/P1. Rim 2 (incurving); medium paste, fine sherd temper, medium quantity. Surface eroded, showed no cooking use. Trench 1, level 2. Diameter 45 cm.
b. part of 138/P1. Rim 7 (flanged); fine paste, fine sherd temper, medium quantity. Showed no cooking use. Trench 1, level 4. Diameter at mouth 18 cm.
c. part of 137/P1. Rim 12 (interior lip). This rim had a slight flange ranging into the 4 rim in some sections. Medium paste, fine sherd temper, medium quantity. Had smudged interior and was labelled a cooking pot. Trench 1, level 3. Exterior diameter 56 cm.

CHAPTER 3

Aulong 1

History and Description

This island, discussed and described in Osborne 1966 (pp. 387–397), is important to modern Palauans because it was the place of the first true period of contact with Europeans. It is not true, however, that the Aulong 1 site, at what is known locally as Englishman's Beach, is Captain Wilson's place of camping and boat building, as I stated (1966: 387) following local usage. The place where the *Antelope* people camped and built their small ship on which they sailed to Macao, is on the opposite, eastern end of the island. I realized this after two visits to the area in March (1969) and after a careful rereading of the Keate (1788) book. I had found it difficult to explain discrepancies (1966: 387–388) and was particularly perturbed by the fancied errors in the map. These do not exist and the English, for some reason not stated in the book, stayed in the small cove east of the south end of Aulong 1 (Osborne 1966: fig. 103, p. 385), and spoke of the major beach and cove area of this island as "the back of the island." I am now upset with myself for not working out the sequence of events correctly before. Apparently I required more knowledge of the site than I had after my first trips there.

In any event the true "Englishman's Beach" lies over a small ridge and a short distance away from the eastern part of the major site of Aulong. Figure 103 in the 1966 report and the "Plan of Englishmen's Harbour..." opposite page 233 in Keate (1788) together give a reasonable understanding of the area. The three small islets in figure 103 are there: indeed, two of them show on the Keate figure. One was known to the Englishmen as the "Flower Pot". No better description could be devised.

Although the 1788 book does not say so, it is very likely that the eastern cove was chosen because it is hidden and probably appeared more easily defended than the large open beach area of Aulong 1. The drawing of the area, opposite page 127 of Keate, gives a fair though somewhat grandiose idea of the place. It is now more heavily jungled than it appears in the old drawing, and the picture does not do justice to the rocky roughness of the terrain. I spent a few hours in this cove searching for some evidence of the English occupation and marvelling at the choice of this place to build and especially to launch a boat. The sand fill is apparently the same as it was in the late 1700's; there can be no doubt that this part of the plan is correct. The launch of the little vessel which Wilson's men built was accomplished at high tide over this same sand flat which would not permit me to bring our 16 foot outboard boat within 100 yards of the little beach when the tide was out.

Needless to say I found nothing that could be attributed to the Wilson occupation although the area was canvassed meter by meter. The coconut trees that the Palauans brought to the place for planting (Keate 1788: 228) apparently did not continue their kind. I searched especially for the copper plaque of commemoration that the English nailed to a tree (page 248) but did not find it. It no doubt became adze blades long ago. There was no evidence of the wall, which caused me problems on the first trip. There was one stump, of a tree possibly sawed down, nearly decayed away, which could be 200 years old although I rather doubt it.

Aulong 1, the major archaeological site on the island is certainly one of the prime prehistoric deposits in the southern or raised reef islands. The soils are Shioya sand (Corwin et al. 1956: pl. 18), limy coral and shell sand over limestone rubble.

Excavations

Work at the site began March 11 and proceeded intermittently to 23 March. There were three excavations: (1) the probe at the old well; (2) F-E test near the cliff at the northeast part of the site and (3) the wall test near the main gate of the defensive wall at the eastern corner of the beach area (Fig. 38). The wall test penetrated approximately the same depth as the F-E test but is apparently beyond (outside of) the fresh water lens that halted excavations at the former. Its last levels, 8 and 9, were in clear, clean, essentially sterile coral beach sand. I now hope that I reached the bottom of the cultural material. The wall test was 1.5 by 4.6 m, the F-E test .76 by 4.6 m plus one 1.5 m square. In all 10.6 cubic meters were excavated at the wall test and 8.9

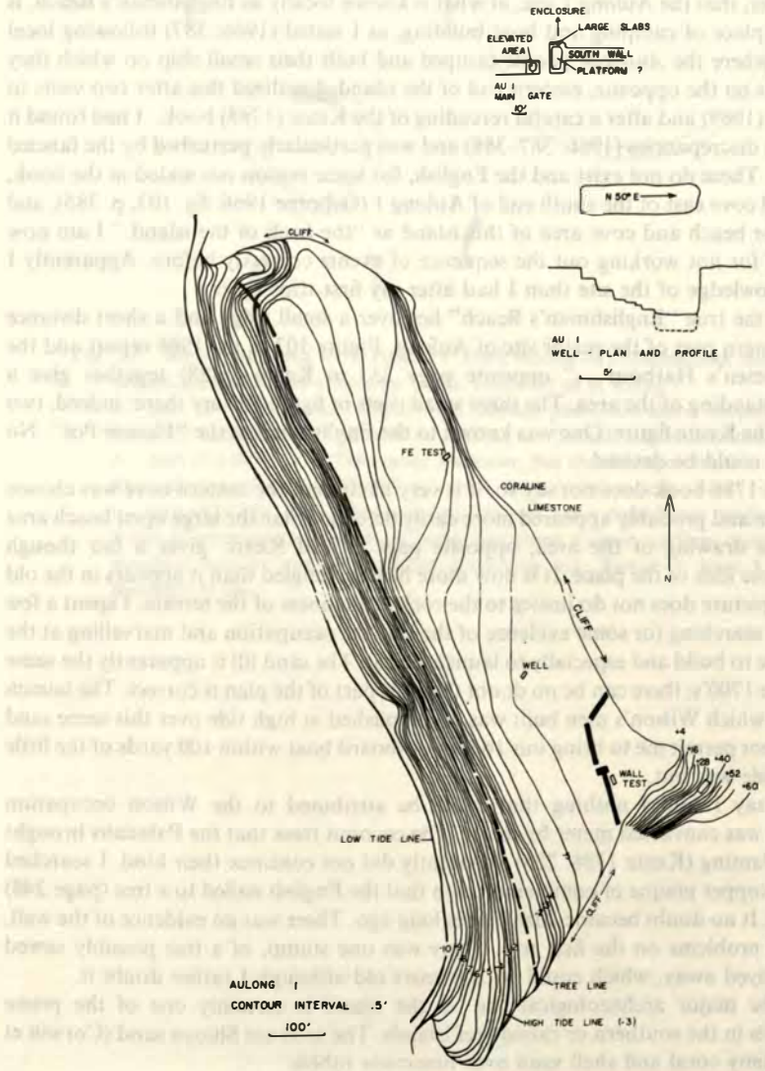


Fig. 38. Aulong 1 site map.

cubic meters at the F-E test. The former was excavated by shovel; the F-E trench by trowel. One hundred and sixty two man hours were expended in the two excavations, in the well probe, the clearing and mapping and photography, in addition to Francis Toribiong's and my own time. Labor costs were $88.50. My daughters drew the same wages as the Palauan youths who dug the wall test, cleared jungle growth and carried the rod.

Walk-in well

One of the interesting aspects of Aulong 1 which I had not seen on my first trip was called to my attention by Gene Helfman, a Peace Corps Volunteer studying coconut crabs. This is the well mentioned in Wilson (Keate 1788: 32). It is a walk-in well about 3.2 m long by .76 m wide at the surface and 1.5 to 1.8 m deep. A series of six steps leads down to the bottom where a sweet water lens (the Ghyben-Herzberg lens) floating on the salt water, becomes available (Fig. 38). At first I believed the construction at this well to be Japanese but a small probing excavation showed no reason for this belief. Wilson's men made trips from their own cove to fill their casks at a "well". I now regard it as aboriginal and the one used by Wilson although some small stabilization may have been done by the Japanese.

Figure 39 illustrates the appearance of the back or northern wall of the well and the character of the rough dry-laid block masonry. I do not believe that this structure was the only such well available to the people of Aulong when the village was at its population peak, whatever that may have been. No doubt others, filled and covered exist in the site area. Although it was not recorded on the map, there is a walk-in well of sorts that serves as a wallow for two pigs who live on the island, at about midpoint of the flat area of the northwest third of the site. These animals, a sow and her adult male offspring, live in incestuous productivity; they have learned to open coconuts and to take full advantage of passing archaeologists.

I do not know how many beaches and back beach areas in the Palaus like Aulong support

Fig. 39. Aulong 1 walk-in well, north wall.

Fig. 40. Aulong 1 walk-in well, steps at south end.

a lens of fresh water. The number is probably rather large. I suspect that the lens is a shallow one but it is constantly replenished by the heavy rains.

The plan and profile of the well (Fig. 38 inset) show that the step slope is gradual. The steps are unequal, rounded and slippery (Fig. 40). The solid line of the profile reflects the outline of a cross section through midlength after the walls and steps were cleared. The depth was then 1.2 m. Excavation of the bottom of the sump went to a depth of 1.7 m where we found sweet water at low tide. This level, of course, rises as the tide comes in. The bottom of the sump penetrated white sand, probably the same as stratum IV of the wall test. Apparently a paving of coral blocks had been laid around the south end of the well and out to a distance of 1.5 to 2.4 m from it. The steps and side and back walls were reinforced by dry laid and probably a once-raised curb of the same rough coral blocks.

The F-E test

The F-E trench, so called for the initials of our two daughters Ellen and Frieda who dug it, was within 7.6 to 9.2 m of the toe of the coral-limestone cliff that closes the landward side of the beach-cove that is Aulong 1. Its position guaranteed that it would yield a glimpse of the earliest history of the building of the cove fill from the present stand of the cliff and deposits at its base. This guarantee was not fully met because the trench struck sweet water at 1.4 m. We were not aware of its presence and depth; the well had not been excavated when the cliff trench was well under way. I had noted the pig's wallow, decided that the ground water must be fresh or lightly brackish but had refrained from tasting it. Nonetheless its presence prevented us from penetrating deeply into the oldest beach sand deposits and from sampling them. There should have been continuity with stratum IV of the wall test and it is probable that there is some fill with sherds below the fresh water table near the cliff.

The F-E test revealed primarily, a dark grey coarse beach sand and shell midden. The organic content is high. A glance at the map of the site reveals the fact that there is an elongate depression, beginning just southeast of the F-E trench, which follows the cliff toe nearly to the north end of the cove, where the wall bends sharply to the northwest. Here the lower area loses itself in a series of small rock shelters which are the remnants of an ancient wave cut notch, formed long before the beach deposits were initiated. The elongate depression is here interpreted as a drainage channel of the north end of the site area. Its formation is dependent on the down-and-in slope from the natural levee crest along the highest of the beach area, about at the tree line, and the need for drainage of typhoon driven waves which often roll inland from such beaches. If the geomorphic descriptive conclusions presented above are correct the ceramic stratigraphy evolved from the F-E excavation could be somewhat disturbed.

Below this fill (Fig. 41) and widening upward toward the cliff, is a band of dark sand and light talus material. The limestone chunks of pebble to cobble size become smaller and fewer as one moves south 2.1 or 2.5 m from the cliff end of the trench. About centrally, the talus material merges and blends with the typical white coral sand of a beach. The same happens to the lower unit of the sloping talus deposit. It is heavier, is made up of coarser and more numerous pieces of limestone, plus the usual sand with the dark organic content. Its character suggests a time of rapid cliff erosion and equally rapid basal deposition. This, too, slants beneath the later beach sand and mixes with it. The water table bisected the sand and talus below the fill of the drainage depression. The clean beach sand in the southeastern end of the trench contained well worn sherds.

This small cut has, I believe, yielded a glimpse of the beginning of the filling process which produced the beach and land area, which eventually supported the human population and now supports two pigs and a dog. The geomorphic succession is (1) the building of the talus slope into the water of the open cove. This deposition sequence replaced the previous erosional one

because of some change in wind, tide or in a relationship between these and the small geography of the cove. In any event the depositing of the talus material, instead of its removal, allowed (2) a beach to develop near the cliff in the shallow water. The drainage channel (3) should be the final local physiographic attribute; it evolved after the beach was deepened enough for the surface soil modification to be initiated.

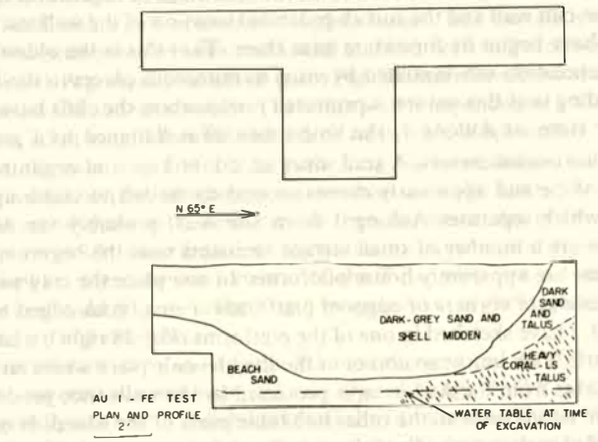


Fig. 41. Aulong 1. F-E test plan and profile. Wall test profile.

It appears to me that Aulong 1 offers an excellent opportunity to study the development of a habitable environment on a small limestone island in the Pacific. The fill should be trenched across twice, probably from near the F-E trench and also from near the well. This would yield two good profiles. Expanded excavating near the walls that fortified the southeast corner, and perhaps other digs of opportunity elsewhere should, with the trenches, yield enough information so that both natural and cultural environmental systems could be understood of themselves, and interlocking as a larger ecosystem. The only difficulty would be penetration of the fresh water lens but then, its study would be a valuable contribution itself.

Wall test

The wall test profile is simpler (Fig. 41) and the profile is more informative. There are four strata: stratum I is the top soil and root mat (essentially the same as level 1). Stratum II is organically stained grey sand, much like that of the F-E test but less coarse (levels 2, 3). Though

sandy, it is heavy with ash or some clay. Shell, sherds and bone were found in it. The sherds are soft and decayed. Stratum III (levels 4, 5) is a black, heavily humic midden in coral sand. It compacts readily and was laden with sherds and coral pieces. All are decayed and softened. Below this was a mix-zone and then stratum IV, sterile beach sand. The mixing zone is included with stratum IV (levels 6–8) for purposes of analysis.

This even straight forward profile reflects an advanced stage of deposition for this corner of the site. The broken cliff wall and the corner-protected location of the wall test area indicate that the beach must have begun its formation near there. That this is the oldest and original part of the site is a conclusion substantiated by visits to numerous places in the Palauan rock islands where the landing is of this nature: a protected *rincon* where the cliffs have been broken by localized erosion. Here, at Aulong 1, the limestone cliff is flattened to a gentle rise 9 to 15.25 meters in 30.5 horizontal meters. A trail, once no doubt kept and organized, makes its crooked way up this slope and apparently curves around to the left to climb up to the high comb of the island which separates Aulong 1 from site Au3, probably via Au2 (Osborne 1966:397–399). There are a number of small terrace remnants near the beginning of the trail and one or two of these are apparently house platforms. In one place the trail passes between what must be the remnants of corners or edges of platforms or small rock edged terraces and a gate of sorts is formed. I have sketched in one of the platforms (Fig. 38 right); a half a dozen or so others are less definite. This southeast corner of the site, the only place where an enemy could get into the island heights from the Au1 area, is protected by the walls (not yet described) and then by a fortified trail which leads to the other habitable parts of the island. It is true that an enemy could have landed in the area of Englishmen's Beach just over a low ridge from this trail. The ridge itself, manned by a few spearmen would have been formidable for an enemy to surmount. It is tremendously rough and steep. Spears in flight would have been more than discouraging. The remaining circumference of the island is practically impossible of ascent. The wave cut notches or the sea cliffs require a ladder or climbing pole in even the best places for landing.

Mapping

Mapping the site presented several problems: the most bothersome was the heavy secondary jungle growth. The young coconut trees of 15 years ago were mature and bearing, but the understory is still very heavy. We cut straight line or angling paths from the beach to the cliff in three places for the instrument. This is hardly sufficient for an accurate map. In other areas, the wall and the bend of the cliff along the northeast part of the site, I had to depend on my Brunton and tape and pacing and estimating. Figure 38 is an adequate map, but I advise any future worker to try for a better one.

The defensive walls are somewhat different than I visualized and described them after the first visit there. Parts of the walls were cleared and there was sufficient time while the digs were under way for azimuths and measurements. Details such as those of the gate (Fig. 38 inset) are correct in the main. It was not possible to clear them completely and attempt the studied reconstruction that would yield architectural details. I cleared and measured contending with the usual spiny *Dioscorea* vine and a poisonous vine. The walls themselves are impressive defensive structures. Figure 42 is a view looking down the northernmost wall section from near the cliff. It is perhaps the highest part of the wall remaining: 2.1 m now as it stands, with sufficient talus so that the structure was more than 2.4 m high at a minimum. Widths were 2.4 to 3 m. No doubt there were variations, even when the fortification was in use, but a fair statement of basal width and height as roughly equal (about 2.4 m) would not be greatly in error. The top of all sections is strongly altered, partly destroyed, so measurements are not helpful. In the best preserved places the top now is a rounded ridge .6 to 1.2 m across. There is no doubt in my mind that most of the structure, or at least the best preserved northern section was truncated

triangular in cross section. The long southern section is much eroded and, as it approaches its southern terminus, becomes an elongate stone mound. Construction is well and carefully laid coral chunk dry masonry (Fig. 43).

The northern gate is an angled abutment which appears to be more of an overlap than it is. The ends of the northern and central wall are, here, about 1.8 m apart. Wall measurements are of dubious value because of the broken nature of the ends. However, the north wall was 15.7 m long, the mid-wall with a gate at each end slightly longer, and the south wall about 29 m long. The opening, the main gate, between the central and southern wall sections is the most complex structure recorded. A ground plan of this gate (Fig. 38 inset) shows that there is a slight offset of the axes of the central and south walls. The south wall is expanded to a T-shape. The bar of the T is a platform 7.5 m long, 3 m wide and 1.2 to 1.5 m high. Each wall is 3 m wide; the offset is thus about 3 m. I was sure at first that both the long platform and the raised end of the central wall were terraced or stepped to a height greater than the walls. Later I became less sure of this. The wall ends are of more solid construction than the remainder of the dry laid coral chunk walls and this no doubt contributed to resistance to erosion, and enabled this gate area to maintain its height. The inner eastern end of the T-bar platform is faced with three upright coral slabs set in the soil (Fig. 44). The length measurement of the largest of these is 1.2 m; other measurements are not available.

A fifth hectare or so is enclosed by the walls on the west and the cliff and sloping section on the east. This was certainly not a major living area although it, like the back beach outside of the wall, is liberally sown with sherds and food shell fragments. This evidence of occupation is generally heavier in the central and south ends of the site than in the northern part. A small test was cut beneath the north wall, outside of the enclosure, about midway at the point where the two photographs of the wall were taken (Figs. 42, 43). The wall here is built almost immediately on beach sand. The foot of this part of the north wall is now buried about 18 cm. Below this is about 24 cm of black brown soil of wall test stratum I type. Below that is white beach sand. It is apparent that the occupational strata dip, thicken and complexify seaward to the south, at least as far as the wall test itself informs us.

Fig. 42. Aulong 1, west side of north wall after clearing; looking south.

Fig. 43. North wall masonry at highest point of wall; to southeast.

Fig. 44. South wall, enclosure side of gate platform, coral limestone slab basal construction.

Table 8. Aulong 1 food (?) shells.

Name of shell	F-E trench										Wall test								
	level										level								
	1 (14/Au1)	2 (18/)	3 (20/)	4 (24/)	5 (28/)	6 (34/)	7 (38/)	8	9	Total	1	2	3	4	5	6	7	Total	Grand total
Strombus luhuanus			2							2									2
Lambis sp.	11	6	3	3				2		25		1		4	2	3	3	13	38
Conus sp.	5	1	1	1						8		1			2			3	11
Cypraea sp.	4		2				2			8									8
Ovula ovum				1						1									1
Trochus sp.		5	1	3	1					10									10
Tectus maximus	6	2	3	5	7					23		1		1	2	3		7	30
Turbo sp.															1			1	1
Cassis sp.														1				1	1
Phos hirase			1							1									1
Barbatia bicolorata				1	1					2									2
Anadara scapha	6	4	1		2	2		1		16	1	2		7	1			11	27
Pinctada margaritifera	1			2						3				1				1	4
Spondylus sp.			1	2	1					4									4
Ostrea sp.	3	1			1					5									5
Fimbria sp.		1	3	1						5									5
Vasticardium	1	4	1	2						8		2		6	1			9	17
Hippopus hippopus	8	2	1	5	5	2	3	5	2	33	4				4	6	1	15	48
Tridacna sp.	40	8	12	15	1		10	5		91	1			11	9		8	24	120
Atactodea striata	9			3						12									12
Mactra			1							1									1
Totals	94	34	33	44	19	4	15	13	2	258	6	7		31	22	12	12	90	348

It may also be important that the wall test was placed within the walled enclosure. Here soil, washed down from the cliff area, and presumably carried in by occupants, would have accumulated comparatively rapidly after the wall construction, with the latter acting as a holding dam. Thus both the cultural and natural deposits in the enclosure would be the deepest and oldest of the site. Further excavation, both within and without the walled area, is required to confirm or deny this conclusion.

Burials

Unfortunately, we lacked the time to relocate the test pit described in our first report (page 388) and thus recover the skeleton found there. No others were found although fragments of human bone were not uncommon in the midden; some are used in formulating the conclusions of Appendix 5. More thorough excavaing would locate skeletal material.

Shell Collections

All shells, probably all food shells, were saved from the levels of the F-E test. The same is not true of the wall test: instructions were apparently not clear and we do not have a full collection from that excavation. We find it difficult to draw conclusions from the tabulation (Table 8) except in a general way. All of the shells that show most importantly can be used for both food and artifact material (Figs. 45–46). *Tridacna, Hippopus, Lambis, Conus, Tectus* and *Trochus*, and *Anadara* were the preferred shells for eating and for tools and ornaments according to our sample. *Tridacna* and *Hippopus*, both large shells, are excellent food, but *Tridacna* was the prime tool shell. *Lambis* was useful for food and artifacts and *Trochus* and *Tectus* for food and ornament.

The figures for the wall test indicate, I believe correctly, that the levels 4 and 5, our stratum III, was a time of intense occupation of this part of Aulong. This is perhaps the same period as levels 7 and 8 of the F-E test. Other than this rise of shells in these two levels there was a moderately regular decrease in shell debris from the top down, after the heavy concentration of

Fig. 45. Aulong 1 food shell sample. *a, c, d, Lambis truncata; b, Murex ramosus; e, Bursa* sp.; *f, Turbo* sp.; *g, Conus* sp.; *h*, unidentified large gastropod probably shell interior; *i, Owla owum; j, Tridacna maxima; k, Conus* sp.; *l, Lambis chiragra; m*, immature *Lambis truncata; n, Strombus* sp.

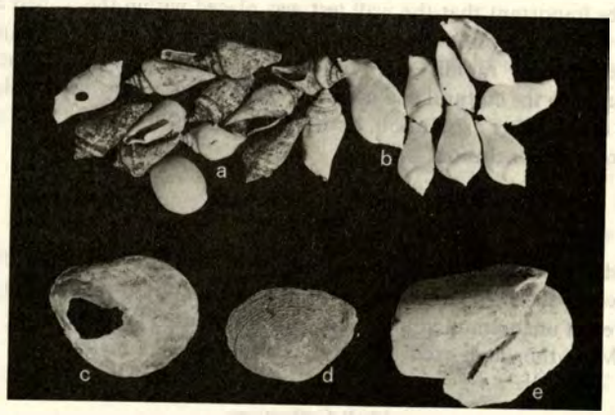


Fig. 46. Aulong 1 and Pelilieu 1 shell sample. *a, Gibberulus* shells from midden of Pelilieu 1; *b* modern beach *Gibberulus; c, Spondylus* sp. *d, Quidmipague palectum; e,* piece of *Tridacna* shell. *Gibberulus* shells average 2.5 to 3cm in length.

near surface and surface shell scree. An examination of Figures 45 and 46 should convince the most skeptical that there is a tremendous amount of information available regarding usages, preferences and methods of extraction in the thousands of food shells in the Aulong 1 midden. A study of these in connection with a large excavation should be most valuable.

Animal Bones

There are two catalog numbers, both from the wall test, that contain land mammal bones that are not human. 57/Au1 from the lower part of stratum II was recognized as pig; 56/Au1 from upper stratum III contained several smaller bones. Both were sent to Dr. Frank C. Whitmore Jr of the U.S. Geological Survey in Washington. He states that 57/Au1, fragments of the mandible of a pig is "*Sus* cf. *S. scrofa*, a heavily built short faced pig." The second catalog number contained 3 bones, a rib, a scapula and lumbar vertebral fragment. The latter are "from a small but adult pig, of the size of *Sus leucomystax riukiuanus* from the Ryukyu Islands. The contrast in size between this specimen and 57/Au1 is considerable...". The rib could not be identified by Dr. Whitmore and as he thought it about the right size for dog and I had thought it was dog, I asked Dr. Barbara Lawrence, Museum of Comparative Zoology, Harvard University, if she would look at it. Because it was a rib it could not be absolutely identified, but she said that it could not be distinguished from an average size goat. Dr. Whitmore had previously identified a goat tooth from site Koror 5 (see page 145) but this was from the first level in a much cultivated manioc patch so I thought it of little prehistoric interest. The rib changed matters. Letters to persons knowledgable of the Philippines brought responses from Harold C. Conklin and Wilhelm G. Solheim and supplied historical and archaeological evidence of the goat in Malaysia and the Philippines (Solheim 1960).

There is no need to belabor the import of these small finds. They indicate that the Palauans once had the kinds of contacts that permitted them to import not only two kinds of swine but also the goat. My bias would be to suggest the Philippines as the source but I do not know that the Ryukyuan pig existed there. The Palauans had chickens (Keate 1788: 300) but apparently used them sparingly. One would suspect that the presence of the three large mammals in the small reef island Aulong would indicate that they existed on others as well, and probably in much greater numbers on the large volcanic islands. Unfortunately and discouragingly bones are not apt to be found in the acid volcanic soils.

If there were a period in which domesticated mammals were important on these islands, and I have not stumbled on an isolated circumstance, then indeed we are faced with an extreme example of the kind of cultural change that has taken place elsewhere in the Pacific. I should not be surprised if the decline and fall of the terrace building period and all that that implies socially, marked the end of pigs and goats there too.

One other fragment of a mammal, the tooth of a small cetacean, probably a killer whale or false killer whale was identified by C. A. Repenning of the branch of paleontology and stratigraphy, U.S. Geological Survey in Menlo Park, Calif.

Artifacts

All artifacts, that is objects which are within themselves a set of completed cultural traits, are listed in Table 9. Three are pottery disks, things of presently obscure function and utility, a paint stone, a part of a pottery pestle, a fine abrader or stone file and 7 shell adze blades. This is not a large collection: artifacts were few on the surface and in the Aulong 1 deposits. Descriptive data appear in the tabulation: Figure 47 illustrates some of the artifacts.

Sherds illustrating the manufacturing process: A small fragment of a rim, probably a backcurve (105/Au1) shows very fine laminations. We were unable to photograph it; the effect is rather like the late Yap pottery in which the process of compaction has yielded strong large laminae (Gifford, E. W. and D. S. 1959). Two other rim sherds (Fig. 48*e, f*) illustrate the blending of the flanged into the interior lip rim and serve notice that the two rim forms can blend from one to the other on the same pot. Such sherds are rare; most potters apparently followed their patterning closely. A thickened rim (109/) has a light channel or groove which apparently circled the entire lip of the rim. Another (Fig. 48*g*) is lightly grooved on the inner side of the interior lip; this sherd also illustrates a common situation in that it is partly bright redware and otherwise smudged.

Post manufacturing alterations of sherds are uncommon. Hole drilling appears to be an aspect of repair, as elsehere, rather than a modification for suspension. A rim sherd (87/, Fig. 48*c*, wall test stratum II) is interesting in that it illustrates the beginning of one drilling and the adjacent completion of a hole. As a matter of interest, we illustrate two sherds (111/, Fig. 49*f, g*) from level 3 of F-E test, that show the heavy wear that was developed on the back beach next to the cliff. These must have been thrown inland during some prehistoric storm, from a strand much nearer the cliff than that of today.

Decorated sherds: Painted and textured sherds are more numerous from Aulong 1 than from any other site. Presumably this is significant; it suggests to us that the inhabitants of this small island made their own pottery and did not depend on a selection of imports. Sherds are redware, buff; some have been smudged, presumbaly from cooking use.

Simple circumferential grooving appears on several sherds; 85/Au1 (Fig. 48*b*) is a straight walled redware body sherd or a piece from near the bottom, with a groove incised across the sherd. Striations are visible on the bottom of the unusually angled groove. A backcurve rim piece also has an incised groove but with a V cross section. It starts on the left side of the sherd 3cm below the lip and ends on the right side 15 mm below it. Eight mm below this is the break of the sherd following another incision that appears to draw close to the first at the right side of the sherd. These grooves may therefore be components of an unusual curvilinear design. This same sherd has a toothed rim, two parallel lines incised into the lip and was painted red on the interior (Fig. 49*h*).

Diagonal slashing in its simplest form as observed on Pelilieu 1 sherds was not found at

Table 9. Aulong 1 artifacts.

Cat. No.	Object	Fig. 47	Material	Length × width × thickness (mm)	Weight (grams)	Cross section		Comments
						Lengthwise	Transverse	
5/Au1	adze blade		*Terebra* shell	broken × 42 × 20	frag.	conical	plane-convex	large type 1; bevel angle 60°. Surface
6/	adze blade		*Terebra* shell	broken × 32 × 13	frag.	conical	plane-convex	small type 1, typical, angle 55°. Surface
1/	adze blade	*c*	*Tridacna* hinge	115 × 45 × 20	129	double convex	triangular oval	type 3, bevel angle 39° Surface.
39/	adze blade	*e*	*Tridacna* hinge	126+ × 44 × 27	230	double convex	nearly circular	Type 3 but with narrow bit like type 2. See 18/Ang19, p. 25 angle 33°. F-E test level 7
45/	adze blade	*d*	*Tridacna* hinge	79 × 35 × 32	96	plane-convex	plane-convex triangular oval	type 3, short heavy bit angle 49°. Surface
46/	adze blade		*Tridacna* hinge	90 × 55 × 13	75	quadrangular	double plane	type 3 triangular, double bevel, flat ground back, front bevel major, angle 130°. Surface
7/	adze blade	*b*	*Tridacna* hinge	100 × 44 × 27	195	plane-convex	plane-convex	type 7. see p. 23 (Ang. 19), heavy, surface wholly modified. Front bevel, angle 143°. Much battered. Surface
113/	paint stone		hematite	55 × 40 × 10	43	quadrangular		imported paint stone. No wear facets. Surface.
62/	pottery disk		redware	68 × 65 × 13	66	concave-convex		from near vessel bottom; edges roughly ground. Wall test level 5
110/	pottery disk		greyware	40 × 37 × 6	26	concave-convex		roughly broken to shape. Edges not ground. Wall test level 6
62/	pottery disk		redware	65 × 64 × 13	62	concave-convex		base piece, unusually large. Wall test level 5
60/	handle to food masher ("*doab*")	*a*	ceramic	broken × 28 × 28 hole 4 mm. diam. 20 mm above flattened unbroken end.	frag.	quadrangular	circular	said to have been used by older people to soften food. Probably had flaring distal end. Wall test level 6.
47/	sharpening stone, abrader	*f*	grey sandstone	119 × 41 × 13	130	quadrangular	quadrangular	one edge broken, one surface deeply ground. Surface.

Au1. The method, however, of slashing or perhaps impressing long slanting grooves was used at Aulong to form somewhat more complex designs. All decorated areas were smoothed after the designs were formed. 91/ (Fig. 49*i*) from a shallow dish with interior lip rim, was decorated with a series of chevrons formed by an upper row of slashes up to the right and a lower row nearly meeting the elements of the first, slanting up to the left. The elements are 25 to 35 mm long and 5 to 8 mm apart. 94/ (Fig. 49*m*) uses the same design method; the chevrons are complete. It was also an interior lip dish. Slashes are about 2 cm long and closely nested. 107/ (Fig. 49*l*) follows the same design but the chevrons on this interior lip sherd open upward; that is they are vertical on the exterior vessel wall instead of paralleling the rim. Grooves appear to be about 3 cm long; they meet at or near right angles, as they do on most other sherds. It is entirely possible that the decoration on this sherd was two series of diagonal lines encircling the rim, one series slanting up to the right and the other up to the left. We may have found one of the sherds on which the two series met. 92/ (Fig. 49*k*) has the same plan of decor. The slashes appear however, to be impressed by using the end of a curved piece of wood or bamboo. Lines or cuts are short, 2 cm long, and about 1 cm apart. Again the decoration appears to be nested chevrons set vertically, starting from and perpendicular to the rim. This was a large interior lip bowl, probably 35 cm in diameter. The interior may have been painted although the clay has hematite inclusions which could easily have led to an ocherous effect as the vessel walls were smoothed. All of the above sherds are from stratum II of the wall test except 107/ which is from level 7, F-E test. All were red painted, either exterior or interior or both.

X-marked sherds: 96/ (Fig. 49*p*) is an elaboration of this form. Diagonal slashes in two series up to the right and up to the left cross one another to form series of X's and contained diamonds below the interior lip rim. The band is about 2 cm deep; exterior was painted in red (wall test stratum II).

Indentations are all on the exterior of sherds. 93/ (Fig. 49*q*) demonstrates an open curved line chevron formed by small punched dots on an interior lip. There are three lines on the left side and 2 remaining on the right curving down at the ends. As is, the longest line is 34 mm long, the ends of the 2 groups of lines are about 1 cm apart. The sherd is painted on both exterior and interior (stratum II wall test). 117/ (Fig. 49*r*) displays 3 triangular punches made with a pyramidally sharpened tool, set together in a triangle. The indentations are 5 mm across and 3 mm apart (F-E test, level 6).

External rim notches appear on 4 sherds: 88/, flanged rim, wall test stratum II; 99/ (Fig. 49*n*) flanged rim, wall test stratum II; 102/ interior lip, wall test stratum II; 114/ (Fig. 49*o*) flanged rim, wall test stratum I. On the first three the notches are impressed and slant up to the right; they vary from about 1 to 2 cm apart. Sherd 114/ indentations are perpendicular to the rim and appear to have been cut out, not impressed. This sherd also has a lunate, probably finger nail impression on the flat lip. None of these sherds is painted. All indentations appear to have been formed in groups, rather than being continuous around the lip.

Comma shaped indentations, or lunate or fingernail impressions appear on 3 sherds: 114/ described above, and on 97/ and 100/ (Fig. 49*d*). There are 3 below the interior lip of 100/, vertical, about 1 cm long and 1.5 cm apart. Indentations on the others vary from 1 to 2 cm apart. The impression on 97/ is on the rim; it and 100/ are wall test, stratum II sherds. Commas below the rim on the exterior appear on 115 (Fig. 49*a*) interior lip, from wall test stratum II. These are true curving comma forms, 12 mm long. There are four in the first line below the lip and remnants of 3 below that. The commas and rows of commas are separated by 3 to 5 mm.

Modeled or sculptured sherds are few; 82/ has been partly described. In addition to the grooving, the exterior aspect of the backcurving rim has been modeled or carved by notching so that 3 teeth appear. It was a surface find.

The other sherd from F-E test level 1 (48/, Fig. 49*e*) is heavily altered chemically and physically. It is what we called "fused paste" under the impression, early in the period of study,

Fig. 47. Miscellaneous artifacts, Aulong 1. *a* (60/Aul) probable handle of pottery food masher; *b* (7/), type 7 adze blade; *c, d, e* (1/, 45/, 39/) type 3 adze blades; *f* (47/) whet or file stone, 11.9 cm long. See table 9 for artifact analysis.

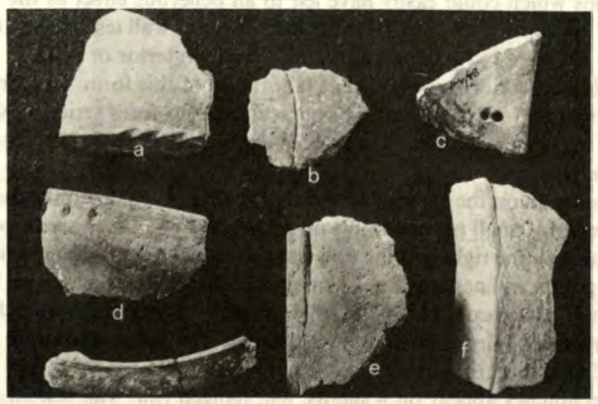


Fig. 48. Aulong 1 unusual sherds. *a* (102/) *b* (85/), *d* (100/) and *g* (98/) have incised or indented designs. See text for description. *c* (87/) drilled rim sherd; *e, f* (90/ 89/) rim sherds showing transition from flanged (07) rim to interior lip (12) rim.

that the pots or the sherds had been subjected to unusual heat. We now believe the peculiar alteration to be due to calcareous penetration, a sort of petrification or fossilization which happens rapidly in some parts of the Palauan environment. The design is a series of triangles basally opposing across a central bar. It is very much the same as the *kim* design representing the toothed edge of the *Tridacna* shell found so commonly on shell insets on wood bowls and in the carvings on *Bai* sructures. Finally sherd 108/ wall test stratum III has 4 fine parallel postfiring scratches on the interior.

The incurving side of an 01 rim of a buff slipped sherd retains one pointed external projection, the base of another and indications of the origin of a third (58/, Fig. 121*d*). The whole process or cog is approximately 1 cm long, 2 cm across the base, and 2.5 cm midpoint to midpoint of the two adjacent cogs. There appears to have been another decoration, perhaps of the same kind set into the wall below the broken projection. A flange and smoothed cross

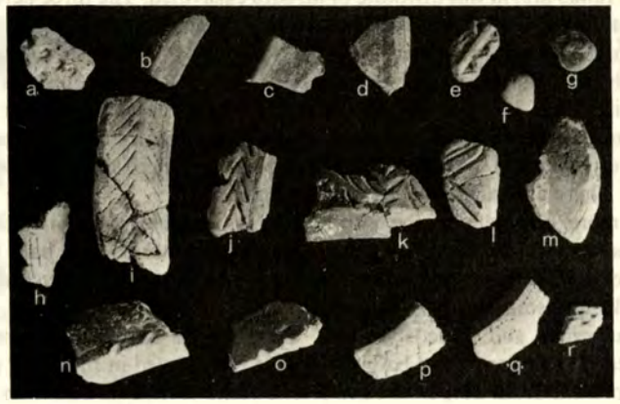


Fig. 49. Aulong 1 unusual sherds. See text for description. *a* (115/), *e* (48/), *h* (82/), *i* (91/), *j* (94/), *k* (92/), *l* (95/), *m* (107/), *n* (99/), *o* (114/), *p* (96/), *q* (93/), *r* (117/) have incised, carved or indented designs; *b* (104/), *c* (103/), *d* (112/) have red paint designs?; *f, g* (111/) are strand worn sherds.

section of the wall suggests this. The sherd may have been painted but included bits of red ocher in the clay may have left the red streaks.

Painting on sherds is all in red. It has been mentioned in a number of preceding descriptions of otherwise ornamented sherds: 82/Au1, interior painting; 91/, interior; 92/, both possibly, interior surely; 93/, 94/, 96/, 99/ both surfaces had painting. Four additional sherds have painting in red: 84/ interior and exterior (wall test statum II); 103/ painted both surfaces (Fig. 49 *c*; F-E test level 6); 104/ (Fig. 49*b*, F-E test level 6) has a red band on the rim; 112/ (Fig. 49*d*; F-E test level 8) painted on both surfaces. All of the above are rim sherds. A large backcurve rim piece, 116/ from wall test stratum IV appears to have been painted on rim interior lip, and perhaps on the vessel exterior.

My sample is not large enough to state associations of decoration with any aspect of the excavation. Decoration of pottery with color or by changing the surface was in use throughout the Aulong occupation.

Ceramic analysis

F-E test

The Aulong site was tested in two different parts of the back beach area: the F-E test near the cliff and the wall test. While describing the former a certain amount of general worry concerning the stratigraphic or vertical integrity of a deposit in its situation was made explicit. There were 1374 sherds studied from the whole site. An examination of the computer percentage-frequency statement will follow for both tests. The F-E test was excavated by levels and no culturally related stratigraphy was apparent. It is therefore necessary to consider the ceramic yield through the nine 15 cm levels (Fig. 41).

Exterior color is red (floated) in the 90 percentile and buff, also float, around 10%. Interior color is predominantly red also, although not as strongly so. Buff is more common in the two lower levels. Red slip appeared in the lower levels. True seriation in relation to depth does not exist. Smooth surface finish of both exterior and interior is the norm although the mid-levels have a minor expression of smoothed exterior, rough interior. Decorated sherds are rare

although this site ranks first in this attribute of all sites excavated. The three percent of the first level is the highest. Lower level sherds have the most surface change, erosion and the like. Level 5 showed a large number of heavily beach-worn sherds, although other sherds in the same level were not worn. I believe that, were a profile available from the near cliff, the area of the F-E test out to the tree line (Fig. 38) it would be possible to state the origin and/or nature of the disturbance that must lie behind such situations. Smudging of both surfaces is most common in the upper five levels; smudged interior reverses this, while smudged exterior is less usual in the superficial levels. There are trends but no even series.

Firing was more complete in the upper levels. A problem exists in the interpretive acceptance of this fact. Sherds having long exposure to salt water become hard and tough and are difficult to break. It is therefore possible that our analysis expresses physical change rather than cultural makeup insofar as this set of attributes is concerned.

Rims are numerous and varied: straight, incurving 03 and 02, interior lip, thinned, thickened, lip greater than flange and backcurve were represented in the order given. Straight decreases in importance from deeper to later levels. Rims 03 and 02 maintain an erratic but similar position throughout. Interior lip, much like the Southwestern "seed bowl" has twice the percentage in the upper three levels as in the lowest three. Thinned and thickened enjoyed a decided preference in the deepest parts of the deposit. Backcurves are recorded from levels 1 (Fig. 50) and 7 (Fig. 54) but are in no way comparable to the backcurve of the wall test (Fig. 58). Flanged rims (07) show their greatest percentage in midlevels. The flanged form from this test is more akin to the interior lip in that the lip is elongate and the flange weak (Figs. 50–53). At Pelilieu, the flange was developed in a variety of forms and that site might be considered classic for the 07 rim. The interior lips of this test are similar from top to bottom with the rim tapered to the lip and a lack of the bulge at the vessel mouth that appeared often at P1. Table 33 shows the prevalence of the broad lip on vessels in the relationship between sherd thickness and mean lip width.

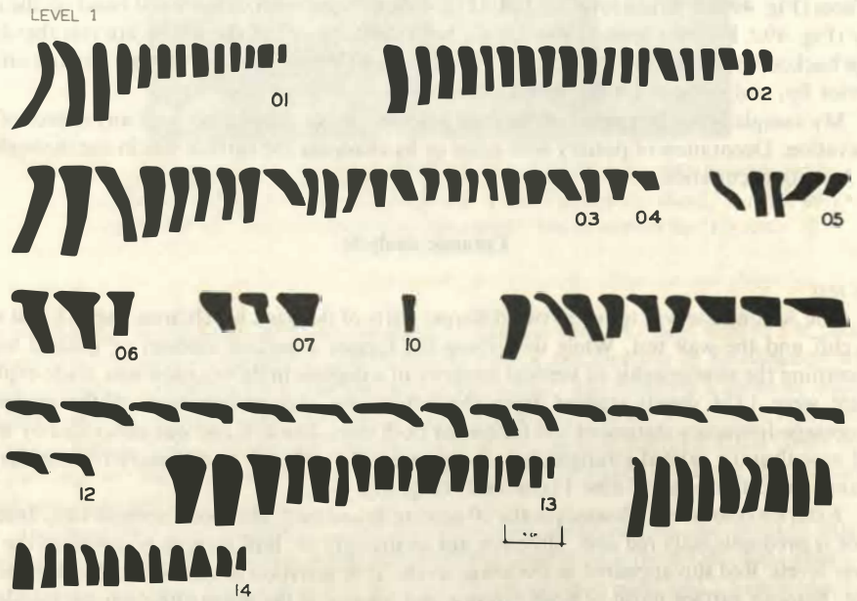


Fig. 50. Aulong 1, F-E test, level 1: rim forms.

Fig. 51. Aulong 1, F-E test, levels 2 and 3: rim forms.

Fig. 52. Aulong 1, F-E test, level 4: rim forms.

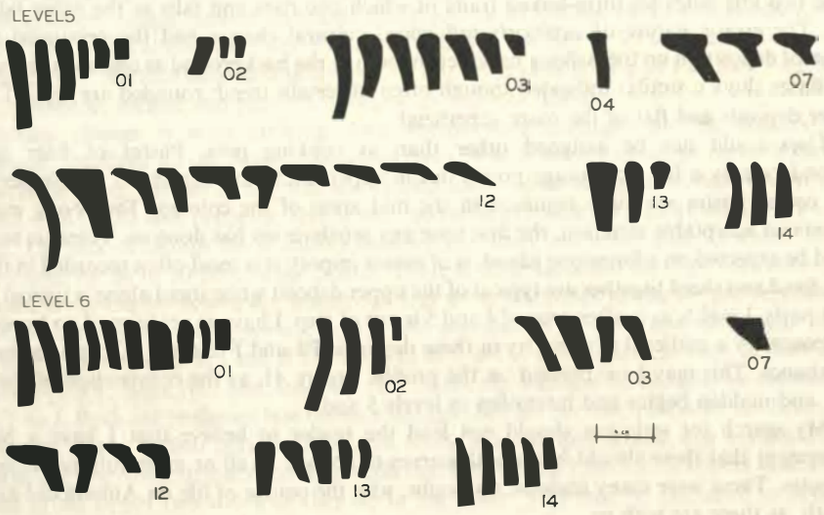


Fig. 53. Aulong 1, F-E test, levels 5 and 6: rim forms

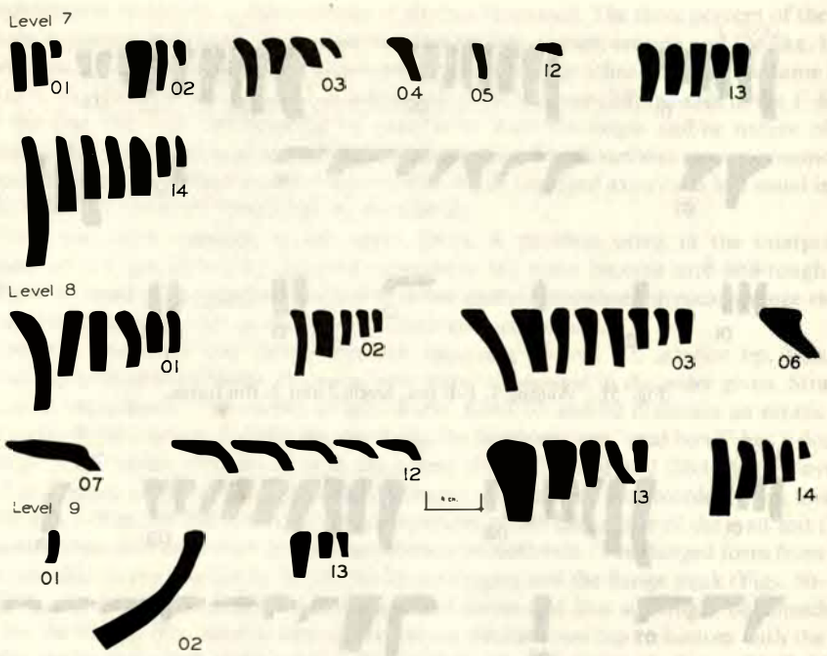


Fig. 54. Aulong 1, F-E test, levels 7, 8, 9: rim forms.

Rounded lips are most common in the lower levels and flat ones in the later. Pointed lips, too, have their greatest percentages in the upper three levels.

Wall shape is most strongly straight and this most emphatically in the upper levels. It is a presumed late characteristic on the basis of this test. The opposite is true of the incurving series. These two attributes set form-linked traits of which one rises and falls as the other falls and rises. The erratic nature of exteriorly influenced cultural change and the presumed erratic nature of deposition on the Aulong back beach loom in the background as ominous unknowns.

Bases show a similar indicated though often uncertain trend: rounded are typical of the deeper deposits and flat of the more superficial.

Uses could not be assigned other than as cooking pots. Pastes of finer quality preponderate by a few percentage points in the upper levels and coarser in the deeper ones. Very coarse pastes are more common in the mid areas of the column. Tempering material presents an acceptable seriation, the first time any attribute set has done so. Volcanic sand, as would be expected on a limestone island, is of minor import; it is most often recorded in the top level. Sand and sherd together are typical of the upper deposit while sherd alone is typical of the lower parts. Level 5, as is often true of 4 and 5 is out of step. I have as yet formed no hypothesis to account for a midlevel irregularity in these deposits (P1 and F-E test) except a recourse to disturbance. This may be expressed on the profile, Figure 41, as the constriction of the dark sand, and midden begins and intensifies in levels 5 and 6.

My search for seriation should not lead the reader to believe that I have a built-in requirement that there should be smooth curves of change of all or most cultural aspects or attributes. There were many reasons, no doubt, why the course of life on Aulong did not run smooth, as there are with us.

Size of tempering particles is commonly fine; coarser temper (and sherd temper) is more

usual in the pottery from deeper levels. Of course, the imported volcanic sand is fine. Probably this and clay were imported into the limestone islands and pottery made there. Quantity of temper is more or less evenly divided between light and medium with heavy, one third to half as important. Medium is slightly more common in later levels and may be negatively associated with coarse tempering.

Dimensions indicate slightly thicker, slightly larger diameters and lesser lip widths of pots in the lower levels. This is associated partly with the trend toward more inner lips in the upper deposit.

Wall Test

This excavation was placed behind, inland from, the defensive wall (Figs. 38, 41) in the belief that the deposits there should have been protected since the wall was built, and that deposits should have grown rather rapidly behind the wall. Now I am not sure of the latter aspect of the hypothesis.

As with most tests starting from a more or less plane surface the wall test was excavated by levels. I had hoped that one of the two short trenches at Aulong would show soil stratigraphy which could then be used to guide a larger adjacent stratigraphic excavation. As is all too common, difficulties arose—two major storms, one a minityphoon, left no time to devote to the larger Aulong trench. However, the wall test dig was fortunate that the 15cm levels coincided very closely with the stratigraphy that appeared and I was able to assign the levels to the strata without doing much violence to the cultural material in the latter.

Unlike the F-E test, the wall test yielded a number of seriations of varying quality. In spite of this, or better, because of it, it is in common disagreement with many aspects of quantity and relationship that we found elsewhere in Palau.

Exterior color is limited to three: grey float which is rare, decreases from stratum IV to I; red float, the common color increases from IV to I; buff, moderately common, decreases from IV to I. We may note that the figures from stratum II are often out of step, too small or too large. This may reflect an error on my assignment of materials from the two upper levels.

Interior color is similar to exterior; grey is about the same; red also increases from lower to upper strata, but not as markedly and buff is much the same as recorded for the exterior. Seriations are acceptable, but II is recalcitrant. Surface finishes often show abrupt change. Smooth exterior, rough interior increases sharply, 3 to 81% from IV to I. Smoothed, both surfaces, acts as the allele of the first finish starting near totality in VI and decreasing to low moderation in I. Surface decorations are rare by our norms but strong by Palauan. Stratum II has 12% painted, incised and painted, stamped or modeled sherds.

Surface change is most striking. Few sherds were smudged on the exterior only throughout; smudged on the interior decreases from IV to I. Sherds smudged on both surfaces also decrease from bottom to top but less emphatically. Both surfaces eroded is most often recorded with depth and, properly, sherds with no surface change are a more usual attribute at the top. The lack of change lies primarily between the lower and upper pairs of strata. Sherds are well fired by 20 to 30 percentage points. There is little variation through the column.

Rims from the collection are numerous and most attributes in the set are represented. Straight, incurving 02 are important in IV and uncommon in I; 03 and 04 appear rarely. Backcurve is about equal in I and II but leaps to 61% in IV. It is an ancient form in the Palaus. Lip greater than flange (07) and inner lip (12) classically increase from rarity to prominence from IV to I. Both are preferred late forms although they are present, probably not because of disturbance, in the earliest period. Other rim forms are rare and erratic; rim variation is far greater in the two lower strata. A count reveals that the Aulong 1 rim forms appear nearly twice as often in the upper two strata as they do in the lower. This may be examined in detail by reference to Table 33.

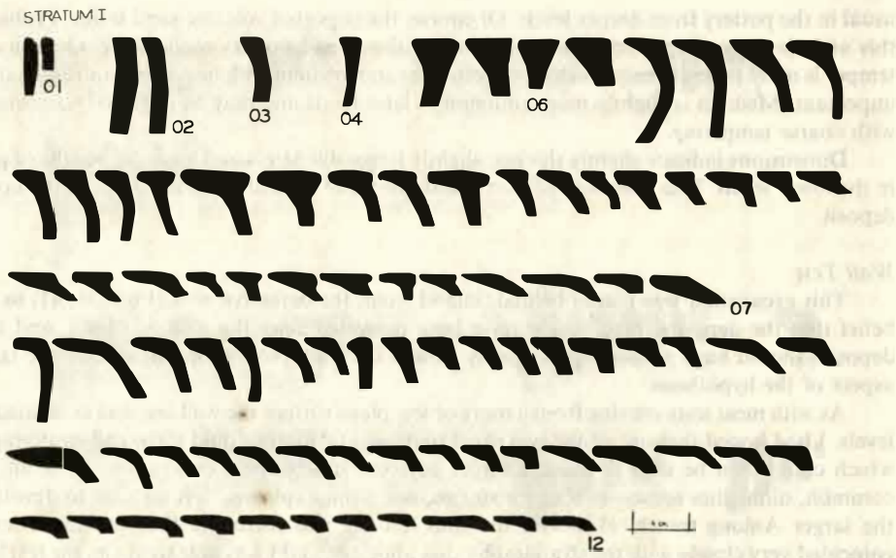


Fig. 55. Aulong 1, wall test, stratum I: rim forms.

Figures 55 to 58 illustrate wall test rims, showing a greater development of flanging in strata I and II than in any F-E test level. The massive P1 sherds are the most alike these except for the totally different stratum IV assemblage. Here the simple rim, backcurving pots and bowls are outstanding. Even the 07 and 12 rims are small, light and appear to be extensions of the 04 and 03 rims. There is no truly developed flange and interior lip. One cannot escape the suggestion that the few sherds from IV represent an early limestone island occupation.

Lips are predominantly flat, all strata. Pointed and channeled lips, few, are lower strata where there is hence the greater variability. Walls are predominantly incurving. The backcurving and a saucer shape appear in IV where there is again more variability. Reconstructions and rim and bowl shape and size, from rim sherds, appear in Figure 59. Bases are about two thirds flat in statum IV, rounded in III and II and absent in I. Possible use is given as cooking but one lamp and one necked jar were recognized. Very fine paste appeared, rarely, in the bottom two strata; fine paste is also most important there. Medium is common at the top but still makes up nearly half of that recorded for the bottom; it is generally stable. Coarse is unusual at the lowest and moderate in upper strata. Pots of the lower strata were about equally medium and fine; those of later times were medium or coarse. Very fine and coarse, the extremes, were equal below. Tempering is nearly wholly crushed sherd in the upper strata, and this predominates in the lower also. Sand and sherd is less often recorded but present in the lower two. The older pottery, imported either in the form of clay or as pottery, as was the later, is the more variable. Tempering size, recorded as two attributes in opposition, is coarser in the later period and finer in the older. Most particles were fine throughout, 71% in stratum I and 97% in IV. Temper quantity is apt to be sparse in the older periods and heavier in the upper strata. It is also finer in the lower strata and is hence more difficult to observe. The pot of the older period was essentially a better fabric.

Measurements of wall thickness and lip width decreased sharply in stratum IV. This reflects the simple rim and the backcurve *ollas* in use at that time. The thickened rim pots of stratum III increased the sherd thickness measurement there. The other figures, especially for

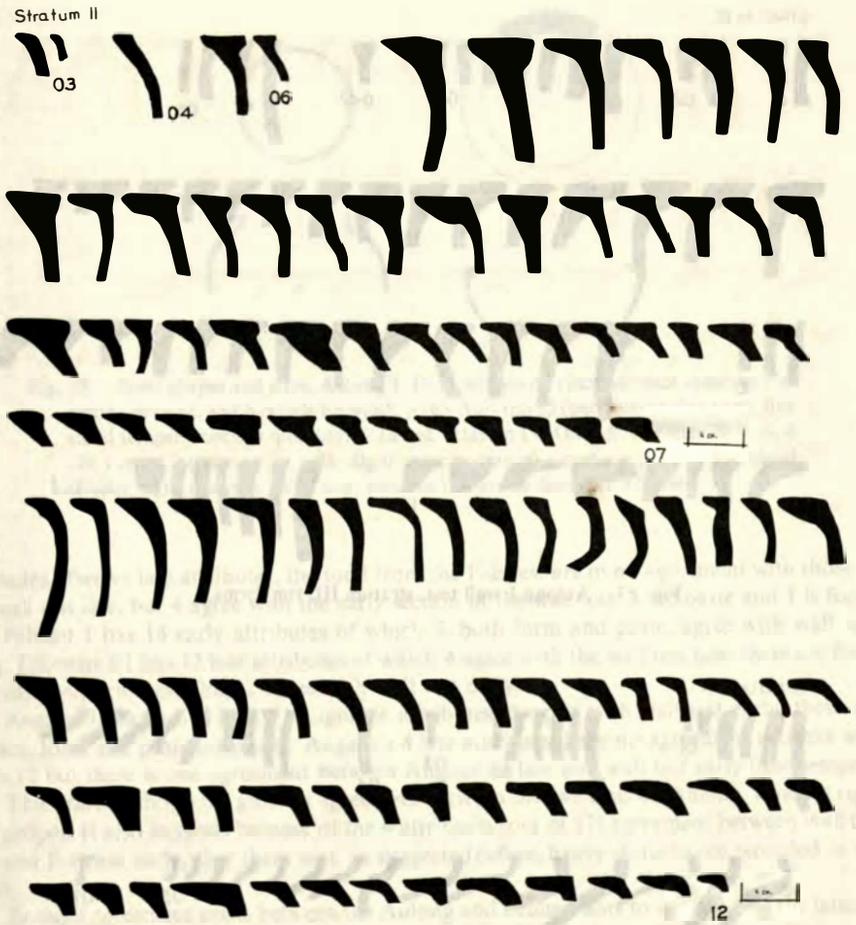


Fig. 56. Aulong 1, wall test, stratum II: rim forms.

the two upper strata, reflect the dimensions of the pots with flanged and interior lip rims.

The preceding three sites all belong to the geomorphologic area of the Palaus that is locally called the Rock Islands or the limestone islands. These raised reef or platform islands form a landscape and offer environments to inhabitants that are far different from the large volcanic islands north of them. It will therefore be well to take stock of the data so far accumulated before leaving these rugged but beautiful places for the more secure volcanic islands.

A descriptive statement of the ceramic analysis of the sherds from the four components selected for the purpose has been given previously. Of these four components from the sites only one, the Aulong 1 wall test, demonstrated consistant seriation. It is therefore chosen as the basis for the following comments.

During the description, the attributes that showed a fine and consistant association with the lower and presumed earlier parts of a deposit, or with the later upper parts, were so recorded. Forty-five attributes were assigned association. A tally of these reveals that the wall

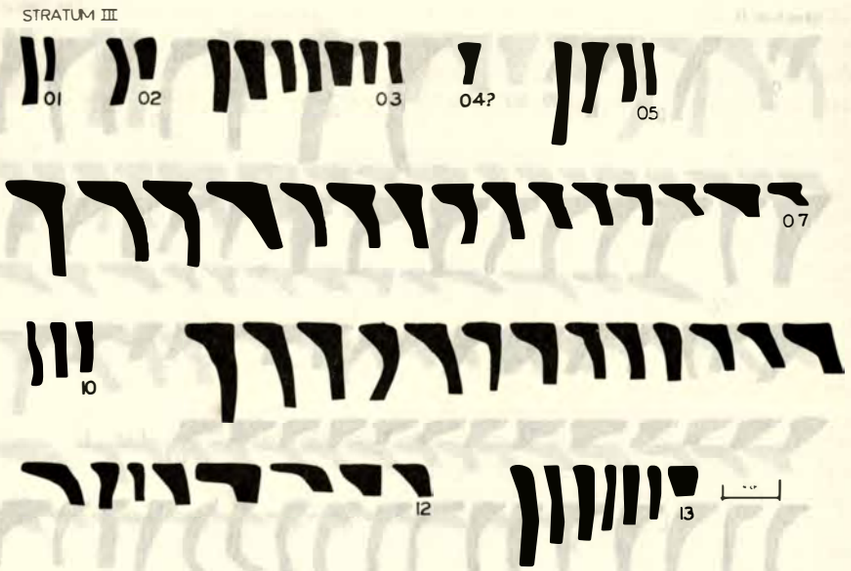


Fig. 57. Aulong 1 wall test, stratum III: rim forms.

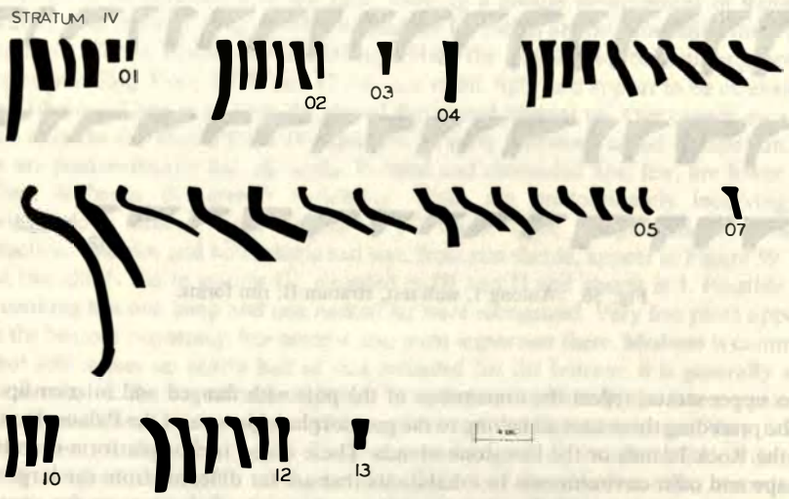


Fig. 58. Aulong 1, wall test, stratum IV: rim forms.

test had 17 early attributes and 12 late ones. Of these 5 are surface attributes, 8 are form, or size, and the remaining 4 are paste attributes.

There are 14 F-E test early attributes of which 7 agree with the wall test; 4 of these are form attributes.

There are 12 wall test attributes given late assignment: 6 are surface, 3 paste and 3 form

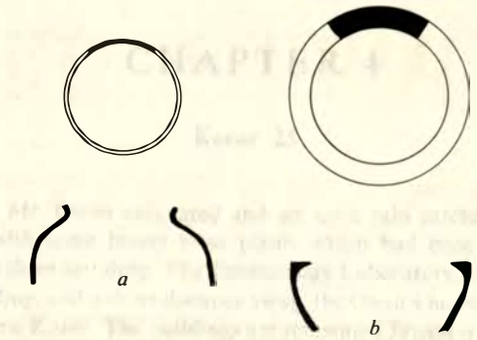


Fig. 59. Bowl shapes and sizes, Aulong 1. Dark section on circumference indicates rim section present; width equals lip width. *a* (65/Aul) rim 05 (backcurve); fine paste, fine sherd temper, medium quantity. Wall test, stratum IV. Outside diameter 20.5 cm. *b* (49/) rim 12 (interior lip with slight exterior flange), medium paste, fine sherd temper, light quantity. Wall test, stratum I. Outside diameter 32.0 cm.

attributes. Twelve late attributes, the total from the F-E test are in no agreement with those of the wall test late, but 4 agree with the early section of the wall test: 3 are paste and 1 is form.

Pelilieu 1 has 14 early attributes of which 5, both form and paste, agree with wall test early. Likewise P1 has 12 late attributes of which 4 agree with the wall test late: these are form and surface attributes. Only 2 agree with wall test early.

Angaur 19 early has only 7 assignable attributes: 5 agree with wall test early: these are surface, form and paste attributes. Angaur's 4 late attributes have no agreement with the wall test's 12 but there is one agreement between Angaur 19 late and wall test early (fine temper).

This exercise shows the greatest agreement between the two tests on Aulong, which is right and proper. It also suggests because of the 4 attributes (out of 12) agreement between wall test late and F-E test early, that there was, as suggested before, heavy disturbance recorded in the latter.

Enough agreement exists between the Aulong and Pelilieu tests to suggest that the latter is not as disturbed as it may have seemed when the tabulations were under analysis. Angaur 19 early, likewise retains some of its integrity in the deeper parts of the deposit.

CHAPTER 4

Koror 25

During our stay, Mr. Owen excavated and set up a rain catchment filling system and planted a lily pond with some lovely lotus plants which had been sent from Japan. The excavation was two to three feet deep. The Entomology Laboratory, the Weather Station and the Conservation building, and a short distance away, the Owen's house, are all atop one of the highest places in western Koror. The buildings are renovated Japanese structures, still bearing the marks of war but sturdy and useful. The pool excavation penetrated through a layer of disturbed soil .18 to .21 m thick, with some midden and plentiful evidence of late occupation. It is the result of Japanese levelling of what we assume to have been an ancient Palauan cultivated area. Below this was a lens of mixed trash with fragments of glass and iron, only 6 to 9 cm thick. The third soil layer was a typical clay deposit with light midden admixture, 24 to over 30 cm thick. It did not appear to be disturbed. Clay subsoil lay under this. Typically, the soil is the Palauan association 1: latosols, volcanic derived, acid red clays, dense and well drained (Corwin et al 1956: pls. 19, 30). We saved a collection of sherds from the midden of the second soil layer in spite of the fact that it had been disturbed. No other artifacts were found.

Examination of the sherds and a partial analysis, together with the disturbance caused us to abandon this site insofar as the usual detail study was concerned. Excavation did, however, show that the area had been used agriculturally. Local changes in slope together with the evidence indicated that it was part of an ancient terrace system.

Koror 3—Ngaramid

This site was listed in the original proposal for this project as one recommended for examininations. When we discovered that K4 and the K15–16 areas, also listed, would not be feasible for field studies we fell back on K3 and K5. K3 is described briefly in the survey report (Osborne 1966: 111–117).

The village of Ngaramid is within a 15–20 minute drive from the laboratory depending on weather, chickens and children in the road, and seemed to be a good break-in site for all of us. Ngaramid is a rather old fashioned village, somewhat out of the main stream of Koror life. It is the end of the line for the volcanic soil deposits. The high rugged limestone reef section of Koror looms in part to the west, around north and east of the village. There is a good landing to the south. A paved walkway to the site passes the *Bai* (clubhouse) named Ngerabaichesis, and goes north past our excavations and then quickly down to a small embayment in the coral limestone ridge that edges the north rim of Koror in these parts. Here is the northern harbor for the village. It is 49 m from the northeast cornerstone of Ngerabaichesis to our datum (Fig. 60). A couple of steps on to the north begins the rapid descent and several series of stone steps accomodate the walker-if they are not slippery with rain. The cobble pavement follows a ridge to the little harbor: the land drops away quickly to the south of the roadway where we excavated trench 1 (Shell Patch) and trench 2. It slopes much more gradually to the north where we tested around Platform 1 and where, indeed, there are other platforms beyond. A side trail leads past these to the remarkable area of springs and bathing places, .8 km from the site, which makes Ngaramid the envy of other Koror villages. Soils underlying the midden and mixed with it belong to the Palau association 1, latosols, the red lateritic clays derived from volcanics.

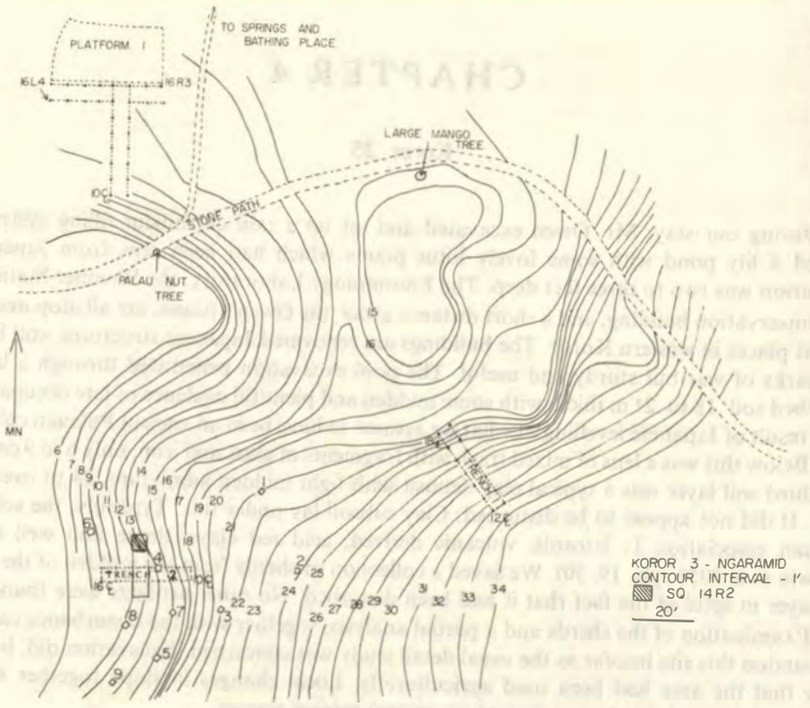


Fig. 60. Koror 3, Ngaramid, site map.

Excavation started on Monday the 26th of August. We had explored the area in the week before, and had decided that K3A, the areas of heavy midden (Osborne 1966 : fig. 40) should be tested first. I leaned heavily on my guide and friend of the survey trip, Sumang, Yachad Ngerahamai. He carried on the local diplomacy and secured permission to excavate in a strongly exposed small sherd midden, then planted in manioc, and to test pit in an adjacent area, then covered with weeds and brush but which I believed to have shown heavy midden at the time of the survey. Tentative permission was also given to partly excavate a small typical stone house platform which lay on the north side of the cobbled path to the sea from Ngaramid. Taro was planted in front of the latter and I was allowed to run a trench up to the platform, which contained graves, with the understanding that the clan concerned would decide if I could move the stones. Of course it was made explicit that payment would be made for any crops destroyed. Sumang made arrangements with local leaders for 6 workers.

On Monday he went with us, delivered a long Palauan lecture on science and history to the young men who were to work for us, and we began test pitting the weed area and laid out a trench running north-south up to the southern edge of the small house platform. The test pits were completed and an area of heavy midden located, while the Stevens began making a plane table map of the site. On Wednesday we completed the trench into the platform and a cross trench running along the south edge of the structure. This latter trench exposed the platform apron, a narrow and shallow paving which acted as an approach to the platform proper. The platform was cleared of weeds and brush and at least six large stones that almost certainly marked graves were visible. We still had no permission to excavate the platform itself and

Francis Toribiong, our new Palauan assistant, was asked to contact the head of the clan that owned it. The latter informed me that he wished to meet with us. We met at the site on September 2 and were told that we could probably remove the apron stones and excavate there but only after the taro was paid for. We had refilled the trench as soon as it was profiled and replanted the taro. There was a long period of bargaining and palaver and finally 85 plants at the price of 50¢ each was accepted as fair to both sides. Payment was made and we were permitted to excavate the apron but no part of the platform proper. It was stated strongly that the removal of the skeletons would be an "unholy" thing. At the same time we reassured the older women that we would also pay for any manioc destroyed. This eventually cost us $12.50 for the shell patch excavation. We also calmed the irritation of the landholder of the area where our test pits had revealed midden and where we had begun trench 2. Sumang had understood that this small piece of land belonged with the manioc garden and that he had secured permission for digging there. Profuse apologies on the part of myself and Stevens and a long oration on the part of Sumang who dwelt on devoted scientests who left their comfortable homes to try to trace Palauan prehistory, saved the day.

On 30 August, the shell patch trench was completed and it was profiled the next day. Test trench 2 had been laid through the area of the deepest and richest midden as revealed by our test pitting, on the same day. Whereas the trenches into the platform and the shell patch trench showed evidence of extreme disturbance almost to the bottom of the deposit, trench 2 offered up to .9 m of deposit, with only 15 to 20 cm of the top disturbed except in small areas where tree roots had penetrated. At its best it was a beautiful dark heavy midden, replete with food shells, sherds and fish bone. The trench was completed and profiled on September 3 but we decided to stake out one more 1.5 m square (14R2) to excavate by trowel, saving all items down to fragmented shell, if identifiable. This was started the next day: the rest of the trench was filled and soil samples taken. Digging was resumed on the platform where the apron stones were removed, after mapping and photography, and the soil beneath them was excavated. Results were minimal and disappointing. Only a small bag of sherds was found in the seven 1.5 m squares, all of which were dug into subsoil.

The troweling was not completed until September 9th. The heavy midden could not be worked rapidly. A number of sherds were found which could be fitted together and the resultant search for the fragments of a restorable vessel slowed us further.

A comment should be made about the weather. September is a rainy season month. Archaeology is difficult at best in the humid tropics but the rainy season adds injury to injury. We worked two weeks at K3: our crew varied from six to two laborers. Two hundred and twinty-nine work hours at 40¢ an hour cost the project $91.60 for labor at this excavation. The most that any one man worked was 45 hours of a possible 80; we lost three whole days and other fragments of work time out of the ten, due to rain.

Sherd washing and sorting and cataloging had started in our laboratory the day after excavation began. Laboratory operations were plagued by rains nearly as much as were those of the field.

Excavation Units

The platform

House platform 1 is an oldish but not an ancient one. The name of the place (all houses are named in this area) is *Odosengel ra Derbei,* or the platform of Derbei, the owning clan. It is thought to have been built before the Spanish came because men were buried there who are said to have been killed at that time. This, however, is legend. It was apparently last used during the German period about 1900. The last inhabitants are reliably reported to have died from eating *Telbudel,* a fish with poisonous skin. Twelve persons died there sometime before 1900 and the

place has been little used since. The construction, after clearing and partial excavation, measured 10.4 m east-west by 7.3 m north-south (Fig. 61). The platform was once rectangular with a 1.5 m wide apron, at the front (south) side. It has been nibbled away by erosion and taro-tapioca (manioc) planting so that the exact plan is now lost. There are flat and regular stone arrangements on the surface that mark at least six graves, plus an enclosed rectangular area near the east end that presumably contains other burials. These were numbered but, of course, remain unexcavated. The plan illustrates the positions of the grave covers: general platform paving was not drawn.

The trench by which we examined the deposit in front of the platform quickly passed through thin midden and penetrated an essentially undisturbed deposit of vari-colored clays primarily red and yellow (Fig.62). It lay perpendicular to the south side of the platform itself. The midden is rarely more than 24 cm thick. This is someshat more than the 12 to 15 cm of the usual agricultural mattock zone, the soil layer that is disturbed. However, it appeared that our first 15 cm level and most of the second were testing disturbed material. It was only in the areas of greater depths of deposit that there could be stratigraphic validity. For this reason only the sherds above and below the paving stones that lay in front of the platform (apron) were analyzed. The pottery from the remaining squares was discarded after rims and unusual sherds had been removed for possible future use.

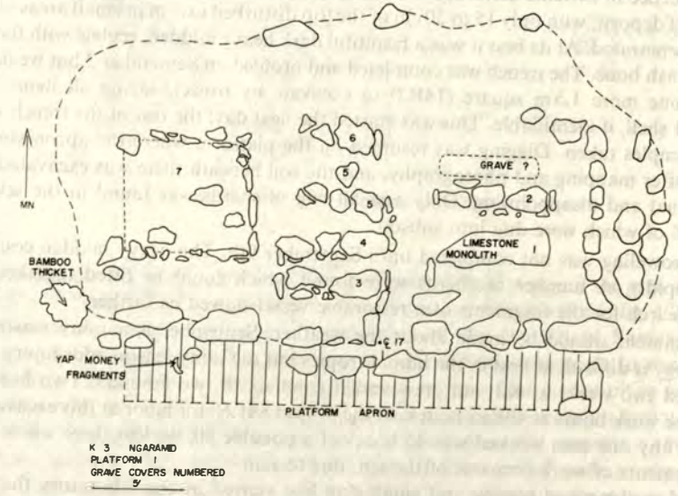


Fig. 61. Koror 3, platform.

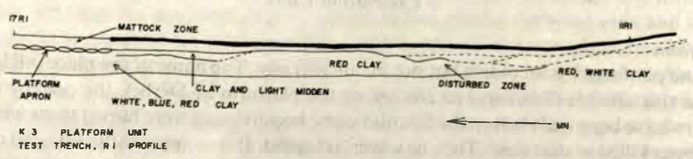


Fig. 62. Koror 3, profile of trench excavated south from the apron of platform.

The 16-line stakes (7 squares) had been put in and the debris cleared from the apron before permission was given to excavate the apron itself. Two fragmentary pieces of Yap money lay among the small apron stones. Following the direction of the clan leader we piled the small apron stones on the platform and then mattocked and shoveled our way through the yellow and red clay below this. A few openings had been noted in the irregular apron pavement and we had hoped that these signified the burial of objects or infants, but nothing except sherds was found.

Shell Patch, trench 1

This area is dark shelly midden in an otherwise yellow-red clay manioc patch. It is elongate down the slope and had been recently planted. Our trench bisected it and destroyed about one-half of the deposit. Excavation was shallow, varying from .6 m at the upper end to about .3 m at the lower end where the deposit is thinnest. The profile (Fig. 63) is simple. The midden varied from nearly .3 m in depth, counting a band of lighter deposit at the bottom, in squares 14 and 15 CL to 12 or 15 cm in the lower parts of the trench. The original deposit had obviously been made in the upper or upper-central area as penetrated by the trench, and had floated down the hill, assisted by the mattocks of the women working in the field. It is therefore probable that the deeper parts of the midden may be relatively undisturbed. For these reasons centerline squares 14 and 15 were chosen as having the best deposit and their yield analyzed and recorded on the computer sheets. The remaining sherds were discarded after examination.

Change from the rich midden of the upper levels of the upper squares of the trench to the yellow-red clays (and yellow clay along the lower part of the trench) is not abrupt. Sherds were found 15 to 21 cm into the clays below the major band of contact with the midden zone. This probably indicates a period of utilization of the area before the heavy overlay of dark earth formed by agriculture and the deposition of the midden.

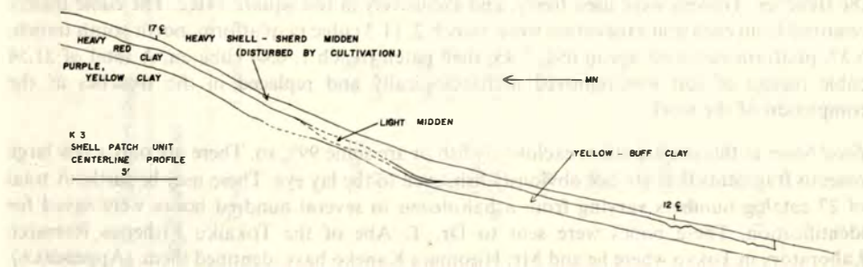


Fig. 63. Koror 3, profile of shell patch unit trench 1.

Trench 2

Our nine test pits in the southeast part of the area showed varying differences of midden depth. The best appeared on the central part of the slope in test pit 4. Here we set up trench 2 running east-west, up and down the slope. Eight 1.5 m squares were excavated, all into subsoil. The central section of the trench at the 14 line showed the best deposit of midden and a short cross-trench (north-south) was opened here and two more squares were excavated (Fig. 64). The collection from square 14R2 was enormous: over 600 sherds came from the richest level, the third. Shell and fish bone appeared in proportion. The profiles of the various parts of trench 2 consisted of overlapping elongate lenses in these main layers. This suggests relatively slow accumulation of an over-the-hill dump from dwellings farther uphill, toward the west and

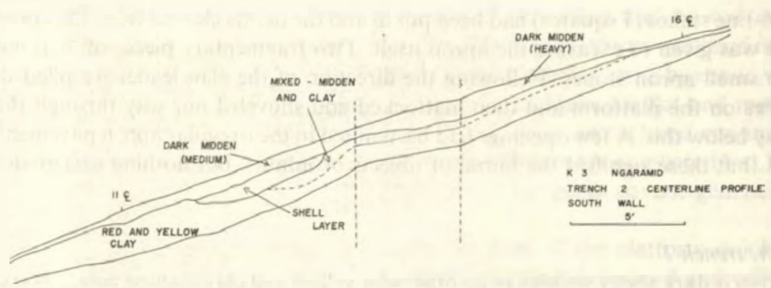


Fig. 64. Koror 3, profile of trench 2.

Ngerabaichesis. No natural agency can have participated in the deposit. A few areas of conecntrated shell and fish bone suggested that we had found the remains of a large feast or of a series of such ceremonies.

The better parts of the profiles showed a heavy surface midden, disturbed to about 15 cm by mattock cultivation, then a shell-fishbone-sherd midden below. This latter became mixed with the yellow clay subsoil, blending from the heavy organic deposit through more and more clay mixture to the relatively undisturbed soil. Evidences of minor disturbance to levels 3 and 4 (Japanese pottery, 172/K3 and shrapnel, 186/) show that peculiar situations have caused some, probably slight, changes in depth. In the deepest parts, this midden column averaged about .9 m. The material from squares 14 centerline, 14R1 and 14R2 was chosen for intensive analysis.

Most of the excavation was done with small hand mattocks: the soil was shoveled out of the trenches. Trowels were used freely, and exclusively in test square 14R2. The cubic meters removed from each unit excavation were: trench 2, 11.3 cubic m; platform, north-south trench, 6.37; platform east-west apron test, 7.43; shell patch trench 1, 6.44 cubic m. A total of 31.54 cubic meters of soil was removed archaeologically and replaced in the trenches at the completion of the work.

Food bones at this site are either exclusively fish or are some 99% so. There are only a few large osseous fragments that are not obviously fish, even to the lay eye. These may be turtle. A total of 27 catalog numbers varying from a half-dozen to several hundred bones were saved for identification. These bones were sent to Dr. T. Abe of the Tokaiku Fisheries Research Laboratory in Tokyo where he and Mr. Hiromasa Kaneko have identified them. (Appendix 6).

Food shells are designated as such fairly securely. This means that we consider all shell remains found to be those of shellfish taken solely for food unless we are aware of other uses. Twenty-one catalog numbers, taken from the same squares whence came the analyzed sherds were selected for intensive study. The shells were washed, identified with both scientific and Palauan names (Table 10). Frieda Osborne, Mrs Lauch, Bonina Towai and Francis Toribiong (and aided by Kira 1965 and other sources) worked together on the sorting and identification. Twenty of the most commonly appearing shells were selected and their counts recorded for each unit and level. The percentage of each form found in each level was calculated. The total number of shells in each excavation unit and in each collection taken by levels, is also given. In all 3359 shells from K 3 were identified. Nearly all of these (3130) are included in the 20 popular shells included in the table.

The tabulation illustrates a wide range of selection of shells. It is in marked contrast to the shell midden observed at Pelilieu 1. True, there is an emphasis on four shells in the tabulation,

Table 10. Identified shells, Koror 3, number and percentage (in parentheses).

Shell	Palauan name	Shell patch unit			Trench 2 unit				Platform unit	Total
		Surface	Level 1	Level 2	Level 1	Level 2	Level 3	Level 4		
Nerita striata	(delsangel)						45 (2)			45
Tectus	(smum)						16 (.8)	1 (trace)		17
Clypeomorus	(murch)						34 (2)			34
Cypraea tigris	(buich)	1 (trace)	1 (trace)	4 (2)	1 (1)	4 (2)	35 (2)	3 (1)		49
Lambis	(sang)	14 (12)	6 (4)	13 (7)	12 (9)	30 (13)	136 (6)	53 (13)		264
Canarium	(irechiil)					2 (1)	28 (2)			30
Conomurex	(semachel)	8 (7)	5 (3.5)	15 (8)	30 (23)	56 (24)	164 (8)	31 (8)	1 (33)	310
Phos hirasei	(murch)		9 (6)	19 (11)	2 (1.5)		35 (2)			65
Conus	(ototl)	1 (trace)	1 (trace)		1 (1)	4 (2)	21 (1)	2 (1)		30
Anadara	(kikoi)	66 (58)	90 (63)	97 (55)	53 (41)	108 (47)	1092 (52)	196 (48)	1 (33)	1703
Lima sowerbyi	(ilekum)						11 (.5)			11
Dendrostraea hyotis	(iiud)		2 (1)	2 (1)			2 (trace)	11 (3)		17
Codakia tigerina	(eduib)	3 (2)						16 (4)		19
Chama ambigua	(ultewech)	6 (5)	6 (4)	6 (3)			4 (trace)	11 (3)		33
Vasticardium	(esechur)	6 (5)	2 (1)	2 (1)	7 (5)	6 (3)	191 (9)	32 (8)		246
Fragum	(esechur)		1 (trace)			7 (3)	36 (2)	7 (2)		51
Tridacna	(all sp.) (kim)		1 (trace)			2 (1)	11 (.5)	4 (1)	1 (33)	19
Gafrarium	(ilekum)		6 (4)	3 (2)	1 (1)		22 (1)			32
Lutraria	(olichel a itotl)						18 (.8)			18
Spisula sp.	(ngduul)						137 (6.5)			137
Total		112	143	176	129	230	2155	411	3	3359

and that on *Anadara*, a medium-sized clam, is obvious. The lack of some shells, notably the highly edible *Tridacna* and *Hippopus* shells is explained by the method of collection: Palauan women do not carry in these heavier shells: instead they are opened where found in the medium tidal flats, the meat removed and carried home in a basket. *Hippopus* and *T. squamosa*, particularly were not used for tools and would not be wanted. The larger *T. gigas* and *duresa* are also opened in the water and the meat removed and the massive shells when not wanted for tools would remain in the ocean.

There appears to have been little or no change in emphasis on the shells taken during the life of the site and, by the same token, no change is indicated for the environment that produced the shellfish. It is entirely possible that this collection reflects as much the availability of the various species as it does any preference on the part of the population that used them. We would like to see population studies of several of the shelling grounds in the Ngaramid (or any other) area.

In addition to the twenty shells listed in the table, the following occurred in the midden:

Surface: *Nemocardium bechei* (*eduib*), 1
Ostrea (*iiud*), 3
Melanoides gunda (*bsungel*), 1
Glycymeris yessoensia (*delbekai*), 1
Trochus stellatus (*smum*), 1

Mattock zone, 14CL: *Hippopus hippopus* (*kim*), 1
Achatina fulica (*katatsumuri*), 2
Polinices vavaosi (*bsachel*), 1

Level 1, 15CL: *Erronea* (*buich*), 1
Ostrea, 2
Callista (*ilekum*), 3
Protothaca (*eduib*), 2

Level 2 15CL: *Achatina fulica*, 1
Thais clavigera (*murch*), 1
Callista, 4
Venus lamellaris (*esechur*), 1

Level 2 17CL: *Protothaca adamis*, 2
Polinices vavaosi, 1
Hippopus hippopus, 1

Level 1 14R2: *Cardium nuttalli* (*eschur*), 4
Achatina fulica, 1
Hippopus hippopus, 2
Neritophis (delsangel, 1 radula)
Fulgoraria, 1

Level 2 14R1: *Venus foreolata* (*esechur*), 2
Cardium nuttalli, 1
Tridacna crocea (oruer), 1
T. elongata (kim), 1

Level 2 14R2: *Chama brassica* (*ultewetech*), 2
Callista, 2
Pinctada (*esiuch*), 1
Mactra (ilekum), 1
Hindsia (*murch*), 1

Level 3 14CL: *Tridacna squamosa* (*kim*), 2

Level 3 14R1: *Clithon sowerbianus* (*delsangel*), 1

Level 3 14R2: *Tridacna squamosa*, 4
T. gigas (*kim*), 3
T. crocea, 2
Pinctada margaritifera (*esechur*), 3
Ostrea, 3
Pecten (*beketekoi*), 1
Vasum turbinellus (*urodech*), 1
Turbo (*sengeruk*), 1
Melanoides, 5
Erronea, 1
Conus virgo (ototl), 18
C. imperialis (ototl), 1
C. litteratus (ototl), 2
Ostrea folium (iiud), 14
Protothaca adamis, 34
Lima sowerbyi (*ilekum*), 11
Chama brassica, 5
Pythia (*murch*), 5
Ostrea sp., 4
Protothaca, 2
Lima sp. (*beketkoi*), 2
Fulgoraria (*murch*), 1
Neritopsis (*delsangel*), 1
Turbo (delsangel), 1
unidentified, 26

Level 4 14R2: *Pollia proteus* (*murch*), 7
Pythia pantherina (*murch*), 1
Erronea (*buich*), 5
Turbo cornutus (*sengeruk*), 1
Tridacna crocea, 3
T. squamosa, 1
Hippopus hippopus, 4
Protothaca, 7
Septifer, 1
Rhinoclavis, 1
Periglypta puerpera, 1
Fimbria fimbriata, 2

Stone artifacts

Stone artifacts are rare and nondescript. The most spectacular have been mentioned: two pieces of aragonite Yap money, one further broken into two pieces (197/K3) and a larger piece that is almost half of a small disk (198/), 35 cm in diameter by about 15 cm thick. Both fragments have been biconically drilled in two places. This is not usual. A piece of Yap money has a central biconical enlarged perforation. I have no explanation for the double drilling unless these were discarded pieces used for practice by persons learning the technique. In any event they were secured by the Palauans and incorporated in the shallow pavement or apron on the south side of the platform along with numerous andesite cobbles and stones. As far as my knowledge goes, the exploitation of Palau by the Yapese for their money is a late phenomenon. If the stones were incorporated at the beginning of the platform building, this would date the apron in the second half of the 19th century as far as I am concerned.

A wedge of andesite (194/) is almost surely artificially formed. It was found broken into two parts in the central part of the apron: it is 30 cm long by 12.5 across the butt end by 13.5 cm thick; weight is 6.24 kgms. One surface is much smoothed, rubbed or ground and is incurvate. The edge is blunt; the poll not battered. On the surface of the wedge that is not smoothed is an indentation suggesting use as a nut-stone. The break occurs here. I can suggest no use for this piece other than as a nether grinding stone and lap stone and consider it to be an artifact.

Another large piece (162/K3) is a broken large oval of andesite likewise from the apron. It is now 22.5 cm long by 12.5 wide by 13.5 cm thick. Length was perhaps around 32 cm before the break. The partly unbroken end is blunt, the surface finish suggests artificial shaping. From the platform unit trench came an indubitable pestle of andesite (26/), 127 by 65 by 54 mm; weight 712 grams. It is worn on both ends and is a sturdy artifact, but certainly not a distinctive nor significant one.

The other category of stone artifacts is very much at the opposite end of the stoneworking scale. There are 15 small chunks of cryptocrystalline rock (Fig. 65*e*) varying from 11 to 23 mm in greatest diameter. One is jasper (61/K3) 18 by 12 by 11 mm, weight 29 grams; the remaining pieces are clear light chalcedony, a truly beautiful moonstone-like material at its best, which occurs in the andesite. It is said both locally and ethnographically, to have been used in the past as the flint member in a strike-a-light, and to form the working bit of the drill that was used to perforate the glass Palau money. Certainly the small fragments that we found could well be debris from fire making, small pieces of impure nodule driven off by blows against the steel. Thirteen of the pieces (182/) were found under and between the small stones of the platform apron, and the fourteenth (124/) came from close in front of the platform. Only one of catalog number 182/shows small flaking under a lens. Another from the same place is a flake. These objects are 2 to 5 cm long. There is thus no true evidence of a flaking industry: none of the attributes of true cryptocrystalline chipping are present. The pieces could have been used in tools but there is no reason to suppose that they were. The late date given for the occupation of the platform is certainly consistent with their use in lighting fires.

Several pieces of aragonite were found throughout the fill. They appear to be naturally smoothed pebbles and may have been attractive before weathering and checking.

Shell artifacts

Shell artifacts form the most numerous category: there were none of bone. A close description of the former is hampered by the fact that most of them have been subjected to soils of varying degrees of acidity and to the mechanics of cultivation for a long time. Surfaces are chalky, edges rounded, use and manufacturing stigmata have been lost. Adze blades of 4 types were found but the entire collection is only 6 items. A single beaked adze, type 2 (110/K3, Fig. 65*a*) an excellent piece, has lost the poll; the present length is 12 cm; width of the body at the bevel is 47 mm and thickness at the bevel origin is 36; angle of the back bevel is 30°. It is made of the dense heavy shell of *Tridacna gigas* from the hinge area. It came from the midden of trench 2, 14CL, level 2.

Two other shell pieces (58/ and 136/) may have been adzes, or may have been in the process of manufacturing. They are roughly rectangular pieces of shell 65 to 90 mm long with broken or beveled ends. A sadly eroded type 6 adze blade (1/) 98 by 36 by 17 mm is a surface find; weight as is, 70 g. Another piece (35/) is a curving eroded piece of *Tridacna maxima* shell. It would belong to type 5 were it a certain artifact; width is 52 mm. Two small adzes (2/ and 160/) are broken and eroded but would surely fit into types 4 and 5 respectively were they whole.

Another uncertain or unknown tool is represented by 3 specimens (49/ 50/ and 92/K3; Fig. 65*f, g*). One is broken. They have been cut from the outer, toothed edge of the aperture of a helmet (*Cassis*) shell. In each case one end has been beveled and ground into a lightly curving spatulate form. 49/K3 is 123 by 21 by 10 mm, weight 50 g (mattock zone, level 1, shell patch);

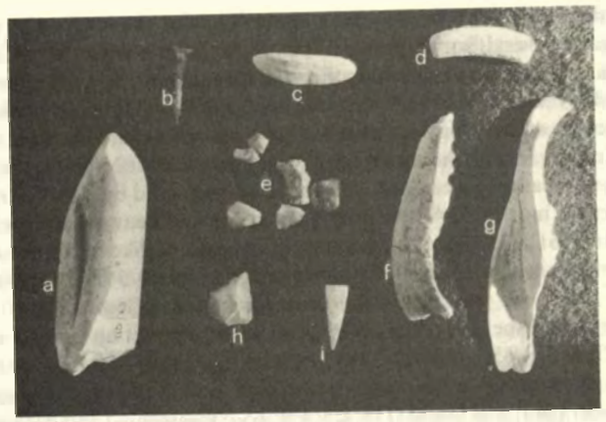


Fig. 65. Koror 3 and 5 miscellaneous artifacts. *a* (110/K3) type 2 beaked adze fragment; *b* (169/) iron ship's nail?; *c* (29/) adze-like artifact of *Tridacna* shell; *d* (118/) antler coral fragment; *e* (182/) fragments of jasper and chalcedony; *f* and *g* (50/ 92/) spatulate tools of *Cassis* shell; *h* (48/K5) chalcedony flake; *i* (191/K3) triangular shell inset. *f* is 10.4 cm. long.

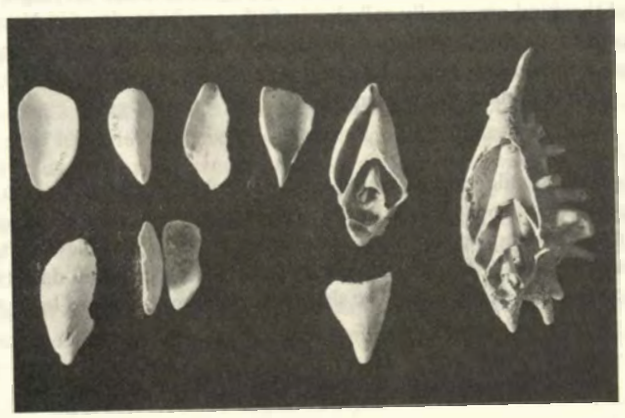


Fig. 66. Koror 3, *Lambis* shell fragments and broken food shells (47/K3) Upper left is 4.6 cm. long.

92/ is 138 by 23 by 10 mm; 64 g (surface); and 50/ is 104 by 23 by 10 mm, 60 g (mattock zone, shell patch). These are not the *Cassis* chisels previously noted; their use is unknown. It was suggested by Palauans who examined them that they were used by toothless oldsters who must mix and macerate the components of a betel nut chew in a mortar. These curved spatulate blades should work well in transferring a quid from a mortar to mouth. This, or use as a shell knife or scraper is most probable.

Still another series of unknown shell objects are formed from the heavy first whorl of a *Lambis* (spider) shell, radula or foot end. Six small spoon-shaped pieces were found, nearly all from the heavy trench 2 midden (47/ is typical). Lengths vary from 55 to 31 mm, widths from 17 to 35 mm and thicknesses from .6 to 1.5 mm. All are eroded and chalky. I vacillate: data are not

sufficient for a decision as to whether these are artifacts or the result of a pattern of decay. Figure 66 illustrates several, some unshaped pieces of the first whorl, and *Lambis* food shells showing the common method of smashing the shell for the meat, and the interior whorl whence the objects are derived. We believe that a full descriptive presentation at this early phase of western Micronesian archaeology is desirable-even though we are not able to pigeonhole its multiplicities. True to form, when queried to whether these little objects were artifacts, our elder men were sure that they were, and that they had been used by elders in removing crushed betel chews from the mortar... A tear drop shaped piece of heavy shell from the same whorl section of *Lambis* (161/K3; 47 by 20 by 8 mm) is almost adzelike in appearance. Item 29/K3 from the platform unit, is a sharpened peg-shaped shell piece 5 by 15 by 9 mm. It, like the preceding could have been used as a small or engraving adze (Fig. 65*c*).

An intersting small shell object probably saw use as an inset on a wood vessel or possibly on a canoe (191/K3, Fig. 65*i*). It is a perfect isosceles triangle 35 mm long by 11 mm across the base. The shell species could not be determined: like all shell objects, the surface has become chalky. Much antler coral was found (118/K3, Fig. 65*d*) fragmented and decayed. This material should have seen use in filing or rasping wood but most of it probably came in to be burned for lime to be used in betel nut chewing.

Worked sherds

The worked sherds from this site are few and not distinctive. Flat sherds from the bottoms or side walls of broken pots were ground into rectangles or ovals varying from 35 to 50 mm long. Objects of this kind are usually called counters or gaming pieces in North America but I have no comment to make concerning their Palauan function. Of the six that we have, one is oval (203/), one is square (81/) and two are elongate rectangles (196/ , 195/ ; Fig. 67*e, f*). The last (99/ , Fig. 155*i*) is almost spoon shaped.

Textured sherds

All sherds with textile impressions were basal sherds and the textured surface was apparently caused when the pot was set on or leaned against matting of pandanus or coconut leaves while it was in the drying stage, preparatory to firing. Eleven sherds with these impressions were found and the information in Table 11 embodies all data that are currently available on the fine mats of the time. The sherds came from as deep as level 3 in trench 2, but

Table 11. Koror 3 Textile (Matting) impressed sherds

Catalog no.	Fig. 68	Provenience	Fabric weave	Count per 2.54 cm, Element size
3/K3		test area, surface	checker 1/1	10 to 12, fine
40/		shell patch level 1	checker	10, fine
40/		shell patch level 1	checker	6 to 7, medium
40/		shell patch level 1	twill, 2/2	4 to 6, medium
40/		shell patch level 1	twill	6, medium
55/		shell patch level 1	checker	20, very fine
66/		shell patch level 1	checker	14, fine
111/	*a*	trench 2 level 3	checker	10, fine
130/		trench 2 level 1	checker	16, fine
199/	*c*	no provenience	twill	8 to 9, medium
204/	*b*	trench 2 level 3	checker	10 to 12, fine

most of them are from more superficial deposits. The matting that was used for covering the ground and possibly also to cover the drying pots from the direct sun (Osborne 1966 : 32–39) was far finer in the archaeological periods than it is now if the few sherd imprints that we have speak truthfully. The counts per 2.54 cm indicate a matting that was close, fine workmanship, in both checker (1/1) and 2/2 twill. Because of their fineness we have wondered if the discarded fragments of matting sails of the outriggers saw their last use around the homes as floor coverings.

Foreign objects

Four foreign objects should be mentioned: an extensively rusted round ship's (?) nail about 10d size, either a fragment or a short nail 39 mm long (169/K3, Fig. 65*b*). Presumably it would not be difficult for an object to settle into a second half foot level in a cultivated field, which this area was at one time (trench 2, level 2).

A sherd of grey-blue and white semiporcelain (172/ , Fig. 67*i*; trench 2, level 3) from a bowl. Again digging to set banana plants or a coconut tree could account for the presence of this sherd and it is not improbable that it could have been an item of earlier trade with the orient. It does, however, suggest disturbance.

Under the apron stones of the platform were found two sherds of a dark stoneware of a kind that is probably Japanese (181/ , Fig. 67*g, h*). As this platform was occupied in the late 1800's according to legend, and if earlier within the contact period as the presence of Yap money fragments indicates, there can be no problem of acceptance of this evidence as contact.

In level 4 of trench 2 a sherd of iron, 20 by 25 by 3 mm was found (205/ , Fig. 67*d*). This is the deepest find of any nonnative material or object in any Palauan archaeological context. It is possible that it is pre-European contact. Keate records the possession by the Ebedule, of an iron adze blade in 1783 (1788 : 55) and Harrisson and O'Connor, the smelting of iron before 1200 A.D. in Borneo (1970 : 197). There would be no great difficulty in accepting iron in small quantities in the Palaus in the pre-European contact period: there was a Malay male living on Koror, a castaway, when the *Antelope* crew was on Aulong (Keate 1788 : 23). However, all of this aside, it is also possible that we found a much rusted and altered bit of shrapnel that had been driven deep into the ground by the force of a nearby explosion. There the matter must rest.

A certain amount of disturbance, found once in the second level was the presence of shell of the African snail (*Achatina fulica*) a species introduced apparently by the Japanese. Such objects owe their position to tillage.

Ceramic Analysis

The sherds from K3 are, when matched against those of other sites, remarkably hard and strong. This is most true of those which came from the midden deposit of trench 2. We believe this to be attributable to the differences in the preservation of the pottery in a midden as opposed to that in the acid soils of the terraces or the leaching encountered in Pelilieu and Aulong. Perhaps because of this preservation, if such it be, there were a number of sherds with true exterior polish or a low burnish. We have rare records of this attribute elsewhere just as we have none of painted decoration from K3.

A single large hard straight rim from trench 2, level 2 (147/K3, Fig. 67*a*) bears a simple lug 15 mm long by 10 thick.

In all 2775 sherds were analyzed in the laboratory (and later subjected to computer analysis) from the three excavation units: shell patch (trench 1); trench 2; platform area. The ceramic analysis of most of the K3 sherds was the training period for ourselves, the Stevens and two Palauans at varying times.

Shell patch (trench 1)

The shell patch lay on a steep slope (Figs. 60, 63). Various kinds and intensities of soil creep on such a slope may invert or otherwise destroy stratigraphy. The patch was also planted in manioc when first seen in 1953 and likewise in 1968. Manioc agriculture as practiced in the Palaus involves the formation of ridges about 6 inches to a foot (15 to 30 cm) high separated by troughs about one and a half to two feet (46 to 61 cm) wide with the mattock. Such agriculture means that the top level of any field is usually disturbed. If agriculture continues, the condition would be archaeologically hopeless. At the shell patch and elsewhere, we removed the entire mattock zone, the area of loose soil, and considered it level 1.

The section of K 3 which we worked yielded late debris according to our own estimates and the charcoal dates. Yet the area had an older occupation. There are terraces lying west of the spring and evidences of the same kind east of our excavations. The Ngaramid area would repay a long and intensive archaeological atudy.

Exterior color, level 1, is almost always still a light brick red. The pots were no doubt totally redware when new. Smudging is light with few exceptions and only about 10% of the sherds showed this surface change. It is seldom sufficient to mask the original surface color. The same is true of level 2, although there may be slightly more smudging there. Grey and white float or slipped sherds were present in trace quantities. Level 3 also yielded 6 white slipped sherds. Interior colors were about the same. Palauan pottery was almost invariably the same color outside and in. The reason for this is that the primary finishing process was floating. Surface decoration is limited to two sherds with matting impression.

Smudged exterior is the most important attribute in the smudged series. Exterior and interior surfaces eroded never rise above 3%, and both surfaces eroded is only a trace, even in the lowest level. Level 1 yielded 2 interior lip sherds and one straight (01) rim and level 2, one conventional and one modified interior lip that were heavily smudged and surface altered. Level 3 yielded more of the heavily smudged sherds; 5 were body sherds, one base sherd, one interior lip and one with lip equal to flange (06). All of these sherds, nearly all thin wares, had almost surely been in intimate contact with the acid lateritic soils away from and almost surely prior to the dark organic soil of the shell patch.

Rim forms illustrate a situation similar to that at the F-E test of Aulong 1, where levels 4 and 5 were commonly implicated. The K3 second level was, like these, often surprisingly different in percentages of most attributes than were its neighbors. Straight rims were moderate in quantity in levels 1 and 3; 2 had a greater percentage. The incurving 02 reversed this and there are further reversals in 03 and 04 rim records. Backcurve and lip greater than flange are stronger in the first two levels. These would be strange bedfellows at Aulong. Other rims are weak and erratic in distribution. Shell patch rim forms are not illustrated. They are essentially the same shapes as those from trench 2; therefore the more extensive and varied series of the latter unit are shown in Figures 67–71.

Lip forms are consistently flat. Rounded takes second place although the rare channeled lip occurred strongest, as might be expected, in level 2. Other forms are low in percentages. Incurving walls are dominating; level 2 has the highest percentage. Straight is next with about one-third of the strength. Backcurving was trace in levels 1 and 3.

Bases were not common. Flat, however, dominates except in the third level. Use was dubious; there was not sufficient change to establish this attribute. Extra fine paste occurred rarely in the top only. Coarse was next least, and fine accounted for about one third of the sherds. The remainder had a medium paste, accounting for slightly more than half except at mid-level. Sand tempering is uncommon and essentially confined to level 1. Sherd dominates in 1 and 2 but drops in level 3 where the mixture of sand and sherd dominated. Fine temper is most important in the upper two levels and dominates in the lowest. Coarse is moderate in the upper two levels and weak in the third. Light and medium tempering characterize level 3 where

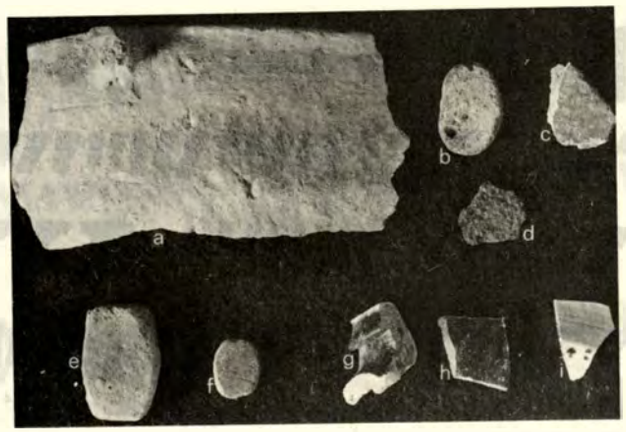


Fig. 67. Koror 3 and Koror 5, unusual and worked sherds. *a* (147/K3) large redware sherd with lug; *b*, *e*, *f* (27/K5, 196/, 195/K3) worked sherds; *c* (204/K3) polished redware sherd; *d* (205/K3) iron fragment, probably shrapnel; *g*, *h* (181/K3) stoneware sherds, probably Japanese; *i* (172/) semiporcelain sherd, probably Japanese. *e* is 7.0cm long.

Fig. 68. Koror 3 textile (matting) impressed sherds. *a*, *b* (111/K3, 204/) checker weave 1/1; *c* (199/) 2/2 twill.

the latter is most common. Heavy and medium is the standard for the first and second levels although level 2 is out of step with the others.

Sherd measurements are in rather good agreement. The largest vessel diameters are at the top and the smallest are in the bottom of the deposit.

In the above descriptive discussion I briefed the data, including that from level 1. We may now examine levels 3 and 2, and disregard level 1. Herein those attributes which suggest change and contrast will be presented. I am not sure that it is consonant with fact that the first level be discarded. It was certainly worked over and over and we could not possibly have removed all of the disturbed soil when we stripped the mattock zone. Yet the samples were large enough (388 sherds from level 1; 148, level 2; 176, level 3) so that the truth should out. Surface finish shows level 3 potters paid less attention to their pot exteriors; one or the other surface was rough or

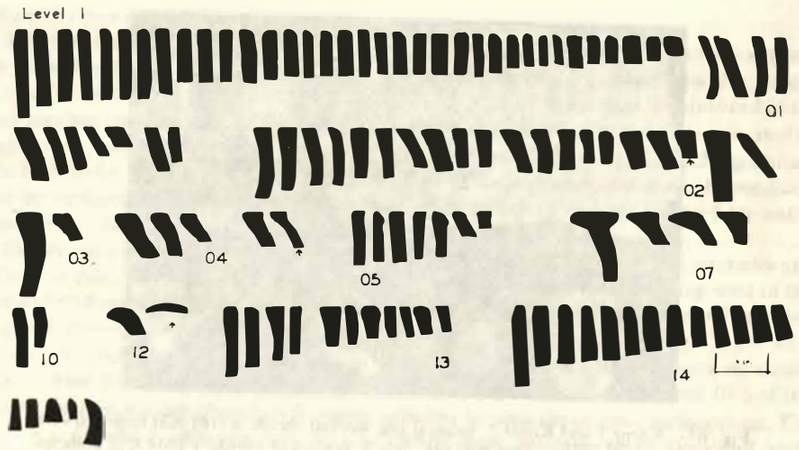


Fig. 69. Koror 3, trench 2, level 1. Rim forms. Attribute numbers are placed along the line but not necessarily as boundary markers. Straight walled vessels precede incurving and backcurving within each rim form. Rim charts include all rims from each level including squares that were not selected for computer analysis. Arrows on the charts indicate sherds that are heavily smudged and are similar to many of those found on the terrace sites.

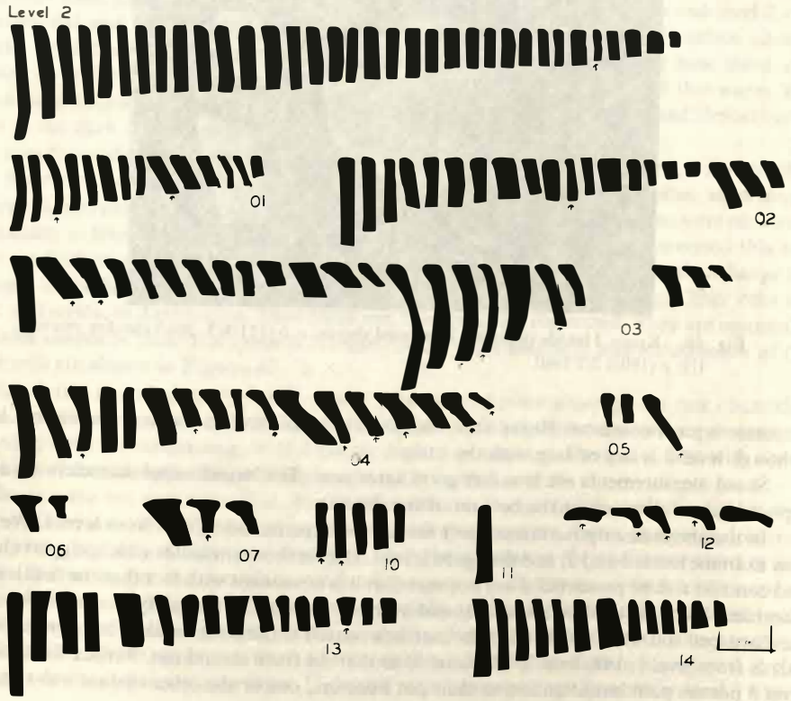


Fig. 70. Koror 3, trench 2, level 2. Rim forms.

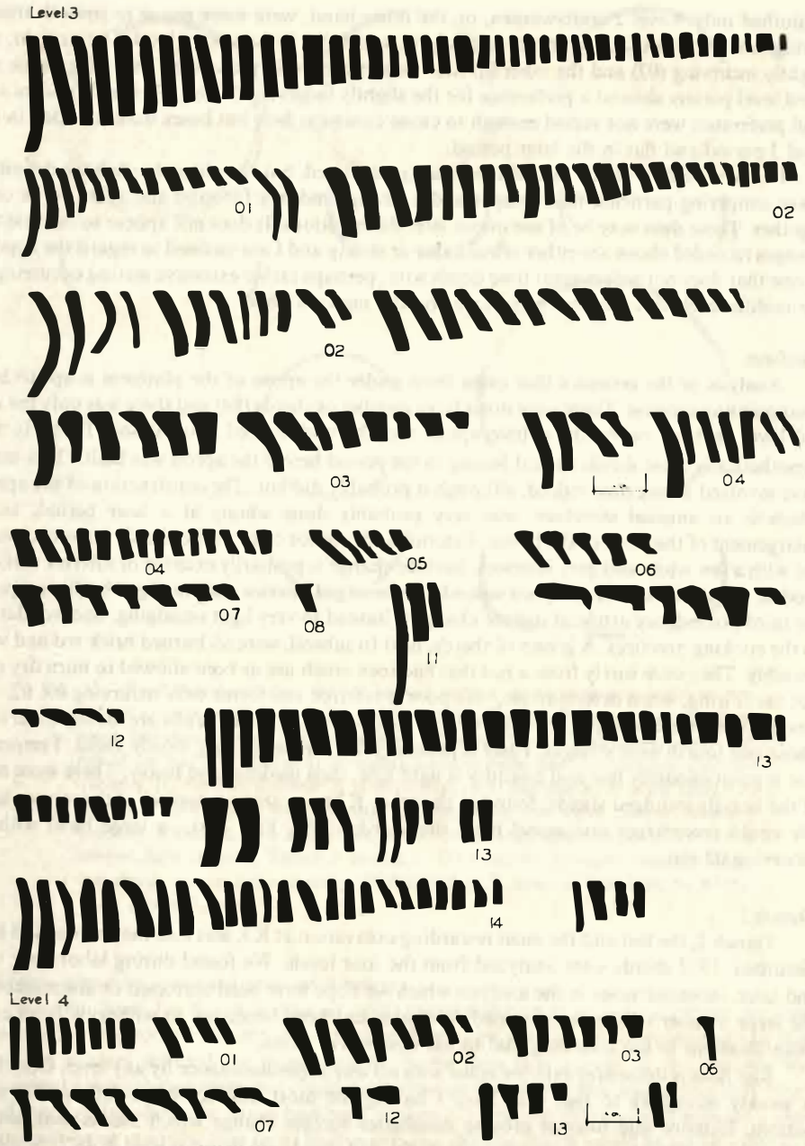


Fig. 71. Koror 3, trench 2, levels 3 and 4. Rim forms. No arrows were inserted in this chart.

smoothed only. Level 2 craftswomen, on the other hand, were more prone to smooth theirs. Firing, not always easy to determine in analysis, was better in the second level. The straight, the slightly incurving (02) and the inner lip rims were preferred in the second level time, while the third level potters showed a preference for the slightly incurving 02 and 03 rims. Lip form and wall preference were not varied enough to cause comment here but bases were rounded in the level 3 period and flat in the later period.

Pastes were finer in the second level than in the third, but the older sherds have definitely fewer tempering particles, finer temper and a strong tendency for sand and sherd to be used together. These data may be of use in our later deliberations. It does not appear to me that the changes recorded above are either remarkable or strong and I am inclined to regard the deposit as one that does not reflect great time depth with, perhaps rather extensive mixing occurring in the middle level with the present surface and the mattock zone.

Platform

Analysis of the ceramics that came from under the apron of the platform is apt to be a disappointing exercise. There were not a large number of sherds (84) and there was only the one soil layer that lay below the cobble apron and the undisturbed mineral soil. Properly and hypothetically these sherds should belong to the period before the apron was built. This might have involved a long time indeed, although it probably did not. The construction of the apron, which is an unusual structure, was very probably done wholly at a later period, as an enlargement of the front of the house. Exterior and interior color of the sherds is almost totally red with a few white and grey interiors. Surface change is primarily exterior or interior surfaces eroded; smudged exterior is a poor second and smudged interior and smudged both vie equally for third place. Since artificial surface change is limited to very light smudging, one wonders as to the cooking practices. A group of sherds, next to subsoil, were all burned brick red and were crumbly. They were surely from a pot that had seen much use or been allowed to burn dry on a hot fire. Firing, when determinable, was poor. Preferred rim forms were incurving 03, 02, and straight in that order. Lips are primarily rounded, secondarily flat. Walls are mostly incurving; about one fourth were straight. Paste is primarily fine and tempering mostly sherd. Tempering size is predominantly fine and quantity is light first, then medium and heavy. There were none of the heavily smudged sherds, found in the other K3 tests, that are typical of the terrace sites. We could reconstruct one vessel from the sherds (189/, Fig. 72*a*), a large bowl with an incurving 02 rim.

Trench 2

Trench 2, the last and the most rewarding excavation at K3, was also the deepest and least disturbed. 1973 sherds were analyzed from the four levels. We found during laboratory time and later, inconsistencies in the analysis which we hope have been corrected or are masked by the large number of sherds examined. Withal it has been necessary to withdraw from exact quantifications in the following and to use descriptive terms.

Red float is dominant exterior color with no true superdominance by any level. Grey float is weakly secondary to red, with level 1 having the most. Interior color follows the same pattern. Exterior and interior erosion dominates surface change which means that natural rather than artificial is the more important. Eroded sherds are fewer in level 3, 48%. Smudged exterior is next with level 1 leading slightly. This is followed by smudged both and exterior eroded, both unusual. We hypothesize and assume that surface erosion attributes are correlated with an acid lateritic environment, although there is the possibility that they represent the exfoliation of a heavily burned surface. Sherds in dark organic shelly midden such as that at K3 are protected from the volcanic soils below.

Firing appears to be slightly poorer in the lower levels. The numerous light colored sherds,

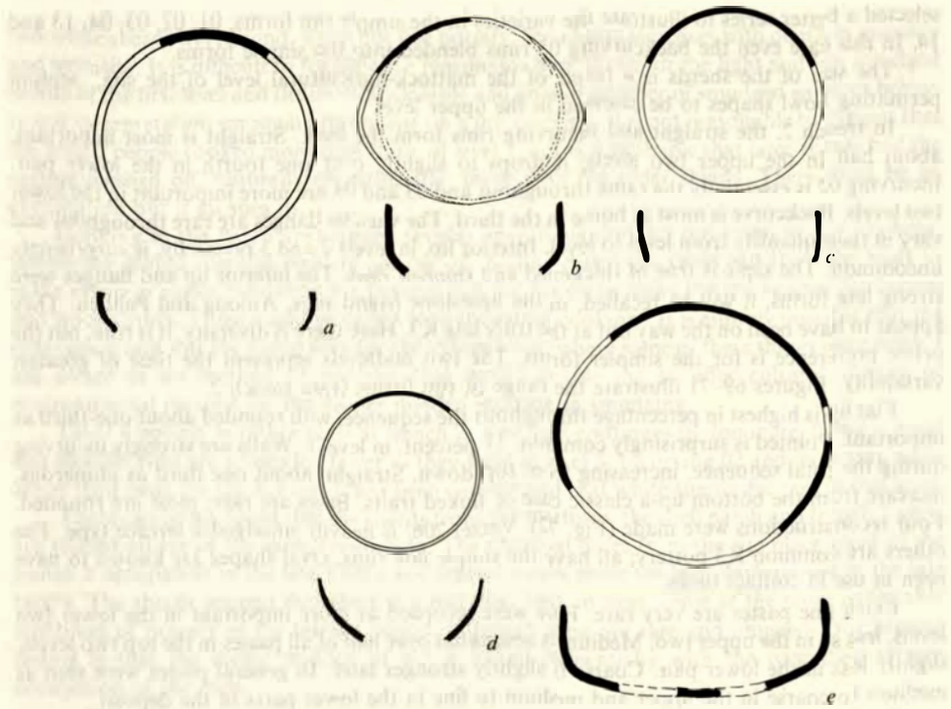


Fig. 72. Bowl shapes and sizes, Koror 3. Dark section on circumference indicates rim section present; width equals lip width. *a*, (189/K3), rim 02 (incurving); medium paste, fine sherd temper, medium quantity. Platform, level 1. Diameter of interior of rim 38 cm. *b* (170/K3); Rim 01 (straight); medium paste, fine sherd temper, medium quantity. If round the diameter is 34cm; if oval, ca 41 cm. long by 34 wide. Trench 2, level 1. *c* (188/), Rim 01 (straight); medium paste, fine sherd temper, medium quantity. Trench 2, level 2. *d* (206/), rim 02 (incurving); very fine paste, fine sherd temper, light quantity. Trench 2, level 2. *e* (171/); rim 01 (straight); medium paste, fine sherd temper, light quantity. Probably slightly oval, 50.5 cm long by 47 cm. wide. Trench 2, level 3.

lacking a grey core, are hard, well fired pottery.

The rim charts for Koror 3 were set up at the completion of analysis for three purposes. First, they would record all rims that could be duplicated with the formagauge-not just those from the squares selected for total analysis. Some rims that appear in the analysis were recognized for what they were, but could not be put on the charts; this was particularly true in the flanged series where the flange had been broken. (2) The rim charts would provide a check of analysis being made (at that time) by five persons. (3) The charts would be set up more from the viewpoint of the potter than the analyst: that is, we would set up a series roughly based on our typology, but without reference to the analysis sheets-on the basis of silhouette only. The figures show well the gradation between many forms; the 02 and the 13 series; between the 04, 05 and into the flanged series. The extremes of the 03 blend into the interior lip series (12). The 02 series was differentiated from the 13 in that we felt it initiated the incurving series; that the manipulation of clay at the rim was solely on the interior of the pot. We could hardly have

selected a better series to illustrate the varieties in the simple rim forms: 01, 02, 03, 04, 13 and 14. In this case even the backcurving 05 rims blended into the simple forms.

The size of the sherds is a result of the mattock-agricultural level of the site, seldom permitting bowl shapes to be assessed in the upper level.

In trench 2, the straight and incurving rims form the bulk. Straight is most important, about half in the upper two levels; it drops to slightly over one fourth in the lower pair. Incurving 02 is essentially the same throughout and 03 and 04 are more important in the lower two levels. Backcurve is most at home in the third. The various flanges are rare throughout and vary in their quantity from level to level. Interior lip, in levels 2 and 3 primarily, is surprisingly uncommon. The same is true of thickened and thinned rims. The interior lip and flanges were strong late forms, it will be recalled, in the limestone island sites, Aulong and Pelilieu. They appear to have been on the way out at the truly late K3. Here there is diversity, it is true, but the prime preference is for the simpler forms. The two midlevels represent the time of greatest variability. Figures 69–71 illustrate the range of rim forms from trench 2.

Fiat lip is highest in percentage throughout the sequence, with rounded about one-third as important. Pointed is surprisingly common, 11 percent, in level I. Walls are strongly incurving during the total sequence, increasing from top down. Straight, about one third as numerous, increase from the bottom up-a classic case of linked traits. Bases are rare; most are rounded. Four reconstructions were made (Fig. 72). Vessel 206/ is heavily smudged-a terrace type. The others are common K3 pottery; all have the simple late rims. Oval shapes are known to have been in use in contact times.

Extra fine pastes are very rare. Fine were recorded as more important in the lower two levels, less so in the upper two. Medium is somewhat over half of all pastes in the top two levels, slightly less in the lower pair. Coarse is slightly stronger later. In general pastes were seen as medium to coarse in the upper and medium to fine in the lower parts of the deposit.

Sand tempering alone is rare; sherd is preferred throughout. Sand and sherd is next most common. If any change is reflected it is for sherds in the presumed older levels. Temper size stresses fine; coarse is about one third as important. Medium quantity of tempering is generally preferred except for the top level where light had a slight edge.

Measurements indicate that the upper deposit sherds are thickest; lip widths were greater in the lower levels and pot size largest in the mid two.

There are some cultural changes with time. The top levels had more white slip or float sherds, although there are a number of white to grey-white sherds from level 3. Medium paste and lighter tempering is also late. Firing may have been better in the later periods. Rims were straight, walls incurving, shapes simple. The peculiar flange with no inner lip (here an extreme of the 05 series) and the pointed lip forms stand out; the interior lip form is rare. The white sherds appear to have more evidence of working, especially of the interior where grooved or wiping marks are noticeable below and parallel with the rim. Smudging is usually light, blotchy and the original red surface shows through. Sherds that are heavily smudged on both surfaces and the core black are rare in the first level; one 04 and one 12 rim were recorded with these attributes. They may have derived from the terraces near K3.

Level 2 sherds have the same overall attributes; the red float, the good firing, fine and medium pastes and straight rims and incurving walls. In this level, there is more variety in the rims although straight continues to dominate. White and grey, or terracotta-white sherds are rarer than in the first level. They are not slipped. Most appear to be from pots that were very well fired and had seen no use for cooking, or at least were never smudged. Smudging itself is more common than in the first level; it is usually light on the interior.

Level 3 is perhaps more diverse than two. The surface finishes are less good although nearly all sherds are redware. Straight rims are fewer than in level 2, but are still the common variety. The incurving 02 rises and the backcurve is most important here. Firing is good. Only

two white sherds were found, worn but fine pottery. Smudging increases with depth in quantity and intensity. It is difficult to formulate a reasonable hypothesis for the light and few smudged sherds of the first level and the more noticeable and greater number of smudged surfaces below. In our interpretation smudging means use on a fire-cooking. It is not reasonable to suggest that the level 3 people cooked more than those of level 1, nor is it probable that later sherds had the carbon washed off, naturally or artificially, more than the older sherds. There must be an explanation but it escapes us.

Cooking in the Palau area means several operations that are not usual in our kitchens: simmering grated coconut meat to get the oil; boiling down the sweet sap from the buds to make syrup or sugar; rendering the paranarium nut for oil to make the red lacquer for canoes and wood dishes. These might be called semi-industrial cooking. It is entirely possible that the excavation unit was the dump area for the village locals where some of these things were done. I am aware of no method of analysis that would enable me to offer cultural change or environmental reasons for the deeper midden increase in smudging.

Level 4 pottery is rather rarer at trench 2. Red float continues to dominate; firing is good and straight rims are somewhat fewer as they were in level 3. Incurving 02 and incurving walls are at their peak for the K3 dig. It has been commented that white sherds are rare in this level.

There can be no doubt that the sherds from the platform, the shell patch and trench 2 units are related-all are of the same occupation. The charcoal dates from the site place most of the trench 2 occupation in the late 1700's and legend would place the last platform use in the late 1800's. The sherds suggest that there is a merging, back in time, some of the more noticeable attributes of pottery of the terrace period, although these are rare and unusual. Our present feeling is that the recent midden of K3 is linked sequentially with the unstudied terrace occupation of the area.

Koror 5 (Ngerbechedesau)

It had been my intention to excavate parts of 3 Koror sites which according to the sherd analysis in the survey (Osborne 1966: 117–120) should have had a strong early component. There were other Koror sites which also yielded the thin, often early wares with straight or backcurving rims seen particularly on Babeldaob. Koror 3, 4 and 16 had been chosen to explore this. K3 was excavated in part but neither K4 or K16 could be. At both places the changes in field and dwelling patterns, largely I believe because of the increase of Koror population, made digging impossible. K4 was under cultivation and any midden that had existed at the time of my first trip had been disturbed-as indeed it probably was before I first saw it.

K5 is close to K4: it displayed the presumed early material and was not under the intensive use that it had been during the first visit. There were small sweet potato and manioc patches on the major open area but there was also plenty of brush and weedy surface for our tests. Latosols blanket the area, the red hard dense well drained clays or silty clays that are typical of the uplands.

The area is like K4, a series of northwest facing terraces which shape the land as it slopes from the northern end of the limestone spine that makes up the eastern and parts of northern Koror, to the lagoon. The K5 terraces are flat and wide with low sloping risers. They are most obviously agricultural and dwelling areas and would offer no military advantages. K5 belonged to a local landowner, Ngiratkel Epison of Koror. He gave his permission through Sumang. We were to backfill excavations and not to disturb areas under cultivation.

Krämer (1917: Abt. iii, pp.256–7) discusses this village area briefly. During his time the place was not inhabited and he inferred that it was abandoned as a political entity presumably before or near 1800. Francis Toribiong secured the local story concerning the conquest of

Ngerbechedesau by Koror. Apparently the inhabitants of the former were poor neighbors, They visited Koror, did not comport themselves well. The final crime was the remonal of the roof of a house and its use as an umbrella on a rainy night. The Ibedul, overchief of Koror, called in all his allies. One of these was the chief of Ngerbodl, northwest of K5 and near the coast. The K5 area was reduced after sharp fighting, burned and the inhabitants fled. Hijikata (1956:8–9) gives a variant of the story. As was common the stones that had belonged to the conquered were removed and used for constructions by the victors. Certainly we found no stone remains on K5, and none of the large andesitic residuals such as are used for platforms and roadways. Their loss would be a crushing blow and might effectively prohibit permanent resettlement of an otherwise acceptable locality. Again, although commenting on the carved stones rather than the andesite boulders used for platforms, Hijikata (1956:9) states his belief that few stones indeed are in their original positions and have their original folklore associated. I agree wholly as to the latter although it will become obvious that some of the large monoliths have not been moved (see site Babeldaob 18).

Excavation started under Mr. Stevens on 23 September. Five local women also began preparing the soil for dry taro planting on the same day. They asked that the test pits in or near the area of their planting be left open so that they could fill them and plant taro cuttings in them at their convenience. Work concluded October 1, 1968 with three days lost because of heavy rain. The labor force varied from 2 to 4 men: they worked 85 hours for a total cost of only $38.20. Stevens dug 21 test pits, and investigated all apparent potentialities for an archaeological deposit of significance. Four large pits were expansions of several of the tests and a single trench 5 by 30 feet (1.5 by 9.1 m) was placed through the central and most prolific sherd area between TP12+15 (Figs. 73, 74). No deposit that could be termed satisfactory was found. We can be rather sure that none exists: 9.9 cubic m of soil were processed archaeologically.

The site itself is in an excellent situation (Fig. 75). On the east is a ravine with a seep which has been developed, probably by the Japanese, with a small concrete dam about 1.2 m high, so that there is a permanent pool. There is no evidence of the aboriginal dam and pool that must have been there as a native bathing place during that occupation. The base of the white limestone cliff has several tunnels which penetrate it deeply and a breastworks has been thrown up in front, all part of the intensive Japanese defensive system. In a small cave some 9 m above the base of the cliff, in the forest obscured area on the right of the knob in the picture, is a decayed 20 mm rapid fire cannon, probably an anti-aircraft piece but now trained over K5 and out over the lagoon to the northwest. Local people informed us that the Japanese forces had used this area extensively. It is obvious therefore that the evidences of disturbance that we discovered could have had recent cause.

On the south, the excavation area is limited by a gently rising terrace edge which leads to a lateritic hilly area, partly terraced and covered with grass, bracken and brush. It was penetrated but could not be adequately explored without some clearing. The western edge dropped abruptly via another terrace riser on which lay the main Koror to Babeldaob ferry road. A test excavation, pit 3 and terrace cut (Fig. 73) of this riser disclosed a line of small generally broken andesite cobbles along the upper edge of the riser and on the K5 terrace itself (Fig. 76). We did not attempt to trace this nor test for it elsewhere. Its function is not known. A much eroded dirt track led from the Koror road into the site area in the northwest corner near the suggested platform stones. The northern edge was sharp; it was certainly partly artificial, a terrace riser, as a flat lay below it.

Stratigraphy over all the site was essentially the same: a mattock zone varying around .3 m in depth in the trench, the area of best deposit. It is dark brown to grey soil, clay and organic and root mixture. Below this is a stratum of generally mixed soils, a lighter B zone which like the mattock zone contained sherds. Midden and clay mixing, the former in small quantities, indicate that the layer grew or was formed partly as a result of the old occupation. Below this

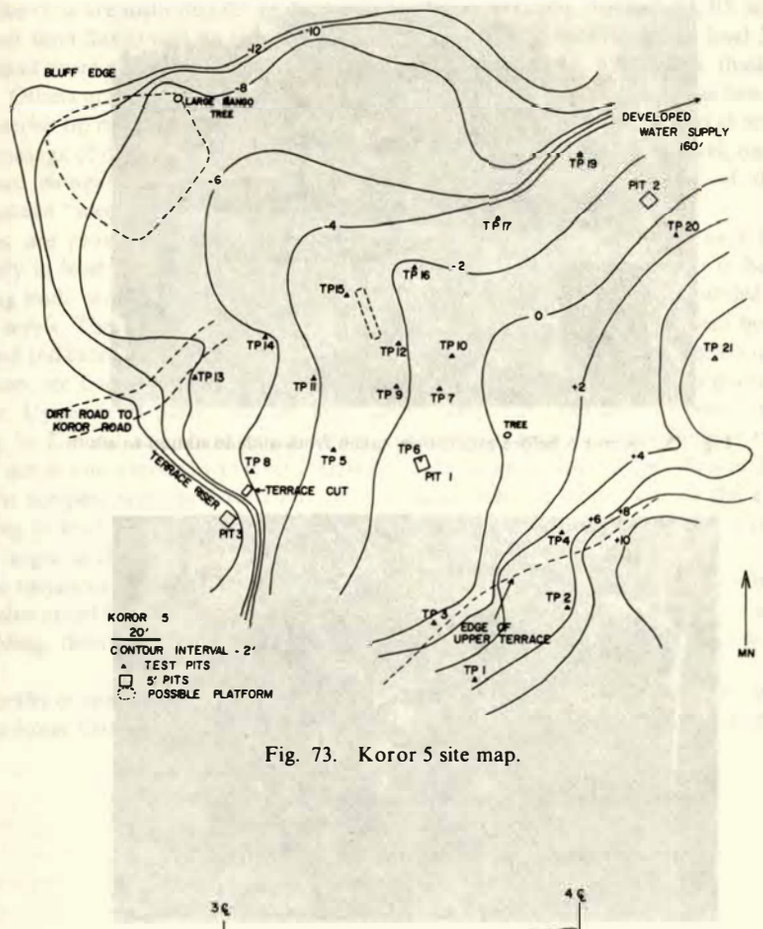


Fig. 73. Koror 5 site map.

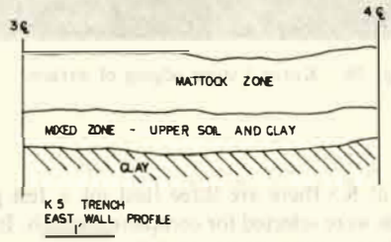


Fig. 74. Koror 5, trench, profile of section of east wall.

lay the sterile latosol subsoil of varicolored clays, reds to blue-grey (Fig. 74).

The only possibility of a structure lay in the northeast edge of the site, above the sharp drop to the lower terrace level which is now covered with heavy growth. Testing revealed a pattern-less concentration of stones over a large area (Fig.73). Unfortunately, destroyed concrete constructions, probably Japanese, overlay the stones.This evidence of disturbance discouraged intensive work in this possible platform remnant-as if the concrete were not enough.

Fig. 75. Koror 5 before excavation, taken from alidade station to south.

Fig. 76. Koror 5 stone edging of terrace.

Ceramic analysis

Of the numerous tests at K5 there are three (test pit 3, test pit 6, and the long central trench) from which the sherds were selected for complete analysis. It is probable that the trench alone would have given sufficient data. Although 932 sherds were analyzed from the site and analysis fed into the computer, only the sherds from the trench will be discussed here. Level 1 of the centerline trench yielded 281 sherds and level 2, 378. All were analyzed.

Exterior and interior color, when recordable, was red float; it made up 90% in each level. Grey and white float (less common) and a few slipped sherds make up the remainder. Decoration is limited to a single incised sherd in level 1. Most fragments showed unremarkable surface change; smudging is strongest in the lower level where there are more smudged sherds than those with no surface change. Surface erosion is a trace only in level 1 and the real difference between the two levels is in the slightly greater variability and the large collection in 2.

Rim forms are surprisingly numerous but none is truly outstanding. In level 1, about one-

fifth of the rims are incurving 02; in decreasing order are straight, thinned, 04, 03, interior lip, lip greater than flange and lip equal to flange, backcurve, and mushroom. In level 2, straight and 02 lead more strongly at about one-fourth each, then 04, 03, interior lip, thickened and thinned. Others are very few. The major difference between the rim forms of the two levels lies in the interior lip rims. The interior lip rims of the top level are thick, heavy and short; they are the beginnings of closure of the orifice of a bowl. The 12 rims of the lower level, on the other hand, are elongate and thin and emphasize the closure in the manner of the classic southwestern "seed bowl". Thickened rims, too, are more usual in level 2.

Lips are primarily flat in both levels, more in the first; rounded is next important (especially in level 2) then thickened and pointed. Wall form is in agreement in both levels: incurving leads, straight next. Bases are similar with flat most common and rounded following in both levels. There is a compact variability here that illustrates an agreement between the levels and indicates that the deposit stems from a single very lightly changing occupation.

Pastes are fine and medium in level 1, and medium and fine in 2. The figures are close together. Upper level pastes are the finer; sherd temper is dominant in both levels, most strongly in 2. Sand and sherd occur rarely (especially in level 1); sand alone is even rarer. Temper size is fine, especially in level 2; coarse is next, more commonly in 1 than in 2. Medium and light tempers were preferred but there is more medium and more of the rare heavy tempering in level 1. Mean sherd thickness is the same but lip widths and pot diameters are slightly larger in the second level.

The variances between the upper and lower parts of the K5 site are thus minor but present as was also noted for K3, trench 2. Although I would require one more excavation as proof of the pudding, there seems no doubt that culture change could be traced through an attribute study.

Worthy of special mention is 43/K5, a tooth. This was identified by Frank C. Whetmore, Jr as the lower first molar of a small goat (*Capra* sp.). It came from the first level of test pit 6.

CHAPTER 5

Babeldaob 10

Most of the work at Babeldaob 10 was done by and under my Palauan assistant, Francis Toribiong, who was there intermittently from January 28 to February 25. During the latter part of this time I was at B40 and Francis went to Ngargasang with me to assist in making the necessary arrangements. He then returned to continue at B10. It is not a long trip by outboard from Koror up the southwest coast of Babeldaob to Aimeliik (Fig. 1). More time is required to walk through the jungle and over the terraces to the high mass of B10. It was therefore feasible to send Francis out on this job to map and dig while I was occupied in the laboratory or on another excavation. I visited the site three times while he was there and gave instruction at the home base and on the terrace. The results are acceptable: we lacked time to work B10 in any other way. Francis' only failure was that he left the film holders of the 4 by 5 camera in the sun one afternoon. As a result, most of his photographs were of small value. Three local men worked 351 man hours for a total labor cost of $140.40.

This site is described briefly in the 1966 report (page 186) as one of the highest of the terraced hills of that part of Palau. After revisiting I am sure that it is the largest and it is truly the most impressive (Fig. 77). These high terraces are the finest expression of the red volcanic derived latosols. They were here remarkably hard and acid (see Corwin et al. 1956: pls. 19, 30).

Such a place obviously requires more in the way of an excavation program than we were able to give it. Although most of our excavations had been tests (adequate tests, I hope) this terraced hill and its environs would require more than the others in order for its problems to have been clarified and partly elucidated. Furthermore it is part of a large area which encircles the landward sides of Ngchemiangel Bay: sites 7 through 13 plus a number of smaller sites or components are geographically contiguous (Osborne 1966: fig. 49, pp. 180–192).

The very mapping of the site presented a problem. Our instruments were not suitable for the accurate recording of a steep-sided hill of the dimensions of B10. It was therefore necessary to use levels and rods and thus secure a series of profiles of the hill. Starting on the top of the

Fig. 77. Babeldaob 10 terraces, to north.

crown at each corner, centrally at each end, and at 1/3 of the distance from each end on the sides, Francis Toribiong ran a series of profiles. Using a string level he measured out a convenient distance, usually 1.5 m on the slopes, and then down from the leveled cord. These measurements, both out and down, were recorded in the usual manner in a surveyor's pocketbook. He thus did ten profiles which, human error aside, are correct representations of the slopes. These were later plotted and the map (Fig. 78) made. Such a method errs only in that the details of the terraces, which did not lie along a profile, were missed. Toribiong attempted to catch some of these by angling his profiles, keeping a record of angles and distances involved. The map is, however, a much smoothed representation of B10. If the site is intensively studied it should be re-mapped with modern air-photogrammetric techniques. Our map is unusual in that elevations are recorded from the top down. The hill is thus about 30 m high.

In addition to the mapping there were some 30 test pits dug in an effort to locate evidence of occupation in depth. Surface remains are present over all of the terraced area. Obviously the slopes themselves have only a few drift sherds but the near-flat areas all have sufficient

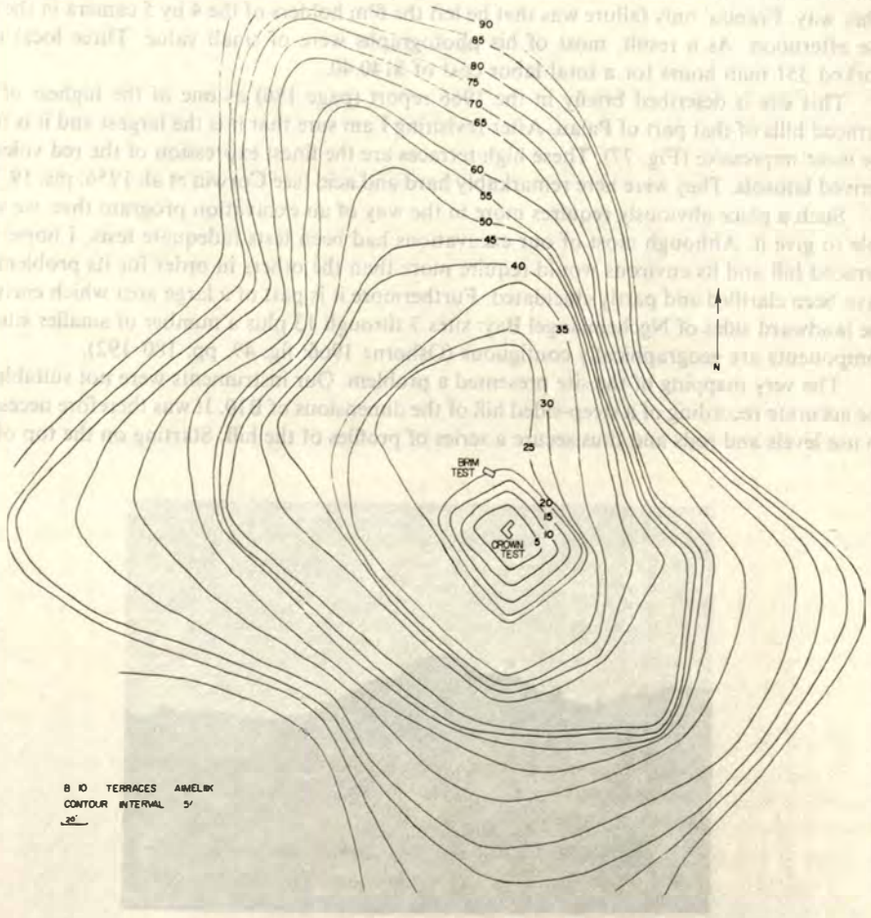


Fig. 78. Babeldaob 10, site map.

development of thin dark soil, or staining of the clay, and potsherds, so that it is apparent that some aspects of living were carried on upon the terraces.

I do not now find dwelling on the terraces as difficult to accept as I did at first. True, there is a primary exposure to the sun but there is likewise nearly constant air movement. Shade of houses themselves, and of sunshades which the Palauans use extensively now and probably always have, would have helped. In addition they could have encouraged the pandanus which grows on the uplands (Fig. 77) and trimmed it properly for protection from the sun. In any event I consider the breeze an important factor and can record that I have not been uncomfortable on terrace tops in the open sun. The same cannot be said for jungled areas where shade is dense but wind is usually lacking.

My hope that we might find a good midden on the B10 terraces was not realized. There may be midden at the lower levels in the grass or brush, somewhere in the square 1.3 km that could center around B10. If so, its discovery must await intensive long term study of the place.

In addition to the numerous test pits, which were frankly soil probes, there were two larger excavations. One, test 10 on the top of the crown was primarily a search for evidence of dwellings. There are no stones there, so house or sunshade posts must have been used if structures were strongly built permanent or semipermanent ones. The crown test was L-shaped, 4.6 by 9.1 m. The longer limb was parallel with the width of the crown, and excavation was carried to a depth of 53 cm at the deepest. There were no post holes or any other evidence of dwellings seen. Charcoal flecks and bits occurred rarely. Sherds were few. A typical profile is 10 to 23 cm of topsoil, dark, clayey with the modern root mat. Then the hard tough reddish clay soil mixed with the decaying remnants of andesite appeared; it is probably a C-type soil. Excavation ceased over most of the test at only 30 cm or a little more of depth; the red clay is sterile.

A 1.5 by 4.5 m trench, test 5, was placed at the meeting edge of crown and brim. This brim test penetrated more deeply. The topsoil depths were 10 to 15 cm, indicating that there has not been much postoccupational deposition at the foot of the crown, where the brim test was located. The plant cover, mostly grass, has apparently stabilized the slopes and kept pace with any deposition at the bottom, presumably throughout most of the postoccupational time.

That there was, however, a time of deposition when the red clay soil and light midden were mixed is attested by the second element in the profile, 10 to 20 cm of earth that contained numerous sherds. The excavation went 10 to 20 cm into the last layer, the reddish heavy clay subsoil. The brim therefore, partly because of deposition from the crown slopes and very possibly because of occupation, carries the most archaeologidal evidence and has the deepest profile: 3 units to the two plus units found elsewhere.

The profiles indicate clearly that there was an occupation of this terrace—as there probably was on all of the others. It was not long, or it was limited to fewer persons than the area suggests. It endured, however, long enough so that the erosion, admittedly always stepped up by human use, could transport soil from the top and slopes of the crown and deposit it at the bottom edge of the crown where the latter and the brim meet. It is important that the zone of mixed soil be dated but we did not have charcoal.

Artifacts

The only items to be described here are two pottery disks, roughly circular and the edges smoothed. Catalog number 11/B10 is 42 by 40 by 10 mm and 22/B10 is 39 by 24 by 9 mm. Both are made of coarse sherd tempered redware. There is also a single painted sherd with a pointed rim from 21/B10. It was painted with a dull red on both exterior and interior. All of these items are from level 2 of the brim test. There were no artifacts other than ceramic from this excavation, due, of course, to the acid soils.

Ceramic analysis

BRIM TEST: The following calculations depend on a total sample of only 74 sherds out of a total of only 231 analyzed from the two chosen tests. Red float was probably the original color and surface, but surface change has masked color of three-fourths of the brim test sherds, especially in level 1. Interior color could not be recorded for level 1, but the two sherds of level 2 in which it could be recorded are red and buff. Surface finish is smoothed, all levels. Surface decoration was not observed. Surface change pairs the upper two levels against the third. Sherds smudged on both surfaces are heavily predominant in the upper two and predominant in the third. In this lowest level, sherds smudged on the interior make up about one-third of the total. Surface erosion is light in the lower two levels. Firing is totally well fired in the upper two levels. Poorer firing is 17% in the lower. This is a difficult attribute to judge when pottery is heavily smudged and friable, and few sherds are unequivocal on the subject.

Rim sherds were few. A discussion based on 3 or 5 rims can be of no value. The same may obviously be said for lip forms; they are few. Rounded and flat predominate. Incurving walls are dominant; only a few are straight. Fine pastes lead in levels 1 and 2 but medium takes over in 3. Medium paste is secondary in the upper two levels; coarse appears as rare in the lower levels. Sherd temper is primary, increasing in strength with depth; sand and sherd together are secondary and trend the other way. These two tempers were apparently competitive in this test. Sand makes a perceptible showing in level 1 only. Fine temper is strongly preferred throughout; coarse appeared a little more frequently in level 1. Medium quantity leads throughout, light is rare, but heavy is 10% in levels 1 and 3.

Sherd thickness is greatest in the lowest level, then the first, and is least in the mid-level. Lip widths are least in the third, 2 and 3 are nearly in agreement. An interior lip and thickened rim account for the variation. A single reconstruction (Fig. 79*a*) comes from the original excavations of test pit 5.

It is obvious that the collection from the brim of B10 was altogether too restricted to yield a glimpse of the ceramics of the trench, except in the paste and temper categories, where there were apparently enough sherds so that attribute relationships are delineated. I should say that we would not expect much in the way of variation on the top parts of a terrace of this kind, in view of its probably short occupation. The brim, it will be recalled, yielded sherds that were presumably older (our level 3) and those that were later and probably the results of wash and erosion from the crown (our levels 1 and 2).

CROWN TEST: A larger sample came from the large L-shaped test trench on the crown: 157 sherds were analyzed. This is still not to be considered an adequate sample for the three levels.

Exterior color appears red, probably always float; buff is next. The record is largely indeterminate because of masking by surface change. Interior color stems from the same tradition. Surface finish, as with the brim test, is smoothed, both sides. Surface decoration is lacking, Smudged on both surfaces is dominant in all three levels but is weakest in the bottom of the deposit. Smudged interior is next, but weak except for level 3. Smudged both is the most common on all Babeldaob upland sites. Although our collection is poor, we accept a definite change in the pottery during the occupation. Firing also indicates a unilateral depth change although we were never happy with our control of this attribute. Figures go from total well fired in level 1 to one-third in level 3.

Level 1 rims are straight, incurving and thickened in that order. Level 2 rims are lip greater than flange, straight, thinned, 03, and others. Only 6 rims come from level 3; they are essentially the same as in the other two levels. Lips are rounded and flat, essentially equal. Incurving walls are most important, straight are next in level 1 only. One shouldered vessel rim sherd from level 2 bespeaks the terrace associations. Similar forms are shown in the B18 rim charts, Figure 161. Bases were too few to support discussion. Possible use is 100% cooking, almost surely close to

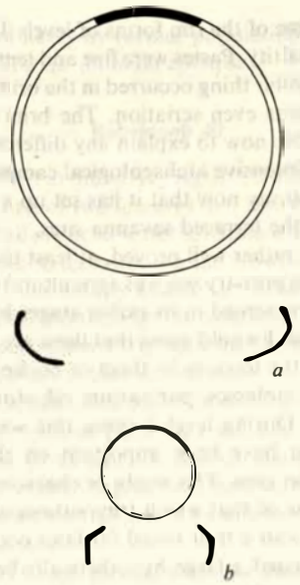


Fig. 79. Bowl shapes and sizes Babeldaob 10. Dark section on circumference indicates rim section present; width equals lip width. *a* (38/B10) rim form incurving 02; extra fine paste, fine sherd temper, medium quantity. Test pit 5 (brim) no depth data. *b* (39/B10), thinned rim on highly incurving bowl; extra fine paste, fine sherd temper, light quantity. Crown test level 2. Lip diameter of *b* 22cm.

the truth. Medium paste is preferred, 50% or slightly more in all levels. Fine takes second place and coarse is a poor third. Sherd tempering is almost 100% in level 3. Sand and sherd was a weak second choice. Fine tempering dominates in all divisions. Quantity of temper is most often medium; light is next but rare.

Level 2 sherds are slightly thicker than those of the third level and markedly so when compared with the first. The several flanges cause the midlevel to have greatest lip width. Vessel diameters could not be taken from the analyzed sherds but a partial reconstruction from a portion of the shouldered vessel is shown in Figure 79*b*.

Although we were plagued with small sampling here and this is reflected strongly in some of the attributes, it is possible to make some pertinent observations and suggestions. Level 1 has weak smudged interior but the best firing and the coarsest paste. Temper, primarily sherd, with sand and sherd secondary, is essentially the same as in level 2. The latter level was weakest in the usually very strong red float and had the strongest buff. It was the most variable in exterior and interior color, surface changes and rim forms. Smudging of both surfaces predominated as well as in the other levels. Level 2 color when obtainable was buff and grey. Level 3 had the strongest smudged interior but the weakest smudging on both surfaces and the poorest firing. The straight and incurve rims are strongest, and the pastes are medium and fine with the greatest number being sherd tempered.

It is significant that the two excavations at B10 showed acceptable seriation (if this is not accidental) in some attributes and not in others. This is to be expected: no aspect of culture change is total, all encompassing. The crown test, test trench 10 showed clear seriation for

surface change, firing and for some of the rim forms of levels 3 and 2. The brim test showed a firing change but of a different quality. Pastes were fine and temper material was moderately so with levels 1 and 2 agreeing. A similar thing occurred in the brim test but, in pastes, levels 1 and 2 agreed and in material there was even seriation. The brim deposit is partly the result of erosion but it is surely not possible now to explain any differences in the percentages on that basis. This huge site requires an intensive archaeological campaign and only such work could unravel its intricacies. Suffice it to say now that it has set up a model of the kinds of cultural change that may be expected in the terraced savanna sites.

The pottery distribution has rather well proved, at least to me, that there was occupation of the terraces and I think that the primary use was agricultural occupation. It may have begun slowly and for some reason is represented in its earlier stages by more of the complex pottery forms, especially in the crown area. I would guess that these are general food and cooking pots and that food was carried upon the terraces in them or cooked there. Other uses of pottery, such as for making coconut oil, molasses, parinarium oil, storage, and so forth might have appeared rarely on the heights. During level 2 times this was not so and many activities, including water catchment, must have been important on the Rois (mountain). The last occupation shows again the simpler rims. This might be characteristic of the decrease of the use of the crown and brim, the reverse of that which I hypothesized as the beginning occupation. The emphasis on simpler rims is also a trait noted for later occupations at a number of sites.

In the 1966 report I summarized a large hypothetically-based discussion of the cultural utility of the terraces by observing that terraces "were primarily agricultural but the crown and brim had military utility..." (1966: 150–155, fig. 48). This was before a terrace excavation had informed us that there is ceramic change entombed in the thin midden deposits of crown and brim. Sherds are perhaps somewhat less numerous on the surfaces of the lower terraces of a large mass such as B10. I do not feel that I know enough about these things to say that there is invariable evidence of heavier occupation of upper terrace units than of lower. But this is surely true of most of B40 and appears to be so at B10. To us, occupation means dwelling and the dwellings of the upper level were in a sense in a fortified position. So we may say that one of the reasons for or uses of terraces is protection, or by extension, fortification.

Yet it is equally obvious that the total terracing of a hill is not fortification. It would be far easier to take B10, terraced as it is, by assault than it would have been to have taken the upper part of the original hill if the top quarter or third were ringed with a trench and breastwork system. And the latter would have represented a small fraction of the man hours that the terracing does.

It is obvious that terrace-making expands the amount of land. If this be arable, which I assume it always is, then indeed the terraces assume a reasonable position in the way of life of their builders. They yielded more cultivable soil, fresh and fertile for a period of time and they furnished dwelling space and, on their upper reaches, protected places to live. Wind, sun and weather operating on new soil and the ultimate fact that a hill can be terraced just so far by the cut and fill method, especially if the crown and brim is to be preserved as a fortified place, or for the elite, all taken together mean that terracing as it was done in ancient Palau represented a finite gain and resource. Presumably the terracing is in one way a response to need, and rather surely the need was more mouths to feed and more villagers to protect, than the older methods of land increase by slash and burn and fallow, and of fortification, could handle.

If this is true that the terracing represents the expansion of the utilized environment, the grasping of another resource, then indeed it was a finite one. The massive terracing bought time for what was then a heavy population confined on an island. Ultimately however, these people had to face an unfortunate reality. No doubt the problem was recognized by many. We have suggested that it was partly alleviated by use of the rock islands but it is impossible to see other than an example of the all-too-familiar cycle of cultural success, population expansion and

expansion of resources, followed likely by further population increases, leading to the partial exhaustion of major resources and an ultimate collapse.

Babeldaob 40

This site was initially described in the survey report (Osborne 1966: 254–257) at which time I recommended excavation because of two features that B40 exhibited: (1) a terrace crown that may have been designed as a small artificial water catchment and holding area and (2) a deposit of thin fine sherds on the terraces. Excavation on the crown revealed no evidence whatsoever that it had ponded water and I was totally unable to rediscover the peculiar sherd outcrop. Although a part of the terraces, principally the southern half had been burned off, thus exposing the surface soil, that part where I had seen the sherds was not. I searched in the high grass and new jungle with much sweat and no success.

The village of Ngargasang is, like other places of eastern Babeldaob, nothing more than an agglomeration of homes in a propitious place on the coast. There is a small dock where the men's clubhouse (*Bai*) stood in years past. A cleared channel leads from this little harbor through the mangrove to the generally shallow tidal flats within the east Babeldaob reef. Much of this coast of the big island is difficult of access by any but small boats unless one travels at high tide or goes outside of the reef.

The village is on a tongue of high ground with low swampy areas both to the north and south. It is thus not only well drained but catches the trade winds. The main road along the east coast, a developed foot trail, leads from Ngersuul on the south through Ngargasang to Ngchessar and on further to Melekeiok on the north. The stretch from Ngchessar to Melekeiok has not, however, been kept clear. I spent eleven days in Ngargasang (February 18–28, 1969). Seven were field working days. While there I stayed at the home of Saito, the legislator from Ngchessar municipality of which Ngargasang is a part. The solicitous hospitality of Saito and the Palauan cookery of his wife made the stay an enviable experience; their home is near the terraces and consequently high. It was a delightful place, even on the hottest days. My crew was small, generally four to five men, all local. Tatsuo and Ucherbelau were regular while Narau, Tosi, Luis and Saito himself joined us at intervals. I experimented here with hiring local women to wash our potsherds. It was only a partial success. I was not able to give the necessary supervision, being out on the terraces, and some of the sherds were not well washed, through no fault of the washers. There is, on many of the sherds from the terrace excavations, some kind of colloidal deposit resembling a heavy slip that develops on old sherds deeply buried in the lateritic clays. It takes on something of the color of a dark smudged sherd or of a lighter red one. It crackles when sun dried and can be flaked off. I have never before seen such a confusing deposit on sherds and it must be removed with a dull knife before the surface can be described. My Ngargasang pottery washers were only partly successful. Nevertheless, our washing in the field saved valuable time in the laboratory. Total field labor costs were $116.90. Transportation back and forth from Koror base cost nearly a quarter of that amount.

The terraces

The terraces of B40 (Fig. 80) are not large or spectacular but the upper surface of the crown was noted during the survey as being unusual in that it appeared to be centrally depressed and could have held rain water. This observation was, and is, considered important because of the possibility that one use of the terraces was as a defense refuge. In such case a water supply, in addition to that carried up in pots, would be useful. The surface of the crown was contour mapped at intervals of .5 feet (15 cm, Fig. 84). The Brunton-sketch map given in Osborne 1966 (fig. 76, p. 254) is only a fair schematic representation of the actual surface of the crown. There is a decided eminence at the north west end (Fig. 81) and a less marked ridge on

the east and southeast (Fig. 83). The central area is flat and low but the southern side slopes off rapidly so that little if any water would be held now. In other words, the upper surface of the crown could be the eroded remnant of a ponding area.

Fig. 80. Babeldaob 40 terraces looking northwest; measured profile (fig. 90) taken in center. Terraces were recently burned off.

Fig. 81. Babeldaob 40 west across the crown surface to crown eminence on northwest.

Fig. 82. Babeldaob 40 terraces from the east; about 1 mile distant.

Fig. 83. Babeldaob 40 southeast across the crown surface. Trench 1 and ridge along south and east sides of crown.

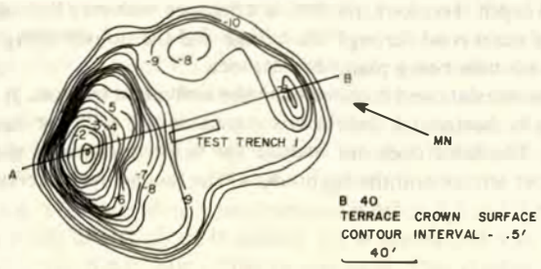


Fig. 84. Babeldaob 40. Crown surface and area of trench 1.

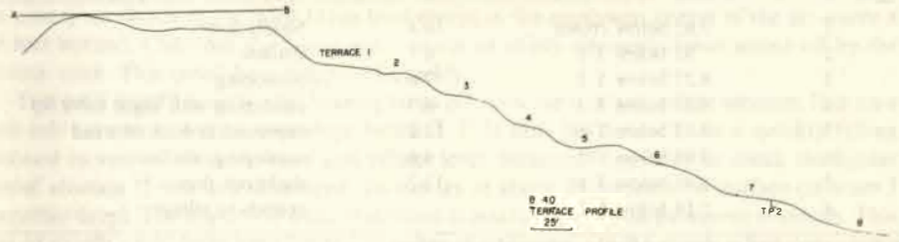


Fig. 85. Babeldaob 40. Terrace profile—southeast slope.

Excavation, however, as will be shown in the following discussion, showed otherwise. There were no waterlaid sediments revealed. The profile is directly comparable to others found in other tests and excavations at B40. This is information that can be used in terrace interpretation and I feel that it would be duplicated were the B22 crown surface trenched (Osborne 1966: 213). I now doubt that the upper surfaces of any of the terrace crowns were used to catch and hold rainwater for any length of time. This still does not mean that terraces were not used defensively or that crops could not have been grown on the tops of the crowns or that the upper surfaces were not structured for certain purposes. After all, Palauan warfare as

we know it historically did not make use of siege, and the crops grown on the terraces as a whole could not have depended on an artificial water supply. Other terraces exist along the northeast trending ridge and inland. They are generally heavily masked with jungle and coconuts (Fig. 82). Our site is actually only a small part of the hill and slope terracing back of the village.

Krämer (1917: 237 *seq*) describes some of the Palau terraces briefly. He apparently decided that they were natural formations although he took pains to ask locally and reported that the natives said that the mountains were not shaped artificially. He noted the crown depression on several and reported water in one of them.

After the upper surface of the crown was mapped a single profile (Fig. 85) was carried down the front (southerly) side of the expression. This traversed a distance of 175 m. The southern terrace front rises at the low angle of only 18°; this must be very close to the slope of the original hill. The near or landward northern side of the crown now is the site of a modern graveyard. Its most interesting monument is a piece of Yap money about 1.2 m in diameter, which marks the final resting place of a native of that island.

Below the crown (not counting it as a terrace) to the south and east are 8 terraces of varying height and depth. Terrace 8, the last, is a flat area with very little slope. It extends south about 400 m to the main road through the village and the houses along it. Parts of it and of terrace 7 above it are now being planted in tapioca.

Table 12 offers size data and comments on the individual terraces. It should be noted that the sum of generally horizontal dimensions (tread depth) will not equal the total terrace traverse of 175 m. The table does not include the slope distance of the risers, between the terminus of an upper terrace and the beginning of the one below it. Terrace soils are the usual latosols.

Table 12. Babeldaob 40 terrace dimensions*

Terrace no.	Riser height (m)	Tread depth (m)	Remarks
1	7.62 below crown	10.4	Nearly level
2	.92 below T 1	6.1	shallow
3	4.27 below T 2	7.6	outsloping
4	4.88 below T 3	6.7	outsloping with slight outer lip
5	3.05 below T 4	12.2	depressed at back of tread
6	3.05 below T 5	4.6	outsloping, shallow
7	5.49 below T 6	12.2	slight out slope
8	5.18 below T 7		extends to village

* Field surveying in feet and tenths: editorial conversion.

Excavations

A number of places on the south and east sides of the terraces were tested for deposit by digging small wedge-shaped holes. No sherds were saved from these hasty tests. The two areas of the large terrace that we examined are those two that had been partly cleared and cultivated or had been burned off by a recent grass fire. I usually abhore these fires: they are not economically advantageous and are ecologically destructive. In this instance I was grateful that the dense tropical grass and brush cover was gone. At the same time I was fearful that some wild carbon from the recent fire might find its way into my charcoal samples.

Five areas for formal test pits were selected from the results of the small holes dug. Number 1, the first excavated, was centrally located on the crown. It was later expanded into a

trench and will be discussed later as trench 1. Test pit 2 was near the edge of terrace 7, immediately above the break-off to the long undulating slope down to the village that is terrace 8. There are, of course, other levels of terracing within the village, many of them partially under cultivation. Terracing apparently ended only when the edge of the fringing mangrove swamp made further cultivation impossible. The pit is on the south-bearing off the crown. Its soil profile is simple: there is 15 cm of stratum I, a black heavy clay humus with the major root mat. Then the lighter yellow-brown clay of my stratum II is weakly present, not as a true soil stratum but as a color shading. Its more definitive presence elsewhere at this site, however, led me to designate it as a soil stratum and to segregate the sherds from it. Thus the black, hard stratum I grades quickly into stratum III at test pit 2. The latter is a brown-red heavy clay with flecks of charcoal and a few sherds. It is obviously a disturbed and much worked over soil. The pit was carried down to 91 cm and stratum IV, a sterile undisturbed red lateritic clay, began to appear in the last 15 cm. A small pot hole was dug down another 46 cm into the dense red clay. No changes appeared.

Test pit 2 provided an ideal starting point for a trench designed to reveal the stratigraphy of the riser, or slope, from T 8 to T 7. A trench 2.5 feet wide and 25 feet long (.76 m wide and 7.6 m long) was excavated 10.7 m out onto the relatively flat surface of T 8. The profile (Fig. 86) showed a thinning of stratum I and II downslope; III remained essentially at its test pit 2 thickness until the edge of the tread of T 8 was reached where it, as well as I and II, pinched out to virtual invisibility. A deep notch in the upper surface of the red laterite (stratum IV) marks the end of tread formation of T 8 and the beginning of the riser between 8 and 7. Stratum III certainly was formed largely as a result of agricultural or other human activity; I and II may have been partly so but appear to be also *in situ* soil developments.

Test pit 3 lay on a small corner terrace intermediate between T 5 and T 6 on the measured profile. It is ca. 61 m NNE of test pit 2. It yielded a few sherds and was abandoned when lateritic clay appeared in the lower part of the second level. This shallow depth of cultural deposit is typical of a large area of the burned over parts of the site.

Test pit 4 was placed on the main level, T 8. It is 18 m south of test pit 5 and above it. It also was somewhat disappointing. Three levels were excavated. Stratum I, the black mattock zone, graded quickly at 15 cm into the dense red-brown clay of III and then into lateritic clay. There were no sherds in the third 15 cm level except in the southwest corner of the pit where a tree had burned. Charcoal was saved but I doubt its utility although it was sealed off by the mattock zone. This could have happened quickly.

Test pit 5 was 88 m on an 85° bearing from pit 2, on the east side of the terraces. It is on a small side or corner terrace two steps below T 7. It thus lies below 8, on a quickly falling southeast to east slope to the road and village level. Stratum I appeared as usual; the lighter colored stratum II was well developed. Its top lay at about 21 cm from the surface (stratum I was rather deep). The upper 3 to 6 cm of stratum II was literally a thin pavement of sherds. This layer of sherds could have been formed in either of two ways: (1) the sherds sifted down from above during the cultivation process and were stopped by the uncultivated and unbroken clay layer at the bottom of the mattock zone or (2) as the result of surface wash, erosion and deposition, during a period of desertion of that part of the terraces. In the latter event soil to

Fig. 86. Babeldaob 40. Profile of test trench 2.

form stratum I would have had to have been spread over the area that includes test pit 5, either purposefully or by erosion and deposition from adjacent, higher terraces as they were again brought under cultivation. The fact that many or most of the sherds of the stratum II top layer were lying flat inclines me to the second explanation but I am not satisfied with my suggestion as to the formation of stratum I over them. Stratum II was thus the heavy yielder of sherds for this test pit; it terminated at 30 cm surface depth. Stratum III lasted to 1 m with sherds decreasing steadily, only two were found in the last 15 cm level. The heavy red clay was in strong evidence irregularly from 91 cm. It was tested with a pot hole and no further cultural deposit encountered.

Crown test

Trench 1 is the major excavation at B40. A trench 1.5 m wide and 7.5 m long was excavated largely in the flattened area of the crown but impinging upon and penetrating the lower slope of the northern hillock or crown eminence. Most of the trench was carried to 1.5 m in depth but the southern 1.5 m square was cut down to 2.7 m. This was as far as we could dig and we never penetrated beyond cultural evidence. The top of the crown of B40 is still inadequately excavated. A far longer and wider and deeper trench is required. Neither time nor funds, primarily the former, would permit me to initiate a major excavation.

The stratigraphy, although basically the same as that noted, is more complex (Fig. 87). Stratum I, the root mat, is 12 to 15 cm deep; it is black, hard clay humus and is essentially the same as described above. Stratum II is yellow-brown heavy clay, hard. It, like the same stratum of test pit 5, appeared to have a heavy concentration of sherds along its upper border. It varies from 21 cm at the south end to 55 cm deep centrally and at the north end. Stratum III, because of its depth, was divided into two parts, stratum III top and bottom. Depths were about equal, as was intended: 37 to 43 cm. The soil is a heavy dense red brown clay with charcoal pieces and flakes: sherds were not numerous.

Below these typical soil and cultural layers were three deposits of presently unknown depth. Because of lack of knowledge concerning them I have designated them as substrata A, B, C. Substrate A was followed to 2.7 m surface depth at the south end of the trench. As we know it, it is 1.5 m thick at a minimum and is composed of red and blue friable and easily dug clays mixed with pieces and chunks of typically hard stratum III material. Sherds were rare, all were well worn with rounded edges and decayed by acid soil reactions. Charcoal bits were also few. Nevertheless sherds and particularly the charcoal were common enough so that, together with the chunks of stratum III, there could be no doubt that the substrate had been worked by man. Furthermore the red and blue clays often appear elsewhere in a patterning of laminae. The lack

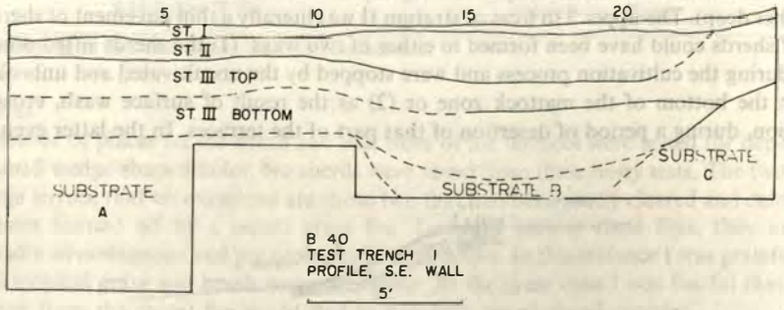


Fig. 87. Babeldaob 40. Profile of trench 1 (crown test). In the sherd analysis stratum III top is III; III bottom becomes IV, and substrate A is stratum V.

of this pattern can be taken as indicating disturbance in most places. I can make no estimate as to the depth of this soil. Were I able to state its distribution on and in the crown I should likewise be able to give the steps of formation of the crown. Substrate B, a hard yellow-thin clay, lies at about 1.4 m surface depth from 3.7 to 6.1 m from the south end of the trench. It was located as we were clearing the trench and cleaning the west wall for profiling. Its observed thickness was only 12 cm; sherds were taken from it. Its relationship could not be determined in the time available.

Substrate C, at the north end of the trench, rose abruptly, truncating stratum III as C followed up the slope of the knob on the north side of the crown. It is C soil, rotted andesite, and should overlie a rock core of the original hill. It yielded cultural material only along the zones of contact and admixture with stratum III. Thus I can suggest that the knob or eminence has a C soil and rock core that was avoided by the workers making the crown. It may not have been useful agricultural soil. Reasoning geologically, substrate C must be the oldest. The yellow clay, B, should be next. I believe it to have been culturally disturbed, at least in the upper parts. "A" must then be the most recent substrate insofar as its cultural associations are concerned. The one remnant of true sterile lateritic clay, stratum IV, that we encountered was in the bottom of the original test pit, 1.8 to 3 m from the south end of the trench. I thought, during this initial testing that I had a normal profile; I expanded the test pit to increase my sherd sample and ran into the problems described. Apparently the inhabitants had leveled and used the crown long enough for a soil profile that included a stratum much like my stratum III to develop. Then they must have decided to change the shape and character of the crown and dug out their used soil, mixing it with typical lateritic clay and probably lowered and enlarged the crown. They did not however, completely cover the core of the crown: a small Japanese cut on the southwest, coming in from the T 1 level shows lateritic soil at the base of the crown.

It is evident from the excavation of trench 1 and the test pits that there has been a long history involving use and reuse, and cutting and filling of the soils at B40. The sherd collections are generally large enough so that they should cast light on the problems if there has not been admixture that destroyed their cultural identity.

Artifacts

It must be remembered that excavations of terraces is at least as much excavation of fields and garden patches as it is of dwelling areas. It seems to me that the large numbers of sherds in the fill and on the surfaces of terraces does betoken strong use as dwelling areas. Whether this was permanent or only part time during periods of intensive cultivation or warfare, cannot be stated. In any event, the twin facts that terraces so far have shown almost no evidence of permanent abodes such as platforms and heavy midden deposits, and that they are exposed and unsheltered, have led me to the conclusion that they were not primary living areas. If this be correct, and the fact that the soils are uniformly acid is added to it, then an explanation for the lack of artifacts on terraces is available.

A pitted hammerstone (36/B40, Fig. 88*f*, trench 1 stratum III) weighing 459 grams (a piece was cracked off during excavation) is 85 by 70 by 45 mm. Made of andesite, the piece is irregularly round, with two pitted flattened surfaces. We have seen the shell duplicates of this form at Pelilieu 1. Such a tool was probably used locally to reduce large *Tridacna* shells to smaller pieces for use in tool making. There is, however, some evidence that minimal stone chipping was done at B40 and elsewhere in the Palaus. Our site yielded a flake of white chalcedony (44/; Fig. 89*a*) 23 by 19 by 7 mm, weight 4 grams. It has a striking platform, a bulb of percussion and to us is surely a flake intentionally made by a person acquainted with stone chipping techniques. It was a surface find.

At Ngerabeched (K8, B or C: Osborne 1966: 123) a Peace Corps Volunteer, Mary Sadler, found a small irregular rectangle of honey-colored chalcedony (22 by 18 by 7 mm, 3 grams; Fig.

Fig. 88. Babeldaob 40 artifacts. *a* (7/B40) scoria file-abrader; *b* antler coral fragments; *c* (2/) edge of rim of thin sherd showing the scaling film and the coarse sherd temper; *d* (4/) sherd with possible ring base; *e* (8/) sherd with colloidal film, see discussion p. 121; *f* (36/) pitted andesite hammerstone, 8.5cm diameter; *g, h* (48/) pointed rim, incurving walled bowl with tridacna design on exterior.

Fig. 89. Babeldaob 40 artifacts, and special sherds. *a* (44/) white chalcedony flake; *b* (Koror 8), chalcedony fragment; *c* (41/) yellow ochre cake; *d, e, f, h*(49/) see text p. 122 for discussion of surface of sherds; *g* (51/) carved sherd.

89*b*). It is bifacially chipped and appears to have been a small hand-held cutting and scraping tool. Of course it could also be a much worn gun flint: the material suggests this. Certainly the flint is not Palauan in origin.

At Ngerkeklau 1, a large andesite flake was found on the surface. This too is a clearly and properly made flake. Certainly these examples are few but they unite in pointing out that stone flaking was understood in these islands.

A piece of red granular chalcedony, part of a onetime larger nodule (3/B40) came from stratum III of trench 1; it is probably locally imported material. The fragment (85 by 72 by 44 mm, 22 grams) is patinated and, like all of the stones that the diggers had to pick out of the hard clay, is cracked. It shows no evidence of having been a source of flakes.

Several pieces of scoria (6/, 7/; Fig. 88*a*; trench 1 stratum III) were found in the deposits of B40. Pieces of this highly vesicular material are washed ashore throughout most of the archipelago and are and were used as abrasive cutters and files. Dimensions are of convenient hand size: 6/B40 is 87 by 50 by 39 mm, weight 53 grams. Fragments of coral 9/ , Fig. 88*b*) were found on and in the terraces. All of this was obviously carried in. Limonite, red ochre and pieces of ironstone (pyrolucite?) were common and are found in the lateritic clay. The yellow ochre (4/, Fig. 89*c*) probably artificially refined, is boat shaped, 26 by 20 by 15 mm, weighs 8 grams; the bottom is flat and may be a rubbing facet. A piece of hematite, also of local origin (47/, test pit 2 stratum III; 44 by 35 by 19 mm, 38 grams) has an excellent heavy streak and no doubt was a source of paint.

Peculiar small deposits and bits of zeolite are found rather rarely throughout the archaeological and natural deposits of the site, and elsewhere in the same environments. According to Robert E. Winchell, they are products of a complex weathering process; an examination of their origin would require a small but specialized mineralogical project. Small white flecks in some of our sand tempered sherds may be this same material, probably derived as a normal part of the clay, but possibly collected purposefully for a tempering additive.

Ceramics

Sherds, as is usual, formed the prime aspect of archaeological recovery. We shall first comment on the decorated and unusual ones. Bowl fragments in 48/B40 (Fig. 88*g*, h) have a straight pointed rim with incurving walls. The bowl is represented now by three large repaired sherds which still have small scraps of red ochre paint on both interior and exterior. The vessel was shallow, about 36 cm in diameter. At least two double rows of triangles, separated by a thin incised line are minimally 65 mm apart. They slant downward at an angle of about 45° from the rim on the exterior. The single rows are 10 mm apart, with the thin line centrally placed. This decoration appears to have been carved, not impressed before firing. It is the same combination of motives seen on sherd 48/Au1, 93/B37 and others (Fig. 49*e*, 115*f*). This is the design called *kim* (*Tridacna*) in modern times.

Another smaller bowl, 49/ is now represented by 7 sherds painted with red ochre on both surfaces. It also has a straight pointed rim. As far as can be ascertained this pot was painted overall. A single sherd with a straight rim is painted on both exterior and interior and bears two opposing lines of indented or carved isosceles triangles immediately below the rim on the exterior (Fig. 89*g*). The triangles mesh, are not separated, and this is presumably a modification of the preceding design. All of these sherds are from trench 1 stratum III.

Decorated pottery is very rare at B40. Yet this site is only about 4.8 km below B37 Melekeiok, where Stevens found a relatively larger number of such sherds.

A single sherd (4/ , Fig. 88*d*) bears the remnant of a ring foot. It is a flat piece and should be from the bottom of the vessel. The exterior has a ridge modeled on it, in no place complete but 1 cm high at its greatest, that curves for 60 mm across the sherd. It is generally worn.

This is perhaps as good a place as any to discuss a baffling phenomenon for which I have not yet secured an adequate explanation. A careful examination will disclose a crackled and scaling appearance on the surface of several of these sherds (48/, 4/ and 51/); the decorated sherds (part of 48/, Fig. 88*g*, *h*) also illustrate it. At first we believed this to be a deteriorated and scaling float or wash. It did not yield to brush and water and we found ourselves considering it as the exterior of sherds in analysis. We soon found that on most sherds it crackled, flaked and was easily rubbed off when wholly dry, showing clearly that it was not fired clay. In the field we placed the sherds from an excavated level in the hot sun, and then rubbed this scale from them before bagging. Nearly always the surface beneath the mud layer, as we called it, was smooth and gave no indication that it was other than the original surface. Furthermore we found that it also lay on the old broken edges of many sherds, giving them an even greater appearance of

having undergone edge wear than they had—and many of the sherds from B40 are heavily worn, suggesting years of exposure near dwelling areas or on cultivated land. We therefore assumed that the layer was a colloidal one, formed by peculiar physical-chemical action while the deteriorating sherds lay in the acid lateritic soils of the terraces. This peculiarity was never noted on sherds from Pelilieu, Aulong or from any normal midden; it is a terrace production. We noted that light sherds often bore a light layer and that smudged ones had a dark layer on them—but this did not always occur. The removal of a red layer sometimes disclosed a smudged surface below it. We assumed that this reflected the fact that the colloidal deposit originated from the red clay of the terraces and explained the dark layer as reflecting a bleeding out of the carbon from smudged sherds.

But this all came under a cloud of doubt when we found red painted sherds with the paint intact and shiny on a surface that crackled and scaled in the same manner as did any other mud layer (Fig. 89*d, e, f, h*). It is true that most sherds show a floated surface, rarely a slip. Red paint over a well-floated surface layer, laid on thickly as it often was, would develop into what is essentially a thick slip. This may be cut and flaked off, as we discovered on painted sherds from the Aulong site. The deteriorating slip and paint combination, if that is what it really is, appears even under a low power microscope to be exactly the same and is removed in the same manner as the mud layer. Yet, in the few places where it has peeled away from the sherds it does not leave a finished surface as does the other. For the present, until we can secure other data, we must accept the occurrence of this layer on most sherds as a natural depositional phenomenon but on sherds that show red paint megascopically as the deterioration of a heavy slip and paint layer.

The soft crumbly nature of the sherds from the terraces is impressive. Apparently much of that which is in the terraces has been there for 2000 years. I would guess that in another 1000 years a major share of this aspect of ancient Palauan culture will not be generally recoverable via present field techniques. This same must be true of other remains in other parts of the tropics where similar edaphic conditions exist. The photograph of the heavy hammerstone (Fig. 88*f*) shows likewise a massive deterioration: cracks and a patination that is soft enough to be removed with the fingernail. And we must remember that no fragments of bone and only very small fragments of coral and shell can be found on or in the terraces. This serves notice that thought should be given to channeling some of our archaeological energy into work in certain of the more actively destructive environments where the processes of decay are strongest.

Shell exposure

An interesting small shell midden which appears to have been deposited in a depressed spot on the surface, lies by the walkway from Ngargasang to Ngchessar. It is some 23 m beyond a log bridge over the stream where there is one of the bathing places.

We salvaged 347 shells and 38 sherds in order to record the place. The mangrove swamp begins below the road and the shells could have all been taken within a short distance out into the water. This would have been simplified if the mangrove were not present or if a channel had been cut through it at sometime in the past. The sherds have been analyzed and will be discussed below. Shell identifications were made by Frieda Osborne shortly after the material was brought to Koror. Gastropods: *Lambis lambis* (48 specimens); *Conomurex luhuanus* (7); *Lentigo lentiginosus* (1); *Conus* sp. (4); *Conus marmoratus* (2); *Tectus maximus* (11); *Trochus* sp. (2); *Cypraea tigris* (19); *Phos hirasei* (9); Pelecypods: *Scutarcopagia linguafelia* (1); *Anadara* sp. (127); *Anodontia* sp. (1); *Vasticardium* sp. (27); *Hippopus hippopus* (1); *Tridacna gigas* (1); *Periglypta* sp. (24); *Gafrarium* sp. (56); unidentified bivalves (4).

This grouping is obviously made up of food shells as the large number of *Anadara* attests. As persons who claim some knowledge of the subject, we are at a loss to explain the rarity of the mangrove clam (*Anodontia*). Of course, this succulent animal lives within a very fragile shell and most of them must have disintegrated into fine shell debris.

Ceramic analysis

The four excavation units at this site will be described in order: test trench 2; test pit 5; the crown test (trench 1); and the shell exposure. The latter is probably not a part of the B40 terraces at all. Nine hundred and ninety-eight sherds were analyzed.

TEST TRENCH 2: We analyzed 325 sherds from this unit out of 734 excavated: 21 from stratum I (all); 128 from stratum II (out of 300); 143 from stratum III (out of 380) and 33 from stratum IV (all). The following information is thus based on two samples that are too small and two that are adequate.

Exterior color is primarily red float: 50% at I to 100% at IV. Stratum I is most variable: grey slip, white slip and buff are all minor. Interior color appears in the same way, although the quantities differ. The above comments are not the whole story. The large Table (33) will show the unhealthily large number of indeterminates in all strata from I to IV and for a number of attributes. The figures in the table emphasize both the nature of the pottery, the difficulties of analysis and point out that there was (is) a use-erosion complex that has erased original pottery color most of the time. Stratum II and IV interiors are exceptions. Most of the change is smudging and it appears that II sherds were heavily used. Local cookery practices, the firewood and other factors may be discussed when a little more is known about this pottery and its history.

Smoothed finish in both exterior and interior dominates in the 90% or near thereto; all strata are in the same bracket. Smoothed exterior-rough interior is next. Surface decoration was not found. Surface change is highest in percentages in the smudged both surfaces attribute; percentages vary from stratum I 38% to IV 76%. Smudged interior is minor and follows the same sequence. Erosion of both surfaces, an attempt to record what happened to a vessel in use and post use, is nearly 50% in I and tapers to 3% in IV. Sherds with no surface change appear only in stratum IV. Firing is acceptably seriated except for stratum III, which is half poor and half well fired. Stratum I is strongly well fired and IV is even more strongly poorly fired.

The few rim forms (Fig. 90) and the possible error of excavating strata II and III as separate units, together have cast a pall over the significance of the collection. Stratum I yielded only 5 rims, IV only 4. Lip greater than flange and interior lip, next, were important in II; together they make up about three-fourths of the rims. Stratum III was similar with about 83% in the two categories. Simpler rims appear to characterize the top and bottom strata. Lips are primarily flat. Incurving walls are dominant, insofar as the poor collection may be trusted. Bases are primarily flat in II and IV while flat are weakly dominant in III. Possible use, when recorded is 100% cooking, all strata.

Paste and temper attributes are considered by us to be more readable and probably to reflect change rather better than other attributes. Subjectivity is less inherent and nearly all sherds can be recorded. Fine dominates at the bottom of the deposit and extra fine is strongest there also. The two mid-strata (II, III) are in close agreement. They alone have coarse sherds. The top is most strongly medium. Temper material is primarily sherd with III and IV in agreement. Sand and sherd are secondary. Temper size is completely fine in strata I, II and IV, and only 5% of coarsely tempered sherds appear in III. Medium quantity of tempering leads in all strata except II where light is 67%. The deepest deposit sherds were more thoroughly tempered than the more superficial.

Measurements were probably similar throughout although thickness decreases downward. Lip widths are largest in middeposit, strata II and III. Vessel diameters, lacking in the lowest stratum, are largest in I.

In summary it may be pointed out that red float, interior and exterior increased with

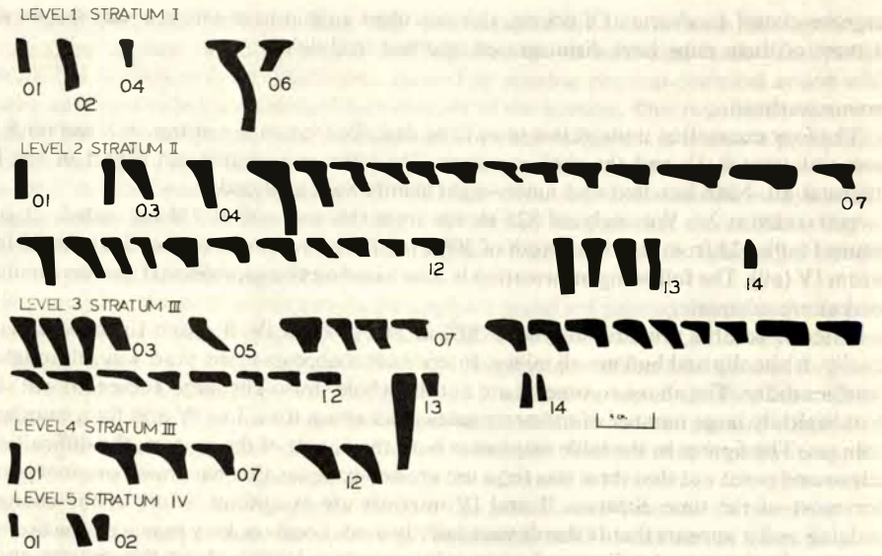


Fig. 90. Babeldaob 40 rim forms, test trench 2.

depth. The interiors and exteriors of sherds followed the same sequences with greater variability in stratum I; strata II and III had closely similar percentages. Surface finishes were similar throughout. Most erosion of the surfaces was noted in the first stratum, but smudging is minor in that stratum. It may, of course, have been masked by subsequent erosion of the surface. Strata II and III exhibited a close relationship in surface characteristics while IV had the least surface erosion and the strongest interior smudging and none on the exterior.

TEST PIT 5: Reference to the discussion of test pit 5 stratigraphy will refresh the reader's memory as to the problems of interpretation encountered. The soil column was divided into what had, by then, become a near convention for Babeldaob savanna sites.

The first stratum is represented by only 10 sherds which somewhat vitiates its status as a separate analytical category. Stratum II yielded 241 sherds and the last unit is again weak with only 29. If this site is excavated again, and I devoutely hope that it will be, the excavator would do well to examine the stratigraphy that I have used critically with an eye to some change, at least in that of the lower terraces in the area of test pit 5.

Exterior color is primarily red float, depending on few sherds in strata I and III. Variants, all in II, are grey float, white slip and rose: this surely offers a truthful picture of the original sherd color attributes. Generally color could not be recorded on sherds from the lateritic uplands. Interior color is also red: total for strata I and III and 82% in III, with grey float, grey and white slip and rose completing the count. Smoothed exterior and interior is the preferred finish 90–100%. Smoothed exterior, rough interior is a very weak second. Polished on both surfaces is trace.

One sherd, incised and painted was found in III and one impressed sherd in II. This may be taken to reflect the average use of decoration Surface change is dominated by smudged exterior and interior; this attribute is most common in I. Sherds smudged only on exterior or interior are moderate to rare. The number of sherds eroded on both surfaces rises slightly with depth; one third were eroded in this manner. Firing is recorded as poor in about two-thirds of sherds in all strata, and well fired follows in the reverse pattern.

There are two rims from stratum I, 102 from II and 5 from III. Our comments revolve around II; the reader may check Figure 91 and Table 33 for the total analysis of rims. Straight rims predominate; lip greater than flange is next most common. Other forms are few. Lip forms are flat in I and II and rounded (but only 3 sherds) in III. Walls are primarily incurving in all strata but straight makes a moderate show in II and III. There is a nice pattern of increase and decrease in the two attributes throughout the deposit. Bases are mostly flat in II but are about one-third rounded in I and totally rounded in III. Possible use is totally cooking.

Paste is fine, increasing from 40% in I to 72% in III. Medium is less important but moderately strong in II, while extra fine is at its percentage peak in I. Coarse is rare in II alone. Temper material is largely sherd throughout; sand and sherd mixed are secondary. Temper size is, with a single exception, fine. Temper quantity is light primarily and medium secondarily. Measurements indicate that the thickest sherds, widest rims and second largest vessel diameters were from stratum I. The smallest are from III.

The impression cannot be resisted that we have here the record of a single lightly changing occupation. As is often the case, the central parts of the deposit are out of step. This may reflect a longer period, perhaps incorrectly divided by my stratigraphy, during which cultural and physical success was most intense. There is no doubt mixture of sherds from the earlier and later times, perhaps essentially throughout, but there can be no doubt that all are associated with terrace life and immediate thereafter. Because of the mixture, the thickest part of the deposit with the most sherds (stratum II) was most variable in all attributes except those that remained constant throughout: temper material and quantity, wall shape, use, firing, and surface decoration.

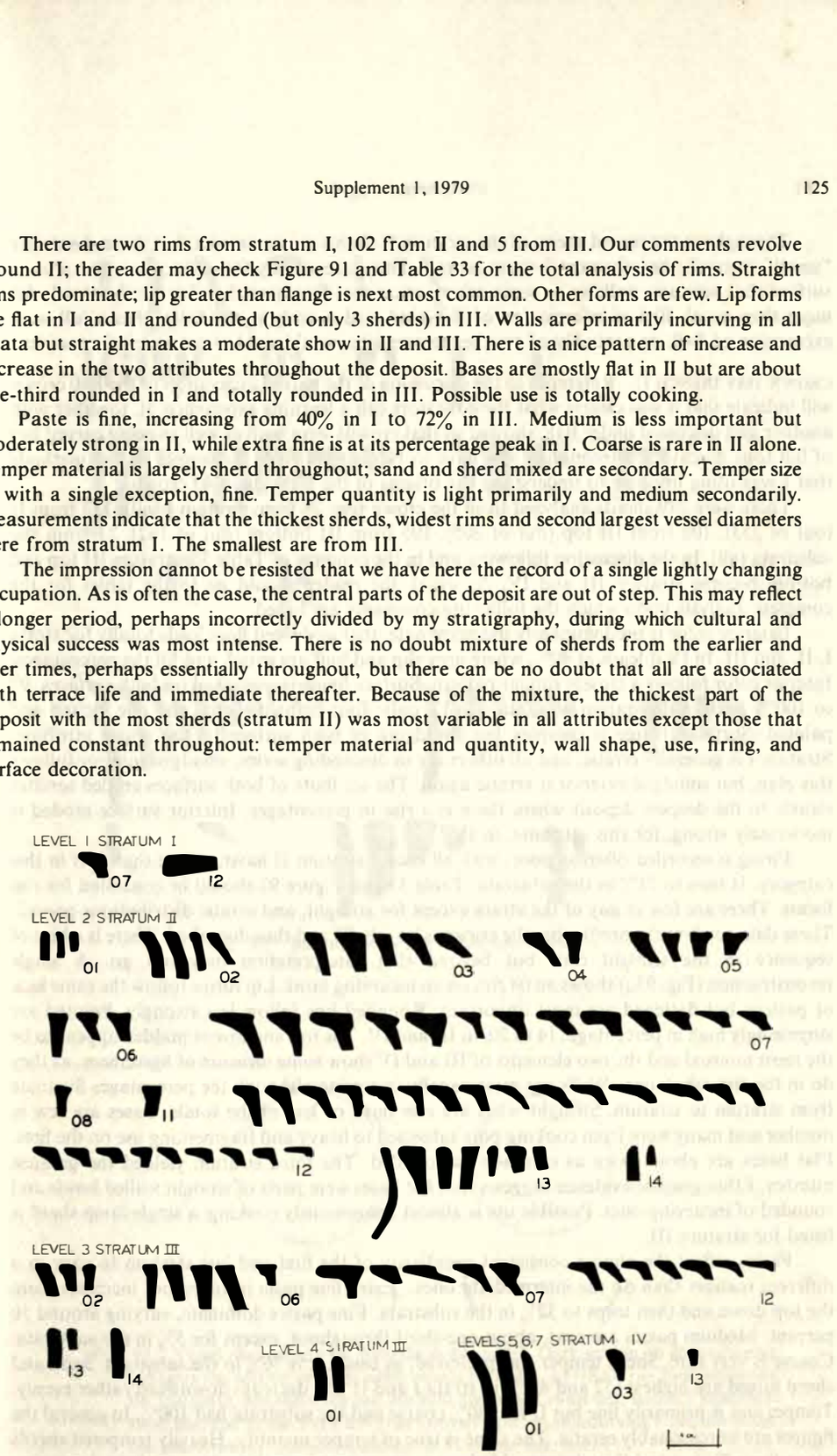


Fig. 91. Babeldaob 40 rim forms, test pit 5

Throughout the record sheets of the stratum II sherds are comments that these sherds are "small" "worn" "heavily worn" "very worn". These are mainly from the pavement area, a surface that saw use, walking or some other action that fragmented and wore the sherds far more than usual. Bits of information of this kind lead quickly to the belief that a full scale excavation of B40, or probably of another terrace site, would yield impressive information.

CROWN TEST TRENCH 1: Reference to the discussion of the partial excavation of the B40 crown will indicate that it was clearly what the educators call a learning experience. It, together with another unit discussed under B18, showed us that crowns were built as well as being carved out of hill tops. Excavation techniques will have to be changed from the simple testing methods that I was using in order to understand the origins of the Babeldaob 40 crown.

There were 389 sherds analyzed from the crown test: 28 from stratum I (all); 133 from II (out of 253); 102 from III top (out of 205); 105 from III bottom (out of 182); 21 from the substrata (all). In the discussion following and in the columns of Table 33, stratum III top and bottom become stratum III and IV. As usual, the reader should go to the tables for the complete analysis upon which the following comments are based.

Exterior color is predominantly indeterminate; that aside, red float leads totally for strata I, II, and III. In IV it leads at 40%, where grey slip and buff are equal, and fill the percentages. Interior color follows a closely similar pattern. Surface finish is smoothed on both surfaces, 97 to 100%. Surface decoration was found in IV only; four painted sherds and one incised and painted. Surface change is complex but smudging of both surfaces is the major attribute. Stratum I is generally erratic, and all others are in descending series; smudged interior follows this plan, but smudged exterior is erratic again. The attribute of both surfaces eroded seriates clearly to the deepest deposit where there is a rise in percentages. Interior surface eroded is moderately strong, for this attribute, in IV.

Firing is recorded often as poor, with all except stratum II having more than half in this category. It rises to 71% in the substrata. Table 33 and Figure 92 should be consulted for rim forms. There are few in any of the strata except for straight, and erratic distributions prevail. These data confirm the profile that the crown is largely fill and thus disturbed. There is a hint of sequence in the straight rims but beyond that interpretation may not go. A single reconstruction (Fig. 93*a*) shows an 04 rim on an incurving bowl. Lip forms follow the same lack of pattern but flattened are most important. Rounded lips follow less strongly. Pointed are surprisingly high in percentage, 14 to 20, in III and IV. The top and lowest midden appear to be the most unusual and the two elements of III and IV show some measure of agreement, as they do in the rim tabulation. Walls are most usually incurving although the percentages fluctuate from stratum to stratum. Straight walls are one third or less of the totals. Bases are few in number and many were from cooking pots subjected to heavy and fragmenting use on the fires. Flat bases are about twice as common as rounded. The third stratum yielded the greatest number. Ethnographic evidence suggests that flat bases were parts of straight walled bowls and rounded of incurving ones. Possible use is almost unanimously cooking: a single lamp sherd is listed for stratum III.

Pastes reflect the almost consistent peculiarity of the first and last stratum to vary in a different manner than do the intermediate ones. Extra fine paste is minor but increases from the top down and then leaps to 52% in the substrata. Fine pastes dominate, varying around 50 percent. Medium pastes are next, about one-third throughout, except for 5% in the substrata. Coarse is very rare. Sherd temper was preferred, as usual; it is 76% in the substrata. Sand and sherd mixed are highest (52 and 42%) in strata I and II and decrease downward rather evenly. Temper size is primarily fine but II had 30% coarse and the substrata had 100%. In general the figures are unreasonably erratic. The same is true of temper quantity. Heavily tempered sherds range from 7% top to 14% substrata. Medium is strong except in the substrata; light dominates

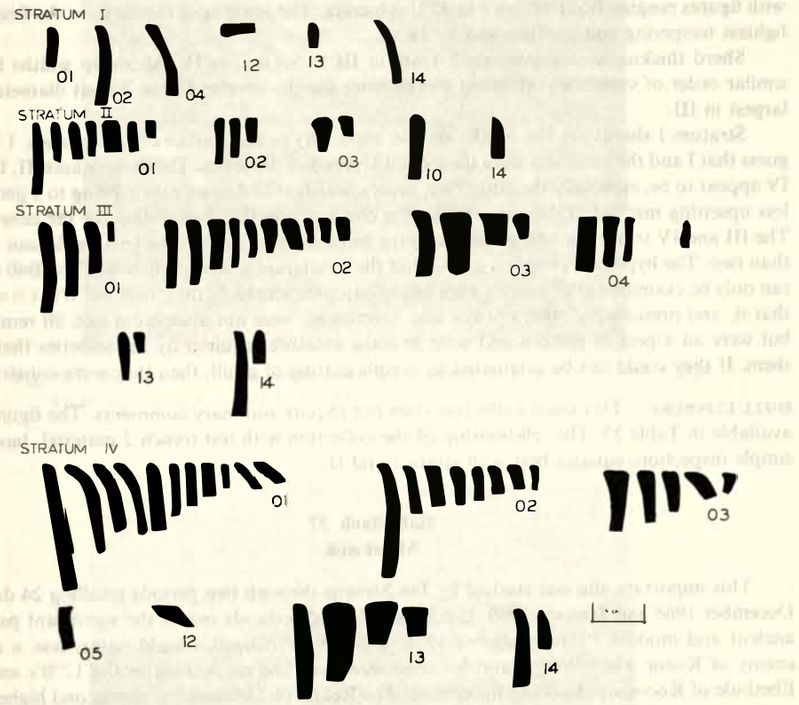


Fig. 92. Babeldaob 40 rim forms, crown test.

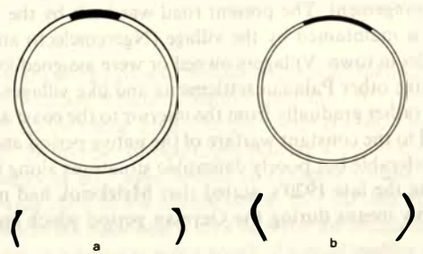


Fig. 93. Vessel reconstructions, Babeldaob 40 and 37. Dark section on circumference indicates rim section present; width equals lip width. *a* (1/B40) rim form incurving 04; fine paste, fine sherd temper, medium quantity. Crown test, trench 1 stratum I. Bowl diameter 32 cm. *b* (18/B37) rim form straight, on an incurving bowl; fine paste, fine sherd temper, medium quantity. B 37 village test, level 1.

with figures ranging from 41% in I to 67% substrata. The lowermost sherds have the finest and lightest tempering and are followed by IV.

Sherd thicknesses are average: 8.4 mm in III to 9.7 mm in IV. Mean lip widths have a similar order of variability, showing a preference for the simpler forms. Vessel diameters are largest in III.

Stratum I sherds are the most variable, especially in the surface characteristics. I would guess that I and the substrata were the most disturbed of the series. The three others, II, III and IV appear to be, especially the latter two, more consistent and to owe their being to a generally less upsetting method of deposition than the construction that I postulate for the other two. The III and IV strata are now assumed on the basis of sherd analysis to be a single unit rather than two. The hypothesis implicit in this and the stratigraphic interpretation of the B40 crown can only be examined after a larger excavation bares the secrets of the structure. What is clear is that it, and presumably other crowns and terracings, were not always cut and fill remnants, but were an aspect of pattern and were in some measure required by the societies that used them. If they could not be originated by simple cutting of a hill, then they were constructed.

SHELL EXPOSURE: This small collection does not require summary comments. The figures are available in Table 33. The relationship of the collection with test trench 2 material, based on simple inspection, equates best with strata I and II.

Babeldaob 37
Melekeiok

This important site was studied by Jan Stevens through two periods totalling 24 days in December 1968 and January 1969. It is large, old and certainly one of the significant parts of ancient and modern Palau (Osborne 1966: 242–249). Artingall, an old name, was a major enemy of Koror when Wilson and his crew were wrecked on Aulong in the 1770's and the Ebethule of Koror was building his empire. The Reklai of Melekeiok is the second highest, or perhaps the highest ranking person of all Palau. The village is presently stretched along an excellent roadway which runs north-south immediately behind the beach from the landing dock north.

The present physical arrangement of the village is said to be the result of the administration of Reklai Brael. During the 1930's, the Reklai took a trip to Japan and was impressed with the layout of streets and houses. After returning to Melekeiok, he decided to duplicate the street arrangement. The present road was built by the Palauans with some help from the Japanese. It is maintained by the village (Ngeremelech) and there are a number of motorcycles and bicycles in town. Villagers owned or were assigned living places along the way (Fig. 94). Melekeiok, like other Palauan settlements and like villages of many other islands of the Pacific, has moved rather gradually from the interior to the coast as European and Japanese domination put an end to the constant warfare of the native period and made it possible for the people to live in the preferable but poorly defensible situations along the coast. Hijikata (1956: 40) working the area in the late 1920's, stated that Melekeiok had moved to the coast "very recently". This probably means during the German period which ended with the first World War.

The narrow beach and back beach, where the road and the houses are built, is squeezed in between the tidal flats and the andesitic bedrock exposures and the rolling hills of eastern Babeldaob, many of which are terraced. The plan of this village is thus unusual since most Babeldaob towns extend inland from a landing place: Melekeiok parallels the sea. It is also unusually close to the eastern edge of the outer reef. A long dock, built with the aid of the Japanese and perhaps with the Germans before them, juts out to a small break in the outer reef,

Fig. 94. Babeldaob 37, view south down the roadway of major Melekeiok village. From near stone A; C and D at right.

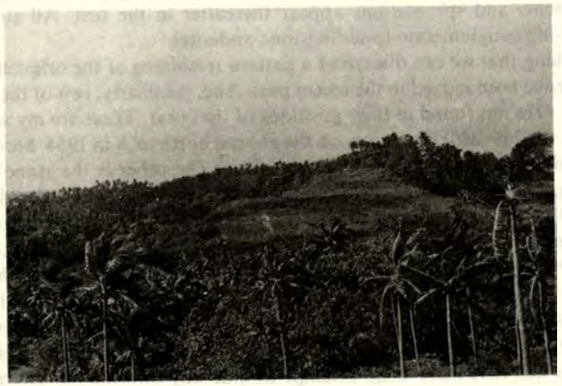


Fig. 95. Babeldaob 37 terraces above coconut grove.

artificially enlarged, so that the dock can accomodate larger craft than can travel within the reef over the tidal flats. Beach soils are Regosols Shioya shell sand (Corwin et al. 1956: pl. 18).

The terraces included, B37 is a huge area. The old village is a short walk into the interior. It is in heavy jungle now but the number of platforms indicate a site of magnitude and no doubt value. Archaeological studies at B37 were limited to (1) tests around and below the carved Great Faces in a central area close to the school house, and the description of the monoliths themselves; (2) midden tests in the back beach area between the stones and the school yard; (3) tests in a heavy midden area in a coconut grove south of a road leading inland to a small dam; (4) small excavations on the terraces above the coconut grove; and (5) preparation of maps.

Melekeiok provided the men for the field crew. The number of crew members varied from day to day as men went fishing, or quit to take jobs in Koror. As with other project sites, the rate of pay was 40¢ an hour for everyone but the foreman who was paid 45¢ an hour. A total of 714 hours were worked by a crew at a cost of $247.60 plus $42.50 for the foreman. The crew worked well together and each man did his expected share of the work. It is surprising how

quickly the men become adept at excavation using artificial levels. Excavation by levels was preferred by the crew over excavation by stratum, which was the technique used if the natural layers could be ascertained.

The Great Faces

There are eight of these spectacular carvings in the hamlet of Ngeremelech, most of them north and east of the school and close to the beach (Fig. 96). Another small stone of the same genre was found and set up high on the terraces. The concentration is definite and, while most of the stones have no doubt been moved from their original positions, the moving has been localized. This, when considered with the several evidences of heavy midden deposits in the immediate vicinity, can only mean that the settlement pattern at some archaeological time in the past was like that of today, or included a ceremonial and secular settlement near the sea at Ngeremelech. Probably there was a phase of cultural deterioration or of disintegration and the local inhabitants found it necessary to move elsewhere. During the latter days, at some time before contact, we know that the old interior village was in use. It is obvious that the modern population, which presumably descended from those who lived in the old village, may not be intimately connected with the carvers of the monoliths, the terrace builders, or those who deposited the midden. Most of the objective data concerning the carved stones can be found in Table 13. Comments and speculations appear thereafter in the text. All stones are either andesite or andesitic conglomerate (puddingstone andesite).

There is nothing that we can discern of a pattern remaining of the original placing of the stones. C and D have been moved in the recent past. And, peculiarly, two of the stones which I observed in 1954 were not found in their positions of that year. These are my seventh stone, a broken Great Face (1966: 245) which was on the ground north of A in 1954. Stevens did not see it and I neglected to check when I was in the village. The other is the stone which Stevens designates H (Fig. 97) which he found recumbent in the woods on the south side of the school house grounds. He erected it, facing northeast. In 1954 I saw a carved stone Marngachui (probably Mangachui, the eater of hair, an oft-encountered mythical name) recumbent on the north side of the school house grounds (1966: 254–5). I was hurried, forgot to take measurements and my black and white film stock was low. I photographed it in 35 mm color and we left the area. An examination of the slide leaves no doubt that Stevens' H is my Marngachui. Yet the Rubak Sacharuleong told Stevens that H was not Marnguchui. My analysis of this is not that there is an attempt to hide any information concerning esoteric aspects of Palauan culture but a supreme disinterest in such things on the part of a people who are ahistorical in orientation.

It adds up then, to the fact that a broken Great Face which I saw was not located, one of my stones was moved, and Stevens found two which I did not see, E and G. A final discrepancy is that I recorded Obadbusch, the Trumpet Holder or Trumpeter, as Stevens' stone D. Hijikata (1956: 41) made the same recording as I did. Yet Stevens more thorough researches assigned this name to E, which I did not see. I believe that this can be explained on the grounds that E which was nearly wholly buried when found, had been completely lost as far as the people to whom Hijikata and I talked were concerned and that only the name remained. Our informants gave this to D, which is now nameless again. The alternative is equally possible: there is no true association of name and stone. There is an interesting bit of instruction here recorded in the vicissitudes that have beset these huge carvings in a small village. They have been moved, been lost and found, have undergone name shifts and sundry defacements in the short period between 1954 and 1969. Granted, this has been an active period of acculturation at Melekeiok but if it is multiplied by a number of years one has cause to wonder that there is any archaeology at all remaining. In spite of repeated attempts Stevens was never able to add to the few ethnographic data which I have recorded concerning the carvings. Most generally, they

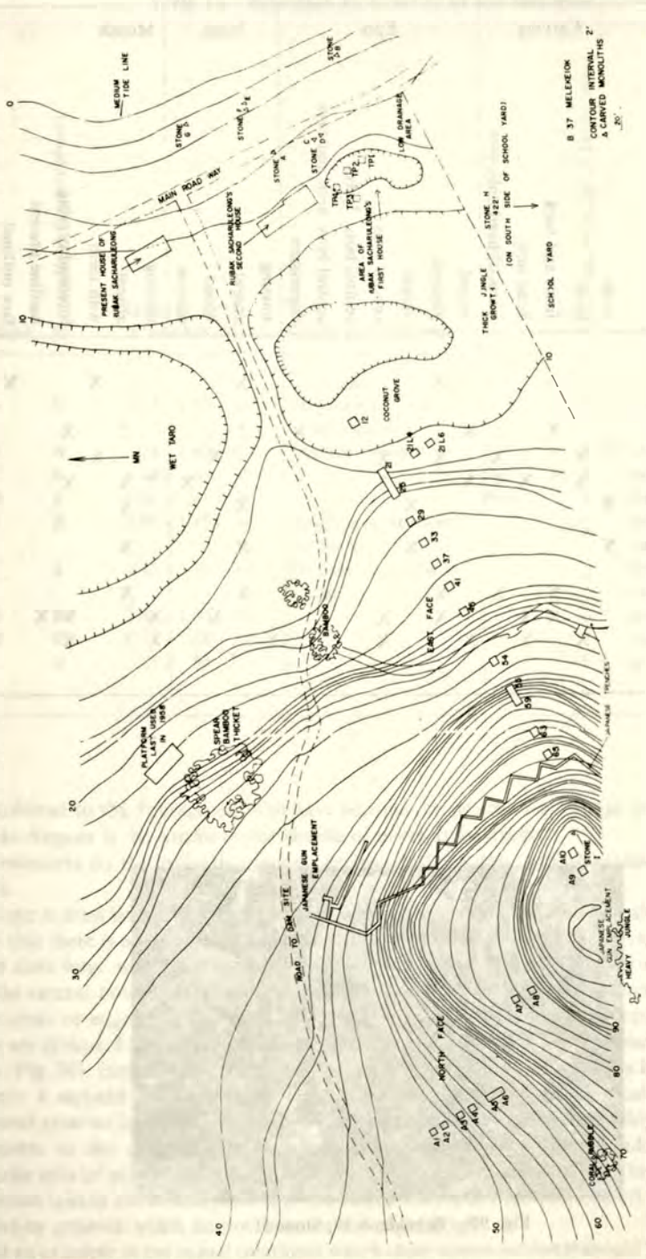


Fig. 96. Babeldaob 37, Melekeiok village area and site map.

Illustration	Carving					Eyes						Nose				Mouth						
	none	front	front and back	head only	parts of head only	round	almond	absent	central boss	central boss, 3 rays	central boss, arch and rays	depression	missing	absent	broad	narrow	missing	absent	with teeth	forehead carving	hairline present	face outlined	other carvings
(Figures)																						
98–99			X				X			X				X					X			X	X
100–101			X			X						X		?				?		X			X
102		X	?	?	X		X		X						X				X				
103		X	?	X	?	X			?			?				X	?	X		X			X
104	X							X						X				X					
104	X							X						X				X					
105, 107			X		X		X				X			X				X					
97			X	X			X		X						X		X			X	X		X
106		X		X	?	X			X				X				X	?		X			

Fig. 97. Babeldaob 37, Stone H.

Table 13. Babeldaob 37. Great Faces and monoliths.

Stone	S (standing) R (recumbent)	Height × width × thickness (m)	Name and meaning	Original direction of face	Condition on scale of 10: 1 = new;	Location
A	S	2.93 × 1.83 × .85	Odalmelech: God of the village	East	6	roadside
B	R	2.74 × 1.40 × .92	Iwaiuch; Sleeper		8–9	beach
C	S	1.04 × .67 × .37		East	7	roadside
D	S	1.01 × .61 × .37		East	8	roadside
E	R	1.95 × 1.25 × .49	Obadbusch; trumpet holder			between beach and road
F	S	1.46 × .76 × .88	Orrengeschais, the listener			between beach and road
G	R	1.46 × 1.04 × .82			6–7	northernmost
H	R	1.19 × .64 × .58			7	south of school
I	R	1.01 × .64 × .21			8–9	on terraces

are attributed to the Portuguese, who have become the origin of all things inexplicable here; much as Angaur is the source to the people of north Babeldaob.

Comments on the individual stones, exclusive of the data and observations in Table 13 follows.

Stone A must be the most complete example of the Great Face extant: it also demonstrates clearly that there is easily observable variation in the carving of each. The eyes carry a central boss in their huge sockets, presumably the eyeball, but ridges of stone, the rays, spread out from the central boss down toward the nasal area, up to the eyebrow region and out to the outer corner or edge of the eye (Fig. 99). The three teeth and fangs and exterior pits of the mouth are typical. Excavation of the base revealed more detail than other such carvings have shown (Fig. 98). Instead of the opposing cut-out indentations which (it has been postulated) represent a stylized quadruped, below the mouth, there are two vertical and two long horizontal grooves and two pits above the vertical grooves which presumably have the same significance as the more abbreviated features on the other stones. In addition there are triangular cuts or pits at the sides, which may or may not be pertinent. This more complex delineation fails to aid in interpretation but, rather, leaves us even more bereft. The face area is outlined by grooves which do not show in the photograph.

As an example of the casual treatment which these stones receive it should be recorded that Stevens found Stone A daubed with grey paint, as if someone had cleaned a paint brush on it.

Fig. 98. Stone A, lower two-thirds of carving with foot excavated and exposed.

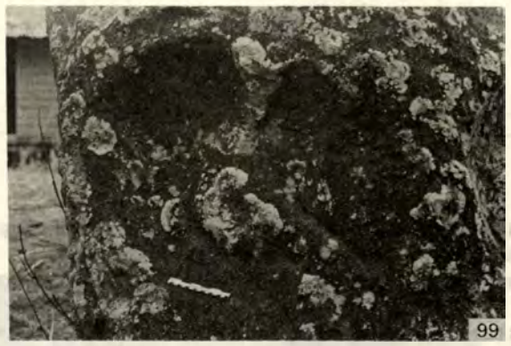


Fig. 99. Stone A, right eye detail.

He cleaned it, trying gasoline and finally using the pumice or light vesicular scoria which is available on most beaches. He also noted the name Mano carved on a side of the monolith.

Face B. Iwaiuch, the Sleeper, was more available in 1969 than it was in 1954. The offending trees have been removed (Fig. 100). This Great Face has large open socketed eyes (Fig. 101) an impressive supraorbital torus and a complexity of carving or erosion of the upper part of the head that defies interpretation except that a double rounding on the top may suggest a coiffure. The mouth parts must have been cut shallowly, they are barely discernable. The structure below them is more conventional than it is on Stone A. The base is rounded in a most unusual manner (Fig. 100). This stone is made of hard, solid andesite; carving with stone tools must have been a tiring task. The weight and situation, on the beach, discouraged efforts to place it upright. It still sleeps.

Fig. 100. Stone B cleared, head to left.

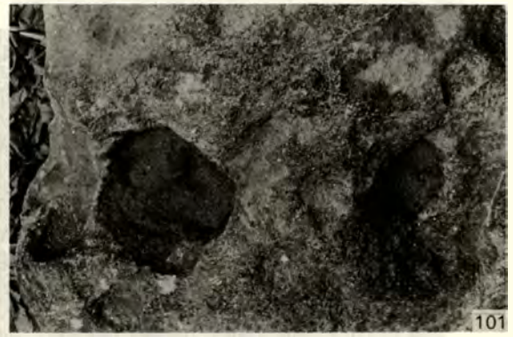


Fig. 101. Stone B, eye socket detail.

Stone C, nameless, is sadly eroded (Fig. 102). Its forehead has been marred by the name Mano, cut in large block letters across it. The same honor has been accorded Stone D and has been recorded for A. It was discovered that this is the name of a village youth for whom this added carving must have been an act of love. The peculiar side position of these eyes suggests an almond shape; all of the usual characteristics of carving are present but they are so thoroughly eroded that they would not record photographically without special lighting.

Stone D is atypical. Instead of the eye sockets and eyeball boss and the elaborately toothed mouth, there is a seeming merging of forehead area and toothed area so that a stylistically reduced representation of a face appears. There are two elongated downward pendant bosses, one on each side. These may be the malar area. Within these is a pair of deep vertical grooves terminating abruptly at the forehead, apparently delimiting the eye sockets. The latter are separated by an elongate, vertical, slightly downward flaring ridge which could be nasal (Fig. 103). Unfortunately the base was not excavated to determine whether or not there were lower carvings. We have no suggestion as to the temporal or representational placement of this stone as compared to the others. The forehead of this stone, too, has received Mano's unfortunate alterations.

Stone E is apparently the true Trumpeter, Obadbusch. It was moved so that all surfaces

Fig. 102. Babeldaob 37, Melekeiok. Stone C, eye area detail.

Fig. 103. Stone D, left side, eye and nasal groove.

Fig. 104. Stone E, left and F, right.

could be examined and, when no carving was found, was returned to its original position. It and its twin F are probably near their original positions (Fig. 104). Stone F, associated with the preceding (also in Fig. 104) is also named. We assume that it is pertinent that the Trumpeter and the Listener were standing side by side.

Stone G was not seen in 1954: in 1969 it was all but covered by beach sand, and the roots of a coconut tree said to have been planted in 1957. Local people had no recollection of it. It is a rectangular block; the two unusually formed eyes are the only carving remaining of the face. It was set up facing northeast (Fig. 105). The unique treatment of the eye area as illustrated in Figure 107 shows clearly the oval or almond shape, the central boss and ray leading up and out to the forehead and the curving arch which unites the lower borders of the boss and the lower inner border of the eye socket or depression.

Fig. 105. Stone G, back, showing unusual shaping.

Fig. 106. Stone I.

Fig. 107. Stone G, detail of left eye.

Stone H has been discussed above and the history of its last move recorded as well as may be. It is of dense andesitic pudding-stone, like others of Melekeiok, of a generally better quality than the material used at B18. The carving is surprisingly naturalistic (Fig. 97); there is a definite hairline and eyebrow ridging, not elsewhere observed. The eye sockets are huge with a central boss. That of the right eye makes use of an included "puddingstone". The nasal area is marked by a single nostril; the alveolar region is huge and flaring. This tapers down centrally to, presumably, the central tooth, and the remaining carved structures of the mouth and any below it are missing. The impression is that, like Stone B, these were not accentuated in the original carving. The basal parts are broken away.

Stone I was found with other, probably platform, rocks which had apparently been removed when Japanese soldiers set up a gun emplacement on the summit of the terraces that we investigated (Fig. 96). It was also set up facing east. Erosion is advanced, but the photograph reveals (Fig. 106) evidence of some treatment of the forehead, the presence of eyes with bosses. The mouth area must remain undescribed.

It is frustrating to leave the carved stones of B37, as it will be of B18 without being able to draw conclusions or interpretations or set up a typological system with some defensible validity which could be tested against time and place. There is certainly variation between the individual carvings at both places and between the two groups. There is also a probably important difference in material. The B37 carvings are, as a whole, larger and more impressive. They are more variable and, thanks to H and A, more detailed and naturalistic. Certainly there is no doubt that the Great Faces of both areas belong to the same tradition.

The excavations

Four different archaeological zones were tested: (1) the village test pits, (2) the coconut grove, (3) the east face of the terraces, and (4) the north face of the terraces. These will be described in this order; all are shown on the site map (Fig. 96).

THE VILLAGE TEST PITS: The numerous minor excavations in the village itself in the Shioya soils were mostly concerned with exposing the carving or footings of the standing monoliths, or clearing or moving those that were recumbent. None were stratitests. There were four pits dug in an area which showed on the surface to be fairly heavy midden, and which had been recommended by the original survey on the basis of this and locally gathered information (Osborne 1966: 245).

The profile of pit 3 is typical (Fig. 108) although in pits 1 and 4 the midden band was not

readily divisible into two layers. The pits were carried to a depth of .91 to 1.1 m which penetrated sterile beach sand, here the subsoil. The humic root mat band in pit 3 was shallow, only 6 to 9 cm in depth (in pit 2 it was twice this). This was followed by a layer 18 cm deep of sandy midden and coral mixture; very possibly it had been treated artificially in order to secure more rapid drainage for living use. Next came a dark clayey heavy midden 21 cm deep, then 27 to 30 cm of midden in a reddish clay soil. There was a mixed zone of midden with light clay and sand 9 to 15 cm thick. This led quickly into the sterile sand.

It would appear that this is a soil column related to that which develops on the terraces. The red and darker clays reflect the amounts of vegetal and cultural organic materials incorporated in the soil as clayey sediments from the adjacent hills to the west, terraced or unterraced, were mixed with the organic deposits. No evidence of structures was encountered.

THE COCONUT GROVE: "Coconut Grove" is the area referred to as "heavy midden" in the survey report (Osborne 1966: 248). It was one of the Melekeiok sites that seemed to require investigation. The midden was heavy but shallow. A band of dark humic material 18 cm in average thickness was first removed; there was then 43 to nearly 60 cm of midden mixed in red clay (Fig. 109). The latter indubitably is derived from the terraced hills either by wash and deposit, presumably during a period of maximal use, or was derived from the lower clays at the toe of the hills, or both. Collections from the coconut grove were large and included a large number of decorated sherds. Moisture and carabao, which go together, made work in these tests difficult. The soil here is heavy, poorly drained organic clayey alluvium (Corwin, et al. 1956: pl. 19).

A 7.6 m trench (Fig. 110), 1.5 m wide, was initiated in the relatively level sediments of the grove and moved on up the terraces. A first square and about 30 cm of the second showed the same profile as the tests in the moist coconut lowland. Beyond that, uphill and up terrace, the

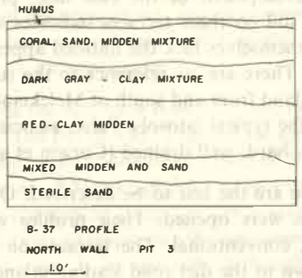


Fig. 108. Babeldaob 37, profile of test pit 3, north wall.

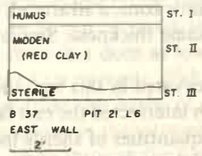


Fig. 109. Babeldaob 37. Profile of pit 21L6, coconut grove, east wall.

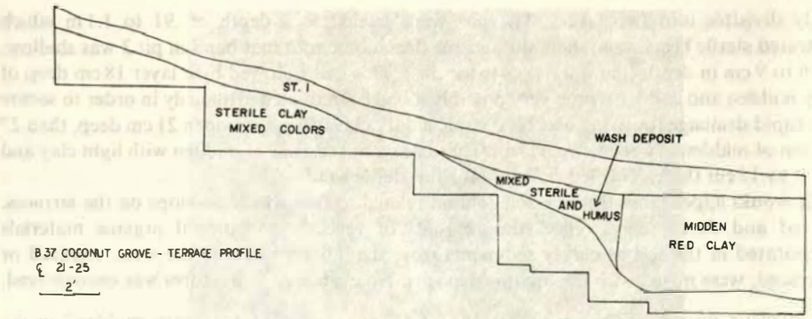


Fig. 110. Babeldaob 37, coconut grove and adjacent terrace; profile along CL 21–25.

profile quickly becomes typical of that area. The test was excavated by levels, later grouped into strata for discussion.

TERRACE TEST, EAST FACE: The east face terrace tests (Fig. 95) were a long line of 1.5 m squares continuing the coconut grove centerline. A square was excavated approximately every 6.1 m except where disturbance due to Japanese war preparations required a change in placement. The profile is simplicity itself. There is the usual humic root mat, stratum I, generally some 18cm thick; then in some parts of the profile a culturally weakened thin 6 to 9cm thick reddish clay zone, which should correspond to stratum II of other terraces and near terrace profiles (B40, B18). The next element is the sterile clay. The culture bearing stratum I and the red zone merge rather quickly into the sterile mineral soil. There had been recent tillage there. Figure 111 illustrates the soils of this trench high on the terrace some 15 m above the coconut grove area. It appears to be typical soil development of the east face; presumably the thin to absent development of stratum II B soil on these terraces indicates a short period of use by their builders. Indeed, the terraces themselves lack the finished appearance that is characteristic of others, such as B40 and B10. There are, as reference to the survey volume will show, other terraces in the vicinity, both inland from and south of Melekeiok, which are finished-to-classic in outline. Here the soils are the typical latosols, Palau association soil 1, red lateritics from volcanic rocks. They are deep, hard, well drained (Corwin et al. 1956: pls. 19, 30).

THE NORTH FACE TESTS: These are the last to be described. Other test pits on and near the highest points of the terraces were opened. Their profiles were thin and insofar as this excavation unit is concerned, conventional. The terraces on the north face are deep and relatively level; they slope down to the dirt road leading inland to the dam area. A series of 1.5 m squares in line plumbed the two major terrace steps (Fig. 112). Two squares, A5 and A6, were joined to result in a 4.5 by 1.5 m trench. An area of heavy sherd concentration was discovered in the north part of A6 and the unexcavated space between A5 and A6 was removed in the vain hope that a feature might be found. The profile is rather more developed than others on the terraces. There is the usual humic zone, a stratum I, 12 to 30cm thick and a light midden in light brown clay with about the same thickness. Sterile clay appeared throughout at about (or less than) 61 cm.

A total of ten squares were excavated in this test; they were placed as nearly as the land conformation allowed in a line which intersected the east face centerline at 90° on the top of the terrace. All test pits yielded goodly quantities of sherds indicating a somewhat more intensive use of this part of the terraces than of the eastern part. The area may also have been well used in

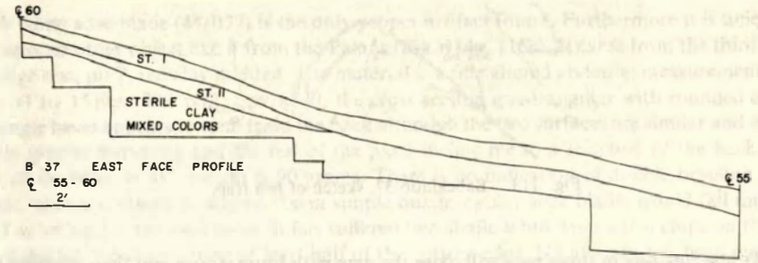


Fig. 111. Babeldaob 37, east face profile along CL 55–60.

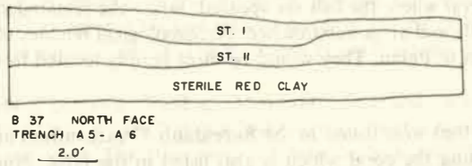


Fig. 112. Babeldaob 37, profile of trench on north face of terrace.

the same way by the Japanese. Stevens found the much rusted fragments of a huge rice cooker there, and a Japanese coin dated 1939 was found in level 1 of test square A4. More amazing was the discovery of an expended 50 caliber shell in the third level of the same test that yielded the coin. Fortunately this evidence of disturbance was not encountered elsewhere. A large number of stones on the top terrace, where stone I was found, might have been the remnants of a platform although there was no structural evidence.

THE FISH TRAPS: Fish taps inside the reef have been seen, though perhaps not recognized, by most persons who have flown in and out of Yap. They are, or some of them are, still in regular use on that island where they remain an undescribed aspect of Yapese culture. I was surprised indeed to observe them in the water off Melekeiok from a flight into Palau. I passed the word to Stevens who secured a few data concerning them. Inquiry revealed that they were known, but little used in Palau and the Melekeiok examples are the only ones that I have seen (see Krämer 1926: 81). Only one, near the pier, is in use now although the informant, the Rubak Sacharuleong, said that when he was a boy (he was approximately 78 then) many were in use. Each household or extended family group had access to one and they were permanent property because of the large amount of work required in their construction.

Figure 113 is an idealized sketch of a Melekeiok fish trap. The object was not mapped. Rocks were stacked, using the material available on the tide flat and the adjacent reef, to make a strong outlining wall high enough to be out of water at low tide. An area near the reef is chosen where water remains two or three feet deep at low tide. The point of the arrowhead outline is out to sea and the open gate (A) is opposite. Fish following the tide out are deflected by the wings which extend landward from the barbs of the arrowhead and find their way between the walls of the trap. They continue in the attempt to follow their seaward course but are unable, except for very small fish, to go through the walls. Few fish turn against the tide to go out the gate and around the wing walls.

Fig. 113. Babeldaob 37, sketch of fish trap.

At low tide one to three men will close the gate with loose stones and then, starting from the reef side, they drive the fish through the small opening into the spearing trap, through the opening at B, close this with rocks and spear the fish. Such work is done either by night or day although the former time, using coconut frond torches was preferable. Even turtle and small sharks were taken. The Palauan terminology recorded is *bens* (*peng* in Krämer) for fish trap; *ilalik*—the final corral where the fish are speared; *imal*—the remainder of the structure. *Imal* means literally hands and arms outstretched. Archaeological remains of these structures must exist in many places in Palau. They would be most readily located from the air.

Shell debris

The few shells that were found in the Babeldaob 37 excavations are listed below. All are useful forms including the coral which is also listed in the table. Numbers are too few for interpretive comment although it should be stressed that nearly all of the shells were found in the village tests where the limey environment contributed to their preservation. They were rare on the terraces, where soils are acid and were not found uphill beyond test square 37.

Village test pit 1, level 2: *Lambis lambis* (1), *Hippopus hippopus* (1). Level 3: *Conomurex luhuanus* (1), *Lambis lambis* (1), *Hippopus hippopus* (1), *Tridacna maximus* (1), *Anadara scapha* (3). Level 4: *Conomurex luhuanus* (e), *Lambis lambis* (1), *Cassis cornuta* (1), *Hippopus hippopus* (1), *Tridacna maximus* (1), *Codakia punctata* (1). Level 5: *Tectus maximus* (1), *Lambis lambis* (5), *Lentigo lentiginosus* (2).

Village test pit 2, level 4: *Tectus maximus* (1) *Conomurex luhuanus* (5), *Lambis lambis* (1), *Turbo* sp. (2), *Hippopus hippopus* (1), *Tridacna maximus* (1). Level 5: *Conomurex luhuanus* (9), *Cypraea tigris* (1), *Anadara scapha* (1).

Village test pit 3, level 1: *Conus pulicarius* (1), *Tridacna gigas* (1) Level 3: coral (1). Level 4: *Tectus maximus* (2), *Conomurex luhuanus* (1). Level 5: *Lambis lambis* (3), *Hippopus hippopus* (1). Level 6: *Conomurex luhuanus* (5).

Village test pit 4, level 4: *Conomurex luhuanus* (6), *Lambis lambis* (1), *Turbo* sp. (2), *Lentigo lentiginosus* (1), *Cypraea* sp. (2), *Anadara scapha* (1), *Fragum fragum* (1).

Under stone F: *Lambis truncata* (1).

Test square CL 21, level 1: *Conomurex luhuanus* (1), *Lentigo lentiginosus* (1), coral (2).

Test square CL 25, level 1: *Lambis lambis* (1), *Turbo* sp. (1 operculum), *Atactodea striata* (2).

Test square CL 37, level 1: coral (1).

Gastropods are best represented with *Conomurex* leading all (37 specimens), *Lambis* follows (16), then *Lentigo, Cypraea* and *Tectus*. Pelecypods are led by *Anadara* (6), then *Hippopus* (5). There were 4 coral fragments.

The artifacts

Babeldaob 37 was no more prolific than the other Babeldaob sites insofar as nonceramic remains are concerned. Indeed, there are only five, so the pieces may be described individually, rather than resorting to the sterile efficiency of tabulations.

A stone adze blade (44/B37) is the only proper artifact found. Furthermore it is unique: I have seen no other object like it from the Palaus (Fig. 114*a*, 116*a*). It came from the third level of village test, pit 2, red clay midden. The material is a fine altered andesite: measurements are 74 by 41 by 15 mm. The poll is rounded, the cross section quadrangular with rounded edges. The single bevel appears to stem from the back although the two surfaces are similar and only a slightly greater flattening and the feel of the piece incline me to a selection of the back. The angle of the bevel is 45°; weight is 90 grams. There is no indication of double beveling. This artifact, almost a classic southeast Asian simple quadrangular adze blade, would fall into my type 3 as set up for the shell tools. It has suffered two shallow but destructive chips on the left side of the bit, wholly marring at least half of the cutting edge. No attempt has been made to alter the pit and resharpen. Gifford (1959: pl. 37*a*) illustrates a stone adze blade of the same type but of hornblende schist or amphibolite from Yap.

Two small pieces of a fine grained limonitic stained light yellow pumice (62/, Fig. 114*e*; 10/) and a larger piece are rounded and smoothed. The material is sharp and hard and the implication is that all of these pieces have seen use as files, abraders or polishers. Item 62/ is 78 by 45 by 41 mm; weight 22 grams and the two smaller pieces of 10/ are 31 by 21 by 11 mm, 1.8 grams and 28 by 20 by 16 mm, 1.7 grams. The three pieces are from the village tests 4 and 2, level 4.

There are two pieces of hematite: 38/ (Fig. 116*f*) from village test 3 level 3, is triangular in cross section, 28 by 19 by 17 mm, weight 9 grams. It shows wear facets and appears to be part of a stick of concentrated red ochre. The other piece is a deep red hematitically stained chert. All surfaces are the natural crust except one end where four flakes have exposed the rich chocolate red of the interior. Other than the flaking which may not be artificial, the piece shows no evidence of human attention. It is 35 by 35 by 16 mm, weight 24 grams (Fig. 116*b*).

Mineral samples

There are four pieces of stone which show no certain evidences of cultural alterations. Two, 46/ and 48/ (Fig. 116*g*), again from level 3, village tests 2 and 4 respectively, are of a clear white finely laminated aragonite. Both pieces are etched and pitted by acid action. Evidences of artificial shaping cannot be defended although they may be present.

Fig. 114. Babeldaob 37 sherds and other artifacts. *a* (44/B37) edge view of adze blade 7.4cm long. plan view fig. 116 *a*; *b* (9/) modeled sherd, strap handle or annular base; *c* (72/) modeled sherd; *d* (86/) sherd from unknown fabric; *e* (62/) yellow sharp pumice; *f* (part of 24/) drilled sherd; *g* (124/) worked sherd; *h* (37/) worked sherd; *i* (135/) rim broken from last coil of vessel; *j* (part of 24/) punch decorated sherd.

Fig. 115. Babeldaob 37 unusual sherds. *a* (134/) with impressed stylized human figure; *b* (36/) worked; *c* (part of 24/) with stab-and-drag punching; *d* (part of 40/) with incised and painted designs; *e* (64/) sherd, and rubbing above, with impressed design; *f* (93/) carved with modified *kim* design; *g* (142/) with crude incised cross hatching; *h*, lamp spout, drilled; *i* (107/) carved with modified *kim* design. *d* is 43 mm long.

Fig. 116. Babeldaob 37 miscellaneous artifacts and unusual sherds. Aulong 1 sherd. *a* (44/) plan view of andesite adze; *b* (137/) hematitic chert; *c* (131/) chalcedony fragment; *d* (58/Aul) rim sherd with carved cogs; *e* (part of 40/) sherd with carved *kim* design; *f* (38/) red ochre; *g* (48/) white aragonite; *h* (part of 106/) sherd with punched hole; *i* (part of 106/) painted sherd; *j* (88/) thickened rim sherd, red washed. *a* is 7.4 cm long.

131/ from level 3 of the north face test is a tongue-shaped piece of hard patinated chalcedony 37 by 40 by 19 mm. It is broken but comes to a wedge-shaped terminus of the rounded edge opposite the break where there are a number of small side-flake scars. I believe it to be a part of a rough stone tool but cannot be certain (Fig. 116*c*).

Table 14. Babeldaob 37, worked sherds

Catalog number	Provenience	Length × width × thickness (mm)	Outline shape	Comments, illustration
30/B37	village test pit 2, level 2	45 × 30 × 8	rounded, rectangular	fragmentary
35/	village test pit 4, level 1	— × — × 11		fragmentary
36/	village test pit 3, level 3	25 × 24 × 8	circular	smudged exterior, Fig. 115*b*)
37/	village test pit 3, level 3	— × 32—21	tongue shaped	fragmentary, made on thickened rim, Fig. 114*h*
41/	east face test square 1, level 1	— × — × 12		fragmentary, probably ovoid
42/	east face test square 1, level 1	30 × 21 × 8	rounded rectangular	smudged exterior sherd
43/	east face test square 1, level 1	— × — × 7		fragmentary, probably circular
90/	coconut grove stratum I	32 × 30 × 8	rounded square	smudged exterior
124/	north face test level 4	70 × 35 × 9	elongate, pointed ovate	appears to have been a tool, possibly a pottery scraper, Fig. 114 *g*

A last fragment of stone is a small sherd of a geode or quartz vein with a crowded stratum of crystals set in a chalcedonic base (68/). It came from level 1 on the east face. There is no evidence of artificial treatment.

Ceramic artifacts

Here are described worked, decorated and unusual sherds. Many of these objects can yield no cultural information of substance because their use is unknown or because work elsewhere has yielded no counterparts for comparative purposes. All are worthy of record.

Worked sherds occur in all levels in the village test, coconut grove, and the north face test. These are the areas of most intensive occupation as judged by the heaviest or most fruitful deposits. All are redware or smudged. The nine examples can best be presented in tabulation (Table 14).

Drilled sherds are not numerous: 5 were found, three in the top levels or stratum and two below into the second. Three holes are biconical and are a centimeter or so below the lip of their vessels. One (105/, Fig. 115*h*) is broken from the heavily smudged end of a lamp spout. It has a simple conical hole and, presumably having been drilled within a spout, could not have been approached from the inner side. Another (24/, Fig. 114*f*) is undistinguished. The last sherd with a biconical hole is a wall sherd although it may have been near the rim. Although these holes show no wear, it is assumed that they were for suspension.

A single punched hole, made with a square tool is 2 cm below the lip of an interior painted sherd (106/, Fig. 116*h*).

Modeled sherds are modestly represented: there are only three but two of these do not present enough of the modeling to give more than a hint of the original character of the work.

9/B37 (Fig. 114*b*) is either a hand grip or handle or an annular base. The curve of the structure, added to an essentially flat wall or bottom sherd, dips at one end; the other end is broken. We are therefore unable to determine whether it is a handle or base. The piece is 15 mm high by 70 long. 72/ is a most unusual sherd; it carries an L-shaped exterior modeled ridging 12 to 15 mm high but a scar on the left of the vertical suggests further extension on that side. The sherd is smudged, indicating cooking use or firing in an oxygen poor atmosphere (Fig. 114*c*). 86/ (Fig. 114 *d*) is a sherd which we cannot place, even through conjecture, as to derived vessel form.

The major interest of 135/ (Fig. 114*i*) lies in that it has broken free from the remainder of the vessel. It is a rim 34 mm wide with an exterior flange and no inner lip: the rim severed from the body of the vessel retains the groove of the preceding coil, showing that the flange was formed of a single very heavy coil of clay melded, in this case incompletely, to the body of the pot.

Impressed or stamped, carved or otherwise texturally decorated sherds are rather striking in their variety. 64/ (Fig. 115*e*; east face, level 1) is surely stamped. The design is baffling; it is poorly impressed and vague. We illustrate it with an almost equally poor rubbing, the best of a dozen attempted. It appears to be tree-like or thunderbird-like or dancing figure-like. The gentle reader may see other equally strange affinities. The design is 15 mm high as is.

134/ (coconut grove, stratum II, Fig. 115*a*) is also considered to have been stamped although the sherd is worn and it could well have been carved or sculptured. It is undoubtedly a stylized human figure design, 24 mm tall. A small ridge originating from the right foot and upslanting suggests a pair or more of these figures in a chain. The decoration is immediately below the lip, on the exterior of an incurving painted rim.

24/ (Fig. 115*c*) is also from the coconut grove deposit, stratum I. A row of four impressed deep exclamation point shaped marks, almost of the stab-and-drag type are on one side. They are matched by an equal number of rounded impressions on the other. The sherd is 31 mm long.

A second decorated item from the same catalog number 24/, (Fig. 114*j*) is also an incurving bowl sherd. It has a series of at least 5 (4 complete) short roulettes or punched lines 25 to 27 mm long. They are the kind that could have been done with an *Anadara* shell. There is then a space of some 30 mm and the beginning of another line. Between these, at 20 mm from the first are the erased remnants of a line of rouletting, perhaps done in error. 142/ a surface sherd has been incised with a relatively blunt point in a crude open cross hatching. It is 35 mm greatest length (Fig. 115*g*). 93/ and 107/ (Fig. 115*f* and *i*) are both from coconut grove, stratum I and II respectively; they carry the same design although the proportions are slightly different. 93/ has a double line of triangles, overlapping and alternately with base and apices upward. It appears to have been placed below the rim but this is broken away. Individual triangles are about 15 mm long and 6 mm deep. They may have been filled with red ochre. 107/ shows a single triangle on the upper rim surface of an interior lip rim. This triangle is about the same size but is enclosed interiorly by an incised angle matching the apical angle of the triangle. Both are fine, heavily blackened sherds.

40/B37 (Fig. 115*d*) from coconut grove, deep in stratum II, is an incurving thickened flat lipped rim piece. The flat rim carries two small alternating triangles, an exclamation slash and a tiny double triangle or toothed figure. The external aspect of the rim is thickened opposite the slash and toothed figure by a shallow process. Below that, opposite the opposing triangles, is a line of 5 serrations. All incised designs have been carved and the entire sherd is painted. There is no indication of filling of the designs unless it were done in the same red ochre as the paint. The illustration failed to record the complexity of the sherd decoration.

Red painted sherds were found primarily in the coconut grove tests in both strata. With one exception they are painted on the interior of bowls with a light buff surface, probably slipped. All rims are incurving and pointed lipped. With only one exception there is no hint of

design. All other sherds appear to have had an all-over wash of red ochre now mottled but well smoothed and strongly adhering (Fig. 116*j*). The single exception, from 106/, is a body sherd with lines of red paint, a centimeter or slightly more in breadth sloppily applied. These lines meet in a V on the interior and are parallel on the exterior (Fig. 116*i*).

Ceramic analysis

TEST PIT 2: Number 2 was chosen as the test pit with a developed profile and rich midden to represent the ceramic column at the old village area. Only 165 sherds were analyzed: 59 from level 1, 64 from 2, 23 from 3, and 19 from levels 4 and 5 which were studied as a unit.

Although red exterior was presumably dominant, we cannot offer firm evidence. A few sherds could be pinned down to color; these are red. Interior color is masked in the same degree as exterior. Surface finish is predominantly smoothed on both surfaces. Rough on both surfaces makes up a 2 to 3% difference. Because of surface change, most sherds were indeterminates and many of these are asterisked in the margins of the work forms as "patinated". The number ranges from 55 in level 1 to 12 in levels 4–5. This patina is a heavy layer of almost translucent buff altered clay which can be scraped off with a knife but cannot be washed or brushed away. It is a part of the original pottery in most instances. This is attested by painted sherds (in other collections) in which red paint was brushed on this surface. It should be noted that this disconcerting "patina" is either different from or a further development of the colloidal like deposit discussed under B40.

Further surface change appears to have been concealed or even prevented by the "patina". Smudged exterior and smudged interior sherds were about equally numerous after the "patinated" sherds were discounted. Smudging on both surfaces is a close third. All have a surprisingly even vertical distribution. Surface erosion and no surface change are of minor import. Variability of spread is strongest in the midlevels; extremes of expression of most attributes are found in the top and bottom two levels. Firing record was unsatisfactory but all sherds so analyzed were well fired.

There are so few rim sherds that any attempt at summary or interpretation will be cramped. It should be noted, however, that straight rims were found in level 1 only, the incurving 02 dominates level 2, the backcurve is 50% in the lowest level where we believe it should be, and thickened is important in level 1. There are no interior lip rims, and flanges are poorly represented. Lip forms are correspondingly few but the presentation is more compact. Round lips appear to dominate level 1, and flat below that. Variability is strongest in the upper two levels. Walls are similar: straight are strongest in level 1 and incurving is most important below that. Variability appears most impressive in the lower levels. A shouldered vessel sherd was found among the three rims from level 4. The unusual type is illustrated in the B18 rim chart, Figure 161. One bowl was reconstructed (Fig. 93*b*) from the excavation at Stone F (village test, level 1). Four bases were found; three are flat. Possible use is wholly cooking, all levels.

Paste variability recalls the situation under surface change where levels 2 and 3 were strongly variable and 1 and 4–5 similar. Extra fine paste is rare; absent in 4–5. Coarse is similar. Fine is next and at its most common in the deposit bottom. Medium is most usual and is also at its strongest (53%) in levels 4–5. Temper material is restricted to sherd and sherd and sand; again the first and last levels are similar and the middle ones variable. Sherd was preferred. Crushed rock temper was observed in small quantities in all levels except 1. It may be a part of the clay or an additive. Reference should be made to Table 33. Temper is almost wholly fine, 100% in levels 1 and 4–5 and 98 and 91% in 2 and 3. Temper quantity continues the tradition: all three, heavy, medium and light are of about equal importance throughout.

Measurements indicate that sherd thickness and lip width are both greater in sherds from level 4–5.

Possibly most important at this unit, but of presently unclear significance, is the fact that the two midlevels and the two extreme levels appeared to vary together. This is especially true in surface finish and change and in the paste (including temper) attributes. The explanation may lie in a disturbance, some form of local earth moving in the past, or it is possible that we have a partial record of a local fluctuation in the importance of certain ceramic attributes. If the latter is so then there must be three subperiods reflected in this test. First and oldest is the material from levels 4–5, then levels 2–3 and finally the latest from level 1. Such change as is indicated is minimal. Smudged exterior and smudged both, indicative of a certain cooking specialization, increased with depth and presumably with age. So did rim forms with flat lips, incurving walls, backcurving walls and shouldered walls. These attributes are usually strong in older deposits and this circumstance lends credence to the deposit as a whole. Likewise, pastes are coarser and sherd thickness greater at depth.

Traits that appear to be most important later are rounded lips, pointed and channeled lips and straight walls. Pastes are inconclusive. Variability is strongest in the mid-levels and secondarily in the upper 3 levels. Mean lip widths, however, average about the same for the upper two levels as a unit, and the lower two also together, and are most variable in the first level.

COCONUT GROVE TEST: This area lay at the foot of the terraces, immediately below the east face. It is improbable that the two places would not at some time have seen simultaneous use. The grove is low lying, now prime carabao country; each rain partly filled any open trenches or pits. It must have seen important use in the past, but I cannot now state that this included stabilized living or midden deposition. A total of 689 sherds was analyzed from this unit in three strata.

Exterior color showed red dominant although most sherds were indeterminate. Buff and rose, grey and white slips were minor. The same is true of interior color. There is a marked increase of the attribute downward but this rests on few sherds. The minority colors are numerous. Surface finish is almost 100% smoothed exterior and interior. Surface decoration was minor, it is true, but B37 showed more ornamentation than any other site. Painting and modeling were the prime forms: the highest percentage, 4%, appeared in the third stratum.

Surface change is complex. Smudged both is well seriated from 55% in stratum I to 82% in III. This attribute dominates; all others are weak. Well fired pottery is the rule.

Rim forms of strata I and II are numerous and varied. Only 4 rims were found in the 28 sherds of stratum III. The rim chart Figure 117, illustrates the rims from the blocks selected for analysis and the rims from the discarded excavation units. Straight rims were found in all strata but are few in I, moderate in II and strong (50%) in III. The latter, however, depends on only two rims. Incurving 02 is not strong but is found in all strata; backcurve is in I and II only. Interior lip and flanged forms are strongly associated with stratum I. This is as is should be. The form is a late one. Straight is essentially the most important and the longest lived form. Rounded lips are dominating throughout the soil column except in stratum I where flat lips prevail. Pointed is weak in strata I and II but achieves 25% in III. Walls are incurving 73 to 96%. Straight are at their strongest at 26% in stratum I. Unusual wall shapes are present in minor to near trace quantities. There is encouragment in this that the grove may contain a valuable sequence entombed in the carabao muck. Flat bases are most important; possible use is recorded wholly as cooking in all levels.

Fine pastes are more usual than the medium but the difference is not great; coarse and extra fine are rare. Crushed sherd tempering is preferred (about three-fourths of the sherds); sand and sherd mixed make up most of the other one-fourth. Other tempers are rare. Crushed rock appears in a few sherds of the upper strata. Temper size appears in much the same manner as the preceding. Fine is strongest, coarse makes up most of the remainder. Stratum III temper is coarser than that of I. Stratum II, as in the previous attribute sets, is usually in a medial

Fig. 117. Babeldaob 37, coconut grove test rim forms: analyzed and unanalyzed sherds are included in this figure.

aspect between the top and bottom strata. This is entirely different than the B40 situation where mid-layers were somewhat unpredictable. Over half of the sherds are medium tempered, somewhat more than one-fourth are light and a lesser quantity heavily tempered. The trend is toward medium tempering with depth and more variability in the upper deposit—true also of temper size and material. Sherd thickness is greater with depth, and lip width, reflecting the interior lip and flanged rims in stratum I, is greater in I. Vessel diameter is greater in I. Thus larger, thinner vessels with specialized lips are typical of the late deposit.

In an effort to summarize this unit at Babeldaob 37, we many contrast those attributes of the pottery that increase with importance with depth, or are more strongly characteristic of the oldest levels, with those which are more often found in strength in the upper strata. Older materials are stronger in red exterior and interior; pot surfaces are nearly always smoothed and decoration more common. Firing is better and smudging on both surfaces, the result of use on the open fire is important. Preferred rims were straight, backcurve, thickened and thinned. These are simple forms—even the backcurving rim, usually found on rounded jars, is not a complex rim. Rounded and pointed lips on incurving bowls on rounded bases complete this part of the picture. Tempering is medium in quantity in the older forms, sherd thickness is greater and vessels were usually smaller than in the more recent.

Color from nearer the surface includes rose and buff more than at depth although red float is the most important color throughout. Smudging of the interior of the pots is slightly stronger later. This may indicate the use of these vessels in the long cooking processes of oil extraction and sugar making in which the smudging may eventually have been burned off the exterior of the pots. There is an overall lack of strong stressing of one or a few attributes in the upper two strata. Variability, a scattering out rather than a concentration of attributes is typical. This should be the mark of a period of greater cultural change. Too, there was often close agreement in the percentages of the same attributes from both upper strata, indicating near unity within these particular attributes. All of the flanged rims, especially the form with lip greater than flange, and the interior lip form were strikingly confined to the upper stratum and often lightly present in the midstratum. Flat bases and greater lip widths were strengthened in the later parts of the deposits.

Thus the attributes of color and form at this unit seriate fairly evenly at times and often show definite changes between older and late. The attributes of paste and temper do not. They appear to be fluctuating more rapidly and in a minor or uncontrolled manner. If these data reflect truth there is a strong variation in the way in which different fragments of the ceramic complex respond to time and its accompaniments.

EAST FACE TEST: This test did not lack for sherds. There were 388 analyzed (out of 439) for the first level of the east face test of the terraces, and 200 (out of 231) from the second.

Although the major numbers of sherds were indeterminate as to original exterior color, there were sufficient for significant analysis of most categories. Red float is 96 and 97% for levels 1 and 2. Buff and grey float filled out the few remaining percentages. Interior color, often masked by smudging, was less strongly red float, but over 90%. The buffs, greys and whites were obviously minor, and there is no true difference between the levels. Surface finishes are 99% smoothed both surfaces. Sherds with smoothed interior and rough interior are obviously rare. Surface decoration is almost nonexistant.

Approximately 70% of sherds in each level were smudged on both surfaces. Sherds smudged on the interior only are next most common. Then comes no surface change and interior erosion. Again there is no representation of cultural change. The fluctuations are minor and subjectivity inherent in the analysis of such pottery is a factor to be considered. Firing does reflect some variation. Well fired pottery is dominant in both levels but more so in the top deposit.

Figure 118 illustrates rims from all squares, whether the sherds are used in this analysis or not. Interior lip is most important, especially so in level 2. Following are incurving 03, lip greater than flange, equal at 12% in both levels; straight is stronger in level 2; incurving 04 with both exterior and interior manipulation of the clay, thinned and backcurve most important (6%) in level 1. Other forms are rare. Lips are usually flat; this attribute is strongest in level 1. Rounded make up about one-fourth and are strongest in the lowest level. Others, except pointed which is 11% in level 2, are minor. Walls are variable. Straight are moderate in level 1 and fairly strong in 2; incurving dominate in level 1 and are very strong in 2. There is thus a

Fig. 118. Babeldaob 37, east face test, rim forms from analyzed and unanalyzed portions of the test.

preference registered. No shouldered vessesls were found. Bases were not present in level 2, and the four in level 1 were flat. Possible use is wholly cooking pot.

Pastes do not separate the two levels. Medium is strongest, slightly over half, in both levels. Fine is next and is more common in level 1. Coarse and extra fine are minor. Temper material is likewise close enough so that identity of the two levels is a proper conclusion. Sherd, most important, is nearly identical and sand and sherd, the second choice, is also. Temper size, however, varies. Less than half is coarse in level 1, more than half is coarse in level 2. Fine temper turns the quantification around so that the earlier deposit stresses coarse and the later fine. Both levels stress medium quantity about equally. Light is next, of moderate import, and heavy tempering is seldom seen.

Sherd thickness is close for both levels but lip widths rise in 2 because of the interior lip rims. Mean vessel diameters are poles apart: 52cm in 1 and 23cm in 2. This is probably fortuitous.

Differences between the two levels are present but are usually not striking or strong. Interior lip and straight rims are present in both collections but weaker in the upper. The incurve series and backcurves are all slightly stronger in the upper level. Incurving walls are stronger in the later deposit but straight walls and pointed lips both lost strength in the upper levels. Flat lips, always primary, also became more common in the later times. Slightly finer pastes, finer tempering material and less tempering and somewhat larger pots appear to be later.

Exterior and interior color, surface finishes, surface decoration (or lack), surface changes and tempering do not record noticeable change. Change, therefore, if it is recorded correctly, appears to center around the handling of temper and fineness of paste and firing, wall and rim shapes. These, especially those attributes of form, may be suggested as being the most responsive to the thrusts of cultural change in this part of Melekeiok.

NORTH FACE TEST: The north face trench and pits probably tested the area of heaviest occupation of the terraces. Here there appear to have been two strata developed above the subsoil. The deposit first two levels may be safely assigned to the first stratum and the third and fourth to the second. Sherds were numerous: of the 2205 that were analyzed from Babeldaob 37, 963 came from the north face test. There were 689 sherds from the four squares in level 1, of which 210 were analyzed; 845 from four squares in level 2 of which 340 were analyzed; 510 from four squares in level 3 (311 analyzed) and 139 from the only two squares that continued into level 4 (102 analyzed).

The percentages of indeterminates in exterior color are high, varying from 70 to 69%. Of the remaining sherds, red float dominates from 83% in level 1 to 100% in level 4. Grey float is minor and next important, but only in level 1. Interior color was less discernable; red float dominates again, following the same trend. Grey float rises slightly, as does buff, in level 1. Interior colors are slightly more variable. Nearly 100% of the sherds were smoothed on both exterior and interior. Surface decoration is limited to a few indented sherds in each of the first three levels.

Surface change is more complex. The attribute of smudged on both surfaces is most important with levels 1 and 4 having the smallest percentages. Smudged interior follows well behind, seriating from 13% in level 1 to 17% in level 4. Both surfaces eroded is strong in level 1, but weak in the others. "Patina" was most common in level 2, then 1. All other attributes are minor. Well fired pottery dominates, increasing slightly from the surface down. Poor firing diminishes in a reverse order.

Rim forms (Fig. 119) are numerous and the tabulation complex. Straight were commonest, 19%, 19%, 14% and 15% from the top level down. A series such as this, and others, indicates that the site should have been excavated stratigraphically. Incurving 02 is also at its

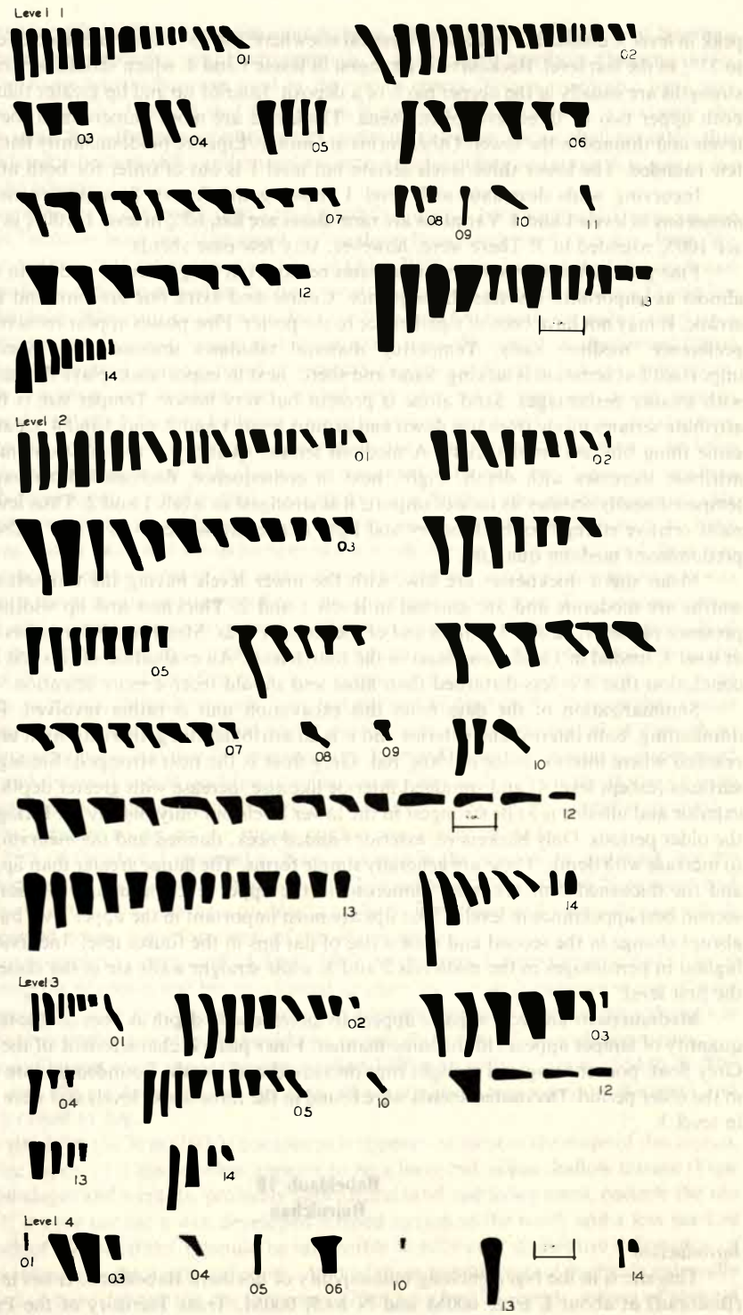


Fig. 119. Babeldaob 37, north face test, rim forms of analyzed and unanalyzed sherds.

peak in level 3, diminishes in 1 and is unusual elsewhere; the 03 rims seriate from a few in level 1 to 31% in the last level. Backcurve is strongest in levels 3 and 4, which should be stratum II. Its strengths are usually in the deeper parts of a deposit. Interior lip and lip greater than flange are both upper two or three level phenomena. Thickened are more numerous in the upper two levels and thinned in the lower. Other forms are minor. Lips are predominantly flat; there are a few rounded. The lower three levels seriate but level 1 is out of order for both attributes.

Incurving walls dominate with level 1 showing the fewest. Straight are next and are numerous in levels 1 and 4. Variables are rare. Bases are flat, 60% in level 1, 100% in 2 and 4 but are 100% rounded in 3! There were, however, very few base sherds.

Fine paste is most important and seriates neatly from 63% in level 1 to 32% in 4. Medium, almost as important, reverses the sequence. Coarse and extra fine are rare and the latter is erratic. It may not have been of significance to the potter. Fine pastes appear to have been a late preference, medium early. Tempering material tabulates unreasonably. Sherd is most important but seriation is lacking. Sand and sherd, next in importance, plays the same lines but with smaller percentages. Sand alone is present but very minor. Temper size is fine and the attribute seriates nicely from top down and groups levels 1 and 2, and 3 and 4. Coarse does the same thing but less emphatically. A medium temper quantity is the most common and the attribute increases with depth. Light, next in consequence, decreased downward. Heavily tempered neatly seriates its lack of import; it is strongest in levels 1 and 2. Thus level 1 has the most relative strength in both heavy and light tempering while levels 3 and 4 sherds have a predominant medium quantity.

Mean sherd thicknesses are low, with the lower levels having the thinnest sherds. Lip widths are moderate and are greatest in levels 1 and 2. Thickness and lip widths reflect the presence of the 07, 12 and 13 forms and of the straight rims. Mean vessel diameters are greatest in level 3, medial in 1 and 2 and least in the fourth level. An evaluation of this test leads to the conclusion that it is less disturbed than most and should receive more attention.

Summarization of the data from this excavation unit is rather involved. Red float is dominating, both interior and exterior and it is an attribute that gathers strength until level 4 is reached where interior color is 100% red. Grey float is the next strongest. Smudged on both surfaces (except level 4) and smudged interior likewise increase with greater depth. Smoothed exterior and interior is at its strongest in the lower levels but only slightly so. Firing is better in the older periods. Only backcurve, exterior banded neck, thinned and the incurving 03 appear to increase with depth. These are generally simple forms. The flange greater than lip, interior lip and the thickened rims are most numerous in the upper levels although interior lip had its second best appearance in level 3. Flat lips are most important in the upper level but there is an abrupt change in the second and then a rise of flat lips in the fourth level. Incurving walls are highest in percentages in the midlevels 2 and 3, while straight walls are in the same position in the first level.

Medium paste and coarse paste appear to increase with depth as does coarse temper. The quantity of temper appears in the same manner. Finer paste is characteristic of the later levels. Grey float, poorer firing and straight rims decreased with depth. Rounded lips are a rarer trait in the older period. Decorated sherds were found in the three upper levels and were commonest in level 3.

Babeldaob 18
Bairulchau

Introduction

This site is in the Ngerechelong municipality of northern Babeldaob. It lies in tract 7–221 (Bisehrad) at about E 69.8, 000M and N 89.5, 000M, Trust Territory of the Pacific, Land

Management Map PB-26. Bairulchau lies inland about .8 km from the coast north of Ngerbau and is on the grassy pandanus sprinkled savannah. It is described briefly in Osborne (1966: 196–205). The name Badrulchau was used in the earlier report. This is acceptable but I was informed by Sumang on this trip that Bairulchau is more proper because it is certainly the remains of a large *Bai*—the men's clubhouse or community house. As we shall see later, this place is considered to be the first *Bai* and embodies some of the legendary and magical origins of *Bai* building in the islands.

After completion of the two Koror sites (3 and 5) Stevens, Toribiong and I went via the weekly Trust Territory boat, an 11 m diesel, to northern Babeldaob, on 9 October, 1968. We unloaded the equipment that Stevens would use at Ollei (B19) at the head of the Ollei dock and found storage for it and then stayed on the boat for its run up to Kayangel, the atoll 32 odd km north of Babeldaob. We returned the same day, the 10th, and fed heavily on wahoo fried on a piece of corrugated roofing with wahoo sashimi as a side dish. We rented an abandoned frame house the next day, moved in and cleaned up, spent Saturday and Sunday in local exploration. On the 14th our crew and carabao cart loaded with gear went from our home base to Bairulchau and we started the men building a ramada, setting up a tent for tools, and clearing. The next day we took Stevens' personal equipment, the cameras and instruments, to Ollei where he was to start work on B19. Toribiong remained with him, but I had an excellent foreman, a Ngerechelong man, Renguul, who spoke some English and understood more. He remained with me throughout the work on the site and I was indeed fortunate to have employed him. Heavy rains and winds hampered our work during the first week and there was rather strong belief among some of the local people that the spirit population at the site was displeased with the excavations. I pointed out that the opposite was true. The savannah grass had been dry and I greatly feared the grass fires that sweep the uplands from time to time. Had we had a fire before the grass and ground was fully wetted, it could have been disastrous to the tool tent and its contents which often included cameras and surveying instruments, and have made the area grimy and difficult to work. I did not attempt to describe the dangers that a large amount of modern carbonized material about would hold if we were fortunate enough to uncover charcoal samples suitable for radiocarbon dating. The spirits, however, understood these things and the local people could see the logic in my fear of fire. After the storm we were given excellent weather and it remained dry for several months. In midwinter I received a suggestion that I return to dig on the site as rainfall was sorely needed.

On the 25th of October, I returned to Koror to help in the laboratory and work out the B18 map which had been started by Mrs Stevens. I returned to the site on 6 November and completed work on the 18th, leaving a problem unsolved. This concerned a deep deposit which we had discovered below a platform east of the site proper.

It was not possible to return until 14 April, 1969, At that time I spent the period of 15 to 20 April deepening the platform test but was forced to cease by a most impressive storm of near typhoon strength. True to predictions, I had again brought rain to Ngerechelong although in an altogether undesirable quantity. I should like to test this series of coincidences again.

B18 was our largest excavation: the crew worked 1220 man hours at a cost of $430.78. The average pay was 40¢ per hour but the two men who were given responsibility, Renguul and Ozarch, were raised to 50¢.

The site straddles the 30 m (100 ft) contour as it appears on most of the maps of this region. The megalithic aspect of it lies on what appears to be a large but vague shallow terrace (Figs. 120, 121). Hill slopes and terraces, probably agricultural land and living areas, encircle the site completely. If it were not for a well developed jungled stream to the north and a less marked drainage south of the megaliths, it would be impossible to offer even descriptive delineation of B18 from the terraces to the north and south. As it is, these boundaries are probably culturally meaningless. As I have defined the site it is some 275 m long by 137 m wide, a tract of about 4

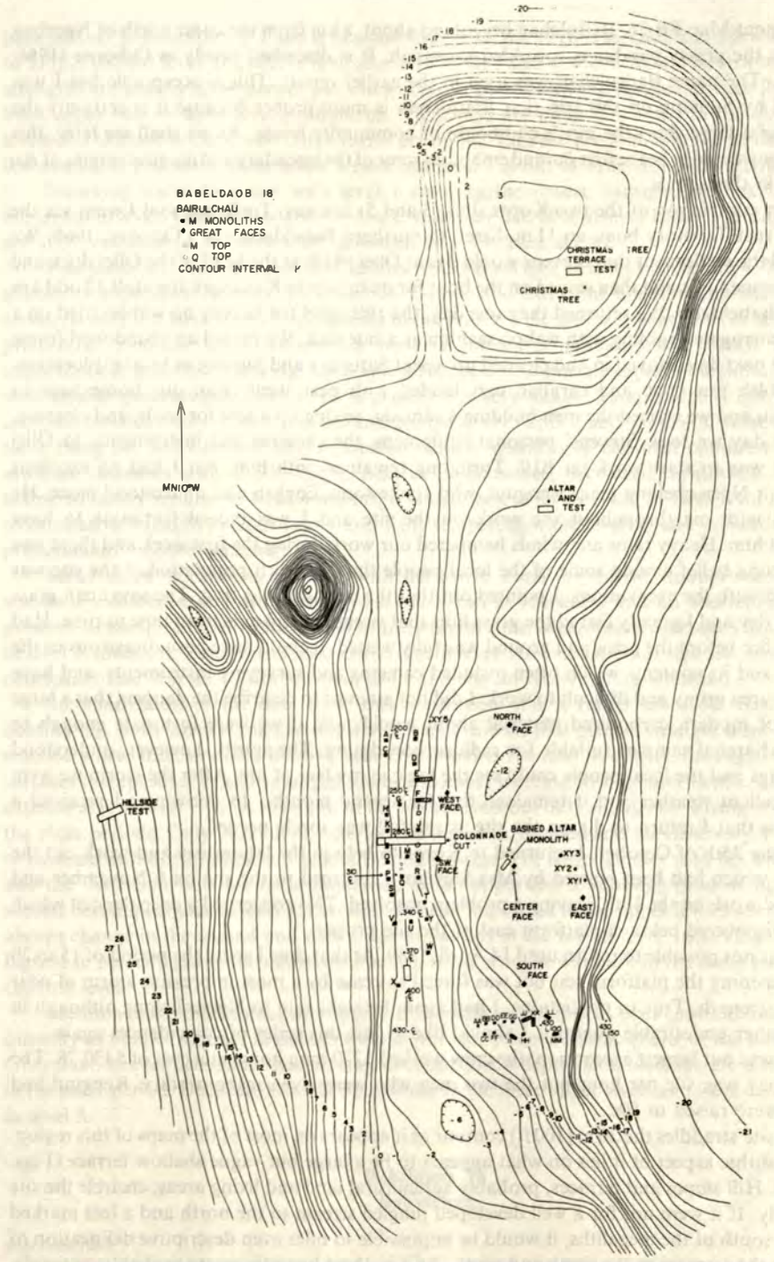


Fig. 120. Babeldaob 18, Bairulchau; site map.

Fig. 121. Babeldaob 18. Plaza area from crown, looking southeast toward slope terraces.

hectares. A plaza area roughly 73 m by 30 m, at the southern end of the whole tract, contains the major lithic remains.

Bairulchau is the largest megalithic site in the Palaus, from the point of view of handling of large, shaped stones. There are several other places where actual tonnage moved may be greater if a somewhat larger area is considered but these are all groupings of platforms and were made of essentially unshaped andesite boulders brought together and arranged. Bairulchau's most striking attribute is a series of large stone monoliths arranged in two colonnades. There are 25 stones in the larger colonnade of which two are but fragmentary remnants. There are 12 in the smaller colonnade, of which 3 are fragmentary. There are two monoliths in the center of the plaza and six large carved demonic "Great Faces" located: (1) centrally (2) at the north end of the plaza, (3) at the south end, (4) in the southeast part of the plaza, and (5) and (6) at the southwest and northwest. There are five piles of fragments or overthrown and decayed stones (XY stones) that were once small monoliths or other simple stone structures. Finally a large block of andesite, surely a place for sacrifices of food, lies 64 m north of the plaza. It may be recently functional because fragments of shell were found around it, not yet fully dissolved by the soil acids. Such shell was noted more rarely elsewhere in the site. In addition to the above, a solid tradition and the presence of a stone itself, attests to the removal of one of the monoliths to the modern village of Ngerbau in the late 1700's (see p. 172). There was thus a total of 52 large to huge monoliths on or near the plaza of B18. All with the exception of the altar north of the site are of andesitic conglomerate or puddingstone andesite.

All stones were measured as to height above ground, width and thickness at ground level. Three were excavated to their roots by a small side pit or as part of a trench. All of the overthrown or broken stones, except one, have fallen to the east, south or north, or have thrown their fragments in those directions. One of the monoliths of the large colonnade (U) is leaning west and one of the smaller colonnade (KK) fell to the south. Thus by far the greater number of monoliths (6) that are not upright and are fragmented, suggest an earthquake with major throw to the west. Three of the faces were overthrown or leaned to the east.

The question of the origin of the stones is not wholly answerable. The andesitic conglomerate does not occur as boulders in the lateritic soil of the Palaus. Andesite does, but the only major item of andesite used at Bairulchau is the northern altar. Pudding stone does occur, however, in large quantity along the coasts, where it forms the major sea cliffs of the area. The best exposures that I have seen are along the western Ollei coast. Here Stevens and I saw a prism, or doubtfully, a shaped monolith with a triangular cross section, at the base of a cliff. I do not know how readily this conglomerate formed regularly sided figures as it cooled, so cannot know if the object were natural or artificial but believe it to be the former. It is about 1.8 m by 46 cm by 20 cm. There are large boulders and fragments of the material at the water's

Table 15. Babeldaob 18 Monoliths. All measurements in meters.*

	Illustrations Figures	Height above ground	Width and thickness at ground	Shape in cross section	Width and thickness at top	Groove Direction	Length × width × depth of groove
A	121, 129	1.65	.70 × .73	square	broken		
B		fragments only, at and below ground.					
C	121, 129	1.34	.73 × .61	square	broken		
D	123, 124	2.26	.55 × .61	square	.61 × .49	E–W	.55 × .30 × .15
E	123	3.05 total	.67 × .46	rectangular	.79 × .58	N–S	.67 × .30 × .18
F	130	2.56 total	.70 × .49	rectangular	.79 × .43	N–S	.79 × .43 × .09
G	131	2.35	.91 × .88	square	broken		
H	131, 121	1.22	.82 × .55	rectangular	broken	N–S	.79 × .40 × .21
I	130	1.68	.79 × .55	rectangular	broken		
J	130, 124	2.07	.88 × .52	rectangular	.98 × .58	N–S	.91 × .37 × .09
K	122, 131	1.28	1.01 × .58	rectangular	1.13 × .64	N–S	
L	127, 131, 132	1.58	1.04 × .73	rectangular	1.16 × .88	N–S	1.16 × .43 × .27
M	126, 131, 133	1.34	1.01 × .79	rectangular	.98 × .85	broken	
N	124, 128, 132, 131, 134	2.26	.91 × 1.01	square	.91 × .82	N–S	.91 × .27 × .12
O	126, 133, 132	1.52	1.13 × .88	rectangular	1.28 × .85	N–S	.85 × .55 × .24
P	135, 133	1.40	.98 × .67	rectangular	eroded	N–S	
Q	135, 133, 131	2.26	.88 × .91	square	.85 × .91	broken	
R	132, 124, 134, 133	2.23	.73 × .61	square	.91 × .73	N–S	.91 × .37 × .18
S	135	1.65	.94 × .58	rectangular	1.01 × .73	N–S	1.01 × .49 × .21
T	124	.98	.70 × .67	square	.76 × .61	N–S	.76 × .40 × .12
U	124, 126, 135, 132	2.23	.82 × .73	square	.82 × .82		
V	132, 124, 134–6	1.55	.88 × .58	rectangular	.91 × .55	N–S	.91 × .37 × .12
W	124, 136	.85	.58 × .61	square		broken	
X	127	2.59	.58 × .79	rectangular	.43 × .82	N–S	.40 × .30 × .15
Y		stub only, set in ground					
AA	137, 138	.46	.61 × .37	rectangular	irregular		
BB	137, 138	.94	.94 × .52	rectangular	.91 × .55	none	
CC		small pile of angular andesite fragments on surface, perhaps includes pieces of AA					
DD	138	1.13	.82 × .70	square	.76 × .67		
EE	137, 138	1.25	.76 × .58	rectangular	.79 × .70		
FF		small fragments only on surface					
GG	137, 138, 139	1.16	.85 × .61	rectangular			
HH	138, 139	1.16	.76 × .67	square	.76 × .67	E–W	.76 × .46 × .21
II		1.04 long					
JJ	137, 138, 139	1.83 total	.82 × .73	irregular	.73 × .58	E–W	.73 × .37 × .12
KK	137, 138, 139	1.65	.82 × .67	rectangular	.85 × .67	E–W	.85 × .46 × .15
LL	137, 138, 139	1.68 long	.91 × .61	rectangular		lengthwise	.88 × .34 × .15
MM		.91	.46 × ?				
Central monolith 140		2.93 total	.73 × .67	rectangular	.82 × .67	none	
Central basined stone 140		.88	.79 × .85	square	.76 × .67	none	
Kual's stone 141		1.86	.82 × .82	square	.82 × .82		
XY 1	142	1.07 long	.52 wide	much eroded, lying on side			
XY 2		1.13 long	.55 × .15	much eroded, lying on face (?)			
XY 3		Two stones, each .30 in diameter.					
XY 4		.76 long	.76 × .30	flat piece appears to be part of XY 5?			
XY 5	123	series of fragments extending ca. 1.83 m.					
Altar	143	.91 long	.70 × .55	dolmen on 4 small cobbles			

* Original measurements made in feet and tenths.

Fallen or Upright	Erosion on 1–10 scale	Major Breakage	Apparent artificial alteration, 1–10	Square meter surface area	Remarks
U	7	top	9–10	6.1	
F				.5	
U	9	top, outer	9–10	3.9	
U	4	eroded	5	6.3	
F	4	top	7	5.9	Tapers to bottom
F	4	groove	7	4.6	Tapers, recumbent, no footing seen
U	6	top	6	5.8	Top broken off
U, F	5	near top	7	7.0	Top half broken away
U	8–9	top, outer	6–7	5.8	
U	3	groove	10	7.2	
U, F	4	groove	10	5.9	Top half broken away
U	2		9–10	7.4	See text
U, F	4	top	9–10	6.8	Top broken off
U	1		10	10.9	See text
U	3	light	9–10	8.4	See text, deep groove
U, F	8–9	top		8.2	Top half broken away
U, F	4	top	9–10	7.9	Top .61 m broken away
U	1	top	9–10	7.4	Top eroded
U, F	5	top	8–10	8.5	Top half broken away
F	9	base?	9–10	4.2	Base not located
leaning	2	basal	9–10	8.3	Top flat, leans west
U	3	groove	9–10	6.5	
U, F	4–5	top	9–10	3.3	Near basal grooving
U	2		10	9.0	South side incurved
				.4	
U	6	top	8	3.5	.67 m below ground
U	6	top	8–9	4.1	Basin .43 × .30 × .15
				.5	
U	7	top	9–10	5.0	
U	6	top	9–10	4.8	
U	9			5.0	
U	2–3	top eroded	8–9	5.0	
F		fragmentary	8–10		fragment lying recumbent
F	2	eroded	3	6.3	.55 m ground stain at base
F	2		9	6.5	recumbent
F	8	eroded	9–10	4.5	see text
F		eroded	9–10	4.6	recumbent
F	3		9–10	5.9	recumbent
U	5	top	9–10	4.7	basin crumbled .79 × .60 × .15
					Basin .60 × .37 × .34 Kual
U	4	top, 1 corner exfoliating	10	8.1	.21 above ground; test excavated
				2.8	test excavated × .5
				3.7	test excavated × .33
		protruding above ground		.5	test excavated × .25
				.9	same; may have been monolith
				.9	or great face × .2
				4.7	see text.

edge that could readily be crumbled and abraded into monoliths. The material, like coral sandstone, works easier when wet than when dry. Also a stone from this area could be floated on bamboo for transport by water around the northern tip of Babeldaob to the Bairulchau coast. The same could be said perhaps for the east coast of northern Babeldaob which I do not know. In any event, there was no lack of available material for neolithic technologists.

The use of this series of monoliths can be assigned although some corollary questions are not easily answered. Of the 23 large monoliths standing in the large colonnade (Table 15; illustration references appear with table) there are three that had flat tops. They are in the central part of the colonnade between the two outer (eastern and western) rows. There are five stones with tops that have been eroded so completely that no guess as to function can be made. Fifteen are grooved; on 14 the grooves run north and south; one only (D) is grooved east-west. These grooves are unmistakable. Even now they are 18 to 24 cm deep and run the entire width of the tops of the monoliths. We do not understand why one monolith (D) at the northwest part of the large colonnade has a groove that runs east-west, at right angles to the others, although we can offer a reasonable suggestion in the succeeding discussion. In any event, there is enough evidence to show that these stones were set up as the foundation pillars for large buildings of the *Bai* type. The grooves must have carried large logs which acted as the stringers upon which the superstructure was suspended. If the large colonnade marks a single building, then it was indeed or was planned to be, gigantic. There are 55 m between the southern monolith X and the northern A. Width was at least 7.6 m. The length dimension is several times that of the modern *Bais* and the width is close to twice. Of course, there may have been a series of shorter buildings rather than a single long one. One thing is sure: this building had a substructural underpinning different from any of the modern *Bais*, which are built on transverse wood sleepers, usually large rectangular timbers, upon which the sills running lengthwise of the building are set. These sills could be structurally analgous to the logs lying in the grooves of the monoliths but the timber sleepers of the modern times have surely replaced the stone pillars.

The large colonnade is oriented 10° west of magnetic north. The long axis of the small one is exactly 90° from that of the larger. It, however, is only about 18 m long. There are complete or remnants of 11 stones in it; there must have been 14 or 16 originally, whereas there are 25 in the large colonnade and may have been 34 to 36 originally. The smaller colonnade is nearer the size of modern buildings, but still in the extremely large range. The grooves run lengthwise of the small colonnade; any structure built on it would have been essentially the same as the structure or structures built over the large one.

As to the six large carved faces set in the plaza, two are on the west side facing in, the north and central faces face south; the southern faces north. The southeast faces in, west. There should have been a seventh, a northeast, for a completely symmetrical arrangement. It may never have existed, or it may have been taken away, like Kual's stone. Three of the faces were not upright, the two western ones were half-buried by soil creep and were leaning in, to the east. The southeast face was overthrown to the east. All were excavated and the three reset in the upright position.

All faces, made of puddingstone andesite, like the monoliths, are badly eroded. The carving has presented more surface to erosion than have the flat surfaces of the uprights, and it has taken its toll. The features are, I believe, all present in one or another of the specimens, although details may be lacking. Table 16 gives measurement details and illustration references. Lengths (six stones) vary from 1.3 m to 1.8 m and average about 1.5 m. Widths across the eyes (4 stones) range from 1.2 m to .91 m and average .95 m; at the butt, widths (6 stones) range from 1.1 m to .82 and average .9 m. Thicknesses through the nasal area range from .37 m to .7 m (6 stones) and average .52 m. At the rear on each side a right angled groove runs from about the level of the eyes to the base. It was thus partly buried when the objects were set in the ground. These grooves are difficult to trace because of erosion. They appear to have averaged about

Table 16. Babeldaob 18. Great Faces. Measurements in meters.*

	Center Face	Southwest Face	South Face	Southeast Face	North Face	Northwest Face
Faces	south	east	north	west	south	east
Figure number	144	145	137, 148	142	146	147
Total length	1.49	1.74	1.62	1.43	1.77	1.31
Above ground length	.98	1.01	1.13	1.16	1.16	.61
Width across eyes	.76	.91	.94	1.16	1.07 ca	.79
Width at ground	.79	.91	1.04	1.13	1.07	.85
Width at base	.85	.91	1.04	1.10	.98	.82
Thickness at eyes	.37	.46	.40	.49	.61	.82 ca
Thickness at ground	.43	.58	.46	.43	.49	.46
Thickness at base	.43	.46	.34	eroded	.24	.46
Condition—extent of erosion on scale 1–10	6	8	5–6	6	8–9	9
Square meter surface area	3.3	5.4	4.8	4.6	6.5	5.9
Rear Grooves						
height from base, right side	.88	.91 ca		.98		
height from base, left side	.88	.91 ca		.91	.91	.85 ca
Width—right	.18			.15	wide	
Width—left	.12	.15		.15	eroded	.15
Depth front to back, right side	.06			.27	eroded	
Depth front to back, left side	.09	.15		.27		.09

* Original measurements made in feet and tenths.

.91 m long and ranged from 27 to 9 cm in depth while width averages somewhat greater than 15 cm. I assume that these cuts delimited the neck area or a coiffure of the Being represented.

By far the most striking and obvious characteristic of these unusual carvings are the huge, staring, bulging eyes set beneath a bulging forehead. The nasal and alveolar area is low and curves down to an open mouth with pits at each end and typically three huge teeth or fangs prominently displayed. One is at each side, curving outward below or inside the pits and the third is central. Below the mouth 4 wide wedge-shaped depressions, opposing one another in pairs, apparently form the highly stylized outline of a quadruped, facing up into the mouth of the Being—or they may represent the latter's genital area. I have so far no ethnological references or legendary information that cast any light on the origin or function of these statues. The type, with variations, was found by the survey at a number of sites on Babeldaob and, rarely, on Koror. One site, B3, with both monoliths and Great Faces, but much smaller and in poorer condition, was found on the west coast of Babeldaob in Ngeremlengui (Osborne 1966: 167). On the east coast Melekeiok, B37, with the largest gallery of these Great Faces of all, has already been described.

The terracing that is closest to the megaliths is included as a part of the site. As commented above, it would be difficult to delimit this site other than by minor geographic features. Cultural features are continuous. A crown or roughly pyramidal (4 sides) remnant (Fig. 122) left by terracing and levelling, lies some 30 m to the northwest of the northern monolith (A) of the large colonnade. Although badly eroded particularly on the sides facing toward the east and the plaza, it is unmistakably cultural in origin, as are all of the other crowns in these islands. It differs from the pyramids of many areas in that it is not built but was carved out by removing

the high land from all four sides. The function of pyramids, or crowns as I have called them because they usually crown a series of mounting terraces, and because of a resemblance of the upper terrace series to a hat, is not known. One can suggest that they had to do with secular or religious authoritative symbolism. Our crown is small, about 18 m on a side and 6.1 to 7.6 m high. Sherds, sadly eroded, are found on the surface; there is no archaeological deposit. Palau association soils, latosols, are classic here: red lateritic, acid, hard and well drained.

The northern limit of the site is a large flat topped terraced area called by us Christmas tree terrace (Figs. 123–124) because of the shape of a conspicuous pandanus tree on it. This flat is a large area, some 49 m by 43 m. North of and below this terrace is the jungled drainage mentioned before. East of the main plaza area the land falls away toward the sea. It is in coconuts and jungle except on the northeast where a tongue of higher land east of Christmas tree terrace is itself terraced. On the extremity of this, some 230 m to the east, are the remnants of two platforms made of large andesite cobbles and small boulders.

Conservation

An estimate of surface square meters for each monolith was made as a step toward stabilization.Normal weathering, wind, sun and rain, plus the fires that rage through the dry grasses of the *ked*, are inexorably reducing the megaliths. Many surface parts are friable and small exfoliates can be removed with the fingers. We wrote to Charlie R. Steen, then of the

Fig. 122. Babeldaob 18. Looking northwest over monoliths K, H (in two fragments), C and A to the crown.

Fig. 123. Babeldaob 18. Monoliths E, recumbent; D, XY5 beyond. Men at altar test and Christmas tree terrace. To north.

Fig. 124. Babeldaob 18. Large colonnade to north, along grid system centerline. Monolith X; V at left; W, T, R, N, J, D, U in center. Excavation on the skyline is Christmas tree terrace.

Southwestern Archaeological Center, National Park Service at Globe, Arizona, concerning the problem and sent him samples. He was able to recommend sealant products that had been successful elsewhere, and would not alter appearances. The amount of sealant was figured on the basis of surface estimates. These data and the evidence that conservation action was required was taken to the District Administrator and to the conservation officer, Mr. Robert P. Owen. Both lack of time and a declining budget prevented me from purchasing the sealant and doing the work myself. It is to be hoped that the Trust Territory can accomplish this conservation. It is not certain how successful such work would be. Efforts of this kind are unknown to us from the Pacific area although experiments must have been made in similar situations in India and southeast Asia. The major problem is probably the burning. I lost no opportunity while in the field to point out to local persons that fires were damaging this major aspect of Palauan heritage and that the megaliths might someday bring tourists to Ngerechelong. When I returned to B18 in April, 1969, there was abundant evidence of fire around the plaza of the site, but that area had been spared. I hope that this was a result of the preachifying and, if so, that it does not fade. An even partly successful stabilization of this site should have an important effect on such things elsewhere in the Pacific area. There must be many aspects of island archaeology which require such treatment.

The colonnades

The map (Fig. 120) and the introductory remarks have presented a generalized and overall picture of the site and perhaps of its problems. There remains, then, the task of describing in detail and of interpreting when foundations for interpretation appear or come to mind.

Table 15 embodies all observed and measured characteristics of the monoliths themselves. All measurements are in meters and hundredths of meters. Widths of the monoliths are lengthwise of the colonnades, thickness is across it. The stones are variable from the original sizes because of erosion and fragmentation: it was often necessary to estimate; subjectivity could not be eliminated. Total lengths are of those fallen stones which now lie above ground: small excavations were made as a check for broken roots. All but one stone are made of puddingstone andesite or andesite conglomerate. An attempt was made to judge the erosive alteration of the individual pieces on a scale of 1 to 10; the latter value indicates reduction of the monolith to a tapered pillar. A more subjective scale, also 1 to 10, is intended to describe the shaping of the pieces. Here 10 would indicate complete reshaping of an original block or andesite column.

Small stones near the bases of various monoliths are surely simple chocks. No evidence of

special treatment of the holes, sacrifices etc. were seen. Outer refers to the outside of the colonnades; inner is within them.

MONOLITHS L, N, O: It would have been advisable to have excavated to the root of each monolith and to have tunneled under in order to examine shapes, footings and to search for possible caches—a problem which exercised my crew greatly; they had visions of hidden Palauan money. However I did not anticipate either archaeological or bead money values to be sufficient to repay cost and time of the test. We therefore excavated to the roots of monoliths L, N and O in the large colonnade.

The colonnade cut (Fig. 125, profile) was aligned tangent to the north surface of L. It was laid out at right angles to the centerline which actually bisected the large colonnade. The cut therefore missed monolith N (see Fig. 120). Monolith L is dagger shaped (Fig. 126) in east-west section; it is rectangular in north-south. Overall length is 3.45 m. It is now buried 1.9 m in the ground. On the south side of this monolith is a large knob of stone, possibly partly natural but obviously partially remaining from the shaping process (Fig. 127). It may be of no significance but reminds one of the similar extensions on the cover of the stone coffin of B19A (Osborne

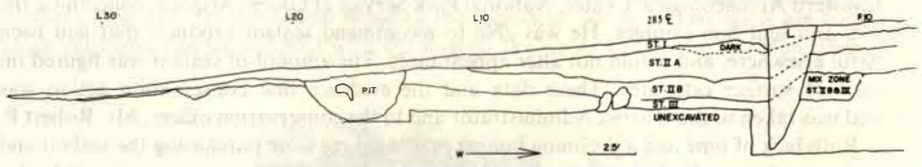


Fig. 125. Babeldaob 18, profile of south wall of colonnade cut at 285 CL.

Fig. 126. Babeldaob 18. Monolith L, excavated to base; disordered soil profiles to right and left of stone. Note alignment of grooves of L and O. Monoliths V and X in far back, U leaning, M to left. To south. Buchuru with shovel.

Fig. 127. Babeldaob 18. Monolith L, before excavation. Note stone knob on south side. To east.

Fig. 128. Babeldaob 18. Monolith N, after excavation. Note under curvature of base. To east.

1966: 207, fig. 65) which were interpreted as handles. The one on L may also have been of use as a lashing or lifting stabilizer. Comments on the change of soil east and west of the stone appear in the discussion of the colonnade cut.

Megaliths N and O were also excavated to the roots but both via test pits on the west sides. Both curved down and toward a pointed butt (Fig. 128) but neigher was as sharply knife-shaped in profile as L. N's overall length is 3.6 m of which 1.3 is in the ground. Width at the narrowed butt is only .43 m. The soil in the pit showed a stratum I dark with root mat, .18 m feet deep in the center and .24 to .27 m at the sides of the monolith. This was followed by a lighter band of B soil, my stratum II, which terminated at .55 m surface depth. Here, it was possible to distinguish a change in the appearance of the stone which I first thought indicated

that the original soil surface had stood at this point, and that the stone was originally buried only .8 m and protruded 2.8 m above ground. Later, because this is the contact between stratum II and the clay subsoil (III), it became necessary to shelve this interpretation as anything more than hypothetical.

Monolith O (Fig. 133) is 3.5 m overall length, 1.5 m is now above ground, 2 m below it. Butt width is .85 m. Again there is a change in the character of the buried surface of the stone at a point where disturbed soil (stratum II) ends and the original old clay sterile subsoil (III) begins, this time at .91 to 1.1 m from the butt or about .91 m from the modern surface. If this change in the character of the stone does indicate old surface, the monolith stood 2.4 to 2.6 m above ground when set. However, the observed textural-color change in the stone may simply reflect soil variance and change.

Megaliths A and B are unusual in that both taper to a top with no suggestion of a groove. We have interpreted this as simply an aspect of erosion but there is the alternative that they originally tapered to a flat or slightly rounded top. There is the east-west orientation of the groove of D which is nearby. It is unfortunate that B is fragmented; there may have been a different structural entity at the north end of the large colonnade than has been suggested for the area as a whole.

It would be expected that the grooves, tops and general upper portions would show erosion. It a megalith bore the side stringers of a building it was the groove that received the thrust. Hence a large number of the stones demonstrate breakage and wear there. There are

Fig. 129. Babeldaob 18. Monoliths L and O from top of the broken pediment of P. Monoliths A and C in back, through the notch. To north.

Fig. 130. Babeldaob 18. Monolith F recumbent; I, J, N to rear. Second alignment in background. To south.

Fig. 131. Babeldaob 18. Monolith G in left foreground; H, K, L, O at right; N at left of G and Q at right of G. To south.

Fig. 132. Babeldaob 18. Monolith V at left; U (with Ellen Osborne) leaning on rock chocking done by excavators; R and N at right rear; O and L at left rear. To north.

Fig. 133. Babeldaob 18. Monolith O, left foreground; M partly behind O, N free standing; at immediate right of N is the southwest face; across cleared path is R (free standing), Q leaning to right and fragments of P in right foreground. In rear the central complex: basined monolith at left, recumbent monolith in center and central face. At far right, partially obscured by pandanus leaves is the east face. To east.

Fig. 134. Babeldaob 18. Sighting over monoliths V, N, R to sealine horizon. To northeast.

Fig. 135. Babeldaob 18. Monolith Q and broken top section, lower left; P and S at right; V and X beyond pandanus; U leaning into picture from left. To south.

Fig. 136. Babeldaob 18. In foreground monolith W broken and with basal groove; V in back right. To northwest.

several, however, which have been broken below the groove to about midway of the protruding shaft of the megalith. H, K, M, P, Q, S all demonstrate this kind of fracture. Q and M are inexplicable as far as I am concerned unless they supported logs which served as ridge pole braces. They have overthrown top sections, both something over 30cm in average depth; M to the south-southwest and Q to the south. They are not properly colonnade stones but are grouped in the mid-part of the two lines of megaliths and between them. M is 12.2 m south of G, also located between the rows in the north and is 15.2 m from U placed between the rows as is G, and at the southern end of the major complex. The top of G is broken; U leans sharply to the west and S and Q have lost their upper sections.

The erosion of the grooves is likewise marked but those of O, L, T, H and others are deep and clearly rounded. T possibly demonstrates the process of manufacture of the grooves. There are a series of ridges and hollows, or lands and grooves, angling across the major lengthwise groove. A well known technique in neolithic stoneworking and woodworking too for that matter, is to reduce a surface by pecking or adzing out grooves, and then knocking or breaking away the ridges between the grooves. There is no doubt in our minds that this technique is displayed by the groove of stone T. I was never able to get the proper lighting on the part of T for a useful photograph.

The stones of the small colonnade (Figs. 137–139) are short, stubby and set shallowly in the ground. AA is, like G of the large group, set at the end of the major part of the small

Fig. 137. Babeldaob 18. Small colonnade and south face, from north; monoliths from the left are LL, JJ, KK (all recumbent); south face; GG, EE, BB and AA on right.

Fig. 138. Babeldaob 18. Small colonnade; AA in foreground, then BB, DD, EE, JJ, KK, LL (recumbent); HH to right. To east.

Fig. 139. Babeldaob 18. Small colonnade; LL with lengthwise groove recumbent in foreground; KK fallen to south; JJ to east with grooved top visible; GG behind, HH to left. Monolith X of large colonnade in far right back. To west.

Fig. 140. Babeldaob 18. Central complex with central Great Face at right; to left the recumbent monolith and basined stone. To northeast.

colonnade and off center between the lines. It is a bulbous thing; the basal parts were not shaped but were buried. Its square heavy butt rests .67 m below the surface on the sterile subsoil. I confess that I cannot understand why a stone with a basin cut in the upper surface, rather than a groove, should be in an alignment as is BB. One can easily suggest re-use, or that the interpretation of these stones as building supports is in error. The former thought (re-use) brings the peculiar recumbent LL to mind. It has a well developed lengthwise groove extending along about one half of the upper surface, clearly visible in the illustration and, perhaps, a basining of the foreground end (Fig. 139). This end, fallen to the southeast was the top. It is sadly eroded but my notes say that it must have been "hollowed". I believe the lengthwise groove to reflect a use different than that of the usual colonnade stone, perhaps as a rung, a step, or ramp and that LL and probably BB are re-used in the small colonnade in a somewhat different way than their original makers intended.

The central monolith, the central basined stone and the central Great Face (Fig. 140) suggest a ceremonial focal point in the central part of the plaza, and the way in which a basined stone should be employed. All of these objects are badly eroded and the basin has been partly removed, through breaking away of the side walls. I assume that it was an altar, a place where food was sacrificed. These three stones were apparently arranged in a rough triangle, if we accept the position of the base of the monolith as its approximate standing point. It is the

Fig. 141. Babeldaob 18. Ngerbau village: Kual and his stone.

Fig. 142. Babeldaob 18. East face overthrown to east, before clearing and repositioning; men clearing XY 1 in back.

Fig. 143. Babeldaob 18. Altar stone, excavated and turned up on north side; four foot stones in place. To north.

western element of the three. Southeast 2.4 m is the face, and northeast 2.3 m is the basined stone. Face and the latter are 2.2 m apart.

The XY stones are simply ragged, eroded remnants. We excavated and profiled around them, dug out and turned over the larger fragments and ceased these destructive labors no wiser. XY4 does not appear on the map.

The altar (Fig. 143) is a small dolmen .91 m long by .7 m wide by .55 m thick. It is a roughly shaped andesite boulder, not the conglomerate. Four small pieces of andesite which vary in size from .24 by .18 by .18 m to .12 by .12 by .12 m underlay and were set close to each corner as legs or rests. An irregularly shaped piece of andesite about 30 cm long lay beneath the central part of the andesite slab and beneath the level of the four rests. Its occurrence may have been fortuitous. The altar was buried for about one third of its thickness in the darkened humic root zone, our stratum I, .18 to .21 m. This may have been a mattock zone of cultivation at one time. A typical lighter stratum II deposit, disturbed and culture bearing, extended 30 cm or slightly more below the first layer and the sterile red clay, stratum III, was below that. This profile is typical of many Babeldaob sites. The presence of shell fragments, smoothed by the attacks of the acid soil, and the strongly organic stratum I all suggest food offerings for a long period at this altar.

In no place on the site were there found mauls or stone working debris that would suggest local manufacturing or finishing of the monoliths. We therefore conclude that this work was done elsewhere.

KUAL'S STONE: Long ago a series of peculiar circumstances prompted the removal of one of the Bairulchau monoliths to Ngerbau, the eastern terminus of the trail that crosses the narrow peninsula of northern Babeldaob that is now the Ngerechelong municipality. Kual (Fig. 141) is the Yachad (his title) ra Klubed. The Klubed is his clan, and the name refers to the unloading place, the docks at the end of a channel through the mangrove from the sea. This stone does not truly belong to Kual but he, as Yachad of his kin group, feels a sense of prideful ownership when he is near it or when he thinks of it. Kual is also president of a strong community club called *Ngaramelemis*. It will be best to present the story of this monolith as Kual told it to me through Riosang Salvador, 8th grade teacher in Ngerechelong. It will be noted that this story embodies some aspects of one that appears in Osborne (1966: 200–201).

"Once an Angaur man came to Ollei. He wanted to live there, and he had a house in the Medong part of the community (this is the B19A area). He heard of a community project that was going on, the building of a canoe house at Yungel (head of the Ollei dock). As a good member of the community would, he went to the scene of activity and offered to help. The people were surprised to see a stranger coming to work although he was following an old Palauan custom. When the Angaur man joined the group they were digging the deep holes for the main posts of the canoe house. He immediately started to dig in one of the unfinished holes, using a coconut half shell to scoop out the earth and fill a basket which was then carried away. While the Angaur man was digging, the hostile Ollei men decided to plant the post in his hole. Be it known that such a structural unit is large and heavy and a man caught beneath such a timber would be crushed. This may reflect a thought of sacrifice although such a suggestion rests on no firm data.

"After the post was in its hole, and the Angaur man was presumably killed, the Ollei men were astonished to hear a voice above them. They looked up and there was the man sitting on top of the post, high in the air. He asked pleasantly if the hole were deep enough and offered to dig more if it were not. It was obvious to the Ollei men that the man could not be killed in this way. Secretly they decided to postpone killing him but also decided to give him no food when they ate. He, of course, knew what they intended to do (or not to do) and told the ants to bring him food and pile it beside his betel nut basket. The Ollei leader called "lunch time, let's eat".

The Angaur man started to eat. The ants had brought him as much food as anyone had. The Ollei men were overcome with surprise.

"Nevertheless he was aware that he was among enemies and kept alert. He also tried to make up his mind whether to stay or to go. Finally he decided to leave Ollei when the canoe house was finished. He walked the way to Ngerechelong, over the river and through the taro patches and up and down the steps carved in solid rock (Fig. 167). Close to Ngerechelong, at Ngetechemadech (a jungled valley near Bairulchau) he met an elderly widow who was gathering pandanus leaves for mats and house things. He asked her what she was doing. "Son," she said, "I am getting pandanus leaves to fix the roof of my house". As he turned he saw a bundle of the leaves beside the road and asked the woman if she would like him to carry it to her house for her. She asked if he knew where her house was located, knowing, of course, that he was not a resident of the area. He replied that he could ask as he went along and she thanked him. While carrying the heavy pandanus bundle the man felt the hot sun on his shoulders and knew that the old woman would be tired and thirsty when she came home. So, when he arrived at her place called Ngerchesuul he put the bundle down and proceeded to empty the water containers so that she could not quench her thirst. He noted a hollowed stone in the front yard, where the widow's husband, who was once a coconut sap gatherer, had sharpened his tools. He carefully cleaned it, washing it, and then filled the hollow with the last of the fresh water. He stood by the stone and changed himself into a tiny male larva. His plan was that the widow would drink from the stone, finding no other water and swallow the larva.

"All went as he anticipated. The widow arrived, hot, tired and thirsty, fussed around her water containers, saw the fresh water in the sharpening stone, drank deeply and swallowed the larva. It swam into her mouth and she swallowed it all unknowingly. Soon she felt uneasy and then ill. Past experience suggested to her that she was pregnant; yet she knew this to be impossible. Within a few days there could be no doubt; she was carrying a child. Less than a month passed before her time came and a baby boy was born.

"The widow, by now somewhat accustomed to astonishing situations was further surprised at the boy's rate of growth. It was perceptible right after birth and not long after while lying in her lap, he started talking. In a year he was running around talking to everyone. His mother was shamed and embarrassed. Her age and widowhood were not ordinarily associated with child bearing. She did not talk to people about it. However, the boy soon forced her hand. She found that he could foretell coming events of any kind. For some time she worried but finally she called on her chief and told him that her son could foretell and asked that the chief observe him. Rubak Rechirei came to Ngerechesuul, saw, was convinced and sent word to Uong, first chief of Ngerechelong, who also came and saw the difference between this and other youths.

"During this time, Ngerechelong was weak and regularly lost in local wars. So, when they found that the young man possessed a very special quality they appointed him their war leader in hope that his intelligence and super-abilities could help them win at war. The confidence was not misplaced. There were many wars and Ngerecheolong won them all. Shortly he became high chief, and had many hamlet chiefs under him.

"Since he had brought glory and fame to Ngerechelong, the hamlet chiefs decided to honor him by building a fine stone platform for his house. So chief Uong and Rechirei took the stones of one of the two abai platforms at Ngerechelong and moved tham to the widow's old place. They now had a fine home which was named Idemai. As a further honor they also were to take one of the Bairulchau stones to his house. He owned all of the stones of this site. In order to move the stones the two chiefs called all of the men of the area and went to Bairulchau. They tried all the vines as ties and all of the trees as logs for poles and levers and found that only one vine (*Kolul*) and one kind of tree (*Koranges*) would serve. It took many days to get the stone to Idemai and the men were all very tired and hungry when the task was done. So the young

man told them to stay there at his new place and rest and said the village would feed them and that he would go away and return shortly with a message. They were to await him.

"He went to Ngeremlengui, changed his face to that of the first chief there and went to the second chief. He told the second chief: "tonight we are going to attack Ngerechelong." Then he changed his face to that of the second chief and went to the third chief and repeated the message. The chiefs got their men together and started for Ngerechelong. When they got there, they went up the channel called Ngcheui and stopped. The young man changed himself to look like a Ngeremlengui warrior and told the others that he would spy out Ngerechelong and they should wait. He went to his house where the Ngerechelong men waited and told them that the Ngeremlengui force was at the head of Ngcheui, that it was low tide and they could not escape. So the Ngerechelong fighters surrounded and took the Ngeremlengui men prisoners and took them to their young war leader's house. There were so many that they did not know what to do with them. So they set up a prison camp and named it Ngeremlengui. But there were still too many prisoners so another place was used. They called the second prison camp Ngetmadei. Thus the people of Ngerechelong and their war leader did things for one another and paid off one another.

"After this victory the people believed even more in him and that if he remained war leader, Ngerechelong would always win. So this position remains: it is in Kual's clan and family, inherited through the mother. An older man now has it, and Kual is the next eldest and will succeed. The house is now a holy place as are Medong and Iuoing at Ollei where the Angaur man stayed. Both are claimed by and cared for by the same clan.

"The young man war leader's name was Ngerelong. He got married and later disappeared. Only his wife could see him. As late as German times his voice could be heard giving war advice. His wife is said to have become pregnant and given birth to a stone named Riumd, which the Germans took away."

There is a vague chronology associated. In Ollei lives Skong, a powerful active man of 60. His grandfather, when young, knew a very old man, who when he was young, knew a very old man, tattoed in his upper arms and shoulders, who had seen the rock moved. The tattoed man was a young boy and carried the betel nut bags for the men moving the stone from Bairulchau. This sequence is difficult to turn into years. Personally I would say that there may well be two hundred years represented. If so the clairvoyant war leader lived and Bairulchau lost a monolith sometime in the late 1700's.

Kual did not know, it had not been remembered, exactly whence came the monolith. It is a basined stone and we would expect it to have been associated with the central complex or one of the Great Faces. Yet the BB monolith of the small colonnade is basined. And the colonnade cut profile (Fig. 125) revealed that there had been an excavation, presumably for a monolith, north of N and east of L where there should have been a stone. This is at about the same relative position within the large colonnade that BB is within the small one. Beyond that we cannot go. The term "box-shaped" was used to describe the basin in Osborne 1966 (page 210). This is not wholly correct; the sides are undercut and it would be better called bowl shaped.

Near Kual's stone is a large flattened discoidal mortar stone .55 by .55 m by ca .52 m deep. It has a hole in the upper surface 15 by 15 by 6cm deep. It is named Le biul (Osborne 1966: 210).

The Great Faces

Table 16 offers pertinent metrical and descriptive data and lists the illustrations of these peculiar carvings. Measurements are even more approximate than are those of the colonnade's monoliths. The illustrations are largely those of the Great Faces after they had been excavated to their roots, returned to an upright position, and drains dug around them on the uphill side where needed. Only one yielded evidence of subsurface structuring: the central face was

Fig. 144. Central face with stone chocking below base. To northwest.

Fig. 145. Babeldaob 18. Southwest face after excavation. To west.

Fig. 146. Babeldaob 18. North face, after excavation. To north.

Fig. 147. Babeldaob 18. Northwest face after excavation, placed upright and ditched. To west.

Fig. 148. Babeldaob 18. Looking north from behind south face to central and north faces.

chocked with a number of angular fragments of andesite in front which held it upright until the original excavation was filled. It is a peculiar face, heavily bulging in the lower facial parts and may have been off balance even before erosion.

The salient characteristics show well in one or another of the illustrations: the bulging forehead, goggle eyes, the three central "teeth", the pits and the side fangs and the quadruped-like object below. I have wondered if this last is not a stylized representation of the more clearly delineated animal figure which I consider to depict a crocodile on the Koror 3 stela (1966: 112–115; Fig. 30*a*). I have never been able to find ethnographic material or local information on these carvings that is more than a shallow latter day rationalization.

While the alignment of the large colonnade is 9° or 10 ° west of magnetic north a line between the north and south faces is 6° west of magnetic north. The central face is set several feet west of this line, possibly so that both the north and central faces could see the south face unimpeded (Fig. 148), or so that the south face could see both.

Height check

A transit level was set up over a point .82 m northwest of the northwest corner of monolith G. With an H.I. of 1.4 the horizontal center hair swept the bottom of the groove of monolith L. All other standing monoliths could be viewed through the instrument from the point selected

and the following record was made. The bottom of the groove of C is minus .11 m; of V minus .18 m; of J plus .03 m; of N plus .06 m; R is equal to L; G is plus .43 m; M is broken; Q top is also broken off but it is plus .06 m as is; D is plus .12 m; C in spite of heavy erosion is plus .37 m; A, more eroded, is plus .03 m and X at the southern end of the alignment is plus .98 m.

There is a pattern here. The main group of aligned monoliths of the large colonnade, from E to V, range from −.18 to +.06 m relative to L, a variance of .24 m. The central monoliths, of course, lack grooves and all four (G, M, Q, U) are broken or well out of plumb but the evidence is that they were substantially higher than the grooved stones, .43 m in the case of G. Time did not permit me to dig out the tops of M and Q and measure or replace them and to reset V. The central monoliths had a structural utility different from those of the side alignments.

It would appear that because the far end monoliths were set well above those of the main central group (C +.37 m and X +.98 m) they were used differently or were parts of a different structure. I am troubled by D. The direction of its groove suggests structural variance but it is only plus .12 m relative to L. If only another cross grooved stone had appeared at either the north or south end I could state that cross timbers were set in end monoliths and that they rather surely signaled the north and south ends of the main structure. But the information is lacking.

At any rate I do not consider the .24 m variance of the main body of monoliths to be so great that they should not have been parts of the same structure. Soil variations and settling of the heavy stones, plus possible errors in setting them or in cutting the grooves after they were set could account for this much. After all, some of the stones especially of the east alignment, are not now in perfect line of sight, yet they probably were once so. The variance from L becomes .3 m as we add D and even that is not great. The possible arrangements of cross members are numerous and a difference in the level of the supports could be a part of the plan. However, the end monoliths A, C, X are too high to have been part of the same structure, on the same level, even though all are in the same alignment. My present guess is that there are at least three structures represented by the large colonnade: (1) the main *Bai*, probably the largest building ever built on Palau, was built on stones from F to V or D to V; (2) a smaller north end structure was built on A, B, C and others and perhaps incorporated D and E; and (3) a south end structure employing X, W and other monoliths now moved away or destroyed. The first structure may have been as much as 36 m long.

No such problems exist for the small colonnade. AA is the only central support, probably at or near the western end of the structure. The peculiar history of LL cannot be detailed. The tops of the standing stones are in fairly close accord. The length from MM to AA is close to 18 m, almost exactly half of the length that a D to V structure suggests. The width of the small colonnade, outside to outside of the stones is around 3 m. It is 7.6 m or a shade wider at the large colonnade, this time more than twice as large. One cannot help wondering if there is significance in any of these figures.

Sea line leveling

An interesting fact is illustrated in Figure 134. At site B40, when we were leveling, I had instructed the men to use the sea line horizon to level the chalkline. It is as accurate and faster than a string level. At Bairulchau I wondered if the builders were aware of this device. Several sightings suggested strongly that they were. In making the photograph referred to, the camera was set up behind V and trained northeast over the top of that monolith toward the distant R and N. The tops of the three stones are close to exact level with the waterline. I believe that they were exactly so before erosion and centuries of settling. The use of the horizon in an area with a clear view out to sea is as accurate as anything short of a telescopic instrument. It should be borne in mind that top leveling at Bairulchau is not the same as groove leveling. Top leveling no doubt was done after the stones were firmly set. Sights were made and the monoliths

trimmed. Some stones, or so I would assume, were grooved differentially if structural considerations would not permit changing the dimensions of timbers.

The bai at Bairulchau

Comments as to the nature of the structure supported by the B18 monoliths have been made elsewhere. Speculations as to its size and nature have been offered. The question that follows is simply how was it built? How did the monoliths function structurally?

In the introductory discussion we pointed out that the latter day *Bai* rests on sills which in turn rest on huge plank sleepers 15 to 20cm thick. These are .90 to 1.2m high and the *Bai* floor is thus some 1.1 to 1.5m off the ground. We find it difficult to believe that the *Bai* at B18 was constructed in the same manner. Discussions of the construction of the Palauan *Bai* have been published by Kubary (1873) and Krämer (1926: 229 seq.). In addition to this we were able to observe the construction of a traditional *Bai* in Ngeremlengui municipality and the raising and ceremonial opening on Koror. We were unable to give as much time to this ethnographic work as we wished but, all in all, consider that we understand modern construction methods. Even the very old *Bais* such as Kubary illustrates (1873: tafel XXIX) which have long since gone, and which were sometimes built on upright monoliths or posts, did not omit the transverse sleepers which in turn bore the lengthwise sills. Had the Bairulchau monoliths carried sleepers as the basic timber unit of the structure they should have had transverse instead of lengthwise notching. Rounded timber sills laid lengthwise as the basic structural unit in the rounded grooves in the monoliths would have been inviting disaster, especially in an area where tropical storms are common and typhoons not rare. This negative appraisal of recent *Bai* building methods as applied to the site in question, leaves us with the responsibility of suggesting an alternative.

It exists on Yap. Here men's clubhouses are constructed on two lines of heavy tree trunk posts or columns, forked or notched, which bear stringers running lengthwise. These are the lower structural members or rafter plates for the roof. In addition the Yap clubhouse has a series of central pillars or tall tree trunk posts which support a ridgepole and thus carry the weight of the roof centrally while the outer two lines of posts and their rafter plates carry weight and stabilize against outward thrust of the roof. The Yap roof thus is low at the eaves, while the Palauan is much higher, having a greater complex of structural items (sleepers, sills, and the roof posts incorporated in the walls resting on the sills) between it and the ground. The roof and subroof supporting members and the carpentry of a Palau *Bai* are all far more complex and sophisticated architecturally than are the Yap counterparts. The Palauans do not use the central roof supports but tie the entire roof structure together with an intricately joined interlocking system of the plates, girders and rafters, thereby clearing their floors of the central roof pillars. Palauans depend more on carpentry, joinery for stability; the Yapese more on lashing, intricate and attractive as it may be.

We see at Babeldaob 18 the lithic remains of a structure of the Yap type. The outer alignments bore roof plates, not floor stringers or sills. The floor was thus at ground level, not 1.8 or 2.1 m above ground at or above the tops of the monoliths. The whole structure was thus not as high as the impressive monoliths suggest. The central monoliths (G, M, Q, V) higher than the outer ones, are not tall enough to match the Yap style roof posts. They must have supported short sections of tree trunks on which the ridgepole rested. All four of these monoliths are broken at the top and I did not dig up and investigate the tops of M and Q, lying nearby—a definite oversight. It is possible that all four were basined, not for some esoteric reason, but as a footing for a wood column to support the ridge poles. If this hypothesis is true then Kual's stone should not have been in place east of L and between N and J. A small bit of excavating should settle the matter. The preceding reconstruction, if it is the correct one, suggests that Palauan material culture had not yet felt the pressures of change which brought more advanced methods of architectural planning and carpentry into these islands from Indonesia (see Moore 1930: 196, 208) along with, perhaps, other things such as linguistic and societal changes and Palau money. The architectural winds of change failed to reach or impress the builders on Yap.

While we were on Yap with Sherman and Judith Lingenfelter we were taken by them to Bulwol, which I believe is the site referred to by Gifford (1959: 154) near Gaychapar village. I have little to add to Gifford's description except that there is a large slab inside the south side of the east wall, leaning against the pillars (a seat) and that there are three out of the west alignment which now includes only 4 stones. The tops have worn shallow notches which run lengthwise of the monolithic alignment. These monoliths are shistose slabs, the site is smaller than Bairulchau but the plan is closely akin and fits the kind of structural basics required by a Yapese clubhouse, as indeed does Bairulchau.

Yap clubhouses are built on platforms and floored with wood. The floor is not the ground and dryness and comfort are obtained. No evidence of flooring was observed in our B18 dig, and of course there is no evidence of a platform. If there were one all stones have been removed, a situation that is possible but difficult to accept. In addition our trench through and across the lines of monoliths showed no evidence of a ditch to protect against runoff from the hillside slope west of the megaliths, though a notch into the toe of the hillside indicated the beginning of ground leveling for the plaza. If there were a floor it was of perishable materials, wood, bamboo and matting, none of which would leave archaeological traces in a land alive with termites. But we still see the need for protection from hillside drainage. Perhaps, as the legend says, the place was never finished.

One short version of the Bairulchau story is given in the survey volume (Osborne 1966: 198). Another was told by Ngatel Rimirch and interpreted by Riosang Salvador. The narrator lives in the northwest part of the major Ngerechelong area in the lowlands called Ngeungel. This is an abbreviated version: the narrator, an elderly and rather frail man, was fearful of telling the story to me. He said that people would criticize him and disagree with his rendition of the story. He had apparently had some difficulty in the past and was upset at the thought that his story might be printed. I could not say that I would not print the tale. Ngatel had promised to tell the whole story and at first stated that this was all that he knew but both Salvador and Kual, who was with us, knew enough of the legend to disagree with him and he finally admitted that he gave only a sketch, unfortunately disjointed. Both Kual and Salvador expostulated at length and Salvador, who was using a small battery driven tape recorder, was afraid that it might have increased the old man's timidity. The legend states that:... "The stones were quarried and shaped in Angaur at a place called Olsachel ra Ruchel (a place where God worked), and carried to Ngiwal. From there they were brought on to Bairulchau but the beams (which appear to have been made of stone also) were left in Ngiwal. A part of the roof was also left but at Ngrul (near the present school) by the mangrove flat." Ngrul is south of Ngerechelong. All of the materials were prepared in, and brought from Angaur.

When the actual building started all of the builders were there except one. Everyone got hungry but they waited for this person Medichi Balau. After a while they started to eat. Then, of course, the missing man came, belated, and was angry because the others had not waited for him. He took a coconut husk, burned it, and threw it beside the others. He then turned it into a rooster, which crowed. This startled the rest of the crew and all ran away home. The reason that these people went home when a rooster crowed was that they worked at night and the rooster crow suggested morning and bed time. The rooster's name was Delsuld, which means "burned husk".

Villages other than Ngerechelong and Ngiwal were involved: the people of Ngeremlengui heard of the work and prepared much food for the workers. They got it to the dock (Ngerutechel) and then got word that the workers at Bairulchau had disbanded. So they left it there and it became stone and is still to be seen on the dock at Ngeremlengui.

The people who worked on the construction were "like spirits". They were peculiar creatures: heavily tattooed, extremely hairy, short and dark. Indeed, they had to comb the hair from their eyes, otherwise they could not see. When one was sitting beside the road he looked like an old tree stump. People would bump into them or tread on them or come close to doing so, and they would say "Don't hit me." They wore the *ksid* flower (*Pagraea ksid*) in their noses, through a hole in the septum or alae. As we know, they worked at night. No one knows where they lived or where they went.

A few comments are in order. The *ksid* have been encountered before in a different context (Osborne 1966: 203--4). As described in this tale, they are the closest that we have come in the Palaus to hearing a reference to the small dark magical builders of the Pacific such as the Menehune of Hawaii. Angaur is considered to be the area whence came wonderful and magical things, at least by the people of northern Babeldaob. Its use in such contexts is patterned. Of course, the andesite could not have come from Angaur. That island is entirely a raised coralline limestone platform.

One of the mythic prefabricated parts of the great *Bai* is said to be lying in the shallow tidal flats off the east coast of Babeldaob south of the Ngerbau docks. Renguul and Osarch offered to take me to it and on the 19th of April, 1969 the tides were right. We took a short cut through the mangrove swamp south of Ngerbau following a path of eroded slippery coral heads along the edge of a narrow old canoe and bamboo raft channel. This led, to my great relief, onto the sand and eelgrass tidal flat. The very low tide made it possible to wade to the stone. In my naivete I had expected a monolith. I saw a small exposure or reef of fine andesite conglomerate. It was nearly wholly exposed at the low tide and, as I saw it, is an irregular low lying curving triangle of bedrock some 43 m east-west by 23 m north-south. It is one side of the intended roof of the incomplete Bairulchau. The other is at Ngiwal (B36) down the east coast of Babeldaob about 16 km, and the ridgepole is still at Airai in the southeast corner of Babeldaob (B29). I have still not seen those pieces. The reef is shaped somewhat like one side of a roof and is probably part of a flow. There is an overlapping of folds or layers on the surface which is vaguely like the overlapping effect of palm frond or pandanus shingles of a thatched roof. The whole *Bai* was to be made of stone. When we returned we were told that typhoon warnings were coming in from the Palau radio station on Koror, and by that night there was a bellowing storm.

Excavations

HILLSIDE TEST: The first excavation was the hillside test, 61 m west and up the hill from the northern part of the large colonnade (Fig.120). There are heavy sherd concentrations in the area but only the vaguest impressions of terracing. It would have been entirely possible that this was a prime living and garden area sometime in the past. Some taro grows well in such a situation (Fig.151). Although this test was set up partly for training, it turned out to be an excellent test. A narrow trench 6.1 m long was dug quickly. Stratigraphy observed on the north wall of this was followed in stripping the remaining excavated part of the deposit stratigraphically, an area of 1.5 by 6.1 m. The soil layers found here are essentially the same as encountered at all excavations.

Stratum I is 15 to 24 cm thick. It is dark with humus (Fig.149), carries a medium root mat and may have been cultivated in the not distant past. Cultural remains are common. Below this is stratum II which I have customarily divided into upper (A) and lower (B); these are properly substrata though I have used the term sparingly. This division is not based on firm pedological or cultural grounds, but upon the depth of the deposit. It is the prime culture bearing stratum of the volcanic parts of the Palaus and there should be culture change entombed within it. Here and usually, A is a light yellow or tan clay, fairly heavy but often friable with little organic stain; sherds and andesite cobbles are both present. Surface depth of the bottom of IIA, the line

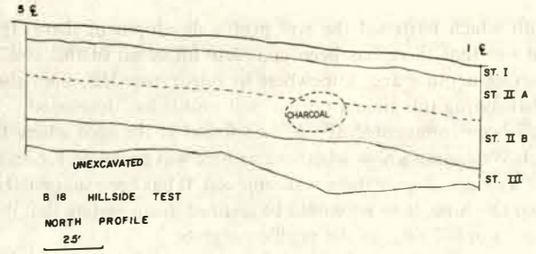


Fig. 149. Babeldaob 18. North profile of hillside test.

of division between A and B, is .61 to .76 m at the hillside test. Stratum IIB is yellower, often more friable, has even less organic material and is penetrated in its lower parts by the red clays of the mineral subsoil stratum III. Surface depth varies to 1.4 to 1.5 m at the bottom of IIB. Sherds were found, though not in quantity, to 1.7 m; most were in the upper two-thirds of stratum IIB. Stratum III is a heavy lateritic red clay, generally culturally sterile. In most areas where I have tested, this same ABC soil profile obtained. It is far shallower in most sites and even more so in places where there is a lack of cultural evidence. Here it is 1.7 m or deeper. Obviously the hillside saw much use in the past and the soil was dug up and turned over as it crept and was moved downhill by the dwellers. The charcoal area(Fig.149), the result of a rather large fire burning small wood stems or branches, is in the midpart of the profile. It was not in a pit but the depth and size of the soil including charcoal or stain is large. It was found through the upper 3/4ths of IIB and into the lower quarter of IIA. It was probably not a short time deposit. This sequence was redesignated stratum I (I), II (IIA), III (IIB), and IV (III) for the ceramic discussion because of coding difficulties.

COLONNADE CUT TEST: Two excavations across or perpendicular to the large colonnade were accomplished. They were placed close together, the first tangent to the north surface of monolith L was 13.7 m long and the second between L and O, lengthened this by adding 3.7 m to the west. The results of these two trenches appear in Figure 125. It will be noted that the typical soil profile appears both above (west of) and below L, but that these differ in that the western uphill profile sequence appears to be raised by about 30 cm above the sequence east of the monolith because of the leveling notch (N, Fig.125). Stratum I blankets the entire profile most properly. Below that IIA is a narrow band .21 to .24 m thick above the monolith but is .46 to .52 m thick below it. IIB is over .3 m thick both above and below; underlying this there is a zone .37 to .40 m thick of mixed material, more akin to stratum III than to II above it, which is terminated only a short .91 m to the west by the cut or step which marks the western edge of the leveling operation accomplished by the builders of Bairulchau when they prepared the site and its environs for the monoliths.

This mixed soil may contain some of the spoil from the socket excavated for L but it is probably largely fill derived from hillside wash from above and from both sides. It is represented by a much thinner deposit, only 15 cm or so thick, some 1.5 m south of L so presumably the monolith caught and held a bank of soil as is so well demonstrated by the truncated mound of earth that has formed on the uphill side of Q (Fig.126). Figure 135 illustrates these soils above and below the monolith. I must admit that I am not wholly satisfied with the extent or results of my examinations of the pedological underpinnings at Bairulchau and should like to excavate there further. Below IIB is a normal stratum III and below the monolith a normal profile exists except for the fact that IIA is pinched to a narrow band by the time it reaches the pit below 285L15. This may have been caused by water ponding and seep

below the monolith which hastened the soil profile development there. It is probably not necessary to point out that there has been complete fill of all of this soil from somewhere around the 1 m surface depth mark, somewhere in substratum IIB, since the monoliths were abandoned and that during this time a normal soil profile has developed.

The pit, as has been commented above, was found in the spot where there should be a monolith but is not. We cannot know whether this hole was prepared for an incumbent which failed to arrive or if a monolith once there was removed. It has been suggested that Kual's stone may once have filled this hole. If so we would be justified in suggesting that it caused the piling up of sediments on its uphill side, as the profile suggests.

Charcoal, which was dated (see 1762K) and another smaller piece which manifested wood structure were found in IIB. F. R. Fosberg of the Tropical Biology program, U. S. National Museum, took responsibility for identifying it: almost surely *Barringtonia asiatica*. The tree is large and spectacular, the wood good, the flowers amazing and the fruit a common fish poison. The tree may have grown nearby on the adjacent beach.

ALTAR TEST: This dig (Fig.120) yielded a simple abbreviated and classic volcanic island soil profile. The stratum I is .18 to .21 m thick, darkened with roots and was probably recently cultivated. Stratum II, not readily divisible into A and B, is .34 to .37 m thick below I and the sterile subsoil (III) lay below that only an approximate .55 m below the surface. Sherds were heavy in stratum I and declined to rarity in the lower part of stratum II.

CHRISTMAS TREE TERRACE: The altar test and numerous test holes that we had dug in exploration in and around the plaza and monoliths gave scant encouragement to the hope of another deposit as good or better than the hillside test. Christmas tree terrace, not truly a terrace but an artificially leveled hill, was the last hope and even it was disappointing. We did not excavate intensively, only a 1.5 by 3 m trench oriented east-west (Fig.120). No structural evidences were seen. The stratum I is well developed. Stratum II is a tan clay, divisible but not readily into A and B sections. Red clay subsoil is completely sterile at .91 to 1 m surface depth. Sherds were not numerous.

There remain two more test trenches to mention and describe briefly. Neither yielded new data except that both added to our areal variation in the sherd collections. The location of the small colonnade test, an expansion of a Japanese pit, may be seen on Figure 120. It was tangent to monolith HH which was buried only about 30 cm in the earth. Another test pit revealed that GG was also set at the same depth. Stratum I was noted to a depth of .21 to .24 m; II, not divisible into the usual two sections, extended to .61 m where sterile C soil began. We did find a sherd buried slightly in the surface of the subsoil, indicating that human activity penetrated the old soil. No evidences of aboriginal digging exists, however, as there has been time for the natural soil horizons to reform and eradicate evidences of the churning of the past.

A last test was made in the southern part of the large colonnade north of Monolith X between stakes 380 and 390CL. The same profile was noted except that it is even more poverty stricken. Stratum I is only 9 to 12 cm thick, IIA is reddish and heavy and like I, carried a few sherds. IIB is barely distinguisable from stratum III beneath. It is heavy reddish and lacks cultural material as, of course, does the third stratum below. It is perfectly patent that there was minimal alteration and probably minimal use of this area in archaeological times. The sherds could well be largely drift from the occupied hillside to the west. The weaker cultural evidences found in the plaza compared to the depth of the hillside deposit, indicate a light use of the plaza and monolith area. Plaza levelling must have removed a large cultural deposit. Presumably this was piled to the east where it remains untested.

In addition to the tests desctibed, 20 small exploratory test pits, 10 probes around monoliths, or small digs necessary to set up a leaning stone, were completed. We need not discuss the test pits or probes and monolith clearances here. The results were incorporated in the pertinent descriptions.

Platforms 1 and 2

There are two platforms, both incompletely paved with very large andesite boulders .61 to .76 m long, on a terraced nose a short .4 km east of Christmas tree terrace. The area was not mapped. While the terraces are linked to the main B18 site chronolgically by the pottery, the platforms themselves are later and are probably not. We decided to clear the platforms in the hopes of finding structural evidences and graves, and of finding pottery that might be associated with them. Siliang, a crew member, belongs to the clan that owns the land and secured permission for excavation with the usual proviso concerning the finding of Palau money.

Neither platform is complete. The stones along the sides and the interior paving do not cover the terrace surface. It seems likely that they were never complete, rather than that they were robbed later. Platform 2 is to the south of 1, on a lower step and close to the jungles that lead down to the mangrove and the sea. It has a near northeast-southwest orientation: the east wall has a south 30° east bearing. Greatest length (east-west) is 12.8 m, greatest width is 10.7 m. There are only 14 of the large boulders outlining the essentially complete northwest side. A test there revealed the same profile as previously described. It should be noted that, although the test was made within the platform, we were testing the old terrace soils.

Platform 1 received the greatest amount of attention. The major orientation of east and west walls is north 10° west, exactly the same orientation as that of the large colonnade. Wall lengths are 10.7 and 10.6 m respectively. The south wall is 8 m long and the north 8.2 m. Corners are right angles. The east wall is incomplete, having only 8 stones; the north has 12; the south only 6 and the west 8 large ones. The central area is incompletely paved; perhaps one third is bare.

A third platform was eventually found as a small remant 19.2 m west of platform 1. It is now 2.7 by 5.4 m with only 25 large stones visible. These remains were found in April after a fire had destroyed the covering grasses.

We cleared an area in the northwest corner of platform 1, where there were few large paving stones to uproot (Fig.152), and warped an irregular T-shaped excavation into it to avoid platform destruction. The upright of the T to the south, covered 2.2 square m, 1.2 by 1.8 m and the bar 3.7 square m, 1.5 by 2.4 m. The digging was prolific of sherds. The stratum I midden is deep; it averages .3 m and is dark. Stratum II is also unusually heavy here, dark brown and organically stained; it too carried a heavy complement of sherds. It dipped deeply underfoot toward the south, the interior of the platform and of the terrace (see west wall profile, Fig.150) and was never worked out. The same is true of the third stratum. As will be recalled, this is ordinarily sterile red, heavy, often lateritic bauxite clay. Here the third stratum is red, but broken, lumpy, mixed with brownish marerial and sherd bearing. On our profile it

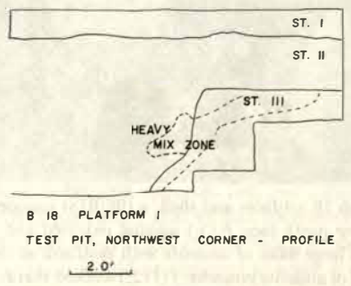


Fig. 150. Babeldaob 18. Profile of northwest corner of test pit, platform 1.

Fig. 151. Babeldaob 18. Taro on the dry terraces near western Ngerechelong, on the road to Ollei.

Fig. 152. Babeldaob 18. Platform 1, paving and vicinity. The arrow on the skyline points to the Ollei (B19B) crown. To north northwest.

Fig. 153. Babeldaob 18 artifacts and shell. *a* (98/B18) rounded fragment of *Tridacna* shell found below north face; *b* (3/) waisted indented and pitted hand hammer of andesite; *c* (70/) large flake of andesite with platform at top; *d* (118/) scoria file; *e* (39/) handle end of andesite pounder; *f* (112/) worked sherd; *g* (2/) andesite spheroid. *b* is 9.3 cm long.

Fig. 154. Babeldaob 18 patinated sherds. All are thin fine pieces. Catalog numbers are lot numbers. *a, b, k* (part of 83/, 124/) with white patina; *c* (84/) with buff patina; *d* (10/) buff patina and cogwheel knob decor; *e* (38/) mottled patina; *f, g, h* (105/, 83/, 79/) with heavy grey patina; *g* is flat base, *h* rim sherd; *i, j* (124/, 104/) with red buff patina or fused paste. Rim length of *a* is 39 mm.

Fig. 155. Babeldaob 18 sherds and Koror 3 worked sherd. *a* (43/) edge view of rim sherd with light patina, smudged core; *b* (105/) heavily smudged sherd with no patina; *c, d* (124/, 125/) edge view of rim sherds with heavy exterior patination, smudged cores; *e* (125/) with mottled patina over heavy smudging; *f, j* (130/) soft patinated surface smooth and painted, lip of *f* is down; *g* (125/) redware sherd with fused? paste; *h* (47/) edge view of thin walled sherd heavily patinated or altered with thin smudged core remaining; *i* (99/K3) spoon shaped worked sherd; *k* (105/) heavily smudged sherd with mottled patina, lip at right; *l* (119/) indented rim sherd, lip at left. Length of *i* is 63 mm. *m* (103/) shouldered bowl section. Figure 162*a* is a reconstruction of this bowl.

was encountered in the north part of the short trench near the edge of the terraces as if it had at one time been fill earth used in terrace enlargement. We found no true recognizable undisturbed sterile subsoil. It soon became apparent that our digging had disclosed essentially the same situation here at the B18 platform 1 that we had encountered on the B40 crown. There had been extensive alteration of the natural soil arrangement, no doubt as a part of the terrace building, and a full scale excavation would be required to work it out. It would be well worth while to do so, as it would at B40. I expect that the same situation will be found at many sites. It

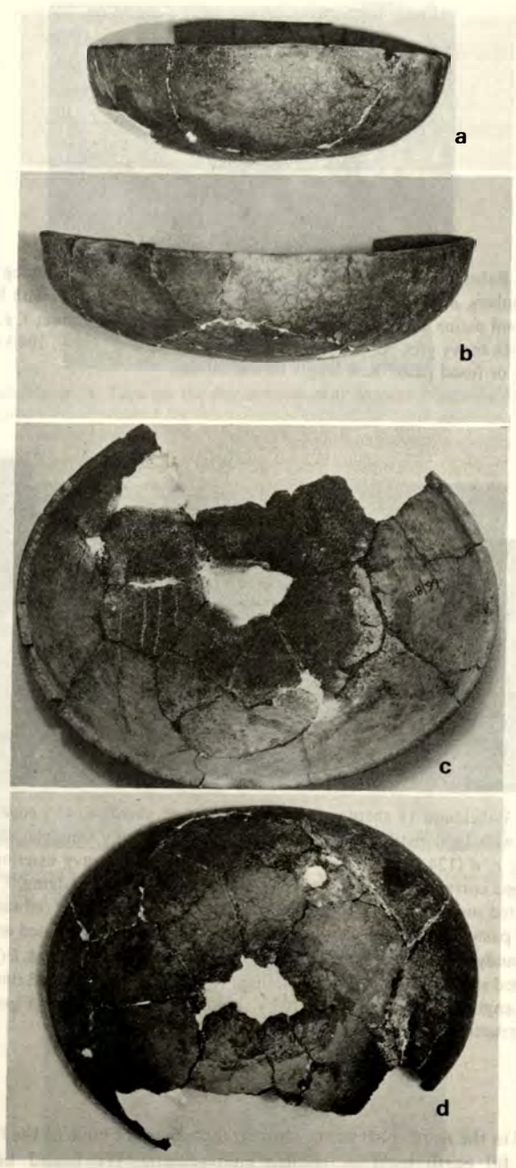


Fig. 156. Babeldaob 18 (66/B18) Repaired oval bowl, platform 1, Stratum II. *a*, end view; *b*, length view; (*c*, interior *d* exterior; bottom had deteriorated and exfoliated from use over fire and eventually broken through. The bottom of the bowl is bright orange-red as all carbon had been burned off. Cross section and plan view in figure 162 *d*.

was here, from stratum II, that we recovered the only fully restorable bowl from all of our excavations (Figs.156, 162*d*).

The dig gave us no reason to associate the platform with the terraces in the sense that the former was built there during the terrace activity period. It is my present feeling that we have no evidence for believing that there ever were large platforms built on the terraces during the major period of their formation and use. This lack of evidence may be due, as was commented in the discussion of the colonnades, to the unfortunate Palauan propensity for moving stones around. Selected stones, especially of andesite, with a large flattened surface, are valuable things. Perhaps we should not expect them to stay in their areas of first use by man.

Artifacts

A small rectangular pitted hammerstone made of very heavy andesite, a broken stone ball, which may be natural, and two pieces of sharp scoria, probably used for filing, were all that we found on the surface. No shell objects can be labeled certainly as artifacts: the acid soil has been too destructive. These and a few other objects, all described below, are all the nonsherd artifacts from Babeldaob 18. Thus we have no evidence that is worthy of the name of the thousands of hand tools made of bone, shell and wood that must have been used on the site. The most spectacular remains, the monoliths, and the most lowly, the potsherds, are all that remain.

The heavy andesite hammerstone (3/B18; Fig.153*b*) is 93 by 54 by 13 mm, weight 258 grams. The object is waisted, the indentations are broad, 30 to 40 mm, and about 5 mm deep. They are opposite the pits, 5 and 7 mm deep which occur on both sides. This configuration suggests that the stone may have been hafted and that the indentations are for tightening wedges or keys. Both ends are rounded, but the erosion that this surface piece has suffered has removed any immediate marks of use. It is cracked and worn.

The stone ball (2/, Fig.153*g*) appears to have been pecked and crumbled to shape but its weathered surface, like the hammerstone, leaves the observer in doubt. It is broken, part is missing. Dimensions are 42 by 52 mm, weight, as is, 120 grams. It may be a hand held hammer. Scoria files are common tools in the Palaus. One (118/, Fig.153*d*) is large and one surface is worn smooth by use, probably on wood or shell. The other (same catalog number) is a small fragment.

Forty-nine much eroded small shell fragments of *Tridacna* were found under and around the small altar dolmen and a larger piece came from the north face clearing excavation (98/, Fig.153*a*). There are no artifacts among them but all are rounded or smoothed by acid erosion and perhaps by African snails in search of calcium. Coral fragments came from stratum I of the platform 1 excavation (71/ and 106/) and a piece of aragonite was found at a depth of .61 m in the Christmas tree terrace trench. It is crumbly and soft and looks like a small piece of white plaster. These objects were all brought in by the inhabitants but they give no indications of working. On the other hand one small block of *Tridacna,* 36 by 25 by 24 mm from the surface of platrorm 2, has a smoothed facet which suggests that it is part of an artifact. If so this argues strongly that the platform, or both platforms are not ancient, as has been suggested on other grounds above. A fragment of iron ore much like the material from B40 was found in stratum I of the hillside trench. This hematite might well be of natural origin in the soil.

There are only three worked sherds: 8/B18 from stratum IIA, hillside test, is part of an oval or circle that was approximately 40 mm in diameter and 8 mm thick; 9/ is from the same provenience, 43 by 40 by 11 mm and 112/ (Fig.153*f*) is a small oval from stratum I, altar test, 32 by 27 by 7 mm, that is indented on both ends. All are of red ware.

Finally there are two stone objects from the excavations. 39/ (Fig.153*e*) is the proximal or handle end of a pestle or food pounder of andesite. It was found in stratum IIA, hillside, and is a four sided truncated pyramidal piece 33 mm long. Top measurements are 25 by 23 mm. The

last piece (70/, Fig.153*c*) is a large side flake of andesite 80 mm wide, 75 long and 24 mm thick across the striking platform. Only a small corner of the bottom edge of the flake remains uncrumbled: it shows the sharp curve of a hinge fracture. The remainder of the edge does not appear to have been hinged. While it is possible that such an item could have been formed accidentally during the large amount of stone working that must have taken place at the site, it nevertheless appears to have been a purposefully formed flake. The platform has all of the attributes of preparation and the bulb is strongly marked. The andesite is fine and dense, the kind of stone that should be chosen for a flake with a cutting edge. It weighs 143 grams and is heavily patinated; it was found in stratum I, platform 2.

ILLUSTRATED SHERDS: Profiles of most of the rim sherds are illustrated in Figures 157–8, 160–1, 163–5. The reference here is to various fragments by which I have attempted to demonstrate visually some characteristics of Palauan pottery, particularly those from sites in the volcanic lateritic uplands. Sherds from B18 are rarely decorated, at least in comparison with those of B37 and B40. A heavily smudged rim piece (119/, Fig.155*i*) has two indentations and part of a third below the rim. Indentations are 2 cm center to center and are 1.5 by 1.3 by .7 cm deep. Painted sherds appear in the same Figure (130/, *f* and *j*). The soft "patina" so soft and flaky that it is removable with the fingernail, might be called a colloidal deposit (if there were such a thing) were it not well smoothed, even polished in spots, and bears the remnants of a painted design, at top and bottom of *j*, and in a splotchy overall manner on *f*. These two sherds and others of the same catalog number illustrate well one problem with our so called patinated sherds. The soft external surfaces appear to be essentially the same in color and appearance, smoothed and irregularly checked as do the extremely hard patinated sherds. Such a sherd is 124/B18 (Fig.155*c*) shown in cross section. The light rimming of hard patina contrasts with the lightly smudged paste, the black speckle of sherd temper and the light inclusions of what are probably zeolite fragments in the clay. On this sherd, the patina so called is tightly bonded to the interior. It is an inseparable part of the sherd and cannot be flaked or peeled off as it can from the two 130/ sherds. The last word has not been said on these peculiar sherd exteriors but I believe them to be related and to be the varied results of exposures to differing aspects of soil chemistry and physical action.

Sherds 43/125/ and 47/ (Fig.155*a, d, h*) illustrate the same situation. The first and second show clearly that our patina cannot be a float; note its irregularity outside of the thin, wavy carbon streak of *d*. It is less visible, thinner and not contrasting on the cross section of *a*.

Sherds 105/ (Fig155*k*) and 125/ (*e*) illustrate another facet of patination. It often occurs as a thin irregular skin (*e*) or as a seemingly random series of linear abrading lines, usually of little depth (*k*). Patination, primarily when it appears as a thin complete skin, may be seen to have developed on a broken edge of a sherd (Fig.154*i*). Thus one may be sure that, in some instances our so called patination is a post fracture, subsurface development. On the other hand, such sherds as another from 125/ (Fig155*g*) and from 105/ (*b*) do not have patina. The former is a fused or almost sintered appearing redware, hard, brittle, easily shattered; the latter is heavily smudged throughout. Why these two sherds, perhaps divergently treated as pots or as accidentally included fragments in hot fires or ashy smudge of some fires of the past, should not have become patinated (if such the change is) is not apparent.

All sherds in Figure 154 are thin hard fine to medium pottery which have been patinated in varying degree. These thin walled sherds if not patinated are very fragile. Figure 154*a, b, f, g, i* are sherds that are heavily patinated or altered. Item *g* is made up of five sherds fitted together; the bottom two are far less heavily altered than the upper three on the side illustrated. The other side, probably the interior of the flat base, is uniformly white patina overall. Figure 154*e* is an interior corner of a flat platelike dish, probably oval but with flattened sides or ends. For our purposes here, it illustrates the peculiarly differential development of the patina, probably

often correlated with heavily smudged or carbonized pottery. Figure 154*c* and *k* illustrate partial development of the exterior layer; *h* is two repaired sherds from a fine hard pot. The paste is grey throughout with medium size sherd tempering particles. It appears that moderately smudged sherds in this instance have altered to a uniform grey color; *j* is a very hard red ware sherd similar to that illustrated in Figure 155*g;* the hole is biconically drilled. Finally, Figure 154 *d* is an aspect of decoration best termed cogwheel modeling. The small fine buff sherd has a simple straight rim, with 3 conical hand modeled and trimmed cogs 12 to 13 mm apart. Temper is medium coarse sherd. The hard buff pottery except for a thin central carbon streak appears to be all "patina".

The oval bowl 66/B18 (Figs. 156, 162*d*) came from a remarkably heavy deposit of large sherds in stratum IIB of platform 1. I believe, although the extent of these sherds is not known, that it may represent an unusual aspect of discard and is a feature. We have seen that oval bowls were the only shape mentioned at first contact and that it was well nigh impossible to ascertain whether or not many of our rim sherds were from oval or circular bowls. Hence this repaired bowl stands as a lone representative of an apparently long lived form. Its archaeological value is far greater than its beauty.

Ceramic analysis

In this site all lots of more than 100 sherds were analyzed as follows: all rims and bases were analyzed. The remaining body sherds were sorted into thick and thin, counted and then stirred. Enough were selected proportionately from the piles to make a total of 100 sherds.

COLONNADE CUT: The sherd supply from the thin midden and heavy clay deposit of the cut was likewise thin. There are 38 sherds from stratum I, 166 from stratum IIA (100 analyzed) and 54 from stratum IIB.

Exterior color was rarely recorded; heavy patina exists on nearly a third of the sherds of stratum IIA and about one-fourth of those of IIB. Red color appears to predominate. Surface finish is essentially the same as that of most Babeldaob sites: smoothed on both surfaces is dominant. Smoothed exterior and rough interior is next, but unusual. Surface decoration is lacking except for one indented sherd from stratum IIA. Smudging on both surfaces is

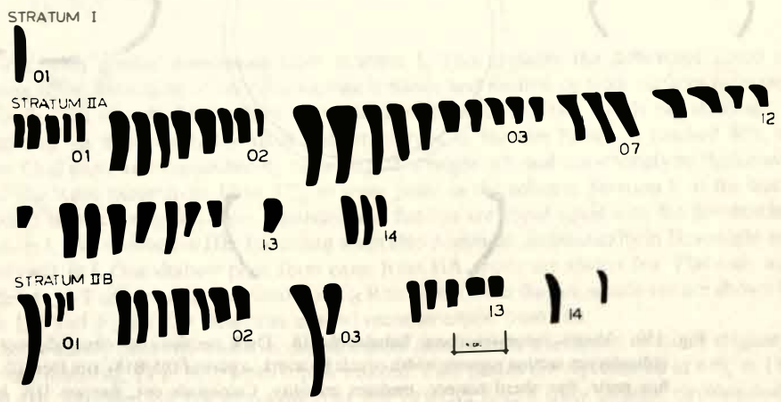


Fig. 157. Babeldaob 18. Rim forms, colonnade test trench. Unfortunately the majority of rims from stratum I could not be drawn with the formagauge due to breakage and erosion.

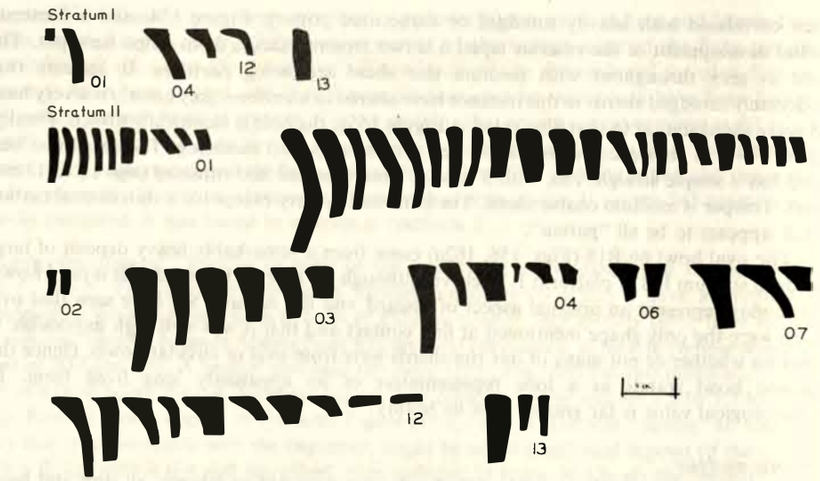


Fig. 158. Babeldaob 18, Rim profiles, Christmas Tree terrace trench.

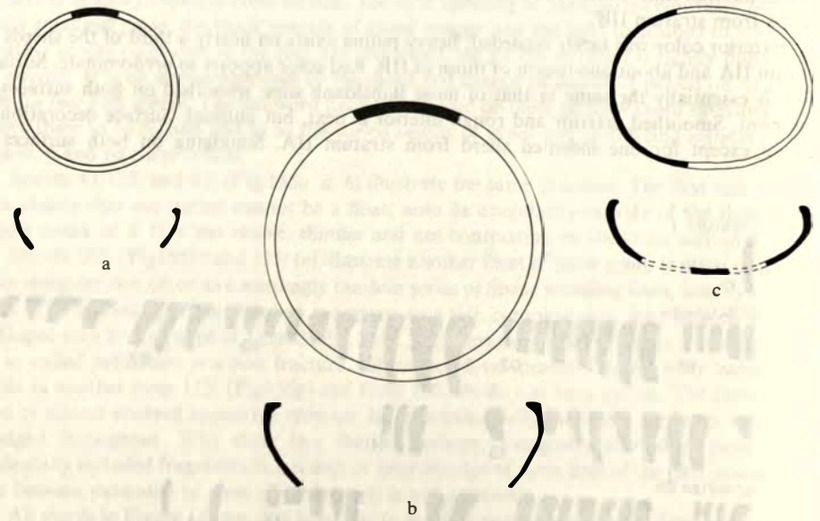


Fig. 159. Vessel reconstructions Babeldaob 18. Dark section on circumference indicates rim section present: width equals lip width. *a* part of 105/B18), rim form 02; fine paste, fine sherd temper, medium quantity. Colonnade cut, stratum IIB. *b* (120/B18); interior lip rim form; extra fine paste, fine sherd and sand temper, light quantity. Christmas tree terrace, stratum II. *c* (58/), rim form 03; fine paste, fine sand and sherd temper, medium quantity. Altar test, stratum I. Diameter of *b* is 55cm. (outside)

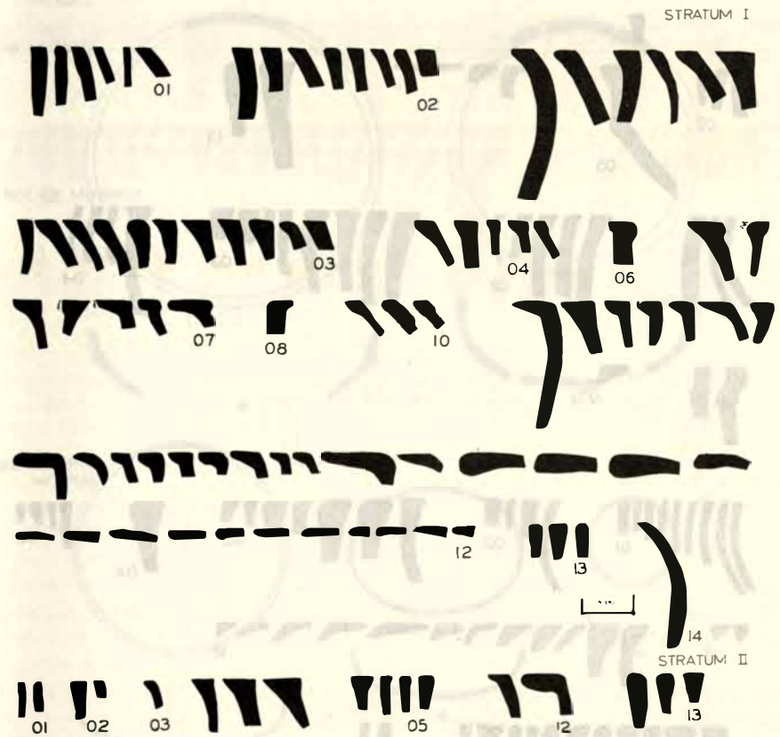


Fig. 160. Babeldaob 18. Rim profiles from altar test. All rims were used in figure, including those from squares deleted from analysis.

dominant, with greater dominance from stratum I. This explains the difficulties noted in observing color. Smudging of only one surface is minor and erosion on both surfaces increases with depth. The record of firing is of no value. It rests on one or two sherds per stratum.

Interior lip is probably the most important type in the rim forms. It reached 46% in stratum I but elsewhere is matched by incurving 02, straight, 03, and less strongly by thickened. All but the latter range from 12 to 37% at some point in the column. Stratum I, at the least, appears to be a late manifestation. Rounded and flat lips are about equal with flat dominating in stratum I, and rounded in IIB. Incurving walls also dominate, emphatically in II; straight are at their peak in I. One shallow plate form came from IIA. Bases are always few. Flat only was recorded from I and rounded dominates in II. Rim forms from the colonnade cut are shown in Figure 157 and Figure 159 illustrates a bowl reconstruction from IIB.

Use is wholly cooking, where recorded. Pastes demonstrate a seriation of minor elegancy. Extra fine is strong, 21 to 32% from top to bottom. Fine pastes are represented at 63% in I to 46% in IIB. Medium are not as common as fine or extra fine, a truly unusual circumstance. Coarse is minor. Tempering material is sherd or sherd and sand. Sherd is dominant but not outstandingly so. This, it should be pointed out, may not be cultural but rather, for example, a change of source of clay. Temper size is overwhelmingly fine. Coarse is obviously rare. Temper

Fig. 161. Babeldaob 18. Platform 1 test; rim forms in strata as excavated. In computer analysis and discussion, Strata IIA, IIB top and IIB bottom were joined as a unit (Stratum II). Figure shows all rims from the excavation.

quantity has its major balance between medium and light. The former is 29% in I and 57% in IIB. The latter goes from 71% to 35. Thus tempering lightens through time. Heavy occurred in a minor way in the lowest two strata.

Mean sherd thickness is essentially the same for all levels, 8.1 mm to 7.9 downward. Lip widths also decrease with depth, 15.6 to 9.4 mm. These figures reflect the decreasing importance of interior lips. Vessel diameters, in line with the other attributes and also in other excavation units and sites, decrease with depth: 42.0 cm in I to 36.1 cm in stratum II.

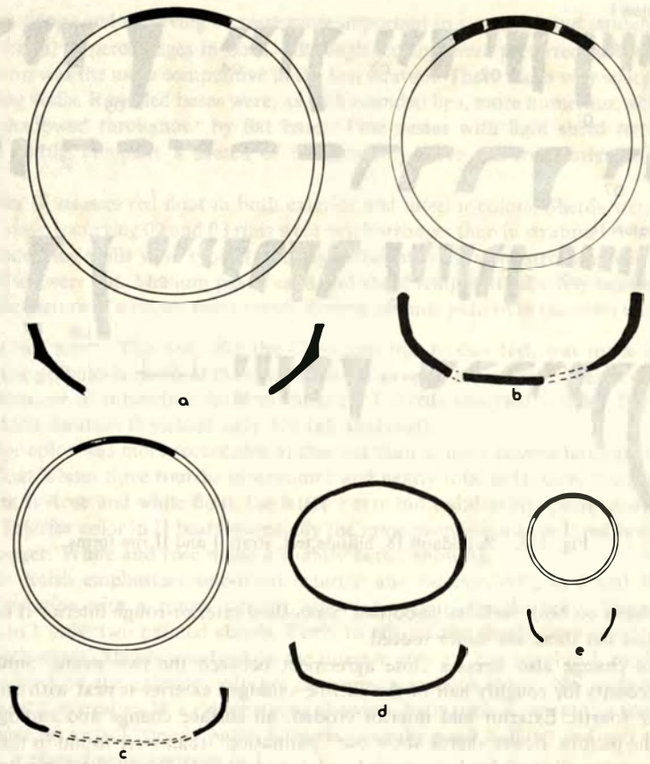


Fig. 162. Vessel reconstructions, platform 1 test, Babeldaob 18. Dark section on circumference indicates rim section present; width equals lip width. *a* (103/B18), shouldered bowl, backcurving (05) rim, extra fine paste with fine sherd temper in light quantity; stratum IIA. *b* (part of 124/) thickened rim, medium paste with fine sherd temper in medium quantity. Stratum IIB; *c* (83/), incurving 03 rim, fine paste, fine sherd temper, medium quantity; stratum IIB. *d* (66/) illustrated in fig. 156), oval bowl with incurving 02 rim, extra fine paste with fine sherd temper, light quantity. Stratum IIB. *e* (132/), thickened rim, medium paste, fine sherd temper, light quantity. Buff exterior and interior with some painting?. Stratum IIB. Outside diameter of *a* is 58 cm., of *e* is 18 cm.

CHRISTMAS TREE TERRACE TEST: Although three separations, stratum I, IIA and IIB were made in the field, it was judged unnecessauy to adhere to this sequence in the laboratory discussion. There were 204 sherds analyzed from the first stratum; 201 (out of 243) from stratum IIA and only 19 from stratum IIB. The latter was therefore merged with IIA and the deposit analyzed accordingly.

Exterior color was better recorded in this test. The indeterminates aside, exterior color is red float (97% in stratum I and 98% in II). Grey float makes up the weak remainder. Interior color is less clear; indeterminates proportionately greater. Red float dominates still but grey is 10 and 7% and white float appears. Stratum I is most varable. Surface finish, as usual, shows a

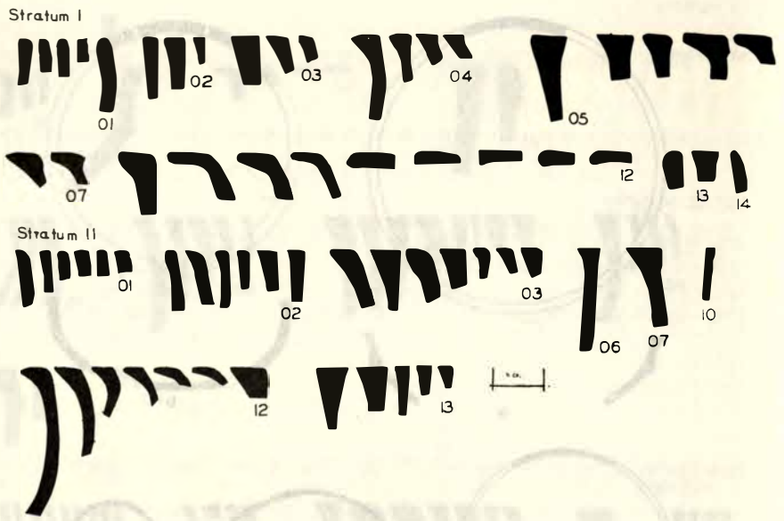


Fig. 163. Babeldaob 18, hillside test, strata I and II rim forms.

heavy emphasis on both surfaces smoothed. Smoothed exterior-rough interior is next and the reverse is last but these are minor indeed.

Surface change also stresses close agreement between the two strata. Smudged both surfaces accounts for roughly half of the sherds; smudged exterior is next with an agreement around one fourth. Exterior and interior eroded, no surfaee change and smudged interior complete the picture. Fewer sherds show our "patination" than were found in the colonnade cut. Firing is primarily well fired, strong in I and dominant in II. Poorly fired reverses the order.

Rim forms are widely and evenly spaced. Interior lip is preferred; 27% in stratum I and 20% in II. Straight are about half these ratios, in each stratum. Rim 02 is poorly represented in I, stronger in II; 03 is likewise stronger in II. The 04 rim is rare but more common in I. Backcurve and lip equal to flange occur once in I and once in II. Lip greater than flange is 19% in the top, while thickened is 17% in II. Figure 158 shows the rim silhouettes and 159*b* the only reconstructed bowl. Lips are preferably flat throughout; rounded are minor but stronger in the lower stratum. Walls are predominantly incurving, more common in I, and straight are next, but stronger in II. There is one backcurving wall in stratum II. Bases are primarily flat, most importantly in II. Rounded, although moderate, are at their best in I.

Paste is strongly fine: 57% in I and 40% in II. Medium follows with 31% and 44% in the same order. Extra fine is about one-tenth of all and coarse is unusual. Tempering is medium to light in stratum I but about the same for all grades of tempering in II. Sherd tempering is dominant in I and moderate in II. Sand and sherd reverse with II preferring the complex tempering (or using a sandy clay). Temper size is less variable, almost wholly fine.

Mean sherd thickness is essentially the same for both strata: 8.6 mm in I and 8.9 mm in II. Mean vessel diameters are identical: 44.9 cm in I and 45.0 cm in II. Lip widths are 21.2 mm and 16.0 mm. There are greater percentages of wide lipped rims in I (Fig.158).

In summary, stratum I differs from the lower in having white float and grey and white float as detail attributes in exterior and interior color. Surface finish is more usually smoothed; surface change is more variable. Firing is somewhat poorer. In rim forms, the interior lip, lip

greater than flange and incurving 04 were more important in stratum I, but straight rims were essentially equal in percentages in both. Although flat lips were preferred in both strata the rounded form was the more competitive in the first stratum. There was a very sharp preference for incurving walls. Rounded bases were, as with rounded lips, more numerous, although they were overshadowed throughout by flat bases. Fine pastes with light sherd tempering and greater lip widths complete a sketch of the generally more uniform pottery of the upper stratum.

Stratum II stresses red float in both exterior and interior colors. Sherds were well fired. Thickened rims, incurving 02 and 03 rims were much stronger than in stratum I. Flat lips on the rims and incurving walls were typical although straight walls were stronger than in the first stratum. Bases were flat. Medium paste, sand and sherd temper in relatively heavier amounts, complete the picture of a rather more evenly diverse ceramic pattern in the older configuration.

THE ALTAR TEST: This test, like the Christmas tree terrace test, was made in the open sherd-bearing grasslands north of the colonnades. It gave no indication of depth of deposit, or heavy midden, or of subsurface features. Stratum I sherds analyzed totalled 104 (out of an abundant 555); stratum II yielded only 108 (all analyzed).

Exterior color was more recordable at this test than at most laterite terraces. Color is the usual red float, about three fourths in stratum I and nearly total in II. Grey float is important here, 20% in I. Rose and white float, the latter a rare but indubitably special production, are incidental. Interior color in II bears essentially the same proportion as in I; red is weaker, grey float is stronger. White and rose make a slightly better showing.

Surface finish emphasizes smoothed exterior and interior, 60% in I and 100% in II. Smoothed exterior with a rough interior essentially completes the tally. There is surface decoration in I only, two painted sherds. Forty to 50% of the sherds were smudged on both surfaces, both strata. Sherds smudged on the interior only are less usual in I, moderate in II. Sherds smudged on the exterior only are uncommon in both strata. No surface change is recorded as 19% in stratum II, a rather strong showing. Patination is rare at this test; one sherd in II showed what we call "fused" paste. Firing is generally good, half in I and very strong in II. Poor firing is thus slightly stronger in I.

Rim forms are diverse. Interior lip is 38% in I, only 18% in II, agreeing with our belief that it is midperiod late. Thickened appeared only in II. Straight are few but more common in II. The same is true of 02 and 04, but 03, which leads into or from interior lip, is 25% in I, weak in II. Backcurve is present in II only, 24%. The flanges are few and erratic. The unusual forms of many of these rims is clear in Figure 160. Lip forms are primarily rounded, flat secondary and about equal in both parts of the deposit. Incurving walls predominate. Straight takes second place, more strongly in II. Backcurving is minor in II. One bowl section, reconstructed, appears in Figure 159*c*. Bases were few; both flat and rounded occur in I. Only one base was found in II; it is rounded.

Pastes are fine throughout but slightly coarser (medium) at depth. Tempering is primarily sherd, most strongly in I. Mixed sand and sherd is moderate in II, rare in I. Temper size is almost totally fine throughout. Temper quantity is usually light, stronger in I; medium is also more important in I and heavy, though minor, occurs more often in II. First stratum sherds are slightly thicker (by .6 mm), have a greater mean lip width (by 21 mm) and greater mean vessel diameter (by 9.0 cm).

In summary, grey float, both exterior and interior occurs at its greatest strength here in stratum I, but it is still less than the figure for red float. Red float increases even more in quantity in stratum II. Likewise while smoothed exterior and rough interior sherds appear more often in stratum I than is customary, they are still fewer than sherds that are smoothed on both surfaces.The latter attribute is still stronger in stratum II. Painted decorations are found

only in the upper stratum . Surface erosion and change is strongest in stratum I as might be expected. Firing is somewhat poorer. In rims, the incurving 02, the flanged and interior lip are at home in stratum I. Walls are incurving and flat bases were found only in stratum I although they are still less common than rounded ones. Fine pastes, sherd temper, light tempering and larger thicker pots with wider rims complete the list of the prime attributes of stratum I.

Those of stratum II are largely a mirror image. Red float, both exterior and interior, is typical. Smoothed exterior and interior and smudging on the interior and a smaller degree of surface change is characteristic. Firing is better. The straight rims, the incurving 02, the backcurve and thickened rims with straight and backcurve walls were found more often. Bases were rounded. Pastes were medium and coarser than in I and sherd and sherd and sand tempering were used more heavily. Vessels were smaller, though not markedly so, in all dimensions.

PLATFORM 1 TEST: Like the crown at B40, excavation of the platform areas on the low terracing east of the north end of the Christmas tree terrace section of B18, led to far more problems than it solved. This is one of the few places in all of the terraced volcanic islands in Palau where an andesitic boulder platform is associated with a terrace archaeologically. It is obviously not possible to state, from inspection, when the platform was built atop the terrace. The excavation was designed to explore the problem. It led, immediately, into difficulties with the internal structure of the terrace and the realization that my small trenches and pits were totally inadequate to examine this. In any event, no midden was found atop the terraces that could be associated with a platform. The sherds were, therefore, those taken from excavations below the stone paving and belonged to disturbed material that came from a time precedent to that of the platform. I believe that the platform was built soon after the terracing was completed but am unable to state the case concretely. Stratum I yielded only 25 sherds; II (A, B top, B bottom) and III had acceptable samples. Analysis was made of 104 and 101 from II and III respectively, about one-half of those catalogued from the excavation.

So strong was the surface change at the platform test that 60% of the sherds in I, 61% in II and 74% in III were indeterminate, badly worn or abraded. Exterior color, when recorded, is predominantly red float, up to 96% in III. Grey slip and rose are weak, strongest in I. Buff is minimal. Interior color is also red float most strongly, where readable. It is dominant in III and strong in I and II. White float is 20 and 21% in I and II, rose the same in I only. Grey slip, half as strong, is limited to II. Other colors are minor. Surface finish is dominantly smoothed on both surfaces, all strata. Surface change is as usual, strongly smudged on both surfaces: 40 to 62% from I to III. Both surfaces eroded is next: 26% to 17% in III. Smudged interior follows the same track more weakly. The three leading attributes seriate nicely; the lowest stratum is the least variable. "Patination" ranged from 45% of stratum I sherds to 51% of III. Firing was generally recorded as poor: 52% to 96% from the top down. Well fired is 48% in I. Sherds at depth appeared poorly fired.

Only one rim was found in stratum I. The collections from the lower two strata are complex and not definitive. Thickened is strongest, about 20%; interior lip is a creature of stratum II, 25%; rare in III; 03, 04 and straight follow. Other rims are very minor. Figure 161 shows all rims from the excavations including, as is usual, those not used in the computer analysis. Lips are primarily flat; rounded about one-third as important. Walls are dominantly incurving, especially in I; straight are at their poor best in II and III. Bases are flat, totally in I and III, but down to 79% in II. Reconstructions of one shouldered bowl and four others from stratum II are shown in Figure 162.

Paste is markedly fine in I but moderately so below that. Medium reverses the seriation, strongest in III, weakest in I. Coarse occurs only in II and III; 19% in II. Sherd temper is typical, most important in II; sand and sherd is moderate in I and III, rather rare in II. Temper

size is almost totally fine. Medium is the preferred temper quantity in II and III, 61 and 64%, but is only 36% in I. Light reverses these figures. Heavily tempered sherds are unusual in II and III. Measurements are striking only in that the vessel diameters for II and III, are very large, 50 cm. Sherd thickness and lip widths are essentially medial.

THE HILLSIDE TEST: This test is one of the largest made in Palau. The slope of the hill indicated the possibility of admixing and disturbance from above and the depth of the archaeological deposit left little doubt that the area had been much used, probably for both living and tillage. The deposit was removed in four strata, of which the last two were an arbitrary division. There was no lack of sherds: 111 from stratum I (all were analyzed), 423 from II (349 analyzed); 827 from III (288 analyzed) and 417 from IV (236 analyzed).

Exterior color was indeterminate for about one-half to three-fourths of the sherds. Red float is in the low 90's in strata I and IV and about 80% in II and III. Buff is next, very rare and grey, white floats are even weaker. As has happened before (B40 crown, Pl) there is evidence of midtime occupation at B18 when several attributes were somewhat differently emphasized. It is possible that this is the result of excavation method but, if so, I am at a loss to explain it. Interior color is even less well recorded than exterior; more sherds are indeterminate. Red float is still paramount with a distribution emphasizing the extremes. Grey float is higher than usual, 30% in stratum II. It is 13% in I but half that in III and IV. This is the same pattern followed in exterior color although the figures differ. White float is stronger in the interiors but like the remaining attributes, it is unusual. Surface finish is, as is usual, primarily smoothed on both surfaces, 90 to 95% for all strata. Smoothed exterior, rough interior is a very poor second, others are still weaker. Polished appears as trace in III.

Surface decoration is barely present. There were no decorated sherds in stratum I, II had one indented sherd, III had one indented and six painted, IV had a cogwheel knob decoration (Fig.154*d*).

Smudged on both surfaces is the usual surface change, especially on Babeldaob. There is an irregular rise from 36% in I to 65% in IV. Smudged exterior is rare but smudged interior includes about 25% of the sherds. No surface change is moderate in strata I and II, not often recorded below. Erosion of both surfaces is 12, 9, 14% in the top three strata but only 3% in IV. "Patination" is virtually absent in I and II but moderately strong in III and IV. Firing is erratic. Well and poor are equal in I; well fired is 65% in II, poor is 62% in III and 50% in IV.

Rim forms in the 02 series are about one-third of the sherds in the bottom three strata, but totally absent in I. Straight filled the gap moderately and then fell off within the lower strata; 03 is moderate in the upper two strata but records in the lower 30% in III and IV. Flange forms are weakly represented: apparently there was not the need for this rim in most Babeldaob areas, or it did not appear until later. Interior lip is 36% in I but weakens below. Thickened, which often accompanies interior lip does so, but in a very minor way at the hillside test. Figures 163 to 165 illustrate all rim forms that could be formagauged. As a test, we matched percentages of rim forms from the above figures and the printouts (Table 33) and found near perfect agreement, indicating that the analysis is duplicatable and that the selection represented the whole. Lip forms are irregular in attribute distribution. Flat leads in all strata, strongly in I and less so in II, moderately in III and IV. Incurving walls are dominant, very much so in I and lesser and equally in the other three strata. Shouldered appears as a trace in the lower two strata and straight is weak but at its best in strata II-IV. Another experiment involved matching the percentagees of wall types as taken from the printouts of the analyzed sherds and percentages as taken from the B18 rim charts. In the wall designations there were major disagreements: for example, stratum I printout showed straight walls at 5% and incurving walls at 95%: our rim charts show straight walls as 33% and incurving walls 67%. The explanation for this rests on the fact that the analyzed sherds include body as well as rim sherds and judgment as to shape of walls appeared to vary sharply from rim to body and , of course, body sherds far outnumber

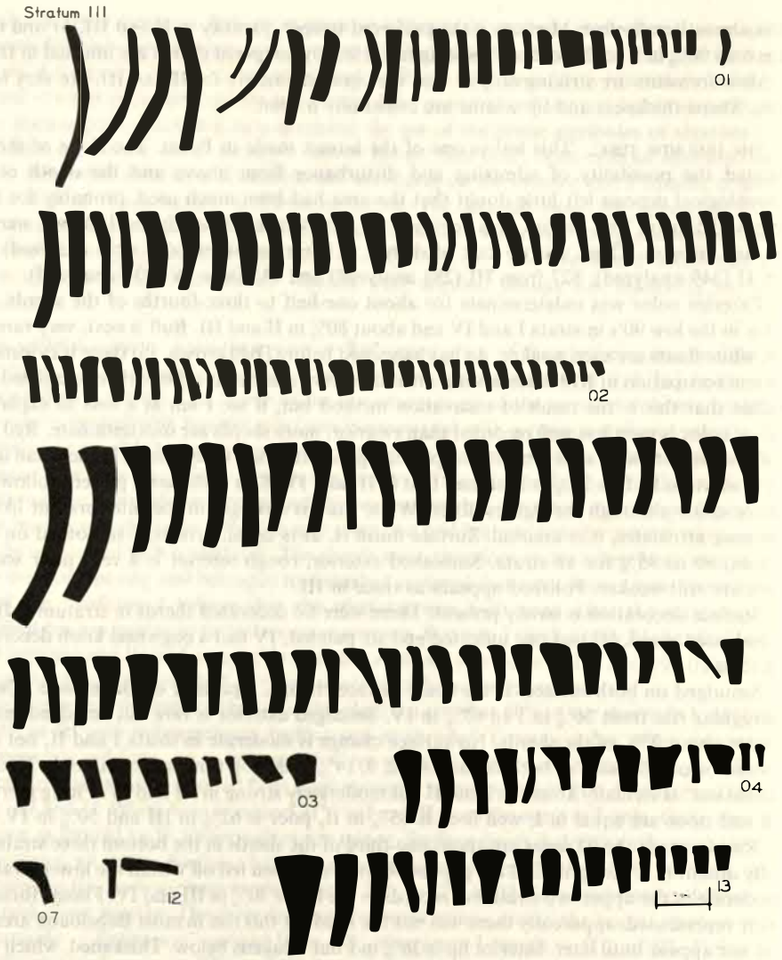


Fig. 164. Babeldaob 18, hillside test, stratum III rim forms.

rim sherds. It would be hard to determine which were the better indicator. This bit of methodological information we pass on to future analysts of Palau pottery.

Flat bases are lacking in I, 46% in II, 73% in III and 67% in IV. Rounded complete the percentages and indicate that flat was preferred in the deeper pair of strata. Most uses are cooking but there is one lamp sherd in stratum II; one sherd from III and three from IV of an incurving interior lip "seed jar" form as it is called in the American southwest; and two "saucers" in stratum III. Reconstructions of five vessels appear in Figure 166.

Fine paste is most used in 50% range for the first two and 60% for the older pair of strata. Medium is next, weaker this time in III and IV. Coarse and extra fine are both minor. Pastes follow a pattern that pairs the upper two strata closely and the lower two less closely. Sherd

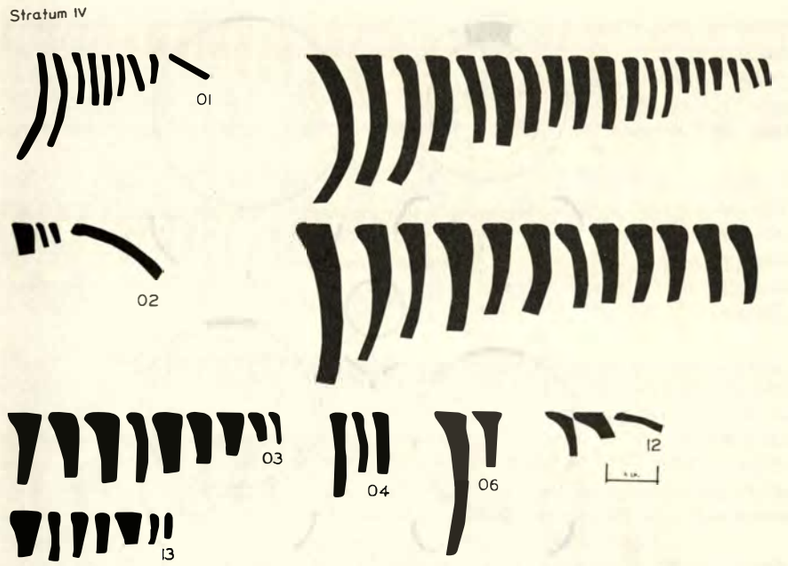


Fig. 165. Babeldaob 18, hillside test, stratum IV rim forms.

temper is most important. I and II are 68% each; the lower pair disagree; 76% and 57%. Sand and sherd together are unusually high. The top strata agree at about 30%, the lower are 12 points apart. Sand alone is unimportant. Here the upper two strata are a unit but the lower two separate. Size of temper lumps the two midstrata. Fine is most important at 69%, 93%, 91% and 68%. Coarse fills out the picture. Light quantity is strongest, the upper two are close and the lower two strata likewise. Medium tempering is slightly in the lead in I and II while light carries the honors in III and IV. The lower two and upper two are alike as pairs here.

Mean sherd thickness is least in I and about average for the other three. Lip widths show agreement between I and III at 13 and 12 mm, and II and IV at 15 mm. The lower three strata have vessel diameters approaching twice the size of the first.

There was in many of the printed tabulations a strong indication of a patternless, fortuitous arrangemint of the percentages and frequencies. This disappointing interpretation however, has yielded to another, that the differing attributes have paired off in a patterned but not always explicable manner. Rim forms, pastes and temper quantity definitely pair the lower two strata and , in a less acceptable manner link the upper two. Exterior color, interior color, surface finish and temper size pair the two midstrata and the two extremes I and IV. Tempering material pairs the upper two and surface change pairs the upper two and the lower two. Walls state that the lower three strata are a cultural unit and the first stratum is separate. The present interpretation is that stratum III should not have been divided into two units III and IV. The attributes that paired the midstrata, color, finish and temper size simply changed in a different manner, at a different rate than the others. Were I to dig the deposit again, I would lump strata I and II, paying no heed to the mattock zone, and also lump III and IV.

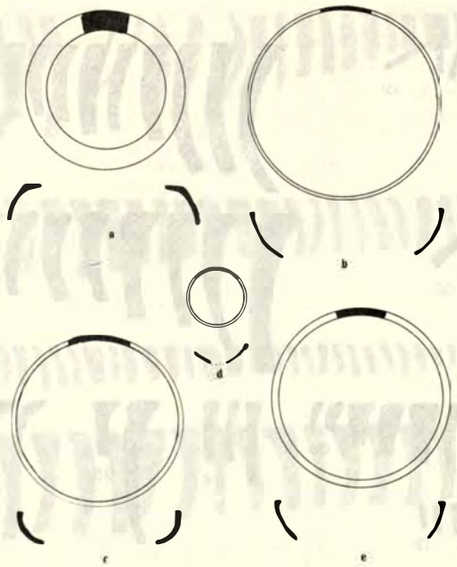


Fig. 166. Vessel reconstructions Babeldaob 18 hillside test. Dark section on circumference indicates rim section present; width equals lip width. *a* (109/B18), Interior lip rim, medium paste coarse sherd and sand temper, light quantity. Stratum II *b* (part of 40/) Incurving 03 rim, fine paste, fine sherd temper in medium quantity. Stratum III. *c* (part of 42/) Incurving 03 rim merging into thickened (13) rim; fine paste, fine sherd temper, medium quantity. Stratum III. *d* (133/) Incurving 02 rim, fine paste, fine sand and sherd temper, heavy quantity. Painted on the interior, lightly smudged. stratum III. *e* (part of 43/). Incurving 02 rim, fine paste, fine sherd temper, medium quantity. Stratum III. Exterior diameter of *d* is 19.4 cm; exterior diameter of *e* is 56 cm.

Babeldaob 19
Ollei

The site designation B19 does not, as explained in the survey report (1966:205–210) pertain to any one of the numerous archaeological manifestations which are present in and near the village of Ollei. Most important, or at least so it meets the eye, are those which lie on the highlands of volcanic red soil which ring the village. North of the village on the crest of a jungled ridge (Fig.173) overlooking the entire area with an especially good view out to sea, is B19A, a series of stone platforms. To the east of this and inland, close under and west of the high point of northern Babeldaob where the remnants of a Japanese light-house still stand, are the unusual terraces of B19B (Figs.188–9). These two aspects of northern Babeldaob archaeology were chosen for investigation and on a rain lashed 15 October, 1968, Jan Stevens, Francis Toribiong, and I walked the Ollei roadway which runs north from west Ngerechelong to the Ngerbau (B20) trail. The road to Ollei follows the high land through the dry grass and pandanus environment north, across the head of a mangrove choked bay, through the taro

swamps and patches that feed Ollei. Here a raised way, sometimes a cobble paved road and at other times little more than a dike between taro patches, leads one eventually to the town which lies on the western slope of the ridge that supports the large archaeological remains. Coming through the taro patches with a heavy load on my back, I failed to negotiate a single log bridge over a drain from the taro swamp. I landed, ignominious but upright, in the mud bottomed water.

As the trail passes down an andesite ridge coming into the taro area from the south, it displays some of the largest and most impressive aspects of trail building that I have seen in the islands.There are monolithic steps (Fig.167) and several places where the trail itself and other steps have been cut into the living andesite. I returned to Ngerechelong and to my B18 excavations that same afternoon, protecting my camera from the rain all of the way, and Stevens remained to attack B19 problems; Toribiong stayed also, to translate and generally assist.

There are a few aspects of local stone working other than the steps and rock-cut roadway, which Stevens recorded somewhat better than I did on the survey. The coffin or trough (Stevens measurements are 90 cm long by 38 wide by 33 cm high); the bifurcated monolith or taro stone (Stevens measurements are 51 cm high by 30.5 wide and 15 cm thick) and the carved stone "Great Face" at the Ollei *bai* (100 cm above ground by 75.5 wide and 25.5 cm thick) require illustration. Figures 168, 169, 170 show these stone objects that were mentioned briefly in the survey report (Osborne 1966:206–7). Also added is the fact that there had been a face carved on the end of the stone trough; photography failed to record it, but it is there.

At the landward end of the Ollei pier the andesite rooster (Osborne 1966:205) still stands guard. When we visited the place there was a stone head that I had not seen on the first trip. I was relieved when Stevens reported that he had been told by Rubak Rengüal that he had carved it himself some three years ago (from fall 1968). When asked regarding the significance of the carving, the Rubak replied: "Oh! I just fixed up this American face" (Fig.171). Across the pier from the rooster and the "American" face is the tall slender monoleth, also mentioned on page 205 of the survey report. Stevens descovered that in certain cross lights there were undeniable vestiges of carving of the type of the Great Faces on the upper part. Local people commented that the features were more visible twenty or thirty years ago. It is unfortunate that the piece is so sadly deteriorated. It is the only presumable full figure surmounted by a Great Face that I know (Fig.172).

Fig. 167. Babeldaob 19, Ollei. Monolithic staircase to the west, on trail to Ngerechelong.

Fig. 168. Babeldaob 19. Stone coffin or trough. Six inch (15.2 cm) scale.


169


170


171


172

Fig. 169. Babeldaob 19. Bifurcated monolith ("Taro stone"). Six inch scale.

Fig. 170. Babeldaob 19. Great Face at the Ollei bai. The "rouletted" scars are a recent defacement.

Fig. 171. Babeldaob 19. "American Face" carved by Rubak Rengüal of Ollei probably in 1965. Six inch (15.2cm) scale.

Fig. 172. Babeldaob 19. Great Face apparently surmounting a full figure carving, now set shallowly on the Ollei pier. To east. Object is 6 feet (183 cm) high by 17" (43 cm) wide. Six inch (15.2cm) scale.

Also inland north of the roadway that leads from the Ollei pier up to the village, in low swampy land is the remnant of what I assume to have been a stone docking facility although it could have been a stone platform. There are piles of andesite cobbles and boulders, some paved areas and 18 small monoliths some .90 to 1.22 m high, standing and overthrown. Many are grooved lengthwise in a peculiar way. We were told that these were taro stones and that

they were associated with crop magic. Unfortunately this aspect of Palauan culture has never to my knowledge been recorded.

It is obvious that this area was once an important part of the settlement and that the land has settled or mean sea level has raised since it was in use, presumably, as the docking facility at the head of a canoe passage through the mangrove. I believe that the former is the more likely.

Babeldaob 19A. Stone platforms

It will be worthwhile to brief some of the historical data concerning the big stone platform which is the prime exhibit of this excavation unit. It is here that Hisakatsu Hijikata found, and in 1940–41 removed to Koror, the large stone coffin (*tet* = handbag) which was a prime exhibit of the pre-war Japanese museum there and is also displayed by the present Palau Museum. Rengüal, previously mentioned, stated that he had worked with Hijikata and assisted in the opening of the stone coffin on Platform A. Inside was found a skull with small patches of hair attached near the forehead, and some long bones. Rengüal could not remember any small bones. He also said that there was one shell of a bivalve inside. The shell itself was neither worked nor modified. The skeletal material was in very poor condition and crumbled when handled. After the coffin had been opened, its contents were removed, placed in paper bags. Later, the bone and shell were taken to Japan. Rubak Rengüal said that no further work was done by Hijikata at the B19A platform.

Rengüal also told the following story about platform A. The old women of Ollei go to the platform and make an offering by burning taro to placate *Weki* (Palauan name for a bird which eats taro). When asked at what time of year the women went to the platform, Rengüal replied "when the birds become a problem." The other men present agreed with this but added that now only very old women did this.

The Palauan name for the large platform (A) is Ollaoldlul mdong: Ollaol is oven or place for burning and dlul is something which has been through fire. Mdong is the geographical location name. A schoolteacher from Ollei said that when he was small, he was told that fire signals lighted on platfrom A carried messages to canoemen off the coast-called them in or informed them that something important was happening in the village.

The platform is in deep jungle (Figs.173, 174). A major task was the clearing of a trail from near the village up the ridge to the site and clearing the growth from the platform itself. A crew of two to four men worked nearly two weeks on platfrom A at a labor cost of $91.20. Permission was secured to excavate the platform. The only stipulations were that it be cleared and photographed and copies of the photo given to the elderly Machas (woman of importance) who owned the land and that she be given an opportunity to see any or all of the objects found while digging. She hoped that Palau money would come from the excavation and would, of course, have claimed it.

After clearing the platform, the structure was sketch mapped (Fig.177). The tumbled rock structure has the present form indicated by the cross section. The rock mass measures 13.2 m and 16 m on the east and west sides and 15.95 and 14.4 m on the north and south. The remnant of the surface is about 11.3 m east-west by 6.7 to 9.14 m north-south. No evidence of a superstructure was found and none could be seen in the nearby jungle, which was not cleared. That the platform is altered by erosion becomes apparent as one examines the profiles (Fig.178) where the usual straight side appears on the west wall of trench 2. Here coral slabs three to six centimeters thick have been stacked to form the edge (Fig.175). These coral slabs, and indeed the bulk of the platform fill, must have been carried fron the sea below-no inconsiderable task. The platform was thus a straight sided block as are all such Palauan structures and not a truncated pyremid. The south wall of trench 1 shows that this area has lost the neat slab facing.

Only the two trenches, each 1.5 by 4,6 m, were excavated. Trench 1, driven in toward the center from the southwest corner and trench 2 from the northwest corner show essentially the

Fig. 173. Babeldaob 19A. View northeast to the hill from the Ollei pier; Platform A is in about the middle of the photograph.

Fig. 174. Babeldaob 19A. Platform A before clearing and excavation. To south.

Fig. 175. Babeldaob 19A. Coral slabs stacked to form part of the west section of platform A, as exposed by the west wall of trench 2. To west. 6 inch (15.2cm) scale.

same aspects of construction. The bedrock of andesite (the core of the hill) was cleared (Fig.176), andesite and coral boulders were collected on it, the structure was modeled in earth and coral fill, presumably faced with chosen coral slabs and floored with andesite and coral cobbles. Its average height above the uneven bedrock was around 1.2m. The surface and

Fig. 176. Babeldaob 19A. Andesitic bedrock floor of trench 2, platform A, and rock fill which made up the bulk of the platform. To south.

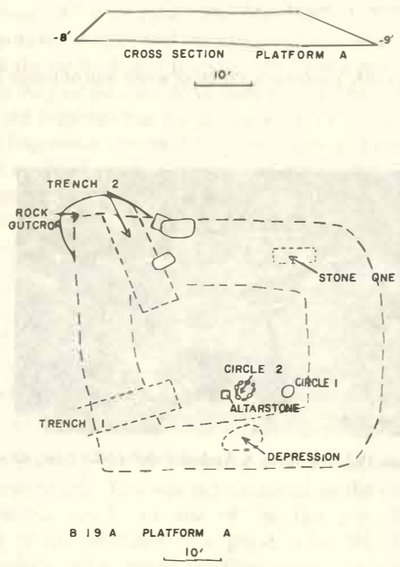


Fig. 177. Babeldaob 19A. Ground plan and cross section of platform A.

general loose fill of coral, coralline limestone and andesite rubble varies around .6 m in depth. Coral slabs, coursed or flooring the first boulder platform, were 15cm deep and this was followed by approximately .3 m of the large rocks. The coral slabs were limited to the northwest section and do not appear to have faced or surfaced the whole mound. The structures on the surface of the platform are not, I believe, the ones usually seen on a house platform. They will be described: first is the large pecked and shaped andesite slab on which the stone coffin rested. It had been my faint hope that this was more than a pediment, and that it concealed cultural information beneath its bulk. It was raised and turned on its side with levers, rope and a mechanical puller (Figs179–180). There was nothing beneath but the coral limestone fill. It was

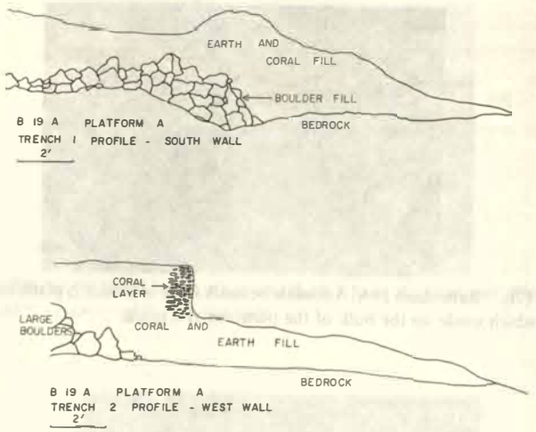


Fig. 178. Babeldaob 19A, platform A Profile of south wall of trench 1 and of west wall of trench 2.

Fig. 179. Babeldaob 19A. platform A Andesite slab coffin base, cleared in position. To south.

Fig. 180. Babeldaob 19A. Andesite slab coffin base, tipped on its side and braced. To north.

the base for the coffin and nothing more. The slab is 2.3 m long .76 m wide and .6 m thick. A large flake, about 2/3rds of the length, had exfoliated from the underside of the stone. On the same (north) side of the platform were two more stones, shaped, fallen and broken monoliths and above these on the side of the trench a third which was said to have been a seat.

On the south slope of the platform, centrally located, is a shallow depression about 1.8 m by 1.2 m. Immediately above that, centered in the southern third of the surface, was a circle of stones about .75 m in diameter. This was excavated (Fig.181) and again only the fill lay below it. Close by and west of the circle stands an altar stone with the usual three small andesite cobbles on it (Fig.182). The altar is an irregular andesite slab some 5 cm thick by 60 or 70 cm on a side. It rested on a base of andesite and coral cobbles, the surface of the platform. This same kind of structure has been encountered previously at Ngardmau (B23, Osborne 1966 : 215, and similarly the B18 altar). There can be no doubt the B19A platform A was an important and "holy" place at one time. East of the large stone circle and altar is another smaller more vague circle .45 to .61 m in diameter. The functions of the circles are unknown. None of the several stones, the seat and the monoliths and other less spectacular ones were carved, nor did they conceal objects or structures. All were raised and examined.

Sherds were saved from the surface and the surface stones (level 1) and from the two levels within the rubble fill. On the bedrock was found a dried areca nut quid, red stained and well chewed (Fig.183*d*), which may or may not have been in situ. Many fragments of human bone were found throughout the trenches but no graves were visible, nor was there a pattern of distribution. Most of the fragments were in the broken edges of the platform and the condition of the bones may be the result of normal erosion and decay. No data other than the few in Appendix 5 could be gained from these small decayed fragments.

The platform was restored after excavation. By now (spring 1971) it would be necessary to excavate the place to know that the place had been excavated.

ARTIFACTS: The betel nut quid has been mentioned. The presence of other vegetal fragments at this level, and the improbability of human or animal intrusion of the object suggests that it is ancient. Perhaps chewed nuts are excellent self preservatives. The only other artifact is a Tridacna shell knife, 60 by 30 by 6 mm (Fig.183*c*). It is not an unusual item although the elongate cutting edge sets it somewhat aside from those recorded from the sites on the limestone islands.

PLATFORM B: This house platform lay 45.7 m north of A. It had been used as late as some 40 years ago according to local people. This was substantiated by the discovery of a bit of broken glass, apparently a Japanese bottle, in one of the fire pits. We were attracted to it archaeologically because of the presence of a grave (Fig.186). The incumbent had been forgotten,our work was locally well accepted and there seemed no reason why we should not be allowed to excavate the platform and burial. The house had stood to the east of and above the platform but no surface vestiges of it remained.

Two 1.5 by 1.5 m test pits were excavated, pit 1 on the west rim or edge of the platform and 2 north of the house between two small piles of rock that mark the cooking place for the old house (Fig.188). They yielded closely comparable profiles. The pit one profile began at .27 m below the platform stones, there is another .27 m to .3 m of mixed midden and clay and sterile red clay begins at about .6 m. In pit 2, the platform stones were replaced by .2 m of root mat and midden. This was followed by .37 m of mixed soil and the clay began at about .6 m. The profile is almost classic. There were sherds in the second zone, indicating old use of the area. It is essentially on a level with the terraces farther east and was probably in use during the time of their use. The soils here, with the exception of the artificial mound, are latosols, red volcanic laterites. These are at their best where the terrace cuts have exposed sections (Corwin et al 1956 : pls. 19–20).

Fig. 181. Babeldaob 19A, platform A; stone circle excavated. See Figure 177.

Fig. 182. Babeldaob 19A, platform A. Altar on platform. Length approximately 65cm.

Fig. 183. Babeldaob 19, Ollei, artifacts. *a* (28/B19B), edge view of andesite adze blade (plan view 190 *h*). Surface of terrace. *b* (30/B19B) scoria abrader or file; *c* (6/B19A) *Tridacna* shell knife, edge ground. length 60 mm. *d* (22/B19A) areca nut chewed quid from bedrock, platform A; *e, i* (part of 23/B19A) interior lip sherds, same vessel, with indentations near shoulder. Platform C; *f, g* (part of 23/B19A) incurving 02 rim sherds with indentations, same vessel probably. Platform C; *h* (25/B19A) redware sherd with scalloped lip. Platform C.

Fig. 184. Babeldaob 19B Ollei, artifacts. *a* (1/B19B) indented decorated sherd from pointed rim bowl; *b* (5/) large circular worked sherd; *c* (30/) tabular fragment of moonstone chalcedony; *d* (2/) chalcedony fragment; *e* 21/) chalcedony fragment; *f* (29/) indented hand hammer of andesite; *g* (30/) fragment of file of volcanic tuff; *h* (28/) andesite adze blade, plan view (edge view fig 183 *a*); *i* (11/) pottery handle fragment; *j* (21/) chalcedony flake showing bulb and platform remnant. *h* is 6.9cm long.

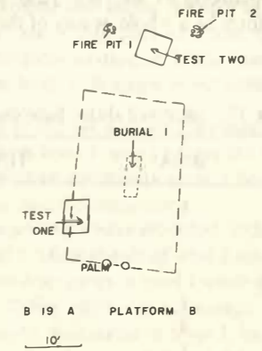


Fig. 185. Babeldaob 19A, platform B groundplan.

Crew members were rather unhappy with the burial excavation, fearing a sickness might afflict them. The Stevens therefore attempted its removal; it was a disappointment. Recovery of bone was not possible: the acid soil had done its work. The skeleton had been extended on the red clay subsoil; orientation was with the platform, north-south with head to the north. There were no furnishings; neither sex nor age could be observed. The soil levels penetrated by the burial displayed essentially the same sequence and depths as recorded above.

PLATFORM C: This house platform is small, and constructed of smaller stones than is B. It lies between A and B but closer to A. Distance between the two is approximately 15 m. C lies in

rather dense forest and was not found until late. It had no surface structures, no graves and hence was interpreted by crew members as being recent. No historic data, however, were collected concerning it. the stone cover was minimal and the two tests were easily accomplished. They yielded the same soil record as has been given above for the platform B tests. A few sherds but no other objects were found. The platform (not illustrated) is approximately 8.5 by 3.7 m and is oriented roughly north-northeast by southwest-west.

UNUSUAL SHERDS: One of the sherds has a much eroded straight rim which appears to have a peculiarly scalloped lip (Fig.183*h*). The single preserved scallop on the small sherd is 27 mm from crest to crest. If correctly interpreted, this is a unique rim treatment.Four other sherds, smudged and black and showing the stigmata of chemical decay from burial in acid soil, are certainly from an interior lip vessel. The shoulder, where the lip meets the body of the vessel, is impressed with shallow indentations averaging about one centimeter from crest to crest (Fig.183*e, i*). Five similarly smudged sherds from one vessel (19/, 23/) straight rimmed incurving bowl also have indentations on the lip exterior (Fig.183*f, g*).

SHELLS: The only shells that were recovered were associated with Platform A. They were generally collected without specific location: 66 identifiable shells or fragments are food and artifact shells, all carried up the ridge from the sea. A number are heavily eroded and a few are attached to fragments of tabular coral limestone. Some of them, therefore, went up as parts of the building material. However, most of the shell selection was economic and not accidental as the list shows (Table 17).

Ceramic analysis

PLATFORM A: Unfortunately platform A did not yield a respectable sherd collection in association with either the platform as a whole or any of the subfeatures. A total of 18 sherds

Table 17. Identified shells, Babeldaob 19A.

Shell	7/B19A	11/B19A	2/B19A
Tectus maximus	1	1	
Turbo sp.			1
Conomurex sp.			1
Gibberulus gibberulus gibbosus	1		
Lambis lambis	3	1	1
Cypraea	1		4
Cantharus		1	
Phos hirasei		1	
Barbatia	3		
Anadara	5	1	8
Vulsella vulsella			1
Spondylus	3		
Ostrea sp.	3		1
Pseudogyra	1		
Chama	2		1
Vasticardium	1		5
Tridacna gigas	9	1	2
Callista		1	1
Total	33	7	26

were collected from the excavations. There is obviously no certitude that even these few are from the same cultural-temporal span. There is no stratigraphic or level separation: all sherds are from the fill and are presumed to have been deposited as the platform was put together.

Exterior color and interior color were indeterminate for 7 of the 19 sherds: otherwise 6 were red on the exterior (5 on the interior); 4 were grey on the exterior (5 on the interior) and 1 was white slipped on both surfaces. The majority was smoothed on both surfaces. One sherd was matting impressed. No surface change was recorded for 44% of the sherds: 28% were smudged on both surfaces, with exterior smudging next most important. There were only two rim sherds: an 03 with pointed lip and an interior lip with a flat lip. Both had incurving walls. The two bases were flat. Paste is strongly fine, medium is second. Temper is 100% sherd, mostly fine. Quantity is medium, light second. Mean sherd thickness is 10.6 mm average; lip width 18 mm, and there were no vessel diameters recorded.

PLATFORM B, PIT 1: This test is as unsatisfactory as its sister pit 2, at least as far as sherd yield is concerned. The following description may lack value, but it is part of the B19A picture as we saw it. The first of the three levels yielded only 15 sherds, the second 40, and the third seven.

Exterior color is predominantly red; there was one white slip in level 1. Interior color is grey in level 1, and red in 2. Surface finish is relatively high in rough on both surfaces, especially level 1,. Smoothed both leads in level 2. Smudged both surfaces is paramount in 2, but weak in 1 and 3. Both surfaces eroded is more than half in levels 1 and 3. No surface change is strongest in level 1. Other attributes are weak. Rim forms from level 1 were half straight. Level 2 had only three, an interior lip, a thinned and a backcurve. Lips are rounded in level 1, and there is no dominance in 2. Incurving walls are strongest of all, half in levels 1 and 3, dominant in 2. Straight is secondary but strong in 1 and 3. Paste is most strongly fine especially in 2. Medium is slightly more than half in the extreme two levels. Temper is sherd in levels 1 and 3, sand and sherd is in control in 2. Temper size is 100% fine in 1 and 3, but 87% fine in 2, where coarse occurs. Temper quantity is importantly medium in levels 1 and 3 and light in 2. Sherd thickness and lip widths are greatest from level 1. A single small vessel diameter is recorded from 2.

PLATFORM B, PIT 2: The deposit in this pit with archaeological inclusions was a thin two levels in depth. Sherds were rare, 22 from level 1, and 15 from the second level. This is obviously no sample, but the following descriptive comments should be recorded as, at the very least, a concession to a normal archaeologist's compulsions.

Exterior and interior colors are red where recorded; indeterminates are high. The latter is also true for surface finish in level 1. Most sherds of level 2 are rough, both surfaces. Decoration is lacking. Smudged both surfaces dominates in level 1 while sherds from 2 are equally smudged both and eroded both surfaces. Other attributes are minor.

Rim forms are simple: straight dominates in level 1; incurving 03 in level 2. Level 1 had four lips: flat, rounded, thickened and pointed. Level 2 had totally rounded lips. Walls are strongly incurving, moderately strong in straight, both levels. Bases were flat, from level 1 only.

Pastes are medium first and fine secondarily, both levels. Temper is sherd, then sand and sherd, rather weakly. Size is invariably fine. Temper quantity is medium, especially in level 2. Light is next. Mean sherd thickness and lip widths are greatest in level 1.

PLATFORM C, PIT 1: It would have been better excavation technique to have made one larger cut into the platform rather than the two smaller ones. The resultant increase of a single large sample of associated sherds would have been more useful than the small ones with which we must now work. This is, of course, post facto criticism and represents knowledge gained by the first excavating program in the area. There were two culture-bearing levels in pit 1, a 1.5 by 1.5 m excavation near the east end of the platform. Each of the two levels, peculiarly, yielded 74 sherds. Subsoil was reached before the bottom of the second 15 cm level. No associations can

be made with the period of construction and use of the platform. Sherd material should be precedent to this although obviously the upper level may have more recent sherds in it.

Exterior color is red float, level I and predominantly red in level 2, although a very minor component of white slip is recorded. In surface finish level 2 is again the more variable. Rough on both surfaces is strong in I, dominant in 2. Smoothed on both surfaces is the reverse. The partly finished, one surface rough is minor, primarily in level 1. Indented sherds were the most usual surface decoration, recorded in both levels; level I yielded one painted sherd. The small collection from this minor test provided a rather large number of decorated sherds, It seems likely, however, that they are fragments of only two vessels, one with an interior lip (Fig.183*e*), and one incurving 02 (Fig.183*f, g*). Smudging on both surfaces is most prevalent. Erosion and no surface change are minor.

Rim forms are mostly straight, moderate in I, preferred in 2. Interior lip is moderate in I; thinned in 2. The single backcurve is from 1; 02 from 2, weakly. Rounded lips are found strong in I, dominant in 2. Flat is moderately strong in I. Walls are primarily incurving, both levels; straight is moderate. Flat bases were preferred.

Paste is medium; fine is secondary, others weak. Sherd temper is stressed in top and strong in the bottom level. Sand and sherd, next, was most used in 2. Temper size is predominantly fine. Medium quantity is most important, light was used in moderation. Heavy, 11% was found only in 2. Sherd thicknesses are almost identical but mean lip widths of 2 are the larger.

PLATFORM C, TEST, PIT 2: The second test pit yielded three levels. There are 107 sherds from the first and only 14 and 27 from the second and third respectively. The latter two were therefore merged and sent in for computation together.

Exterior color was recorded as indeterminate for 64% of the sherds from each level. Exterior and interior color, fighting this high level of indeterminacy, is red float dominant in both levels. White slip and white float are 17% each in I, and the white float is the same in level 2; unusually strong. The first level, with more sherds, is the more variable. Surface finish is almost equally divided between rough, both surfaces and smoothed both, in both levels. Unusually, all percentages are in the 40's. There is one decorated sherd, a scalloped rim (Fig.183*h*). Surface change is variable. Smudged on both surfaces leads modestly in I; eroded both is in second place. The reverse is true for levels 2–3 with eroded in first place and smudged in second place with 22%. Smudged interior is third, slightly weaker.

Rim forms are usually incurving 02, the more common in 2–3. Straight takes the lead in level I, and 03 is weakly equal, both levels. One interior lip came from 2–3. Lip forms are primarily flat in 2–3 and rounded in I. Rounded are a strong second in 2–3 and flat in I. Two other lip forms were recorded, a thickened and pointed in level I. Incurving walls are equally and strongly important in both levels. Straight were second. Level I bases are primarily flat and 2–3 bases strongly rounded.

Pastes are medium in level I and this dominates in 2–3. There are more fine pastes in I. Ground sherd is the common temper; sand and sherd is a strong second below and weaker above. Temper is dominantly fine in both levels. Medium temper quantity is lightly preferred in I, dominated in 2–3. Light tempering is used moderately in I, almost not at all in 2–3. Mean sherd thickness is fairly close for the two levels. Lip width is almost the same, with level 1 the slightly smaller in both categories. Vessel diameters recorded are small.

Babeldaob 19B
Ollei Terraces

Stevens and his crew moved from the platform excavations to the terraces east and northeast of Ollei on 28 October, 1968. The terraces were numbered as Step 1, 2, 3 from the crown down and the areas selected for excavation were staked in a checkerboard or modified checkerboard pattern (Fig.190) with north-south orientation. This site is best described by the illustrations (Figs.188–189, and site map Fig.191). The terraces are low, broad, but well defined. A rather large surface collection was made as it became quickly apparent that we could expect only a minimal archaeological deposit.

The same weak deposit was observed on the high terraces of Babeldaob 10. It is apparent as far as our work has illustrated the problem, that there was neither a long nor an intensive use of these high terraces as actual dwelling areas. It cannot be denied that they saw such use but it was either not intensive or of short duration. The four squares excavated on step I, the crown, were unanimous in demonstrating a profile of an upper 24 to 30 cm of humic midden, a weak and narrow zone of mixture of midden and clay and the sterile red-yellow clay subsoil. The tests were laid out so that the southernmost on the crown cut into the edge of a small mound or hummock. Here the midden zone followed the surface up over the hummock; its core was sterile clay. The mound is thus a natural remnant left by the diggers who formed the top terrace, and is a barely discernable expression of the structure that I have called the peak (Osborne 1966 : 148, fig.48).

There is another small mound between the −6 and −8 foot contour lines east of and immediately off the upper crown surface. The excavator tested this, as he had the peak, in the hopes of a grave or other structure. Unlike the peak the humic-midden band extended beneath the bulk of this earth accumulation. It had been formed after the occupation. The profiles of the squares opened on steps IA and 2 presented exactly the same brief sequence. Such simplicity does not require illustration. It was only on 1A that sherds were found into a third 15 cm level. There were abundant evidences of modern disturbance (World War II) and recent agricultural activity. The crew stated that parts of step 2 had raised a crop of sweet potatos within the last four years and the illustrations (Figs.188, 189 and 190) all show young coconut trees. Excavation was completed on 31 October and the tests backfilled; there were only 3 days work at a labor cost of $35.20.

The andesite Great Face (Fig.187) mentioned in the survey report (Osborne 1966 : 208) is still there. Stevens excavated it to its roots and photographed it. Unfortunately exposure has destroyed the apparently shallow sculping but he states in his notes that his interpretation of the face would make it closely akin to the Sleeper at B37. There are the two eye sockets and two large depressions below the eyes with a bar or boss in each. The object is about 45.7 cm in width, 53.3 cm overall high. It has been broken square across the base through the area of the mouth and teeth. Although set shallowly, only 10 to 15 cm in the soil, it has remained stable since I first saw it in 1954. Presumably the base is still buried in the ground or is otherwise near the original home of the carving. Its present position cannot well be the place where it first functioned.

ARTIFACTS: The lack of midden depth suggested an emphasis on surface collecting. The result is a few objects, two of them rare on Palauan sites. A stone axe or adze blade (28/B19B, Fig.183*a* and 184*b*), a most unusual piece, was found on step 2. It had been in the position in which it was found long enough for the weather surface to become eroded and pitted while the under side still retains some of the old polish. Dimensions are 69 by 38 mm (bit width) and 23 (poll width) by 17 mm (central thickness). Weight is 67 grams. A chip from one corner of the bit defaces the tool or weapon. This is the same kind of tool and very nearly the same size as the blade in the Owen collection (Fig.204*a*) but is not made of as dense material. The Owen's piece

is of a very dense felsitic stone, while our blade is of a fine andesite. We doubted that the Owen piece is local: 28/B19B and the B37 piece (Figs183*a* and 116*a*) probably are or could be. The bit of our tool fills 31° of a circle and is therefore an axe as much as it is an adze. It is an unusual artifact if it is a native piece.

The next artifact, also a surface piece, is a small indented hammerstone of andesite, one of those things of humble but ancient lineage in the southeast Asia-Pacific area. It is 74 by 55 by 27 mm, weight 124 grams. All surfaces are well rounded, both from use and later erosion (Fig.184*f*). The thumb and finger holds are on both sides; one is about a millimeter deep, the other 5 mm.

Interestingly and again in pattern, an employee said that this tool must have been used by oldsters to macerate the betelnut chews. The areca nut and lime were wrapped in the pepper leaf in the usual way, placed in or on the depression and struck with a long thin pestle of a *Tridacna* shell. This is, I believe, the most unusual interpretation of any tool as betel chewing paraphernalia of the elderly, that we received.

Chalcedony fragments and chips occur in four catalog numbers: 9/ and 21/ from the first level, steps 1A and 2 respectively; 17/ from the second level of step 1A and 30/ from the general surface collection. Most pieces are 2 to 3 cm long although some small flakes 1 cm long are in the collection. Unusual is a small piece of a broken pink nodule and a piece of 30/B19B which is a tabular piece of the moonstone chalcedony (Fig.184*c*). A large flake, 23 by 35 by 12 mm is short and heavy. Platform and bulb are clearly delineated (Fig.184*j*). An oval piece of scoria 32 by 31 by 14 mm, also from 30/ is obviously a broken fragment of a larger rounded abrader or file (Fig.183*b*). Another grinding stone fragment of volcanic tufaceous material, 21/ shows no evidence of working but is foreign in the immediate area.

A large worked sherd disc (5/ , Fig.184*b*) comes from the base of a vessel with a red exterior and had been smudged on the interior. The edges are ground; dimensions are 98 by 95 by 11 mm.

DECORATED POTTERY: Handles fron archaeological pottery are rare items. Unfortunately 11/ , a curved truncated cone (Fig.184*i*) is broken. It is made of fine sherd tempered paste. The base is 24 by 18 mm; it is 32 mm long as is.

1/B19B is a large eroded decorated sherd repaired by us. Paste is medium with sherd temper. It is from a bowl with incurving wall and a thinned pointed rim (Fig.184*a*). The exterior is decorated with two double rows of indentations which meet at right angles. It is probably significant that the shape and rim of this pot as well as the decorations are very like 48/B40 (Fig.88*g*), 40/B37 and 24/B37 (Fig.115*c*). Such near identities suggest rather close cultural associations between these sites.

Ceramic analysis.

STEP 1. (THE CROWN): Not enough excavation was accomplished on the B19B crown to inform us as to the processes of origin of that crown. We do not know that it was carved from the lateritic soils of the original hill, as I am sure that of B10 was, or if it were built and shaped of soils from unknown sources as that of B40 appears to have been. The tests of the B19B crown must, therefore, stand by themselves without the problems that have become a part of the B40 description. The first of the two levels at this unit yielded 181 sherds but only 45 were taken from the second.

Color indeterminates vitiate the discussion somewhat. Red float is very strong in level 1, dominates in 2. Grey float and buff, both weak and equal, make up the level 1 remainder. Interior color also stresses red float but not emphatically. It is strongest in level 2. Grey float is 21% in 1 and 20 in 2. Buff is 24% in level 1. Smoothed both surfaces is the highly preferred surface finish, both levels. Rough both follows, slightly stronger in 1. Surface decoration is

Fig. 186. Babeldaob 19A. Platform B, cleared, and grave, to south.

Fig. 187. Babeldaob 19B Ollei terraces. Great Face, to south. width is 1.5 feet. (45 cm).

Fig. 188. Babeldaob 19B. Ollei terraces to southwest and west from the road to Mount Ngedeh.

Fig. 189. Babeldaob 19B. Ollei terraces to northeast. Arrow points to Great Face on the skyline.

Fig. 190. Babeldaob 19B. Checkerboard testing on Step 2 of the Ollei terraces, to south. Young coconuts in left background are planted on a lower terrace.

absent. Surface change is strongly smudged on both surfaces. Smudged interior is second; surface erosion unimportant.

Rim forms are widely variable; no true preferences appear importantly. None of the percentage figures exceed 25%. Straight, incurving 03, 04, backcurve and thinned were most used in level 2 while incurving 02, interior lip and thickened are more common in 1. The series seems classic and the deposit is probably not severely disturbed. Lips are preferably flat, very strongly so in level 1. Rounded are equal in each at 25%. Pointed are the same in level 2. Incurving walls were strongest, straight a weak second but most used in 2. There were two backcurving walls. Three shouldered forms appeared in level 1, and one possible in level 2, similar to the one illustrated in Figure 192, step 1A, level 2.

Fine paste is most important; extra fine and medium equal and secondary preference. Temper material is sherd and sand as a weak first, sand slone a strong second. Sherd alone, as elsewhere at this site, was least used. Temper size is fine, dominant in 1 and slightly less so in 2. Quantity was usually light, medium follows, again more often in 2.

Mean sherd thickness is low, at least for level 1. The thin sherds of this level are often the buff color. Mean lip widths are greater in 1; a single vessel diameter is recorded, level 1 (52.7 cm).

STEP 1A: Step 1A lies southwest of the crown of the Ollei terraces (Fig. 191). Logically it should have been formed and used before the crown, if the cutting of the terraces were not planned and

excavated as one construction. The test revealed three 15 cm levels of thin midden with rather heavy concentrations of sherds. Level 1 yielded 203 sherds (155 analyzed); level 2, 329 sherds (298 analyzed) and level 3, 205 sherds (166 analyzed), for a total of 619 sherds in computer analysis. The midlevel appears to have been the result of time of heaviest occupation.

When recorded (only 33% of exterior and 20% of interior), red float is strongest; it dominates in level 2. Next is buff, about equal in 1 and 2, more common in level 3. Grey float, white float and slip are present but very weak. It is likely that the white float (?) and slip are late developments on a red float base, and possible that they were special serving or luxury finishes. Buff sherds, here and elsewhere belong to a special class of thin walled vessels. Almost vitreous, our "fused paste" is often associated with the buff color. The number of sherds of this kind, as recorded for each level in both exterior and interior color are the same though percentages may differ. A very possible major ceramic problem, that of "patina" and "fused paste" remains unsolved by us. However, Ray (1976: 31) describing sherds from Tarague Beach, Guam says "Also, in some instances, a sherd with buff/tan paste appeared to contain fluxed material. Shepard indicated that this is possible in the low range of firing when volcanic ash is present (1968: 29)." I have not investigated this possibility for Palauan sherds.

Indeterminates dominated interior color also. Red float is strong in levels 1 and 2, especially in 2, and weaker in 3. Buff runs the opposite: strong in 3, moderate in 1 and 2. Greys, whites, and a red slip are all very few. Level 2 is variant. Surface finish is dominant rough both surfaces in level 1, moderate in 2 and 3. Smoothed both, a more normal volcanic island finish, is weak in 1 but 62% in 2 and 52% in 3. Other finishes are minor. I would trust the high percentage

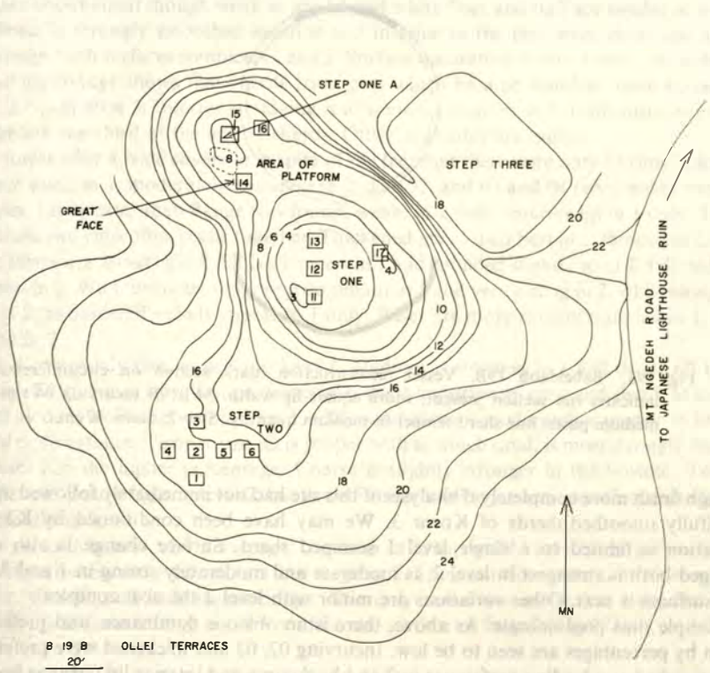


Fig. 191. Babeldaob 19B. Map of Ollei terrace site with excavation units. Contour interval 2 feet (60cm); contouring is from the crown down.

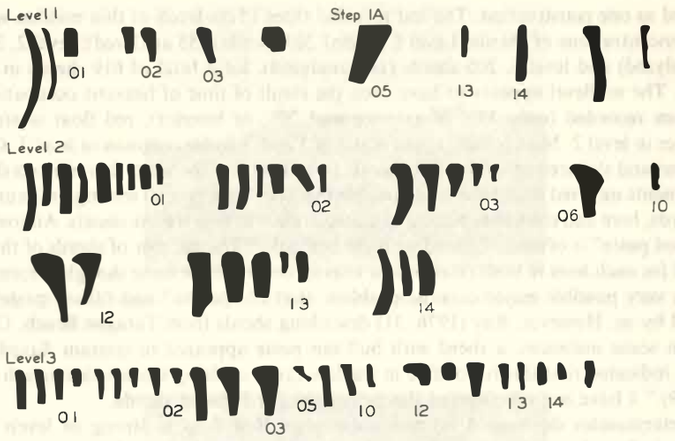


Fig. 192. Babeldaob 19B. Rim forms, step 1A of Ollei terraces.

Fig. 193. Babeldaob 19B. Vessel reconstruction: dark section on circumference indicates rim section present, width equals lip width. 34/B19B Incurving 04 rim, medium paste, fine sherd temper in medium quantity. Step 2. diam. 40cm.

of rough finish more completely if analysis of this site had not immediately followed that of the beautifully smoothed sherds of Koror 3. We may have been conditioned by K3. Surface decoration is limited to a single level 1 stamped sherd. Surface change is also complex. Smudged both is strongest in level 2, is moderate and moderately strong in 1 and 3. Eroded both surfaces is next. Other variations are minor with level 2 the nost complex.

Simple rims predominate. As above, there is no obvious dominance, and preferences as shown by percentages are seen to be low. Incurving 02, 03 and thickened were preferred in 1, only straight has a leading preference in 2 and backcurve and interior lip (strange bedfellows) are the two which level 3 potters preferred more than did their counterparts of levels 1 and 2. Figure 192 shows the rim forms of this test. Lip forms are about equally flat and rounded: the

preference is flat in 2 and 3, rounded in the first level. Pointed is in third place. Walls are primarily incurving, predominant in level 2, very strong in 1 and 3. Shouldered forms appear, the best in level 2. Bases are usually rounded but the preference is not strong and flat is preferred in level 1.

Pastes are medium generally with a good seriation from 72% in 1 to 30% in 3. Fine is very strong in 2 and strong in 3. Extra fine is absent in 1 and at its best in 3. The mid level often has a mid position in this and other attributes. Temper material is outstandingly sherd, especially the first level. Sand and sherd is strongest in 2 but sand alone occurs more often in 2 and 3 than in level 1. Temper size is overwhelmingly fine; wholly dominant in 1. Coarse is slightly stronger in 2 and 3. Temper quantity seriates from 85% medium in level 1 to 41% in 3. Light is most usual, moderate, in the third level. Heavy use of tempering is weak but most important in 2 and 3.

Mean sherd thickness decreases from top down and lip width is also greatest in level 1. The whole series almost lacks flange-interior lip rims. Vessel diameters are large in 1 and 3, medium in the midlevel.

STEP 2: The steps or treads of the terraces at Ollei were tested severally in the major hope that differing steps might reflect differing ceramic combinations which could enable us to suggest time or societal changes. The thin deposits and the fact that some of the collections are small may perhaps leave us little wiser than we were at the beginning. The step 2 test yielded 285 sherds (271 analyzed) in level 1 and only 72 in level 2.

Exterior color, where recordable, is dominantly red float with weak grey, white slip (?) and buff. Interior color is even more restricted but red float is very strong in 1 and in 2. Grey float and buff are about equal though weak in level 1 and white float and buff are similar in level 2. Surface finish is strongly smoothed exterior and interior in the first level, dominant in the second. Rough both surfaces completes 1 and 2. Surface decoration is level 1 only, one indented sherd. Surface change shows that sherds from pots which became smudged both surfaces is strongest, 57%, in level 2. Interior smudging is also more common in 2. Both surfaces eroded includes about one-third of the level 1 sherds. Other attributes are minor.

Rim forms offer a wide coverage in spite of the fact that there were only 13 rims in level 2. Straight are weak in 1, moderately common in 2. The 02, and 03 and 04 (very weak) rims are level 1 types. Lip greater than flange was found, weak, in 2 only; interior lip in 1 only. This is unusual; these two rims often occur together. Thickened are at their best in 1, thinned in 2, both weak. Lip forms are about equal; flat is strongest in 1 and rounded slightly so in 2. Pointed is at its weak best in 2. Wall forms are incurving dominant in 1 and very strong in 2, while straight is common in 2. Shouldered vessels appear in 1 only. Bases are more usually rounded in 1; none were found in 2.

Paste is commonly fine, most so in level 2. Medium is stronger in 1 and drops off in the second level. Extra fine is rare. Temper material is most importantly sand and sherd, at its best in 2. Sherd alone is a close second in level 1, while sand alone is moderately common in level 2, an unusual circumstance. Temper size, as is proper with so much sand, is most strongly fine but the first level has the higher percentage. Coarse is slightly stronger in the bottom. Temper quantity is most usually light in level 2, but is medium in 1. Heavy, about equal, occurs slightly more frequently in level 1.

Mean sherd thickness, about average, is greater in 1. Lip widths are also larger in the top level. Vessel diameters are medium in 1 but large in 2. Thus our data state that older vessels were larger, thinner and had narrower lips. The only vessel reconstruction from the Ollei terraces was made from a large sherd found on the surface of Step 2 (Fig.193).

CHAPTER 6

Similarity Analyses

Introduction

The first treatment accorded our IBM cards was a simple frequency and percentage analysis using a Fortran (3, 2) master program. I was in the beginning a wide-eyed neophyte in the use of computers, and this is still true but a certain blending of cynicism has evolved. At the early level I was, of course, wholly dependent on the people of our institution's Data Processing Center; Bruce Hanks spent much time trying to work my needs into the Center's capabilities. Others who helped and advised me at the Center when a key punch machine would not punch our data, or some other disaster struck, were often nameless. My gratitude is not lessened by our mutual anonymity. I was materially assisted by a short correspondence with David M. Thomas.

Later, as matters were beginning to jell, I was tremendously fortunate to gain the assistance of Barrie Wall. Ms. Wall, (now a doctoral candidate in Geochemistry at UCLA) had programming experience and picked up the ball readily. As the frequency and percentage information began to flow, and I was briefing the information for the comments in the ceramic analysis sections of the site descriptions, I was also searching for a method within my reach which would illuminate the relationships that we knew to exist between the ceramic collections from many of the various excavation units. A proximity or similarity analysis was the obvious answer. The major problem was that this work had to be low in cost. My budget was, by this time, well nigh exhausted.

Discussions with Mr. Kenneth Tom, now the director of the Center, and Ms. Wall, led to the arrangements whereby the computer facilities at UCLA could be used for this final step that I could take. A biomedical program was determined to be the best available for the work.

A total of eleven runs was made on three cards which I had prepared and which were punched for each Excavation Unit (EU). The first card carried the data from the sherds of a particular level or stratum which recorded, in addition to the Excavation Unit, exterior and interior color, surface finish, surface change and firing. The second card presented the same introductory information and surface decoration, rims, lip form, wall shape and base. The third card had possible use, measurements (thickness, pot diameters and lip widths), paste, temper material, temper size and temper quantity: a total of 87 OTU (operational taxonomic units) plus the location data. The biomedical program resulted in three different printouts in which each excavation unit (cases on the printout) was examined in terms of each OTU as related to each and all other units. The first was the Standardized Input Data; here the data were treated and recorded. The second was the correlation sheet or Initial Distance Between Cases. Here the standardized inputs were reflected in a large similarity or proximity tabulation where it was possible to observe the closeness or lack of the same, between the units. The following discussion is based on this table. Last was a dendrogram, or tree of relationships where the computer had drawn together the basic data of the distance tables.

The eleven different runs exhausted the grant funds and some personal ones. Only one run appeared to have been vitiated by error: run 1 from which one of the OTU (temper quantity, light tempering) was omitted. It was discarded and a second run 1 which worked all OTU's and all EU's took its place. Run 2 included those EU's which were correlating the best on the first dendrogram: there were 65 of these, largely Babeldaob and Koror volcanic island sites but Aulong 1 and Pelilieu 1 were included. Run 2 was not used in the similarity analysis as run 4, an

augmented version of 2 was judged to be better. Run 3 is the group of 46 cases, the least well correlated in the first dendrogram. It is a mixture of all sites. Run 4 added seven close units to the original 65 of run 2 making a total of 72 EU's. It is the run used in the similarity analysis. Run 5 was similar to 3, except that it used the most distant, poorest or weakest correlators in the first dendrogram, 36 cases. Run 6 used the cases from the volcanic island sites only (Koror and Babeldaob); run 7 those from the limestone islands of Aulong, Pelilieu and Angaur.

The last 3 runs are based on a selection of variables (OTU) rather than on the cases (EU's). Run 8 includes all rim variables (see Fig. 2, *b, c*). Run 9 uses those having to do with paste, temper material, temper size, temper quantity; and run 10 those having to do with lips, walls, bases, sherd thickness, vessel diameter, lip widths.

An upsetting amount of time, fortunately not recorded, has been spent with the correlation tables, correlating. I have for each site, recorded the relationships at the +0.0 to 5.0 initial distance levels (+0.0=identity, 100.0 would presumably be total difference), at the 5.0 to 8.0 level; at the 8 to 10 level, and finally the most extreme distances, 20.0 and above. This has been accomplished for both the intrasite excavation units and for all other sites that were investigated. This information appears on the large Table (18). The basic data in this table, together with such inferences as appear in this section and elsewhere, embody one major result of the study, that of the overall cohesiveness of the ceramics of the Palauan archipelago. The information summarized in this section is sufficient so that further archeological studies and problem oriented researches of narrower specialization may be developed and pursued.

It should be stated here that the totality of our data are in storage and available; the laboratory analysis sheets, the IBM cards for both series of runs frequency-percentages and initial distance analyses) and the computer printouts themselves. We should be pleased if others, especially those with interests and skills different than ours, were to request and use them. We are generally convinced that the second exploratory phase of the research design which we had in mind for the Palaus has been well enough completed so that the third phase, detailed studies of carefully selected areas, can be initiated. There are now sufficient data so that problems having to do with special sites, special areas and certain environmental regions may be formulated and investigated.

In the following pages are listings of the few correlations found at the 0–5 distance. These are not separated in Table 18 where the symbol ● indicates 0–8 distance. The former are few they represent virtual identity and are therefore usually found intrasite. Comments under each site heading are descriptive, inferential and hypothetical.

Site correlations: Babeldaob 19A

0–5 distance: none.

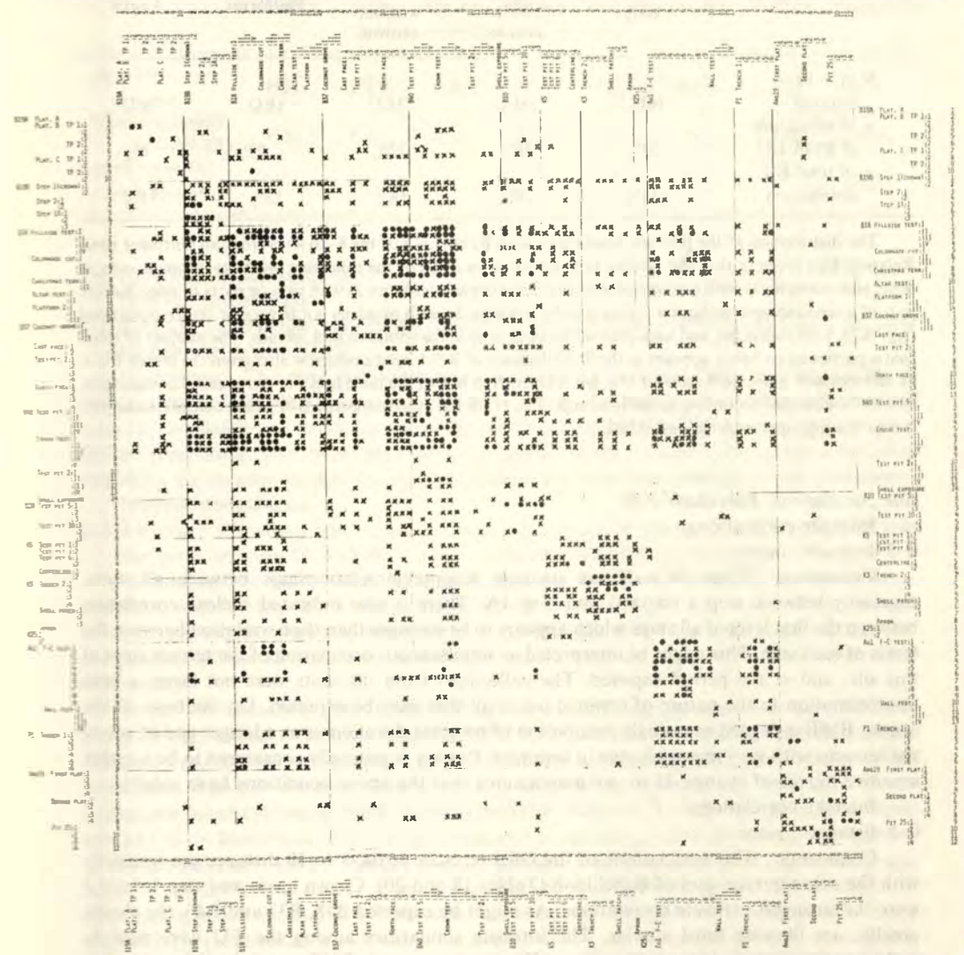
Comments: the platforms appear to have had a single occupation, except for platform A, which yielded poor and insufficient ceramic data. The occupations are somewhat correlated at the 5 to 8 level and perhaps enough so at the 8 to 10. Platform C, test pit 1, level 1, followed by platform B, test pit 2 level 2, yielded the closer relationships. The two tests of platform C correlated best at the 8 to 10 level. There seems to be every reason to infer that the area was occupied throughout by people using similar ceramics and a more tenuous suggestion, that the use did not cover a long period.

Intersite correlations:

0–5 distance: Platform C, test pit 2 level 1 with B18 hillside test, stratum IV. A peculiar correlation: I believe it to be fortuitous.

Comments: (Tables 18 and 19). Of the fifty correlations, only three (with Angaur 19, second flat) are with other than terrace manifestations, which we classify B19A as being. B18, B40 and B37 are the preferred relationships with the much smaller excavations at B19B close behind: Platform B test pit 2, level 2 (EU6) and platform C test pit 1, level 1 (EU7) have the

Table 18. Correlation of each EU with all others. Solid dot indicates 0–8 distance: × as 8.1–10 distance.



greatest number of exterior correlations. The 8–10 distance is strongest with levels 1 to 3 and strata I to III inclusive, of exterior sites. We may infer that the time spans were generally medial and late during the terrace occupations. It is of real interest that the Angaur site is included in the correlations within the 10 distance. The folklore connections with Angaur in this northern section of Babeldaob have been mentioned elsewhere. I find it difficult to believe that the folklore preoccupation with the most distant island in the group was actually reflected in trade and is now making itself known via ceramic analysis. Yet so it appears to be.

Table 19. B19A, correlation survey, 8–10 distance.

	Crowns only	Terraces with crowns	Terraces without crowns	Platforms	Angl9
N at 8–10 distance	16EU	18EU	11EU	1EU	3EU
% of similarities of B19A EU	33%	36%	22%	2%	6%
% of total EU distribution	11%	24%	18%	13%	11%

The distribution of the intersite similarities with B19A EU's at the 8–10 level from all pertinent runs. Relationships given in this and similar tables have some or all of the following headings: Crowns only of other sites (column 1) with terraces of sites that have crowns (column 2) with sites or parts of sites that are part of a terraced area without a crown nearby (column 3); with middens not terrace or crown associated (e.g., K3), with platforms, and with each of the three sites in the southern rock islands. The number of times that a particular category appears in the 8–10 distance of B19A relationships is also given: 16 crown EU's, 18 terraces with associated crown EU's, etc. The bottom line of the table lists, for purposes of comparison, 110 EU's, classified according to the headings. The 111th EU, shell exposure B40, is not considered herein: it was not a proper archaeological test.

Site correlations: Babeldaob 19B

Intrasite correlations:

0–5 distance: none

Comments: Table 18 indicates strongly acceptable relationships between all units, especially between step 1 (crown) and step 1A. There is also indicated a close correlation between the first level of all steps which appears to be stronger than the correlation between the levels of each step. This might be interpreted as simultaneous occupation of the terrace steps at this site, and at the period exposed. The collections from the units were not large: a near approximation to the nature of ceramic use is all that may be expected. On the basis of the above, B19B is pegged as a single occupation of no great duration or as a longer period use of the terraces with very minor change in ceramics. Pottery is generally considered to be a rather sensitive mirror of change. If so, we may assume that the above conditions have validity.

Intersite correlations:

0–5 distance: none.

Comments: The associations of the Ollei terraces at the 8 to 10 distance are primarily with the other terrace sites of Babeldaob (Tables 18 and 20). Crown levels and step 1, level 1 were the strongest extrasite correlations. As might be expected B18, B37 and B40, the closest areally, are likewise most similar. The intrasite similarities among the EU were near to inclusive: the intersite ones are likewise so. We see, for example B19B step 1, level 1 correlating at the 8 to 10 distance with all four strata of the B18 hillside test. There is enough of this kind of thing in this one listing so that I am now, reinforced by more subjective observations previously made, willing to state that the terrace occupation was not a time of great change in the ceramic technology.

The relationships of the terrace to crown to terrace-related sites to the B19B EU arrangement is closer than the EU distribution as excavated. There is however a likeness to the EU distribution from the southern islands, particularly to Aulong 1. One might suggest that the Aul Eu's are not far from the terrace ones, and that the Angaur site, possibly later, was closer to the platforms of B19A.

Table 20. B19B correlation survey, 8–10 distance.

	Crowns	Terraces with crowns	Terraces without crowns	Middens	Platforms	Aulong 1	Pelilieu 1	Angaur 19
N at 8–10 distance	12EU	42EU	26EU	4EU	4EU	16EU	4EU	4EU
% of similarities of B19B EU	11%	37%	23%	3.5%	3.5%	14%	3.5%	3.5%
% of total EU distribution	11%	24%	18%	7%	13%	12%	5%	11%

Site correlations: Babeldaob 18

Intrasite correlations:

0–5 distance: Christmas tree terrace stratum I (8) with colonnade cut stratum I (5) with hillside test stratum II (2)

Comments: The three 0–5 distance units should all be late at B18. It is reasonable to interpret this as indicating a general use of the area into the final phase of occupation. Sherds from the colonnade cut, which lay below the gently sloping hillside test, may have been in part derived from there. The rather poor showing that platform 1 strata make in the correlation reinforces the conclusion that my excavation there was less than definitive, even inaccurate.

Intersite correlations:

0–5 distance: Christmas tree terrace stratum I (8) with B40 test pit 5, stratum III with B40 test pit 2, stratum III with B40 crown, stratum I with B37 north face level 1.

Comments: It will be noted here and following that the third stratum at B40 is often correlated with superior levels and strata elsewhere. I believe them, therefore, to be superficial in origin and suggest that this relationship at the intersite 0 to 5 distance indicates that late occupations on the several terraces are not badly disturbed and are in satisfyingly close relationship.

At the 5–8 distance (Table 18) correlations are seen throughout with essentially the same group. It may be taken therefore that these B18 units and the correlates had similar ceramic complexes and that the occupants of the sites lived in much the same area, probably during the same times. The 0–8 distance, close as it is, is reflected by the sites and units that appear throughout the above listing: B19B (9 times), B37 (22), B40 (33), B10 (4). All are in the volcanic area and all on Babeldaob; B10 is at the southwest of the island, while B18 is near the extreme north. The two major sites of the reef islands, Aulong 1 (6 times) and Pelilieu 1 (only once) also occur. It is true that the counts of the distance citations of the EU's do not always reflect an equal similarity of occupation. The amount of excavation, the nature of it, disturbance, chance and local site peculiarities should cause variances that are not under our control. I am struck, however, by the common appearance of Aulong 1 F-E test on these lists. This had been considered to be a wave disturbed area, yet the collections from it are falling into place with many others. It was not disturbed as much as was believed and the pottery is enough like that of Babeldaob so that we may not argue with a volcanic island origin for either or both the material or whole pots which must have been traded to the people of the reef islands. Table 21 presents the B18 intersite relationships up to the 8 distance. They are wholly with the terrace areas of Babeldaob and with Aulong 1, with a slight nod to Pelilieu 1.

The 8–10 distance brings a large number of sites into some aspect of relationship with B18. B 37 (38 citations), B40 (36) and B19 (30) are apparently closest in kind, if we may judge by count. B19A where most of the work was concentrated on platforms had only 15 citations. The

Table 21. B18 correlation survey, 0–8 distance.

	Crowns only	Terraces with crowns	Terraces without crowns	Aulong 1	Pelilieu 1
N at 0–8 distance	31EU	35EU	4EU	6EU	1EU
% of similarities of B18 EU	40%	45%	5%	8%	1%
% of total EU distribution	11%	24%	18%	12%	5%

Table 22. B18 correlation survey, 8–10 distance.

	Crowns only	Terraces with crowns	Terraces without crowns	Middens	Platforms	Aulong 1	Pelilieu 1	Angaur 19
N at 8–10 distance	45EU	75EU	52EU	24EU	15EU	35EU	20EU	4EU
% of similarities of B18 EU	17%	28%	19%	9%	6%	13%	8%	2%
% of total EU distribution	11%	24%	18%	7%	13%	12%	5%	11%

platforms were probably more recent and it is now seen as next to impossible to segregate later from earlier sherds in such situations. B10 is satisfactory (20 citations) when one recalls that most of the brief digging was done by my local assistant. Koror 3 (10) is different and a late occupation according to radiocarbon. K5 (with 17 citations) shows that it is remote from B18. It was also a disturbed area. K25 was likewise a disturbed site with only 2 citations Aulong 1 had 34, 32 of which were with the F-E test. The other is wall test stratum III. I am constantly forced to eat crow on this site where the wall test appeared to be a more useful indicator than the F-E test. Aulong 1 is most deserving of a full excavation. P1 with 18 citations shows relationship with the terraced giants of the north that is tenuous but obvious (Table 22).

Site correlations: B37

Intrasite correlations:

0–5 distance: Test pit 2, level 1, with test pit 2, level 2; Test pit 2 level 3 with test pit 2 level 4.

Apparently the deposit should not have been divided into 4 levels.

At the 5–8 distance (Table 18), the north face and the coconut grove appear to be the most valid excavations although the site ties itself together throughout. The older levels are apt to be associated with more superficial ones. Test pit 2 is the weakest or most distant of the units.

At the 8–10 distance B37 is well tied together. Coconut grove, north and east faces and test pit 2 are all well enough represented at the 8–10 distance so that given the difficulties of terrace and the coconut grove excavation, there is good evidence that there is a single occupation represented. This may mean a fairly short one, but it probably means a longer but little changing one.

Intersite correlations:

0–5 distance: north face, level 1 and B18 Christmas tree terrace stratum I.

Table 23. B37 correlation survey: 8–10 distance.

	Crowns only	Terraces with crowns	Terraces without crowns	Middens	Platforms	Aulong 1	Pelilieu 1	Angaur 19
N at 8–10 distance	44EU	54EU	27EU	5EU	15EU	17EU	12EU	8EU
% of similarities of B37 EU	24%	30%	15%	3%	8%	4%	7%	4%
% of total EU distribution	11%	24%	18%	7%	13%	12%	5%	11%

Comment: Christmas tree terrace seems to have yielded a most agreeable collection.

At the 5–8 distance the relationships of B37 are essentially with the large terrace sites; B19, B18, B10: 38% are with crown EU's, 41% with terraces that have crowns, 17% with terraces that do not have crowns. Angaur 19 (3%) and Aulong 1 (less than 2%) are the only other sites that turn up at this distance from B37. It is unfortunate that the extent of the project did not permit us to excavate the western Babeldaob sites such as B1, B4. A personal prediction is that these would have aligned in a similar way.

The proximity of the B37 EU's is stronger to the later levels of B18, B19, B40, K3, K5 and Ang19 at the 8–10 distance. B40 and P1 are essentially equal throughout while Au1 shows closeness to B37 in its lower levels. I am uncertain as to the sensitivity of some parts of our excavations. Table 23 shows that B37 while obviously a northern Babeldaob terraced entity, had strong relationships elsewhere, Koror to Angaur.

Site correlations: Babeldaob 40

Intrasite correlations:

0–5 distance: test pit 5 stratum III with test pit 5 strata I, II; crown stratum I with crown stratum III; test pit 2 stratum III with test pit 5 stratum III.

Comments: the two closest distance groupings are between test pit 5 (4 strata) and the crown sequence (first 3 strata). Strata IV and V of the crown are left out of the picture; they have no correlates. This is reasonable; it was ascertained in the field that the lower levels were the result of terrace fill, a building episode. It would appear that the crown sequence might be slightly later than the test pit 5 one; there are several correlates between strata II and III of the crown and IV and V of the pit. Test pit 2, III and IV are similar to III of testpit 5. This is not a strong relationship as it is expressed here but serves to tie the site together.

The 8–10 distance, the last two strata of the crown are again weak in correlates, as are the first two of test pit 2. When these appear they point to the upper strata of the crown and test pit 5 sequence. The latter two strata of test pit 2 correlate with the upper two strata of the crown and the crown upper strata correlate well with all four of test pit 5. It would appear that the test pit 2 (and 4) area was the last use of the B40 hill and that that of test pit 5 was occupied concurrently with the later use of the crown. This probably melds together into a single occupation. The parts of the crown penetrated but probably inadequately sampled by the test should be the earliest traceable use of the hill, at least in the terrace style.

Intersite correlations:

0–5 distance: test pit 5 stratum I with B18 platform 1 stratum II; test pit 5 stratum III with B18 Christmas tree terrace stratum I; crown stratum I with B18 hillside test stratum II, with B18 Christmas tree terrace strata I, II, with B18 colonnade cut strata I, II, with B37 north face level 1, with Au1 F-E test, level 2.

The similarities are strongest at this level with terrace sites, especially B18, although Aulong is not far behind.

5–8 distance: this distance strengthens and in effect repeats the 0–5 relationship. Apparently the upper and midlevels were the best expression of a relationship between B18, B19, B37, B40, B10 and Aulong 1, Pelilieu 1 and Angaur 19 that was always present. There is enough of level 3-stratum III and below appearing in these lists to indicate continuity in ceramics rather than any massive disturbance.

A count of the similarities in the 8–10 distance bracket shows that there are 173 EU's throughout the excavated sites that are similar to those of B40. There were 46 similarities with actual crown excavation units (27%); 71 with general EU's on terrace sites but not on the terraces themselves (midden and other tests) (42%). Twenty-three similarities (14%) were found with sites that I have termed terrace related such as K3 or K5. There are terraced slopes in the areas of these two, but no crowns. Aulong had 20 (10%), two with the wall test and 18 with the F-E test. The spread of similarity of B40 to Au1 is rather even between the upper and lower levels but concentrated in the midgroup. I am reinforced in the field interpretation that the Au1 deposit was somewhat mixed but it appears obvious that it may be treated as a unit with close relationships with the north Babeldaob sites. There are 10 similarities with the P1 tests (8%). Angaur 19 had only 4 similarities (3 with level 1 and 1 with level 4).

As might be expected the sites most like B40 insofar as geographic and ecological situation and patterning of the artificial landscape are concerned and which are likewise near to B40 on Babeldaob, are overwhelmingly similar to B40, 69% in the two classic terrace categories. The terrace related sites are on Koror, which is more distant. They are lacking in crown development but are in closely similar environmental situations. They are medially related to B40. Of course, Au1, P1 and Angaur 19 are distant and in an entirely different geographic zone. In spite of this, they are obviously similar ceramically although the similarities are weaker.

Test pit 2, B37, levels 2, 3, 4, like B40 crown IV and V and test pit 2, I and II, have no correlates. Such a lack of correlation, visible consistently in Table 18 (see also P1, level 4) should indicate an incorrect archaeological EU or major disturbance, or both. The strong relationships with the mid-levels of the F-E test on Aulong is striking. These EU in the north and on the island must represent a time of close contact between terrace builders and Aulong 1 peoples.

Site correlations: Babeldaob 10

Intrasite correlations:

0–5 distance: test pit 10 level 3, with test pit 5 level 2.

Intersite correlations:

0–5 distance: none

Comments: B10 was a specialized excavation; only a map and two ceramic tests were accomplished; work was limited to the crown and brim of this spectacular site. There were no midden tests or excavations in structural remains as at B19,37,18 or 40. It may therefore not be worthy of stress that the major similarities noted are with terraces. The intrasite similarities lock the site together moderately well at the 0–5 and 5–8 distances and complete the process at the 8–10.

Intersite relationships appeared at the 8–10 level only. There were 90 (Table 24). The table illustrates the overwhelming correlation between B10 EU's and the crowns and terraces with crowns.

Site correlations: Koror 5

There are no intrasite correlations at the 0–5 distance. The intrasite relationships at the 5–8 and 8–10 distance (Table 18) group into two: Centerline trench levels 1 and 2 with test pit 6 level 2, and test pit 6 level 2 with centerline trench level 2, and test pit 1 level 1, and test pit 3 level 2 and test pit 6 level 1. The site is well integrated.

Table 24. B10 correlation survey: 8–10 distance.

	Crowns only	Terraces with crowns	Terraces without crowns	Middens	Platforms	Aulong 1	Pelilieu 1	Angaur 19
N at 8–10 distance	18EU	43EU	19EU		4EU	4EU		2EU
% of similarities of B10 EU	20%	48%	21%		4%	4%		3%
EU distribution	11%	24%	18%	6%	13%	12%	5%	11%

Table 25. K5 correlation survey: 8–10 distance.

	Crowns only	Terraces with crowns	Terraces without crowns	Middens	Platforms
N at 8–10 distance	16EU	22EU	11EU	15EU	3EU
% of similarities of K5 EU	24%	33%	16%	22%	5%
% of total EU distribution	11%	24%	18%	6%	13%

There are no intersite correlations at the 0–5 distance or 5 to 8 distance. Table 25 summarizes the correlation at the 8–10 distance. There are no correlations with the reef and rock island sites. Koror 5 is itself a terraced site without crown. As a matter of fact, these manifestations are truly limited to Babeldaob and Ngarkebesang although site K1 (see Appendeix 3) may have an atypical crown. The K5 similarities are obviously strongest with the terraced sites and with the middens. The latter is K3 which lies slightly over 800 m to the southeast of the terraces of Koror 5. The latter are an extension of the terrace pattern of Babeldaob.

Site correlations: Koror 3

Intrasite correlations:

0–5 distance: trench 2 level 2 with trench 2 level 1, with shell patch level 2.

This site is perhaps the most closely tied together of all. Trench 2 level 1, for example, is correlated with all other EU's except the apron at the 5–8 distance, while trench 2 level 2 and shell patch level 2 are tied together at the 0–5 distance. The only EU that was unpopular is the apron (EU 8). We are aware that this house site was in use relatively later than the major aspects of shell patch and trench 2 midden were. When a correlation table is set up the numbers of unfilled correlation blanks are fewer than usual: 24 of the 64 (8 of the 64 are correlation line squares) and 14 of the 23 are apron squares. I have no choice but to interpret the material excavated as representing a time of little change, and probably one that was recent and of short duration. Most of this duration preceded the major time of use of platform 1.

Intersite correlations:

0–5 distance: none.

Table 26. K3 correlation survey: 8–10 distance.

	Crowns only	Terraces with crowns	Terraces without crowns	Platforms	Pelilieu 1
N at 8–10 distance	13EU	15EU	20EU	3EU	1EU
% of similarities of K3 EU	25%	29%	38%	6%	2%
% of total EU distribution	11%	24%	18%	13%	5%

Table 26 offers the relationships developed. K3 has shown itself to be ceramically related to the terrace complex of Babeldaob. Ninety-two percent of the correlations are with EU's of terraces, crowns and terrace-related sites, which includes K5. The complex is obvious in its dominance of the Palauan past, at least ceramically and, by virtue of the classification that is being used here and of the time depth of our penetration. Our choice, somewhat enforced by circumstances, has left middens, platforms, and the rock island sites weakly related to K3. This is partially an artifact of site selection but the fact remains that 92% of the similarities are with various aspects of the terraced sites. This turns the face of the K3 people, at least insofar as ceramics is concerned, toward the Babeldaob north.

It is unfortunate that other artifacts were too few to give us a comparative base.

Site correlations: Koror 25

It will be recalled that K25 was a brief salvage test, of a lotus pond near the entomology laboratory. Data are few. The most thoroughly disturbed parts of the site, collected into level 1 are most correlated with the big sites of northern Babeldaob (Table 18). The less disturbed level 2 is with the northern Koror site 5. This is reasonable and follows the pattern.

Site correlations: Aulong 1

Intrasite similarities.

0–5 distance: F-E test level 2, with level 1.

A charting of the correlations of all three distances (Table 18) shows that the F-E test levels correlate well with each other, although only 1 correlation is at the 0–5 distance. There are 4 correlations at the 5–8 distance and 9 at the 8–10. This, as far as I am concerned ties the site together closely. Of the 72 possible correlations of the F-E test (9 removed from the diagonal 1 : 1 line) there are 47 at the 0–8 distance and 25 at the 8–10 distance. This is strong evidence of close cultural ceramic relationships between the 9 levels of this test. Even were I wholly correct in my field interpretation that the area of the F-E test was disturbed by wave action then, indeed, the waves mixed the sherds nicely and elegantly. One must assume that either the water action (if such there were) was working with clearly similar groupings of ceramics or that its effect was small.

The wall test however, is an entirely different matter. We have no similarities at the 0–5 or 5–8 distance between the wall test EU's. Stratum I is correlated with II, and III with I, and stratum III with II at the 8–10 distance, and that is all. Clearly the wall test is a separate and distinct unit and one that is not as well bound together as the F-E test.

Intersite similarities:

0–5 distance: none.

5–8 distance: Table 27 summarizes the Aul correlation at this distance. There is obviously expressed the strongest relationship with the big terraced sites of the north and a secondary, but impressive correlation with Pelilieu 1.

8–10 distance: An analysis and tabulation (Table 28) of the Aul correlations at the 8–10 distance shows that the major interests of the people of this island were turned toward the north insofar as their acquisition of ceramics is concerned, with the proviso that we have not excavated elsewhere on Aulong. Along this line we note (Table 18) that the correlations are weaker by far than are the massed similarities shown in the upper left of the same tabulation. F-E test level 6 is the strongest level in Babeldaob relationships, but it cannot compare to the almost tight similarities so evident in the charting of the northern terrace sites.

For the first time the distribution of the percentages of correlation, or similarity with the terrace sites approaches that of the normal distribution of the EU's as these happened to be chosen for excavation. Nonetheless, the ceramics were derived from the north and, as an inspection of Table 18 will show, the north was Babeldaob, not Koror sites. This is based almost wholly on the F-E test. The wall test is a thing unto itself. It was listed intersite only 3 times with a P1 correlation. Its relationships thus lie in the southern reef islands most and it may probably be interpreted as a manifestation of that area, probably a relatively early one, that was smothered out by the continuing and growing contacts with the volcanic islands. An examination of Gregory's Appendix (4) may throw some light on the reasons for this: if the pictographs of the old sea cave were in some way associated with the occupation that left the phenomena we call the wall test.

Table 27. Aul correlation survey: 5–8 distance.

	Crowns only	Terraces with crowns	Terraces without crowns	Pelilieu 1
N at 5–8 distance	6EU	8EU	4EU	7EU
%of similarities of Aul F-E test EU	24%	32%	16%	28%
% of total EU distribution	11%	24%	18%	5%

Table 28. Aul correlation surveys: 8–10 distance.

	Crowns only	Terraces with crowns	Terraces without crowns	Platforms	Pelilieu 1	Angaur 19
N at 8–10 distance	9EU	17EU	7EU	1EU	21EU	2EU
% of similarities Aul EU's	16%	29%	12%	2%	36%	4%
% of total EU distribution	11%	24%	18%	13%	5%	11%

Table 29. P1 correlation surveys 0–10 distance.

	Crowns only	Terraces with crowns	Terraces without crowns	Platforms	Aulong 1	Angaur 19
N at 0–10 distance	14EU	32EU	11EU	2EU	38EU	4EU
% of similarities of P1 EU	14%	32%	11%	2%	38%	4%
% of total EU distribution	11%	24%	18%	13%	12%	11%

Site correlations: Pelilieu 1

Intrasite correlations:

0–5 distance: Trench 1 level 1 with levels 1 with levels 3, 5, 6.

Level 4 (Table 18) has no similarities at the 0–8 or the 8–10 with its fellows. Three and 5 are also disruptive of a fullsome correlation. Apparently there is a cultural hiatus or change in the central part of the deposit, or a disturbance there that failed to register with me during excavation. If work is resumed at P1 care must be taken to reveal the reason for the break in relationship in the central part of the deposit. This may be reflected in the peculiar level 2 differences noted in the terrace sites and in the weakness of Aulong 1 F-E test level 4 correlations.

Intersite correlations:

0–5 distance: none.

Table 29 offers the distribution of numbers and percentages of P1 EU similarities to others. Again, it is the terraces of the north that provide the Mecca for cultural similarities, probably trade in ceramics and other normal implied relationships. Or, stated otherwise, we see the Babeldaob terraces as the general arbiter of ceramic trends and typologies, and presumably of numerous other aspects of living in the Palaus.

The terraced sites draw together in the first three tabulation categories, 57% of the P1 EU similarities at or below the 8–10 distance level. Aul has the same figure but Aul has only 12% of the total EU distribution whereas the three aspects of terrace sites have together 53% of that distribution. Their EU similarities are thus only slightly beyond the normal EU distribution. It is clear that, like Aul, P1 had strong relationships with Babeldaob (almost none with Koror) but was closest to Aulong 1, within its own physiographic and bioenvironmental area. Angaur 19, across 11.3 km of open sea to the south, was not as close ceramically as was Aul.

Site correlations: Angaur 19

Intrasite correlations:

0–5 distance: none.

Of the several units, pit 25 and the first flat seem to be the better excavations. At the least, they correlated more frequently with each other and the second flat. Levels 3 and 4 of the second flat yielded the weakest collections insofar as correlations with others are concerned.

The upper levels of one unit do not necessarily correlate with those of another. There are 144 possible correlations when the 12 units were matched with one another. Removal of the 12 of the correlation diagonal leaves 132. There are 50 true matches in the list. This leaves 70 unused spaces. Somewhat over one-third of the units lie at the 8–10 or less distance from one another. The place may presumably be accepted as an unsystematized disturbed site.

Intersite correlations:

0–5 distance: none.

5–8 distance: none.

Table 30 shows the distribution of the exterior EU's at the 8–10 distance. The people of Angaur 19 appear to have reciprocated the interest that the people of northern Babeldaob have shown in Angaur. One notes that the similarities were with the first headings: crowns and terraces with crowns. Correlations with Aulong, while moderately strong could not compete with those of the northern volcanic area.

Table 30. Ang19 correlation survey 8–10 distance

	Crowns only	Terraces with crowns	Terraces without crowns	Platforms	Pelilieu 1	Aulong 1
N at 8–10 distance	9EU	8EU	2EU	2EU	2EU	4EU
% of similarities of Ang19 EU	33%	30%	7%	7%	7%	15%
% of total EU distribution	11%	24%	18%	13%	5%	11%

CHAPTER 7

Dating

The dating of the Palau excavations has been difficult, frustrating and, at least in part, inconclusive. In the first place my funding was not adequate for both the computer work and the radiocarbon dating. Both had to be pinched. My samples were sent to Rainer Berger at the Isotopes Laboratory, Institute of Planetary Geophysics and Planetary Physics, University of California, Los Angeles. As a partial compensation for the low order of funding that I could send to Isotopes, Berger suggested student assistants. Two graduate students from our department at Long Beach, William Butler and John Petterson went to Isotopes on an irregular basis, learned techniques and did all of the sample preparation for no more return than experience and expenses. Petterson was able to spend more time on the task than was Butler who, unfortunately, was there during a period when the counter was not in working order. Berger has thus been both understanding and helpful and I am most grateful to him.

I was able, by lumping certain sherd samples to send 37 samples to Berger: 24 were sherd, 12 were charcoal, and 1 shell. I later sent four more shell samples but lack of funds prevented an attempt to date them. Of the 12 charcoal samples, 7 could be dated. It is my opinion that they provide the backbone of the present sketchy temporal framework.

Hope, however, had been placed on C14 dating of potsherds which was described by Taylor and Berger in 1968, while we were in the field. These authors demonstrated success with the method and good accord between charcoal and potsherd dates from Guam. Answers to my letters to Berger offered encouragement sorely needed in the dating department for by that time it had become obvious that charcoal deposits in the sites were small and widely scattered. It was primarily in the preparation of the sherd samples that both Butler and Petterson aided our studies.

The sherd dates are all shockingly old, ranging from 8150 to 3320 radiocarbon years. I had suggested that there were possibly ancient carbon in the clays from which the pottery was made and that this could yield us very old dates. Berger asked if I could get a sample of Palauan pottery clay. I secured three, all small. Berger dated the clay at 1900 ± 400 radiocarbon years. This amount could then be subtracted from each of the dates made on pottery assuming as Berger pointed out, that the pottery was all made from the same clay in the same manner. Sherd dates were taken from Aulong, Babeldaob 37, Babeldaob B19B and Babeldaob 18. It is improbable that the same clay deposits were used for all and that firing techniques, mixtures etc., could have been more than approximately the same.

The following Tables (31 and 32) list all dates, the provenience of the samples, approximate conversions into our calendric system and such comments as I am able to make.

All dates are presented in radiocarbon years except two charcoal ones, 1762E and I (italics in Table 31). These are the only two that seemed worthy of calibration following the tabulation in Damon et al. 1974. Inasmuch as all others are not calibrated the lower case designations (b.c. for B.C.) have not been used.

An attempt was made to subject my sherds to thermoluminescence dating (T.L.). After some correspondence I have sent sherd samples to Elizabeth Ralph at the University of Pennsylvania. A batch had gone in previously but there was doubt that they had originally been fired at a high enough temperature. It is not, of course, certain that the finest and hardest sherds were fired at a higher temperature, but those were the criteria used in selecting the second

Table 31. Radiocarbon dates—charcoal.

UCLA No.	Provenience	Radiocarbon Age	BC/AD before 1950	Comments
1762A	Cat. No. 201/K3, trench 2 square 14R2, level 1	165 ± 80	AD1785 (1705–1865)	Acceptable in lower range, though more recent than expected. Level 3 had no intersite comparisons at 0–5, 5–8 distances. They range widely at 8–10.
1762B	200/K3, trench 2 square 14R2, level 4	320 ± 80	AD1630 (1550–1710)	Same comments. K3 is considered to have been occupied intensively not long before contact and while Koror was building strength.
1762E	29/B40, crown test stratum III bottom	1480 ± 80	AD470 (310–550) *AD491*	Acceptable, older than expected if charcoal was formed during latter period of terrace building. May not date terrace if fill brought in to form part of crown. Relationships are primarily with terraces at 5–8 distance.
1762F	19/B40, test pit 4, stratum II (level 3)	800 ± 80	AD1150 (1070–1230)	Acceptable but small sample, and suspect; evidences of presence of tree roots mixed with charcoal suggest clearing of brush and hence late occupation or a second use of terraces.
1762G	1/ , 4/ , 5/B37 combined coconut grove, square 21L6, stratum II, 12 to 36 inches from surface	1055 ± 80	AD895 (815–975)	Acceptable; combining of samples makes this a medial date: 36 inch occupation presumed 1–2 centuries earlier. This should date latter terrace occupation. Intersite relationships of level 3 are all with terrace components.
1762I	20/B18, hillside test stratum IIB	1800 ± 80	AD150 (70–230) *AD161*	Acceptable. Taken from an area of fragmented charcoal in soil (Fig. 149) probably all from same fires. Should have been clearing and land leveling. Intersite relationships are primarily with terrace components. It is not now possible to prove that this date also dates terrace building but I believe it to do so.
1762K	22/B18, colonnade cut above monolith L, stratum II, possibly B.	285 ± 80	AD1665 (1585–1745)	Surely too late. This strengthens dissatisfaction with stratigraphic relationships described in the text and shown in Figure 125.

Table 32. Radiocarbon dates: sherds.

UCLA No.	Provenience	Radiocarbon age	1900 ± 400 subtracted	BC/AD before 1950	Comments
1855H	52/Au1, wall test, stratum II	3320	1420 ± 400	AD530 (130–930)	The wall test showed no intersite relationships except within the rock islands. It may be an early and somewhat different cultural manifestation than that which includes most of the EU's. The date may be acceptable.
1855I	58/Au1, wall test, stratum III	6530	4630 ± 400	2680BC (3080–2280BC)	Altogether too old, too many years between this and stratum II, although relationship is correct. Also lacked correlations intrasite except with I at 8–10 distance. Older than J; should be younger.
1855J	61/, 63/, 65/Au1 wall test, stratum IV	4970	3070 ± 400	1120BC (1520–720BC)	Probably a reasonable date but lying in the shadow of 1855I.
1855K	37/, 66/Au1 F-E test, levels 8, 9	3780	1880 ± 400	AD70 (330BC–AD470)	Intersite relationships are primarily with volcanic terrace occupations. This date in latter ranges overlaps terrace dates. Possibly acceptable, but if so older than expected.
1855S	108/B37, north face, level 2	6200	4300 ± 400	2350BC (2750–1950BC)	Date unacceptable. Major intersite similarities to other terraces at 8–10 distance. Ca 2500 years too old.
1855Q	26/, 106/B37 east face, square CL21, levels 2, 3 stratum II	4475	2575 ± 400	625BC (1025–225BC)	Should date more closely to 1762G. No good intersite relationships but on proximity and depths Q is judged as 1000 to 1400 years too old.
1855X	6/10/11/16/, 18/, 19/, 23/, 24/, 25/, 31/B19B, steps 1, 1A, 2, levels 2, 3	7610	5710 ± 400	3760BC (4160–3360BC)	Combined sample. Intrasite these levels closely related. Intersite relationships with volcanic terraces. Date approximately 4500 years too old.
1855BB	57/B18, altar test, stratum I, level 1.	3760	1860 ± 400	AD90 (310BC–AD490)	Acceptable date. Intersite relationships primarily terrace. Area around altar was interpreted as having seen ceremonial use that postdated major occupation, but sherds are no doubt older. True date should be in late part of 5th century or somewhat later if this is late terrace area.
1855FF	124/B18, platform 1, stratum II, brown clay.	8150	6250 ± 400	4300BC (4700–3900BC)	Unacceptable. A mixed sample but all sherds from terrace period. Relationships with terrace occupations and Aul wall test, stratum III!). Must be 5000 years too old.

group. No results have arrived and it may well be that the Palauan ceramics will turn out to be as difficult to date by T.L. as they have been by C14.

Sherd dates

The reasons for the pronounced disagreement between the dating trends of charcoal and sherd-contained carbon are not known. At the outset I regarded the entire series of ceramic dates as a total failure. Berger counselled caution, pointed out that charcoal sometimes fails and suggested careful examination. After this I am somewhat more moderate but still consider that the sherd dates are generally too old. Of the 9, there are 4 that come within the range of acceptability as this is now predicated on the charcoal dates and the partly ethnocomparative (and partly impressionistic) sequence that is published in the survey report (1966: ch. 19), and appears, abbreviated, at the end of this chapter.

The four pottery dates are 1855H, J, K, BB. Of these H and BB are the most dubious. These 4 shall be discussed briefly, followed by a discussion of the charcoal dates and then by a suggested chronology. Finally, comments and recommendations will be in order.

1855H should date the second stratum of the wall test, Au1. This small test was so clearly and almost elegantly stratified, and the sherd variance between the strata was obvious in the field, that I had high hopes that the test could be used as a type location, as far as the limestone island area was concerned. A reference to the results of the similarity analysis will show that the wall test stood almost alone; that it showed unnecessarily few similarities abroad. It was stratum II, it will be recalled, that yielded the bones of two kinds of swine and of goat from its lower soil. Given, then, the facts of the wall test's cultural individuality, and that if it is so unusual it must date earlier rather than later than the general run of Palauan material, it becomes possible to find the date a useful one. The major difficulty in acceptance lies in the fact that this is only stratum II; it seems early for the second soil band. Of course, we are working here with the medial date. There is a deviation of 400 years which may be added to the AD 530.

In the field I had chosen the wall test because I believed some of the later deposits there to have been caught and held by a defensive wall. Excavation never achieved a study of the relationships between wall and deposits. That problem will have to remain perhaps for some other and fortunate excavator. Hopefully, 1855H dates a medial part of the formative period of Palauan culture on the rock islands. It could be that Lower and Middle Early, in the original formulation, would be reasonable.

1855J is, if the above approaches fact, a reasonable date for wall test stratum IV. The concentration of thin, often fine paste sherds of globular pots with the type 5 rim in this stratum has suggested age—although it may be remembered that sherds of this form, though in variable pastes were found in terrace associated EU's. It is thus possible to accept this date and provisionally place stratum IV in the Lower early or Archaic, an aspect of early formative. We may comment that the formative in the Palaus included both physiographic aspects of the group: sherds from strata III and IV contain volcanic sand (see ceramic discussion and appendix 1). 1120BC $\pm$400 puts the stratum into Archaic. Frankly the term Archaic does not seem to fit this stratum or III either; a redefinition of the local chronological sequence, when that becomes possible, should discard Archaic in favor of some such term as Colonial or Settlement period.

1855K presumably dates the older levels of Aulong 1, F-E test. The various ceramic analyses related the sherds from levels 8 and 9 to volcanic island terrace associations, primarily. AD70 or even AD470 are rather old for many of these terraces (but see 1762E) but the dating seems reasonable and acceptable to me for what probably should be considered as the mid- or lower early (Classic) Palauan period.

1855BB, AD90 medial, was expected to date much later on the belief that the area around

the altar was in use ceremonially after the major B18 occupation. This inference was derived from the surprising amount of solution worn pieces of large shell, many of them *Tridacna*, which were thought to be aspects of sacrifice and certainly did not occur elsewhere on the site. However, there is no reason to assert that the shell, which has to be recent in the acid environment, is the same age as sherds from the thin altar test deposit. These may well be as old as the BB date indicates, easpecially if one focusses on the later part of the range.

Charcoal dates

Of the seven charcoal dates, six are acceptable. Some brief amplification of the comments on the table should be made. 1762A (K3, trench 2, level 3) AD1785 was expected to be earlier but the great time depth, and the wide areal range of similarity in matters ceramic which we have discovered leads us not to be surprised that a place such as Ngaramid could have a level 3 midden which was ceramically somewhat like (at the 8–10 distance) the terrace collections of Babeldaob. It is possible that the K3 trench 2 midden built rapidly. There are terraces ringing the Ngaramid valley to the west and northwest. It would be useful to have more information on them.

1762B, AD1630 is properly older than A as level 4 should be older than 3. The 150 years difference is reasonable. Dates A and B fall into that intriguing period of movement and war which I have called the mid-Late. More excavation in the area is sorely needed to round out the picture.

1762E, fits with or close to the range of several of the pottery dates. Hopefully this block of dates means what it says. If so, terraces and terracing were going full blast during the first few centuries of the Christian era. This would make the original dating of my terrace period essentially the Early (Osborne 1966: 462 seq) awry. It, or most of it, should be earlier or a major thrust of terrace building activity belonged in the lower or earlier part of the period. AD470 dates a major soil layer on the crown of B40. It is not known if this surface was stabilized early or late in the general process of terrace growth. The trench, however, cut far below the find spot of the charcoal and we were still in disturbed or "made" soil. This construction of the crown could not well have taken place until the crown, the highest part of the terrace was somewhat isolated. It therefore could not have been the first or earliest aspect of construction. It is possible, however, that the builders did tap early soil deposits for some of their fill and thus included charcoal that was derived from an older period than the last time of shaping the crown. Deeper digging at the B40 crown is most desirable.

1762F, AD1150, presents something of a problem. The charcoal was collected in level 3 of a 1.5 m square test pit, but in the southwest corner of the square was evidence, interpreted by both Palauan workers and myself as a tree stub or roots that had burned. My belief is that a small tree was burned there, ca AD1150 as a part of clearing operations that were aimed at reuse of an agricultural surface that had been out of use for a period of time. The wood was not identified but the size suggests a plant of 4–10 years growth in this area. I therefore suggest, with no further data than the above, that the B40 terraces were, at least in part, fallowed and cultivated during the mid- to late 12th century. This sounds like terminal terrace use, perhaps more intensive but somewhat like that of the present, in the upper or last part of the early period.

1762G, AD895 was made on a combination of charcoal fragments from coconut grove, stratum II, 30 to 91 cm S.D. The date should be an average, medial, of the time required for the accumulation of 51 cm of midden below the toe of the East face of the B37 terraces. It should date the medial and later occupation of the area, including the use of the terraces. The relationships are primarily with terrace EU's.

1762I AD150, is the earliest occupation discovered at a site with terraces, B18. However, it

is not possible to show that the date also dates terrace building of any phase. The relationships of the ceramics are with terrace collections but the depth of similarities of this kind precludes any firm temporal fix. All that can be said at present is that this date, if accepted as is, may date the earliest time of upland agriculture and possible terrace association in northern Babeldaob. The interpretation may be overly extended but there is no reason known why the date should not be a good one.

1762K, AD1665 the last of the charcoal dates is the only one that is not acceptable in terms of the field interpretation. It is too late for a soil horizon that must have been one of the earliest formed after abandonment of maintenance of the plaza of B18. The soils, incidentally, must have formed rapidly here. The hillside was surely farmed or lived upon, and consequently lacked a good plant cover at this time so that soil wash into the megalith area should have proceeded apace, or so I assumed in the field where I felt sure that I discerned a variant of the typical profile found in volcanic island sites. It is true that the profile was not as explicit as it was elsehwere, and therefore the charcoal could not be assigned to the stratum IIB with surety.

One of the major reasons that I cannot accept the late date is ethnographic. I may place more credence on folklore than proper but 1762K comes very close in time to the period of the magic youth Ngerelong, and the removal of Kual's stone from the large colonnade. To me it brings the terminal period of the megaliths uncomfortably close. If it were so close then there should be myth or folklore in some abundance. True, we do not yet have the full Bairulchau story but we have the skeleton and I would not expect more data that could be used to set up time schedules.

The solution to the problem (other than contamination of the sample at some time) lies in the interpretation of the soils involved. I now believe that these profiles form rapidly in some places and, of course, slowly in others. An excavator's dependence on the idea of common soil characteristics may lead him astray. I have commented, passim, on what are probably errors of stratigraphy that depended on soil type and suggested often that the division of stratum II into A and B should not have been done. 1762K is a good example of this. I trust the collection of the charcoal and doubt that it was contaminated although the acid volcanic soils have done strange and wonderful things to potsherds and they might have an influence on charcoal. However that may be, I believe now that I was not able to trace the fill resulting from downslope wash successfully and erred in expecting it to have been moved onto the western plaza rim soon after abandonment. The suggestion now is that there was rather long stabilization in the area and that agricultural use of the hillside in the 17th and 18th centuries resulted in a rapid fill above the monoliths and carried charcoal of the time along with it. We certainly need more field work to settle these problems.

The following hypothetical chronology appeared as a part of Chapter 19 of the survey report (1966). It is based on historical and ethnological (geneological) references and on my interpretations of Palauan and Micronesian archaeology in general.

Upper Late (AD 1750–). The contact period and that of Koror's rise to power.

Middle Late (1600?–1750). A period of strife and movement within the southern limestone islands and consistant migrations north to the volcanic islands, primarily to Babeldaob. The latter part of this time was probably marked by remarkably violent typhoons.

Lower Late (1400?–1600?) was marked by population—subsistence imbalance. This I believe, resulted in more than usual strife, power failure and the flight of many volcanic islanders to the limestone islands of the south.

Upper Early (tentatively 900–1400). During this time I visualize the final phases of terrace building and formation of local power and population centers in the volcanic area. Megalithic activity was probably declining. Trade contacts with Malaysia, the Philippines and the Orient may have continued from the Lower Early.

Middle Early (tentatively 2–300 to 900). The beginning of the Classic, which would include

Upper Early. There were exterior contacts. Terracing, population expansion, new forms of taro, perhaps Palau money arrived to add force to the trends toward development of elite groups. Finer ceramics were more usual than during later times.

Lower Early (some centuries BC through the first 2 or 3 AD) was a formative, generalized period. Terracing may have been begun. Archaic (perhaps starting –1800BC) was the colonial time.

Comments on this formulation have appeared above.

CHAPTER 8

Site and Areal Relationships

Each computer run turned up a somewhat different sequence of correlations for each of the 110 EU's. In general, however, there was a concentration of the higher and more extensive correlations. These are brought together in Table 18, where the core of correlation, as it were, centers around the terrace sites with crowns. Other methods of visual presentation were tried or considered: correlations for each EU were counted and the results graphed: a table listing the differing sequences of the EU's for the differing components of each run was considered. Such manipulation has attractions methodologically but Table 18 seemed the best presentation and one must stop somewhere. It is obvious that varying bases of comparability will alter the numerical values of the several comparisons.

We must be mindful, however, that neither excavation nor laboratory can be controlled as are the data when they are finally on cards. We may only hope that we are catching most of our variables about midpoint as they rise and fall of themselves and in relation to one another.

A series of test excavations such as ours and a pattern of laboratory methods in use for the first time should not be followed by the application of a methodological wringer to the carded data. There would be time for that when the next phase of excavation, that of a complete study of several outstandingly important sites has been accomplished. For example I know that some of the EU's of the sites tested were deficient. They were wrongly selected (as it turned out) or lacked sufficient sherds. An EU may be deficient in an attribute and correlate well with other EU's with similar deficiencies. A systematized disturbance (long term agriculture or wave action) may prevent stratigraphy and make all levels similar or equal. On the other hand, level 4 at Pelilieu 1 bears the stigmata of an upset part of a deposit, or one that was misunderstood. The problem of change of terminology of Koror 3 has been described in the caption for Table 33.

There are thus reasons to avoid an overdetailed presentation of the data from tests in this chapter. Table 18 is an overall, gross presentation and we hope that it will smooth some of the off-line attributes. It becomes apparent as we turn to the table and those on following pages that the terraced sites of northern and east central Babeldaob were those that had the greatest number of similarites to other sites, both within and exterior to the two groups in the two areas. There is one major exception to this, the platforms of site B19A, especially platform A, were not well integrated. This was in a way expected. Platform A was initially explored because of its peculiar megalithic association. Platforms B and C show an increasing number of correlations, which mean cultural integration or similarity, largely because the test pits were penetrating through the platforms, which were presumably late and superficial, into older terrace deposits below. Even the poor collections from these tests began to trend toward integration with those from neighboring sites.

The sites in question, B19B, B18, B37 and B40 show the best integration of all, not only with each other, but with the most distant excavation units on the rock islands. B10, K5 and K3 appear to be another unit if quantity of similarity of external correlations may be a fair basis for judgment. This is reasonable from the viewpoint of physiographic similarity and geographic propinquity. Koror and south-southwest Babeldaob are easily reached one to another, by water. The only uncertainty lies in the sketchy nature of the B10 excavations: a few terrace tests can hardly do justice to that enormous site. We do not even know that there is a midden deposit in the immediate area, other than the thin skin of debris on the terraces. The Aulong F-E test

Table 33. Percentages and frequencies of analyzed sherds from each Excavation Unit (EU). K3 and K5 data suffered: surface finish was not recorded and color designations were less discriminatory. There are complete data on sherds from all other sites.

ANGAUR 19		First Flat								Second Flat								Pit 25					
		Level 1		Level 2		Level 3		Level 4		Level 1		Level 2		Level 3		Level 4		Level 1		Level 2		Level 3		Level 4	
		%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F
Exterior color	Ind		7		14		12		3		23		26		19		21		33		16		16		12
Grey float	1											2	1			5	1								
Red float	2	63	5	93	13	50	3	71	5	83	20	93	40	88	15	91	20	100	15	92	11	100	20	100	19
White float	3					33	2	14	1																
Grey slip	5											2	1												
White slip	6													6	1										
Buff	8	17	1	7	1	17	1	14	1	17	4	2	1	6	1	5	1			8	1				
Interior color	Ind		9		21		12		6		39		52		28		33		39		23		29		22
Grey float	1																	100	9	80	4	100	7	89	8
Red float	2	75	3	86	6	50	3	50	2	63	5	82	14	87	7	80	8								
White float	3					33	2	25	1																
Grey slip	5											6	1												
White slip	6											6	1			10	1							11	1
Buff	8	25	1	14	1	17	1	25	1	38	3	6	1	13	1	10	1			20	1				
Surface finish	Ind.																								1
SmExt - RInt.	1																					3	1		
RoughExt -SmInt	2											1	1												
RoughExt & Int	3									89	42	84	58	89	32	88	38	21	10			11	4	10	3
SmoothExt & Int	4	100	13	100	28	100	18	100	10	11	5	15	10	11	4	12	5	79	38	100	28	86	31	90	27
Surface change	Ind.																				2				2
Smudged exterior	1			4	1	6	1	10	1	2	1	7	5	6	2	9	4	2	1	8	2	3	1	7	2
Smudged interior	2	15	2	29	8	22	4	40	4	34	16	44	30	31	11	35	15	23	11	31	8	39	14	41	12
Smudged both	3	54	7	54	15	50	9	30	3	55	26	38	26	56	20	47	20	65	31	54	14	42	15	24	7
Eroded exterior	4																	2	1					3	1
Eroded both	6	31	4	14	4	22	4	20	2	9	4	12	8	8	3	9	4	6	3	4	1	17	6	24	7
No change	7																	2	1	4	1				
Firing	Ind.		8		22		14		7		39		56		29		32		39		22		26		20
Well fired	1	60	3	50	3	50	2	67	2	63	5	69	9	57	4	55	6	67	6	83	5	80	8	73	8
Poorly fired	2	40	2	50	3	50	2	33	1	38	3	31	4	43	3	46	5	33	3	17	1	20	2	27	3
Rim forms	Ind.		13		25		15		9		43		60		32		41		42		23		32		27
Straight	01											11	1			50	1	33	2	20	1	25	1	25	1
Incurving	02					33	1			25	1	11	1							40	2				
Incurving	03			33	1							44	4	50	2									50	2
Incurving	04			33	1					50	2			25	1									25	1
Backcurve	05											11	1	25	1	50	1	33	2	20	1	50	2		
Flange	07											11	1												
Flange	08					33	1													20	1				
Exterior band	10																					25	1		
Interior lip	12			33	1	33	1					11	1					17	1						
Thickened	13							100	1	25	1														
Thinned	14																	17	1						
Lip forms	Ind.		13		25		15		9		42		60		33		41		42		24		32		27
Rounded	1			33	1							11	1									25	1	25	1
Flat	2			67	2	67	2	100	1	40	2	89	8	67	2	100	2	100	6	100	4	75	3	75	3
Thickened	3									40	2														
Pointed	4													33	1										
Channeled	5					33	1			20	1														
Wall shape	Ind.				1		2				3		3		2										
Straight	1		4		1					5	2	3	2	3	1			13	6	4	1	8	3	7	2
Incurving	2	92	12	89	24	94	15	90	9	91	40	92	61	94	32	98	42	77	37	82	23	78	28	94	29
Backcurving	3	8	1	4	1	6	1	10	1	5	2	3	2	3	1	2	1	10	5	14	4	14	5		
Saucer-shaped	5			4	1							2	1												
Base shape	Ind		13		28		18		10		46		69		35		43		48		28		36		31
Flat	1									100	1			100	1										
Possible use	Ind		2				2		2		3		7		4		1		9		5		2		6
Cooking	1	100	11	100	28	100	16	100	8	100	44	98	61	100	32	100	42	100	39	100	23	100	34	100	25
Jar	4											2	1												
Thickness ave mm.			9.2		8.9		9.5		10.0		9.5		9.7		9.8		8.8		9.9		9.5		9.0		9.4
Lip width ave mm.					8.7		12.7		11.0		13.6		17.3		9.5		6.5		9.2		11.0		6.8		16.8
Paste Fine	2	15	2	18	5	6	1	10	1	21	10	20	14	14	5	19	8	19	9	25	7	17	6	10	3
Medium	3	77	10	82	23	83	15	90	9	66	31	71	49	72	26	73	27	60	29	61	17	79	28	25	17
Coarse	4	8	1			11	2			13	6	9	6	14	5	9	8	21	10	14	4	6	2	36	11
Temper mat. Sand	1	15	2	4	1					6	3	4	3	3	1	9	4	2	1	4	1	6	2	3	1
Sherd	2	46	6	64	18	86	15	60	6	53	25	54	37	50	18	33	14	60	21	30	14	46	16	32	10
Sand and sherd	3	39	5	32	9	17	3	40	4	40	19	42	29	47	17	58	25	38	18	46	13	48	18	65	20
Temper size Coarse	1	62	8	57	16	61	11	50	5	51	24	68	47	53	19	33	14	61	30	54	15	61	22	77	24
Fine	2	38	5	43	12	39	7	50	5	49	23	32	22	47	17	67	29	38	18	46	13	38	14	23	7
Temper quan. Heavy	1	31	4	18	5	17	3	10	1	26	12	32	22	31	11	33	14	27	13	14	4	22	8	45	17
Medium quantity	2	39	5	71	20	72	13	70	7	62	29	64	44	64	23	54	23	69	33	82	23	75	27	42	13
Lightly tempered	3	31	4	11	3	11	2	20	2	13	6	4	3	6	2	14	6	4	2	4	1	3	1	3	1
N =			13		28		18		10		47		69		36		43		48		28		36		31

PELILIEU 1		Level 1		Level 2		Level 3		Level 4		Level 5		Level 6	
		%	F	%	F	%	F	%	F	%	F	%	F
Exterior color	Ind.		14		22		40		21		22		7
Grey float	1	25	51	5	6	10	15	4	8	6	8	7	5
Red float	2	75	154	94	113	90	134	96	172	94	133	92	67
Interior color	Ind.		26		34		46		23		23		11
Grey float	1	26	51	5	5	11	15	5	9	6	8	7	5
Red float	2	74	142	94	102	90	128	94	168	94	132	91	62
White float	3							1	1				
Red slip	4			1	1							2	1
Surface finish	Ind.		7		24		25		5		4		14
SmExt - RInt	1	5	11	12	14	13	22	26	50	26	42	19	12
RoughExt - SmInt	2	1	2					1	2				
RoughExt & Int	3			6	7	1	1	3	6	2	3	2	1
SmoothExt & Int	4	93	198	82	97	86	141	70	138	72	114	80	52
Surface decor	0		219		142		187		199		161		78
Incised	1					50	1	100	2				
Painted	3									50	1		
Indented	8					50	1			50	1	100	1
Surface change	Ind.		11				1		1				
Smudged exterior	1	3	7	8	11	10	19	14	28	7	12	4	3
Smudged interior	2	9	18	11	15	10	19	5	9	3	5	13	10
Smudged both	3	4	8	20	29	18	34	12	24	12	19	13	10
Eroded exterior	4	1	2	5	7	2	3	1	1				
Eroded interior	5	4	8	2	3	1	1					5	4
Eroded both	6	20	42	7	10	5	9	1	2	7	12	22	17
No change	7	59	123	47	67	55	103	68	136	71	115	44	35
Firing	Ind.		4		8		18		6		12		1
Well fired	1	86	184	87	116	81	138	86	167	83	126	82	64
Poorly fired	2	14	31	13	18	19	33	14	28	17	25	18	14
Rim forms	Ind.		20		13		21		1		1		2
Straight	01	8	16	8	10	10	16	4	6	3	5	5	4
Incurving	02	14	27	13	17	7	11	5	10	3	5	9	7
Incurving	03	10	20	19	24	22	37	12	25	6	10	21	16
Incurving	04	9	18	9	12	4	6	3	5	2	3	9	7
Backcurve	05	2	4	4	5	2	4	4	7	2	3	7	5
Flange	06	3	5	1	1	1	2	3	5	4	6	5	4
Flange	07	20	40	17	22	13	23	16	34	35	57	25	19
Flange	08	2	4	4	5	2	3	1	1	2	3	1	1
Flange	09	1	2	3	4			1	1				
Exterior band	10	4	7			1	1	1	1	1	1	1	1
Interior band	11	1	1	1	1			1	1				
Interior lip	12	20	39	16	21	34	57	45	92	39	63	12	9
Thickened	13	5	9	3	4	2	3	3	5	4	6	3	2
Thinned	14	4	7	2	3	3	5	3	5			1	1
Lip forms	Ind.		20		14		25		1		4		2
Rounded	1	50	100	35	45	38	62	32	63	23	36	43	33
Flat	2	47	94	63	81	59	97	66	133	77	123	57	44
Thickened	3			1	1								
Pointed	4	1	2	1	1	2	4	1	1				
Channeled	5	2	3			1	1	2	3				
Wall shape	Ind.		35		34		52		70		59		10
Straight	1	27	50	29	31	33	45	32	40	29	30	38	20
Incurving	2	72	133	69	74	67	92	64	80	69	72	59	41
Backcurving	3	1	1	2	2			3	4	2	2	3	2
Shouldered	4							1	1				
Saucer-shaped	5				1								
Base shape	Ind.		200		129		169		200		162		77
Flat	1	74	14	46	6	20	4	100	1			50	1
Rounded	2	26	5	54	7	80	16			100	1	50	1
Possible use	Ind		130		78		107		111		100		50
Cooking	1	99	88	100	64	100	82	100	90	100	63	100	29
Water vessel	2	1	1										
Thickness ave. mm			10.4		9.6		9.1		9.0		9.1		9.7
Diameter ave cm.			44.8		40.7		43.8		47.2		44.1		43.0
Lip width ave. mm			17.0		16.8		17.2		22.8		24.4		16.4
Paste Ex. fine	1	1	2	4	6	2	4	5	9	2	3	1	
Fine	2	25	54	32	46	35	66	30	60	29	47	39	31
Medium	3	55	121	51	72	46	87	55	111	55	89	46	36
Coarse	4	19	42	13	18	17	32	10	21	15	24	14	12
Temper material	Ind.												
Sand	1	1	1	2	3	3	5	4	7	1	1		
Sherd	2	86	188	75	106	67	127	70	141	76	114	81	64
Sand and sherd	3	14	30	23	33	30	57	26	53	29	46	19	15
Temper size	Ind.				4		2		2				
Coarse	1	16	36	9	12	10	17	7	14	4	6	17	13
Fine	2	84	183	91	120	89	176	93	185	96	155	83	66
Temper quantity	Ind.				8		5		11		13		2
Heavily tempered	1	17	38	9	12	10	19	6	11	11	16	26	20
Medium quantity	2	61	134	62	83	59	108	54	102	57	85	55	41
Lightly tempered	3	22	47	29	39	31	57	41	77	33	49	21	16
N =			219		142		189		201		163		79

/ULONG 1

		F - E Test																Wall Test							
		Level 1		Level 2		Level 3		Level 4		Level 5		Level 6		Level 7		Level 8		Level 9		Stratum I		Stratum II		Stratum III		Stratum IV	
		%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F
Exterior Color	Ind.		103		52		42		53		32		26		48		20		4		15		16		20		13
Grey float	1																			1	1	3	4	7	4	17	15
Red float	2	90	84	90	43	98	57	92	43	81	59	82	74	97	56	79	68	97	30	76	75	83	100	69	43	41	36
White float	3											1	1														
Red slip	4															1	1										
White slip	6											1	1														
Rose	7	1	1																								
Buff	8	9	9	10	5	2	1	6	4	19	14	16	14	3	2	20	17	3	1	23	23	14	17	24	15	42	37
Interior Color	Ind.		116		56		72		70		61		40		72		41		15		19		29		22		34
Grey float	1									2	1									1	1	5	5	5	3	25	17
Red float	2	80	65	84	37	96	27	87	26	80	35	74	56	90	31	68	44	100	20	73	69	80	86	67	40	30	20
White float	3											1	1											2	1	3	2
Red slip	4															5	3										
Grey slip	5											1	1														
White slip	6											1	1														
Rose	7	2	1											3	1												
Buff	8	18	16	16	7	4	1	13	4	18	8	23	17	6	2	28	18			26	25	16	17	27	16	42	28
Surface finish	Ind.		1		1		3				2		6		5				2		1		1				
SmExt - Rint	1	2	2			1	1	2	2	6	6	2	2			7	7			81	91	80	106	31	25	3	3
RoughExt - SmInt	2																			1	1						
RoughExt & Int	3	1	1																	2	2	1	2	9	7	1	1
SmoothExt & Int	4	99	193	100	99	99	96	98	98	94	97	98	108	100	101	93	99	100	33	17	19	21	28	61	50	96	97
Surface Decor	0		194		100		100		97		103		113		105		104		34		114		120		79		97
Incised	1	33	1																							100	4
Painted	3	67	2					100	3	100	2	33	1	100	1	100	2	100	1			18	3				
Incised & painted	4																					35	6				
Stamped	6																							33	1		
Indented	8											67	2									47	8	67	2		
Surface change	Ind		8		3		9		13		7				22												
Smudged exterior	1	12	23	14	14	9	9	10	9	3	3	17	20	17	14	7	7	3	1	5	6	2	3	9	7	6	6
Smudged interior	2	15	29	18	18	39	35	21	18	28	27	19	22	37	31	24	25	29	10	8	9	12	16	11	9	23	23
Smudged both	3	40	75	41	40	28	25	44	38	26	25	21	25	20	17	14	15	6	2	18	20	24	33	17	14	16	16
Eroded exterior	4					2	2	3	3	1	1			1	1												
Eroded interior	5					1	1																				
Eroded both	6	1	2	1	1			2	2	42	41	12	14	11	9	48	51	63	22	12	14	11	15	24	20	33	33
No change	7	32	60	26	25	22	20	20	17	1	1	30	35	14	12	8	8			57	65	51	70	39	32	23	23
Firing	Ind		119		61		65		67		16		34		54				1				1				
Well fired	1	83	64	80	31	97	34	88	29	43	38	55	45	52	27	33	35	60	19	57	65	57	77	63	52	50	50
~~Poorly fired~~	2	18	14	20	8	3	1	12	4	57	51	45	37	48	25	67	71	40	15	43	49	43	59	37	30	51	51
Rim forms	Ind		63		64		90		50		65		83		77		69		30		9		12		17		44
Straight	01	10	13	14	5	30	3	8	4	18	7	33	11	14	4	22	8	40	2	2	2				4	14	8
Incurving	02	17	23	25	9	10	1	16	8	13	5	9	3	10	3	11	4	40	2	2	2			3	2	5	3
Incurving	03	18	24	25	9	10	1	20	10	18	7	12	4	21	6	22	8	20	1	1	1			9	6	2	1
Incurving	04							2	1	2	1									1	1	2	2	2	1		
Backcurve	05	4	5			10	1									3	1							6	4	61	35
Flange	06	3	3	3	1																	2	2			2	1
Flange	07	3	3	6	2			8	4	8	3					3	1			42	42	50	63	22	14	2	1
Flange	08	1	1																	1	1						
Flange	09							2	1																		
Exterior band	10													3	1									3	2	2	1
Interior lip	12	22	29	22	8	10	1	22	11	22	9	15	5	4	1	14	5			50	52	46	58	37	24	11	6
Thickened	13	11	14	3	1	10	1	6	3	10	4	15	5	17	5	14	5			2	2			12	8	2	1
Thinned	14	15	21	3	1	20	2	16	8	10	4	15	5	31	9	13	5										
Lip forms	Ind.		63		66		90		50		65		83		77		69		30		9		13		19		45
Rounded	1	48	64	47	16	70	7	54	27	58	23	67	22	41	12	57	21	100	5	3	3			6	4	4	2
Flat	2	40	54	53	18	10	1	28	10	38	15	30	10	28	8	43	16			95	100	100	124	92	58	91	51
Pointed	3	12	16			20	2	16	8	5	2	3	1	31	9											2	1
Chaneled	5									2	1									2	2					4	2
Wall shape	Ind.		51		28		4		20		27		30		19		23		12		31		20		10		9
Straight	1	37	55	22	16	77	74	49	39	26	20	6	5	34	30	5	4	4	1	4	3	1	1	6	4	2	2
Incurving	2	61	88	78	56	23	22	51	41	73	57	91	78	66	56	95	79	96	22	95	79	99	116	90	65	97	89
Backcurving	3																			1	1			3	2		
Shouldered	4	2	3									4	3														
Saucer-shaped	5									1	1													1	1	1	1
Base shape	Ind.		176		92		100		96		99		115		98		91		29		114		128		74		93
Flat	1	43	9	63	5			75	3	83	5	100	1	75	6	47	7	17	1			11	1	13	1	63	5
Rounded	2	57	12	38	3			25	1	17	1			25	2	53	8	83	5			89	8	87	7	37	3
Possible use	Ind.		64		29		24		19		40		55		24		53		25		79		89		41		55
Cooking	1	100	133	100	71	100	76	100	81	100	65	100	61	100	82	100	53	100	10	100	35	100	48	98	40	98	45
Lamp	3																							2	1		
Jar	4																									2	1
Thickness ave. mm.			9.1		9.0		9.0		9.0		9.4		9.7		9.3		9.6		7.8		8.3		8.1		9.3		7.0
Diameter ave. cm			39.6		46.0				33.5		47.0		46.2		33.5		45.8		48.0		45.1		39.9		42.5		41.0
Lip width ave. mm.			15.0		16.8		12.6		15.5		14.9		12.2		9.1		15.1		9.8		26.5		27.2		21.2		8.9
Paste Extra fine	1	15	30	15	15	9	9	9	7	7	1	1	8	9	6	9	5	5								1	1	5	5
Fine	2	53	104	53	53	32	32	50	50	39	41	41	47	42	44	38	40	66	23	4	5	12	16	23	19	47	47
Medium	3	28	56	26	26	34	34	31	31	44	46	28	33	47	50	46	49	34	12	66	75	56	77	48	39	43	43
Coarse	4	4	7	6	6	25	25	12	12	15	16	23	27	3	3	11	12			30	34	32	44	28	23	6	6
Temper mat. Sand	1	6	12			1	1	1	1			1	1	2	2									9	8		
Sherd	2	33	65	45	45	65	65	51	51	85	88	72	84	76	80	93	98	87	31	97	111	100	137	78	64	93	94
Sand and sherd	3	61	60	55	55	34	34	48	48	15	16	27	31	23	24	8	8	13	4	3	3			22	18	7	7
Temper size	Ind.																										
Coarse	1	3	6	5	5	7	7	13	13	2	2	25	29	9	9					29	33	18	24	9	8	3	3
Fine	2	97	191	95	95	93	93	87	87	98	102	75	87	92	97	100	106	100	35	71	81	82	113	90	74	97	93
Temper quantity	Ind.										1																
Heavily tempered	1	16	36	12	12	24	24	15	15	6	7	15	17	16	17	5	5	3	1	17	20	25	34	26	21	8	8
Medium quantity	2	38	75	44	44	39	39	44	44	50	52	47	54	48	51	43	46	40	14	65	74	53	73	44	36	43	43
Lightly tempered	3	44	86	44	44	37	37	41	41	43	45	39	45	39	38	52	55	57	20	18	20	30	30	30	25	50	50
N =			197		100		100		100		105		116		106		106		35		114		137		82		101

KOROR 3
Ngaramid

KOROR 5
Ngerbechedesau

		Trench 2						Shell Patch				Apron		Test Pit 3		Test Pit 6		Centerline Tr.			
		Level 1		Level 2		Level 3		Level 4		Level 1		Level 2		Level 3		Level 2		Level 1		Level 2	
Exterior color	Ind.		14		23		124		14		17		43		17		14		10		3
Grey float	1	18	30	5	20	7	75	6	15	6	24	13	13	2	4	T	1				
Red float	2	81	138	94	352	91	932	92	220	93	342	87	91	98	155	100	69	100	15	93	14
White float	3					T	1														
Red slip	4			T	1	T	1														
White slip	6	1	2	1	4	1	5	T	1	T	2	T	1								
Rose	7					T	1			T	1										
Interior color	Ind.		12		2		24		13		17		44		17		15		10		3
Grey float	1	16	27	5	18	7	67	5	12	6	23	2	4	2	4	1	1				
Red float	2	77	130	92	347	89	901	91	216	91	337	88	90	98	155	96	67	100	15	93	14
White float	3					T	1														
Red slip	4	1	4	1	3	T	4	T	1												
Grey slip	5						1	1	3												
White slip	6	6	11	2	9	3	28	2	5	3	10	10	10			2	2				
Rose	7					T	1			T	1										
Surface finish not recorded																					
Surface decor	0		183		195		1133		249		388		147		175		84		25		17
Incised	1					17	1													100	1
Wat impressed	5	100	3	60	3	67	4	100	1		100	1	100	1							
Stamped	6			40	2	17	1														
Surface change	Ind.		12		43		29		8		39		3		13		7		9		1
Smudged exterior	1	15	26	18	64	16	178	20	48	29	100	21	30	18	30	19	15	13	9		
Smudged interior	2	10	17	15	55	17	184	15	35	11	30	8	11	14	23	8	6	6	9	12	2
Smudged both	3	9	15	10	37	17	189	11	27	6	20	8	12	16	26	10	8	63	10	18	3
Eroded exterior	4	4	6	4	13	1	12	1	3	2	8	1	1	3	5	1	1				
Eroded interior	5	1	2	1	3	1	9	1	2	1	2	2	3	1	1						
Eroded both	6			2	6			T	1	T	1			1	2	5	4				
No change	7	62	106	50	179	48	534	52	126	52	180	61	88	48	76	56	43	19	3	71	12
Firing	Ind.		2		8		132		16		5		2		14		5		10		2
Well fired	1	30	54	40	150	50	498	42	97	31	117	40	58	22	36	23	18	13	2	44	7
~~Poorly fired~~	2	70	127	60	234	50	508	59	137	70	266	60	88	78	126	77	61	87	13	56	9
Rim forms	Ind.		148		325		960		206		317		117		152		76		18		14
Straight	01	47	17	41	31	29	51	29	13	34	24	42	13	38	9	25	2	29	2	100	4
Incurving	02	14	5	20	15	19	34	16	7	21	15	13	4	21	5	36	3	14	3		
Incurving	03	11	4	4	3	13	23	21	9	7	5	16	5	8	2			29	2		
Incurving	04	8	3	4	3	12	22	18	8	14	10	7	2	21	5	38	3				
Backcurve	05	3	1	3	2	11	20			6	4	7	2	4	1						
Flange	06	3	1	1	1	1	1														
Flange	07			5	4	2	3	1	1	1	1										
Flange	08	6	2	7	5	3	6			3	2			4	1						
Exterior band	10	3	1	4	3	1	2	2	1	4	3										
Interior band	11			4	3			2	1	1	1										
Interior lip	12			1	1	3	6			3	2	7	2	4	1						
Thickened	13	6	2	3	2	2	4					3	1								
Thinned	14			3	2	3	6			6	4	3	1								
Lip forms	Ind.		148		322		963		207		317		117		152		77		18		14
Rounded	1	22	8	26	20	31	55	23	10	24	17	19	6	17	4	57	4	43	3	75	3
Flat	2	67	24	68	53	64	112	77	33	73	52	74	23	75	18	43	3	57	4	25	1
Thickened	3			4	3	1	1							4	1						
Pointed	4	11	4	3	2	5	8			3	2	7	2	4	1						
Channeled	5					1	1														
Wall shape	Ind		19		106		264		62		115		16		33		25		7		1
Straight	1	33	55	27	79	26	229	22	41	32	88	17	23	19	27	24	14				
Incurving	2	67	110	73	214	73	637	78	147	65	178	83	109	80	115	76	45	100	18	100	17
Backcurving	3			T	1	1	9			2	6			1	1						
Shouldered	4									T	1										
Base shape	Ind.		164		356		1081		249		385		143		157		84		24		18
Flat	1	60	12	57	25	52	30	100	1	67	2	100	5	37	7						
Rounded	2	40	8	43	19	48	28			33	1			63	12			100	1		
Possible use	Ind.		144		386		841		208		324		112		167		70		14		13
Cooking pot	1	93	37	93	13	100	297	100	42	100	64	97	35	100	9	100	14				
Water vessel	2	5	2	7	1	T	1											100	11	100	5
Jar	4	3	1									3	1								
Thickness ave. mm.			10.3		9.6		9.3		8.8		9.7		9.9		8.7		8.8		8.4		9.2
Diameter ave cm.			34.3		41.0		41.0		35.2		42.9		38.1		34.5		46.0		34.7		
Lip width ave. mm.			10.4		10.8		10.5		12.1		9.6		10.9		10.8		8.3		11.0		8.5
Paste	Ind.						1														
Extra fine	1	2	4	T	1	2	19	3	8	1	2										
Fine	2	36	66	33	134	41	467	42	106	36	139	22	32	39	68	66	55	80	20	56	10
Medium	3	51	93	57	227	49	558	44	111	51	199	67	99	59	103	30	25	20	5	44	8
Coarse	4	11	20	10	38	8	94	10	25	12	48	12	17	3	5	5	4				
Extra coarse	5	1	1																		
Temper material	Ind.		1				25		3						1		2		1		
Sand	1	4	7	9	35	5	51	4	10	4	16	1	1	14	24	17	14				
Sherd	2	76	140	71	285	83	923	73	181	88	342	91	135	69	121	71	58	71	17	59	10
Sand and sherd	3	20	36	20	80	13	140	23	56	8	30	8	12	17	30	12	10	4	1	29	5
Temper size	Ind.		1		6		27				2				7		2				
Coarse	1	31	57	31	122	22	243	39	97	31	119	31	46	9	15	23	19		1		1
Fine	2	69	126	69	272	78	869	62	153	70	267	69	102	91	154	77	63	46	11	59	10
Temper quantity	Ind.		5		7		13		1		4		2		8		2		1		1
Heavily tempered	1	24	43	24	95	24	267	30	74	35	136	45	65	14	24	26	21	4	1	24	4
Medium quantity	2	36	64	49	191	40	448	38	95	44	170	35	51	52	88	28	23	25	6	47	8
Lightly tempered	3	40	72	27	107	37	411	32	80	20	78	21	30	33	56	46	38	71	17	29	5
N =			184		400		1139		250		388		148		176		84		25		18

		Test Pit 6 Level 1		Centerline Tr. Level 1		Level 2	
Exterior color	Ind.		88		70		108
Grey float	1				4	9	3
Red float	2	14	100	61	95	200	97
White float	3						263
Red slip	4						
White slip	6				14	7	16
Rose	7	1			1	3	7
Interior color	Ind.		88		70		108
Grey float	1				4	9	3
Red float	2	14	98	60	92	195	97
White float	3						263
Red slip	4						
Grey slip	5						
White slip	6						
Rose	7	1	2	1	4	8	7
Surface finish not recorded							
Surface decor	0		149		282		380
Incised	1						
Wat impressed	5		1				
Stamped	6						
Surface change	Ind.		6		22		18
Smudged exterior	1	7	8	7	19	9	31
Smudged interior	2	12	21	30	20	52	18
Smudged both	3	2	62	91	22	58	36
Eroded exterior	4				2	6	3
Eroded interior	5						
Eroded both	6		1	1	7	1	1
No change	7	1	10	16	48	124	34
Firing	Ind.		117		53		100
Well fired	1	2	72	23	28	64	18
~~Poorly fired~~	2	9	28	9	72	165	82
Rim forms	Ind.		131		235		323
Straight	01		11	2	19	9	27
Incurving	02		61	11	21	10	27
Incurving	03		11	2	6	3	11
Incurving	04				13	6	13
Backcurve	05		6	1	2	1	2
Flange	06				4	2	
Flange	07				4	2	2
Flange	08				4	2	
Exterior band	10				6	3	2
Interior band	11						
Interior lip	12						
Thickened	13				6	3	7
Thinned	14		17	3	4	2	6
Lip forms	Ind.		132		233		322
Rounded	1		42	22	26	58	26
Flat	2		41	7	63	31	55
Thickened	3				14	7	16
Pointed	4				10	5	7
Channeled	5		6	1			
Wall shape	Ind		97		59		69
Straight	1		42	22	26	58	26
Incurving	2		56	29	74	165	72
Backcurving	3		2	1			223
Shouldered	4						2
Base shape	Ind.		149		263		323
Flat	1				58	11	53
Rounded	2				42	8	47
Possible use	Ind.		22		249		319
Cooking pot	1		100	127	100	33	100
Water vessel	2						59
Jar	4						
Thickness ave. mm.			9.4		9.4		9.3
Diameter ave cm.			49.3		38.8		41.0
Lip width ave. mm.			11.1		12.4		14.0
Paste	Ind.						
Extra fine	1				1		2
Fine	2		9	14	T	1	
Medium	3	10	50	75	54	152	48
Coarse	4	8	37	55	45	127	50
Extra coarse	5		3	5	T	1	2
Temper material	Ind.		12		2		15
Sand	1						
Sherd	2	3	6	17	2	6	
Sand and sherd	3	10	61	83	77	216	88
Temper size	Ind.		2		31		
Coarse	1	1	22	33	23	65	13
Fine	2	6	78	116	77	215	87
Temper quantity	Ind.		1		4		39
Heavily tempered	1		4	11	16	6	18
Medium quantity	2		27	41	47	131	55
Lightly tempered	3		62	92	46	129	40
N =		18	149		282		380

DABELDAOB 40 Ngargaaang		Test Pit 5								Shell Expoaure		Crown								Test Pit 2							
		Stratum I		Stratum II		Stratum III		Stratum IV				Stratum I		Stratum II		Stratum III		Stratum IV		Stratum V		Stratum I		Stratum II		Stratum III		Stratum IV	
		%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F
Exterior color	Ind.		8		49		98		21		10		24		90		98		95		10		15		116		86		24
Grey float	1			14	7	2	1			33	7																		
Red float	2	100	2	82	42	95	41	100	8	52	11	100	5	100	15	100	4	40	4	100	11	50	3	92	11	93	53	100	9
White float	3									10	2																		
Red slip	4									5	1																		
Grey slip	5																	30	3			17	1			4	2		
White slip	6					2	1															17	1						
Rose	7			4	2																					2	1		
Buff	8																	30	3			17	1	8	1	2	1		
Interior color	Ind.		8		62		122		24		16		27		103		101		91		18		16		122		100		31
Grey float	1				9					44	7																		
Red float	2	100	2	74	28	90	17	100	5	27	4	100	2	100	2	100	1	50	7	100	3	40	2	83	5	86	37	100	2
White float	3									13	2																		
Red slip	4									7	1																		
Grey slip	5					5	1											14	2			20	1			5	2		
White slip	6					5	1															20	1						
Rose	7			3	1					7	1															7	3		
Buff	8																	36	5			20	1	17	1	2	1		
Surface finish	Ind.				1		2								3		5				1				2		4		
SmExt - RInt	1	10	1	13	13	4	6			10	3	3	1			1	1					5	1	12	15	7	9	6	2
RoughExt - SmInt	2			1	1	1	1											1	1					1	1	1	1		
RoughExt & Int	3			2	2													1	1					1	1	1	2		
SmoothExt & Int	4	90	9	84	83	94	131	100	29	87	27	97	28	100	102	99	96	98	103	100	20	95	20	87	109	91	126	94	31
Polished Ext	5									3	1															1	1		
Surface decor	0		10		99		141		28		30		29		105		102		100		21		21		128		143		33
Tainted	3																	80	4										
Incised & painted	4							100	1									20	1										
Mat impression	5									100	1																		
Stamped	6			100	1																								
Surface change	Ind.				4		1										1		1						5		5		
Smudged exterior	1	10	1	6	6	7	10	10	3	29	9	3	1	2	2	6	6	8	8	5	1	10	2	10	12	7	9		
Smudged int-rior	2			18	17	22	31	10	3	3	1	7	2	13	14	19	19	19	20	43	9	5	1	24	29	18	25	21	7
Smudged both	3	60	6	32	31	38	53	41	12	32	10	55	16	75	79	64	65	49	51	33	7	38	8	53	65	51	71	76	25
Eroded both	6	30	3	44	42	28	39	38	11	29	9	35	10	10	10	11	11	22	23	19	4	48	10	14	17	18	25	3	1
No change	7					5	7			7	2							2	2							6	8		
Firing	Ind.				4										52				4								27		
Well fired	1	20	2	31	30	23	33	24	7	48	15	45	13	64	34	45	46	36	36	29	6	62	13	27	34	50	58	12	4
Poorly fired	2	80	8	69	66	77	100	76	22	52	16	55	16	36	19	55	56	64	65	71	15	38	8	73	94	50	58	88	29
Rim forms	Ind.		8		33		106		24		28		23		83		74		70		19		16		88		103		29
Straight	01			4	3	9	3	60	3	33	1	17	1	64	14	29	8	40	14			20	1	5	2	3	1	25	1
Incurving	02			2	1	9	3					33	2	5	1	21	6	20	7	50	1	20	1			3	1	50	2
Incurving	03			7	5	9	3	20	1					14	3	21	6	14	5	50	1			5	2	10	4	25	1
Incurving	04											17	1	5	1	7	2					20	1	3	1				
Backcurve	05															7	2	3	1										
Flange	06			5	3	3	1															40	2	3	1				
Flange	07	50	1	30	20	26	9			33	1													50	20	40	16		
Flange	08			2	1																			3	1				
Interior band	11			2	1																								
Interior lip	12	50	1	37	25	29	10					17	1	5	1	4	1	6	2							43	17		
Thickened	13			9	6	14	5	20	1					5	1	4	1	11	4					27	11	3	1		
Thinned	14			3	2	3	1			33	1	17	1	5	1	7	2	6	2					5	2				
Lip forms	Ind.		8		33		106		24		28		23		84		74		70		19		16		89		103		29
Rounded	1			3	2	14	5	60	3			17	1	43	9	21	6	26	9			20	1	3	1	15	6	75	3
Flat	2	100	2	96	64	83	29			100	3	83	5	43	9	64	18	54	19	100	2	80	4	95	37	83	33		
Pointed	4			2	1	3	1	40	2					14	3	14	4	20	7					3	1	3	1	25	1
Wall shape	Ind.		3		19		30		5		5		4		18		13		18		9				38		57		3
Straight	1			14	11	12	13	17	4	8	2			36	31	15	13	36	31	17	2	19	4	16	14	9	8	17	5
Incurving	2	100	7	86	70	88	98	83	20	92	24	100	25	64	56	84	75	64	56	83	10	81	17	84	76	91	78	83	25
Shouldered	4															1	1												
Base shape	Ind.		10		93		133		26		26		27		104		91		90		18		21		123		134		31
Flat	1			86	6	38	3			60	3	50	1	100	1	36	4	40	6	100	3			60	3	44	4	100	2
Rounded	2			14	1	63	5	100	3	40	2	50	1			64	7	60	9					40	2	56	5		
Possible use	Ind.		2		20		12		2		10		2		4		7		14		2		6		9		19		
Cooking	1	100	8	100	80	100	129	100	27	100	21	100	27	99	100	99	94	100	91	100	19	100	15	100	119	100	124	100	33
Lamp	3													1	1														
Jar	4															1	1												
Thickness ave. mm.		9.1		9.2		8.2		8.5		8.9		9.0		9.0		8.4		9.7		8.8		8.2		8.0		7.9		7.0	
Diameter ave. cm.		42.0		44.0		46.6		26.5		32.0		36.3		27.6		40.2		44.9		24.0		49.7		39.6		44.2			
Lip width ave. mm		25.5		19.4		18.6		9.0		12.3		11.2		8.9		10.1		10.4		9.5		15.0		22.8		19.7		7.0	
Paste	Ind.														1														
Extra fine	1	50	5	9	9	23	32	24	7	19	6	3	1	9	9	10	10	11	12	52	11	10	2	16	20	13	18	39	13
Fine	2	40	4	44	44	61	86	72	21	65	20	59	17	64	66	57	58	50	52	43	9	38	8	59	76	53	76	52	19
Medium	3	10	1	42	42	15	21	3	1	16	5	35	10	28	29	33	34	36	38	5	1	52	11	23	29	31	44	9	3
Coarse	4			5	5	1	2					3	1					3	3					2	3	4	5		
Temper mat. Sand	1													11	12			1	1										
Sherd	2	60	6	86	86	81	114	72	21	84	26	48	14	47	49	72	73	66	69	76	16	76	16	79	101	88	126	88	29
Sand and sherd	3	40	4	14	14	19	27	28	8	16	5	52	15	42	144	28	29	33	35	24	5	24	5	21	27	12	17	12	4
Temper size Coarse	1					1	1					7	2	30	31	1	1	3	3	100	21					5	7		
Fine	2	100	10	100	100	99	140	100	29	100	31	93	27	71	74	99	101	97	102			100	21	100	128	95	136	100	33
Temper quan-heavy	1			3	3							7	2	4	4	8	8	8	8	14	3			2	3	5	8	18	6
Medium quantity	2	20	2	49	49	42	59	35	10	52	16	48	14	42	44	51	52	32	34	19	4	57	12	31	39	50	71	82	27
Lightly tempered	3	80	8	48	48	58	82	65	19	48	15	45	13	54	57	41	42	60	63	67	14	43	9	67	86	45	64		
N =			10		100		141		29		31		29		105		102		105		21		21		128		143		33

BABELDAOB 37 Melekeiok		Coconut Grove						East Face						Test Pit 2						North Face					
		Stratum I		Stratum II		Btratum III		Level 1		Level 2		Level 1		Level 2		Level 3		Level 4		Level 1		Level 2		Level 3		Level 4	
		%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F
Exterior color	Ind.		257		209		23		267		148		56		57		23		14		158		288		237		70
Grey float	1							2	3											14	7						
Red float	2	87	98	88	71	100	5	96	119	97	71	100	3	100	7			100	5	85	44	93	68	99	74	100	34
White float	3									1	1																
Grey slip	5			1	1					1	1													1	1		
White slip	6			1	1			1	1													3	2				
Rose	7	5	6																	2	1	1	1				
Buff	8	8	9	10	8			1	1													3	2				
Interior color	Ind.		303		235		26		313		178		59		62		23		17		181		326		284		87
Grey float	1							3	2	5	2									17	5	3	1			6	1
Red float	2	75	50	82	45	100	2	92	72	91	39			100	2			100	2	76	22	80	28	100	28	94	16
White float	3	2	1					1	1																		
Grey slip	5	2	1	2	1					2	1																
White slip	6			2	1			4	3													6	2				
Rose	7	9	6																	3	1	3	1				
Buff	8	13	9	15	8					2	1									3	1	9	3				
Surface finish	Ind.		2		1				8				1		1		1		1		10		23				
SmExt - RInt	1	2	7					1	4	1	2											1	3				
RoughExt - SmInt	2			T	1																						
RoughExt & Int	3	1	4									2	1	10	6	5	1			3	5	4	14				
SmoothExt & Int	4	97	355	100	288	100	28	99	379	99	219	98	57	91	57	91	20	100	18	98	195	95	321	100	312	100	104
Polished both	7	T	1													4	1										
Surface decor	0		366		279		27		389		221		59		64		23		17		209		270		310		104
Incised	1							100	1																		
Painted	3	25	1	67	10	100	1																				
Stamped	6			20	3																						
Indented	8	75	3	13	2															100	1	100	1	100	4		
Surface change	Ind.		91		35				12				27		24		3		8		2		9				
Smudged exterior	1	6	26	12	31	4	1	3	10	1	2	38	12	28	11	25	5	64	7	1	1	1	5	3	8	2	2
Smudged interior	2	18	56	11	29	14	4	12	45		19	38	12	35	14	25	5	36	4	13	36	15	62	15	48	17	18
Smudged both	3	55	152	67	171	82	23	71	269	76	168	38	22	7	35	14	40	8		58	120	75	264	80	203	69	72
Eroded exterior	4	1	2	2	5			1	4	1	1	3	1				5	1		1	1	1	2	1	1	2	2
Eroded interior	5	1	1	1	2					1	2						5	1									
Eroded both	6	6	16	2	6			5	18	8	17									23	47	4	13	4	11	9	9
No change	7	15	42	4	11			9	33	5	12			3	1					6	13	5	16	1	1	1	1
Firing	Ind.		184		201		25		288		172		58		57		23		17		183		316		280		88
Well fired	1	93	172	88	78	100	3	83	86	71	35	100	1	100	7			100	2	82	22	84	38	94	30	94	15
Poorly fired	2	7	14	12	11			17	17	29	14									19	5	16	7	6	2	6	1
Rim forms	Ind.		205		208		24		313		179		38		57		20		15		125		237		262		91
Straight	01	11	18	23	19	50	2	8	6	12	5	14	3							19	16	19	23	14	7	15	2
Incurving	02	12	20	10	8			9	7	7	3	10	2	57	4			25	1	17	14	8	10	20	10		
Incurving	03	9	15	7	6	25	1	15	12	12	5	14	3							4	3	11	13	10	9	31	4
Incurving	04	7	11					12	9	5	2	19	4			33	1			4	3	7	8	6	3	8	1
Backcurve	05	1	1	6	5			6	5	2	1							50	2	4	3	6	7	14	7	6	1
Flange	06	5	9	2	2			4	3	2	1	5	1							4	3	6	7			6	1
Flange	07	15	25	1	1			12	9	12	5									7	6	4	5			6	1
Flange	08	3	5	1	1					5	2			14	1	33	1			14	12	11	14				
Flange	09																			4	3	1	1	2	1		
Banded exterior	10	1	1	4	3			3	2	2	1			14	1					1	1	2	2	2	1	1	1
Banded interior	11	1	1	1	1			1	1														3				
Interior lip	12	17	28	4	3			19	15	33	14									7	6	11	14	8	4		
Thickened	13	12	20	16	13			3	2	2	1	33	7	14	1			25	1	12	10	11	13	8	4	5	1
Thinned	14	7	12	24	20	25	1	9	7	5	2	5	1			33	1			9	8	9	11	8	4	15	2
Lip forms	Ind.		205		210		24		313		183		39		57		20		16		125		233		262		91
Rounded	1	41	68	55	44	50	2	17	13	26	10	55	11	29	2	33	1	33	1	19	16	23	28	16	8	15	2
Flat	2	52	85	25	20	25	1	78	61	61	23	25	5	57	4	67	2	67	2	80	68	68	86	72	36	77	10
Tickened	3	1	1	1	1					3	1											1	1	4	2	8	1
Pointed	4	6	10	16	13	25	1	3	2	11	4	10	2							1	1	8	10	6	3		
Channeled	5	1	1	3	2			3	2			10	2	14	1									2	1		
Wall shape	Ind.		83		50		1		77		28		25		19		7		11		64		93		10		4
Straight	1	26	75	20	49	4	1	18	57	41	79	59	20	38	17	44	7	13	1	31	45	21	55	16	48	24	24
Incurving	2	73	208	77	185	96	26	82	257	59	114	41	14	62	28	50	8	63	5	67	98	77	207	84	254	75	75
Backcurving	3	1	2	2	4											6	1	13	1			2	4			1	1
Shouldered	4	T	1	T	1													13	1			1	2				
Saucer-shape	5	T	1	T	1																	1	1				
Base shape	Ind.		352		287		27		387		221		58		64		23		17		205		356		311		101
Flat	1	56	10	33	1	100	1	100	4			100	1					50	1	60	3	100	5			100	3
Rounded	2	44	8	67	2													50	1	40	2			100	1		
Possible use	Ind.		63		35				48		27				5		2		3		23		25		14		4
Cooking	1	100	307	100	254	100	28	100	343	100	194	100	59	100	59	100	21	100	16	100	187	100	336	100	298	100	100
Thickness ave. mm		9.4		9.8		10.5		8.8		8.7		10.6		10.9		11.9		11.2		8.4		8.4		8.1		7.8	
Diameter ave. cm		37.4		27.4				52.0		23.0		42.8								46.4		43.1		55.3		38.0	
Lip width ave. mm		16.7		11.4		11.0		15.2		10.9		13.6		12.3		9.7		16.0		16.1		15.1		10.8		13.0	
Paste	Ind.		1		2																						
Extra fine	1	4	15	5	13	7	2	1	3			12	7	9	6	13	3			5	11	8	29	3	8		
Fine	2	55	201	48	137	50	14	45	177	38	83	34	20	36	23	39	9	47	9	63	132	52	187	40	124	32	33
Medium	3	37	136	46	131	39	11	52	204	58	127	49	29	45	29	35	8	53	10	32	67	37	133	51	160	59	61
Coarse	4	4	16	2	7	4	1	2	7	5	11	5	3	9	6	13	3					3	11	6	20	10	10
Temper material	Ind.		1		3				11		8				1								2		4		2
Sand	1	7	1	2	6			1	5	4	9									1	2	2	7	2	6	5	5
Sherd	2	76	286	64	183	86	24	71	271	69	146	66	39	51	32	48	11	58	11	60	143	85	305	87	268	63	64
Sand and sherd	3	22	82	34	96	14	4	27	104	27	58	34	20	49	31	52	12	42	8	31	65	13	47	11	34	32	33
Temper size	Ind.		1		2				10		8				1												
Coarse	1	14	52	33	96	25	7	44	168	53	114			2	1	9	2			14	29	15	53	34	104	43	43
Fine	2	86	317	67	192	75	21	56	212	47	99	100	59	98	62	91	21	100	19	86	181	85	307	66	203	57	58
Temper quantity	Ind.		3		2				11		9				1								1		5		3
Heavily tempered	1	18	65	7	20	11	3	5	19	3	7	29	17	41	26	35	8	32	6	13	28	11	39	5	16	3	3
Medium quantity	2	56	205	66	190	71	20	73	278	80	170	32	19	29	18	26	6	26	5	44	92	57	205	79	243	75	76
Lightly tempered	3	26	97	27	78	18	5	22	83	17	35	39	23	30	19	39	9	42	8	43	90	32	116	16	48	22	22
N =			370		290		28		391		221		59		64		23		19		210		361		312		104

Babeldaob 18 Bairulchau		Hillside West						Colonnade Cut				Christmas Tree Terrace				Altar Test				Platform 1			
		Stratum I		Stratum II		Stratum III		Stratum IV		Stratum I		Stratum II		Stratum III		Stratum I		Strata II&III		Stratum I		Stratum II		Stratum III	
		%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F
Exterior color	Ind.		50		200		234		171		36		93		54		136		132		29		56		15		65		72
Grey float	1	5	3	10	16	4	2	4	3			14	1			2	1	2	2	20	15	2	1						
Red float	2	93	57	61	124	78	43	94	66	100	2	86	6			97	66	98	86	75	57	96	50	80	8	90	35	96	24
White float	3	2	1	3	4	9	5									1	1			4	3								
Grey slip	5																							10	1	5	2		
Rose	7																			1	1	2	1	10	1	3	1		
Buff	8			6	9	9	5	1	1																	3	1	4	1
Interior Color	Ind.		79		276		257		213		36		98		54		174		177		40		79		20		85		84
Grey float	1	13	4	30	23	6	2	7	2			50	1			10	3	7	3	29	19	7	2			5	1		
Red float	2	81	26	49	38	72	23	82	23	100	2	50	1			87	26	93	40	65	42	90	26	60	3	58	11	92	12
White float	3	3	1	9	7	6	2									3	1			5	3			20	1	21	4		
Grey slip	6																									11	2		
White slip	6	3	1			33	1																						
Rose	7																			2	1	3	1	20	1				
Buff	8			13	10	13	4	11	3																	5	1	8	1
Surface finish	Ind.		15		58		15		15		9		6		1		25		41				10				4		4
SmExt - RInt	1	4	4	5	14	6	16	2	5	3	1	5	5			6	11	2	4	36	38								
RExt - SmInt	2	3	3	T	1	1	3			7	2					2	3			1	1					2	2		
RoughExt & Int	3	1	1	2	6	3	8	3	6			2	2								3			4	1				
SmoothExt & Int	4	92	88	93	275	90	246	95	215	90	26	93	87	100	53	92	165	98	175	60	63	100	98	96	24	94	97	100	93
Surface Decor.	0		111		353		279		240		38		99		54		204		219		103		108		25		104		97
Incised	1					33	3																						
Painted	3					66	6													100	2								
Disc	7							100	1									100	1										
Indented	8			100	1							100	1																
Surface change	Ind				3		4		3																				
Smudged exterior	1	5	5	2	7	6	17	6	15				2	2			3	6	1	1	5	5	4	4	4	1	12	12	8	6
Smudged interior	2	7	30	25	86	11	31	22	52	13	5	17	17	13	7	21	43	25	54	12	13	24	26	20	5	15	16	13	13
Smudged both	3	38	42	50	177	66	189	65	154	82	31	75	75	76	41	59	120	47	104	45	47	47	51	40	10	46	48	62	60
Eroded exterior	4	1	1	1	3	T	1	1	2																				
Eroded interior	5	1	1	T	1	T	1																						
Eroded both	6	12	13	9	31	14	39	3	7	5	2	6	6	11	6	16	32	16	36	37	39	6	6	28	7	26	27	17	16
No change	7	17	19	13	46	3	7	3	8							2	3	11	25	1	1	19	21	8	2	1	1		
Firing	Ind		61		254		242		221		35		98		53		175		182		52		82				1		
Well fired	1	52	26	65	65	28	13	50	10	67	2	50	1			55	16	92	35	49	26	81	21	48	12	14	14	4	4
Poorly fired	2	48	24	35	35	72	34	50	10	33	1	50	1	100	1	45	13	8	3	51	27	19	5	52	13	86	89	96	93
Rim forms	Ind		103		280		109		166		27		67		35		167		179		17		91		24		48		76
Straight	01	25	2	16	12	14	25	15	11	18	2	12	4	37	7	14	5	12	5	7	6	12	2			16	9	5	1
Incurving	02			37	27	35	63	31	23	18	2	18	6	37	7	8	3	22	9	9	8	12	2			7	4	10	2
Incurving	03	13	1	15	11	33	60	31	23	9	1	33	11	16	3	11	4	20	8	25	22	6	1			13	7	14	4
Incurving	04	13	1	8	6	5	9	3	2							11	4	2	1	7	6	12	2			2	1	10	2
Backcurve	05															3	1					24	4			7	4	5	1
Flange	06			3	2													2	1	1	1							3	1
Flange	07			4	3	1	2	4	3			6	2			19	7	2	1	9	8					4	2	9	1
Flange	08																			1	1			100	1				
Exterior band	10													5	1			2	1	2	2					2	1		
Interior band	11					1	1																						
Interior lip	12	38	3	15	11	1	1	5	4	46	5	24	8	5	1	27	10	20	8	30	33	18	3			25	14	10	2
Whickened	13	13	1	3	2	11	19	11	8	9	1	6	1			5	2	17	7			16	3			21	12	14	4
Thinned	14							1	1							3	1			1	1					4	2	4	1
Lip forms	Ind.		105		281		110		168		27		67		35		167		180		22		91		24		49		66
Rounded	1	17	1	49	36	36	60	47	34	27	3	64	21	74	14	16	6	32	12	27	22	24	6			16	10	24	4
Flat	2	83	5	51	37	66	119	52	38	73	8	36	12	26	5	81	30	68	27	72	60	77	13	100	1	78	43	76	13
Pointed	4							1	1							3	1												
Channeled	5																	3	1							4	2		
Wall shape	Ind.		32		196		40		23		11		12		11		76		130		35		74		5		27		27
Straight	1	5	4	19	30	18	44	18	39	37	10	16	14	16	7	16	21	37	33	26	18	35	12	5	1	13	10	14	11
Incurving	2	95	75	81	128	82	204	82	178	63	17	84	74	84	36	84	107	62	56	73	51	56	19	95	19	86	66	86	66
Backcurving	3																	1	1	1	1	9	3						
Shouldered	4					T	1	T	1																	1	1		
Base	Ind.		111		341		278		235		37		94		47		188		206		98		107		23		85		84
Flat	1			46	6	73	8	67	4	100	1	67	4	14	1	63	10	86	12	43	3			100	2	79	15	100	9
Rounded	2			54	7	27	3	33	2			33	2	86	6	38	6	14	2	57	4	100	1			21	4		
Possible use	Ind.		39		76		37		24		3		2		3		126		34		41		28		6		16		6
Cooking	1	100	72	99	277	99	248	100	217	100	35	100	98	100	51	100	78	100	86	100	64	100	80	100	19	100	88	100	91
Lamp	3			1	1																								
Jar	4					1	4																						
Thickness ave. mm		7.7		8.7		9.0		8.9		8.1		7.8		7.9		8.6		8.9		8.8		8.2		8.3		10.0		9.1	
Diameter ave. cm.		24.8		42.3		43.3		42.2		42.0		36.8		36.1		44.9		45.0		44.3		35.3				49.4		50.6	
Lip width ave. mm		12.9		15.3		12.2		14.7		15.6		13.9		9.4		21.2		16.0		17.5		15.4		14.0		13.8		16.4	
Paste	Ind.				2																								
Extra fine	1	3	3	6	20	10	29	8	18	21	8	24	[illegible]	32	[illegible]	11	22	11	25	15	16	7	8	8	2	2	2	3	3
Fine	2	50	55	55	195	63	183	64	155	63	24	[illegible]	0	[illegible]	[illegible]	57	116	[illegible]	87	61	64	50	54	80	20	28	30	34	33
Medium	3	42	47	36	128	23	66	24	57	13	5	[illegible]	[illegible]	40	11	31	64	44	96	20	21	40	43	12	3	50	52	57	55
Coarse	4	5	6	3	9	4	11	5	11	[illegible]	[illegible]	[illegible]	[illegible]	2	1	1	2	6	14	4	4	3	3			19	20	6	6
Temper Material	Ind.				4																								
Sand	1	4	4	2	6	3	9	10	24																				
Sherd	2	68	75	68	239	76	220	57	138	66	25	44	44	63	34	63	129	43	95	91	96	71	77	76	19	86	89	78	76
Sand & sherd	3	29	32	30	105	21	60	33	79	34	13	56	56	37	20	37	75	57	125	9	9	29	31	24	6	14	15	22	21
Temper size	Ind.				2																								
Coarse	1	31	34	7	26	9	26	32	77	3	1	4	4	6	3	1	1	3	7	1	1	1	1			1	1		
Fine	2	69	77	93	326	91	263	68	164	97	36	96	96	94	51	99	202	97	213	99	104	99	107	100	25	99	103	100	97
Temper quantity	Ind.				2																								
Heavily tempered	1	23	26	11	40	7	21	12	30			4	4	7	4	7	15	32	70	2	2	17	18			12	12	11	11
Medium quantity	2	40	44	46	162	35	102	35	85	29	11	41	41	57	31	33	68	30	66	38	40	30	32	36	9	61	63	64	62
Lightly tempered	3	37	41	43	150	57	166	53	126	71	27	55	55	35	19	60	121	38	84	60	63	54	58	64	16	28	29	25	24
N =			111		354		289		241		38		100		54		204		220		105		108		25		104		97

BABELDAOB 19A Ollei		Platform A		Platform B Pit 1				Platform B Pit 2				Platform C Pit 2				Platform C Pit 1			
				Level 1		Level 2		Level 3		Level 1		Level 2		Level 1		Level 2		Level 1		Level 2	
		%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F
Exterior color	Ind.		7		11		30		6		19		12		70		27		52		47
Grey float	1	36	4																		
Red float	2	55	6	75	3	100	10	100	1	100	2	100	4	87	32	92	13	100	22	85	23
White float	3													5	2						
Red slip	4																			4	1
White slip	6	9	1	25	1									8	3					11	3
Rose	7															8	1				
Interior Color	Ind.		7		12		37		7		20		12		95		35		68		69
Grey float	1	46	5	33	1						1			8	1						
Red float	2	46	5	67	2	100	3			100	1	100	4	58	7	83	5	100	6	80	4
White float	3													17	2						
White slip	6	9	1											17	2	17	1		20	1	
Surface finish	Ind.		4		12		32		7		21		11		62		20		55		42
SmExt - SmInt	1	7	1												3					6	2
RoughExt - SmInt	2					13	1								3	5	1			2	2
RoughExt & Int	3			67	2	38	3					60	3	44	20	48	10	37	7	53	17
SmoothExt & Int	4	86	12	33	1	50	4					40	2	42	19	48	10	63	12	34	12
Surface Decor	Ind		17		15		40		7		21		16		106		41		69		69
Painted	3																		20	1	
Mat impressed	5	100	1																		
Miscellaneous	7													100	1						
Indented	8																		80	4	100
Surface change	Ind.										1		1								
Smudged exterior	1	17	3				5	2				7	1	1	1	5	2	1	1		
Smudged interior	2	6	1	7	1	10	4			5	1			19	20	20	8	23	17	18	13
Smudged both	3	28	5	20	3	73	29	29	2	85	17	40	6	43	46	22	9	54	40	42	31
Eroded exterior	4													3	3					3	2
Eroded interior	5	6	1											2	2						
Eroded both	6			53	8	8	3	57	4	10	4	40	6	22	23	46	19	18	13	35	26
No change	7	44	8	20	3	5	2	14	1			13	2	11	12	7	3	4	3	3	2
Firing	Ind.		5		11		34		6		20		12		79		38		53		69
Well fired	1	39	5	25	1	17	1			100	1	25	1	29	8	33	1	19	4		
Poorly fired	2	62	8	75	3	83	5	100	1			75	3	71	20	67	2	81	17	100	5
Rim forms	Ind		17		11		37		7		14		13		96		34		63		65
Straight	01			50	2					71	5	33	1	46	5	14	1	36	4	78	7
Incurving	02													27	3	43	3			11	1
Incurving	03	100	1	25	1					14	1	67	2	18	2	14	1				
Backcurve	05					33	1											9	1		
Flange	08			25	1									9	1						
Exterior band	10															14	1				
Interior lip	12					33	1			14	1					14	1	27	3	11	1
Thinned	14					33	1											27	3		
Lip forms	Ind.		17		11		37		7		14		14		96		34		63		65
Rounded	1			75	3	33	1			29	2	100	2	46	5	43	3	55	6	89	8
Flat	2	100	1	25	1	33	1			29	2			36	4	57	4	45	5	11	1
Thickened	3									29	2			9	1						
Pointed	4					33	1			14	1			9	1						
Wall shape	Ind		11		4		34		1		6		2		17		11		12		35
Straight	1			46	5	17	1	15	3	17	7	36	5	36	32	33	10	32	20	31	12
Incurving	2	100	7	55	6	83	5	50	3	33	8	64	9	64	50	63	19	68	42	69	27
Backcurving	3															3	1				
Base shape	Ind.		16		14		40		7		17		16		94		30		64		62
Flat	1	100	2	100	1					75	3			54	7	27	3	60	6	67	8
Rounded	2									25	1			46	6	73	8	40	4	33	4
Possible use	Ind.		13		8		4		2		2		4		34		3		26		5
Cooking	1	100	5	100	7	100	36	100	5	100	19	100	12	100	73	100	38	100	48	100	69
Thickness ave mm		10.6		9.5		8.1		7.0		8.8		7.4		8.4		9.3		8.2		8.3	
Diameter ave. cm.						30.0								16.0		12.0					
Lip width ave. mm.		18.0		13.5		7.3				9.9		8.5		9.0		11.0		7.9		9.1	
Paste Extra fine	1	6	1													12	5			3	2
Fine	2	56	10	33	5	78	31	43	3	24	5	38	6	28	30	83	34	31	23	41	30
Medium	3	40	7	53	8	23	9	57	4	71	15	63	10	62	66	5	2	66	49	50	37
Coarse	4			13	2					5	1			10	11			3	2	7	5
Temper material	Ind.				1		1		1		5				3		2		1		2
Sand	1			7	1	10	4			6	1	6	1	6	6			4	3	13	9
Sherd	2	100	18	86	12	15	6	100	6	69	11	75	12	73	76	62	24	78	57	56	40
Sand and sherd	3			7	1	74	29			25	4	19	3	21	22	38	15	18	13	32	23
Temper size	Ind.				1		1		1		7		1		8		3		1		2
Coarse	1	28	5			13	5							14	14	18	7	8	6	14	10
Fine	2	72	13	100	14	87	34	100	6	100	14	100	15	86	85	82	31	92	67	86	62
Temper quantity	Ind.				1		1		1		7		1		9		3		1		2
Heavily tempered	1	6	1			8	3			7	1			9	9	5	2	3	2	11	8
Medium quantity	2	50	9	71	10	26	10	67	4	50	7	67	10	59	58	92	35	69	50	60	43
Lightly tempered	3	44	8	29	4	67	26	33	2	43	6	33	3	32	31	3	1	29	21	29	21
N =			18		15		40		7		21		16		107		41		74		74

BABELDAOB 19B Ollei Terraces		Step 1 (Crown) Level 1		Level 2		Step 2 Level 1		Level 2		Step 1A Level 1		Level 2		Level 3	
		%	F	%	F	%	F	%	F	%	F	%	F	%	F
Exterior color	Ind.		128		28		175		45		102		217		104
Grey float	1	12	7	6	1	3	3						2	1	
Red float	2	72	42	94	16	90	86	96	26	76	40	83	67	73	45
White float	3									4	2				
Grey slip	5	3	2												
White slip	6					1	1			6	3	1	1		
Buff	8	12	7			6	6	4	1	15	8	16	13	26	16
Interior color	Ind.		157		40		213		65		120		260		136
Grey float	1	21	6	20	1	10	6							3	1
Red float	2	48	14	80	4	76	44	71	5	54	19	63	24	37	11
White float	3					2	1	14	1						
Red slip	4											3	1		
Grey slip	5	7	2												
White slip	6									6	2	3	1		
Buff	8	24	7			12	7	14	1	10	14	32	12	60	18
Surface finish	Ind.		100		32		161		40		77		128		75
Smext - Rint	1	2	2			1	1			1	1			4	4
RoughExt -Smint	2	2	2							1	1	1	1	3	3
RoughExt & Int	3	12	10	8	1	26	28	6	2	91	71	37	63	41	37
SmoothExt & Int	4	84	72	92	12	74	81	94	30	6	5	62	106	52	47
Surface decor	0		186		45		270		72		154		298		166
Stamped	6									100	1				
Incised	8					100	1								
Surface change	Ind.		8		1		3								
Smudged exterior	1	3	5			1	2			1	1	7	1	4	7
Smudged interior	2	17	30	27	12	14	37	29	21	4	6	9	27	17	28
Smudged both	3	64	114	64	28	38	102	57	41	28	43	53	159	45	75
Incised exterior	4	1	1							1	1			1	2
Incised interior	5	2	3			1	3			1	1	1	3	2	3
Incised both	6	6	10	5	2	35	94	7	5	57	88	29	85	19	32
No change	7	8	15	5	2	11	30	7	5	10	15	7	22	11	19
Firing	Ind.		152		39		210		63		136		265		130
Well fired	1	50	17	83	5	49	30	67	6	42	8	61	20	53	19
Poorly fired	2	50	17	17	1	51	31	33	3	58	11	39	13	47	17
Rim forms	Ind.		164		37		240		59		137		263		138
Straight	01	9	2	25	2	16	5	31	4	17	3	31	11	25	7
Incurving	02	27	6			19	6	8	1	17	3	11	4	11	3
Incurving	03	5	1	13	1	29	9	8	1	28	5	17	6	11	3
Incurving	04			13	1	3	1								
Backcurve	05	9	2	25	2					6	1	3	1	14	4
Flange	06					3	1								
Flange	07							15	2						
Flange	08	5	1					8	1						
Exterior Band	10	5	1			3	1	8	1	6	1	9	3	7	2
Interior Lip	12	18	4	13	1	7	2					6	2	14	4
Thickened	13	14	3			13	4	8	1	22	4	14	5	11	3
Thinned	14	9	2	13	1	7	2	15	2	6	1	9	3	7	2
Lip forms	Ind.		166		37		241		59		137		263		139
Rounded	1	25	5	25	2	40	12	46	6	44	8	46	16	22	6
Flat	2	70	14	50	4	53	16	39	5	39	7	46	16	56	15
Thickened	3					3	1					3	1		
Pointed	4	5	1	25	2	3	1	15	2	17	3	6	2	22	6
Wall shape	Ind.		104		16		131		31		45		122		74
Straight	1	28	23	35	10	15	21	22	9	28	31	15	27	23	21
Incurving	2	68	56	62	18	85	118	78	32	71	78	85	149	75	69
Backcurving	3	4	3	3	1					1	1			2	2
Shouldered	4														
Base shape	Ind.		186		45		246		72		111		263		151
Flat	1					44	11			52	23	43	15	33	5
Rounded	2					56	14			48	21	57	20	67	10
Possible use	Ind.		41		5		148		9		155		156		80
Cooking	1	100	145	100	40	100	123	100	63			100	142	100	86
Pitcher ave. cm.			6.7		7.7		8.5		7.5		8.7		7.8		7.2
Diameter ave cm.			52.7				38.5		60.0		56.0		28.0		54.0
Lip width ave cm.			11.0		8.0		10.9		9.5		10.6		9.3		9.8
Paste Ex. fine	1	24	44	27	12	2	5	7	5			3	9	15	25
Fine	2	54	101	44	20	40	107	63	45	19	30	52	155	48	80
Medium	3	20	37	27	12	49	132	31	22	72	111	42	124	30	49
Coarse	4	2	4	2	1	10	27			9	14	3	10	7	12
Temper Material	Ind.		2		2		6		1		16		19		8
Sand	1	35	64	28	12	9	25	23	16	11	15	22	60	22	34
Sherd	2	20	36	16	7	42	110	25	18	67	93	36	101	44	70
Sand and sherd	3	46	84	56	24	49	130	52	37	22	31	42	118	34	54
Temper size	Ind.						7				17		18		9
Coarse	1	16	29	24	11	22	59	32	23	2	3	18	49	16	25
Fine	2	84	157	76	34	78	205	68	49	98	135	83	231	84	132
Temper quantity	Ind.						7				17		18		9
Heavily tempered	1	5	9	7	3	17	46	14	10	6	8	13	36	12	19
Medium quantity	2	23	43	33	15	53	141	28	20	85	117	54	151	41	64
Lightly tempered	3	72	134	60	27	29	76	57	41	9	13	33	91	47	74
N =			186		45		271		72		155		298		166

BAULLDAOB 10 Aimeliik		Pit 5 Level 1		Level 2		Level 3		Pit 10 Level 1		Level 2		Level 3	
		%	F	%	F	%	F	%	F	%	F	%	F
Exterior color	Ind.		17		20		19		11		73		26
Grey float	1									3	1		
Red float	2	100	4	75	3	100	10	100	3	82	27	91	10
White float	3												
Grey slip	5												
White slip	6												
Buff	8			25	1					15	5	9	1
Interior color	Ind.		21		22		27		12		88		36
Grey float	1									6	1		
Red float	2			50	1	100	2	100	2	67	12		
White float	3												
Red slip	4												
Grey slip	5												
White slip	6												
Buff	8			50	1					28	5	100	1
Surface finish	Ind.												
Smext - Rint	1												
RoughExt -Smint	2												
RoughExt & Int	3												
SmoothExt & Int	4	100	21	100	24	100	22	100	14	100	106	100	37
Surface decor	0		21		24		29		14		106		37
Stamped	6												
Incised	8												
Surface change	Ind.												
Smudged exterior	1												
Smudged interior	2	19	4	8	2	28	8	7	1	13	14	27	10
Smudged both	3	81	17	83	20	69	20	86	12	75	79	70	26
Incised exterior	4												
Incised interior	5												
Incised both	6			8	2	3	1	7	1	11	12	3	1
No change	7												
Firing	Ind.		18		21		23		13		82		34
Well fired	1	100	3	100	3	83	5	100	1	67	16	33	1
Poorly fired	2					17	1			33	8	67	1
Rim forms	Ind.		17		22		26		13		81		34
Straight	01	25	1			100	3			16	4	33	1
Incurving	02									8	2		
Incurving	03	25	1							12	3	33	1
Incurving	04	25	1										
Backcurve	05												
Flange	06												
Flange	07			50	1					32	8	33	1
Flange	08							100	1				
Exterior Band	10		17		22		26		13		81		34
Interior Lip	12	25	1	50	1	100	3			36	9	33	1
Thickened	13	50	2	50	1			100	1	64	16	67	2
Thinned	14												
Lip forms	Ind.		17		22		26		13		81		34
Rounded	1	25	1	50	1	100	3			36	9	33	1
Flat	2	50	2	50	1			100	1	64	16	67	2
Thickened	3												
Pointed	4	25	1										
Wall shape	Ind.		1		1		1		1		12		2
Straight	1	5	1	8	2	4	1	39	5	6	6	14	5
Incurving	2	95	19	92	22	93	26	62	8	94	88	86	30
Backcurving	3												
Shouldered	4					4	1						
Base shape	Ind.		21		24		29		14		100		35
Flat	1									67	4		
Rounded	2									33	2	100	2
Possible use	Ind.						1				3		
Cooking	1	100	21	100	24	100	28	100	14	100	103	100	37
Pitcher ave. cm.			9.0		8.0		9.7		7.0		8.8		8.6
Diameter ave cm.													
Lip width ave cm.			16.5		17.0		9.0		15.0		14.1		14.0
Paste Ex. fine	1												
Fine	2	71	15	67	16	38	11	36	5	42	44	43	16
Medium	3	29	6	29	7	59	17	50	7	55	58	54	20
Coarse	4			4	1	3	1	14	2	4	4	3	1
Temper Material	Ind.												
Sand	1	10	2			3	1			2	2		
Sherd	2	71	15	83	20	90	26	86	12	84	89	100	37
Sand and sherd	3	19	4	17	4	7	2	14	2	14	15		
Temper size	Ind.												
Coarse	1	14	3	8	2	3	1	7	1	8	8	5	2
Fine	2	86	18	92	22	97	28	93	13	92	98	95	35
Temper quantity	Ind.												
Heavily tempered	1	10	2			10	3			3	3	3	1
Medium quantity	2	86	18	96	23	86	25	93	13	92	98	89	33
Lightly tempered	3	5	1	4	1	3	1	7	1	5	5	8	3
N =			21		24		29		14		106		37

and Pelilieu 1, trench 1, probably had similar exterior and interior correlations. The wall test at Aulong 1 must remain something of an enigma and the site on Angaur indicates that those who lived there lacked close or numerous interrelationships abroad, although the examination of the similarities will show listings primarily of the north Babeldaob EU's.

The period of terrace use, which would be primarily that of terrace construction if it is correct to postulate a relationship between terracing, soil removal and the local style of agriculture (Osborne 1966: 150–155 and fig. 207b, Appendix 2) was the prime time of cultural development and integration on the islands. Reasoning from the ethnographic data one would suggest that it was a period of empire building and local conquest. It would be helpful to know if other major site areas, such as those around Karamado Bay would fall into this same orbit or would evidence a different tendency.

It was obvious as we studied the collections, that the sites of the rock islands were closely related to those of the volcanic areas to the north. We were aware that some aspect of the ceramics had to be a part of volcanic island ceramics because of the rock island lack of clay deposits. And, of course, the lack of other artifacts locked us into a potsherd viewpoint. However, our working hypotheses did not lead us to expect as much integration as shown in the similarity analysis and in the figure under discussion. I would hypothesize now, and predict, that future work will show that the islanders of the past made extensive use of all environmental variables open to them. Trade and various other forms of diplomatically organized exploitations probably formed the major basis of this integration. I have pointed out previously, working with data from a far different area and situation, that differential ecological exploitation is an important factor to a viable economy (Osborne 1957: 127–128). Very probably the legends of the Palaus, some of which have been printed in the survey report (1966) give a fairly good idea of the contacts between the big islands and small raised reefs of the south if one discounts the emphasis on war. The legends were recounted, through the generations, by men who lived in a combat-oriented society. Trade was probably far more important. Certainly it must be the major aspect of relationship from our viewpoint as archaeologists compelled to rely on sherds. In any event we can see trade and numerous accompanying socioeconomic factors, obviously not now delineable, as tieing northern and east-central Babeldaob together very slosely. Koror and southwestern Babeldaob probably fall into another similar district or districts. Pelilieu and Aulong (no doubt with other adjacent rock island inhabited areas) were distantly but definitely related to the sites of the north, somewhat with the Koror-southwest Babeldaob group or groups but more with the northern two. Angaur shows the greatest divergence from the pattern. We explain this in terms of greatest distance and a sadly churned deposit.

It should be pointed out, perhaps belatedly, that the correlations of the EU's, one with another, are generally very high. A 10.0 figure, the lowest used in the general discussion, is equivalent to 90% similarity. The correlation sheet of Run 8 (rim forms only) ran high and 14.0 was about as far apart as any of the EU's lay from one another.

It is also of interest that the correlations at these high levels seemed to flow from the terraced sites of north Babeldaob to the rock islands. B18 EU's correlated more often with Aul EU's than those of Aulong 1 F-E test did with B18. There was always something in B18 to fit Aulong, probably because the source of trade and influence was from the north. The same was true of Angaur, but not of Pelilieu 1 (see Table 18).

Divergences

The approach heretofore has been positive: all attention has been paid to close relationships and not to differences. It will be useful to examine the latter. Most of the divergences lay between an initial distance of 10.0 and 16.0 or 17.0. I chose 10.0 as the upper

Table 34. Count of divergences among EU's: distance of 20.0 and over.

Excavation Unit	Run 1	Run 3	Run 6	Run 7	Total
B19A platform A	4				4
B19A platform B test pit 1, level 1	3				3
level 2	2				2
platform B test pit 2, level 1			2		2
level 2			1		1
B19A platform C test pit 2, level 1	3		2		5
B19B step 1, level 1	6				6
step 1A, level 3			1		1
B18 platform 1, stratum I	8	1	4		13
stratum II			1		1
B37 east face, level 1	23		1		24
test pit 2, level 3	2				2
level 4	3		2		5
B40 test pit 5, stratum V			1		1
crown, stratum IV			3		3
stratum V			1		1
test pit 2, stratum I	7		3		10
stratum II	4		2		6
shell exposure	11	1	4		16
B10 test pit 10, level 1			1		1
level 3			1		1
K5 test pit 3, level 2			1		1
test pit 6, level 1	3		1		4
centerline trench, level 2			1		1
K3 trench 2, level 1	2		1		3
level 2	2		1		3
level 4			1		1
shell patch, level 2	2		1		3
apron	4		2		6
K25, level 2	4	1	1		6
Aul wall test, stratum II	24				24
stratum III	2				2
stratum IV	3			1	4
P1 trench 1, level 4	2	1		1	4
Ang19 first flat, level 3	3				3
second flat, level 1	3				3
Pit 25, level 3	2				2

limit for the discussion of positive relationships. This was a frank attempt to skim the cream from the computer printouts.

There is no distance greater than 26.51, between Pelilieu 1 trench 1, level 1 and B18 platform 1, stratum I. Even this diversity records approximately a three-fourths similarity and only a one-fourth variance. The cultural dissimilarities as expressed ceramically are not at all striking. The island group is one in which neither space or time have greatly skewed the pattern of life. The warlike see-saw of political life and power that we glimpse in Wilson's records (Keate 1788) was essentially superficial when cast against the information that we have been able to present.

Table 34 presents the excavation units that showed diversities of 20.0 distance or more and the computer run on which it appeared. The tabulation is arranged by site and EU's from north

to south. It will be recalled that Run 1 included all EU's and all attributes. Following Run 1, the 46 least well correlated were sorted in Run 3. Run 5 cut the number of EU's to 36 of the least well correlated. Run 6 made use of the EU's from the volcanic islands only and Run 7 from the rock islands only. Only 4 EU's correlated at more than 20 distance among the 46 selected for Run 3: B18 platform, stratum I; K25, level 2; P1 trench 1, level 4; B40 shell exposure.

A few comments may be in order on the more divergent EU's: B37 east face, level 1 is on a down slope eroded terrace front that saw considerable trenching and minor use by the Japanese during the later part of the war. Au1 wall test, stratum II is a problem. My own hypothesis is that the wall test is an area of cultural divergence at site Aulong 1. It may be divergent because of time, or the answer may lie in a cultural specialization that developed behind the presumably defensive wall. In any or either event, a proper excavation of the site should tell the story. The above hypotheses would do to guide the intial excavations.

B40 shell exposure was recognized as a poor risk, archaeologically speaking, when collected: its divergence is accepted as indicating that it was essentially a meaningless collection. The B18 platform 1 test revealed that the section of the terrace on which the platform had been built was reworked, much as the crown of B40 had been. The first stratum would appear to be the most thoroughly mixed so that it is far distant from both complexes, the terrace and the (later) platform. Stratum II has only one major divergence. Test pits 2 at B37 and B40 were high in divergences and low in the number of correlations. The test at B37 was simply a searching test, part of an attempt to find a buried platform that locally derived information suggested. Test 2 at B40 cut into the edge of a small terrace. The collections of the upper two strata were taken from a slope and had been subject to soil movement more recently than those from the deeper parts of the test. Collections from the deeper strata, III and IV, correlated far better with units from other sites.

It seems possible that a thorough statistically based approach could make an important anthropological use of these divergences. It would be possible, even in such areas as the Palaus, to search out and select excavation problem areas and eventually develop acceptable explication for most of them. Exploratory testing, such as we did, has probably served its purpose.

Table 35. Percentages of distance of rim forms of all sites in relation to the combined rock island EU's.

Site	0.0–3.1	3.1–4.1	4.1–5.1	Total
B19A	20%	29%	33%	82%
B19B	19%	27%	32%	78%
B18	21%	28%	23%	72%
B37	15%	20%	26%	61%
B40	16%	24%	27%	67%
B10	14%	11%	26%	51%
K5	23%	19%	28%	70%
K3	18%	32%	32%	82%
K25	16%	13%	40%	69%
Aul	31%	35%	34%	100%
P1	26%	15%	34%	75%
Ang19	28%	25%	26%	79%

Read: line 1, 20% of rim forms of B19A EU lie at 0–3.1 distance from those of the combined EU's of Aul, P1, Ang19.

A series of graphs and tabulations were made in this study other than those presented. There seems to be no point in printing most of them as they all, based as they were on the same data, tell the same story. The following comparison between the rim form correlations (Run 8) of the islands of the two different physiographic provinces is of more interest than most.

The comparison was made at 3 distances (Table 35); percentages were added for all EU's at each site. The percentages in the first column, 0.0 to 3.1 distance are the most significant; the low distance indicates close correspondence of the collections insofar as rim types are concerned. It will be seen, not only in the first column, but thereafter that the similarities are strong for the far northern sites B19A and B and B18; then K5 and K3; and finally the strongest cohesiveness between the three rock island sites Aul, Pl, Angl9. The latter three form an expected close grouping but are not far ahead of the first three sites.

The tabulation echos comments previously made. First that sites in the volcanic large island environment are similar insofar as rim variables are concerned to sites in the limestone reef island environment from 50% to 80% up to and including a distance of 5.1. This is surprisingly close to the similarities of the rock island group within itself. Indeed, were it not for the Aulong performance, the rock island sites would not have been able to demonstrate this strong cohesiveness. Both B19A and K3 have stronger totals than Pl and Angl9. The Palau sites hold together well as a group, apparently through both time and space and for individual as well as total attributes.

The Dendrograms

A dendrogram illustrating the similarities of the various excavation units to others at varied amalgamated distances (see Sokal and Sneath 1963: ch. 7 for a description of the form of presentation) was a part of each printout. These "tree" illustrations actually reflect the data which appear in the correlation tables. And, like the tables they are large cumbersome sheets, averaging usually .84 m^2 in size. For this reason it is impractical to reproduce any one of them here. I shall, however, comment on those from runs 1, 8 and 9 and illustrate the most intense areas of branching of dendrograms 1 and 8 (Figs. 194 and 195).

Tree 1 (Fig. 194) considers all attributes with all excavation units. The crucial area of final clustering takes place between the amalgamated distances of 4.3 to ca. 7.0 This hot spot includes 42 of the 111 EU's from B37 coconut grove, east face test and north face test; B40 test pit 5, crown, test pit 2; B18 hillside test, colonnade cut, Christmas tree terrace, altar test; Aul F-E test; B10 test pits 5 and 10; Pl trench 1; B19B step 1, step 1A, step 2 and Angl9 first flat, second flat and pit 25. There are four sites that did not have excavation units that lay between the given amalgamated distances, those of Koror (K3, K5 and K25) and Bl9A, the series of platforms. The units from these sites and the units that do not appear on the figure were drawn into the overall clustering between distances 7.0 and 20.87. The latter is, rather expectably level 4 of Pl trench 1. The collection from this unit has failed to find agreement in all situations and all runs.

An examination of the first tree as illustrated, in comparison with the following runs 8 and 9 shows at least two major differences: (1) the run 1 tree is more concentrated, more symmetrical while numbers 8 and 9 are less concentrated, more diffuse; (2) the first dendrogram does not begin its cluster pattern until 4.4 distance, while run 8 (Fig. 195) has small clusters at 0.0–, virtual identity (see below). Likewise the totality of attributes led the run 1 tree to a far greater amalgamated distance than any of the others. The run 8 tree (rims only) is fully formed (all excavation units drawn into the pattern) at 12.22 initial distance. It is obvious that the use of 87 attributes created more noise which could only be reduced over a rather large distance. On the other hand, the 14 attributes, all rim forms, of run 8, were more evenly scattered over a smaller distance. Perhaps this is an aspect of sampling and would occur in many such situations.

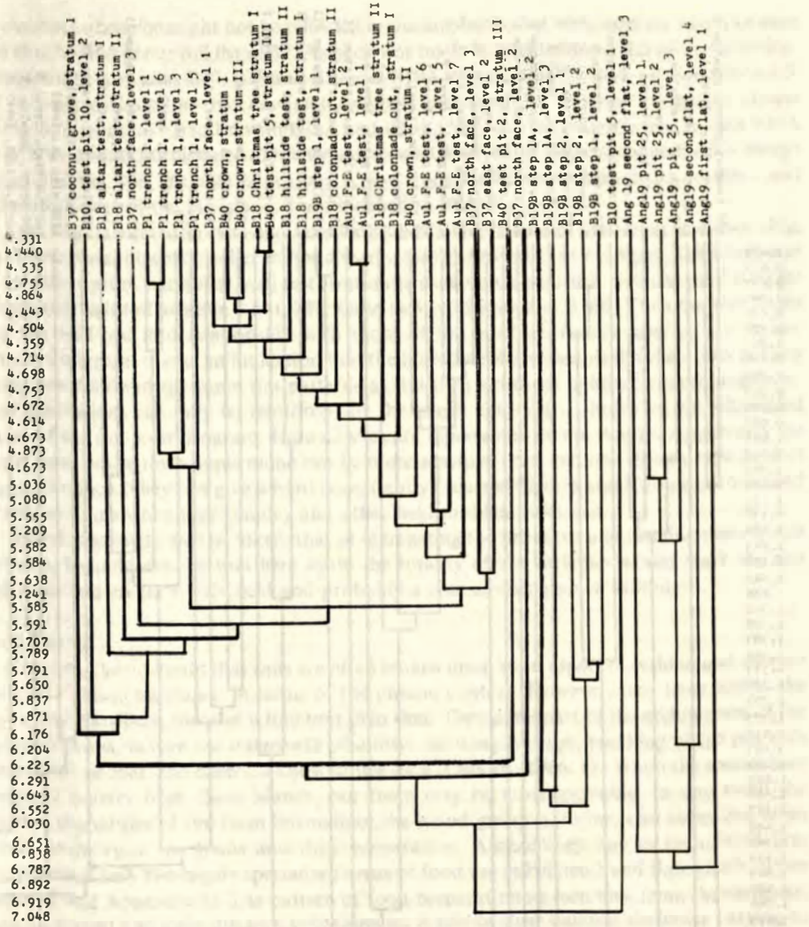


Fig. 194. Dendrogram, core group of 42 EU's, Run 1, all attributes.

Run 9, (variables 75–87) includes the pastes and temper material, size and quantity attributes. No illustration has been taken from the resultant dendrogram. Amalgamated distances lead from 0.491 through 110 steps to 7.549 which completes the closure. This tree is even more diffuse than the run 8 tree. This suggests that differences in paste and variations in temper, the techniques of gathering, preparation, mixing, and the requirements of supply were none of them controlled culturally to the point of compulsion. Indeed, almost any archaeologist knowledgeable in ceramics of Neolithic peoples would say, after a short experience in Palau, that there are few evidences of a striving for excellence (according to our standards). This, plus the problems of securing raw materials, especially acute for the limestone island dwellers, probably explains the nature of this tree. One cannot be sure that the dendrogram can be expected to reflect relationships of trade for clay or tempering or even pots.

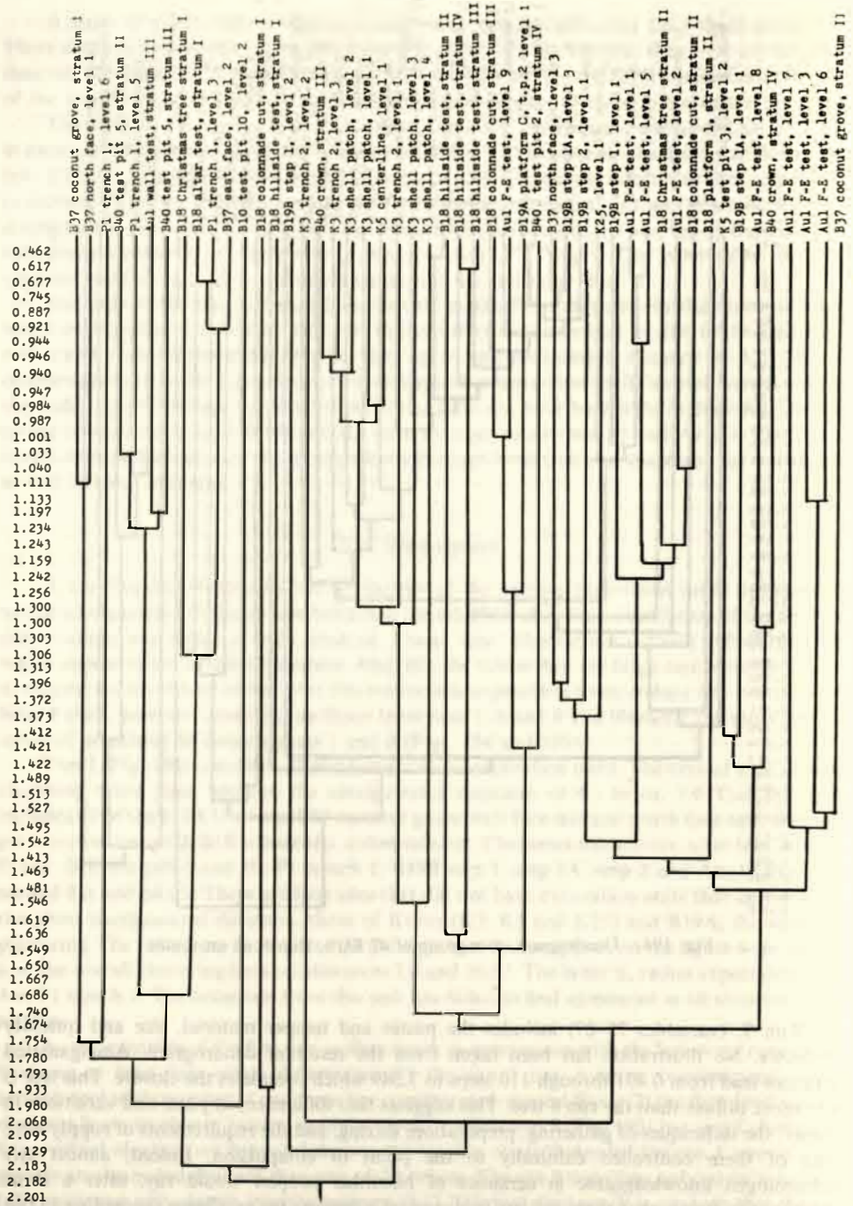


Fig. 195. Dendrogram: core group of 50 EU's, Run 8, rim attributes. Note that the closest convergences are within northern terrace excavation units and between northern terrace and rock islands. See rim charts for the sites. Rim forms are the attribute cluster with the highest similarity throughout the island group.

The elements of choice might not be reflected in the attributes that were used for run 9, or even those that we had in our full list of 87. A check was made in an attempt to clarify this question. It appears that Aul joins B40, B18 and B37 and B19A at generally less than 1.0 distance to 1.5. The wall test extends this and does not generally join until 4.0 distance. Pl has its closest relationships from ca. 1.0 to 1.6 with B19A and B19B. Ang 19 is far less exclusive: it joins B19A and B18 at about 3.0 distance. This would suggest that all of these sites and units except Angaur and the wall test area of Aulong 1, had trading relationships with the northern and northeastern part of the big island. I am inclined to include Angaur.

Tree 8 is illustrated in part and here likewise the major core of clustering is shown (Fig. 195). There were, however, other minor clusters worthy of note. For example. B18 Christmas tree terrace stratum I and Aul wall test stratum II were united at 0.462; B40 test pit 2 stratum III and Aul wall test stratum I at 0.745; these two pairs joined at 0.887. Thus the rim forms bring the wall test into relationship with those of the northern terrace sites at a very low distance. I interpret this as an indication that the limestone island people did their own pottery making but followed the same rim patterns as did their northern volcanic island neighbors. These conclusions can only be reinforced by the major cluster sets shown on the illustrated portion of the run 8 dendrogram. Here all sites are represented except Ang19. Apparently the 14 attributes of the rim sample alone can be more sensitive than the total 87-attribute field of ceramic variance. They can give a hard core, tightly focussed picture and I would recommend rim studies alone when time, money and other field problems dictated.

A next step might well be taken: that of segregating the rim cards and running them for all attributes. I would assume that here again the totality of the variables would mask the rim similarities and create a wide field and probably a core covering much latitude.

Uses of vessels

There can be no doubt that rims are often looked upon as an aspect of fashion and they no doubt are. This is significant in terms of the present context. However, they have had in the Palaus, and elsewhere, more of a function than that. They are a part of the architecture of the vessel and this is, in turn, an outgrowth of utility: cooking, storage, handling of the pot with contents hot or cold, and others. I know of few data (Osborne 1966: 17–31) on the special uses of ancient pottery from these islands, but there may be more available. In any event the indicated similarities of rim form throughout the island group is, to me, also indicative of an overall similarity in the foods and their preparation. Archaeology has so far offered firm suggestions of only two highly specialized areas of food use at Pelilieu 1 and Babeldaob 20 (see Chapter 2 and Appendix 2). The pattern of food preparation as seen now from the ceramics, based on spread and close distance containment, is one of close cultural similarity varying to identity. Although there are striking regional environmental variations there do not appear to be as striking cultural ones.

The run 8 dendrogram appeared to be the best of the three to subject to study in detail. There are 14 rim attributes considered in it, but probably dimensions and relations of sherd thickness to rim width should have been added. Working with a series of attributes is a constant learning process. Others may be expected to profit from our errors and omissions.

The number of rim fragments varied surprisingly within the various collections: K3 trench 2 level 2 had 411 sherds and 76 rims; B18 platform 1 stratum II had 104 sherds and 57 rims; BI8 hillside test stratum III had 280 sherds and 180 rims; Aul wall test stratum III had 279 and 64. This is a worrisome thing. In order to examine the basis of the relationships shown in the tree, the 26 excavation units with 51 or more rims were segregated and broken down into rim form percentages (all 14 rim form attributes) and listed in order of their first correlation with another EU on the tree. For example B37 coconut grove stratum I and B37 north face level 1 join at 1.111 distance. This tabulation was diffuse, but when examined, showed groupings of

percentages that led to a further reorganization.

We had been haunted throughout by the thought that our rim attributes which we believed typologically valid would not be "typologically" valid to the women who made and used the pottery. Following indications in the tabulation, attributes were placed in four known related groups. The first includes the simpler rims: straight or near straight and variants (01, 02, 10, 11, 13, 14). The second is those with interior lips, the closed or closing forms (the relatively simple 03 grading into the developed interior lip 12). The third is the backcurve 05; it stands alone. Fourth is the group of those rims which have a closing lip with an exterior flange (04, 06, 07, 08, 09).

We may dispose of the 05 backcurve quickly. It has been remarked that its great area of strength was Au1 wall test where it is 61% of the rims. With this, there was 20% simple rims and 13% of the interior lipped (group 2 above) and a smattering (4%) of the flanged. This wall test stratum is odd. We do not know that it is age or simply circumstances that resulted in 61% of the 05 rims. The hypothesis for the present is that it is age.

The first group, simple rims, is always present. It is over 50% in B37 north face level 1, K3 trench 2, level 2 (76%), level 3 (with a date of AD 1785), K3 shell patch level 1 (67%), B18 hillside test stratum II, stratum IV and III (61%) with a date of AD 150, Au1 F-E test level 1, B37 coconut grove stratum II (81%) and K5 centerline level 2. It thus appears in high percentages in both early terrace and late midden sites as a major rim-group component.

The interior lip group, rims 03 and 12, appears likewise to have had a long life. We have noted its presence in Au1 wall test stratum IV. It is also present in B18 hillside test stratum III (33% 03 and 1% 12) at a date of AD 150. It is weak at K3, our late site. Both rims appear at greatest strength in B18 altar test, stratum I at 63% together. This makes us doubt anew the old sherd date from that EU. The rims suggest a medial date rather than AD90. Other units are P1 trench 1 level 3 (62%), 4 (59%), Au1 wall test strata I (51%), II (46%) and III (46%). This group thus is pegged as one which reached its greatest strengths in midperiods of occupation but was of great importance in the limestone islands, possibly for a longer time. The function or fad that these rims served was also served on occasion in north Babeldaob.

Our final (fourth) group is the flanged, 04, 06, 07, 08, 09. The classic and prime example is the 07 rim; it and probably the whole group, seems to be associated with the interior lip forms. The strongest expression is Au1 wall test strata II (52%) and I (44%) then P1 trench 1 levels 5 and 6 (40%), and 1 and 2 (34%). In the north the highest percentages for the flanged group is B40 testpit 5, stratum II (34%) and B37 coconut grove stratum I (30%) about the same as the upper levels at P1. Altogether the 07 group is primarily a creature of the southern rock islands as, indeed, were the interior lips. Its greatest strength in the north lies in B37 and B40. Its area of greatest weakness is essentially that of the interior lips, the Koror 3 units. These bowls were therefore most at home in the mid-time horizon like the interior lip forms. And like the latter, they were in use in our oldest EU's (6% B18 hillside test stratum III, AD 150) and in the latest K3 ones.

The above is probably the best that can be done with the problem of dating the rise and fall of our attribute groups. It agrees well with the hypotheses (or were they guesses) that were developed in field and laboratory. A trial was made of the run 9 tree which portrayed the relationships of the various paste and temper taxonomic units. The results were not helpful: pastes were apparently minimally variable throughout the islands.

The reader's attention may be called to the discussion of the use of the Pelilieu pottery in Chapter 2, Table 7. Here heavy smudging denoted cooking use; 45% of the simple rims showed the stigmata of cooking; 40% of the interior lips and 27% of the flanged. The latter two included the largest cooking pots made. They are assumed to have been used in quantity cooking, making coconut syrup, oil etc. Those that were not used over the fire, or were used there part

time, were most likely water catching and storage containers for both water and food. The areca tree (betel nut) is a natural funnel. If an obstruction and spout is rigged low on the trunk, a simple thing to do, a large pot would be quickly filled with water in a tropical storm. The same is true of rain from thatched roofs. The rock islands lacked streams and water holes and the fresh water lens could not be tapped in most places. The same methods of water catching are used on these islands today but 50 gallon drums have replaced pots. Fishermen set these up on the larger uninhabited islands and one can always expect to find water at a stop there, discounting the occasional dead toad and numerous insects in the drums.

An analysis of a volcanic excavation group, B37 north face (Table 36) follows the method used in developing Table 7. The differences and similarities (note the amazing coincidence of 199 rims of indeterminate size vessels in each table) are easily seen. The great percentage of these in the B37 table (85%) in opposition to the acceptable proportion in Table 7 (58% indeterminate size) makes it somewhat less significant. The pottery was not as fragmented at P1 as at B37 and obviously the deteriorating effect of the laterites did not operate at P1. Given only 15% of rims that could be used in a size study we have a good coincidence of percentages in the size ranges although the P1 bowls may be slightly larger. More important is the fact that total A, the smudged cooking pots, is 89% of total rims (B) This contrasts sharply with Pelilieu 1, with 40%. The latter, and presumably rock island pottery in general, was used primarily for tasks other than over the fire. At B37, the vessels were used primarily on the fire. No further comment can be made except to point out that there is a fresh water permanent stream flowing at Melekeiok and a shallow water table at the foot of the terraces. Probably catching rain water was rarely practiced there.

Palauan relationships and problems

The top 10 all-Palau groups of Excavation Units, those which have the most exterior correlations, are listed in descending order: B37 north face; P1, trench 1 levels 5 and 6; B18 hillside test; B18 colonnade cut; Au1 F-E test; B37 coconut grove; P1 trench 1, levels 1, 2, 3; B40 crown; B19A platform C; B40 test pit 5 strata II, III, IV. Seven are volcanic island and three are from the limestone area. Of the three however, one (P1) is split into two sections and appears twice, thus increasing the limestone island count. However, that may be, we have a 7 to 3 ratio in favor of the volcanic islands. It will be recalled that of the 111 excavation units 80 (72%) are in the volcanic area and 31 (28%) in the reef island area. The unexpected coincidence between these figures (which may reflect somewhat more luck than statistical accuracy) causes us to believe firmly that cultural variability insofar as we are testing it with ceramics was minor throughout the islands. Comments along these same lines have been made, following presentation of data in the summarizing part of the Similarity Analysis.

To us this conclusion is something of a surprise. There is no doubt that the culture was overriding. It had been expected that the ceramics, analyzed against a large number of variables, would reveal the pressure of the different environments in some indubitable way. It appears impossible to sustain such a position. Of course, the peculiar situation in which the population of one environment found itself, that of being dependent upon the other for clay or pots, may vitiate the whole argument.

A similar situation appears to exist through time. If we examine the few radiocarbon dates that we have judged to be trustworthy, we see that even here dated excavation units with moderately close ceramic similarity have a surprisingly wide range through time. For example B40 crown test stratum IIIB is dated medially at AD470. It is similar intrasite at the 0–5 distance with B40 crown test stratum I and at the 5–8 distance with II. Although IIIB is culturally similar to the other two it should predate them stratigraphically unless the crown were built of soil that was moved in (which is possible). It is acceptably similar to five other B40 EU's.

Table 36.

Rim sherds of B37 north face showing cooking use: all levels.

Bowl size	01	02	03	04	05	06	07	08	09	10	11	12	13	14	Total	%
small (−20 cm)	1	1	0	0	0	0	0	0	0	0	0	1	0	0	3	1%
medium (21–40 cm)	3	3	2	0	0	0	3	0	0	1	0	0	1	0	13	6%
large (41–60 cm)	2	4	1	1	1	1	4	0	0	0	0	1	0	0	15	6%
extra large (+61)	0	1	1	1	0	2	0	0	0	0	0	0	0	0	5	2%
indeterminate	35	20	18	12	17	8	18	4	2	5	0	19	26	15	199	85%
Total A (cooking)	41	29	22	14	18	11	25	4	2	6	0	21	27	15	235	89%
Total B (all rims)	46	32	24	15	19	12	28	5	2	6	0	23	30	23	265	

Intersite relationships are of the same pattern. B18 hillside test strata I, II may be roughly the same date as B40 crown stratum IIIB. On the other hand the B18 colonnade cut date is much later (AD1665) yet the B40EU was similar ceramically at the 5–8 distance to all of these. The altar test stratum I was similar at the same level yet it dates some 400 years earlier than the B40 crown.

At the 8–10 distance are the lower strata of the B18 hillside test, dating some 3 centuries earlier. The B40 date is also far older than the K3 trench 2, level 3 date; they too are similar at the 8–10 distance. It might be possible, had we sufficient trustworthy dates, to detect a pattern of change between the EU's at various levels of the similarity analysis, and various times, and thus build a dating of change, a sort of cultural growth scale. While this may be an excellent research hypothesis I do not know that it would work well in the Palaus where the clusters appear to be elongate spatially and temporally.

The lack of dramatic change in ceramic attributes throughout the Palauan occupations and between the two different environments, the Aulong 1 wall test excepted, has been interpreted as indicating no great change in food habits, resources and preparation, throughout the long time of occupation. The ceramics of the terrace occupation in Babeldaob do not show great variation from the ceramics of the nonvolcanic areas and there was simultaneous inhabitation. It is not difficult to understand this. Climatic variation is minimal; the resources of the sea were variable only locally and the food crops of ancient times all originated in the southeast Asia tropics and would grow, though different in quantity and productivity, in all parts of Palau. Cooking, if locally variable, in no way required local or major caramic innovation. Pottery never became a toy of artistry: it began and remained a down-to-earth functional craft, unassociated with individual or group prestige (as far as we can discern) and changed very little areally or temporally. The strong exterior similarities of the sherds from the F-E test of Aulong 1 so often remarked in the similarity analysis, is an excellent example. The people of Aulong surely derived their pottery from the clay beds of the volcanic islands. They saw no reason to stress or create any major changes. It is perhaps worth commenting, as a personal note, that I never felt, as long as my fingers were in the archaeological earth, that I was in anything truly different, were I near a sunwashed beach on a jungled cove of the rock islands, or on the grassy savanna of a volcanic island. In the large, things were the same.

It was something of a disappointment that ceramic seriation did not work out. It can be a useful tool. But Palauan pottery is too closely alike, too well tied together. There are excavation units with low similarities, such as stratum IV at B40 crown and the B18 hillside. These may be age, which should lead to seriation, or they may be explicable on other grounds. The latter seems more reasonable now. Both wave action and constant agriculture create a form of systematized disturbance which should result in reduction of difference and hence obscure serial change. It is obvious that this kind of thing has been a factor in the collection and study of the sherds but the overall consistency indicates that obfuscation was not great.

Certainly the simple ceramics of the Palauans do not have sufficiently contrasting attribute groupings to provide an easy basis for culture change studies. The pottery fitted the needs of the people, apparently both closely and efficiently. We get the impression that art was largely the provenience of the males unless the women stressed the decorative weaving of mats, basketry, sails, etc. far more than they did pottery, which they probably did. Certainly most areas and many potters turned out fine pottery at various times, both early and late. The deteriorating effect of the soils has caused us to withdraw from a statement that the pottery of a particular time was better or best. The same is true insofar as certain attributes are concerned. We were able to assign a serial development to four rim form groupings in the preceding section. They are about as close to markers as we can come in this context. Use (other than cooking) is too difficult to determine; decoration is rare; shape difficult to determine: all should probably be dropped from computer attributes and be considered individually when outstandingly

recognized. Such a reduction might make the research more efficiently accomplished and, possibly, sharper. We went about as far as was possible to the left from the simpler (though defintely not simple) system used in the survey. Perhaps the best route is somewhere in between.

It does appear that one aspect of minor cultural differentiation which the attribute list revealed is that which has been referred to as the alleles. So many of the items listed have an unequal and entirely separate opposite with which there is related variance. When, for example, flat bases are numerous, rounded are few. The same is usually true of sherd and sherd and sand temper, of straight and incurving walls, of rough exterior and interior versus smoothed, and of others. The statement and analysis of the alleles is no doubt partly conditioned by the needs of method. It was not possible to record all degrees of curvature to a perfect plane, of all bases. Therefore they are recorded as rounded or flat in the records. The pottery makers might have regarded the situation as a sort of continuum. Some bases are rounder than others. But, and this is important, some are flat. Whatever the consensus may have been among Bairulchau potters a few centuries after the time of Christ there is still a mechanical and recordable difference. I believe that several of these continua should be selected with their so-called alleles at either end and very carefully studied in contrasting stratigraphic and environmental situations. This might be better and hopefully it would be more efficient than the overall attribute approach that we used this time. One must experiment with these things. Cultural changes and adaptations might be more readily discernable in this way than in a method using a less precise focus.

The sequence

I felt presumptious when setting up a chronology in 1958 on the basis of the survey work and ethnographic data. The same introspective conclusion assails me as this modification of the first is written. A year and a half in the field, doing archaeology and a thousand other things in difficult and time-consuming situations is not a firm base for conclusions. For these reasons and others plainly obvious to the reader, our conclusions should be considered as hypotheses created by the preceding data and comments. It is our hope that they in turn will be the inspiration for further study in these islands or elsewhere in western Micronesia.

There is only one date that may be reasonably assigned to the Colonial or Archaic time (1855J): stratum IV of the wall test certainly marked the first occupation of Aulong that was found; it lay on apparently undisturbed beach sand. Sherds were not numerous; many apparently came from the same pots, and the midden was thin. Certainly appearances suggested an original occupation but the excavation was so limited that I hesitate to stress the point. If this is of the Colonial period it is obvious that a well-developed ceramic complex existed and the presence of some fine sand temper indicates an already developed relationship between the reef islands and the volcanic. An assumption that this is correct leads to the conclusion that our date is not early in the Colonial period. It should be pointed out in this context that a date such as that under discussion has strong back up. Dr. I. C. Glover, Institute of Archaeology, University of London has kindly sent me a mimeographed preliminary report on his 1973 excavations in southern Sulawesi (Glover 1974) and has amplified his mimeographed comments in correspondence. He has an apparently good C14 date early in the fourth millenium BC, before pottery, and suggests that ceramics may well have been present late in the fourth or in the third. If this is correct, and it is correct elsewhere in Indonesia, then there was both time and cultural basis in a generally acceptable area for outgrowths to have reached Micronesia and resulted in dates of over 1000BC from the Marianas and probably from Palau.

The terrace period has four dates associated with terrace use: AD90 $\pm$ 400 (1855BB), AD150 $\pm$ 80 (1762I), AD470 $\pm$ 80 (1762E) and AD895 $\pm$ 80 (1762G). These dates place the total period, originally my Early, as earlier than previously believed. As a matter of fact they group

rather well in the so-called lower Early. True, 1762F (AD1150 $\pm$ 80) is also a terrace date. I have interpreted it as a later use of the B40 terraces but it could as well mark an aspect of continuing use. Terrace land may have been fallowed. Granting this, the total terrace period becomes a very long one indeed. The number and size of these expressions makes this seem reasonable.

The Koror 3 dates AD1785 $\pm$ 80 (1762A) and AD1630 $\pm$ 80 (1762B) belong to the Late period and the site seems to fit the assumed pattern of the time. 1762K (AD1665 $\pm$ 80) would also be a Late date whatever may have been its true associations.

The major cultural and prehistorical information that appears to emerge here is the length of the terrace building and use period, perhaps some 1200 years or more. This span emphasizes a remarkable cultural continuum, gives time for the construction of the terraces at a fairly leisurely pace. It is nearly as long as the entire Early period in the original formulation where I suggested that terraces may have been present throughout.

Unfortunately none of the samples dates Bairulchau. It is bracketed by AD1665 and AD150 but this is small consolation. No undeniable association between a monolith and datable material was found. There may be a sacrifice of organic material beneath one of the monoliths; there was none under the ones that we checked. The same is true of stone items elsewhere. House or *Bai* platforms very rarely are found on terraces; if they are, they are all late period constructions or appear so to me. It may be that the house platform was not an original or ancient trait on Palau, that it arrived later, perhaps with the kind of architecture and carpentry that resulted in the recent houses and *Bais*. Had we a date for one of the megalithic displays, preferably Bairulchau, we should be able to say that the new architectural practices, probably from an Indonesian or Philippine area, came in after that time. I am guessing that Bairulchau was built between AD800 and 1000. It was most probably not built as early as AD150.

Terraces, taros, ceramics, the language, the older form of architecture, the newer forms, adze types, Palau money, to select a few outstanding traits, all diffused from the larger islands south, southwest and west. The first was apparently in the group by the time of Christ or a few centuries thereafter. The next four must have been brought by original colonists, although additions and changes took place later. Palau money and the new architecture (especially the architecture) indicate rather intimate contact between Palauans and outlanders whether on our group or abroad is not known. Although I know of no technological study of Batak houses of northern Sumatra, these and others of the islands of Indonesia and Malaysia bear an amazing resemblance to the old houses and *Bais* of Palau (Moore 1930: 196, 208). The architecture and carpentry would seem to have been ultimately mainland Asian. Very likely the megalithic period on Palau ended or lost its living force, shortly after the arrival of late architectural influence. The interest lived on, witness Kual's stone, but was not very active.

Extra-Palauan relationships and problems

Major aspects of Palauan culture as we know it ethnographically and archaeologically, point to the great area of important islands which now make up the Philippines, Indonesia and Malaysia. This, unfortunately, is not saying much. We can however, give somewhat of a focus and shall try very briefly in the following.

Terracing has been a diffused trait at least insofar as the idea or stimulus is concerned. We know of no near duplications of Palauan type terraces in the presumed areas of origin. Surely they are there. Megalithic activity in a number of manifestations similar to those of the Palaus has been recorded for Yap and mentioned in this report. The latte of the Marianas, while typologically different than the simple notched columns of old Palau or modern Yap were used structurally in the same manner (Freycinet, 1829: pl. 81; Safford 1903: 501; Thompson 1940) as those of Palau appear to have been—as longitudinally deployed side supports, and functioning parts of the superstructure rather than as aspects of a foundation. Archaeological studies of

Indonesia have not, as far as I am aware, isolated periods of architectural development or stability during which the kind of structure that is found on Yap now, and once existed on Guam and Palau, was popular.

Beads of various forms of glass are well known both archaeologically and ethnologically from various parts of the southeast Asia archipelago. These, like the pottery, terraces and structures had an indubitably strong role in the fashioning of Palauan social structural change (Barnett 1949: ch. III and IV). Discussions of Palauan and Indonesian bead-glass money may be found in Osborne 1966: Appendix 1 and van Heekeren 1958 passim. Van Heekeren (page 69) mentions terrace graves. I believe that this trait also occurs in the Palaus and have described (1966: 166 and 234) as pyramidal grave markers what are truly terraced pyramidal structures somewhat larger than an ordinary grave would require. It is likely that this is another material relationship, obviously socially controlled, with the southwest.

Of major interest are the large monolithic carvings herein called the Great Faces. Certainly the megalithic remains of Indonesia, especially of Sulawesi (Celebes) are the most like those of the ancient Palauans insofar as we are aware. The graves, standing stones, stone sarcophagi, troughs, and the amazing images (Raven 1926; Kaudern 1938 and van Heekeren 1958) all appear to have Palauan relationships. Certainly the old Celebes carvings are more realistic than the Palauan but I seem to discern a similar treatment of eyes, the genitalia (obvious on Celebes, postulated on Palau) and a peculiarity between the "fangs" and what is probably an outline of the lower rib cage (van Heekeren 1958: pl. 24).

All in all there is as much cause to look southwest to the Celebes and adjacent islands for the origin of certain Palauan traits as there is to look to the Philippines. Probably terracing, carpentry, bead money could have come from either the Philippines or Indonesia-Malaysia although I would prefer the latter as an origin area for carpentry. It is unfortunate that so much of the anthropological work of the areas in which we are interested is still in the exploration stages and that data are certainly not readily available, if they exist, for a comparative effort, simply and easily made.

That such work can be done, and I believe successfully, is attested by the results of a study of the Aulong 4 pictographs (Schmidt 1974 and Appendix 4). She was able to make a surprisingly good case that certain archaeological areas of eastern Indonesia had more closely similar design patterning to Aulong 4 than did others in the same general latitude, with the implication that cultural relationship is involved. Another student researching a problem in the same region is John Craib who is concerned with a typological and historical study of Micronesian adze blades. He tells me that he is on the track of especially interesting affiliations of western Micronesian and Malaysian beaked adze forms. I venture to predict that, even though the prehistorical data from both western Micronesia and the great groups of large islands lying off southeast Asia are not of the first water, there will be amassed within a few more years, information that will enable us to hypothesize or even to predict that certain areas of the west were prime contributors to Palauan cultural development.

Very likely the same areas contributed to Yap and Guam. Certainly the indications are that the early architecture of the three main groups had a common or closely related origin. Only Palau, however, appears to have received the later influences that brought more advanced woodworking technology. The three island groups are, too, the pottery making islanders of Micronesia. I have described the Palauan ceramics, Gifford (1959) those of Yap and Spoehr (1957) and Reinman (1977) the sherds of the Marianas. The ceramics of the three island areas may well have stemmed from a single tradition although there are differences: Guam pottery does not have sherd temper as did the Palauan and less well finished pottery appears to characterize later levels. At K3 we found very well finished pottery but, like Guam, the simpler rims were most important at this late site. The Yapese pottery also lacks sherd temper; it appears to have been all igneous. Later pots, laminated ware, were hand modeled; earlier, unlaminated, may have been coiled.

Lack of fishhooks or any recognized aspect of their manufacturing is rather surprising. They have been found archaeologically on Yap and the Marianas. Kubary (1889: 125–126, and tafel XVII) and Krämer (1926: 77/80) describe the artifacts and fishing practices at the ethnographic level. The Palauans had hooks made primarily of wood and turtle shell. Neither of the two are very enduring or were found by us in either physiographic province. Shell hooks were also used, but must have been rare. None were found, and indeed there was a lack of coral or other files that would be expected to accompany a large hook industry. We suggest that the presence of the great lagoon and the vast amount of within-the-reef waters has greatly encouraged spearing and trapping and that the Palauans may not have developed as much dependence on angling as did the people of Yap and the Marianas. Nonetheless it is certainly true judging from architecture and ceramics, that all of the three little Micronesian island groups did not vary greatly culturally through time or space (within the individual groups) until contact.

Social change

It is obvious to an archaeologist, or to this archaeologist, that there can indeed be few evidences of material culture change, which archaeology might reveal, that do not have social influences. This requires an holistic view of culture; there is no other way. To us the lack of any major ceramic change, or at least our lack of proof of it throughout the archipelago, means very little change in women's duties and responsibilities and hence very little change in her social standing and position throughout our archaeological time. We are reasoning, of course, from the fact that women made the pottery during the brief ethnographic period. Indeed so unsure must we remain of the plain and undistinguished ceramics of the Palauans that we cannot even suggest an area of origin, whether Malaysian or Philippine or, perhaps, Melanesian and thus examine late period pottery and the position of women there and then contrast the Palauan situation with that of a probably related ceramic industry. Of the other industrial achievements of the females, invariably so important an item bearing on their socioeconomic position, we can do no more than point to the few sherds with checkered matting impressions from Koror 3.

It is dubious that I can say much more concerning ancient Palauan society than could any anthropologist who has visited a few sites and is moderately cognizant of modern Palau. But, the situation in which I find myself does not differ greatly from that of any other writer and I rather believe that my results are as useful and as near to the truth as are most of those that have been published. For example, Renfrew (1973) stresses the need for more total interpretation of archaeological data and for the sharpening of our conceptual and technical tools toward this accomplishment. One can only applaud these strivings and do what one can to forward the good work. For my part, I must do so with the reservation that it is not new; all of these things have been called for and sometimes accomplished in the past. What we should encourage is that more writers try more and different archaeological-social explanations from more viewpoints and more places and more times. This developmental kind of history will almost surely characrerize the next major advance in the anthropological use of archaeological data.

Let us, as a brief test examine Renfrew's attempted elucidation of aspects of European Neolithic chieftainship and compare it with our Palauan. Renfrew brings a not uncommon European approach to an interesting discussion of formative chieftainships. I believe that he overstresses birth (although the reader will note that Palauan chieftains do not often come up from the ranks). He states that efficient socioeconomic organization "makes possible a greater population density..." (pp. 157–8). Agreed, it does: but what brings about the integrated society, the organization, in the first place? Almost surely it is the increasing number of people,

who need leadership, guidance, organization and control. Renfrew has the cart before the horse or, more likely they would run side by side. And, as if to clinch his viewpoint, this author speaks about the chief's subjects. Yet, of course, all of these things are true somewhere, some time. The difficulty lies in finding out what is most apt to happen.

Let us see what we can do with the Palauan situation. In the first place it is described quite well in a broad way by the Renfrew discussion, which is the major reason for this use of that reference. In the islands, the chiefs, Rubaks, are all heads of kin groups, sibs. Their positions carry titles and sacred as well as secular duties. Their's are, as would be expected, the more important kin groups; they may be outstanding historically so that the title and hence the titled heads of these groups, are persons of importance—not wholly because of what they are but of whom they are. Too, their kin groups may well be larger, wealthier. This obviously does not detract from the position of the head. Thus the organization is pyramidal. Kinship furnishes the sanctions and the chiefs themselves, and the more powerful and prestigeful sibs furnish the most awesome titles and the men who bear them fill the most important positions. They are the chiefs. Stratification is achieved, age and sex aside, primarily because of the higher or lower positions of different kin groups. Chiefs are thus nearly always the result of a sort of automatic placement because of birth and succession. This is, however, not always so. Men can achieve titles and all that goes with them without being in a direct line of descent and conversely, a person who comes into a chiefdom through the usual route may not wholly fit the pattern of a chief; authoritative, intelligent, a man of action and responsibility. Men who did not behave as chiefs and did not succeed, might step aside or be forced.

An overchief, a district leader, had usually three other chiefs upon whom he depended, plus a council made up of all chiefs, men who headed lesser and local groups, with whom he discussed all important matters. General agreement usually preceded action. Action itself might vary from war to public works to the judgement of some small personal strife in one of the villages. This, in a very small nutshell is the governing organization of aboriginal Palau.

What is a chief like? How is he distinguished? Ordinarily it would be difficult to impossible to distinguish a chief from his fellows. There was no conspicuous consumption at least in our terms. Yet the chief of Koror, during the time of first contact when the Antelope was wrecked off Aulong (1783), the "Abba Thule" (Keate 1788) went nude as did all of the men but carried an adze with an iron blade. Some iron had been taken from the recent wreck of a Malay ship. According to this work, which is characterized by a Rousseauan noble savage idealism, this Ebedule "was more a father than a sovereign." He was treated with great respect, people bowed or lowered themselves before him, he had a special stone seat ("chief's seats" are found archaeologically), his commands appeared to be absolute, inferior chiefs spoke to him in a low tone, faces averted. Yet he held regular council meetings and appeared to do no important business without advice. He worked and was known as an excellent maker of adzes and did this when not occupied with more important affairs (Keate 1788: ch. XXIV).

The methods whereby the chiefs, whether the overchiefs such as the Ebedule of Koror, or less powerful incumbents, carried out large and important tasks such as war or construction is a most interesting one. All persons of working active age belonged to clubs. Age grading lay as the basis of these organizations. Women, too, had clubs which followed as a rather pale reflection the men's organizations. Each club properly had its club house, *Bai*, at which the men met and stayed much of the time. Each governed itself and most had traditional duties or duties were assigned. Each village had several clubs: they were divided into two groups, a moiety organization, and there was great and aggressive rivalry among them. They formed not only the labor supply but a disciplined, skilled, sometimes highly specialized labor supply. Membership crosscut the community and titled men did not ordinarily belong to or control a club. The chief and his council assigned duties, gave orders to the club suited to a task: defense or offense, building a road, public platform, police duty, supplying food or entertainment at a

feast, and so on. The total population was thus efficiently organized for government, representations to the supernatural and for all manner of specialized or unspecialized work. Each functioning member had training and community responsibility from the overchief to the newest member of the lowliest club. High and low kin groups, titles, authoritarian chiefs and their councils, a massive work organization in the clubs; all of these, functioning properly, should have been efficient indeed. It was almost a complete social contract.

Now comes the rub: can we use this archaeologically? I think so, perhaps somewhat better than Renfrew was able to do with the Neolithic chieftaincies of Europe, because we have a recently living, or partly living analogy. But, sadly, we cannot do enough better so that this writer is sanguine about the value of the approach, unless he falls back on the need for further field research, which he will do. After all, we may have the analogy in the Palaus, but we do not have the massive data that Europeans have accumulated. So it evens out.

As evidence of great construction tasks that were accomplished by some kind of organized labor we have:

1. The terraces, earthwalls, dugways ("footcatchers").
2. The roads, platforms, docks, quays, walls, graves which were usually made of residual andesitic boulders and cobbles.
3. The large and small carved stones.
4. Monoliths, usually shaped, set in a pattern for architectural use.
5. Smaller stone monoliths, usually uncarved, chief's seats.

These five may be grouped as earthworks and stonework.

Terraces (the major earthworks) are probably primarily agricultural. Figure 200 (and see Appendix 2) shows modern cutting into an old terrace riser, an embankment at site K1. This suggets, and the variability of the terracing on all terraces suggests, that terracing was done as need dictated, for primarily agricultural use but that it was under sufficient social control so that a generalized typology (Osborne 1966: ch. 6) is discernable. Each terrace expression may be interpreted as the result of both private (tillage) and public (the crown) work publicly controlled.

Earthwalls (see Osborne 1966: 78, 217, fig. 67*b*, ch. 6) are a different matter. None has been excavated, but all appear to be boundaries or defenses. As such they must have been public projects done by clubmembers at the behest of councils and chiefs.

Platforms that underlie private dwellings almost surely come into being or are owned by families or larger kin groups. Roads and public platforms (see Osborne 1966: 190; fig. 31A) stairways and walls are now looked upon as public property and were public works. It is indeed peculiar that there are so few evidences of the boulder roads associated with terraces. I can think of only two: B12 (Osborne 1966: 190) and B1 (page 164) My belief is that the people of the terrace-using times did have roads and platforms in the same manner as do their modern descendents but that the latter have moved the stones as they moved themselves, leaving the terraces bare. The removal of stones is not uncommon historically.

Docks, causeways, quays, or wharfs were also built, surely as public works. Carved stones, Great Faces, great and small of the two varieties (Osborne 1966: fig. 51*A, B* and fig. 73*A*, *B*); carved stones of other kinds, monolithic pillars such as at B18; all of these and others vary from small projects that may have been the labor of love of one person to such monstrous tasks as the B18 colonnades and the carving of the Great Faces.

No one can look at many of these larger examples of stone working without realizing that, while there is a governing pattern there is no evidence whatever of control of size, depth and kind of carving. Each object, whether it be a Great Face at Melekeiok, or one of the pillars at B18, is unique. The appearance, finish, measurements and variation of andesitic conglomerate that was used; all differ. The same skilled workmen with the same mental templates and the same material did not turn out these carvings. It can only be suggested that different

organizational or soical units made the different objects. These units are available at the modern level: villages, clans, families, etc. and the several working clubs that some villages have. There is no doubt in our minds, for example, that each different stone at B18, whether face or column, was made by a different working club somewhere in adjacent northern Babeldaob.

Let us turn to the last commentary on our interpretations of the Palauan work ethic and method. On pages 230–231 Renfrew gives two of the very many man-hour estimates that have been made of large construction tasks that have been accomplished in the past. I have no great quarrel with this; some estimates may in fact be close to the truth. It is the impression that these estimates leave with the reader that I find upsetting. A man hour calculation of 100,000 hours, coupled with a discussion of chiefly powers, leaves this reader with an impression of powerful chiefs (who had subjects!) and could control many thousands of man hours. It is doubtful if this were the case very often. The situation elsewhere in the world was probably much as it was in Palau where the terraces, certainly the most imposing monuments of the past, were made as they were needed, for the growing of food, over many centuries of use. Terraces were certainly in use by the time of Christ or shortly thereafter. We cannot express certitude as to the effective termination of terrace use; actually it is not now terminated and probably never will be, but the major period must have run to past 1000 A.D. and should go well beyond that (date 1762G). This gives ample time for the women of a clan, perhaps helped from time to time by their men, to slowly carve out the terrace. True the "man-hours" (better the women hours) would still add up but the social and leadership implications are qualitatively entirely different.

Conspicuous consumption by chiefs or leading families was not characteristic of the ethnographic period on Palau as it seems to have been in Europe. Wealthy and powerful families, and as usual these two attributes are linked, were prestigeful in that among other things, they had a quantity of Palau money. But the baubles were not conspicuous, at least in our terms. Money was secreted, its use was secretive, but on the other hand, most persons knew of it. It was a rather subtle arrangement. Other than these variations in wealth and power, the chiefs lived and consumed much as did other people.

Conspicuous burial practices are likewise few and far between insofar as present knowledge goes. I know of very few raised or terraced graves. These are kin group affairs and are a part of the house platforms of important families who continue to use them. There is only one stone sarcophagus in the entire island group that is known. Perhaps there are others underground but this is dubious. The known coffin was found on B19A and is described by Osborne (1966: 207–208). The coffin itself, even to the knob handles on the cover, is a closely similar artifact to many from the Indonesian metal age period (van Heekeren 1958: pl. 20). However this stone object may have been made, and why, it is the only true burial differentiation that we know, whether it was occupied by an elite personage or not. My generalization from all of this is that the leadership functioned primarily in that cultural segment as leadership, and the power over people and things was not an attribute that needed celebration and panoply in other aspects of life. Power and its uses were, at least to the Neolithic Palauans, a responsibility, not a right to flaunt. We may wonder if some Neolithic Europeans did not do things in as efficient a way as did the Palauans and in a far less regal manner than Renfrew appears to believe.

Recommendations and Critique

Each new field venture accomplishes something left undone by the previous one and changes viewpoint and problem recognition and eventually research design. The following are my recommendations in the order of importance as I see it now.

1. The most baffling, interesting and possibly most valuable research that could be done involves the problem posed by the specialized middens of sites Pelilieu 1 and Babeldaob 20 (Appendix 2). Enough has been said under the two above headings so that there need be no repetition. Potentially, a problem such as this, even though it may not be solved, could lead to the development of new techniques and interpretation of foodgathering.

2. Excavations at Ngerkeklau island (Appendix 3) will yield a large collection of shell artifacts. Further excavations of the sites in the south, especially P1 and Au1, will yield well. There will then be collections from the limestone islands and from the northern volcanic islands which should encourage the search for ecological adjustments in these tool types.

3. The terraces of B18 platform 1 and of B40 crown both presented evidence that they were not formed by simply removing sections of a hill or ridge, and leaving a remnant, but they were actually shaped in part by filling. It is probable, in both instances, that soil including old midden was hauled in for use. It is likely that large trenches into these terraces, and perhaps others, will reveal information on the terracing when combined with present interpretations, or will force revisions. Probably both sites should be investigated.

4. B18 continues to call. Enough has been said to indicate that I find fault with some of my conclusions, particuarly having to do with the soil profiles at that site. A series of trenches from the plaza west up the hillside and an excavation check of each monolith are both sorely needed. Presumably this digging would yield more charcoal, as it surely will other information.

5. Aulong 1 is the site that should be chosen if there were only one excavation possible in the group. The relationship of the fresh water lens is as intriguing as the archaeology alone. Perhaps this recommendation is overly influenced by the beauty of the little isle and the need for further study of the pictographs at Au1.

6. A complete study of a large terrace needs to be made. This should start with local phytogeographic studies such as was attempted (Osborne 1966: part II, ch. 2) and continue through the range of applicable approaches, with as much digging and sampling as is required. For this study I would choose B10 where an acceptable start has been made.

7. Finally, there is the matter of the incomplete survey (Osborne 1966: 471). The areas mentioned there should be walked.

There is, however, another aspect of survey which was used, lightly, to locate unreached terraces (Osborne 1966: 262–266). This involves an air-photo study of the volcanic island terraces. The old photographs used, or a new set of them, might suffice. A careful examination of each terrace, in the context of its typology and local environment, might prove illuminating in terms of the social implications that are hinted at in these pages. There have been techniques developed since the work was done in 1957. They will at once make an air photo study simpler and more profitable than it once was.

8. Investigations of the peculiar sites on Merir or Pulo Ana (Osborne 1966: page 49 *seq*) would be the most logical first step toward tracing western Micronesian traits to the southwest. The excavation of the remarkable archaeological remains on either or both of these tiny islands can only be evaluated as a major contribution.

If an excavation is to be made on the rock islands, where there are indeed apt to be human remains, intensive preparations for bone salvage must be made.

As a final thought one wonders if such high correlations as were found between some areas (B37 coconut grove, B18 Christmas tree terrace, B40 crown, and Aulong 1 F-E test; dendrogram, Fig. 195) represent times of maximal intersite contact. If so, does this mean peace, maximal travel and trade or may it suggest overall rulership due to success in diplomacy or war, or both?

Critique

There are perhaps too many self criticisms in the body of the report. We believe that these may be of value to those who follow. It is surely patent that a statistical sophistication

especially in a situation where the yields of a number of small exploratory excavations are being studied is a prime attribute. Some of this was achieved, but not enough. Awareness developed, for example, that many of our collections are deficient in size in some of the attributes. They may have created more noise than harmony. For this reason they were not often employed in interpretation. As an aspect of this, the small variants, which may be important, could be lost in the mass of data being manipulated. One of these is the fine buff to grey ware found most commonly but rarely in the terrace sites (B18 hillside, stratum III bottom; IV in the computer runs). Attention was given to this fine and early pottery in the descriptions, but the statistics submerged it. A discovery of a good deposit of this variant, and one with a strong percentage of 05 rims in the volcanic area should cast light on the time of early occupation and make comparisons to the west of the Palaus more possible.

Computers may be a modern miracle but we are not sure that we would card the potsherds from a single excavation. Were there two to be compared it would become a necessity. It is probable that a classic seriation study would be of help if the collections were larger. The lack of decoration removes a major tool for serial studies. Lacking decoration, and accepting the fact that Palau ceramics from one end of the archipelago to the other are only moderately variable, and the subjectivity in analysis that this implies, we did not try for overall seriation.

The technical problem of disturbance often mentioned, can be solved for each site by excavating larger areas, longer trenches. Disturbance has been a factor in our evaluation of some of the collections. The intersite consistencies, however, indicate that obfuscation of this nature is not dangerous, even when the study base is a number of small field tests.

We cannot claim to have solved the field problems of the Palaus. Hopefully the discussion will be helfpul to others. The level system used in an exploratory way by me and generally used by Stevens is altogether too fine a dissection of the deposits. It appears as if the stratigraphic system based on soil change, used whenever possible may be likewise too divisive in many places. Larger sherd collections from some depth, especially in the terraces are a desideratum. In this way a sorting of sherds with most attributes (rims, bases etc.) would be made. Extensive excavation with careful clearing and close examination of subsoil and midden contact is required again on the terraces. There should be architectural traces remaining there; we could hardly hope to observe them in our test trenches and pits. Above all there should be sufficient time so that sites with terrace problems (such as B40 and B18 platform 1) can be carefully investigated.

The discovery of sherds in the yellow-red subsoils below several midden deposits (K3, B18 small colonnade) suggests: (1) that early habitants cultivated into these clays long before their agricultural and living activities had developed humus in the soil; (2) that leaching and attendant latosol formation in pre- and early occupation times was active and that humic root mat development was retarded in many places. A careful study of midden—subsoil contact would be enlightening.

References Cited

Barnett, H. G. 1949. Palauan Society. University of Oregon Publications, Eugene.

Buck, Peter H., Kenneth P. Emory, H. D. Skinner and John F. G. Stokes. 1930. Terminology for ground stone cutting implements in Polynesia. Journal of the Polynesian Society 39: 174–180.

Corwin, G., C. L. Rogers and P. O. Elmquist. 1956. Military geology of Palau Islands, Caroline Islands. Prepared under direction of Chief Engineer, U.S.A. with U.S. Geological Survey, Intelligence Division, HQUSA Far East.

Damong, P. E., C. W. Ferguson, A. Long and E. I. Wallick. 1974. Dendrochronologic Calibration of the Radiocarbon time scale. American Antiquity 39(2): 350–366.

Dickinson, William R. 1971. Temper sands in Lapita style potsherds in Malo. Journal of the Polynesian Society 80(2): 244–6.

Freycinet, Louis de. 1829. Voyages Autor du monde. Tome deuxime, premier partie.

Gifford, Edward W., and D. S. Gifford. 1959. Archaeological excavations on Yap. Anthropological Records 18: 2.

Glover, I. C. 1974. Preliminary report on the excavation of Ulu Leang cave, Maros, Sulawesi Selatan. 1973 season. London.

Harrisson, Tom, and Stanley J. O'Connor. 1970. Gold and megalithic activity in prehistoric and recent west Borneo. Data Papers No. 77. Southeast Asia Program, Department of Asian Studies, Cornell University, Ithaca.

Hijikata, Hisakatsu. 1956. Report on consecrated stone images and other stone works in Palau, Micronesia. Japanese Journal of Ethnology 20: 1–54.

Kaudern, W. 1938. Megalithic finds in Central Celebes. Ethnographic Studies V. Göteborg.

Keate, George. 1788. An account of the Pelew Islands situated in the western part of the Pacific Ocean composed from the journals and communications of Captain Henry Wilson and some of his officers who in August 1783 were shipwrecked in the Antelope. G. Nicol, London.

Kira, Tetsuaki. 1965. Shells of the western Pacific in color. Hoikusha publishing Co., Osaka.

Krämer, A. 1917. Palau. *In* G. Thilenius (ed.), Ergebnisse der Südsee-Expedition 1908–1910, II, B, III, i: 1–252. Friederichsen & Co., Hamburg.

———. 1926. Palau. II, B, III, iii: pp. 1–363. Friederichsen & Co., Hamburg.

———. 1929. Palau. II, B, III, v. Friederichsen & Co., Hamburg.

Kubary, J. S. 1873. Die Palau-Inseln in der Südsee. Journal of the Godeffroy, Museum.

———. 1889. Ethnographische Beitrage zur Kenntnis des Karolinen Archipels. Trap, Leiden.

Moore, W. Robert. 1930. Among the hill tribes of Sumatra. National Geographic Magazine 57(2): 187–227.

Moore, Raymond C., Cecil G. Lalicker, and Alfred G. Fischer. 1952. Invertebrate fossils. McGraw Hill, New York.

Osborne, Douglas. 1957. Excavations in the McNary Reservoir basin near Umatilla, Oregon. Bureau of American Ethnology Bulletin 166.

———. 1966. The archaeology of the Palau Islands: an intensive survey. Bernice P. Bishop Museum Bulletin 230.

Raven, H. C. 1926. The stone images and vats of central Celebes. Natural History 26(3): 272–282.

Ray, Erwin R. 1976. Prehistoric pottery from Tarague Beach, Guam: a description and classification. M. A. thesis, Arizona State University, Tempe.

Reinman, Fred M. 1977. An archaeological survey and preliminary test excavations on the island of Guam, Marianas Islands, 1965–66. Micronesian Area Research Conter, Univ. Guam.

Renfrew, Colin. 1973. Before civilization. Alfred A. Knopf, New York.

Rouse, Irving. 1939. Prehistory in Haiti, a study in method. Yale University Publications in Anthropology 21.

Safford, W. E. 1903. Guam and its people. Smithsonian Institution Annual Report for 1902: 493–508.

Schmidt, Lynn W. 1974. An investigation into the origin of a prehistoric Palauan rock art style. Thesis (M.A.) California State University, Long Beach.

Shepard, Anna O. 1968. Ceramics for the Archaeologist. Carnegie Institute of Washington, Washington DC.
Sokal, Robert R., and Peter M. A. Sneath. 1963. Principles of numerical taxonomy. W. H. Freeman and Co., San Francisco.
Solheim, Wilhelm G. 1960. Jar burial in the Babuyan and Batanes Islands. The Philippine Journal of Science 89 (1).
Spoehr, Alexander. 1957. Marianas prehistory, archaeological survey and excavations on Saipan, Tinian and Rota. Fieldiana: Anthropology 48.
Taylor, R. E., and Rainer Berger. 1968. Radiocarbon dating of the organic portion of ceramic and wattle-and-daub house construction materials of low organic content. American Antiquity 53 (3): 363–66.
Thompson, Laura. 1940. Functions of the latte in the Marianas. Journal of the Polynesian Society 49.
van Heekeren, H. R. 1958. The Bronze-Iron age of Indonesia. Martinus Nijhoff, S. Gravenhage.

APPENDIX 1

Petrographic and Mechanical Analysis of Selected Sherds

W. R. Dickinson, David L. Weide, and D. Osborne

Sherds were sent to two analysts, William R. Dickinson of the Department of Geology, Stanford University who has experience in the area (Dickinson 1971) and to David L. Weide then of the Department of Geography, University of California Los Angeles. Dickinson's comments appear in the body of this discussion under two headings WRD 14 and 30, his report numbers, and finally in summation as WRD 35. The discussions written by Weide are labelled DW.

Six sherds were sent to DW; 25 to WRD of which he thin-sectioned 12. Each sherd was accompanied by specific queries or requests for comments. The questions asked appear in the text following the sherd catalog number and the answers are quoted or paraphrased below. Finally a comment concerning the pertinence of the analysis to our own laboratory work is given where required. The catalog number is usually that of all sherds from the EU.

WRD in a series of general comments, makes the point that the "suspected slip" (sherd 21/B40) and the odd paste (61/Aul) require someone with "straightforward ceramic experience", and not a sedimentologist. He closes his discussion with the following remarks. They are quoted in full with a brief comment by me at the end.

"*Two main temper types.* These Palau sherds contain two main temper types, similar to the two types noted earlier in report WRD-14, and apparently represent two separate technical traditions: (1) The largest number of sherds examined in thin section, 8 of the 12, contain mainly angular, broken sherd fragments as temper. Sherds 53/B37 and 10/B40 also contain a few weathered volcanic rock fragments, which amount to less than 10% of the sand temper. From the tiny crystals of quartz and feldspar in the paste, I infer the clay was probably weathered volcanic strata, or detritus from such a source, hence that the few weathered volcanic rock fragments in the sherds were probably natural residue in the clay, rather than added temper, all of which was a broken sherd aggregate. The Koror sherds of report WRD-14 are probably of this type, although they were partly misinterpreted before, and the bedrock affinities suggested for them in that report lack some force.

"(2) Three of the sherds sectioned, numbers 112/B37, 94/Ang19 and 97/Ang19, contain a well sorted and partly rounded volcanic sand temper similar to the one in the Aluptaciel sherd of report WRD-14, but containing markedly fewer feldspar grains and more fine-grained volcanic sand, but could be stream sand.

"On the available evidence, it would seem that the two kinds of sherds with the two types of tempers represent distinct manufacturing traditions, whether at different times, in different places, for different purposes, or merely by individual or clan habit. Only one sherd seen, 63/Aul is a hybrid. In this sherd, the temper is a mixture of (a) a few rather coarse volcanic rock fragments similar to those seen in some of the sherd-tempered sherds, and (b) sherd fragments in which the temper is fine volcamic sand similar to that in the sand-tempered sherds.

"The sherds examined in thin section each contain one of two indigenous tempers, either volcanic (beach?) sand showing a placer concentration of heavy ferromagnesian minerals, mainly pyroxene, or a broken sherd aggregate."

Comment: WRD-14 is printed as the last part of this section. The interesting sherd

63/Aul is probably the result of trade, either of the paste components or as a vessel. Neither volcanic sand or clay is available on Aulong; the island is raised coral limestone reef. So the pot that eventually contributed the sand-tempered-sherd temper came from the volcanic islands (Koror in part, Babeldaob, Ngarkebesang, Malakal) and/or the sands themselves were imported. The same is true of 94/ and 97/Ang19. WRD was not furnished this information. The following were specific queries.

97/Ang19 (pit 25 level 1: WRD-30). Question asked:tempering? shiny black material? Answer: volcanic sand, pyroxene.

94/Ang19 (pit 21 level 2). Question asked: does this sherd have both sherd and rock tempers? Identifications? Answer: "this is volcanic sand temper made of miniral crystals, clearly visible as sand, and microcrystalline volcanic rock fragments, which appear somewhat similar megascopically to broken sherds".

61/Aul (wall test stratum III). Question asked: note the peculiar character of the paste. We ealled it fused paste. Any comments? Answer: this paste is odd, and a strong fluidal fabric of contorted streaks supports the inference of a partly fused or flowed paste, but I am unfamiliar with this type of ceramic reaction and can make no useful comments.

63/Aul (wall test stratum III). Question asked: is this a fine sand temper? Answer: This appears to be mixed volcanic sand and broken sherd temper in which a number of sherd fragments contain volcanic sand temper.

53/B37 (east face test level 2: WRD-30). Question asked:tempering material? Answer: sherd and a few weathered volcanic rock fragments, possibly natural components of the clay. Our analysis was sherd and crushed rock temper.

88/B37 (coconut grove stratum II). Question asked: tempering material, white sand? Answer: sherd and am unsure what the white material is. Our analysis was sherd and white sand. See comments, page 121 on Winchell's analysis of this "white material". He was given a large sample of it: Dickinson saw only the fine specks in the paste of the fired sherds.

89/B37 (coconut grove stratum I). Question asked: tempering, what of the red ochre? Answer: sherd temper: the red ochre appears to be "just strong surface oxidation". Our analysis:sherd temper with surface streaks caused by particles of red ochre. The analysis indicates that there were ferric particles in the clay itself.

112/B37 (north face test level 4). Question: fine sand temper? Answer: volcanic sand temper.

94/B37 (coconut grove stratum II; DW). Questions: note that the sherd appears to have a thick interior slip with red paint on the slip and a light overpolish on the red. Yet, the sherd was fired in an atmosphere that produced a heavy carbon streak - in fact, totally black paste. How is it that the red was not masked by the carbon if fired in a reducing atmosphere? Could it be a fugitive red paint applied after firing? Can the thin section help? The carbonized interior might also have come from cooking use-burning food-boiling out oil etc. Answer:The red is indeed a "post firing" coating. Note that it is heaviest on the raised portions of the parallel surface striations across the concave surface. Furthermore, it appears to have been applied to a slip (about 0.5 mm thick) that was applied to the body of the sherd proper. In places where the slip has peeled off, short subparallel striations can be seen on the body of the sherd. Composition is one with crushed sherd temper although the crushed fragments are quite large (up to 3 mm) and there are relatively few of them (ca.10% of the total volume). The rest of the matrix does not contain much in the way of a mineral grain temper and appears to consist almost entirely of poorly mixed clay to silty-clay. The orange "scabby" coating appears to be a postoccupation natural deposition of minerals by ground water. It does not, however, contain calcium carbonate which is somewhat surprising. I expect it is some oxide of iron admixed with manganese." Our analysis: that color-decoration of sherds was often a post firing addition, perhaps the renovation of older bowls. The "scabby" material is our "colloidal" deposit,

confirmed by Weide. The sherd had been in an acid environment, which Weide did not know, hence it did not contain the expected calcium carbonates.

88/B37 (coconut grove stratum II) and 110/B37 (north face level 3). Question: patinated sherds, as we called them. Is there any minerological difference between the outer carbon-free skin and the body of the sherd? It looks very different megascopically. Answer: 88/B37 (Fig. 196). This sherd contains a nonsherd temper. In fact it has essentially no temper at all. It does contain minor quartz grains but these I feel are accidentally included with the clay paste. The binding agent is, or was, organic. We can see numerous carbonized threads of what appear to be the remnants of a thin bladed grass. Flow structures of light and dark clay paste indicate poor mixing of clay. The surface coating on both of these sherds is unusual in that it is obviously an added slip but ... it does not contain carbonate. I strongly suspect that the slip was made initially from a finely ground up laterite soil mixed with a white to light grey clay and then either fired with the original pot or refired as a second operation. Temperatures were considerable in that there has been some partial melting of the edges of the laterite fragments.

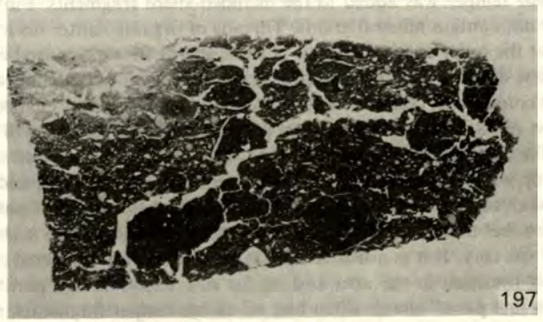
110/B37. Although the slip is similar to that on 88/ it has a definite crushed sherd temper. Approximately 35% of the volume consists of subrounded fragments of black, very fine grained pottery. No particular temper was added to the included sherd fragments. Furthermore, the general matrix does not contain mineral grains. Threads of organic matter (as in 88/) are also lacking. I expect that the outer coating of both of these sherds (if it did indeed consist of iron and aluminum oxides) did not turn black during firing under reduced circumstances because neither of the above compounds combine well with carbon. Furthermore, I expect that a good deal of the blackness of 88/ is due to carbonized organic material, while in 110/ much of the blackness is due to the original color of the sherds added as temper. The upshot of all of this is that we could wind up with a fairly dark sherd without the necessity of firing under a reducing atmosphere." Our analysis is still not aided greatly by this discussion of the "patination" as a slip, which we do not feel that it is. The organic temper of 88/ is unusual; it may be natural organic inclusion in the clay. If it is a true temper it represents an unexpected and unknown ceramic trait or even tradition in the area and, as far as I know, in that part of the world. However, our "extra fine paste" sherds often had no visible temper fragments, so the subject cannot be closed.

67/B37 (north face level 1, Fig. 197). Question: we need a reading on the temper of this "rock-tempered" sherd. Answer: it contains a sherd temper which accounts for about 25% of the sherd volume. There is also a nonsherd component of subrounded quartz grains with about 2 percent of a highly birefringent mineral-most probably olivine. Note that the quartz grains included in the tempering sherd fragments which are considerably smaller than the quartz grains in the matrix paste. Also no olivine is included in the mineral component of the tempering sherds. This might suggest a slightly different source area for the temper mixed into the clay mix which ultimately became the tempering sherds. Size of the crushed pottery used as temper is about 1-2 mm." Comment: this answer indicates that our analysis may have overstressed the rock tempering of some sherds, probably because rock tempering is the rarer of the two.

30/B37 (village test area level 2; Fig. 198). Question: sand tempered? - the white material is of special interest. Is the mineral specimen the same? what is it? Answer: we tried both thin-section and x-ray on the white material without significant results. In transmitted light (thin section) the material appears to be isotropic. The pattern produced by x-ray diffraction was ambiguous to say the least. The best estimate that I can offer is that the material is some form of iron-clay material perhaps derived from a lateritic type soil. In one area of the thin section the white material is in well rounded "nodules" that appear to be partially digested or chemically altered. This form of alteration is common in what are called pisolitic soils but that is only a guess. The mineral fraction consists of quartz and olivine grains ... The sand was greatly

altered before it was incorporated into the sherd and the original feldspar content had altered to clay. Sherd temper is not present. Rather, the white material probably was added to serve that function. I think we would be safe in saying that a temper of a crushed iron/aluminum silicate material was added to the clay paste. Furthermore, the iron aluminum silicate probably


196


197

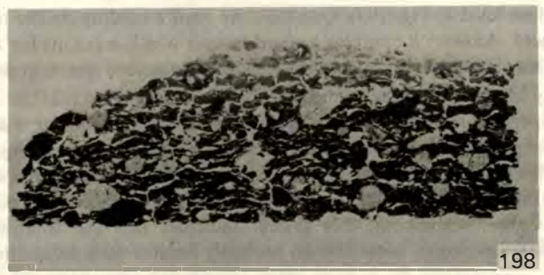

198

Fig. 196. Thin section of sherd with no visible temper (part of 88/B37). This sherd illustrates well the extra fine paste with indeterminate (in this case not visible) temper.

Fig. 197. Thin section of sherd with sherd temper in large quantity (part of 67/B37). This sherd illustrates a fine paste with fine sherd temper in large quantity.

Fig. 198. Thin section of sherd with coarse "nodules" of iron-clay material as temper (part of 30/B37). This sherd illustrates a coarse paste with coarse indeterminate temper in large quantity.

existed as a highly weathered crust either slightly below ground surface or, where recent erosion had stripped off the cover, as a cemented crust similar in some respects to the "duricrust" developed in iron-rich soils in arid areas (no arid inference here)." Comment: we later found this to be Winchell's zeolite. It is obviously a rare but definite temper material.

112/B37 (north face level 4). Question: "fused" paste. Is the peculiar stoneware appearance of the paste the result of any mineralogical or physical change? Answer: the primary temper consists of well-rounded fragments of a fine-grained rock (apparently a volcanic, but diagnostic structures and minerals are not visible). The sherd also contains one or two very large fragments of other sherds apparently added as temper. The red color is the result of (1) a high temperature oxidizing firing and (2) a considerable quantity of iron rich clay added to the original paste. I expect that the "stoneware" appearance of this sherd is due more to the iron content of the original clay than to firing conditions. Comment: it is clear that this analyst believes that our "fused paste" is not the result of greater heat, which our term implies, but is rather a physical-chemical change that resulted from the use of iron-rich clay.

1/B40 (crown stratum I), 10/B40 (test pit 2 level 1); WRD-30. Question: tempering? the patina change? Answer: mainly sherd with a subordinate component of volcanic rock fragments. Comment: our analysis agrees. WRD not able to comment on paste change. Suggests reference to a ceramicist.

8/B40 (crown stratum III bottom). Question: are the inclusions iron particles? Answer: these are pyroxene crystals.

21/B40 (test pit 5 strata II-III). Question: is the white surface a slip or a float? Answer: has sherd temper; the discolored surface has a slightly fluidal fabric, as if a slip had been smeared on, or as if a surface regime had softened; the contact with interior material appears locally discrete and locally gradational. Comment: our analysis encountered the same difficulty in separating a slip from a float. This would have been labelled a slip. It appears likely that the pottery making methods of the Machas Becheklidil (Osborne 1966: 32-39) would have left the slip-float condition if they or something like them were followed in the past.

WRD-14. The following discusses sherds returned from the survey in 1953-4 and sent to WRD in 1966 after the survey report was published. The data are given here in toto. It should be noted that WRD has modified some of the statements of this report in this appendix. All of the sherds are aurface finds.

Ten thin sections were made. Six were informative. The other four (two of Alup 2/6 and one each of K3A/7-10 and K9/10) are too weathered to provide reliable data but appear consistent with the others similarly labelled. The informative slides fall into 3 groups with respect to temper as follows:

(1) K2/16, K7/6 and K7/29 from Koror. The only abundant medium and coarse sand grains are pale green dacitic tuff that weathers pale brown. In the tuff, tiny crystals of quarrz and minor feldspar are set in a murky groundmass once vitric but now largely recrystallized to cryptocrystalline materials. Rare porphyroblasts of epidote suggest that the pyroclastic sequence from which the tuff fragments were derived was altered at low grade. In the same sherds, fine sand and silt of quartz and opaque iron oxide grains with minor grains of feldspar, epidote and cherty chalcedonic aggregates were probably derived from weathering of the same pyroclastic sequence from which the larger tuff fragments were derived. Many of the tuff fragments are of irregular shape and some may even have been deformed by the kneading of the clay matrix. The striking homogeneity of the temper suggests that its source was residual weathering debris rather than transported sand. This inference is supported by the irregular shapes of the temper grains which show no evidence of abrasion and by their variable size, indicating an unsorted aggregate. Perhaps the potters collected a naturally tempered sandy soil-clay. The most likely bedrock source from which the dacitic tuff products in the temper could

have been derived is the Nghemesed dacitic breccia basal member or the Medorm andesitic-dacitic breccia middle member of the early Tertiary (Oligocene?) Ngeremlengui formation which crop out widely around Karamado Bay in western Babeldaob. The Ngarsul member of the Aimeliik formation which forms the bedrock of Koror does not appear from descriptions available to me to be a credible source for the temper of these slides.

(2) Alup2/5. The temper of Alup2/5 is a well sorted and rounded sand of the following composition: plagioclase, 40–45%; augite, 20–30%; opaque iron oxides, ca. 20%; vitrophyric volcanic rock fragments, 10–20%; hornblende, 1–5%. This highly crystalline aggregate could have been concentrated from any of the early Tertiary andesitic sequences of Palau, but most likely from the Aimeliik formation in which basalts do not occur as they do in the Babelthuap formation, and in which the augite is predominant over hornblende and hypersthene, which are more abundant in the Ngeremlengui formation. The Aimeliik formation crops out along the eastern side of Babeldaob and on Koror

(3) Japanese ware. The temper in this slide is mainly quartz with some mica. I assume it is wholly foreign to Palau. Conclusions: there is no evidence that any temper except that in the Japanese ware is foreign to Palau, but relations of pot manufacture site to temper source are unclear.Comment: there are deposits of black sand in several areas, notably southeastern Babeldaob. Apparently they were used by some potters.

Petrographic report WRD-35

Temper sands in prehistoric potsherds from Palau.

A total of 20 prehistoric sherds from Palau sent to me by Osborne were examined in thin section with a polarizing petrographic microscope to identify the nature of the temper. Two main temper types are present, and apparently represent two distinct technical traditions.

A majority of the sherds, 15 in all, contain mainly angular broken sherd fragments of coarse sand size as temper. Of these, 5 also contain a few weathered volcanic rock fragments and rare mineral grains amounting to less than about 10% of the temper. Tiny crystals of feldspar and quartz in the paste suggest that the clay used as weathered volcanic strata or detritus from such a source. The few weathered volcanic rock fragments in the sherds were probably natural residua in the clay, rather than added temper, all of which was a broken sherd aggregate.

Well sorted, rounded to subrounded volcanic sand, of probable beach origin but possible stream origin, forms the temper in 5 of the sherds. The Tertiary andesitic sequences of Palau (Corwin et al. 1956) are the probable bedrock sources for the sand grains. Distinctive grain types indicative of such a source include: (1) volcanic rock fragments, commonly of brownish color with textures ranging from vitrophyric to halopilitic; (2) pyroxene crystals, mainly augite but including subordinate hypersthene; and (3) plagioclase feldspar crystals, commonly with glass blebs as inclusions. The table gives approximate compositions of the temper sands, in which dark ferromagnesium, or "black sand" minerals, vary from one-quarter to two thirds of the total.

Approximate grain frequency percentages of grain types in volcanic sand tempers in prehistoric sherds from Palau. VRF denotes andesitic to dacitic volcanic rock fragments of varied texture; based on counts of 100-250 sand grains in each sherd.

grain type	30/B37	A12/5	112/B37	94/Ang19	97/Ang19
plagioclase	46	41	20	13	6
pyroxenes	24	23	32	34	43
hornblende	1	1	—	—	—
opaques	—	22	5	5	24
VRF	29	13	43	48	27

References Cited

Corwin, G., C. L. Rogers, and P. O. Elmquist. 1956. Military Geology of Palau Islands, Caroline Islands Prepared under direction of Chief Engineer, U.S.A. with U.S. Geological Survey, Intelligence Division HQUSA Far East.

Dickinson, William R. 1971. Temper sands in Lapita style potsherds in Malo. Journal of the Polynesian Society 80 (2): 244–6.

Osborne, Douglas. 1966. The archaeology of the Palau Islands: an intensive survey. Bernice P. Bishop Museum Bulletin 230.

APPENDIX 2

New Sites and Old Sites Revisited

Although we had intended to explore parts of the islands that were incompletely assessed archaeologically during the survey (Macharchar and some of interior Babeldaob) the press of laboratory work, especially sherd analysis, would have required a decrease in the excavation program if time were to be devoted to survey. It was decided that the excavation and ceramic analysis was more important, and survey plans were abandoned reluctantly. It is much more pleasurable to explore for new sites than to sit in the laboratory with a hand lens in one hand and a sherd in the other.

Three new sites are well worth recording. Koror 26, a Yap money source, is a small cave on the northeast coast of Koror. Reference should be made to the survey report, page 90, fig. 29. The site is located very close to, but slightly north of the point where longitude 134°31′ crosses the coastline. The cave is a small one, 23 to 30.5 m across and twice as deep. Aragonite veins are well developed here, no doubt the major reason for the cave itself. The cave opens immediately onto a beach, slightly stony. The area is shallow, generally has a sand bottom, and is a most attractive locale. Figure 199 shows a very large part of the aragonite deposit which has been partly cut, smoothed and cleared. A ditch 30 to 60cm wide and now only about 60 cm deep, at greatest depth, outlines most of the money piece. As can be seen, cutting had proceeded to a partial rounding of the exposed upper part before the task was abandoned. The object is now 2.4 to 3 m in diameter depending on where measurements are taken. In front of it, to the right, is a small rounded fragment of the same material, also never completed. There are a few sherds in the cave, none distinctive or non-Palauan. We believe that the cave would repay excavation. Certainly some of the techniques of Yapese money mining would reveal themselves.

Ngemingel, Babeldaob 56

While at B40 we were told of the remains of an occupation inland from Ngargasang. It was said to be that of a warlike enemy village which was finally wiped out by the Ngargasang people after long fighting. The victors had dug a large pit, set the bottom with sharpened bamboo stakes, and lured a number of the enemy fighting men into the trap. After that the reduction of the remainder was easy. All of this is said to have taken place hundreds of years ago.

We visited the place after two tries. My guides became lost after several hours of the most difficult jungle work and decided that they needed the help of an old hunter who knew the country well. The next day we tried again, with the hunter. By that time our two daughters had arrived from Koror and my wife, daughters and I followed our guides. Again, travel was excruciatingly slow, with much machete work, through the dense growth. The site Ngemingel lay inland, northwest of Ngargasang on a high ridge east of and above the Ngardok River. Reference to figure 49, page 157 of the survey report will show the general position of the site. The main river stem flows from Lake Ngardok in the north and enters the sea at Ngersuul, south of Ngargasang. Neither the river nor Ngersuul appear on Fig.49 but the system and the small bay where Ngersuul is are easily located

The ridge which lies close to the river is not breached by tributary channels from the east for about 5 km. It lies about half way between B40 and the river. At the place where we climbed it to arrive at Ngemingel it was high, narrow and comblike. We located seven platforms in the

dense growth but found no sherds. There must be such evidence but the forest duff was thick on the ground.

Babeldaob 57

We also visited Ngersuul and while there my wife and I secured a number of fine old wood taro platters and fish plates. We were totally unable to map the platforms, walkways and other lithic architectural remains that we found. There was a series of walls, a small platform 2.7 by 4.3 m set about with five monoliths which our guides from Ngargasang said was called the council platform. A stone paved walkway ran inland from this, and near the edge of the road apparently on a growth obscured platform was a stone head of andesite of exactly the same kind as is illustrated in Osborne 1966 (the center of fig. 72, Ngekeklau, B34 and in fig. 51 A and B, Babeldaob 1). It is .91 m tall, above ground and .98 m in circumference at the base. I have photographs of it but the features are so worn or abraded that they lack definition. We were told that there was, in the hills upstream a set of stone monoliths like Bairulchau but smaller. Tide, which controls travel in the islands was due to change and we were never able to return to Ngersuul.

At this place we saw an artifact that is wholly unique and for which we know no use. It lay on the edge of a stone wall, part of a platformed area. There are two pieces, a stone trough .46 m long, .27 m wide and .14 m deep. The second piece is a boat-shaped stone .34 m long which fits the trough perfectly. At first we thought that the two pieces, both of andesite, were examples of a peculiar and clean break, perhaps caused by a stone hammer in strong and capable hands when the wall was being built. But the trough exhibits evidence of pecking and shaping—or it appeared to after we brushed off the vegetation. I asked what the stone was used for and was told it was a shell crusher. My next question: Why did people crush shells? could not be answered. Obviously this area should be examined carefully. It would be a matter of much work and clearing of vegetation.

Ngerbau shell midden

The B20 site has been superficially described in the survey (1966: 1968, 210). It is a massive area and its adequate study through the testing phase would be a major archaeological task. For the present all that I can do is add bits of description to the survey data. One of these is a peculiar midden deposit on the south side of the road west of the Ngerbau (east Ngerechelong) docking area at the top of the first hill. Another exposure of the same midden exists about 137 m farther west. About 99.9% of this midden is the small edible gastropod *Phos hirasei,* as the Pelilieu 1 site midden is equally *Gibberulus.* The soil, opened by the German or Japanese dugway through the ridge top, exposed a very dark red heavily shelly midden up to .9 m deep. There are dwellings old and new and many old platforms along this part of the road. The place has excellent excavation potential and I am sure that permission could be arranged.

One cannot help being intrigued by the social implications of these sites where the midden is composed of the remnants of a single food discard. The problem is sharpened when the remnants are those of very small even though very edible shellfish. We did not wrestle with the problem in the Pelilieu 1 site discussion, and there is no more that I am able to do here except underscore it. We must remember that the people of both P1 and B20 had physical access to a wide variety of shellfish and both used others but in trace quantities only. A food preference is understandable but not one which endured through the accumulation of .9 m of midden at Ngerbau and the immense quantity of shells on Pelilieu. An area characterized by a poverty of resources may well be expected to show maximal use of those that are available in quantity, but this is not the Palaus. Modern Palauan cookery is varied and well known in Micronesia. This is especially true of Ngerechelong where quality, quantity and remarkable feats of ingestion are recounted. Surely this was so in the past.

Fig. 199. Yap money cave (K26), initial clearing and shaping of a major part of the aragonite vein for a large piece of Yap "money".

Fig. 200. Site Koror 1. Fork mattock excavation at the back of a terrace tread into the lower part of the riser. Spoil is spread behind on the tread. This is a mechanism which may explain some or much of the terrace building.

In any event it would seem obvious that social or ceremonial restrictions must be the answer. The real extent of the Ngerbau manifestations is not known but that on Pelilieu is, and it is enormous. In addition legend has it that the Pelilieu 1 people were successfully warlike (Osborne 1966:359–360). They are not recorded as a depressed group; dietary restrictions must have had another sanction.

Koror 1

In August we examined site Koror 1 which had not been visited during the survey (1966:109–110). The area is one which, unlike the Babeldaob terraces and the southern coralline limestone reef islands, gives every indication of continuous habitation. It lies between the village of Ngarekesauol and the town of Koror and is therefore now valuable and prime

farming land. The tongue of red volcanic clay soil which has been slope terraced, leads from the main Koror upland south toward the bay to a small round crown. Lowlands on both sides of the small ridge are devoted to taro and the higher area to manioc and fallow.

We made a sherd collection but the heavy land use dissuaded us from accepting it as useful for analysis. No good midden exposures were seen. Of interest is the observation of modern terrace building. Figure 200 taken toward the west, shows headward cutting with the fork mattock into the toe of the riser of an older terrace at the upper left. The modern cutting is loosening and spreading clay subsoil and an overlying thin midden, rather probably moved once before, over an area being prepared for manioc plants. The hilling and ridging, locally characteristic of manioc patches, can be seen in the lower left. It is my belief that this pattern of soil preparation is ancient, and accounts for much of the terracing. It should have been far more common in times past on Babeldaob when population pressure was presumably strong, as it is in the Koror area now.

Reference Cited

Osborne, Douglas. 1966. The archaeology of the Palau Islands: an intensive survey. Bernice P. Bishop Museum Bulletin 230.

APPENDIX 3

Collections

Records were made and some photos taken of a number of artifacts which had been given to the Palau Museum on Koror, others that are in the personal collection of Mr. and Mrs. Robert Owen and a few that were given to the project. Hera Owen has devoted herself and her considerable abilities for a number of years to the salvage and preservation of Palauan prehistory and ethnography. The museum that she has fostered will house most of the key material links with the Paluan past that have come down to us and that have managed to persist through past and present acculturative periods. A careful survey of Palauan objects in European and Asian museums has yet to be completed.

The greater share of the items that I recorded will not be described here; these are duplicates of artifacts which we collected in some archaeological context. Others are not and are well worth comment.

Owen collection

SHELL: Two artifacts of shell are personal ornaments. (1) a pointed oval shell gorget (Fig. 201 *a*) of *Tridacna,* 66 by 42 by 7 mm, weight 32 grams, biconical holes at each end. It is a whole piece of the same genre as 54/Ang19 (Fig. 9*g*). The provenience is unknown except that it came from the rock islands. (2) a fragment of shell bracelet, probably *Trochus,* larger but similar to 128/Pl (Fig.26*a*). It is one fourth of a circlet approximately 7.5 cm in diameter. Cross section is rounded oval; the provenience is the same as that of the gorget.

STONE: Of greatest interest are a group of 4 stone blades, adzes, axe-adzes or (with one exception) possibly true axes. The gouge bit (Fig. 204*d*) is part of an adze blade of andesite, dulled and worn. Greatest thickness is 34 mm, width 46 mm. It is in every way typologically the same as the similarly broken bit of the andesite gouge 42/Ang19 (Fig. 7*f*). The other items are as far as I am concerned, axe blades. A dark grey felsitic blade (Fig. 204*a*) is quadrangular, has a square cut poll, expanding bit with equal bevels. The bit subsumes 34° of a circle. Dimensions are 68 by 44 by 19 mm, weight 107 grams. A closely similar item was found on the B19B surface (Fig. 183*a* and 184*h*).

Axe *b* (Fig.204) is a tiny greenstone celt, 40 by 27 by 13 mm : weight 34 grams. It has a rounded poll, slightly contracting bit formed by equal bevels which fill 32° of a circle. The last item, *c*, is a typical petaloid greenstone celt with all of the attributes of this almost worldwide tool. Dimensions are 120 by 60 by 30 mm, weight 318 grams. It was found in a manioc patch in Ngarabeched, a "suburb" of the town of Koror, by a Palauan woman, a friend of Hera Owen.

The two greenstone pieces are absolutely foreign to the Palaus. The others may be. We do not find illustrations of exactly similar items from the Philippines. But, the greenstone celt, as an axe is a thoroughly Melanesian tool. Little more can be said of these tools except that they cannot be native; the material does not occur in the islands, and there is very little indication of shell axes or axe-adzes. The islands to the south appear to be the best, though an hypothetical source. And finally the Japanese maintained a small pan-Pacific museum on Koror.

Saunders collection

An almost complete lamp was found on a beach, not located, on the island of Ngurkthabel by a Mr. Saunders of the Trust Territory Department of Education. He generously permitted

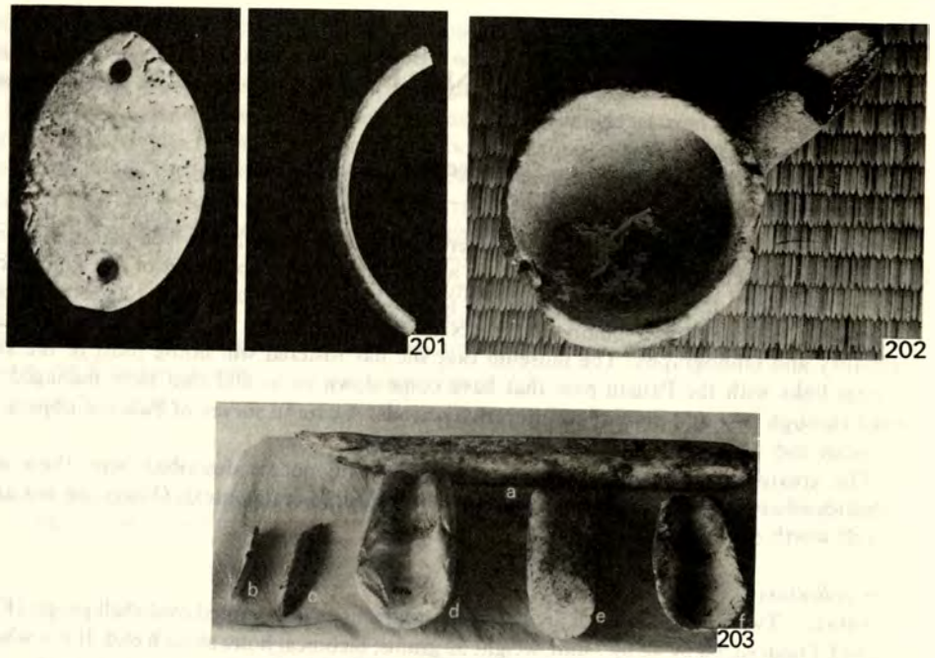


Fig. 201. Shell ornaments from the rock islands, Owen collection. Shell gorget 6.6 cm long and section of *Trochus* shell bracelet.

Fig. 202. Pottery lamp found on Ngurkthabel beach, top view. Bowl diameter 8.8 cm.

Fig. 203. Palau Museum shell artifacts. *a* (363) pestle; *b* (153) elongate shell object of unknown use; *c* (152) same, 4 inches (10 cm) long; *d* (156) gouge adze blade from Sonsorol; *e* (209) type 3? adze blade; *f* (213) gouge, Sonsorol. All items are of *Tridacna*.

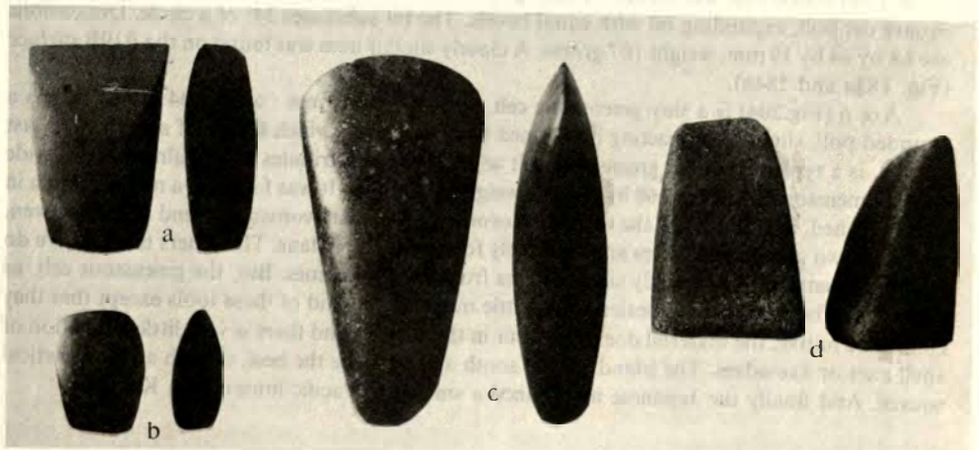


Fig. 204. Stone axe and adze blades, Owen collection. *a*, axe blade of felsite; *b* small greenstone celt, axe; *c* greenstone petaloid celt, axe; *d* gouge bit, andesite. Length of *c* 12 cm.

us to examine the artifact shortly before he left the islands. The lamp (Fig.203) is heavily smudged both inside and out; the paste is fine, lightly sherd and sand tempered, The rim is peculiar: it appeared to have been basically straight but to have been thickened by the addition of a band or fillet around the exterior (10 rim). Bowl diameter is 88 mm, depth 46 mm, the spout, damaged at the end was 58 to 60 mm long, 33 mm thick at the base and tapering.

Palau Museum collections

SHELL: The items illustrated are miscellaneous donations and the data concerning them are no better than my hurriedly done photographs. Palau Museum 153 and 152 (Fig. 202*b*, *c*) are shaped polished sticks of *Tridacna* shell, locally called sinkers. The first is 7.8 cm and the second 1.2 cm long. I do not know their use. The gouge-adze blades (Fig. 202*d*. PM 156, 15 cm long) and *f* (PM 213, 13.7 cm long) are both from Sonsorol. It has been commented before that I have not encountered this logical and it would seem necessary type in the Palaus. Both are *Tridacna*. Fig. 202*e* (PM 209, 15 cm long) shows a type 3 adze, or close thereto. It is a sturdy item. The *Tridacna* pestle in the background (*a*) is 39.7 cm long. Such things are no longer made; this is of course, also true of the shell adzes.

CERAMIC: Three bowls with painted designs are illustrated: Figure 205*a*, *b* shows the exterior and interior of bowl B; *c* and *d* the exterior and interior of bowl 13, *f*, bowl 18. Bowl 18, probably a serving plate, is painted on both exterior and interior, but as has been observed throughout the ceramic discussions, the interior is the better preserved and the only surface that recorded photographically. It is red on buff, roughly smoothed on both surfaces, diameter is 42.2 cm, depth 8.3 cm, thickness 1.6 cm. The rim is an incurving 02. The accompanying bowl 17 (Fig. 205 *e*) is 31.75 cm at the mouth, .95 cm thick, roughly finished. It is an incurving bowl with a straight rim. It is not decorated and the central nature of the destruction serves notice that the pot has been on a hot fire.

Bowl 13 is a large spectacular piece. It is slightly oval, diameters are 55.25 and 57.2 cm; the ear handles are 5.7 by 18.4 cm. One of the handles is double perforated, probably for suspension. Rim form is an 04 or an incurving 02; the painting on the exterior only is red on the red-buff clay. Figure 206 records our best efforts toward a reconstruction of the curvilinear loop design in red.

We lack measurements and other observations on bowl B. It has been thoroughly covered with a wide, straight line geometric design. Figure 207 shows a reconstruction of the design on the interior of the bowl as closely as could be interpreted from the slides. The exterior design is essentially the same except for the filling of the central square which appears to be more of a gridwork.

The discerning reader will note that the bowl photographs are not good. We used both black and white and color film and found that a black and white print of the color slide gave the best design definition.

Project collections

SHELL: A single adze blade, much like the double-beveled one from Tobi, was given us with the information that it came from the east coast of Babeldaob. The piece is very heavy, short and thick, 105 by 58 by 30 mm, weight 316 grams, made of the hinge area of *Tridacna gigas*. The poll is rounded but a large chip has been detached from it, following the parallel layers of the shell so that the edges of the poll were left sharper than is desirable. These have been flattened and rounded by pecking. The blade was thus somewhat longer originally. Cross section is planoconvex; the back is flat. Back bevel angle is low, 20° while the front bevel angle is 130°. Typologically it would be placed in type 7, although the bit is wide and has an asymmetrical slant down to the left.

An adze blade was presented to us by Adelbai of Ngarabeched, who was a long term

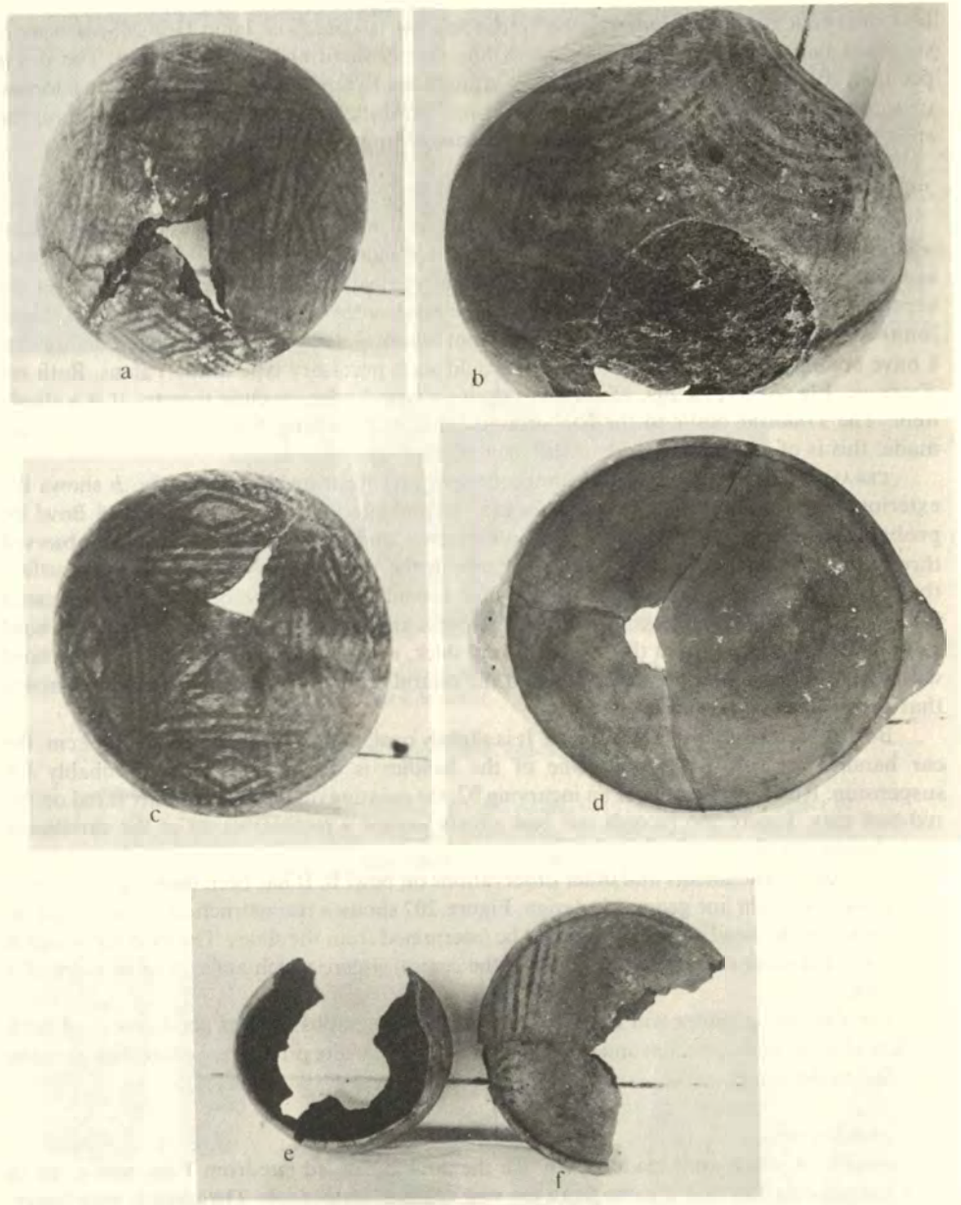


Fig. 205. Palau Museum bowls. *a, b*, exterior and interior of bowl B with painted design of red on red-buff; *c, d*, exterior and interior of bowl 13 with painted design on exterior only; *e* interior of bowl 17, and *f* interior of bowl 18.

employee of Robert Owen at the Trust Territory Entomology Laboratory and has been a friend of ours for many years. He stated that his family had had the item for a long time. It is not archaeological, shows none of the effects of soil and water. We can be sure that it has seen use;

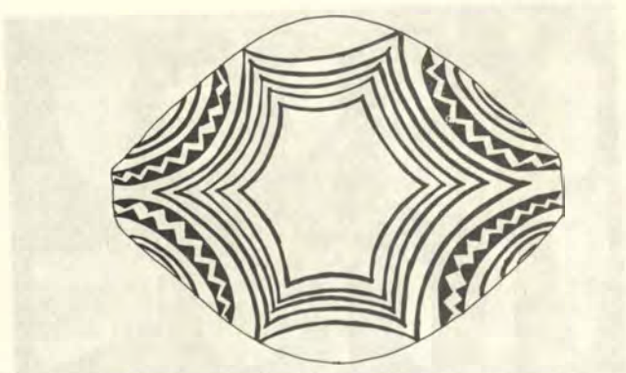


Fig. 206. Reconstruction of design on exterior of Palau Museum bowl 13.

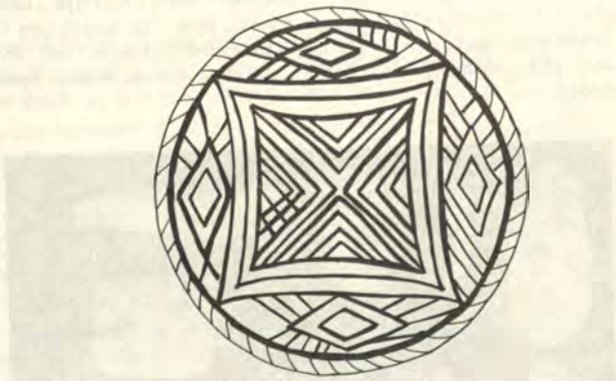


Fig. 207. Reconstruction of design on interior of Palau Museum bowl B.

there is a break, a chip, on each corner of the cutting edge. It is of *Tridacna gigas*, the back is relatively flat but the cross section is trianguloid; the front is a rib of the shell. The edge is relatively sharp. Dimensions are 97 by 51 by 27 mm; weight 186 grams. Back bevel angle is 25 , front bevel angle is 133°. I am sure that it is an ethnographic piece. Perhaps for this reason it is typologically uncertain. The greatest width is at the bit and the back bevel is moderately strong. These two characteristics are not typical of our type 7, which it resembles otherwise.

Aluptaciel 3. This site, Ngerenchol, is a favorite beach picnic place for local residents. It is recorded in the survey report (1966:444) and was revisited several times on this second trip. The inner limestone labyrinths back of the beach were explored for a short distance. A few sherds were found, but no evidence of permanent use. On the beach occured an unusual type 1, *Terebra* adze blade that merits recording (Fig. 208*f*). The piece is clean and shiny from sand wash and has retained some of the color of the original shell. All aspects are rounded by wear and it is not possible to be sure how well or where the bit was sharpened. The bit itself may be described as offset. It has been cut in on one side about half of the distance to the columella, thus decreasing the size of the cutting edge and making it more pointed. I believe this to be a specialized tool but cannot suggest a purpose other than wood carving. It is 75 by 28 by 14 mm and weighs 23 grams; the bevel angle is approximately 36°.

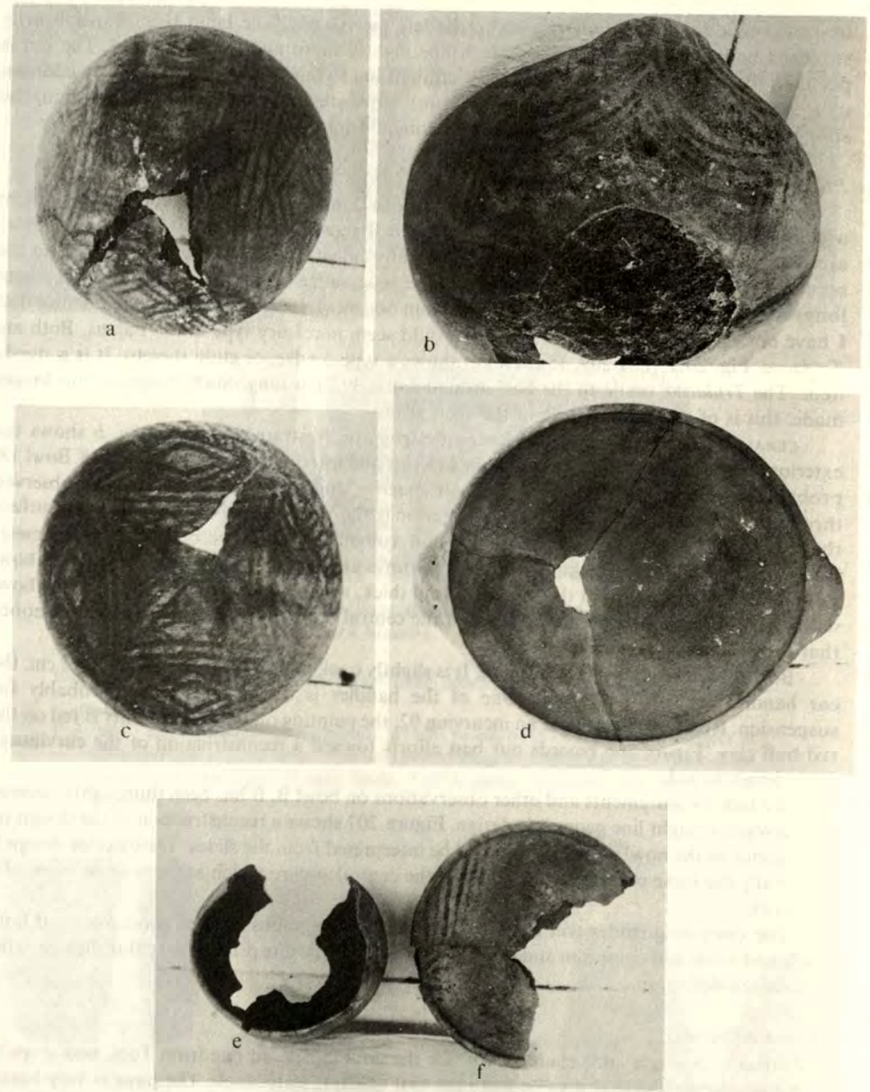


Fig. 205. Palau Museum bowls. *a, b*, exterior and interior of bowl B with painted design of red on red-buff; *c, d*, exterior and interior of bowl 13 with painted design on exterior only; *e* interior of bowl 17, and *f* interior of bowl 18.

employee of Robert Owen at the Trust Territory Entomology Laboratory and has been a friend of ours for many years. He stated that his family had had the item for a long time. It is not archaeological, shows none of the effects of soil and water. We can be sure that it has seen use;

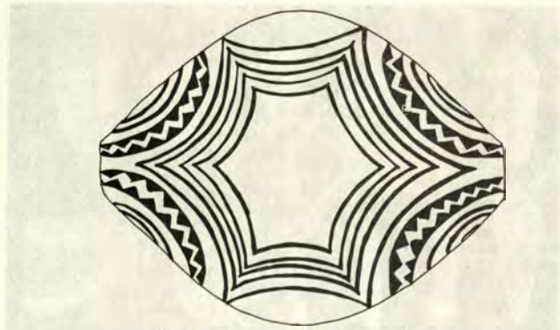


Fig. 206. Reconstruction of design on exterior of Palau Museum bowl 13.

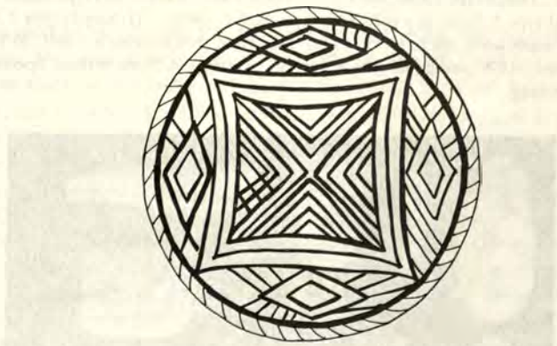


Fig. 207. Reconstruction of design on interior of Palau Museum bowl B.

there is a break, a chip, on each corner of the cutting edge. It is of *Tridacna gigas*, the back is relatively flat but the cross section is trianguloid; the front is a rib of the shell. The edge is relatively sharp. Dimensions are 97 by 51 by 27 mm; weight 186 grams. Back bevel angle is 25°, front bevel angle is 133°. I am sure that it is an ethnographic piece. Perhaps for this reason it is typologically uncertain. The greatest width is at the bit and the back bevel is moderately strong. These two characteristics are not typical of our type 7, which it resembles otherwise.

Aluptaciel 3. This site, Ngerenchol, is a favorite beach picnic place for local residents. It is recorded in the survey report (1966:444) and was revisited several times on this second trip. The inner limestone labyrinths back of the beach were explored for a short distance. A few sherds were found, but no evidence of permanent use. On the beach occured an unusual type 1, *Terebra* adze blade that merits recording (Fig. 208*f*). The piece is clean and shiny from sand wash and has retained some of the color of the original shell. All aspects are rounded by wear and it is not possible to be sure how well or where the bit was sharpened. The bit itself may be described as offset. It has been cut in on one side about half of the distance to the columella, thus decreasing the size of the cutting edge and making it more pointed. I believe this to be a specialized tool but cannot suggest a purpose other than wood carving. It is 75 by 28 by 14 mm and weighs 23 grams; the bevel angle is approximately 36°.

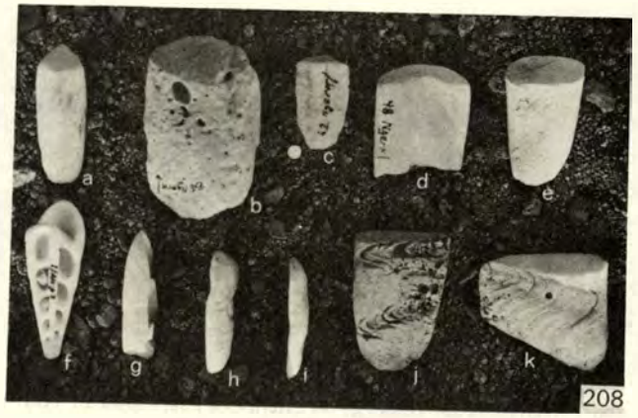


Fig. 208. Shell artifacts from Ngerekeklau 1, Aluptaciel 3 and Ngurkthabel 1. *a*, (79/ Ngerk 1) small type 2 adze, back; *b* (85/) type 2 adze, back; *c* 62/) type 2 adze verging toward type 3, back; *d, e* (48/, 64/) type 3 adzes, back; *f* (1/Alup3) type 1 *Terebra* adze, beach worn, back; *g* (73/) type 1 side view, poll broken; *h, i* (66/, 36/) type 4, side view; *j* (1/Ngurkthabel 1) type 4 front; *k* (6/) type 4, front, broken. Specimen *e* is 62 mm long.

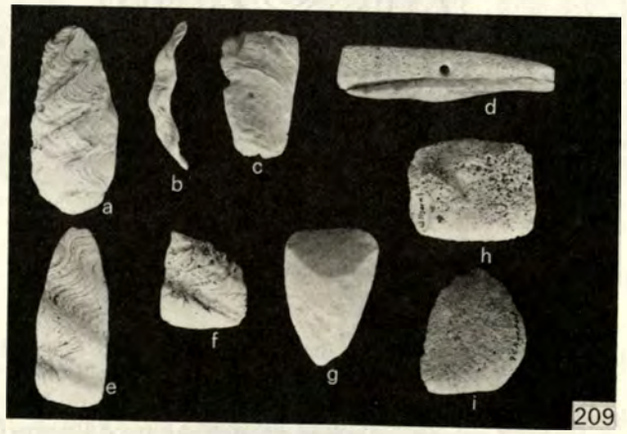


Fig. 209. Shell artifacts Ngerekeklau and unknown provenience. *a* (58/) type 5 adze blade blank, front; *b* (60/) type 5 adze blade blank, edge; *c* (50/) adze blade blank, probably type 4, front; *d* (unknown provenience) unique shell artifact, see text; *e* (11/) type 5 blank, front, bit end down; *f* (9/) type 5, front, broken; *g* (46/) type 7 blade, front, bit up; *h* (61/) shell hammer; *i* (95/) percussion derived andesite boulder flake. Length of *h*, 80 mm.

Ngurkthabel 1 A, B, C. A single type 4 adze blade was given me. The description of the area where it was found is that of the sites indicated (1966: 421-427). The item is typical although the sides are rather more parallel, and hence the poll less sharp than they are on most of this type. Dimensions are 65 by 44 by 7 mm, weight is 38 grams, bevel angle 134°. It is a surface find. The adze is made of the wall section of a *Tridacna maxima* (Fig. 208*j*).

An object of unknown use is made of *Tridacna gigas* shell, hinge area (Fig. 209*d*). It is a

Fig. 210. Shell artifacts, Ngerekeklau 1. *a* (57/) shell flake, probably adze blank; *b* (88/) tridacna shell knife, edge view; *c* (2/) type 6 bit, side view; *d* (1/) type 6 adze blade, bit only, front; *e* (7/) *Cassis* shell chisel. Length of *e*, 8.7 cm.

tapering well-shaped block of shell, the natural structure of the shell is partly ground away. Ends are squared. Two conical holes are drilled to the same depth, 9 mm in from each side. The object is 19 mm thick at the center where the holes are. It would appear that complete perforation was not intended. Length is 134 mm, width 32 and thickness 21 mm at the larger end and 16 and 11 mm at the smaller. Weight is 152 grams. The object carries a slight red staining, hence it was found on one of the volcanic islands with red laterite soil.

The last to be discussed is a shell tool collection, mostly adze blades from the island of Ngerekeklau (Osborne 1966:297–299). This small bit of land is littered with the evidences of occupation. These range from the archaeological to modern stone pig pens. Monoliths, walkways and a rather large number of unusual sherds led to the suggestion in the survey report that the island may have been a local social and ceremonial retreat. After the last trip there I am inclined to doubt this.

In November 1968 my two daughters and I were in Ngerechelong, northern Babeldaob where I was excavating B18, and they were making botanical and shell collections. I had wanted to visit Ngerekeklau again and we were taken there by Mr. David Imes, Peace Corps Volunteer in his outboard powered boat. He was then in northern Babeldaob on a fisheries project. Another PCV, Gene Helfman accompanied us. We spent the better part of two days and one night on the little island, staying with an elderly man of Yapese derivation who was copra gathering. We combed the island, not for the ubiquitous potsherds but for shell tools, and found 93 whole and fragmentary. All of these were surface items but two which were found on the west beach of the island where the waves were cutting into a midden exposure some 1.2 m deep (76/Ngerk 1, type 2, beaked adze, and 6/Ngerk 1, type 4, triangular). They obviously cannot be assumed to have been surface material. On the other hand, there would be no reasonability in an assumption that surface items from any part of the site were all of the same, presumably late, age. We therefore treat the collection as a unit.

Ngerekeklau is one of the several lovely little virtually uninhabited islands, laden with pertinent archaeology, that cause yearning in the heart of the confirmed excavator. Someone, sometime will do delightful and valuable work there.

The adze blade collection will be described in the manner previously employed.

Terebra blades, type 1 were not the most numerous. There are only 12, all but 2 are broken in some degree; generally the polls are missing. Catalog numbers are 67/, 69/, 75/Ngerk 1 unbroken; and 68/, 70/, 71/, 72/, 73/ (Fig. 208*g*), 76/, 77/, 78/, all broken.

Lengths: range 66–90 mm (78/ and 68/ projected); average 77 mm, 7 specimens. Widths

taken at the origin of the bevel, range from 24 to 41 mm, median 30, mode 29–31, average 31 mm, 12 specimens. Thickness taken at the same place, ranges from 12 to 22 mm, median 15, mode 15, average 15; 12 specimens. Weights for the 5 specimens (extrapolated for 68/ and 78/) are 13, 21, 27, 29, 39 grams; average 26 grams. Angles of the bevel are all taken with the horizontal projection of the back. Range is 25° to 62°; median of 50°, mode 50–53°, average 46°; 12 specimens.

Beaked adze blades, type 2 found at Ngerekeklau 1 are 62/, 79/ (Fig. 208*a*), 80/, 81/, 84/ (? bit broken), 85/ (Fig. 208*b*, 87/ Ngerk 1). Seven apecimens. All are of *Tridacna*, probably *T. gigas*. Lengths range from 44 to 105 mm, median 85, mode 85–86 mm, average 81.5; 6 specimens. Widths range from 22 to 51 mm, median 33, mode 33–34, average 33; 6 specimcns. Thickness ranges from 7 to 41 mm, median 23, mode 22–23, average 22 mm; 6 specimens. Weight ranges from 11 to 270 grams, median 99, mode 99–102, average 131 grams; 5 specimens. Angle of the bevel ranges from 44° to 63°; median 51°, mode 51–52, average 52°; 6 specimens.

One of these blades, the tiny 62/ is of the kind that trends toward intermediacy between type 2 and the following type 3. As the illustration shows (Fig. 208*c*) the two ground surfaces on the front which join with the major back bevel to complete the triangular outline of the working bit of a beaked adze, are low and slightly rounding. The result is a bit which approximates that of the next type 3.

Type 3 bits are gouge cutters with a deep back bevel and rounded cutting edge much like the bevels and edges of the *Terebra* type 1 bits. The blades are of *Tridacna*. normally the hinge area, but in two instances in this collection (19/, and 48/) are made of the walls of the shells. The latter (Fig. 208*d*) is broken so that length and weight cannot be measured. Catalog numbers are 19/, 48/, 63/, 64/ (Fig. 208*e*), 65/Ngerk 1.

Lengths are 45, 61, 64 and 85 mm; average is 64. Widths range from 31 to 42 mm, median 35, average 36 mm; 5 specimens. Thickness ranges from 8 to 19 mm, median 11, average 13; 5 specimens. Weights are 28, 30, 64, 80 grams; average 51. Angles of the bevel range from 39° to 55°; median is 41°, average 51°; 5 specimens. In general the steeper angles are on shorter heavier specimens and the lower angles are on the thinner, flatter ones.

Type 4 triangular blades are always made of the walls of the *Tridacna*, usually *Tridacna maxima* shells. They are short and broad. The objects are nicely finished; the major bevels are all front (Fig. 208*j*). There are 24 whole or only slightly broken specimens. The breaks usually involve the loss of a part of the relatively fragile pointed poll. Catalog numbers are 17/, 18/, 20/, 21/, 22/, 24/, 26/, 29/, 30/–35/, 37/–45/, 66 (Fig.208*h*). Five blades have been badly broken approximately midway so that lengths cannot be taken; catalog numbers are 6/ (Fig.208*k*), 8/, 23/, 25/, and 36/ (Fig.208*i*). We have one unfinished blade in the collection. It has been roughed out by percussion. One edge appears to have been ground, but poll, surfaces, bit and the other edge show no finishing (50/, Fig.209*c*). Catalog number 24/ appears to have never had the bit ground. There is no evidence of bevel. It was either not completed or the cutting edge was badly broken and not resharpened. It is reasonable to assume that the grinding and sharpening of the bit would be the final task in adze-blade manufacture. Most of these blades show grinding on the inner surface of the shell, the back of the piece. Fourteen of the 26 finished bits have this interior grinding, giving them a minor back bevel, or an asymmetrical double bevel. All with the interior back bevel also have a ground facet on the back of the poll, suggesting nearly flat grinding of the whole piece, probably as a final sharpening. No doubt these and type 5 are together the usual all purpose, light to medium duty adze blades.

Lengths range from 50 to 84 mm, median is 63, mode is 63–4, average 66 mm, 25 specimens. Widths are available on all specimens. They range from 28 to 58 mm, median is 42, mode 42–44 (11 specimens), average 42; 30 specimens. Thickness ranges 5 to 12 mm, median is 7, mode is 7–8 mm (16 specimens), average is 7.5; 29 specimens. Weight ranges from 20 to 60 grams, median 32, mode 30–31 (3 specimens) and 35–36 (4 specimens), average 35; 24

specimens. Angle of the bevel ranges from 117° to 152°, median 128°, mode 128–130 (6 specimens), average 129°; 26 specimens.

This is a strongly consistent form of blade although one item (66/, Fig.208*h*) is a variant. It is thick, elongate, rather oval in cross section, as are the type 3 blades, but the bevel is as it should be for a type 4.

Type 5 is a larger adze blade than the type 4. It too has as the back the interior of the shell, the major bevel is on the front, and there is evidence of a partial interior (back) bevel and of grinding on the back (interior of shell) of the poll. These attributes all demonstrate inter-type continuity, an aspect of the shell blades that has received prior comment. Differences from the type 4 blades are largely in size, as can be seen by comparing lengths, the much greater curvature (a function of the length) and the lesser tendency toward triangular outlines. More usually the outline is elongate, relatively narrow triangular, with slightly excurvate sides and a more pointed poll than the type 4 blade has. These long curved blades are fragile. We collected 18 specimens. Of these two (58/, 60/, Fig.209*a, b)* are certainly blanks and 2 more, broken, probably are (51/ 54/). Lengths and widths of the whole blanks appear with the measurements of the finished specimens. Catalog numbers 13/, 14/, 15/, 16/, 52/, 53/ and 56/ are all poll fragments. There are 3 bit fragments, 7/, 9/ (Fig.209*f)*, 27/, and only 5 whole blades, 10/, 11/ (Fig.209*e)*, 12/, 28/, and 101/Ngerk 1. Of these 101/ is a variant; although badly eroded its major bevel springs from the back. Only one blade (11/) is whole and exhibits all of the attributes of its type. The several facts of length, thinness, that they all are made from *Tridacna maxima* walls, and the curvature, unite to have caused much breakage. Like all adze blades, the bits are often battered. Four of the five whole blades show this. We assume that the last stages of use of many of these artifacts was as a hammer, perhaps on the percussion roughout of a piece of shell that was to become the replacement blade. Length ranges from 76 to 128 mm, median 108, average 102; 7 specimens. Widths are taken at the proximal edge of the major bevel, these are often less than the greatest width of a blade, which, because of the excurvate sides, may be central. The range is from 40 to 59 mm, median 44 mm, average 46 mm; 8 specimens. Thicknesses available are 5, 8, 8, 8 mm; average 7. Weight can be given for 11/ only: 68 grams. Angle of the bevel is measurable on 4 specimens: 133°, 140°, 141°, 155°, average 142°.

Type 6 blades from this collection are no more satisfactory for descriptive purposes than were those from Angaur. Fragments of only 4 were found. All are probably bits although I must confess that 2 of the 4 specimens could well be ground and shaped polls of unusually heavy type 4 or 5 blades. This possibility is small now, enough of the artifacts have been handled so that type 4 or 5 blades of this kind should have been observed if they existed. Catalog numbers of these bits are 1/, 2/, 3/, 5/Ngerk 1. One (1/ Fig.210*d)* is heavy and thick and was made from the hinge section of *Tridacna gigas;* the others are from shell walls, moderately heavy. Bits are sharply rounded, almost pointed. The major bevel on 3 of them (1/, 3/, 5/) is from the front, although the back bevel is strong. But, the bevels of the bit of 2/ (Fig.210*c)* are approximately equal. This bit, then, is the same as that of an axe. This leads to the suggestion that these tools were either splitting adzes or were actually axes, or were wedges. The kind of breakage illustrated by our limited collection (all are snapped off close to the origins of the bevels) not only indicates heavy usage, but also suggests twisting or prying such as occurs when splitting is done. Lengths, not available. Widths are 32, 32, 33, 37 mm, average 33.5. Thicknesses are 7, 9, 11, 13 mm, average 10 mm. Weights not available. Angles of the bevel are taken of the top bevel as with types 4 and 5: 146°, 156°, 158°, 160°, average 155.

Type 7 adze blades are apparently always rare. There are two, 46/ (Fig.209g) and 47/ in this group. They are heavy, chunky objects with top bevels. 46/ lacks part of its poll, which no doubt emphasizes its unusual triangular shape. The lengths are estimated at 91, 112 mm, average 101. Widths 58, 63 mm, average 60. Thicknesses 24, 27 mm, average 25. Weights are

Table 37. Miscellaneous artifacts, Ngerekeklau 1.

Cat. No.	Object	Illustration	Material	L × W × Th (in mm)	Weight (grams)	Cross section lgth, transv.	Comments
88/	shell knife	Fig. 210*b*	*T. maxima*	56 × 38 × 5	16	rectanguloid-wedge	lunate or ulu shape
89/	shell knife		*T. maxima*	58 × 29 × 4	11	rectanguloid-wedge	lunate or ulu shape
90/	shell knife		*T. maxima*	— × 37 × 5	—	? wedge	lunate or ulu shape
61/	shell hammer	Fig. 209*h*	*T. gigas*	76 × 63 × 28	226	plano-convex	roughed out by percussion
91/			*T. gigas*	— × 42 × 35	—	— rounded	
92/	shell hammer		*T. gigas*	— × 43 × 37	—	— rounded	
59/	adze blank		*T. gigas* wall	106 × 69 × 17	156	concavo-convex	percussion rough probably for type 4 or 5 adze blade
49/	adze blank frag.		*T. gigas* wall	— × 43 × 18	—	wedge-oval	
55/	shell flake		*T. gigas* wall	68 × 32 × 10	—	plano-convex	one ground facet. from broken adze
57/	shell flake	Fig. 210*a*	*T. gigas* wall	73 × 32 × 16	—	plano convex wedge	percussion flake, shows platform and bulb
87/	chisel	Fig. 210*e*	parietal callus of *Cassis cornuta*	87 × 21 × 9	41	concavo-convex	poll slightly battered. equal bevel of ca 30°
96/	hammerstone?		chalcedony	66 × 49 × 36	126	oval oval	one end abraded
95/	flake	Fig. 209*i*	andesite	79 × 62 × 19	111	double convex	percussion flake
94/	pestle, food masher		andesite	150 × 69 × 60	785	conical	same as Ang 19 pestle girdled 50 mm from distal end, shallow. distal end broken

189, 329 grams, average 259.

The remaining artifacts in this collection can be most efficiently presented and apprehended in tabulation (Table 37).

There are a few comments that should be added to the comments in the table. The shell knives made of *Tridacna maxima* were no doubt used in the same manner as those made of the *Conus* shells. They must have been held in the hand like a small lunate or ulu. Pearl oyster shells and handleless ulus of metal are still in occasional use. These *Tridacna* knives, because of the conformation of the ribs of the shell are, when sharpened, hollow ground in cross section. This form of blade should have been superior to that of the cone shell knives. None of the latter was found on Ngerekeklau.

Both the shell and andesite flakes show the required structure of a flake detached by percussion. The platform of the stone flake is crumbled. The latter, indeed could have been accidentally struck from an andesite hammer or pestle that was doing unaccustomed duty. I am still unsure that the stone pestles were not used as hafted hammers. The presence of the girdling groove suggests hafting. But then, the conical shape suggests the opposite.

Sherds were not collected on Ngerekeklau on this trip. One sherd, 99/Ngerk 1, had been worked to the usual near circular shape of the typical "counter". It is redware, 50 by 49 by 9 mm.

Reference Cited

Osborne, Douglas. 1966. The archaeology of the Palau Islands: an intensive survey. Bernic P. Bishop Museum Bulletin 230.

APPENDIX 4

The Aulong 4 Pictographs

Lynn Gregory and D. Osborne

Introduction (Osborne)

This site appears to have been photographed extensively since 1954 but the adequate recording that Osborne called for after the survey visit (1966: 400–402) has not yet been achieved, although it has been approximated. Certainly the two most productive records were made by Dr. Robert McKnight during his period in Palau and by the Osbornes and Toribiong in early June 1969. McKnight made his record, color 35 mm transparencies, available for this study. The 1969 record together with McKnight's photographs was adequate but the lack of time prevented either of the photographers from measurement and mapping the gallery. It was possible to reconstruct sizes and relationships fairly well, but a near exact reproduction and a keyed reconstruction of the more decayed pictographs do not yet exist.

The method used to enter the rockshelter, previously recommended, was the use of a ladder to span the wave-cut notch and then a sharp climb up the cliff. Fortunately the cliff is heavily vegetated and an interlacing of roots covers it. Ascent is not as difficult as it might appear to be. Even here, however, the omnipresent Aulong chiggers gratefully accepted the presence of interlopers.

The following data do not depend on a properly executed recording of the rock paintings. The overhang wall and ceilings should have been superficially gridded and each grid area suitably recorded photographically and by sketching. To have done the task properly would have required more time and equipment than were available. We therefore in 1969 contented ourselves with five 35 mm cameras with different types of color film and a single camera loaded with black-and-white film. It is of interest to note that the two which yielded the most useful results in color were the least costly—a Kodak Instamatic and an Olympus Pen half frame.

Desctiption and Interpretation (Gregory)

The rock art found in Palau is of interest historically because it does not reflect a recognizable stylistic affinity to any known ethnographic art in the area. It was felt, consequently, that a comparative study of art styles in the Oceanic area might contribute to our present knowledge of the prehistory of the Palaus. There are six known sites of prehistoric rock art activity throughout the Palau group, all of which are similar geographically and whose art is similar stylistically. The following is an attempt to determine a possible origin for the style of one of these sites-that of Aulong 4 (for further information concerning the other five see McKnight 1964; Schmidt 1974). My map of the pictograph display worked out primarily from color photographs, appears as Figure 211.

In order to determine the most likely geographic area from which the style of the Aulong 4 pictographs originated, it was first necessary to make a comparative study of Oceanic art in general. My method of comparison was largely inductive. The first step involved perusing the available literature, particularly publications containing illustrations of Oceanic and southeast Asian art. Some 60 such publications were investigated but only 17 of these proved fruitful. From the 17, a sample of 77 designs was chosen on the basis of an impressionistic stylistic similarity to the Palauan art. All of these designs were found to be either Melanesian or Indonesian in origin.

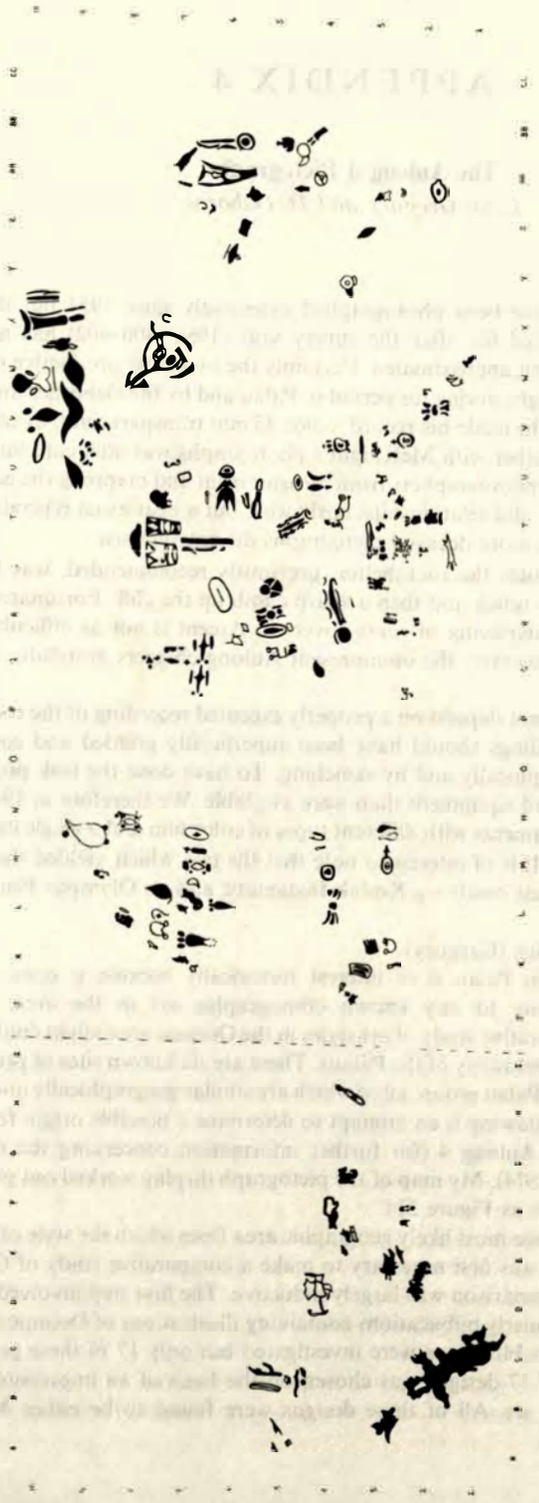


Fig. 211. Map of pictographs, Aulong 4 gallery, compiled from all available photographs. Relative positions, sizes and outlines are all approximate. The total red paint area is about 66 feet (20 m) long; very roughly the spaces between adjacent letters represents two feet (60 cm) and between numerals one foot (30 cm). Pictograph M-6 is 7–8 inches (18 to 20 cm) long. Groupings may not be trusted; they tend to illustrate a group as it appeared in slide or photo.

The second step was to compare the art styles within potentially quantifiable frames of reference. Three kinds of variables were found to be fruitful ones in this respect: design elements, organizational factors, and overall design similarities.

The design element proved to be much less satisfactory as a singular variable of comparison than the organizational factor. Only two distinctive design elements found at Aulong were repeated at all frequently at other locations. These are illustrated in Figures 212 and 213. Four organizational styles found among the Aulong 4 series were compared with those of the sample in figures 214–217. Figure 218 compares overall design similarities of the individual designs.

Design element: Four-pointed star. (Fig. 212).

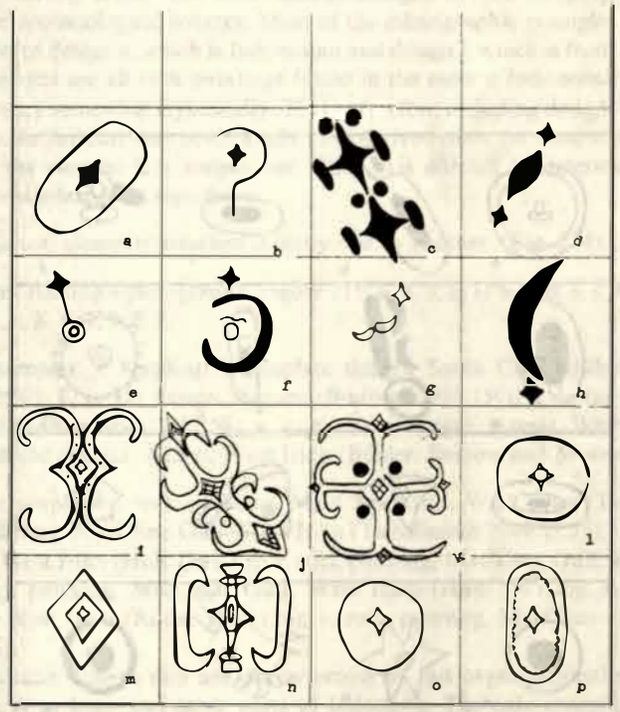


Fig. 212. Aulong 4 pictograph comparison: design element four-pointed star.

Sources of designs: Aulong 4 pictographs, Figure 211 *a*, M 6; *b*, L 7; *c*, Q 6–7; *d*, Q 7; *e*, T 3-4; *f*, U-V 2; *g*, R 3; *h*, U 4. Ethnographic examples: *i*, jacket design, Borneo (Bodrogi 1959: 150); *j*, barkcloth decoration, Celebes (Hough 1932: pl. 2); *k*, barkcloth decoration, Celebes (Hough 1932: pl. 6); *l*, dance costume decoration, Trobriand islands (Chauvet 1930:53); *m*, carved door frame design, New Caledonia (Guiart 1963:255); *n*, vase design, Admiralty islands (Leenhardt 1950:71); *o*, cult house figure, lower Sepik, New Guinea (Bühler, Barrow and Mountford 1962:56); *p*, shield-shaped plaque, middle Sepik, New Guinea (Santa Barbara Museum of Art 1964:15).

The four-pointed star element is repeated frequently throughout the Aulong 4 series. It is also fairly common among Melanesian and Indonesian designs. It is interesting to note, however, that all of these are from ethnographic sources. No archaeological designs outside of

the Palau area could be found with this characteristic.

Designs *i, j* and *k* are Indonesian in origin. Like most ethnographic designs from the Indonesian area, these are more finished in appearance than the Aulong pictographs. Designs *j* and *k* are of particular interest in that both are characterized by a central design flanked by small circles. This organization also characterizes Aulong design *o* and a number of other pictographs found at Aulong 4 site.

Designs *l* to *p* are all Melanesian. Simpler than the Indonesian ones, they are generally more like the Palau paintings. A variation is found in designs *l* and *n* which are characterized by small circles enclosed in the four-pointed star element, a feature that is not found among the Aulong pictographs.

Design element: circle within a circle. (Fig. 213).

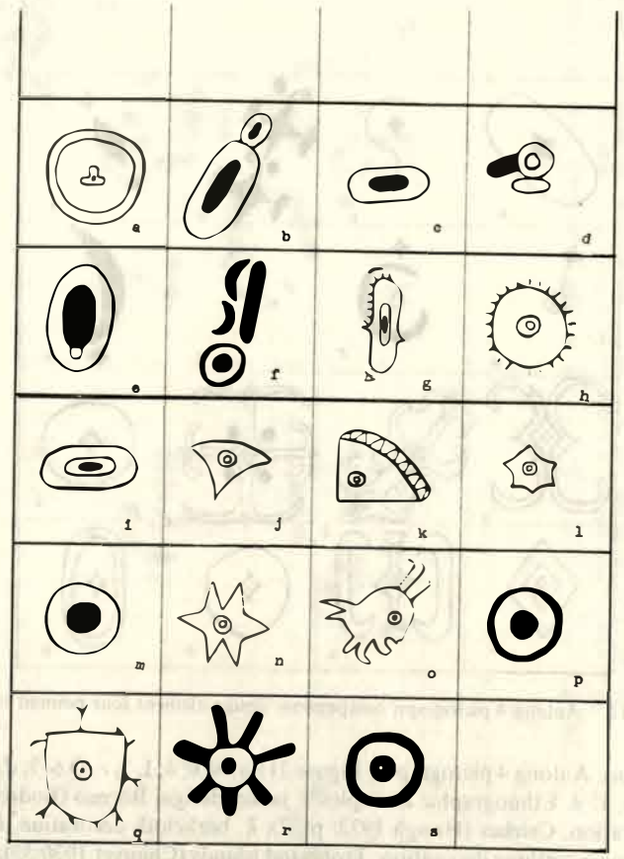


Fig. 213. Aulong 4 pictograph comparison: design element circle within a circle.

Sources of designs: Aulong 4 pictographs, Figure 211: *a*, L-M 4; *b*, H 3–4; *c*, U 4–5; *d*, Y 3–4; *e*, R 5; *f*, AA 6.

Ethnographic examples: *g*, dance costume decoration, Trobriand islands (Chauvet 1930:53); *h*, motive incised on bamboo stick, New Britain (Guiart 1963:289); *i*, spatula handle design, Massim, Papua (Firth 1936:57); *j*, tobacco pipe design, Vailala River, New Guinea (Firth 1936:66); *k*, tobacco pipe design, Vailala River, New Guinea (Firth 1936:66); *l*, loin cloth design, Lake Sentani, West Irian (Guiart 1963:90); *m*, wooden shield design, Papuan gulf (Bühler, Barrow and Mountford 1962:95); *n*, textile design, east Sumba (Adams 1969:201).

Archaeological examples: *o*, rock painting, Kei islands (Van Heekeren 1957:108); *p*, rock painting, MacCluer Gulf, West Irian (Röder 1959:109); *q*, rock painting, MacCluer Gulf, West Irian (Röder 1959:153); *r*, rock painting, MacCluer Gulf, West Irian (Röder 1959:94); *s*, rock painting, Tala, Ceram (Röder 1938:22).

The circle within a circle or oval within an oval element is another that is found commonly throughout the Aulong series. The non-Palauan designs in this category are from both ethnographic and archaeological sources. Most of the ethnographic examples are Melanesian with the exception of design *n*, which is Indonesian and design *l*, which is from West Irian. The archaeological designs are all rock paintings found in the eastern Indonesian area.

The designs vary somewhat stylistically. There are a few, including designs *b, c, e, f, i, m, p,* and *s*, that are so similar that they could easily have derived from the same style tradition. On the other hand, the element is a simple one. Thus it is difficult to determine whether the existence of these similarities is significant.

Organizational factor: elements attached directly one to another. (Fig. 214).

Sources of designs: Aulong 4 pictographs, Figure 211: *a*, K 3; *b*, U 6; *c*, R 3; *d*, U-V 3; *e*, W 1; *f*, T-U 2; *g*, S-T 2; *h*, K 6–7; *i*, E 3.

Ethnographic examples: *j*, KapKap breastplate design, Santa Cruz (Bühler, Barrow and Mountford 1962:50); *k*, jacket design, Borneo (Bodrogi 1959:150); *l, m*, tapa designs, Lake Sentani, West Irian (Rousseau 1951:56); *n, o, p*, shield designs, Asmat, West Irian (Wingert 1965:219); *q, r*, shield designs, Asmat, West Irian (Bühler, Barrow and Mountford 1962:113).

Archaeological examples: *s*, rock painting, MacCluer Gulf, West Irian (Tichelmann 1944: pl.35); *t*, rock painting, MacCluer Gulf, West Irian (Tichelmann 1944: pl.25); *u*, rock painting, MacCluer Gulf, West Irian (Holt 1967:13); *v*, rock painting, MacCluer Gulf, West Irian (Holt 1967:12); *w*, rock painting, MacCluer Gulf, West Irian (Holt 1967:20); *x*, rock painting, MacCluer Gulf, West Irian (Röder 1959:126); *y*, rock painting, MacCluer Gulf, West Irian (Röder 1959:135).

The non-Palauan designs that are characterized by this organizational style are almost exclusively from West Irian and other parts of Indonesia. The only exception is design *j*, a breastplate design from Santa Cruz in Melanesia. It appears to depict a human and resembles particularly in the style of the head(s) the only known human representation found at Aulong, T 6. Other ethnographic examples, designs *k*, to *r*, although not identical to any particular Palauan pictographcs, have enough design elements in common with them to blend in easily at the Aulong 4 site.

Organizational factor: Elements attached to string-like motives. (Fig. 215).

Sources of designs: Aulong 4 pictographs, Figure 211: *a*, M 8–9; *b*, K 3; *c*, M-N 4; *d*, P-Q 2–3; *e*, T 3–4; *f*, V-W 3; *g*, W 1–2; *h*, U 6–7.

Ethnographic examples: *i*, divining book design, Sumatra (Albright Art Gallery 1948:91); *j*, textile design, east Sumba (Adams 1969:200); *k*, textile design, east Sumba (Adams 1969:200); *l*, tapa design, Lake Sentani, West Irian (Rousseau 1951:56); *m, n, o*, canoe prow designs, Minika Avea, West Irian (Guiart 1963:207).

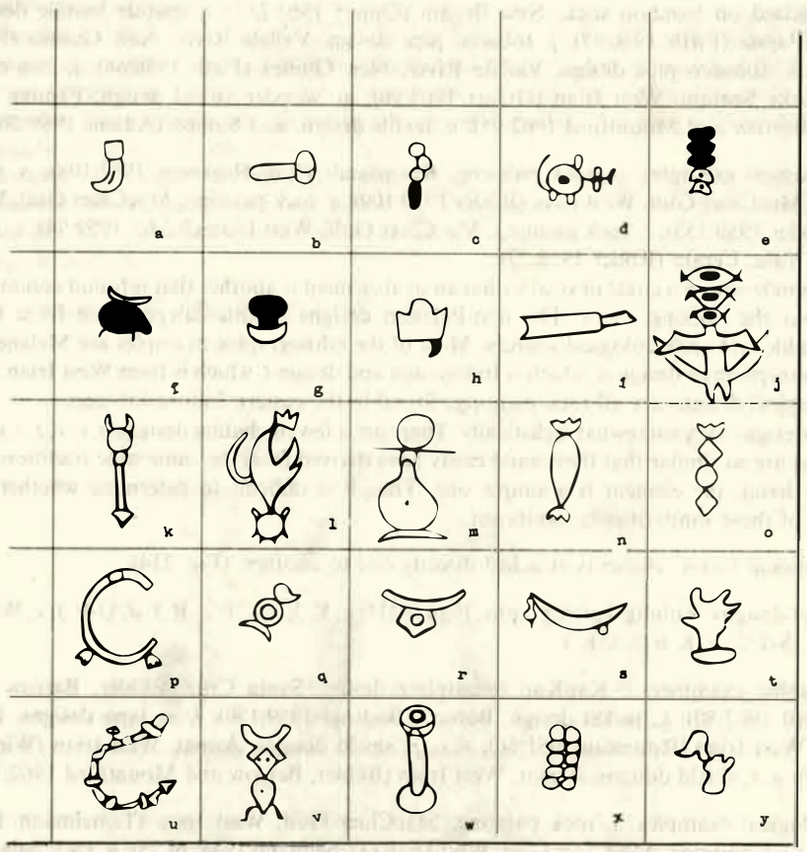


Fig. 214. Aulong 4 pictograph comparison: organizational factor elements attached directly one to another.

Archaeological examples: *p*, rock painting, MacCluer Gulf, West Irian (Tichelmann 1944: pl.35); *q*, rock painting, MacCluer Gulf, West Irian (Tichelmann 1944: pl.12); *r*, rock painting, MacCluer Gulf, West Irian (Röder 1959:108); *s, t*, rock paintings, MacCluer Gulf, West Irain (Röder 1959:126); *u, w, x, y*, rock paintings, MacCluer Gulf, West Irian (Röder 1959:139); *v*, rock painting, MacCluer Gulf, West Irian (Röder 1959:138); *z*, rock painting, MacCluer Gulf, West Irian (Röder 1959:153); *aa*, rock painting, MacCluer Gulf, West Irian (Röder 1959:152); *bb*, rock painting, Seleman Bay, Ceram (Röder 1938:25).

Another organizational factor found frequently throughout the Aulong series, this characteristic is also common among ethnographic and, particularly, archaeological designs found in West Irian and other parts of Indonesia. The three ethnographic designs from Indonesia, designs *i, j, k*, are more finished in appearance than the others yet contain other elements in common with the Aulong group, including the circle within a circle element. Design *l*, contains the four-pointed star element. Those of the sample which are most similar to the Palauan in style, designs *p-bb*, are again found among the eastern Indonesian rock art series.

Fig. 215. Aulong 4 pictograph comparison: organizational factor—elements attached to string-like motives.

Organizational factor: Elements enclosed within a larger shape. (Fig. 216).

Sources of designs: Aulong 4 pictographs, Figure 211: *a*, V 3-4; *b*, S-T 2-3; *c*, S-T 7-8; *d*, T 7-8; *e*, AA 4; *f*, K 3-4; *g*, R 6; *h*, U 3.

Ethnographic examples: *i*, design, Indonesia (Allbright Art Gallery 1948:66); *j*, shield design, Asmat, West Irian (Guiart 1963:107); *k*, Jipae funerary mask design, Asmat, West Irian (Guiart 1963:66); *l*, dance shield design, Trobriand Islands (Bühler, Barrow and Mountford 1962:101).

Fig. 216. Aulong 4 pictograph comparison: organizational factor—elements enclosed within a larger shape.

Archaeological examples: *m*, rock painting, MacCluer Gulf, West Irian (Tichelmann 1944: pl.19); *n*, rock painting, MacCluer Gulf, West Irian (Röder 1959:142); *o*, rock painting, MacCluer Gulf, West Irian (Holt 1967:13); *p*, rock painting, MacCluer Gulf, West Irian (Tichelmann 1944: pl.21); *q*, rock painting, Tala, Ceram (Röder 1938:22); *r*, rock painting, MacCluer Gulf, West Irian (Röder 1959:109); *s*, rock painting, MacCluer Gulf, West Irian (Röder 1959:157).

This factor is one of the more difficult to use for comparison because the designs are rather diverse. There are a few, however, which compare quite nicely. Design *l*, was chosen for its fine-lined characteristic, a feature atypical of most Palauan rock art, but characteristic of Aulong 4, design *b*. Another design represented by Palauan designs *f*, *g*, and *h*, is similar to a rock painting found in Ceram, design *q*. Although simple, this oval with a line enclosed was not found to have occurred elsewhere in literature. A third similarity was found between Aulong design *e*, and the MacCluer Gulf pictograph, *r*. Finally, the element enclosed in the MacCluer Gulf pictograph illustrated by *s* is much like that of design *b*.

Organizational factor: elements grouped together, but not attached. (Fig. 217).

Fig. 217. Aulong 4 pictograph comparisons organizational factor—elements grouped together but not attached.

Sources of designs, Aulong 4 pictographs, Figure 211: *a*, F 2; *b*, J 4; *c*, V 8–9; *d*, U-V 9–10; *e*, T 3–4; *f*, R 2; *g*, K 8; *h*, S-T 5–6–7; *i*, L 3–4; *j*, V 1–2; *k*, S-T 3; *l*, R 5; *m*, S 5; *n*, T 4–5; *o*, R-S 3-4.

Ethnographic examples: *p*, Jipae funerary mask design, Asmat, West Irian (Guiart 1963:68); *q*, shield design, West Irian (Firth 1936:97).

Archaeological examples: *r*, rock painting, Kei Isiands (Van Heekeren 1957:108); *s*, rock painting, Maccluer Gulf, West Irian (Röder 1959:127).

While this organizational pattern is probably the most common at Aulong 4, it does not appear to be at all common elsewhere in the literature cited. I was able to find only 4 designs with this characteristic. The first, *p*, a design from a funerary mask found among the Asmat. Although the individual elements are enclosed, I included the design in this category because they are so like the smaller groups of designs found at Aulong 4 such as *a*, *c*, *e*, *f*. This is particularly so of the half moon and small circle elements. Design *q*, a shield design from West Irian compares nicely with Aulong design *d*, particularly in the nose element. Designs *r* and *s*,

both eastern Indonesian rock paintings, are enough like the Aulong style to blend in at that site without notice. It is important to note, however, that the larger pictographs with this type of organization do not appear to be duplicated elsewhere. Such designs as *i, j, k* and *l* which appear to depict insects or paw prints, are unique to Aulong. Others, such as *n* and *o* have been interpreted by some to represent "maps" of the surrounding rock islands (McKnight 1964:26).

Overall Design Similarities. (Fig. 218).

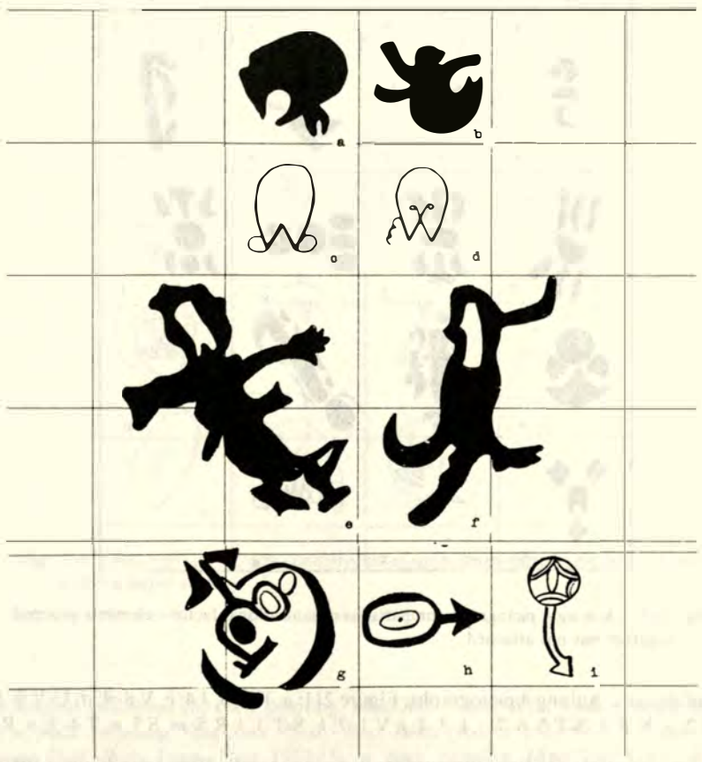


Fig. 218. Aulong 4 pictograph--overall design similarities.

Sources of designs: Aulong 4 pictographs, Figure 211: *a*, T-U 7; *c*, K-L 7; *e*, B-D 1; *g*, W 7; *h*, M 3.

Archaeological examples: *b*, rock painting, MacCluer Gulf, West Irian (Holt 1967:14); *d*, rock painting, MacCluer Gulf, West Irian (Tichelmann 1944: pl.51); *f*, rock painting, MacCluer Gulf, West Irian (Tichelmann 1944: pl.35); *i*, rock painting, MacCluer Gulf, West Irian (Holt 1967:12).

This last group of designs is a comparison of overall design similarities, thus accounting for their placement in relation to one another. The designs on the left side of the series are

Aulong 4 pictographs, while those to the right are sample designs. Designs *a* and *b* both appear to depict some kind of sea creature as evidenced by their common claw-like appendages. The next Aulong 4 pictograph in the series, *c*, has been the subject of varying interpretation. Mine is somewhat different from that of McKnight (1964:27, pl.20). His, which coincides with that of Frieda Osborne, both of whom sketched the design at the rock shelter itself, may be more accurate. A black and white photo also agrees with them. However, perhaps due to erosion or lighting, all of the pictographs of that particular section led me to the same interpretation. If this is valid, the shape of *c* compares nicely with that of *d*, a pictograph from the MacCluer rock shelter series. Another Aulong pictograph which may be in question is *e*. It was taken from a section of the wall that did not photograph well; it may be significant to mention here that the chart of the Aulong pictographs (Fig. 211) was developed before I began to search through the literature for comparable designs. Again, as it has been interpreted, this design looks very much like *f*, a "dancing figure" depicted on a MacCluer Gulf rock painting. And finally, designs *g, h* and *i* are presented here for their similarity in principle: the circular shape enclosing a number of smaller elements and appended by an arrow-like attachment.

Tables38--41 on the following pages are designed to reflect the similarities of each non-Palauan design to the Aulong style in terms of the three variables according to which they were compared in Figures 212–218. Each non-Palauan design has been rated according to the variables of design element and organizational factor similarity; the total of the individual rates will reflect the overall design similarity of each individual design. Values were assigned in the following manner: Variable I: design element (quantitative).

0—has no design elements in common with the Aulong pictographs.

1—has one design element in common with Aulong pictographs.

2—has more than one design element in common with Aulong pictographs.

Variable II: organizational factor (qualitative).

0—design elements are not organized like elements of Aulong pictographs.

1—design elements are organized similarly to those of Aulong but are not exactly like any single pictograph found there.

2—design elements are organized like those at Aulong and the overall similarity is great. Thus, any one design could rate a total of 0, 1, 2, 3, or 4 with 4 being the ultimate measure of comparison. As has been noted above, the design element variable is quantitative because any single design will either have none, one, or more elements in common with the Aulong pictographs. On the other hand, the organizational factor, or qualitative variable rates must necessarily be determined subjectively.

The designs are grouped according to two factors, geographic area and whether they are archaeological or ethnographic. They are divided into three geographic areas: Melanesia, including all designs found in New Guinea and the Melanesian islands to the east and south of New Guinea; eastern Indonesia, including designs found in West Irian and the Indonesian islands of Kei and Ceram; and western Indonesia, including all of the designs found in Indonesia with the exception of the areas included in the preceding category. Only one of these areas is represented by archaeological designs, that of eastern Indonesia. This does not mean that other archaeological art was not considered in determining what designs would be included in the sample. Archaeological materials from both Melanesia and Indonesia were dealt with in the first step described above, but none observed appeared to be similar enough to the Aulong pictographs to be included in the sample.

In order to determine which geographical area produced the most similar style to the Palauan, I have applied simple statistical tests of central tendency to the data. The arithmetic mean was first calculated for each variable to determine whether one or the other was more significant to the design's overall design similarity. Then, means were calculated for the totals in order to determine which geographical area produced the most similar designs to those found

Table 38. Melanesian Designs—Ethnographic.

Design	Variable I	Variable II	Total
Fig. 212*l*	2	1	3
m	1	1	2
n	2	0	2
o	2	2	4
p	2	1	3
Fig. 213*g*	1	1	2
h	2	1	3
i	2	1	3
j	1	1	2
k	1	0	1
m	2	2	4
Fig. 214*j*	1	2	3
Fig. 216*l*	1	1	2
Total	20	14	34
Mean	1.54	1.08	2.62

Table 39. Eastern Indonesian Designs—Ethnographic

Design	Variable I	Variable II	Total
Fig. 213*l*	1	1	2
Fig. 214*l*	2	1	3
m	2	2	4
n	1	1	2
o	2	2	4
p	1	1	2
q	2	2	4
r	1	1	2
Fig. 215*l*	2	1	3
m	1	1	2
n	2	2	4
o	1	2	3
Fig. 216*j*	1	1	2
k	2	1	3
Fig. 217*p*	2	1	3
q	1	2	3
Total	24	22	46
Mean	1.50	1.38	2.88

at Aulong. Because the sample was chosen with no attempt to obtain equal numbers of designs for each category, the numbers in each vary. It was felt, however, that the determination of the mean would nullify this error and would be the most reasonable statistical device for the purpose of comparison.

The data are presented in Tables 38 to 41. Each design is represented by a number and a letter referring to its placement in the figures. Variable I refers to the design element variable; variable II refers to the organizational factor variable and the total refers to the total of the two variables or overall design similarity.

A review of the results of the tests indicates that the eastern Indonesian archaeological art

Table 40. Eastern Indonesia Designs—Archaeological.

Design	Variable I	Variable II	Total
Fig. 213*o*	1	1	2
p	2	2	4
q	1	1	2
r	2	2	4
s	2	2	4
Fig. 214*s*	2	2	4
t	1	2	3
u	2	1	3
v	2	2	4
w	2	1	3
x	1	2	3
y	2	2	4
Fig. 215*p*	2	2	4
q	2	2	4
r	2	2	4
s	2	1	3
t	2	1	3
u	2	1	3
v	2	2	4
w	2	2	4
x	2	2	4
y	2	2	4
z	1	1	2
aa	2	1	3
bb	2	2	4
Fig. 216*m*	2	1	3
n	2	1	3
o	2	1	3
p	2	2	4
q	2	2	4
r	2	2	4
s	2	1	3
Fig. 217*r*	2	2	4
s	1	2	3
Fig. 218*b*	2	2	4
d	2	2	4
f	2	2	4
i	2	2	4
Total	70	63	133
Mean	1.84	1.65	3.5

style is most similar of the four to that of the Aulong 4 series. This is true, not only with respect to overall design similarity, but also for the design element and organizational factor variables. The second highest means indicating overall design similarity and organizational factor similarity were scored by the ethnographic style of the eastern Indonesian area. The means scored by the western Indonesian and Melanesian ethnographic styles were quite similar for all three variables.

In all cases the means scored for the design element variables were higher than those for the organizational factor variables. This would lead one to suspect that design elements were

Table 41. Western Indonesian Designs—Ethnographic.

Design (Figure)	Variable I	Variable II	Total
212*i*	1	1	2
j	2	1	3
k	2	1	3
213*n*	1	1	2
214*K*	2	2	4
215*i*	2	1	3
j	1	1	2
k	1	1	2
216*i*	1	1	2
Total	13	10	23
Mean	1.44	1.11	2.55

more important to overall design similarity than organizational factors. However, inspection of the designs makes it clear that common design elements in and of themselves, do not indicate overall design similarity. Although certainly necessary for comparison, unless they are combined with common organizational factors, they can be used to create very different motives. For this reason I feel that the clue to overall design similarity lies primarily with the organization of the elements.

Edward Sapir (1916) lays out the conditions under which cultural associations between traits, elements and complexes can be determined. Some of these which may be relevant to this study are that: the firmer traits are attached to a complex, the older they are; elaborateness denotes age; and the more frequently a given elements is found in association with others, the more likely it is to be older (Sapir 1916: 404–409).

Substituting the design element concept for Sapir's element or trait, and overall design similarity for his complex, we come to the following conclusions. Individual design elements that are not associated with organizational factors in such a way as to denote overall design similarity are not as close in time or space to the cultural concepts that determined their original meaning as elements that are found in such conditions.

If this is so, and we assume that the original home of the Palauan rock art style was prehistoric eastern Indonesia, then it would be reasonable to conclude that the design elements could have diffused over time and space as far as western Indonesia and Melanesia and in the process lost or altered their original meanings, which would explain why they are no longer found in their original organizational contexts. On the other hand, the relatively high means scored for organizational factor similarity among the ethnographic style of the eastern Indonesian area can be explained as the result of a continuity of cultural tradition. In this case, less drastic changes in meaning would have been likely to have occurred over time.

The implications of this line of thinking for the Palauan style's origin are obvious. The overall design similarity and organizational faetors remained intact as the Indonesian style was diffused to the Palaus. This would indicate that they were transferred over space, but not over time. In other words, it is very likely that the Palauan art was produced by people who had recently migrated to the Palaus from the home area of the art style in question, eastern Indonesia. It is unfortunate, in view of these indications of relationships that we have no firm dating at either end. Both, of course, are long pre-contact.

Discussion (Osborne)

This is the second paper that is devoted to the red rock paintings of the Palau Islands.

McKnight (1964) describes and portrays paintings from six localities, including Aulong 4, his Olechukl lars Ulong.

The quality and character of the paintings differ from site to site. Those of Aulong appear to be rather more cursive and impressionistic than do some or most of the others, where there are numerous figures which are not difficult to place within a known category. Hands, masks, dancers, human figures, canoes etc. can all be recognized. Such an exercise is practically impossible at Aulong where pure design or symbolic design was the order.

On the other hand there may readily be noted similarities between Aulong 4 and other pictographs, as these appear in McKnight's report; the shield symbol of McKnight (page 20) and Gregory's 7–8. The quality of her S-T 2 (Fig. 211) and McKnight's plate 6 are easily noted examples. In this connection our own illustration (Osborne 1966: Fig. 109D) taken from the same site but from a black and white photograph, should be consulted. It shows the same kinds of figures and outlines of the two upper elements in McKnight's plate 6, but lacks the remainder. We are certainly not seeing a deer-like figure as McKnight suggests, but the same cross-like figure that appears in the ST2 area and in McKnight's plate 19. Figure 219 is a drawing from all usable photographs of the Aluptaciel pictograph (McKnight's pl. 6, my Fig. 109D). There appear to have been 3 perhaps 4 interconnected cross-like figures. Below them, to the left (not right as the caption of 109D states) is McKnight's deer like figure. This I would say is a boat, canoe. Probably it is a soul boat or death canoe (see Spiegel, 1971). It is not possible to be sure, without revisiting the site, to know if the boat and crosses are part of a single presentation.

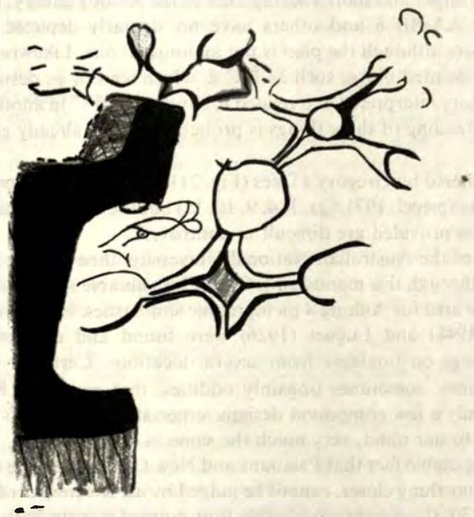


Fig. 219. Aluptaciel 1 pictograph: "crosses" and soul boat?

It is obvious that the trait of pictography in red, English red as the German writers called it, was at one time rather important in the central section of the Palaus from the latitude of Aulong north to southern Babeldaob. The trait does not appear to have been functional during the time of exterior contact since the later 1700's; nor are the design elements or motifs

themselves discernable in latterday artwork. Actually I know of only two items in all of the Palau craft that I have seen that in any way remind one of the Aulong pictographs. These are archaeological and ceramic. Figure 115 *a* (B37) is a stamped human stick figure, apparently one of a series and *e* (Fig. 115) is another stamp decorated sherd. Both are more Aulong-like than modern, and there my comments must end. The reader should refer to the folding illustrations in Krämer 1929: Band V, Abt. X.

The question of the proper delineation of these red painted pictographs on the scaling Miocene coralline limestone walls of a once drowned solution cavern, is a major problem. For example, Osborne (1966: 402, fig. 106 upper left) illustrates the group displayed in Figure 211 J-M 7, this paper. The delineations published in 1966 were worked out using the black and white negatives. The figure section is printed upside down. Other than that, the differences are immediately visible. The same is true of the upper right group, also upside down, which appears in this report as AA-BB 5–7. Careful examination of the illustrations in McKnight (1964: pl. 14–20) shows similar differences. It is of special interest that the human figure (Fig. 211 U 5–6) appears in the McKnight plate 14 (upper right) without a head. It was drawn in the same manner in 1969 by my daughter Frieda, who sketched several of the outstanding pictographs. She too did not see the head. Gregory working with all our color photographs was able to add the head which showed quite clearly, in a manner congruent with the remaining unit. There can be no doubt that the Aulong and other red pictographs should be carefully studied by skilled personnel at the site, who have time and adequate equipment. In this way only can individual and instrumental variances be mitigated and an approximation of the truth attained.

It seems surprising that there are no designs recorded from elsewhere than the Palaus that are like several of the larger and more striking ones of the Aulong gallery. For example, Figure 211 M-N 9, S-T 7, AA-BB 6 and others have no similarly depicted qualitative stylistic organizations elsewhere although the plan is not an unusual one. Likewise it is not possible to comment on the red painted blobs, such as B-C 2, which we saw as destroyed larger painted areas but which Gregory interpreted and related to similar "blobs" in another area. The answer to the proper understanding of these things is probably the one already given: they should be studied further.

I am further bothered by Gregory's faces (Fig. 211, U-W 10). I had previously interpreted them as death canoes (Spiegel, 1971 figs. 1, 4, 9, 10, 12) but the reconstruction and comparative data that Gregory has provided are difficult to controvert.

Pater Bellwood of the Australian National University, then visiting at the University of Hawaii, kindly read through this manuscript. One of his valuable suggestions was that we look at the New Caledonia area for Aulong 4 pictographic similarities. He offered four references of which two, Oriol (1948) and Luguet (1926) were found and examined. Oriol describes petroglyphs, engravings on boulders from several locations. Certainly there is a flavor of similarity, bold outlines, sometimes ungainly oddities, that recall the Palauan red-painted designs. There are truly a few compound designs, especially from Oriol's sites Nekraoua and Rierrghene that are, to our mind, very much the same as some Palauan. Whether or not this results from the indisputable fact that Palauans and New Caledonians are ultimately culturally related, or signifies something closer, cannot be judged by us. References of especial interest are Oriol's figures 6, 29, 30; the almost world-wide four pointed star (in New Caledonia a central cross and one or two cruciform outlines). The Palauan variations appear in our Figure 212. The only other similarity is the short straight line enclosed by an oval or elipse (our Figure 211, S8; Fig. 216*g*). Oriol illustrates these from Nekraoua in his figures 7, 15, 16.

Luguet's 1926 report is the more ambitious or, at least, my notes are more full. His designs, too, are petroglyphs and I am dubious that it is methodologically correct to compare petroglyphs and pictographs, at least in the gross manner that I am doing here. Gregory's more detailed approach is obviously far superior. The four pointed star (Figs. 211, N7; G7, 8; V3) is

seen throughout the New Caledonia material, specifically Luguet's figures 132, page 79 and 235, page 138. The complex Palauan design (Fig. 211, T3) which may be an elaboration of the star, is suggested by a number of the Melanesian petroglyphs (see Figs. 173, 181, 209, 230). Masks or faces (Fig. 211 V, W, X-9, 10) resemble but do not approach identity with such items as are illustrated in Luguet's figures 189 and 277. Butterfly shaped figures (Fig. 211 L4; S, T3) are organized somewhat like the petroglyph shown in figure 144, page 84. All of these and others are suggestive and of interest but any phrasing of cultural-historical relationships would be of less value than the above comparisons. There are enough data, in this and other aspects of the cultural record, to suggest old Palauan-eastern Melanesian relationships. Those are possibly enough to support a useful exploration of such an hypothesis.

References Cited

Adams, Marie Jeanne. 1969. System and meaning in East Sumba textile design: a study in traditional Indonesian art. Cultural report series 16. Southeast Asia studies, Yale University.

Albright Art Gallery. 1948. Indonesian Art. Asia Institute Gallery Press, New York.

Bodrogi, Tibor. 1959. Oceanian Art. Athenaeum Printing House, Budapest.

Bühler, Alfred, Terry Barrow, and Charles P. Mountford. 1962. The Art of the South Sea Islands. Crown Publishers, New York.

Chauvet, Stephan. 1930. Les Arts indigenes en Nouvelle-Guinee. Societe D. editions geographiques-maritimes et colonies, Paris.

Firth, Raymond. 1936. Art and life in New Guinea. Studio Publications, New York.

Guiart, Jean. 1963. The Arts of the South Pacific. C. S. Golden Press, New York.

Holt, Claire. 1967. Art in Indonesia. Cornell University Press, Ithaca.

Hough, Walter. 1932. The buffalo motive in middle Celebes decorative design. Proc. U.S. Nat. Museum 79 (29): 1–8.

Krämer, A. 1929. Palau. *In* G. Thilenius (ed.), Ergebnisse der Südsee-Expedition II, B, 3, v, x: Baiverseichnis. Friederichsen & Co., Hamburg.

Leenhardt, Maurice. 1950. Folk Art of Oceania. Les Editions du Cheme, New York.

Luguet, Georges Henri. 1926. L'Art Neo-caledonien. Institut d'ethnologie, Paris.

McKnight, Robert K. 1964. Orachl's drawings. Micronesian working papers I. Literature Production Center, Saipan.

Oriol, T. 1948. Decouvertes Recentes de Sites petroglyphique en Novelle Caledonie. Etudes melanesiennes, Noumea.

Osborne, Douglas. 1966. The Archaeology of the Palau Islands. Bernice P. Bishop Museum Bulletin 230.

Rõder, Josef. 1938. Felsbilder auf Ceram. Paideuma 1: 19–28.

———. 1959. Felsbilder und Vorgeschichte des MacCluer Golfes West Neuguinea. L. C. Wittig Verlag, Darmstad.

Rousseau, Madeleine. 1951. L'Art Oceanien; sa presence. Paris APAM.

Santa Barbara Museum of Art. 1946–1965. Arts of New Guinea. Santa Barbara Museum of Art, Santa Barbara.

Sapir, Edward. 1916. Time Perspective in Aboriginal American Culture, a study in method. *In* D. Mandelbaum (ed.), Selected Writings of Edward Sapir. University of California Press, Berkeley.

Schmidt, Lynn Woodworth. 1974. An Investigation into the origin of a prehistoric Palauan rock art style. M.A. thesis, California State University, Long Beach.

Spiegel, H. 1971. Soul Boats in Melanesia, a study in Diffusion. Archaeology and Physical Anthropology in Oceania 6 (1): 34–43.

Tichelmann, G. L. 1944. Nieuw-Guineesch Oerkunst. Uitgevery W. Van Hoeve, Deventer.

Van Heekeren, H. R. 1957. The Stone age of Indonesia. S-Gravenhage-Martimus Nijhoff.

Wingert, Paul S. 1965. Primitive art, its traditions and styles. World Publishing Co., Cleveland.

APPENDIX 5

Human Skeletal Materal from sites Angaur 19, Pelilieu 1 and Babeldaob 19A

Catherine Anderson

Introduction

Skeletal fragments consisting of parts of 26 individuals were recovered from four sites on four islands in the Palau group: Pelilieu 1 (Fig. 16), Angaur 19 (Fig. 11), Aulong 1, and Babeldaob 19A. The collection was sent to Washington University for analysis. Dr. Stephen Molnar had accepted responsibility for the study; he offered it to me as a research problem and I gratefully accepted.

Five numbered burials came from Angaur 19 but fragments of additional individuals were recovered from two other excavation units and from one of the numbered burials. A total of eight individuals was identified; all are fragmentary and in poor condition.

Pelilieu 1 bones, possibly due to drainage into the shell midden from an adjacent hill, were extremely fragile. Five numbered burials were recovered. Several of the burials included fragments of more than one individual and fragments of another from an additional excavation unit make a total of eleven individuals identified at Pelilieu 1.

Skeletal remains at site Babeldaob 19A were encountered in two stone platforms at the site. Human bone was recovered from two trenches and a number of additional excavation units in platform A. Fragments of six individuals were identified. A grave was located in Platform B but the skeletal material was too fragile to permit recovery.

A few human bones were taken from the midden beach sand at Aulong 1. Although the bones were identified, no accurate assessment could be made of the number of individuals represented.

Thus a total of 26 individuals or fragments of individuals have been identified including the Platform B burial from Babeldaob. The fragility of the collection resulted in further breakage during shipment; every attempt was made to keep handling to a minimum and cleaning was done only when detailed inspection made it necessary.

The osteological report of the Palau collection will be divided into two main parts. Part one will present a description of pertinent demographic and cultural factors including interment patterns, age and sex groups, nutritional factors and pathological conditions. The second part of the report will describe the genetic structure of the population represented in the sample. This description will include metrical and nonmetrical data for both the skeleton and the dentition.

Although metrical information was recorded where possible, the fragmentary nature of the remains did not yield sufficient data to enable comparisons to be made with other collections. Most of the information reported for the Palau sample, therefore, consists of a description of morphological characteristics variously called discontinuous, nonmetrical traits (Brothwell, 1965:93) and/or epigenetic traits (Berry, 1967). Like metrical data, variations in the occurrence of these characteristics have been used to suggest genetic likeness or difference within and between samples of human skeletal remains. Because many nonmetrical traits can be detected from fragmentary parts of the skeleton and the dentition, they provide a particularly promising source of data in extremely fragmentary collections such as the Palau sample. The dentition is particularly useful in this respect; teeth will be preserved long after

Table 42. Population distribution and interment patterns.

Site	Burial	Surface Depth *	Indiv	Age Group	Age/Yrs.	Sex	Type of Burial	Position	Orientation
Pelilieu 1	1	3.0	A	Adult	45+	Male	Extended	On Back	Head NE NE-SW
Pelilieu 1	2	2.5	A	Child	8–13	?	Extended	On Back	Head NW NW-SE
Pelilieu 1	2		B	Adult	?	?	?	?	?
Pelilieu 1	3	2.5	A	Adult	?	Male	Extended	On Back	Head NW NW-SE
Pelilieu 1	4	2.5	A	Adult	45+	?	Extended	?	?
Pelilieu 1	4		B	Child	8	?	?	?	?
Pelilieu 1	4		C	Child	8	?	?	?	?
Pelilieu 1	5	2.5	A	Old Adult	50+	Male	Extended	On Back	Nead NW NW-SE
Pelilieu 1	5		B	Child	10–12	?	?	?	?
Pelilieu 1	159**		A	Adult	?	?	?	?	?
Pelilieu 1	159**		B	Child	5	?	?	?	?
Total			11						
Angaur 19	1	1.8	A	Adult	?	?	Flexed	?	Head N N-S
Angaur 19	2	2.0	A	Adult	?	Male	?	Face Down	N-S
Angaur 19	2	3.0	B	Young Adult	15+	?	?	?	?
Angaur 19	3	3.0	A	Adult	40+	?	Flexed on Left Side	On Side	Head S N-S
Angaur 19	4	2.2	A	Adult	45+	?	Flexed on Rt. Side	On Side	N-S
Angaur 19	5	2.3	A	Adult	25–30	Male	Extended On Left Side	On Back	Head NE NE-SW
Angaur 19	76**	1.3	A	Adult	?	?	?	?	?
Angaur 19	82**	2.0	A	Adult	?	?	?	?	?
Total			8						
Babeldaob 19A									
Platform A	Trench 1								
"	FS3		A	Old Adult	?	?	?	?	?
"	"		B	Adult	?	?	?	?	?
"	"		C	Adult	?	?	?	?	?
"	Trench 1								
	FS9		A	Adult	?	?	?	?	?
"	Circle 2		A	Adult	?	?	?	?	?
"	Trench 2		A	Adult	?	?	?	?	?
Platform B	1		A	Adult	?	?	Extended	?	N-S
Total			7						
Total Sample			26						

* Surface depth measured in feet and tenths.

** Catalog numbers, misc. human bone.

other parts of the skeleton have decayed.

Part One: Demographic and Cultural Factors

Population Distribution

The distribution of the sample by age, sex and interment patterns is summarized on Table 42 by site. Each numbered burial, individual skeleton or parts of skeletons have been differentiated with a capital letter. Wherever possible age in years is given as well as overall age group. Age groupings are as follows: Old adult 50+, Adult 21–50, Young adult 15–21, Child 1–15. The interment pattern is summarized according to type of burial, flexed; position of the body within the grave; general compass direction of the body.

Nineteen of the 26 individuals or 73% of the sample are adults. The individual age, determined largely from endocranial suture closure (McKern, 1957:19–37), could be assessed in only six instances. Of these six, five are over forty years of age. Seven out of the 26, or 27%, are children or young adults ranging from age 5–15. Age assessment of this group was made on the basis of dental eruption (Brothwell, 1965:59). The material was too fragmentary to determine sex accurately. Assessment, where made, was based primarily on overall appearance of rugged, well developed musculature and fragmentary portions of the sciatic of the pelvis.

Two patterns or types of interment are suggested in the sample.One is an extended position, on the back, oriented in a N.E.-S.W. or N.W.-S.E. compass direction. The second is a flexed position, on the side, oriented N.-S. The adult burials at Pelilieu 1 are extended; all but one of the Angaur burials are flexed. The exception at Angaur conforms to the Pelilieu pattern. A variant of the pattern at Pelilieu is seen at platform B at Babeldaob where the compass direction is N.-S.

The subsistence economy of the Micronesians is tropical agriculture and fishing. The type of diet and methods of food preparation available to the individuals represented in this sample do not appear to have contributed significantly to occlusal or incisal surface wear of the teeth.

The degree of wear was minimal within the sample. It is summarized by site in Table 43. The wear exhibited in the incisors and canines is grouped in the rows initialed I; in the rows initialed M, the bicuspids and the molar wear appears. The columns summarize the range of wear exhibited in the specified tooth group. Tooth wear for each tooth in the sample was described according to criteria established by Molnar (1970). The first column describes a range from no apparent loss of enamel to minimal facets in which flattened areas of enamel can be observed on the occlusal surface of the teeth. Teeth described in the second column exhibit minimal facets of wear, one of which has progressed through the enamel and into the second layer of the tooth, the dentine. The third column describes teeth in which several such dentinal patches are apparent. Teeth in column four have been sufficiently worn that the enamel of the occlusal surface is nearly obliterated. Those in the fifth column exhibit complete enamel obliteration, revealing an occlusal surface of dentine ringed with enamel.

As the table indicates, wear in most of the teeth in the sample ranges from unworn to minimal wear facets or wear to the extent that dentinal patches are evident. In only two instances have the dentinal patches coalesced completely or in part. In one instance, Pelilieu Burial 4A, the age of the individual has been assessed as 45+ on the basis of skull suture closure. In the second instance, the Babeldaob burial was too fragmentary to permit aging.

The prehistoric Palauans chewed betel nut. The teeth of the adults exhibit the red-brown stain that results from this practice.

Pathological conditions

The examples of degenerative change occurring with age are summarized by site in Table 44. The table includes the degree of osteoarthritic lipping occurring in the skeletal material and

Table 43. Degree of tooth wear

Site	Burial	Teeth	1 Unworn-minimal wear facets	2 Minimal facets-one dentinal area	3 Sev. dentinal patches-no coalescing	4 Coalescing	5 Complete coalescence
Pelilieu 1	1A	I	X				
		M			X		
	2A	I	X				
		M	X				
	2B	M		X			
	3A	M			X		
	4A	I			X		
		M					X
	4B	I	X				
		M	X				
	4C	I	X				
		M	X				
	5B	I	X				
		M	X				
	159B	M	X				
Angaur 19	3A	I	X				
		M	X				
	5A	I		X			
		M		X			
	82	I		X			
		M		X			
Babeldaob 19A Platform A	Trench 1 FS3	I		X			
		M				X	
	Trench 1 FS9	I	X				
		M	X				

the degree of calculus formation on the teeth and alveolar resorption. Skeletal remains have been grouped in the table according to the joint involved. Under elbow, for example, the degree represents a summary of osteoarthritic lipping occurring at the distal portion of the humerus and the proximal portion of the radius and ulna. No severe arthritic lipping was apparent. Slight to moderate lipping is illustrated by the vertebrae from B.1 of Pelilieu (Fig. 220*a*). Calculus formation and alveolar resorption vary in degree from slight to medium as defined by Brothwell (1965:150).

In Pelilieu B.5 and B.4, both older adults, other degenerative changes were observed. Examples of reactive bone in areas of muscle attachment are found in several of the bones in B.5: the phalanges, a proximal metatarsal, the left and right ulna, the left and right olecranon fossa of the humerus. Such areas of reactive involvement were not observed in any other bones in the sample. In B.4, the inferior articulating surface of the atlas is badly compressed and exhibits moderate to severe lipping (Fig. 220*b*).

Table 44. Pathological conditions.

Site	Burial	Osteoarthritis: Head	Vertebrae	Sternum	Elbow	Hip	Knee	Hands & Feet	Alveolar Resorption	Calculus Formation
Pelilieu 1	1A	moderate	slight moderate	slight				slight	medium	medium
	2A	none	none	none	none	none	none	none	none	none
	2B							none	slight	medium
	3A	slight moderate				slight		slight	none	slight
	4A	slight moderate	moderate	slight	none			slight	medium	medium
	4B								none	none
	4C								none	none
	5A	slight	moderate	slight moderate	slight moderate	slight moderate	slight	moderate		
	5B								none	none
	159A/			none				none		
	159B/								none	none
Angaur 19	1A							slight		
	3A									medium
	4A		slight					none		
	5A		slight		slight	slight		slight	slight	slight
	76/	none								
	82/								none	slight
Babeldaob 19A	Trench 1 FS3									
	B									slight
	Trench A FS9								none	none

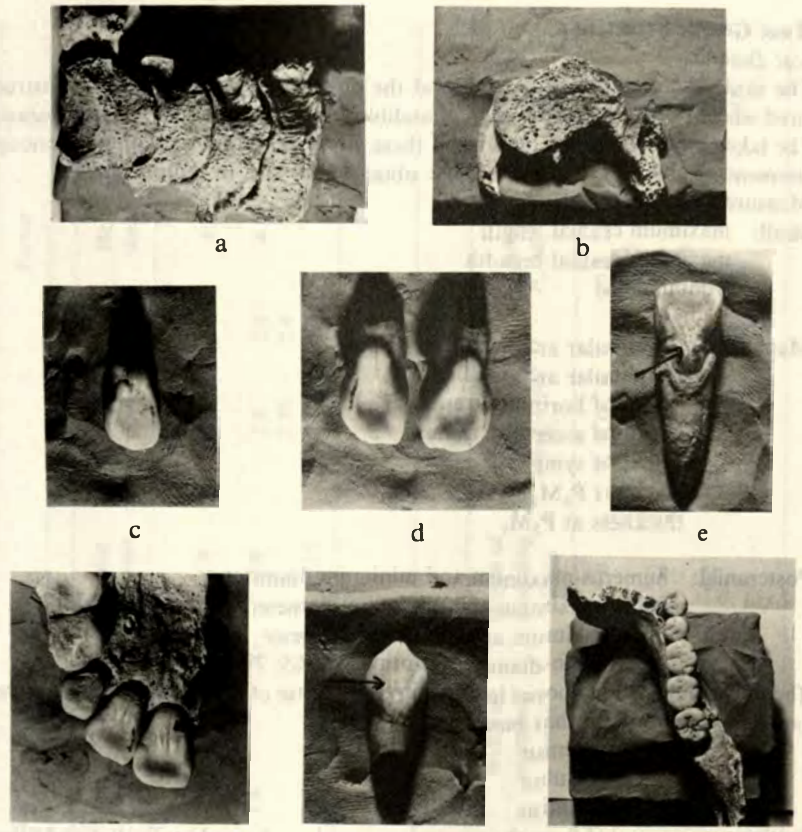


Fig. 220. Osteology. *a*, 2, 3, 4, 5 cervical vertebrae illustrating slight to moderate osteoarthritic lipping of the rims of the vertebral bodies. Burial 1/P1.
b, atlas bone compressed on inferior articular surface (B. 4/P1).
c, trace of shovel in left lateral. (B 5/P1).
d, extra shovel, left and right centrals (B.4/P1).
e, semi-shovel; no tuberculum dentale, right central (B.1/P1).
f, semishovel distinct tuberculum dentale, left central and lateral.
g, canine with slight double folding (B. 4B/P1).
h, mandibular cusp pattern right quadrant (B. 3/P1).

Six out of fourteen, 43% of the dentitons had caries. Nine teeth are involved. In eight instances, the caries are small buccal or lingual pits. All eight occur on molars. One large mesial carie is noted on a maxillary incisor.

In Pelilieu B.5, a flattened area is observed below the lambdoid suture on the left side of the occipital region of the skull. It is possibly an area of trauma resulting from a blow. In Pelilieu B.1 there is a lesion in the costal tuberosity of the right clavicle, etiology unknown.

Part Two: Genetic Structure

Metrical Data

The skull, the mandible, the teeth and the postcranial remains were reconstructed and measured where possible. For the skull, mandible and the postcranial remains, measurements could be taken on only 6 of the burials. Of these, no single burial was complete enough for all measurements. Table 45 summarizes those obtained, by site, in centimeters.

Measurements taken include:

A. Skull: maximum cranial length
maximum cranial breadth
frontal chord

B. Mandible: mandibular arch length
mandibular arch width
length of horizontal ramus
height of ascending ramus
height of symphysis
height at P_2M_1
thickness at P_2M_1

C. Postcranial: humerus-maximum and minimum diameter
femur-maximum and minimum diameter; diameter of head
tibia-maximum and minimum diameter
acetabulum-diameter (Brothwell 1965: 77–84)

The only complete long bones in the sample are those of B.5 of Pelilieu. Measurements for the complete long bones in that burial are:

left femur	46.5 cm
right ulna	25.5 cm
left radius	22.0 cm

Stature was computed from the regression equations devised by Trotter and Gleser (1952, 1958). Micronesians are said to have genetic backgrounds from all three major races; Palauans appear to have more phenotypic characteristics of the Pacific negroid than peoples immediately to the south and east of Palau (Osborne, communication). The regression formula of whites, negroid and mongoloid groups was computed for each of the long bones. The ulna, the least accurate bone for estimating stature (Brothwell, 1965:103), is omitted. Its inclusion increased the range of measurements well outside of the range for the negroid formulas. The mean of the range of the femur and the radius in all three racial groups is 161.86 cm.

A sample of between 70–75 teeth were measured. Two measurements were taken for each tooth in the sample: the mesiodistal diameter (anterior-posterior diameter of the tooth in the dental arch), the buccolingual diameter (lateral diameter of the tooth taken at right angles to the mesiodistal diameter). Since almost all of the Palau teeth were loose, none of the teeth in the sample were measured in the socket. Table 46 contains the mesiodistal diameter measurements for both the maxillary and mandibular arches; Table 47 the buccolingual diameter measurements for both. Table 48 summarizes the range in measurements in the sample by tooth, by site and by dental arch. No distinguishing patterns of distribution were observed.

Nonmetrical Data: The Dentition

A number of studies of dental morphology and variability were consulted in order to assure some degree of standardization in both definition and measurement of the gradation of the nonmetrical characteristics of the dentition: Moorrees (1957), Dahlberg (1963, 1951), Carbonell (1963), Hrdlicka (1920), Lasker (1950), Dahlberg and Mikkelsen (1947). The

Table 45. Metrical Data: skull, mandible and post cranial remains (in cm).

	Skull			Humerus		Tibia		Femur			Mandible				
Site/Burial	Length	Breadth	Nasion-Bregma	Max. diam.	Min. diam.	Max. diam.	Min. diam.	Max. diam.	Min. diam.	Head diam.	Acetadulum diam.	Width of ascending ramus	Height of ascending ramus	Height of symphysis	Height at P_2, M_1	Thickness at P_2, M_1
Pelilieu 1 1A		13.0	11.8	2.4	1.8	2.7	2.5					4.0	5.0	3.1	2.7	1.25
3A				2.3	1.7	2.5	2.35	4.3		5.2				2.5	2.95	1.3
4A				2.3	1.3							3.25	5.2	2.5	2.8	1.2
5A	19.2	13.6	11.9	2.1	1.8	2.8	2.4	4.2				3.6		2.0	2.15	1.3
Angaur 19 1A						2.75	2.4					4.2	6.5	3.1	3.9	1.4
5A				2.5	1.85	3.0	2.15	2.85	2.4		5.35			2.55	2.9	1.35
	Mand. arch length	Mand. arch width	Length of horiz. ramus													
Pelilieu 1 1A	3.75	4.45	10.0													
3A	3.75	4.1	9.1													
4A	3.9	4.5	8.7													
5A			9.25													
Angaur 19 5A	3.9	4.4	8.8													
Babeldaob 19A	4.4	4.75														
Tr. 1 FS9																

Table 46. Odontometry mesial-distal dimenson.

Maxillary (in mm)

		PELILIEU									ANGAUR			BABELDAOB		
		1A	2A	2B	3A	4A	4B	4C	5B	159B	3A	5A	82	FS3B	FS9	
I^1	L		8.5				9.0			9.0		8.5		8.5		5
	R	8.5	9.0				8.5				9.0	8.5				5
I^2	L	8.0	7.5						7.0	8.0		7.0				5
	R		7.5									7.0				2
C	L	9.0				7.5				9.0		8.5	9.0	7.5		6
	R	8.5					8.5					8.0				3
PM^1	L	7.5				6.5	7.0	8.0				8.0				5
	R	7.5		7.5		7.0						8.0				4
PM^2	L	7.5			7.5	7.0						7.0		7.5		5
	R			7.0		7.0						7.0				3
M^1	L	10.5	10.5		10.0	11.0			11.0	11.5		10.5	11.5	10.0		9
	R	10.5	10.0	12.0		10.5			11.0			11.0	12.0			7
M^2	L	9.0			9.5	12.0						10.0	11.0	10.0		6
	R	9.0		10.0		10.0						10.0				4
M^3	L	9.5			9.0							9.0	10.0			4
	R	10.0										9.5				2
		13	6	4	4	9	4	1	3	4	1	16	5	5	0	75

Mandibular (in mm)

I_1	L		6.0					5.5			6.0					3
	R		6.0									5.0				2
I_2	L		6.5									6.0				2
	R		6.5			5.0						6.0				3
C	L	7.0			8.5							7.5				4
	R	7.0			7.5	6.0						7.0				4
PM_1	L	7.0			8.0	7.0						7.5				4
	R	7.0			8.0							7.5			8.0	4
PM_2	L				7.5			8.0				7.0	8.0			4
	R				8.0			8.0				7.0			9.0	4
M_1	L	12.0	11.0		11.5	11.5	12.0	12.5		12.0		11.5	12.5		12.5	10
	R	11.5			11.5	11.0						11.5			12.5	5
M_2	L	11.0			11.5	11.0					11.0	12.0	12.0			6
	R	12.0	12.0		11.5	11.0	12.5					12.0	12.5			7
M_3	L				11.5	11.0						12.0	13.0			4
	R				12.0	11.0						12.0	12.5			4
		8	7	0	12	9	2	4	0	1	2	15	6	0	4	70

Table 47. Odontometry buccal-lingual dimension.

Maxillary (in mm)

		PELILIEU									ANGAUR			BABELDAOB		
		1A	2A	2B	3A	4A	4B	4C	5B	159B	3A	5A	82	FSB	FS9	
I^1	L		7.5				7.0			7.5		7.5		7.5		5
	R	7.0	7.5				7.5				7.0	7.5				5
I^2	L	6.0	7.0						7.0	7.0		6.0				5
	R		7.0									6.5				2
C	L	8.0				8.0				9.0		8.0	7.5	8.0		6
	R	8.5					8.0					8.0				3
PM^1	L	9.5				9.0	10.0	11.0				10.0				5
	R	10.0		10.0		9.0						10.0				4
PM^2	L	9.5			9.5	8.0						10.0		9.0		5
	R			9.5								10.0				2
M^1	L	11.0	11.0		11.5	10.0			12.0	12.0		12.0	12.0	11.0		9
	R	11.0	11.0	11.0		10.5		12.0				12.0	12.5			7
M^2	L	11.0			12.0	10.0						12.0	12.0	11.5		6
	R	11.0		11.5		11.5						12.0				4
M^3	L	11.0			11.0							12.0	12.5			4
	R	11.0										12.0				2
		13	6	4	4	8	4	2	2	4	1	16	5	5	0	

Mandibular (in mm)

I_1	L		6.0					6.5			6.0					3
	R		6.0									6.0				2
I_2	L		6.0			5.5						6.0				3
	R		6.0			6.0						6.0				3
C	L	7.0			8.0							7.5				3
	R	7.0			8.0	7.5						7.0				4
PM_1	L	7.0			8.5	8.0						7.5				4
	R	8.0			8.5							7.5			8.5	4
PM_2	L				9.0			8.5				8.0	9.0			4
	R				9.0				8.5			8.5			9.0	4
M_1	L	10.5	10.0		10.0	10.5	10.0	11.0		11.0		10.5	11.5		11.0	10
	R	10.5			10.5	10.0						10.5			11.0	5
M_2	L	10.0			10.5	11.0					10.0	10.5	11.0			6
	R	10.5	10.0		10.5	10.5	11.0					10.5	11.0			7
M_3	L				11.0	10.5						11.0	11.5			4
	R				11.0	10.0						11.0	11.0			4
		8	6	0	12	10	2	3	1	1	2	15	6	0	4	

Table 48. Summary of range.

Maxillary (in mm)

	Pelilieu		Angaur		Babeldaob	
	M-D	B-L	M-D	B-L	M-D	B-L
I^1	8.5–9.0	7.0–7.5	8.5–9.0	7.0–7.5	8.5–	
I^2	7.0–8.0	6.0–7.0				
C	7.5–9.0	8.0–9.0	8.0–9.0	7.5–8.0		
PM^1	6.5–8.0	9.0–11.0				
PM^2	7.0–7.5	8.0–9.5		9.0–10.0		
M^1	10.0–11.5	10.0–12.0	10.5–12.0	12.0–12.5		
M^2	9.0–12.0	10.0–12.0	10.0–11.0	12.0–12.0		
M^3	9.0–10.0	11.0–	9.0–10.0			

Mandibular (in mm)

I_1	5.5–6.0	6.0–6.5	5.0–6.0	6.0–
I_2	5.0–6.5	5.5–6.0		
C	6.0–8.5	7.0–8.0		
PM_1	7.0–8.0	7.0–8.5		
PM_2	7.5–8.0	8.5–9.0	7.0–8.0	8.0–9.0
M_1	11.0–12.5	10.0–11.0	11.5–12.5	10.5–11.5
M_2	11.0–12.0	10.0–11.0	12.0–12.5	10.0–11.0
M_3	11.0–12.0	10.0–11.0	12.0–12.5	11.0–11.5

following description includes:

1. shoveling of the incisors
2. cingulum or tuberculum variation of the incisors and canines
3. molar cusp numbers
4. paramolar cusps

SHOVELING: The term shoveling describes incisor teeth which, when viewed lingually, have the appearance of a shovel because of the predominant lateral borders on that surface. Five gradations were defined; no shovel, trace shovel (distance between fossa and rim is <1 mm), semishovel (distance between fossa and rim 1 mm), shovel (distance between fossa and rim $+1$ mm), extra shovel (distance between the fossa and rim well in excess of 1 mm). The two extremes in the Palau sample are illustrated in Figures 220*c* and *d*.

The gradations of shoveling are usually defined on the basis of Hrdlicka's subjective scale (Hrdlicka, 1920). Dahlberg and Mikkelsen (1947) and Carbonell (1963) have both devised means of measuring the distance between the highest part of the rim and the deepest point in the fossa with calipers. In an attempt to reduce the subjectivity of the assessment a tape was devised which measured the height of the rim. The height measured in this manner was found to coincide closely to the depth of the fossa defined using the other techniques.

The frequency of distribution of shovel shaped maxillary incisors and laterals in the Palauan sample are presented by site and by gradation in Table 49. The number of teeth in the sample including both left and right centrals and laterals, totaled only 18. By site, 1 was from

Table 49. Distribution of shoveling.

Site	Burial	Extra shovel				Shovel				Semi shovel				Trace shovel				No. shovel				
		I^1	I^2	I^1	I^2	I^1	I^2	I^1	I^2	I^1	I^2	I^1	I^2	I^1	I^2	I^1	I^2	I^1	I^2	I^1	I^2	
		L		R		L		R		L		R		L		R		L		R		
Pelilieu 1	1						X				X											
	2A									X	X											
	4B	X		X						X		X		X								
	5B													X	X							
	159B																					12
		1		1			1			1	2			1	2							
Angaur	3						X					X				X						
	5									1				1								5
Babeldaob 19A platform A	B						1				1				1			X		1		
																						1
																						18 teeth in sample

Table 50. Distribution of cingulum variation tuberculum dentale.

Site	Burial	Tuberculum distinct L I¹	Tuberculum distinct L I²	Tuberculum distinct R I¹	Tuberculum distinct R I²	Tuberculum faint L I¹	Tuberculum faint L I²	Tuberculum faint R I¹	Tuberculum faint R I²	Tuberculum absent L I¹	Tuberculum absent L I²	Tuberculum absent R I¹	Tuberculum absent R I²
Pelilieu L	1										X	X	
	2A	X	X	X	X					X			
	4B					X		X					
	5B						X						
	159B	X											
		2	1	1		1	1	1		1	1		
Angaur 19	3A						X	X			X		X
	5A					X				1		2	1
Babeldaob 19A	TR. 1											X	
	FS3B									1			
													Total 16

Babeldaob 19, 5 from Angaur 19 and 12 from Pelilieu. The distribution of the feature by gradations is described below:

Sample Size			18
Gradations	Central	Laterals	
Extra shovel	2	0	2
Shovel	1	2	3
Semi shovel	3	4	7
Trace shovel	3	2	5
No shovel	1	0	1
	10	8	18

No particular pattern of distribution was noted either by site or by age.

CINGULUM VARIATION: The lingual surfaces of the incisors and canines were also studied for variations occurring in the cingulum. In the maxillary incisors and laterals the presence and size of the tuberculum dentale was noted. Figure 220*e* illustrates the lack of tuberculum and Figure 220*f* distinct tuberculum development. The distribution of the feature is summarized below:

Sample size	16
Gradation: distinct	5
faint	6
absent	5

The canines were studied for a ridging of the cingulum referred to as a double fold (Fig. 220*g*). The distribution is summarized below: sample size 6; present 3; absent 3.

The distribution of the cingulum variation by site and by tooth is presented in Tables 50 and 51. Twenty-two teeth were examined for the occurrence of cingulum variation in both maxillary incisors and canines. The presence of the tuberculum dentale was noted in 11 teeth. No pattern of distribution was noted either by site or by age.

Table 51. Double folding.

Site	Burial	Left Present	Left Absent	Right Present	Right Absent
Pelilieu 1	1		X		X
	4B			X	
Angaur 19	5	X		X	
Babeldaob 19A	FS3 B		X		
		1	2	2	1
					Total 6

MOLAR CUSP NUMBER: Variations in the number of cusps are known to occur in both the maxillary and mandibular molars. They occur as a result of a tendency toward the reduction of the cusp numbers. The cusp reduction of the maxillary molars is frequently from four to three, and in the mandibular molars from five to four. This information is summarized by site in

Table 52. Overall cusp number.

Site	Burial	Maxillary Left M^3	M^2	M^1	Right M^1	M^2	M^3	Mandibular Left M_3	M_2	M_1	Right M_1	M_2	M_3
Pelilieu 1	1	4	4	4	4	4	4	2	3	7	3	5	2
	2A			4	4			2	2	2	1	2	2
	2B												
	3	4	4	4	4			2	2	2	1	2	2
	4A		4	4	4	4							
	4B												
	4C			4									
	5B			4									
	159/			4									
Total	42	2	3	7	4	3	1	1	2	3	2	3	1
Angaur 19	3												
	5	3	4	4	4	4	3	1	2	2	2	2	1
	82/	4	4	4	4								
Total	21	2	2	2	2	1	1	1	2	2	2	2	1
Babeldaob 19A	FS3		3	4									
	FS9												
Total	5		1	1									
Total	68												

Table 52. Sixty-eight maxillary and mandibular molars were examined. The distribution is:

Sample Size	68
Maxillary	
Four Cusps	29
Three Cusps	3
Mandibular	
Five Cusps	27
Four Cusps	9

Figures 220*h* and 221*a, b* illustrate typical quadrants of the maxillary and mandibular molar cusp number in the Palau sample.

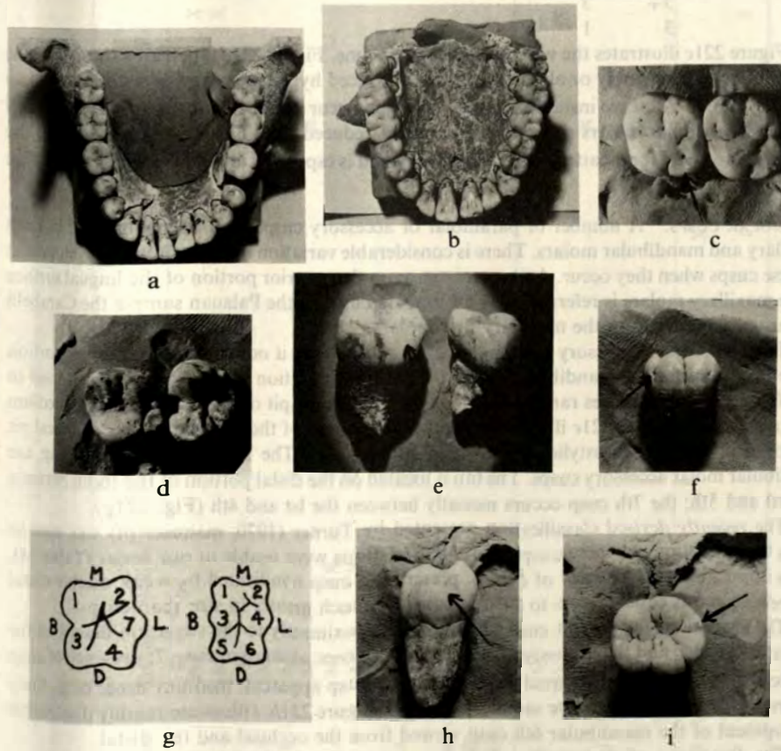


Fig. 221. Osteology.

a, mandibular dentition (B. 5/Ang 19).
b, maxillary dentition (B.5/Ang 19).
c, well developed hypocone, maxillary molars.
d, reduced hypocone, maxillary M^2M^3 (82/Ang 19).
e, slight development of Carabelli cusp, maxillary L and R M^1 (82/Ang 19).
f, protostylid pit development mandibular right M_2 (B.2A/P1).
g, cusp diagram.
h, 6th cusp looking at the distal of the tooth, mandibular M_1 (B. 4B/P1).
i, 6th cusp, occlusal surface, mandibular M (B.4B/P1).

The process of cusp reduction in the maxillary molars occurs through the elimination of the hypocone or distolingual cusp. As a result of the reduction, the form of the crown becomes triangular. A means of describing the gradation in the reducing hypocone has been suggested by Dahlberg (1951). These variants are a well-developed hypocone, reduced hypocone, absence of the hypocone accompanied by a cuspule on the distal lingual border, total absence of the hypocone. The development of the hypocone is summarized by site on Table 53. The distribution by gradations is summarized as follows:

Sample size 32.

Gradation		
	4	21
	4–	7
	3+	3
	3	1

Figure 221*c* illustrates the well developed hypocone. Figure 221*d* illustrates the lack of the hypocone. The completely or almost completely reduced hypocone covaries with a three cusp maxillary molar. All three instances of this reduction occur in Babeldaob 19A and Angaur. Of the nine mandibular molars showing cusp number reduced from 5 to 4, six are found on the M_2. There is a trend for a pattern of M_2 M_3. This trend is especially apparent among the Pelilieu burials.

PARAMOLAR CUSPS: A number of paramolar or accessory cusps have been observed in both maxillary and mandibular molars. There is considerable variation in the degree of development of these cusps when they occur. An accesory cusp on the anterior portion of the lingual surface of the maxillary molars is referred to as a Carabelli cusp. In the Palauan sample the Carabelli cusp usually occurred on the maxillary first molars.

The mandibular accessory cusp is called the protostylid; it occurs on the anterior portion of the buccal surface of mandibular molars. The same gradation of development was used in classifying both: the degrees range from no cusp, a fissure or pit only, a slight cusp, a medium cusp, a full cusp. Figure 221*e* illustrates slight development of the Carabelli cusp; bilateral pit development of the protostylid is shown in Figure 221*f*. The sixth and seventh cusp are mandibular molar accessory cusps. The 6th is located on the distal portion of the tooth between the 3rd and 5th; the 7th cusp occurs mesially between the lst and 4th (Fig. 221*g*).

The recently devised classification presented by Turner (1970, manuscript) was used to assess the gradations of these cusps. Not all gradations were usable in our series (Table 54). Those applicable are: Absence of cusp 6; presence of cusp 6 indicated by weak double distal grooves; cusp 6 is equal in size to cusp 5; cusp 6 is much greater in size than cusp 5.

The gradations for the 7th cusp correspond approximately to the variation described for the Carabelli cusp and the protostylid. They are as follows: absence of cusp 7; presence of cusp 7 indicated by weak double lingual grooves; distinct cusp apparent; medium sized; large. Only the first of these appeared in our sample (Table 54). Figure 221*h, i* illustrate readily discernable development of the mandibular 6th cusp viewed from the occlusal and the distal.

The frequency of occurrence of the mandibular and maxillary paramolar cusps are summarized by site in Tables 54, 55, 56; 23 maxillary molars were examined for the occurrence of accessory cusps. Sixteen of these were first molars; the remainder were second and third molars. The distribution of all of the paramolar cusps considered is summarized below.

Mandibular 6th & 7th Cusp	
Sample Size	73
6th Cusp gradations	
Groove	11
C6 C5	1

Table 53. Hypocone development.

Site	Burial	Tooth	Left 4 Well dev.	Left 4– Reduced	Left 3+ Cuspule	Left 3 None	Right 4 Well dev.	Right 4– Reduced	Right 3+ Cuspule	Right 3 None
Pelilieu 1	1	M^3		X				X		
		M^2		X				X		
		M^1	X				X			
	2A	M^1	X				X			
	2B	M^2								
		M^1								
	3	M^3	X							
		M^2	X				X			
		M^1	X							
	4A	M^2	X				X			
		M^1	X							
	4C	M^1	X							
	5B	M^1	X							
	159/	M^1	X				X			
Angaur 19	5	M^3			X				X	
		M^2		X				X		
		M^1								
	82/	M^3	X							
		M^2		X				X		
		M^1	X							
Babeldaob 19A	FS3	M^2								
		M^1	X							
			13	4	2		8	3	1	32 Total

Table 54. Mandibular accessory cusps.

Site	Burial	Tooth	6th Cusp						7th Cusp					
			Left				Right		Left			Right		
			Absent	Groove	C6=C5	C6<C5	Absent	Groove	Absent	Groove	C6=C5	Absent	Groove	C6=C5
Pelilieu 1	1	M_2	X				X		X			X		
		M_1	X				X		X			X		
	2A	M_2												
		M_1		X			X		X			X		
	3	M_3	X				X		X			X		
		M_2		X			X		X			X		
		M_1	X				X		X			X		
	4A	M_3		X			X		X			X		
		M_2	X				X		X			X		
		M_1	X				X		X			X		
	4B	M_2			X						X			X
		M_1				X			X			X		
	4C	M_1	X				X		X			X		
	159/	M_1	X				X		X			X		
			8	3	1	0	7	2	1	12	0	10	44	
Angaur 19	3	M_2		X			X		X			X		
	5	M_3	X				X		X			X		
		M_2		X			X			X			X	
		M_1	X				X		X			X		
	82/	M_3		X			X		X			X		
		M_2	X				X		X			X		
		M_1	X				X		X			X		
			4	2	0	1	2	3	0	5	1	5	23	
Babeldaob 19A	FS3	M_1		X										
	FS9	M_1	X				X		X			X		
			1	1	0	0	1	0	0	2	0	1	6	
			13	6	1	1	10	5	1	19	1	16	73	

C6 = C5	2
Absent	59
7th Cusp	
Groove	1
Absent	72
Protostylid	
Sample Size	21
Gradations	
Fissure/pit	2
Slight	1
Absent	18
Carabelli Cusp	
Sample Size	16
Gradations	
Pit	0
Slight	6
Medium	4
5th cusp	1
Absent	5

The protostylid was observed only in the teeth from the site of Pelilieu. No other pattern of distribution for accessory cusps was observed either by site or age group.

Table 55. Maxillary accessory cusp of carabelli M^1.

Site	Burial	Left					Right					Other	
		Absent	Pit	Slight	Med.	5th	Absent	pit	Slight	Med.	5th	Absent	Pres.
Pelilieu 1	1	X					X					X	
	2A				X					X			X
	2B								X				
	3			X								X	
	4A			X			X					X	
	4C						X						
	5B	X											
	159B/					X							
Angaur 19	5				X					X			X
	82/			X					X				X
Babeldaob 19A	FS3			X								X	
		2	0	4	2	1	3	0	2	2	0	4	3

Table 56. Mandibular accessory Cusps.

Site	Burial	Protostylid M_2					
		Left			Right		
		Absent	Pit	Slight	Absent	Pit	Slight
Pelilieu 1	1		X		X		
	2A	X				X	
	3	X			X		
	4A	X					X
	4B	X			X		
	4C	X					
	159B/	X			X		
Angaur 19	3	X					
	5	X			X		
	82/	X			X		
Babeldaob 19A	FS3B	X					
	FS9	X			X		

Nonmetrical Data: The Skeleton

Variability similar to that occurring in the teeth also occurs in the skeleton. The characteristics of the skull have been the most thoroughly discussed (Berry, 1967). Work has now also been done with the post cranial skeleton (Anderson, 1968).

The Palau sample is too fragmentary to enable investigation of most of the postcranial characteristics. There are three instances of the perforation of the coronoid fossa of the humerus. This trait of arrested ossification was the only postcranial morphological characteristic observed. No tori, as described by Brothwell (1965) were observed in the Palau remains.

Many of the cranial characteristics typically described are variations in sutures. In 6 instances, cranial fragments were reconstructed sufficiently to permit the observation of ossicles along sutures. Ossicles were observed in 3 of the burials, all from Angaur 19. Variations may also occur in the presence or absence of several of the cranial foramen (Berry, 1967). Those tabulated in this sample include: the frontal foramen, the supraorbital foramen or notch, the zygomatic-facial foramen, the parietal foramen and the foramen of Huschke. These characteristics have been described by Berry as follows:

1. frontal foramen or notch-a well defined secondary foramen in the vicinity of (usually lateral to) the supraorbital foramen.
2. supraorbital foramen or notch-foramen above the orbit frequently incomplete or open and in these instances described as a supraorbital notch.
3. zygomatic facial foramen-small foramen piercing the zygomatic bone opposite the junction of the infraorbital and lateral margins of the orbit, may be single, multiple or absent.
4. parietal foramen-foramen that pierces the parietal bone near the sagittal suture a few centimeters in from the lambda.
5. foramen of Huschke occurs in the floor of the external auditory meatus, is always present in young children but usually closes after the fifth year. (Berry, 1967:364–70)

The frequency of occurrence of these foramena are presented by site in Table 57. The

Table 57. Distribution of Foramen.

Site	Burial	Frontal	Supra-orbital	Zygom	Parietel	Huschke
Pelilieu 1	1			X	X	O
	2A	X	X	X	X	X
	3	X		X		X
	4A			X		
	5	X	X	X	X	O
Angaur 19	2A	0	X			X
	3				X	
	4					0
	5	X	X		X	
	76/	X	X			
		6	5	5	5	6

foramen of Huschke was observed in only two burials.One of these occurrences may be accounted for by the age of the individual who is estimated to be 8–13 years old. The other occurrence was observed in Burial 3, an adult from Pelilieu.

No particular pattern of distribution was noted, either by age or by site for the occurrence of the other cranial foramen tabulated.

Summary

Affinities between the islands of Micronesia and the two nearby large land masses, the Philippines and New Guinea, have been suggested because of linguistic similarities and similarities in cultural traits. Interment patterns should eventually provide additional cultural information for comparison. Metrical and nonmetrical analysis of the skeletal remains themselves will provide information about the biological constituency of the prehistoric populations which occupied the islands.

Despite the small sample, there emerge from the materials described in this report interesting patterns. There are two patterns of interment noted, the extended pattern on Pelilieu and the flexed on Angaur. Clusters of nonmetrical traits tend to co vary with each of the two patterns of interment. The fully reduced hypocone and the occurrence of ossicles along sutures both occur only in skeletal materials from Angaur. The development of the protostylid occurs on Pelilieu only. A pattern of reduction in the size of the mandibular 2nd. molars is apparent in Pelilieu and also in B.5 from Angaur. The Angaur burial significantly exhibits the extended interment of Pelilieu.

References Cited

Anderson, J. E. 1968. Skeletal anomalies as genetic indicators. *In* D. R. Brothwell, Skeletal Biology of Early Populations. Pergamon Press, London.

Berry, R. J. 1967. Epigenetic variation in the human cranium. J. Anat. 101: 361.

Brothwell, D. R. 1965. Digging Up Bones. British Museum (Natural History), London.

Carbonell, Virginia M. 1963. Variations in the frequency of shovel shaped incisors in different populations. *In* D. R. Brothwell, Dental Anthropology. Pergamon Press, London.

Dahlberg, A. A. 1951. The dentition of the American Indian. *In* W. S. Laughlin, Papers on the Physical Anthropology of the American Indian. The Viking Fund, New York.

Dahlberg, A. A. and Mikkleson, O. 1947. The shovel shaped character in the teeth of the Pima Indian. Am. J. Phys. Anthro. 5: 234.
Hirdlicka, Ales. 1920. Shovel shaped teeth. Am. J. Phys. Anthro. 3: 429.
Lasker, G. W. 1950. Genetic analysis of racial traits of the teeth. Cold Spring Harbor Symposia Quarterly, Biol. 15: 191.
McKern, Thomas W., and T. D. Stewart. 1957. Skeletal age changes in young American males. Headquarters Quartermaster Research and Development Command Technical Report EP-45. Natick, Mass.
Molnar, Stephen. 1970. Human tooth wear, tooth function and cultural variability. Manuscript prepared for 1970 meetings of the American Association of Physical Anthropology.
Moorrees, Coenraad, F. A. 1957. The Aleut Dentition. Harvard Univ. Press, Cambridge.
Trotter, M., and G. C. Gleser. 1952. Estimation of stature from long bones of American whites and Negroes. Am. J. Phys. Anthro. 10(4): 463–514.
———. 1958. A re-evaluation of estimation of stature based on measurements of stature taken during life and of long bones after death. Am. J. Phys. Anthro. 161(1): 79–123.
Turner, C. G., Jr. 1970. New classification of non-metrical dental variation: cusps 6 and 7. (Manuscript presented at 1970 meetings of the Am. Assoc. of Physical Anthropology.

APPENDIX 6

Fish Bones

Hiromasa Kaneko and *T. Abe*

Bones which we recognized as fish, plus some turtle (but not all our "fish bones" were fish) were sent to Dr. T. Abe of the Fisheries Research Laboratory, University of Tokyo. Here Mr. Hiromasa Kaneko, an archaeologist at Waseda University with extensive experience in the specialty, working under Abe's direction, identified such of the remains as were possible. I am indebted to Mr. Gene Helfman, Peace Corps Volunteer and ichthyology student, for making initial contact with Dr. Abe for me.

Collections were made from five excavation units: Koror 3 (Trench 2, 11 catalog numbers), Angaur 19 (1 catalog number), Babeldaob 40 (shell exposure, 1 catalog number), Aulong 1 (14 catalog numbers) and Pelilieu 1 (7 catalog numbers). Lower case letters in parentheses indicate different species not identifiable; upper case suggest that all bones carrying the letter belong to the same species.

The identifications were received in tabular form; we are presenting them by site and excavation unit. It will be noted that the collection is not extensive and I must view it for what it is, a first presentation of data of this kind from the area. A few more collections of this kind, also suitably processed might then be studied by persons with some sophistication in Indo-Pacific fishery ecology with illuminating results. This is not a task which I am competent to attack, and I doubt that there are sufficient data in my material for such a study. Finally, I believe that this information should be presented as a unit, hence it appears here as an appendix rather than under the various sites of origin.

I am indeed grateful to Dr. Abe and Mr. Kaneko for their interest and aid to my project and I hope that the experience gained thereby will be of value.

KOROR 3 (132/K3, level 1).
Serranus (D): left dentary 1
Lethrinus (A): right premaxillary 1
Monotaxis: left premaxillary 2, right dentary 1, left dentary 3.
Scarus (*chlorurus*?) (A): left upper jaw 1
Scarus (C): righr upper jaw 1, (a or b) upper pharyngeal 1
Ballistes (A—long type): left premaxillary 1
(A or B) dorsal spine 1
Miscellaneous bones 19
Vertebra 15.

KOROR 3 (109/, 129/, 135/, 149/, 165/K3, level 2). The latter yielded 107 identified bones and 292 unidentified. Others were minor.
Erasmobranchii: vertebra (a) 5
Serranus (B): right premaxillary 1
(C): right premaxillary 1, left premaxillary 1
(D): left premaxillary 1
(G): right premaxillary 1 (c) left premaxillary 1
Lethrinus (A): right premaxillary 1, left premaxillary 2, right dentary 1, left dentary 1
(B): right dentary 1
Labridae (B): right premaxillary 1

Monotaxis: right premaxillary 8, left premaxillary 2, right dentary 7, left dentary 4
Scarus (*chlorurus*?) (A): right upper jaw 2, left upper jaw 2, right upper pharyngeal 1, left 4, lower pharyngeal 4.
(B): right lower jaw 1, left 3, right upper jaw 4
(D): left lower jaw 1
(E): right upper jaw 2
(B ~ E): (a) lower pharyngeal 1, (b) 2, (a or b) upper pharyngeal 4
Balistes (A-long type): left premaxillary 1, right dentary 1, left 1
Muraenidae: left dentary 1
Scombrina: vertebra A 34, vertebra B 3
Miscellaneous fish 288
Vertebra 6
Miscellaneous turtle 8, right humerus 1, left 1.

KOROR 3 (113/, 141/, 152/, 174/K3; level 3) the latter yielded 279 identified bones and 942 unidentified. Other catalog numbers were minor. Level 3 is C14 dated at ca AD 1785 (UCLA 1762A).
Erasmobranchii: vertebra (a) 8, (b) 8, (c) 13, (d) 6
Serranus (A): right premaxillary 3, left 2
(B): right premaxillary 1, left 1
(C): right premaxillary 2, left 3, fight dentary 8, left 3.
(D): left premaxillary 1, left dentary 1
(E): right premaxillary 1
(F): right premaxillary 2, left 1, right dentary 1.
(G): left premaxillary 1, (a) right dentary 4, left 1, (b) right dentary 1, (c) left dentary 2, (d) right dentary 1
Lethrinus (A): right premaxillary 9, left 9, right dentary 5, left 1
(B): right premaxillary 3, left 1, right dentary 3, left 1.
Lutjanus ?: right dentary 1, left 1
Labridae (A): lower pharyngeal 2
(B) lower pharyngeal 2, right dentary 1, left 1
Monotaxis: right premaxillary 9, left 9, right dentary 15, left 13.
Scarus (*chlorurus*?) (A): right upper jaw 7, left 8, right lower jaw 4, left 5, right upper pharyngeal 7, lower 7 unassigned 1, lower pharyngeal 6
(B): right lower jaw 5, left 8
(C): right upper jaw 6, left 4, ? 1
(D): right upper jaw 2, left 1, right lower 1, left 1
(E): right upper jaw 2, lower 1, right lower jaw 2, left 3
(B ~ E): (a) lower pharyngeal 3, (b) lower pharyngeal 13
(a or b) upper pharyngeal 24.
Balistes (A-long type): right premaxillary 3, left 3, right dentary 5, left 2
(B-short type): right premaxillary 2, left 2
(A or B): dorsal spine 2.
Sphyraena: right dentary 2
Tetradon: right lower jaw 1.
Scombrina: vertebra A-1.
Diodon: jaw plate 1
Miscellaneous fish 491
Vertebra 480
Bird bones: 1 tibia ?, 3 humerus sea bird, 1 ulna ?, 2 femora *Gallus* sp., 1 tibia *Gallus* sp., 3 misc. (humeri?)

Turtle bones: 1 humerus, 33 fragments of carapace, plastron.
Mammal: *Felis* sp. 1 left humerus, 1 astragalus, 2 metacarpus or metatarsus, 1 phalange

KOROR 3 (187/K3; level 4).
Lethrinus (A): left premaxillary 1
Monotaxis: right premaxillary 3, left 1, right dentary 1
Scarus (*chlorurus* ?) (A) right upper jaw 1, right lower 1, upper pharyngeal 3, lower 1
(C): right upper jaw 1
Miscellaneous fish 19
Vertebra 15
Turtle: fragments 4
Mammal: *Felis* sp. right pelvis 1, right ulna 1, left 1, vertebra 1, indeterminate species vertebrate 1

ANGAUR 19. This site yielded only one fish bone, a shark tooth found in possible association with Burial 2, second flat, level 2 (87/Ang19).

BABELDAOB 40. 3 fish bones from shell exposure: 2 indeterminate miscellaneous bones and one indeterminate vertebra.

AULONG 1 (9/Aul, F-E test surface).
Scarus (A) jaw 1, upper pharyngeal 2, lower 4.
Diodon: jaw 1

AULONG 1 (13/Aul, F-E test level 1).
Monotaxis: teeth 3
Scarus (A): jaw 5, upper pharyngeal 1, lower 1
Diodon: jaw 1
Indeterminate 4
Vertebra 14

AULONG 1 (17/Aul, F-E test level 2).
Monotaxis: left premaxillary 1
Scarus (A): jaw 5, upper pharyngeal 1, lower 1
Diodon: jaw 1

AULONG 1 (22/Aul, F-E test level 3).
Labridae: upper pharyngeal 1
Scarus (A): jaw 2
Diodon: jaw 2
Tetrodon: jaw 1
Vertebra 1
Dolphin: vertebra 1

AULONG 1 (26/Aul, F-E test level 4).
Labridae: jaw 1
Monotaxis: left premaxillary 1, teeth 5
Scarus (A): jaw 3, upper pharyngeal 1, lower 1
Diodon: jaw 2
Balistes: tooth 1
Indeterminate 2

AULONG 1 (29/Aul, F-E test level 5).
Monotaxis: teeth 3
Balistes: tooth 1
Indeterminate 1

AULONG 1 (35/Aul, F-E test level 6).
Scarus (A): jaw 2

AULONG 1 (40/Aul, F-E test level 7).
Monotaxis: tooth 1
Scarus: upper jaw 1, lower 1
Balistes: right premaxillary 1, tooth 2
Indeterminate fish 4
Vertebra 2
Dolphin: tooth 1
Human skull fragment 1
AULONG 1 (44/Aul, wall test stratum I).
Scarus: lower jaw 1
AULONG 1 (50/ , 53/Aul, wall test stratum II. may date in AD 500's [UCLA 1855H]).
Shark: vertebra 7
Lethrinus: right premaxillary 2, left 1
Scarus (A): upper pharyngeal 2
Indeterminate 3
Vertebra 6
AULONG 1 (55/ , 59/Aul, wall test stratum III).
Scarus (A): jaw 1
Diodon: jaw 1
Balistes: left dentary 1, left premaxillary 1
Indeterminate 11
Vertebra 19
AULONG 1 (68/Aul, wall test stratum IV. may date ca 1000BC, UCLA 1855J).
Diodon: jaw 1
Balistes: left premaxillary 1, tooth 1
Indeterminate 1
Vertebra 1
PELILIEU 1 (85/Pl, trench 1 level 2).
Vertebra 1
PELILIEU 1 (26/ 27/ 56/ 101/Pl, trench 1 levels 3, 4.).
Monotaxis: left premaxillary 1, right 1
Diodon: jaw 3
Vertebra 5
PELILIEU 1 (70/Pl, trench 1 level 6).
Monotaxis: left premaxillary 1
Vertebra 1
PELILIEU 1 (91/Pl, test pit 1 level 4).
Indeterminate 2

Comments (D. Osborne)

Anthropologically, I am impressed with the surprising coherence in the better aspects of the collection. The careful reader will note that there is an agreement in the number of rights and lefts and uppers and lowers, which suggest that the fish bone contents of the middens are close reflections of the characteristics of the garbage disposal. This is especially true of Koror 3, trench 2 which was the only important aspect of the collection. It will be sufficient here to call attention to a few examples from K3, trench 2 level 3. Here *Lethrinus* (A) right premaxillaries numbered 9, so did left. (B) and *Lutjanus* are in agreement. *Monotaxis* right and left premaxillaries are 9 each, right and left dentaries are 15 and 13. *Balistes* shows 3 each right and left dentaries.

Aspects of this kind of agreement may be discerned throughout the K3 sample where there were sufficient identifiable bones. Further work in the K3 midden would probably give a pretty complete picture of fish use at a fairly recent Palauan village.

The presence of a few turtle or seabird bones and chicken in the collection is to be expected. But the *Felis* bones were not. These should not have been sent to Japan but Mr Kaneko was equal to the task that they imposed. Cats were apparently present on the Palau islands at time of first contact. Keate (1788:300) records the observation of the English crewmen of the *Antelope:* "...and three or four meagre cats, which were seen in some of the houses in Pelew [Koror] probably brought in on some drift or part of a canoe of other islands wrecked in the reefs."

References Cited

Keate, George. 1788. An account of the Pelew Islands situated in the western part of the Pacific Ocean composed from the journals and communications of Captain Henry Wilson and some of his officers who in August 1783 were shipwrecked in the Antelope. G. Nicol, London.

APPENDIX 7

Tobi Island Artifacts

Peter Black, D. Osborne and *Patricio M.*

Stone figure (Osborne)

Some of the archaeological remains of Tobi are discussed in Osborne (1966: 52–56). During the early winter of 1968, Peter Black, Peace Corps Volunteer on Tobi, was in the Palaus. He brought me a stone figurine (Fig. 222) which had been given to him by an elderly Tobi man who said it was a modern carving made for sale to the Japanese. A cursory examination convinced me that it was ancient. The figure is of a seated or squatting male, grasping his (broken) penis with both hands. There is a bulge below the chin as if he were wearing a gorget or some such object. Height is 38 cm, width across the shoulders 23, basal thickness 21.6 cm. The head is 12 cm by 14 by 15 cm; weight is 11.4 kgm. The material is poorly indurated coral sandstone. The object is eroded but the carving was crude.It was done by simple cutting, probably hewing with an adze. The material is easily cut when water soaked. It is now in the collections of the Palau Museum on Koror.

Adzes (Osborne)

Among the objects of craftsmanship which Black brought to Koror to sell for the Tobi people were three hafted archaeological adze blades of *Tridacna*. These are illustrated in Figure 223. There are 3 types represented. The central blade is a type 2 beaked adze, large and elongate, between 35 and 40 mm in breadth.The gouge is a form that has not been encountered on Palau although there are examples of the type from Sonsorol. I cannot understand its absence on Palau sites. Measurements could not be taken adequately on these specimens but this object is about 45 mm in width. The third blade is a peculiar form, much like my type 7 except that the back bevel is strong, nearly equal to that of the front. It is the smallest of the 3, about 34 mm wide. I cannot vouch for the authenticity of the hafting of these tools which obscured several aspects of the blades. Such hafting would not have held up under rough usage. It will be noted that all were set in swiveling beds so that cuts could be made at a variety of angles in several positions. All of the tools had a good feel and balance.

The Tobi stone figurine (Black)

Although I have hunches and suspicions regarding the ancient and modern functions of the stone carving none of these are presently supportable. These ideas may or may not be developed after I have had another opportunity to work with the Tobi islanders, on Tobi. It therefore appears the wisest to give here a narrative statement of the circumstances and information that I now have concerning the stone image.

In the late spring of 1968 several Tobi people and I were building a fireplace for fish smokng. We dug the hole at the edge of a small hill near my house on the west side of Tobi and others collected stones with which to line the fireplace. I stopped work in the late afternoon and left the site while work was still in progress. The next morning I found the carving perched on a stump near the fireplace site. Some one had put it in this very obvious place after I had left.

It is difficult now, three years later (1971) to understand the excitement I felt as I first examined the stone. It had something to do with a feeling which had become more and more definite as the months passed—a feeling that there was a whole area of life which the Tobi

Fig. 222. Tobi figurine, front and side views.

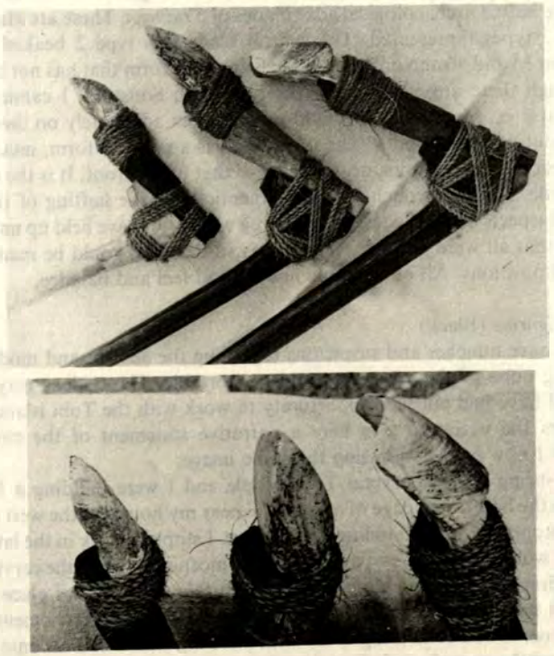


Fig. 223. Two views of three archaeological adze blades from Tobi; modern hafting on swivelling beds. Left to right, type 7; type 2; gouge adze. Gouge is 4.5 cm wide.

people had originally kept from me but which they were becoming more and more willing to expose. Now out of nowhere, here was this sexually explicit carving, different in style and "feeling" from anything else I had seen on the island. I must have felt that at last the people were beginning to trust me enough to reveal their "secrets" to me. As it turned out I was wrong. While I did eventually become aware of a lot of hidden attitudes and feelings as well as the intense political activity which had been kept from me, this did not start to happen until two or three months after the stone turned up. I eventually came to feel that the stone was in the nature of a "test" and my reactions that morning did not reassure the people that I could be trusted with sensitive information.

The first thing I did upon seeing the stone was to bring out my camera and photograph it. There was no one in sight at the time but shortly afterward some of the men started to drift onto the scene. As I asked them about the stone they began to laugh pointing out the figure's penis to each other and saying it was "bad". To my repeated questions for information about the stone they answered that one of the old men (since dead) had carved it before the war in order to sell it to the Japanese who were stationed on the island. The Japanese, so the story went, were disgusted with it and would not buy it so the old man tossed it into the thick brush behind the meeting house from which one of the men had retrieved it yesterday to use in lining the new fire pit. This is the only story I ever heard about the stone while I was on the island. By the end of the day it had become clear to me that, true or false, this was the story I would have to accept. That evening I asked the old men if they thought it would be alright if I kept the stone in my house. They said that it was and as far as they were concerned I could keep it. I carried the stone to my house where it remained for the rest of the time I was on Tobi. Two or three months later, these same old men asked me if I could have the stone placed in a museum. A few days after that during an island-wide meeting I asked if this was what the people wanted done with the stone; they answered that it was, that they wanted the figure where "scientists" (their word) could study it.

There were at least two facts that led me to doubt the story I was told on the island. I never saw, or heard of anyone carving in stone. Some of the men carve in wood, making simple little figures called by the Americans "monkey men" and by the islanders "sen". The same word, "sen" is used in referring to the stone figure. I could find it in neither Capell (1969) or in Eilers (1936). The treatment of the human figure and the position is essentially that of the tourist figurines. It is also a widespread form in the Pacific and might well be expected in both ancient and modern times. The second part of the story which I found hard to believe is that the Japanese refused to buy the stone because it was too erotic. This certainly did not fit with my knowledge of the Japanese. At any rate, this was as I have said the only story about the figure I heard while I was on the island. After I returned to Koror, however, I collected the second and richer version.

On Koror, Osborne and I took the stone to the southwest settlement (where Tobi people live) in Eang and confronted various people with it. An elderly woman and several other discussants told us that the stone was one of a set that Yango (the first chief of the island) had carved to border the "yard" of Ramonparuh's (the "mother of the island") house. The story went that the Germans had taken away the rest of the set. I have gone through Eilers quite carefully and could find no reference to these stones. If I had to guess where the stone (s?) originally stood I would say either around the "yard" of the menstrual house or else around the "yard" of the "chief of the women" (an office which I know very little about).

There can be no doubt that the reticence exhibited particularly on the part of the older women, was due to the sexual nature of the carving. I am sure that much information is available if this hurdle can be overcome. One of the younger men, well trained and a Trust Territory employee commented that the object (or others of its kind) had been used in "sex education" in the old days.

I am including a copy of the story of the settling of the island as told to me by Patricio—one of the more influential of the men. This is not a verbatim account; my method was to take notes as material was translated for me, to write up a rough draft and then have this retranslated to the original source for any suggestions or comments. As you can see this legend traces the present population back to Fais. Other evidence of a Fais-Tobi connection is in Reisenberg and Gayton (1952:349) where in a discussion of brocading it is stated that "... usually the addition is made with the aid of an awl (or an eye needle on Fais and Tobi). Lessa (1950 : 48) reports a link between Ulithi and the southwest islands as follows: "while these [the southwest islands] are farther from Ulithi than Palau, they are more important to it. It is said that some of the local sibs (Ulithian) established themselves on these four islands when people from Ulithi became lost at sea and eventually found refuge there. These sibs continued to survive, forming the incentive for a certain amount of trade." I never heard any local mention of Ulithi pelple settling or visiting Tobi, but I do not remember asking.

The story of the lady from Wolei is echoed in Gladwin and Sarason (1953 : 36) account of the Trukese tradition that both Truk itself and the Westerns were settled by the progeny of a lady from Kusai who paddled to Truk on a frond of the ivory nut palm.

Linguistically, Capell (1969 : 1) classifies Tobian as one of four dialects spoken in the Southwest Islands which have a "fairly close resemblance" to Ulithian. Culturally the resemblance to the islands of the Yap empire seem both obvious and overwhelming and in view of this it is difficult to credit the Murdock (1953 : 216) classification of the Southwest Islands as one of the 15 subareas of Micronesian culture on the basis of "strong Papuan influences".

How the first people came to Tobi (Patricio M.)

The first ruler of Tobi Island and also its dicoverer was a woman from Fais called Ramonparuh. She and her husband Yongoihar and her father Tahabech were fleeing a war on Fais and came directly to Tobi without stopping. Patricio does not know how long it took them to get here, or anything about Ramonparuh's mother or about the equipment in the canoe, except that she did have a piece of thatch from which she ate her food at every new moon. He does not know if they had a crew or not but he does know that their God's name was "Mabuwat". Ramonparuh was the navigator.

They landed on Tobi about where the present channel is and Ramonparuh buried a clam shell in a small hill near the beach. The island was much smaller than it is now; it was about the size of Helen Reef. There was only one tree on the island, a tree called *Moh*. (*Moh* is now extinct on Tobi, but they do grow on Sonsorol, Merir, Helen Reef and maybe Pulo.) There were no spirits on the island either.

They decided to go back to Fais for awhile and they went straight back, not stopping on the way. After a short stay in Fais, they decided to go back to Tobi and once again they left Fais. On arriving back on Tobi, they found Souhopit, Ramonparuh's full brother. A dispute arose because Souhopit and Ramonparuh both claimed the island. Souhopit asked: "you say that you were first, but where is your sign?" So they dug in the hill and found her clam shell but underneath it they found an old piece of thatch which Souhopit said belonged to him; thus it was proved that he was the first to come to Tobi. [This is probably the first stratigraphic excavation in the Pacific area! D.O.] Ramonparuh said that he had put it underneath her clam shell and chased him off the island. A little while later Tahabech left Tobi for Fais but his daughter and son-in-law remained.

On his way back to Tobi, Tahabech stopped at Merir where he found Souhopit who had discovered Merir after being chased off Tobi. Tahabech did not stay long but continued on to Tobi. After several years had passed, Tahabech, Ramonparuh and Yongoihar decided to go up to Merir and visit Souhopit. When they arrived, Ramonparuh was seasick so Tahabech asked Souhopit to take her ashore and keep her for awhile. But Souhopit answered that if she came

ashore he would kill her and burn her like a turtle. So they turned back to Tobi, where Tahabech left the other two and went to Fais-never to return.

Ramonparuh had her first child soon after this. His name was Yango and he was to be the next ruler of Tobi. She had six more children and from them she made five clans. About this time a woman named Roubah drifted to Tobi from Wolei on a bundle of material used in making mats. Her children became the sixth clan. Haworei and Yango and Ramonparuh were in the seventh or chief's clan.

Patricio does not know the story of the first settlers of Sonsorol but he does know that it was settled before Tobi, and that Palauans used to live there until killed off by people from Wolei. Merir, of course, was settled by Souhopit who was the first ruler, and Pulo had a god named Martaifur.

References Cited

Capell, Arthur S. 1969. Grammar and vocabulary of the language of Sonsorol-Tobi. University of Sidney, Australia.

Eilers, Anneliese. 1936. West Karolinen. *In* G. Thilenius (ed.), Ergebnisse der Südsee Expedition, 1908–1910; II, B, 9, 2. Friederichsen and Co., Hamburg.

Gladwin, Thomas, and Seymour Sarason. 1953. Truk: Man in Paradise. Viking Fund publications in Anthropology 20. Wenner Gren Foundation for Anthropological Research Inc.

Lessa, William. 1950. Ulithi and the outer native world. American Anthropologist 52: 27–52.

Murdock, George P. 1953. Culture areas in Micronesia. 7th Pacific Science Congress. Pegasus Press, New Zealand.

Osborne, Douglas. 1966. The archaeology of the Palau Islands: an intensive survey. Bernice P. Bishop Museum Bulletin 230.

Riesenberg, Saul, and A. H. Gayton. 1952. Caroline Island belt weaving. Southwestern Journal of Anthropology 8: 342–375.

MARC

INSTRUCTIONS FOR CONTRIBUTORS

Research reports, review papers, bibliographies, notes, and book reviews in anthropology and biology are accepted on the bases of their originality and their pertinence to Micronesia and adjacent Pacific areas. The language of publication is English, but summaries in another language are acceptable. Measurements are given in metric. Abstracts must be informative, not indicative. Each manuscript received will be acknowledged and reviewed by at least two members of the editorial board or by specialists other than board members in whose field the paper lies. Authors will be notified as soon as possible on the decision reached. Manuscripts should be sent via airmail to the General Editor, *Micronesica*, The Marine Laboratory, University of Guam, P.O. Box EK, Agana, Guam 96910.

Manuscript: An original copy and one duplicate of each manuscript should be submitted. Text, tables, and legends should be typed on 8-1/2'' by 11'' nonerasable, white bond paper, double-spaced throughout. An abstract of not more than 300 words should be included for each research report. In the text, citations are to be made as follows: "it was stated (Smith, 1951) that..." or "Smith (1951) states...". References should be listed in alphabetical order by authors at the end of the text under the heading REFERENCES CITED as follows:

Gosline, W. A., and V. E. Brock. 1960. Handbook of Hawaiian fishes. Univ. Hawaii Press, Honolulu. ix+372 p., 277 figs.

Lessa, W. A. 1955. Depopulation of Ulithi. Human Biol. 27(3):161–183.

Illustrative Matter: All line drawings must be executed in ink and photographs must be of high-gloss finish. Illustrations in color will be printed only if the author bears the cost of reproduction. Legend for figures should be supplied on a separate page and placed with all figures at the end of text.

Proof: Page proofs should be corrected immediately by the authors and returned via airmail to the General Editor. Authors are reminded that only a minimum number of corrections and alterations are acceptable.

Reprints: Reprints may be ordered on a form sent out with the author's page proof.

Printed by the International Academic Printing Co., Ltd.,
8–8, 3-chome, Takadanobaba, Shinjuku-ku
Tokyo 160, Japan