50,000 YEARS OF JAPANESE PREHISTORY:

A Transcript of the Symposium of November 1, 1978,

Univeristy of Manitoba.

Edited by:

Gregory G. Monks

University of Manitoba

Participants

Tatsuo Kobayoshi, Kokugakuin University

Richard Pearson, University of British Columbia

Fumiko Ikawa-Smith, McGill University

Appendix

"Intensity of Shell Collection Activities among the Jomon Shellmound People: an Estimation based on Paleotopography and Recent Fishery Data."

by

Hiroko Koike, Saitama University

Yoshiake Matsushima, Kanajawa Prefectural Museum

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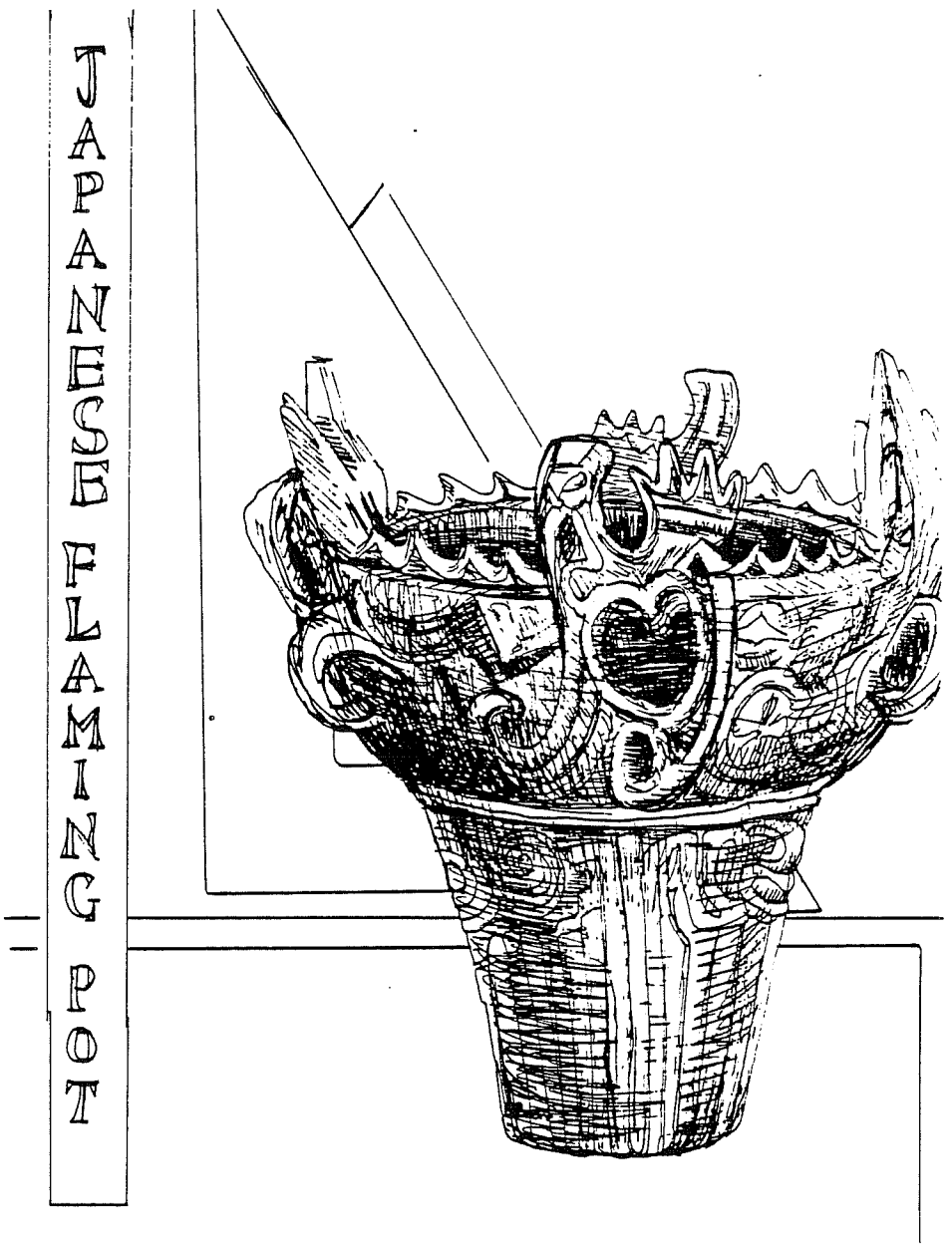
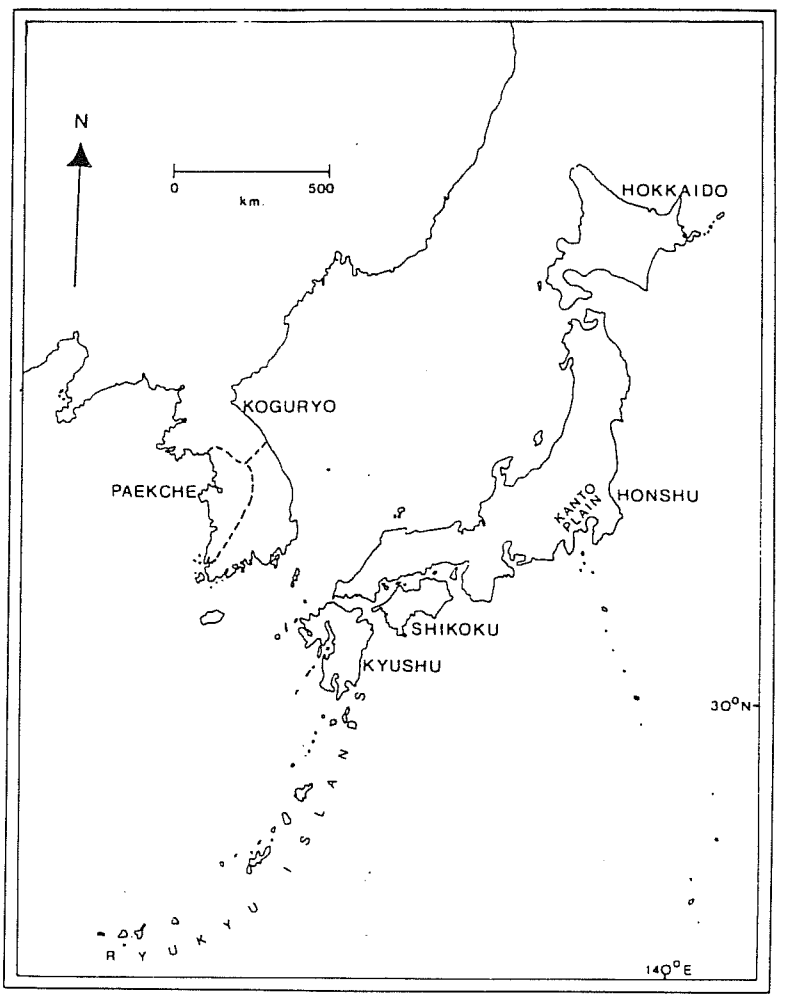
Department of Anthropology, University of Manitoba



JAPANESE FLAMING POT



Japan, Korea and the Ryukyu Islands

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Transcript of the Symposium

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(edited by Gregory G. Monks)

Participants:

Tatsuo Kobayashi, Kokugakuin University
Richard Pearson, University of British Columbia
Fumiko Ikawa-Smith, McGill University

Commentators:

Sid Kroker
Chris Meiklejohn

PREFACE

This volume contains two presentations. The first is a transcript of a seminar on Japanese prehistory presented by Professors Richard Pearson, Fumiko Ikawa-Smith and Tatsuo Kobayashi. The seminar, held on November 1, 1978, at the University of Manitoba, was given in conjunction with the exhibit 50,000 Years of Japanese Prehistory at the Manitoba Museum of Man and Nature. All three seminar participants are authorities on Japanese prehistory. Professor Kobayashi has worked for the Japanese Ministry of Education, Agency of Cultural Affairs, as a coordinator of government archaeological projects and he is now a faculty member of Kokugakuin University in Tokyo. Professor Ikawa-Smith of McGill University is an authority on east Asian prehistory. Professor Pearson, a faculty member at the University of British Columbia, has a special interest in man-land relationships in the Ryukyu Islands of southern Japan.

The seminar was a special academic presentation designed to provide some context for the museum display. Materials for the display were borrowed from the Japanese government and were formed into an exhibit designed to show the course of cultural development throughout prehistoric times. This exhibit was displayed in Vancouver, Ottawa, New Haven, Austin, Ann Arbor, Chicago and San Francisco as well as in Winnipeg. It was intended to foster cultural ties between North America and Japan and to highlight the rich cultural heritage of an important ethnic component of North American society.

In transcribing the seminar into its present form, it has been necessary to edit heavily in places to ensure clarity, eliminate redundancy and improve grammar. There have also been additions of citations, examples and illustrations that were not part of the original seminar.

The second presentation is a paper by Drs. Hiroko Koike and Yoshiaki Matsushima. Dr. Koike is a faculty member at Saitama University and Dr. Matsushima is a staff member of the Kanagawa Prefectural Museum. Dr. Koike has published extensively in Japanese and English on seasonality estimation using bivalve mollusc shells.

The editor is indebted to the symposium participants and the contributors. Each one has graciously assisted in improving the style and the accuracy of this volume. The symposium was recorded by Jim Batura, transcribed by June Hayward and initially edited by Pat Badertscher. Professor Louise Sweet and the UMAP Editorial Committee are gratefully acknowledged for their constructive comments. Line drawings were done by Linda Roberts and Michael Kelly. Final editing and research were conducted by the editor who accepts responsibility for whatever inaccuracies or oversights may exist in this volume.

PROFESSOR RICHARD PEARSON (University of British Columbia):

First, I would like to tell you who we are and the kind of things we do. Then I will make a few introductory remarks about the practice of Japanese archaeology which will lead us into five discussion sections. It is the best way, we think, to provide a brief sample of the major issues in the four main periods of Japanese archaeology. This organization will be helpful because the exhibit is divided very clearly into these four areas. In the final part of the seminar, we will be pleased to answer your questions.

Professor Fumiko Ikawa-Smith of McGill University has, until recently, been a specialist primarily in the Paleolithic of Japan. Both Professor Ikawa-Smith and her husband, Philip Smith, are two of the few students ever to have finished doctorates with Hallam Movius from Harvard -- a very rare distinction. Philip Smith is well-known for his work in Near Eastern archaeology, and Fumiko is widely recognized for her work in Asian archaeology, including a recent publication entitled The Early Paleolithic of South and East Asia (1978), as well as numerous articles in a variety of journals. Recently, she has turned her attention from the Paleolithic to the real juggernaut of Japanese studies, and the burning issue in a lot of anthropology today, the origin of the state. The origin of the Japanese state, in particular, is a complicated and challenging issue in which history, archaeology, art history and a number of other fields all merge.

Professor Tatsuo Kobayashi has been a member of the Agency for Cultural Affairs, part of the Japanese Ministry of Education (Bunkacho). He held a position in the Bunkacho for six years and was involved in coordinating the government archaeological projects for forty-seven prefectures. Since each prefecture averages three projects at any one time, this means he was the trouble-shooter, organizer, legal person and archaeological consultant for some 120 projects at once. Japan is only 1/27 the size of Canada (Fig. 1)

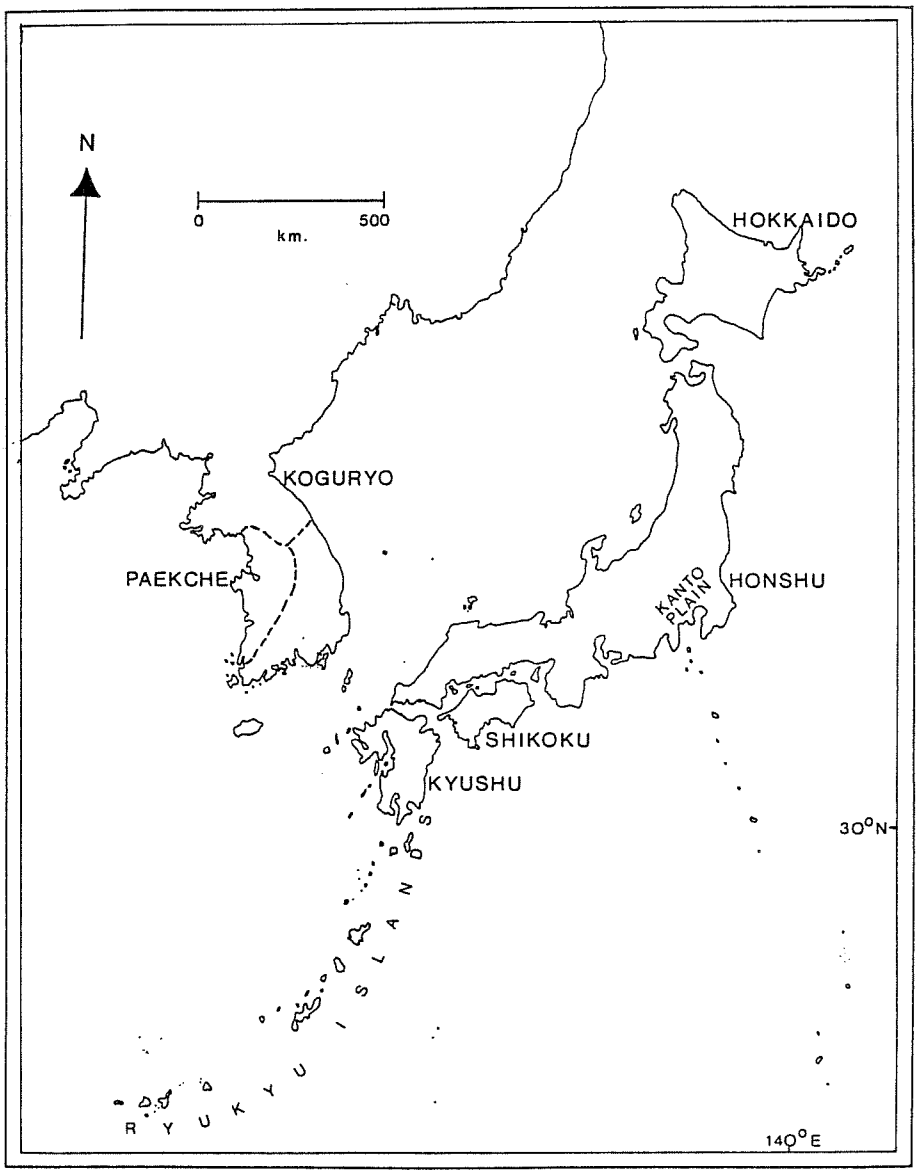

Figure 1. Map of Japan and adjacent mainland.

but, as you know, it has five or six times our population. He is, therefore, a very important person in questions of cultural resource management. He has extensive contacts throughout the Japanese archaeological community and has recently taken up a teaching position at Kokugakuin University. It was through Professor Kobayashi that we were able to borrow some of the objects for this exhibition which is travelling for two years in North America.

I received my Ph.D. at Yale University under K.C. Chang. Since that time I have taught at the University of Hawaii and the University of British Columbia. My interest in Japanese archaeology has centered on the Ryukyu Islands as well as on the main Japanese islands. I have been interested in applying principles of cultural ecology to the archaeology of Japan, and I have found that the environmental diversity and cultural complexity of the area make this field extremely rich and detailed.

There are probably more Japanese archaeologists per unit of population in Japan than in any other country. Chester Chard, in his book Northeast Asia in Prehistory (Chard 1974), has mentioned this. Recently, Mr. Karoku Miwa from the Agency for Cultural Affairs noted that there are some 300,000 registered sites now in Japan, an average density of approximately 1-2 registered sites per square kilometer. Some of you who are involved in archaeological recording in Canada will know that this is an incredible density, and it reflects a number of factors. One factor is the precision of site recording methods - in some cases, these may be very small sites. A second factor is the density of research. At any one time in Japan, there are literally hundreds of projects going on. The publication output is something like one hundred and fifty items per month, and this means that most libraries in Japan are unable to house all of the reports. They therefore specialize in local periods within the country.

This richness has led to very fine subdivisions, a great deal of study on chronology and, recently, many applications of scientific techniques that North Americans are, unfortunately, not fully aware of due to the language barrier.[1] However, Professor Hiroko Koike from Saitama University has published a monograph recently on the seasonality of shellfish (Koike 1980).[2] It is a very detailed study in which she cut through every clamshell in layers in certain shell middens and counted the growth rings on them. She was able to determine how many days from the dormant period in the middle of winter the shells had grown before they were collected. She was also able to show deposition patterns across archaeological sites. In some cases, day by day, people threw away shells from one place to another. She went further to show trends in ocean temperatures. Something else that is well developed is fission track dating, about which I know very little, a method for dating inorganics. It is possible to date certain kinds of inorganics which have been heated in the past if they have the requisite materials in them. These are some of the main techniques that are currently being applied in Japanese archaeology.

The Japanese have also turned away, as have American archaeologists, from test excavations to wide area excavations. In the exhibition at the Museum of Man and Nature, you will see totally excavated villages. Some of these are relatively large, and some of them span more than a thousand years. The Japanese are now beginning to look at the regional approach in archaeology which has become so popular in North America. Rather than look at an individual site, one looks at a whole region, plots all of the sites and tries to discern the interrelationships. There is a film being shown at the Museum of Man and Nature which, in part, shows trading relationships - how

[1] The Senri Ethnological Studies series publishes Japanese research in English (ed.).

[2] Professor Koike has published a number of articles on seasonality estimation from bivalve mollusc shells. A bibliography of her publications in English is included with other references cited in this paper (ed.).

various people traded back and forth for obsidian and dried shellfish. This sort of study has arisen from the regional approach in archaeology.

There are four periods in Japanese prehistory - Paleolithic, Jomon, Yayoi and Kofun (Fig. 2), and we would like to summarize briefly each one. Dr. Ikawa-Smith will talk about the Paleolithic, Professor Kobayashi will talk about Jomon and I will comment on the subsistence patterns of Jomon because they are of relative interest to people in other parts of the world. Since Jomon people were very affluent hunters and gatherers, they are relevant to studies of hunting and gathering societies in other places. Professor Kobayashi will discuss Yayoi, and then Professor Ikawa-Smith will talk about Kofun. In these summaries we will limit ourselves to the main issues.

PROFESSOR IKAWA-SMITH:

Paleolithic research in Japan actually has a very recent history. Until about 1949, no Paleolithic remains were supposed to exist in Japan. Before that, when archaeologists hit the Pleistocene formations, they would just pack up and go home because nothing was supposed to exist in the Pleistocene formations. But in 1949, by accident actually, an amateur found some tools sticking out of a Pleistocene formation at the Iwajuku site on the Kanto Plain (see Fig. 1). He went around to various universities, as the story goes, until he was able to persuade one graduate student that this was indeed worth investigating. That graduate student now is Professor Chosuke Serizawa of Tohoku University, who has been the major figure in Japanese Paleolithic research for the last twenty years or so. Once the excavation was conducted, some stone tools were indeed found <u>in situ</u> from the Pleistocene formation (Sugihara 1956). When this find was accepted, various people started investigating Pleistocene formations which were not looked at before.

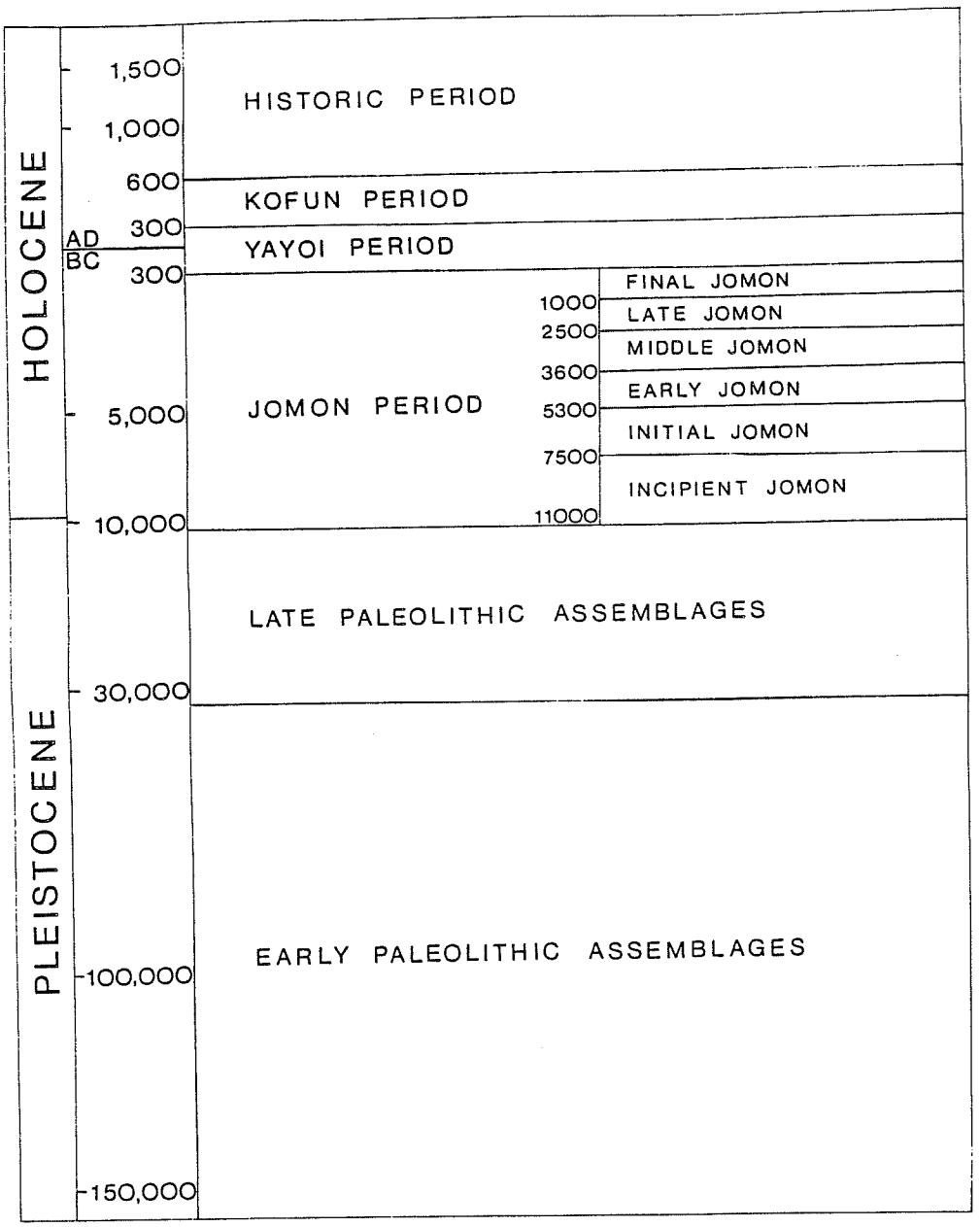

Figure 2. Generalized chronological sequence of Japanese prehistory. Reproduced courtesy F. Ikawa-Smith.

Within a matter of four years, large numbers of Paleolithic assemblages were found. By that time, various people such as Professor Serizawa and his supervisor, Sosuke Sugihara, and also Professor Masakazu Yoshizaki, now in Hokkaido, were proposing a chronology of Japanese archaeology (e.g. Sugihara 1967; Serizawa 1964, 1969; Yoshizaki 1961).

Paleolithic researchers in those days were mainly interested in establishing cultural sequences. I think they were influenced very much by the textbook notion of what the Paleolithic sequence was supposed to be -- handaxes, flakes, blades and microblades. As they investigated further, it became quite clear that things were not that simple. Without going into details, it is fair to say that Paleolithic research really has a rather short history in Japan.

By now there are about one thousand sites which date to the Pleistocene in Japan (Fig. 3). An overwhelming majority of these thousand or so sites are dated to the late Pleistocene, especially after about 20,000 years B.P. Some of the tools identified at the original (Iwajuku) site were first referred to as handaxes because the site did include axelike tools, but further investigation revealed that the assemblage is not really of the Lower Paleolithic age. Actually, it dates to about 20,000 years ago. It was, therefore, becoming clearer by about the 1960's that practically all of the Japanese Paleolithic dated to the last 20,000 or, at the most, 30,000 years B.P.

Around 1962 it was thought that there might be even earlier assemblages from Pleistocene formations in Japan. One of these sites was called Nyu in Kyushu and Professor Kobayashi was involved in this new investigation. I do not think I would offend Professor Kobayashi if I said that none of the fifty localities really turned out to be stratigraphically secure. Consequently, Professor Serizawa started a very energetic investigation at a series of

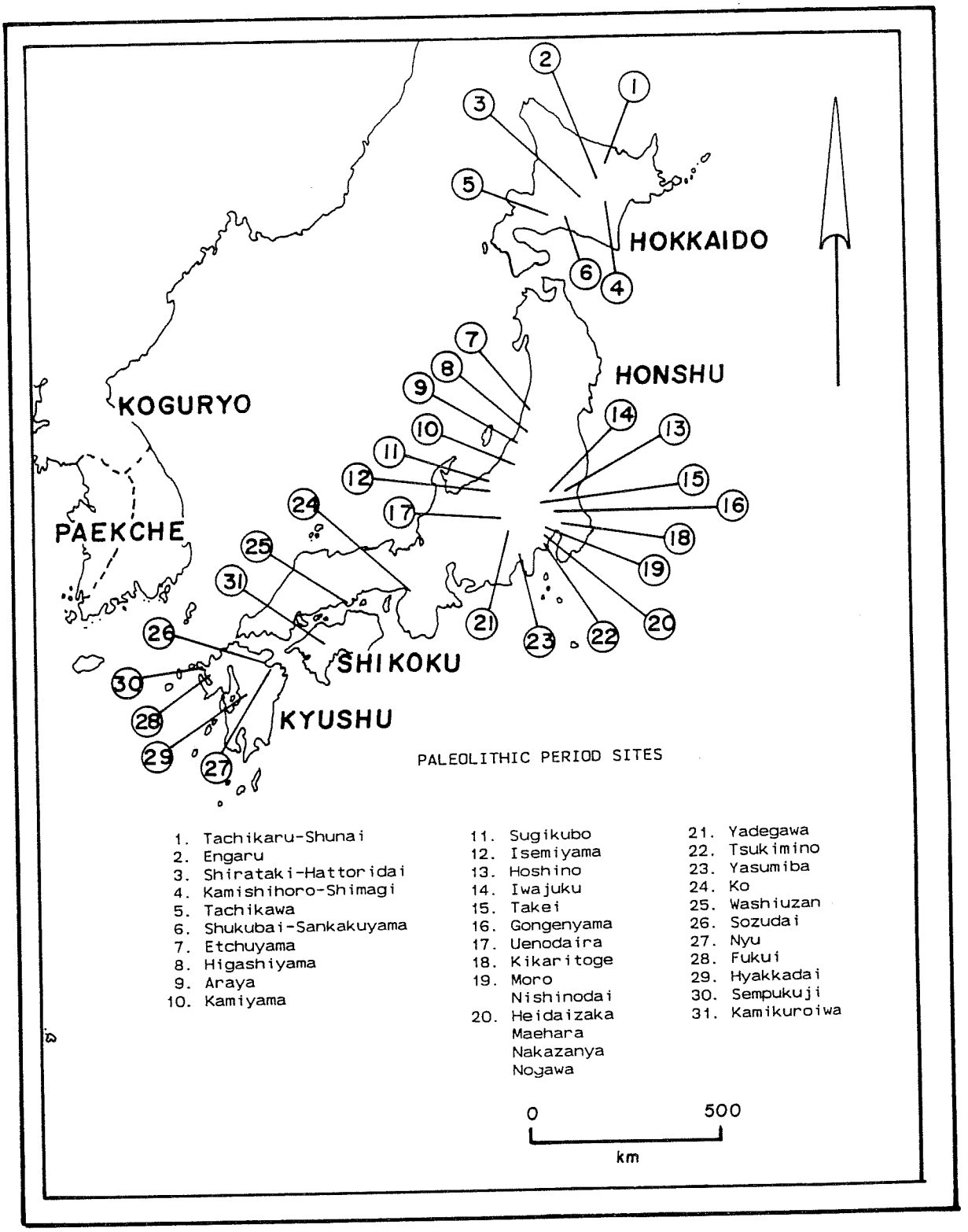

Figure 3. Major sites of the Paleolithic period in Japan (after Ikawa-Smith 1978: Figs. 1 and 8, and Aikens and Higuchi 1982: Fig. 2.4).

sites which he felt predated 30,000 years B.P. He also investigated the Sozudai site which was recently discussed in a short paper by Peter Bleed in Science (1977). It was on these bases that he proposed the division into Early Paleolithic and Late Paleolithic at 30,000 years B.P. This is not an entirely arbitrary figure. The fact that it is more or less contemporaneous with the Upper Paleolithic of Europe is quite irrelevant. In Japan 30,000 years B.P. is the basal date of one well-known geological formation, the Tachikawa loam. All of the Paleolithic is still considered by many to date from the beginning of that formation onwards.

When I looked at the Early Paleolithic materials closely, about 1970, there were at least one hundred assemblages reported to predate 30,000 years B.P. The purpose of my research was to investigate the Early Paleolithic. This group of assemblages was the subject of a very, very heated debate beginning about 1965. It raged on for about a decade but is rather quiet these days.

There appear to be three issues involved. One is whether these things which were presented as tools are really tools -- whether they are artifacts or not artifacts. A second issue is the basis for the suggested antiquity. It is a matter of debate whether this basis is tool typology, geological correlation or chronometric dates, and whether the association between the dated samples and geological formations is sound. A third issue is the stratigraphic context of the specimens. In any event, I have examined each of these one hundred or so assemblages rather closely and have come to the conclusion that probably about twenty or so assemblages may be considered artifactual assemblages which could predate 30,000 years B.P. Those who believe that there is an Early Paleolithic in Japan are a minority among the Japanese archaeologists. There are a large number of people who are totally

skeptical that these items are artifacts at all. I think Professor Kobayashi is one of them.

Another of my conclusions was that it is not appropriate to draw a neat line between the Early and Late Paleolithic periods. I believe that there is an Early Paleolithic tradition in Japan which seems to last at least until about 20,000 years B.P. and it overlaps with Late Paleolithic traditions. The latter word, "traditions", I would prefer using in the plural because by that time (30,000 years B.P.) there was a large number of functionally specific tools. There also was stylistic variability, and the variety which technological skills make possible enables us to distinguish various traditions and styles. The Early Paleolithic tradition of Japan shares many characteristics with the Early Paleolithic in South and East Asia, which is the title of the book Professor Pearson mentioned. By saying that there is an Early Paleolithic tradition of south and east Asia, I think I am following the pathway of my thesis supervisor, Professor Hallam Movious, who proposed the chopper-chopping tool culture of south and east Asia as opposed to the great handaxe culture of Europe. To call it the chopper-chopping tool culture, however, seems to overemphasize the big tools. What is characteristic of the Early Paleolithic tradition of south and east Asia, including Japan, seems to be flakes which were used without very much secondary retouch. I believe that these flakes really were tools to make other tools from such things as bone and bamboo. The latter were probably more important numerically and functionally in comparison to flake tools.

Let me speak briefly about human remains. Organic materials in Japan, human or non-human, are extremely scarce. That is due to the high acidity of the soil which is mainly of volcanic origin. Except in a very few places, such as limestone fissures and caves, animal bones and human remains are

seldom recovered. There are several sites in the Lake Hamana area where a large amount of animal bone has been recovered and three localities where human bones occurred. There were several localities near Kuzu in the Kanto Plain, north of Tokyo, and another one in Kyushu where Pleistocene human remains were found (see Fig. 3).

Earlier reports refer to the Middle Pleistocene age for the Ushikawa specimen from the Hamana region. Unfortunately, this has received international circulation. Also the investigator suggested the existence in Japan of Neanderthals. The Ushikawa bone actually amounts to 9.6 centimetres of humerus, and I think it is preposterous to talk about the existence of Neanderthal in Japan on the basis of less than ten centimetres of the medial portion of one humerus. Also, because most of the remains are from cave fissures the stratigraphy of this area is extremely confusing. There are fluorine test results, but I am not fully convinced that fluorine tests are conclusive for indicating that these bones are contemporaneous with the associated fauna. I do not believe that any of these bones, which come only from about six or seven localities, predate 30,000 years B.P. Therefore, from the human remains themselves, we cannot say that there were human beings at a specific date in Japan. Human remains are not very much help in this respect.

From animal remains it is clear that the Japanese archipelago was not a separate biome. There is a series of fauna which indicate a land connection with the Asian mainland. The argument that the Japanese islands were isolated during the Pleistocene and that people could not have come to Japan at that time does not hold. Big animals, like moose and elephants, certainly got to Japan, so humans could have come too. We cannot argue, on the basis of geological isolation, that there was no Early Paleolithic in Japan.

I mentioned that the overwhelming majority of Late Paleolithic assemblages all postdate 20,000 years B.P. and that there was a diversity of technological traditions. One such tradition consists of a group of assemblages in which primary flakes were detached by the classic blade technique. There is also a group of assemblages which, as far as the technique of primary blade detachment is concerned, appear to be a continuation of the Early Paleolithic tradition. There are others which specialize in producing flakes through a very complicated process of side blows. This is a blade technique in the sense that flakes are produced from prepared cores in a continuous fashion. However, the bulb of percussion is not at the bottom but at the side. There were also assemblages, especially in Hokkaido and the northern half of Honshu, where the method of secondary retouch is based on invasive flat retouch. Then, in the middle of Honshu, the technique of secondary retouch is based on extremely abrupt marginal retouch. Japanese archaeologists have proposed a large number of so-called type tools, named after type sites; Araya burins, the Kamiyama burins, the Moro knives, etc. It is possible to establish style zones from the distribution of these tools.

In the Late Paleolithic, another thing worth mentioning is the occurrence of partially ground tools in the Pleistocene context. The first Paleolithic artifacts ever obtained by controlled excavation, in 1949, were first called handaxes and assumed to be of great antiquity. On closer examination, as I mentioned earlier, they dated to about 20,000 years B.P. or even later--perhaps even 15,000 years B.P. There are three axe-like tools and at least two of them have a working edge which is smooth. I would hesitate to say they are polished. They are smooth, which may be due to use-wear, or it may be that they are partially ground artificially. Since then, there have been at least a dozen instances of partially ground axes. Several of them can be

dated geologically and referred to radiocarbon-dated formations about 25,000 years old. At least one specimen of these partially ground axes, which was obtained in connection with the Narita airport construction, has a radiocarbon date of about 28,000 years B.P. That specimen, from a photograph at least, indeed appears to be ground artifically in part rather than just smoothed by wear.

There was also a whole series of microblades, which I will not go into here. Another peculiarity of the Japanese Paleolithic, which gets us into trouble, is the appearance of pottery in a Pleistocene context dated by radiocarbon. There is one cave, a well-stratified cave called Fukui, in Kyushu, where pottery was found in one layer which is radiocarbon-dated to about 12,700 years B.P., and another layer dated to about 12,400 years B.P. This pottery -- really fragments -- from these sites appears to be sand tempered and is very well fired; it could not possibly be the first attempt at pottery making. It has a raised applique pattern; that is, it appears to have a strip of clay attached to the wet clay. A similar pottery is also found from another site in Kamikuroiwa in Shikoku which is also radiocarbon-dated to about 12,000 years B.P. I think those are the two sites which are directly radiocarbon-dated.

There are a number of other sites which produced the same kind of pottery. Actually, this really is not the first mode of decoration of pottery in Japan. In a site in northern Kyushu, called the Sempukuji site, the stratigraphy is duplicated. Below that is the horizon where there is applique decoration of pottery. It is not a continuous line but rather a series of dots. Japanese archaeologists call it a "bean pattern" decoration (toryu-mon in Japanese). The bean pattern pottery has a limited distribution, but the linear applique pottery is associated, at Fukui and Sempukuji,

with microblades detached from wedge-shaped cores. In many other sites, it is associated with bifacial points -- in most cases with a slight stem development. Sometimes, linear applique pottery is associated with partially ground axes.

We do not know where pottery was first invented. As far as radiocarbon dates are concerned, it is oldest in Japan so we really cannot seek a homeland of pottery outside of Japan at this point. This makes the Japanese archaeologists very uncomfortable because they seem to think that Japanese pottery must have come from some advanced centre on the continent. Wherever it was invented, it does not seem that pottery-using people arrived in Japan and pushed away the non-ceramic-using people. Ceramic technology seems to have been adopted by people with at least two different kinds of lithic traditions -- one with a microblade tradition and another with bifacial foliates and partially ground axes.

PROFESSOR PEARSON:

Now, I would like to mention further that Professor Kobayashi has been involved in a very vigorous series of publications over the years. There are two English publications, one in Arctic Anthropology (Kobayashi 1970), which deals with the microlithic-microblade industries of Japan. There is another publication on the nature of deposition in archaeological sites of the Jomon period in Arctic Anthropology (Kobayashi 1974). I think there is a foreshadowing of some of Michael Schiffer's (1976) ideas on c-transforms in depositional processes in Behavioral Archaeology in this article. Professor Kobayashi looks at the human behaviour responsible for the production of particular kinds of layers in archaeological sites. Some archaeologists have thought that if you take all of the objects in a Jomon house and map them all, and do a very careful recording, you can then talk about the

activities that went on in that house when it was in use. Professor Kobayashi has pointed out that, in many cases, the objects that are found in these houses were thrown in after the people left. If you dig carefully, there is a layer of sterile soil that separates the objects from the floor so any attempt to reconstruct the behaviour that went on in the house from the objects in the house is fallacious. I think it is really an important contribution.

Now Professor Kobayashi will talk about the Jomon period.

PROFESSOR TATSUO KOBAYASHI:

I will speak in Japanese and Dr. Ikawa-Smith will translate for me.

Toward the end of the Pleistocene, there was a large variety of micro-blade industries. Within this context, ceramic technology began in Japan, and this is a major event in Japanese prehistory. Because these dates are so old, there are many who do not believe them. However, there was another centre of early ceramic production in west Asia. In comparison with the ceramics from western Asia, it becomes apparent that the early ceramics in Japan were made for totally different functions. Western Asian pottery is seen to have copied the stone bowls of pre-ceramic times, or the floor basin attached to the floor. Therefore, western Asian pottery appears to be intended for storage as its major function. This contrasts with Japanese pottery which is a pottery for cooking purposes. Therefore, Japanese pottery may be considered as having a separate origin in Japan or in the surrounding area.

With the beginning of pottery, we speak of the Jomon pottery period. However, certain people call the very early pottery a final Paleolithic pottery because it is in excess of 10,000 years old.

PROFESSOR IKAWA-SMITH:

The question is (if I can just interject at this point) how to classify this very, very early pottery. I mentioned the pottery in the context of the Paleolithic because it dates to the Pleistocene and, commonly, anything which occurs in the Pleistocene is considered to be Paleolithic. So, in this case, I mention pottery. This is a grey area, a confusion of terminology, over naming this final period of the Pleistocene which has pottery. Some people call it the Mesolithic. Others call it the Epipaleolithic, or Incipient Jomon, or Proto-Jomon. Still others insist that the Jomon begins with the advent of pottery no matter whether it is 12,000 or 13,000 years B.P.

PROFESSOR KOBAYASHI:

With pottery it became possible to boil foods which were not edible without boiling, especially plant foods. This was an important nutritional breakthrough. In contrast to resources from big and small game, plant foods do not run away, they are safe, and they produce a large amount of energy. According to one calculation, plant remains which could be collected in sixteen hours are equal in energy to one deer. Therefore, with pottery, additional time then became available. The leisure time was then utilized for other cultural activities, such as the general development of Jomon culture.

The Jomon period lasted from about 10,000 or 11,000 B.C. to about 300 B.C. (Fig. 4). By the ceramics found, it is generally divided into six subperiods which most North Americans translate as Incipient, Initial, Early, Middle, Late, and Final Jomon. During the Incipient Jomon, which lasted about 2000 years, the amount of pottery produced was very small, and it is possible that the presence of pottery may not have had wide significance. In any event, the northern island of Hokkaido and the northern part of Honshu

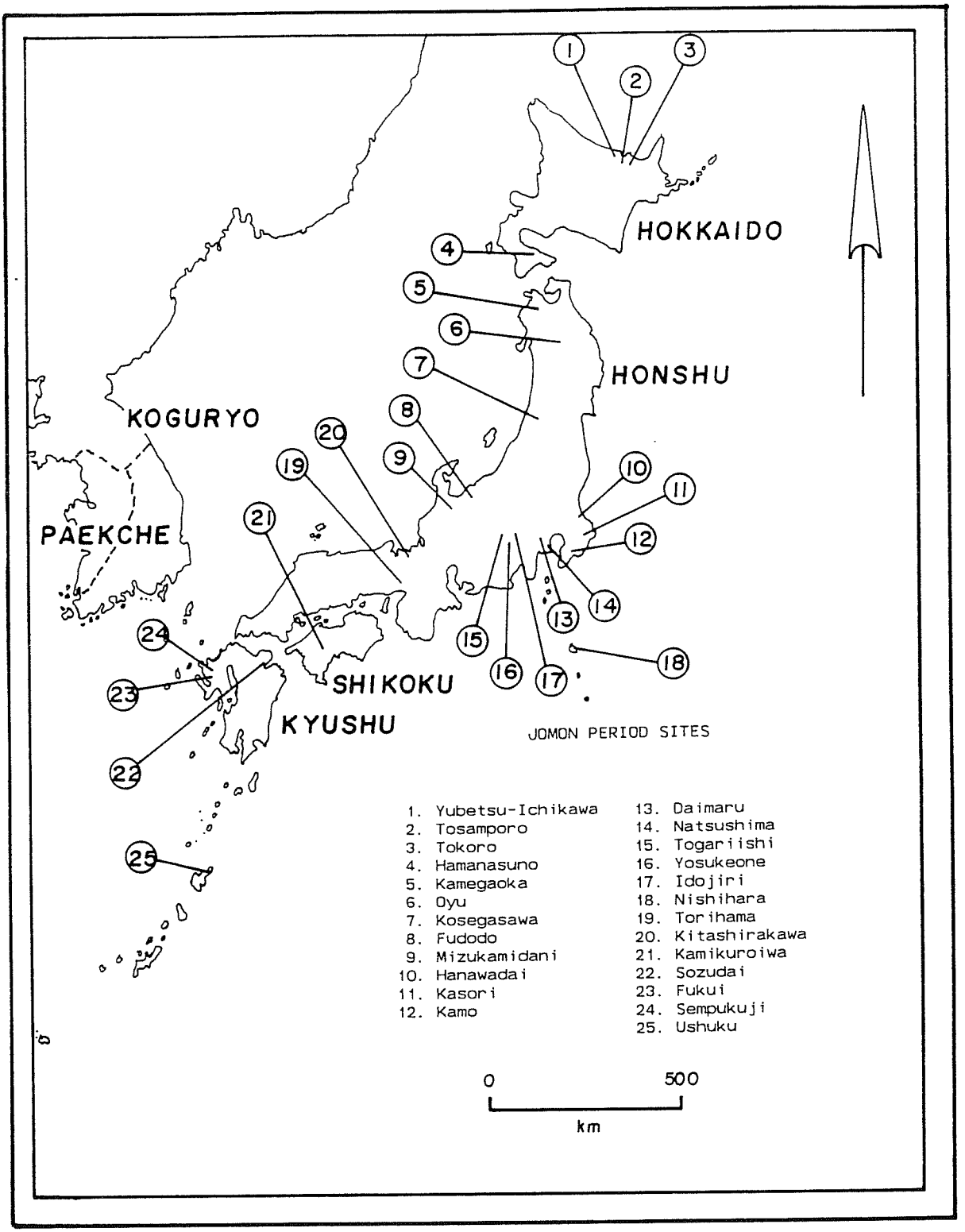

Figure 4. Major sites of the Jomon period in Japan (after Aikens and Higuchi 1982: Fig. 3.3).

remained non-ceramic for a long time. Recently, there was a startling discovery that, during the Incipient Jomon, there appears to have been long-distance voyaging to the main land of Okinawa.[3]

During the Initial Jomon period, the use of pottery spread throughout the Japanese archipelago and, also during this period, the utilization of maritime resources began. A large number of shell middens were formed during the Initial Jomon period. Not only the coastal resources but also those of the open sea were utilized, as evidenced by the presence of fish hooks.

The Early Jomon coincided with the worldwide climatic optimum and in Japan some coastlines moved inland as much as fifty kilometers. Another event during the Early Jomon, in addition to the use of pottery for cooking and storage, is the occurrence for the first time of pottery intended for serving food, i.e. serving vessels. Until then, pottery seems to have been used exclusively for cooking. During the Early Jomon, pottery was used both for serving and for storage. Most of the development occurred in the Kanto Plain, an area of mixed deciduous and coniferous forests.

This trend continued into Middle Jomon times, and there was a large variety of pottery produced during this period. There are several examples of Middle Jomon pottery shown in the exhibition. Another innovation during the Middle Jomon period is the appearance of a new category of tool. Up until then, tools were either for hunting, gathering or cooking. During Middle Jomon times, tools intended for spiritual life appear for the first time. This second class of tools, related to spiritual life, really expands the limit of the first category of tools from direct use in hunting, gathering and cooking to use for magical religious-activities.

During Middle Jomon, it appears that Jomon culture reached its highest

[3] There seems to be considerable debate as to the time of first occurrence of Jomon on Okinawa. Pearson (1969:4,110,134) places this event in Middle Jomon, Serizawa (1979:340,348) places Japanese-Okinawan contact in the Pleistocene, and Aikens and Higuchi (1982:184) report that Late Jomon is the earliest in Okinawa (ed.).

level of development. Therefore, Late and Final Jomon developments are a continuation of what occurred during Middle Jomon times. Most of the development occurred generally in the northeastern part of the Japanese archipelago, but during Late Jomon times it also reached to the western part of the islands. After the Final Jomon period came the Yayoi period which will be discussed later. First, however, I will make some comments on Jomon society.

In a Jomon site, one can recognize several settlement types. During Incipient Jomon times, caves and rock settlers were favourite habitations. Sites were commonly about 500 square metres in area and they very rarely exceeded 1000 square metres. This indicates that the social group was limited in size by the natural size of the caves and rock shelters during Incipient Jomon times. Later, during the Initial Jomon, settlements first appeared in open sites and were characterized by pit houses thought to have been built and maintained by individual family units.

Throughout the Jomon period, the settlements can be classified into six types: A through F. Type A settlement occupies a wide area on a flat surface and contains the remains of approximately 200 houses with their associated storage pits. Type A settlements are found during a fairly long period of time, about three ceramic types, which is probably 200-300 years. The artifactual remains also include "second type" tools; that is, tools which were not directly involved with subsistence activities. Type B settlements do not occur in flat areas but rather on slopes, like the backs of horses. They contain about 100 houses with storage pits occurring rarely. The duration of Type B, by ceramic types, is approximately 100 years. Type C consists of two or three house remains. In settlement pattern D, there are no house remains, only ceramic remains, and no "second type" tools. Settlement patterns E and F are not pertinent for this discussion.

Comparing the settlement types with the ceramic periods, one finds that during Incipient Jomon there are only settlement types C and D. During Initial Jomon, B is added to C and D. In Early Jomon, settlement type A appears and this combination of settlement types continues through Middle Jomon. The distribution and frequency of settlement patterns are currently under investigation; that is, in a given area there are a certain number of A type settlements, a certain number of B and a certain number of C. The data suggests an integration of various geographical regions, characterized by the frequency of settlement patterns. In other words, there is a structure in settlement pattern frequencies which can be arranged hierarchically. Within each region which consists of sub-units, there is a either a large structure, in some cases covering an area of 120 square metres, or a stone circle. A stone circle in Japan is a vertical boulder with long lines of stones radiating out from it (Fig. 5). These may have been astronomical structures or maybe purely ceremonial objects.

PROFESSOR PEARSON:

I would also like to talk a little bit about Jomon. There has been some speculation that these stone circles are comparable in some way to medicine wheels or alignments in other parts of the world but, unfortunately, there is not much comparative literature on this topic.

I would like to mention briefly the environment and some of the subsistence problems in Jomon. When I first came interested in the Jomon period, I remember very clearly reading in any number of publications that the Jomon people relied very heavily on maritime resources and on seeds, roots and berries gathered in the interior. It really made very little impact on me until I travelled to Japan and read further on the environment of Japan. I found that much of the English language material on Japanese archaeology

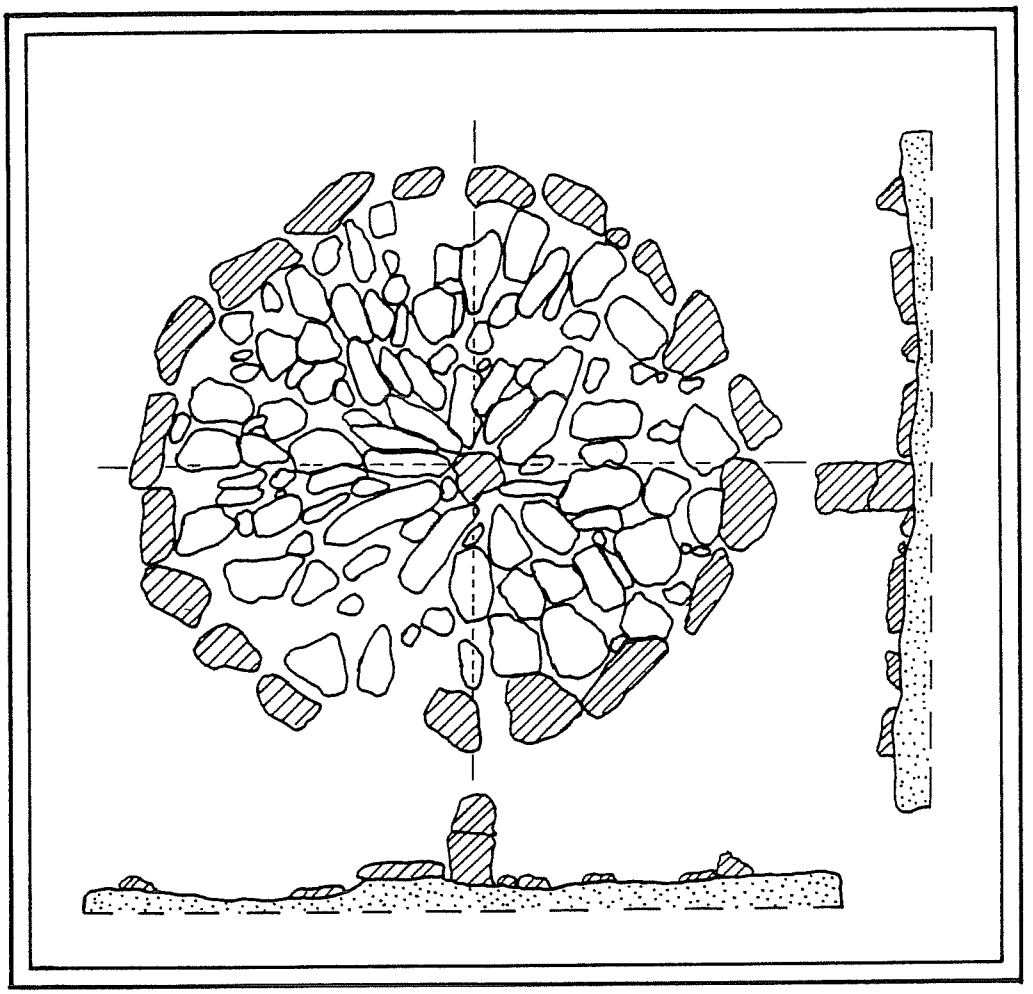

Figure 5. Circular stone feature from the Jomon period in Japan (after Aikens and Higuchi 1982: Fig. 6.66).

had relied very heavily on artifact styles and had really given very little attention to subsistence patterns. At first I thought this was a fault of the Japanese literature. Now I think it is because some of the people who have been involved in translating materials into English have been art historians who have concentrated primarily on the styles of materials rather than on their ecological relationships.

One of the things that struck me in particular is that Japan, as an archipelago, runs from 48^0 to 28^0 north latitude. This is an enormous range of latitude, considering the relatively small land mass it contains. There are also two major ocean currents that affect the Japanese islands -- a cold current coming down from the north, and a warm current coming up from the south. They meet somewhere off Tokyo and go right out into the Pacific. Even though Japan's area is miniscule, the environmental diversity is extreme. Although the diversity is extreme, these extremes are modified by the maritime climate.

Another very important point that emerges when looking at the Jomon ceramics is the range of local diversity created by problems in communication due to mountain ranges. In Japan, only a tiny percentage of the land is habitable, the remainder being steep. One finds, therefore, localized pockets of culture, a characteristic that is important in Japanese prehistory, art, and literature.

There is one particular forest type, unique in the world, which is found in eastern Asia and this is referred to as broadleaf evergreen forest. When we use the word evergreen, we have to be careful because in the very north of Japan and in the high alpine areas, there are evergreen coniferous forests similar to North American ones. In lower elevations in the southwestern portion of Japan, there is a type of forest made up of evergreen

oaks in particular and a wide variety of other broadleaf evergreen trees. These trees do not have very clear counterparts in the Americas except, perhaps, in the southeastern United States.

There are so many different kinds of edible Quercus (oak) and Castanea (chestnuts) plus a number of other genera that to translate them into English creates all kinds of confusion. Think of a situation in eastern Canada until the 1930's when we had the edible chestnut. We had a sweet chestnut that existed in Ontario until it was wiped out by a blight. Now most of us cannot even remember that such a thing ever existed, but it was a very important food item for the aboriginal people living in the eastern part of North America. In Japan there are any number of equivalent genera within an environmental zone that extends from central China along the Yangtze River Valley and into southwestern Japan. It is a zone that is relatively rich in these broadleaf evergreens that provide a large variety of different kinds of edible nuts. In these forests, there are also wild yams and a wide variety of edible roots.

We must keep in mind that Jomon period populations were relatively affluent hunters and gatherers. They had rich maritime resources and a wide variety of nuts, roots and tubers. Further north in Japan there are deciduous forests and streams up which Pacific salmon migrated and which also contained trout. Coastal shellfish and pelagic sea mammals were also utilized as subsistence resources. This subsistence base is similar to what one sees on Canada's Pacific coast and, indeed, some Japanese ethnographers have drawn a comparison between the two areas. As one goes south in Japan, the environment becomes more similar to that of Oregon and California where aboriginal people subsisted very satisfactorily, and with a degree of sedentism, on processed nuts and other foods (see also Koyama and Thomas 1981).

One of the big problems in Jomon archaeology in the 1960's was whether Jomon people could have been farmers. It raised what was called the "noko ronso" in Japanese - a big discussion among Japanese archaeologists about whether there could have been indigenous cultivation about 3000 B.C. in Japan. This is heretical compared to the usual interpretation that cultivation came in some time around 400 or 300 B.C. At that time, it was thought, rice cultivation was imported from continental Asia. The controversy has died down somewhat, but it raised a lot of issues and made people rethink many of their positions. One of the issues pertained to the diffusion of agriculture - whether people could just arrive from the continent and say, "OK, folks, from today on we start cultivating rice." Does agriculture diffuse like pottery styles or other aspects of stylistic things? Rice cultivation or any kind of shift to cultivation involves high population density otherwise it is not worth the effort, and it involves certain kinds of organization in addition to simply the technology and the crop.

A number of observations led the Japanese to suggest that Jomon people were cultivators. Firstly, on the Asian continent there was evidence for early cultivation. For instance, at the mouth of the Yangtze River the Chinese have found in the last year a stratified site, Ho-mu-tu, containing a fifty centimetre thick deposit of rice grains, radiocarbon-dated to 5000 B.C. The whole controversy of rice cultivation in Southeast and East Asia has really changed dimensions now because the Southeast Asian archaeologists have nothing as clear as this material found at the mouth of the Yangtze. We now know that on the continent people were cultivating rice as early as 5000 B.C.

Another thing that has already been mentioned is climatic amelioration. This may have made certain parts of Japan more favourable for cultivation.

If you read anything on Japanese archaeology, you know that by the Middle Jomon period the people are making enormous pots that just could not possibly be transported by transhumant hunters and gatherers. They are also living in permanent kinds of houses which seem to be bigger, better built and more stable than earlier structures. As Professor Kobayashi has mentioned, Middle Jomon people began to make a lot of things which did not relate directly to their subsistence activities. This implies an increase in ritual activity.

There are certain Jomon tools that raised interpretive problems for archaeological researchers. At first, large numbers of stone hoes, little saw-like tools that might have been used for cutting cereals, saddle querns and grinding stones led archaeologists along the treacherous path of interpreting cultivation. Similar interpretive situations have arisen in the Near East and Mesoamerica, for example. When all of the artifacts were considered together they appeared to suggest cultivation. However, in a similar way to Professor Ikawa-Smith's investigation of the Paleolithic, when they were examined one by one, the cultivation hypothesis became a house of cards. The little stone saws were probably used for some activity other than reaping because they did not show any silica sheen. The stone hoes could have been used for collecting roots just as well as cultivating them. Native roots are known to have been available, and the film which goes with the exhibition shows people digging them in the wild. The pottery is very elaborate and it suggested full-time specialization to the archaeologists, but studies of western Canadian hunting and gathering people, for instance, have shown that beautiful wooden art or other kinds of art can be produced by people who are not specialists. In fact, some affluent hunters and gatherers have more time on their hands than incipient cultivators.

Some archaeological sites have produced objects that look like baked grain of some kind. One such object looked like a very crudely made cake or cookie. It was thought to contain cultivated carbonized grain but, upon analysis, the object turned out to be primarily clay.

Many of these issues were discussed at length by archaeologists, and they raised interesting questions about the kinds of cultivation that might have been going on in East Asia. A number of crops were proposed. One was buckwheat which does seem to have an old history in Japan. Professor Hurley, from the University of Toronto, is fairly sure that he has found one grain of buckwheat from Early Jomon in Hokkaido (Crawford, Hurley and Yoshizaki 1978). Root crops have also been suggested. Of course, one feature of root crops is their poor archaeological preservation. The issue of whether root crop or cereal cultivation occurred first has also been debated.

Over the years, researchers have ceased to suggest the possibility of cultivation as early as Middle Jomon, but the discussion has led researchers to look at different kinds of hunters and gatherers. In the 1960's when we were talking about hunting and gathering and cultivation, we had the idea that all hunting and gathering people were rather miserable. This was before a number of books such as Man the Hunter (Lee and deVore 1968) and Stone Age Economics (Sahlins 1972) changed our conception of hunting and gathering people. Because the Jomon material is so rich, I think it provides an excellent example of hunting and gathering people.

An important point made by Professor Kobayashi is that there is no clear archaeological method of defining a territory for many hunting and gathering people. That is one of our biggest problems, I think. How can one calculate how much territory they moved through? One of the great things about Jomon archaeology is that there are such incredible stylistic

descriptions of pottery. There are at least 150 pottery types, each with very fine stylistic analyses. Additionally, every prefecture in Japan publishes maps of the entire prefecture showing the location of all the archaeological sites. These are on 1/50,000 topographical maps and I am really impressed with them. Many Japanese colleagues will sound a cautionary note if a map is five years out of date, but we just do not have anything to compare in most of Canada. Site distribution maps can be used as the beginning for a research design instead of the end as it too often is for us. To produce such a map is an enormous job. The Japanese maps, prepared by the Agency for Cultural Affairs, show codes for all the sites and list relevant site reports and bibliographies on the back. These maps, in conjunction with analyses of artifacts and faunal remains, are an excellent device for looking at expanding or contracting group territory. This is one of the issues that Harris (1977) discusses.

Japanese evidence on intensification of collecting is extremely interesting. Many of the food resources used by Jomon people could not be eaten in their natural state; instead, they had to be processed. There are important foods eaten today in Japan that require processing. For example, the root called Konnyaku cannot be eaten unless it is prepared in a complicated series of stages. Jomon people ate the horse chestnut although it apparently was not a favourite food. Horse chestnuts cannot be eaten off the tree, of course, so they must be leached.

There is a whole series of learning steps in intensifying the yield of collected resources. Processing resources to make them edible is one step and storing resources for future consumption is another. Professor Kobayashi mentioned storage pits. Jomon people had very elaborate ways of lining pits in the ground and packing them full of acorns so that they could be used

months later. Another step in intensification is conversion of resources of one type into another type, e.g. exchanging fish for lithic raw material.

There seems to be evidence that Jomon people were experimenting with cultivation by the end of Jomon, about 1000 B.C. Professor Yoshinobu Kotani, of the National Museum of Ethnology, Osaka, has undertaken some studies that suggest the cultivation of rice ca. 1000 B.C. Buckwheat is another candidate for early cultivation. It has been suggested that Jomon people were growing these things in a dry land situation and that only later did they start to grow rice in an irrigated context. Some of the rice authorities have difficulty with that suggestion because the varieties of rice available to people at that time would only grow favourably in wet environments. Also, there is some question as to whether these varieties of rice could be grown in an intensified system. Perhaps rice seeds were scattered in swamps at first. Rice does not seem to be native to Japan so it must have been imported. This has raised interesting questions about the extent of communication between Japan and the continent during the Jomon period. Many people have suggested that during the Jomon, Japan was very isolated. Yet there is evidence of growing connections between Japan and Korea for at least the last 1000 years B.C. (see Pearson 1976).

This brings up one last issue, and that is the origin of the Japanese language. Traditionally, linguists have said that Jomon people did not speak Japanese, and there has been a debate about their language. One theory held that Jomon people were all Ainu. Another theory maintained that the Ainu may have been one of a whole mosaic of populations in Japan that shared Jomon culture. The Japanese language is thought to have been brought in with the Yayoi period. I wonder if we can see in the evidence of cultivation techniques and the similarities in pottery styles in the last part of

the Jomon period some sort of communication between the Korean peninsula and Japan. Perhaps there was a gradual divergence between these areas as communities came out from Korea and became isolated in Japan. This could account for the differences which linguists say exist between Korean and Japanese.

Korean, Okinawan and Japanese are all in one language family, and most linguists agree that they are related to Mongol, Goldi and several other languages (see Aikens and Higuchi 1982). After these, the nearest relative is Turkish. So, the origin of the Japanese language is an enormous enigma. Japanese linguists will sometimes talk about genetic relationships when they discuss non-Japanese linguistics but when they talk about Japanese linguistics, they change and use different words. I have been told that they use Shinzoku Kankei to talk about other languages and Keito ron to talk about the origins of Japanese. They regard the language almost as if it literally came out of the Japanese islands as in one of the origin myths in which people just came out of the ground already formed, or as in another myth in which they come from heaven. In any event, the origin of the Japanese language is a major research problem.

Professor Kobayashi has suggested that perhaps the people on the Asian continent belonged to some different linguistic community from the Jomon people. One of the enigmas is that during Jomon times, they were able to get themselves to Okinawa. Yet, why is there so little similarity between the Japanese islands and the Siberian coast? One suggestion is that these people were not friendly, that there was some barrier there, and that maybe it was a cultural barrier. What I am suggesting is that these people would have been derived from the mainland through a gradual separation process.

Finally, one of the debates in Japanese archaeology concerns how to

label Jomon. In the tradition of Northeast Asian archaeology, cultures which have ceramics and polished stone tools are called Neolithic. This creates no end of confusion, unfortunately, but it is firmly entrenched in the literature. It affects Japanese, Korean, Siberian and Chinese archaeology. If there is pottery it is immediately Neolithic. If we are accustomed to a developmental definition of Neolithic from other parts of the world in which Neolithic means food production through cultivation, this different definition can be extremely disconcerting. In reality, it seems that Jomon represents, in its early stages, a form of Mesolithic cultural development or perhaps some form of Archaic development similar to the Archaic Period that we know from the Eastern Woodlands of North America. But we are still left with the question of what to do with the later Jomon periods when there is evidence that people are starting to manipulate plants. This issue remains unresolved.

The third period in Japanese prehistory is Yayoi which will be discussed by Professor Kobayashi. This will be followed by a discussion of the final period, the Kofun, by Professor Ikawa-Smith. We hope to leave time afterward for questions and discussions.

PROFESSOR KOBAYASHI:

At the end of the Jomon period there appeared in the northern part of Kyushu a new cultural group called the Yayoi. Yayoi culture was not an indigenous development within Japan but was established as a result of strong influences from the continent. It was characterized by the cultivation of rice and the use of iron. Before the establishment of Yayoi culture, however, there appeared to be a period during which the cultivation of rice was known to Japan. Even though there is no clear evidence of the tools associated with rice cultivation, there were cultural traits present

which are associated with rice cultivation. One such trait is the burial dolmen (burial under a pile of large boulders), and another is weaving.

PROFESSOR IKAWA-SMITH:

Perhaps if one refers to a map it can be noted that the Korean Strait is about 200 kilometres across and that the earliest Yayoi deposits are known from the northern part of Kyushu (Fig. 6).

PROFESSOR KOBAYASHI:

It is interesting to note that before the subsistence base of rice agriculture entered Japan, the associated traits, such as burial customs and weaving, arrived. Familiarity with these cultural traits may have prepared the way for the later acceptance of rice cultivation.

Another factor that may have prepared these people for the acceptance of agriculture may have been the seasonality of activities during the hunting and gathering, i.e. Jomon, period. The beginning of rice cultivation in northern Kyushu, which signifies the beginning of Yayoi culture, is estimated to have occurred about 300 B.C. From the beginning, it was associated with the preparation of cultivated fields. The kind of cooperative activities that are required in the preparation of irrigated fields would be different from the kind of cooperation that would be involved in Jomon hunting-gathering. The results of cooperation in a hunting and gathering society would be immediate. In contrast, the results of cooperation during preparation of cultivated fields would involve a delay in reward of six months or more. Therefore, the nature of social control in agricultural society would have been different in comparison to a hunting and gathering society.

Another difference is the nature of leadership during Jomon times. Jomon hunter-gatherers are thought to have been organized at the level of

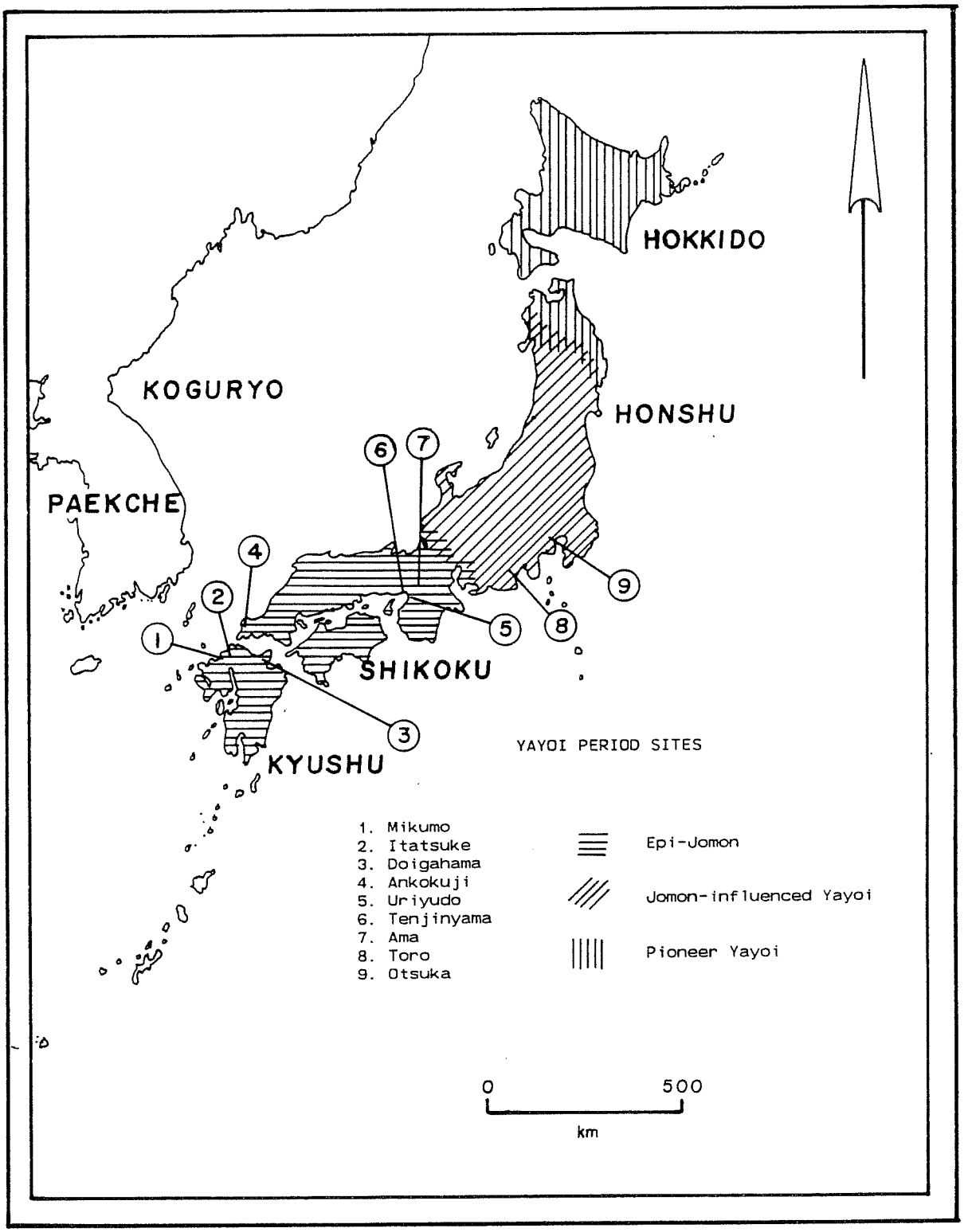

Figure 6. Major sites of the Yayoi period in Japan (after Aikens and Higuchi 1982: Figs. 4.1 and 4.37).

chiefdom and the chief's authority is thought to have been mainly magico-religious. In Yayoi times, new functions were required of the chief in practical, political and managerial areas. Chiefs also would have controlled stored agricultural products, and their sphere of influence tended to spread from their own community to neighbouring ones. Evidence to this effect, for example, is differences in burial goods in grave sites.

The integration of neighbouring communities by a leader may be modelled after social organization in the Han Province of China. This activity --- the integration of neighbouring communities by means of warfare -- appears to have begun in northern Kyushu first. This process, characterized by man-to-man combat, began in the Middle Yayoi period. Yayoi, I should mention, is usually divided into three sub-periods: Early, Middle and Late; so it is simpler than Jomon. I should also mention that man-to-man warfare occurred only between chiefs, not between groups. Jar burials first occur in Middle Yayoi. Jar burials consist of huge ceramic jars, often paired and oriented mouth to mouth, in which a corpse and burial goods were placed. In Kyushu these goods were frequently bronze weapons. Such weapons have been interpreted as special treasures -- status symbols -- rather than functional weapons but, recently, there have been cases where only the tips of these spears and swords were found in jar burials. In some instances, these fragments were embedded in the corpses so not all bronze weapons were symbolic items; some were indeed used for killing.

In Chinese records, at a date equivalent to our A.D. 57, one of the Yayoi chiefs is reported to have gone to China and asked for validation of his status. The Chinese Emperor is said to have been very pleased and to have given this person a golden seal. In the Eighteenth Century, long after this, a seal was excavated from northern Kyushu and it is supposed

to be the seal that was given in A.D. 57. In any case, it says, "the seal of the King Na of Wa." The Wa are the people who are thought to have been living in Japan and southern Korea. The leader of this group was called Na and the seal was to validate his status as King.

This union of groups that developed in northern Kyushu began to expand eastward where it encountered another union of groups. At this time, one finds settlements on higher ground, a location which would not have been practical for agricultural activities, and large numbers of stone arrowheads suggesting armed conflict. Arrowheads were not made in great quantity until that time, but those made in the latter part of Middle Yayoi and into Late Yayoi times are large ones with sufficient weight to have been effective enough to kill human beings. This confrontation between the northern Kyushu group and the other group was centered in the former Yamato district, a narrow basin of rich agricultural land surrounded by mountains near the present cities of Nara, Kyoto and Osaka. The Yamato group won this confrontation.

After this period of conflict, a chief's power became more political than magico-religious. This is indicated by the disappearance of artifacts which had symbolic meaning only, such as bronze bells and bronze swords. In later Yayoi times, these bells and swords, which had previously been both religious and functional, became too large and too thin and ceased to be functional. They are generally considered to have become of magico-religious significance only. When this magico-religious Yayoi period ended and the nature of control became purely political, then the Kofun period began.

PROFESSOR IKAWA-SMITH:

When the Kofun period begins and ends has always been a problem, but

I think it is generally considered to begin about A.D. 300 at the end of Yayoi. I would prefer an ending date of about A.D. 600 because after that date, in the Historical period, written documents become much more reliable. There is a legendary history of Japan which takes the whole history back to 600 B.C. but, in those accounts, emperors lived for 114 years which, even by today's life expectancy, is somewhat excessive. We think that the early writings are legendary, but about A.D. 600 the historical record becomes quite reliable. Also, there is good archaeological evidence to indicate that the administrative structure at this time was a state form of political organization. Kofun, then, roughly dates between A.D. 300 and A.D. 600 (Fig. 7).

Kofun literally means "old burial mound". There are many kinds of old burial mounds, but the most characteristic type of Kofun mound is the key-hole shape. These occur first in the southern part of the old Yamato district.

I should like to restrict myself to one issue during the Kofun period; that is, the role of continental groups in the formation of the Japanese state. As I said earlier, through documents and the archaeological record we can see that by about A.D. 600 there exists a state which exhibits an administrative structure and evidence of force. One of the issues about the Kofun period, revived in North America by Professor Gary Ledyard of Columbia University, was the idea that the ancestors of the Japanese emperors were foreigners who invaded from Korea and established the Yamato dynasty. This notion became rather popular in North American literature after the publication of Ledyard's (1975) paper in the Journal of Japanese Studies.

The idea was originally suggested by Professor Egami in Japan as early as 1948 (see also Egami 1950). Actually, 1948 was about the earliest time

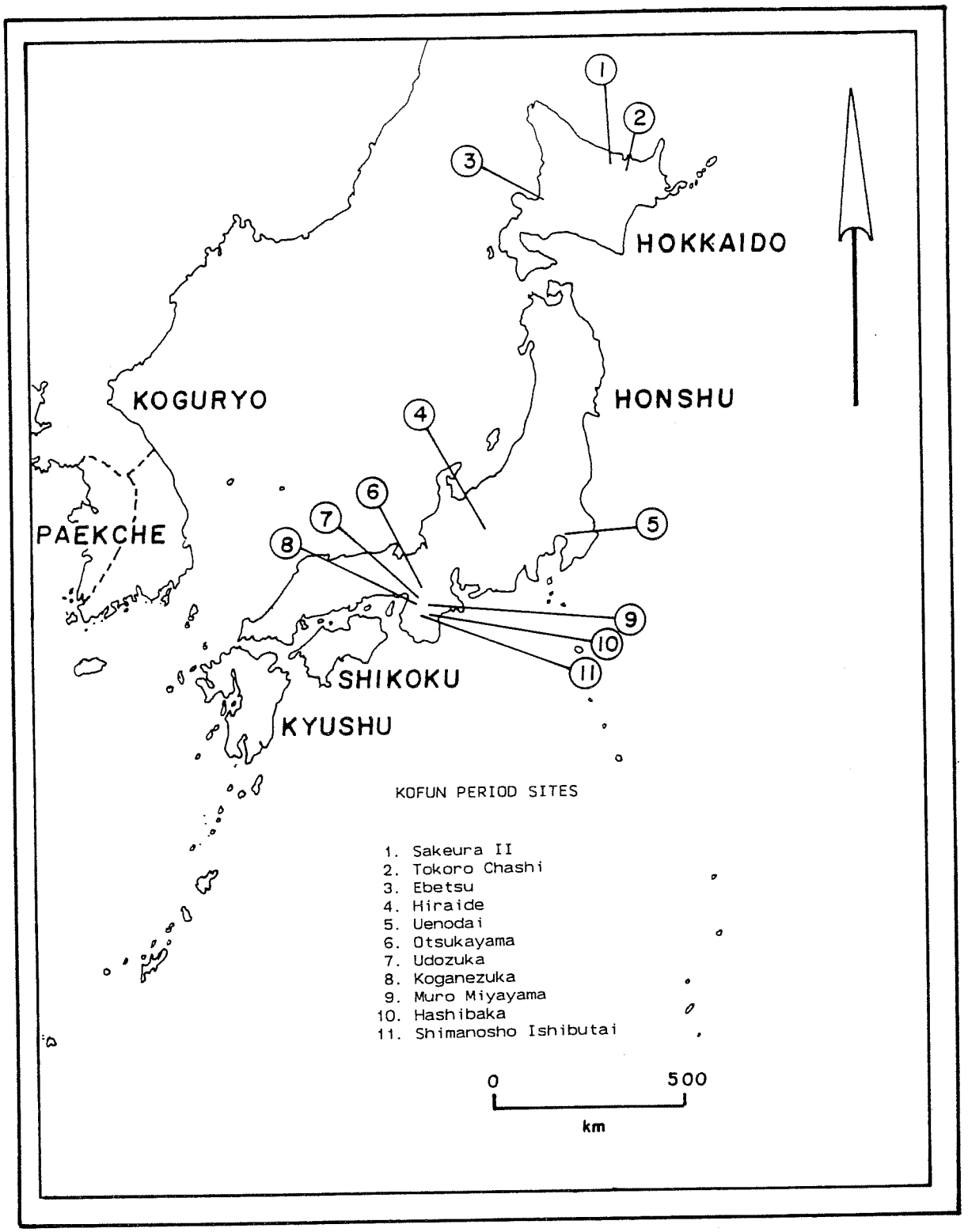

Figure 7. Major sites of the Kofun period in Japan (after Aikens and Higuchi 1982: Fig. 5.1).

he could have talked about this publicly because if he had done so during the war he would have met with a rather unpleasant experience. In any event, Professor Egami has suggested that sometime in the middle of the Kofun period there is an indication of an armed invasion of Japan. As archaeological evidence for this invasion he noted that during the 5th and 6th centuries increased quantities of weapons were included as burial goods. Another piece of archaeological evidence, he suggested, was the presence of elegant trappings connected with riding horses. The importance of horses was therefore suggested. The third evidence of invasion is the occurrence of artifacts with clearly continental motifs. There are objects, such as swords with a lion's head motif on the hilt, that reminded Professor Egami of the Scythian art style of central Asia. The later Kofun burials also contain a large quantity of ornaments with continental motifs. Earrings made of gold clearly indicate a high degree of technical craftsmanship that can be duplicated by examples from Korea. This is the kind of archaeological evidence he suggested.

Based on the nature of burial goods in the later part of Kofun, he felt that military horsemen were present in Japan and that they bore some vague relationship to the nomadic horsemen of central Asia. He proposed that the people who migrated to Japan were rather like the Puyo in the southern Manchurian plain.

Professor Ledyard, with his expert knowledge of ancient Korean and ancent Japanese languages and documents, has reexamined the evidence and come out largely in favour of this idea, but he has also pointed out various problems. Actually Professor Ledyard sees two waves of movement from the continent into Japan (see Fig. 1). The first one occurred approximately coincident with the fall of the Lolang and the withdrawal of the Chinese

forces. All this disturbance in northern Korea made the people in southern Korea feel unsafe. Professor Ledyard feels that these people were engaged in the trade of iron to Han, and the withdrawal of the Chinese meant the disruption of the profitable trade. Thus they moved to the relative peace of the Japanese archipelago. It was inhabited by the Wa, the same ethnic group as those who had lived in southern Korea. This may have taken place, according to Professor Ledyard, in A.D. 318 and the leader of the moving group may have been Emperor Sujin. This date of A.D. 318 is about the time when the Kofun period begins.

Then there was a second wave which began when the Puyo of southern Manchuria came down and established the state of Paekche in Korea. The Puyo then invaded Japan, but they were not really galloping horsemen even though they did have horses. This occurred in A.D. 369, and the leader may have been the person recorded in the Japanese legend as Emperor Ojin. Ledyard also thinks that Ojin's foreign dynastic line became extinct, permitting a a resurgence of native Wa kings. So, after all, in Professor Ledyard's conclusions the Emperor's ancestors were not foreign.

I was interested to examine the archaeological evidence with this hypothesis in mind. I agreed with Professor Ledyard's first migration hypothesis: originating in southern Korea or northern Kyushu, there was an eastward population movement at the end of the Yayoi period. However, I just cannot escape the impression that there is a break from late Yayoi to early Kofun times in the Nara Basin itself. As far as his second migration hypothesis is concerned, indeed there are numerous Korean earrings and swords in the archaeological record, but that does not mean that the people who wore them were Koreans. By that logic, all the Japanese walking around in Japan today should be Europeans. Things can be imported or they can be made

by craftsmen who came to Japan from Korea. There is no question that many Chinese and Koreans were in residence in Japan. The Koreans did have strong ties with the Imperial household in early times. There were very powerful lineages of Korean origin that provided consorts for the ruling family, so the ruling family could indeed have had a very strong component of Korean genes after several generations. Nevertheless, I do not think that the material evidence for invasion of Japan by a group headed by the Imperial household.

As far as the increase in weapons and horses is concerned, I discuss this in a paper I am preparing now. Saunders and Price (1968:206) and Morton Fried (1967:240-242) talk about this idea of a secondary state which is formed in a competitive situation as a response to pressure from a pristine state. I agree with the idea that states are formed in competitive situations, but the crucial factor in the Japanese context is competition within the various chiefdoms of Japan, not competition with Korea or with more distant pristine states in China. In this competitive situation, things like horses would have been powerful war machines. One who could afford to have horses would have had an advantage in his competition with other chiefs. Ledyard thinks that in A.D. 369 the Puyo king Ojin unified Japan and, at one point, Puyo power stretched from the middle of the Korean peninsula to central Honshu. I don't think there is any evidence of actual unification within Japan at that early date. There is no archaeological evidence for an administrative structure for the governance of such a large territory. The rapid spread of Kofun throughout Japan is sometimes interpreted by Japanese archaeologists as indicating a process of unification, but I think it indicates the reverse situation. The occurrence of large burial mounds (Kofuns) would indicate the existence of chiefs powerful

enough to erect these huge tombs for themselves, so the country appears to be far from being unified until the seventh century.

PROFESSOR PEARSON:

A replica of the gold seal mentioned by Professor Kobayashi is in the exhibition. I understand that the original is held by the Kuroda family, the old ruling family in Kyushu. As for the bronze weapons, I am amazed at how sharp these were. I was under the illusion that all of the Japanese bronze weapons were thin and that if they were stuck into somebody they would bend but these certainly will not. Some of them are still razor-sharp after 2000 years, and it is amazing how substantial they are.

Are there any questions or comments?

SID KROKER:

I am not sure who this should be directed to, perhaps Dr. Ikawa-Smith because she spoke on this. Up until very recently, North Americanists have thought that we had only a lithic technology to begin with. Now some of the new material coming out of northern Alaska and the Yukon suggests a culture with bone technology. Would you care to speculate on the possibility of a pre-Paleolithic bone technology in Japan?

PROFESSOR IKAWA-SMITH:

Well, there are few organic remains. There is at least one with which you are familiar, Professor Kobayashi, that is the bison rib from Hanaizumi. It appears to be artificially cut but it does not have a very definite shape. Also, it is not from the pre-Paleolithic because it has a radiocarbon date of about 20,000 years B.P.

PROFESSOR CHRIS MEIKLEJOHN:

I would like to indicate an interesting comparison. I have been work-

ing within the last year on the Mesolithic in northwestern Europe. When the discussion on Jomon came up, I noticed a lot of very similar patterns, one being the evidence of a rather marked population increase, apparently in a preagricultural population. For example, we have evidence now in northwestern Europe of a several-fold increase in population in the north German plain in the millennium prior to the appearance of agriculture.

Following from work such as that of Binford (1978) and Lee (1972) on cultural aspects of the development of population, I think that people should very carefully consider physiology in conjunction with sedentism. There are some good suggestions that the shift to sedentism involved primary mechanisms in populations that have nothing to do with cultural reactions whatsoever but are, first and foremost, physiological reactions to changed patterns which probably are connected via body fat levels to fertility. There is good evidence now that fertility is controlled not by absolute amounts of body fat but by relative proportions. Therefore if there is a change in the pattern of behaviour associated with sedentism that reduces the work load in any way, it increases the average body fat content and you will observe a marked increase in fertility right away. Binford's figures on sedentism from Anaktuvuk Pass would suggest an immediate seven-fold increase in population growth after 1940. The figures we have on northwestern Europe suggest the same kind of pattern and it would look like the pattern here in Jomon is similar thus adding weight, interestingly, to the hypothesis that agriculture is a product of population growth and not the other way round. That is, sedentism comes first, not agriculture.

PROFESSOR PEARSON:

I think this is one of the things, as I mentioned very briefly, that concerned some of the Japanese cultural geographers. There is a book called

Before Rice Cultivation by Komei Sasaki (1968), an ethnographer at the National Museum of Ethnology. I think he was one of the first people to be concerned about requisite levels of population and to look at the beginnings of agriculture in Japan not simply as a product of invasion. There would have to have been certain preconditions to allow for its acceptance. One interesting idea is that Jomon culture experienced social changes that led to its replacement by Yayoi.

I think one of the points that Professor Kobayashi has made in discussion is that the flowering of Jomon took place along an ecotone in the Kanto Plain where one finds deciduous forests and broadleaf evergreen forests in close juxtaposition with the maritime resources of Tokyo Bay. These ecotones are very, very rich because there is a changing shoreline that results from deposition of alluvium and detritus from Mount Fuji.

In addition to these ideas, I think a lot of archaeologists, particularly in this book by Friedman and Rowlands (1977), The Evolution of Social Systems, are now trying to get away from topics like population levels and subsistence in favour of social phenomena that lead to cultural evolution. I wonder whether there are some changes within the mental culture of Jomon. I may sound normative and mystical, a betrayal of good behavioural cultural ecology, but I wonder if there may not be something there anyway.

PROFESSOR MEIKLEJOHN:

May I ask a question? Is there any evidence for depletion of resources in terms of Jomon that could result in changes? If you presumed the exhaustion of resources was based on high population density, you will run into a crisis point faster.

PROFESSOR PEARSON:

Well, there is another thing about Jomon that is interesting. Most of

the real "goodies" come from the northern part of Honshu where the Jomon material is very rich. When I started working in Okinawa and Kyushu, I thought that this was a plot by the Honshu archaeologists who always claimed that their Jomon was better than anybody else's, but it really seems to be true. The culture reaches a peak there. The southwestern part of Japan apparently always had a sparse population, and Jomon material culture is less elaborate there. As a result, this area may have been more receptive to new subsistence modes.

This has always bothered me, and it is why I would like to make a comparison between the Jomon in Kyushu and the Jomon in the northern part of Honshu. I wonder whether the apparent richness of Jomon in northern Honshu is a result of Tokyo archaeologists moving north to do their field work or of the Kanto Plain being so well-known because Tokyo sits in the middle of it, thus facilitating field work in that area. If it is true that southwestern Japan has an impoverished Jomon culture then maybe there is something fragile about that ecosystem that enables it to break down easily and admit this input from the continent.

PROFESSOR IKAWA-SMITH:

One of my pet peeves about Jomon is that people talk about Jomon culture in the singular, and I think this is totally wrong. Jomon is a technological tradition characterized by a certain range of ceramic decoration. In that sense, there is a long period applicable to the whole of Japan that is Jomon, but it is only a ceramic tradition. The "culture" really includes a large number of cultures which appear and disappear and have very different adaptive strategies. Talking about Jomon as one monolithic entity is very misleading, I think.

As far as the collapse of the ecological base is concerned, I read in a

recent archaeological journal that there is evidence for a depletion of population in the central mountainous area, which was one of the areas of the flowering of the Middle Jomon. In the Middle Jomon there is a large concentration of population, and in the Late Jomon the population declines. It is suggested that perhaps a climatic change may have had something to do with it. A cooling of climate may have been one factor. Another commentator said that if these Middle Jomon people were indeed practising cultivation then deforestation may have upset the ecological balance, and that may have speeded up the collapse of the resource base. In any event, it really becomes important to look at small regions more closely. If what he says is true, the Middle Jomon population in the central mountainous area, which was always considered to be the centre of this Middle Jomon activity, becomes rather sparse in the Late Jomon. The population shifts to the coast, and it is during the Late and Final Jomon on the Pacific coast where one finds new maritime technology and the active pursuit of different kinds of resources. About this same time, in southern and western Jomon, evidence of cultivation techniques becomes apparent, such as the incidence of harvesting knives in the Late and Final Jomon of Kyushu, rice impressions found on pieces of pottery, and rice grains.

PROFESSOR PEARSON:

So they were looking for alternative strategies when the main strategy began to fail.

PROFESSOR IKAWA-SMITH:

As far as the establishment of Yayoi is concerned, I personally do not think that the migration of a group from outside can totally explain the beginning of Yayoi. We might, for instance, see rice as an alternative resource that may have been cultivated by the broadcast method in the low-

lands. It is a lowland plant after all. I am sorry that I always come back to the climatic change, but a warming of the climate may have made wet rice cultivation in Japan profitable enough to initiate an adaptive shift at that particular time. Rice was known from Late and Final Jomon, but it always reamined a rather small proportion of the subsistence base. Prior to about 300 B.C., it apparently was not worthwhile to invest a large amount of time and effort in rice cultivation; however, about that time it might have become sufficiently profitable. In any case, Japan is the northernmost perimeter of the rice cultivation area, and it did become sufficiently profitable. The harvesting method of cutting off individual ears with knives may have selected for varieties which were suitable for that kind of climate and which, subsequently, became widely distributed.

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EPILOGUE

Gregory G. Monks

EPILOGUE

Five years have elapsed since the symposium recorded here was presented. The editor's other job commitments have accounted, in large part, for this untimely delay.

Subsequent to the symposium, two relevant events have occurred. The first is the publication in 1982 of Prehistory of Japan by C. M. Aikens and T. Higuchi. This volume now supercedes the chapters on Japan in C. Chard's (1974) Northeast Asia in Prehistory. The Aikens and Higuchi volume is a valuable contribution to the literature in that it makes available to English-speaking scholars a current comprehensive summary of the extensive archaeological literature in Japanese. The volume is also timely with respect to the gradual awakening of western scholars to the topical and substantive importance of Japanese archaeology.

The Aikens and Higuchi volume must, however, be treated with some caution. There are several editorial flaws such as listing sites on maps that are not discussed in the text. There is also a marked tendency to present data selectively without clearly rationalizing the means of selection or the importance of the selected data. Further, the book places heavy emphasis on substantive data (material remains, technology, dates, stratification) that is presented within a cultural-historical framework. What little synthesis and interpretation is present takes the form of inductive generalizations about past lifeways. One might argue that Aikens and Higuchi are severely constrained in this regard because of the corresponding approach taken by many Japanese archaeologists; nevertheless, the authors would have performed a valuable service if they had at least pointed to the potential fruitfulness of such areas of enquiry as exchange systems, subsistence systems, population growth models, cultural ecological concepts and settlement pattern analysis

to name only several. The point was made in this symposium that Japan is a very rich and diverse phenomenon archaeologically, and Aikens and Higuchi's volume clearly supports the assertion. The full range of analytic approaches to Japanese archaeology has yet to be explored, but Aikens and Higuchi pass over this important issue.

The second relevant event that occurred since the symposium was the consent of Dr. Hiroko Koike to the inclusion of one of her papers, jointly authored with Yoshiaki Matsushima, in this volume. In this paper, Koike and Matsushima discuss the affects of sea level fluctuation and intertidal flats formation on shellfish collecting during the Jomon period along the east coast of Tokyo Bay. Contemporary data on shellfish collecting in the Ariake Sea area is then used to estimate density of shellfish resources available to Jomon populations and intensity with which these resources were collected. In this endeavour, the authors clearly set themselves apart from the cultural-historical tradition in Japanese archaeology. It is noteworthy in this regard that Dr. Koike is also one of the few Japanese archaeologists who regularly publishes in both English and Japanese.

APPENDIX A

"Intensity of Shell Collection Activities among the Jomon Shellmound People: An Estimation based on Paleotopography and Recent Fishery Data."

by

Hiroko Koike

and

Yoshiake Matsushima

I. Introduction

There are over six hundred known shellmounds of the Jomon Period (13,000 to 2,500 B.P.) in the area surrounding Tokyo Bay. These shellmounds, or middens, contain many types of food remains that provide useful information on diet and environmental exploitation activities. Jomon culture appears to have been based primarily on hunting and gathering; consequently, environmental factors, particularly fauna and flora, would have had a significant affect on population size and settlement patterns.

Molluscan fossils found in Holocene deposits are useful for constructing the coastal environment. According to Matsushima (1979), changes in prehistoric shorelines during the Jomon transgression can be divided into three phases: the advancing phase (8000 to 7000 B.P.), the maximum phase (6500 to 5000 B.P.) and the post-maximum phase (5000 to 3000 B.P.). During the advancing phase, rapid sidecutting of terraces took place along valleys. Most of the prehistoric sites on the lower terraces facing the shoreline are assumed to have been destroyed during this phase. Only sites on higher inland terraces have been preserved, suggesting that such a natural destruction of prehistoric sites might be informative for paleodemographic analyses.

During the maximum phase, the sea level is thought to have been 3 - 5 m above the present level. Sea water flooded into valleys and formed narrow estuaries, creating a complicated shoreline.

Six different types of molluscan assemblages have been distinguished on the basis of Holocene sediments accumulated during the Jomon Transgression: the innermost-bay, muddy bottom assemblage (Type A), the inner-bay, intertidal sandy bottom assemblage (Type B), the inner-bay, upper sublittoral muddy bottom assemblage (Type C), the bay-mouth, sublittoral gravelly bottom assemblage (Type D), the open-coast, sandy bottom assemblage (Type E), and the wave-cut bench, rocky bottom assemblage (Type F).

The shell assemblage also changed through the Jomon Transgression. The first molluscan assemblage to appear in the drowned valleys was the Type A assemblage, such as *Crassostrea gigas*, *Anadara granosa* and *Batillaria zonalis* living at the innermost part of an embayment. The Type A assemblages predominated in accordance with the development of muddy facies along the heads of drowned valleys. After the maximum phase, the estuaries were reclaimed by sandy sediments transported from the adjoining rivers. Then the Type B assemblage, consisting of sandy bottom dwellers such as *Meretrix lusoria*, *Mactra veneriformis* and *Umbonium moniliferum*, appeared during the maximum phase and became dominant during the post-maximum phase of the transgression. The sandy bottom provided the broad habitat for the species of the Type B assemblage which were important to prehistoric people and which continue to be important to the present-day coastal fishery.

Development of intertidal flats during the Jomon period provides a key for an analysis of prehistoric shell-collecting activities. In this report, distribution of Jomon shellmound sites in the Murata River area is compared with paleotopography and prehistoric shorelines based on the data of Holocene estuarine deposits. In addition, density of living molluscan resources in tidal flats and intensity of shell-collecting activities of present fishermen are discussed using ethnographic data from the Ariake Sea.

II. Archaeological Analysis of the Murata River Area

The area studied is located on the eastern coast of Tokyo Bay, about 8 km south of Chiba City (Fig. 1). The topography of the area is characterized by a low hilly land called the Shimousa plateau. The Murata River system is composed of several branch valleys which separate peninsula-like terraces that rise 20 - 40 m above sea level (e.g. the Ariyoshi, Kidosaku, and Kusakari Terraces). On these terraces, which are about 10 - 25 m above the adjacent valley bottoms, lie shellmound sites.

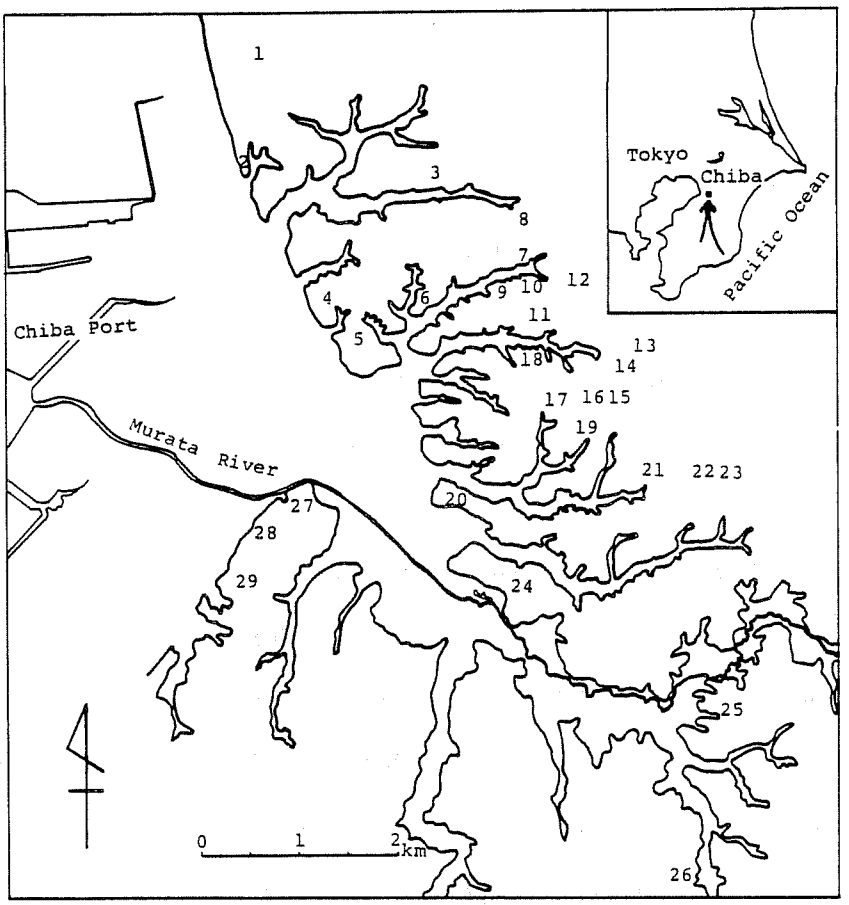

Figure 1. Map of the Murata River Area. (Numbers on the map indicate analysed Jomon sites in Figure).

1. Distribution of Jomon Sites

Mapping surveys at the Murata River area (Sakazume, 1961; Education Committee of Chiba City, 1974) showed that large shellmounds, so-called horseshoe-shaped shellmounds, are densely distributed along the branch valleys of the Murata River.

Twenty-nine Jomon sites have been reported so far in the Murata River area (Fig. 2). Among them, 18 sites are accompanied by sufficient molluscan shell accumulations to be categorized as shellmound sites. Horseshoe-shaped shell accumulations were recognized at 7 sites, while the remaining 11 have relatively small so-called spotted shellmounds.

The first Jomon occupation of this area occurred ca. 6000 B.P. during the later part of the Earliest Jomon Period (Kayama pottery-type stage). Occupation sites of the Earliest and Early Jomon periods were few, and they contain few artifacts. The number of sites increased during the later stage of the Middle Jomon Period (Kasori E pottery-type stage), and the formation of shell accumulations seems to have been most rapid between the early stage of the Late Jomon Period (Horinouchi pottery-type stage) and the middle stage of the Late Jomon Period (Kasori B pottery-type stage). Some of the shellmound sites continued until the later stage of the Late Jomon Period. The one exception to this is the Rokutsu Shellmound Site (Horinouchi, Kasori B, Angyo I, II and Angyo IIIa pottery-type stages) which is the largest shellmound in this area.

Archaeological excavations in the Murata River area were limited to test pitting until recently (Education Committee of Chiba City, 1974). Now, intensive geological survey has been promoted in accordance with the Chiba Newtown project and large-scale excavations have been started by the Cultural Property Centre of Chiba Prefecture. The entire settlement of the Kidosaku Shellmound Site has been unearthed and excavation of other sites (Kokanza and Kusakari Shellmound Sites) is continuing.

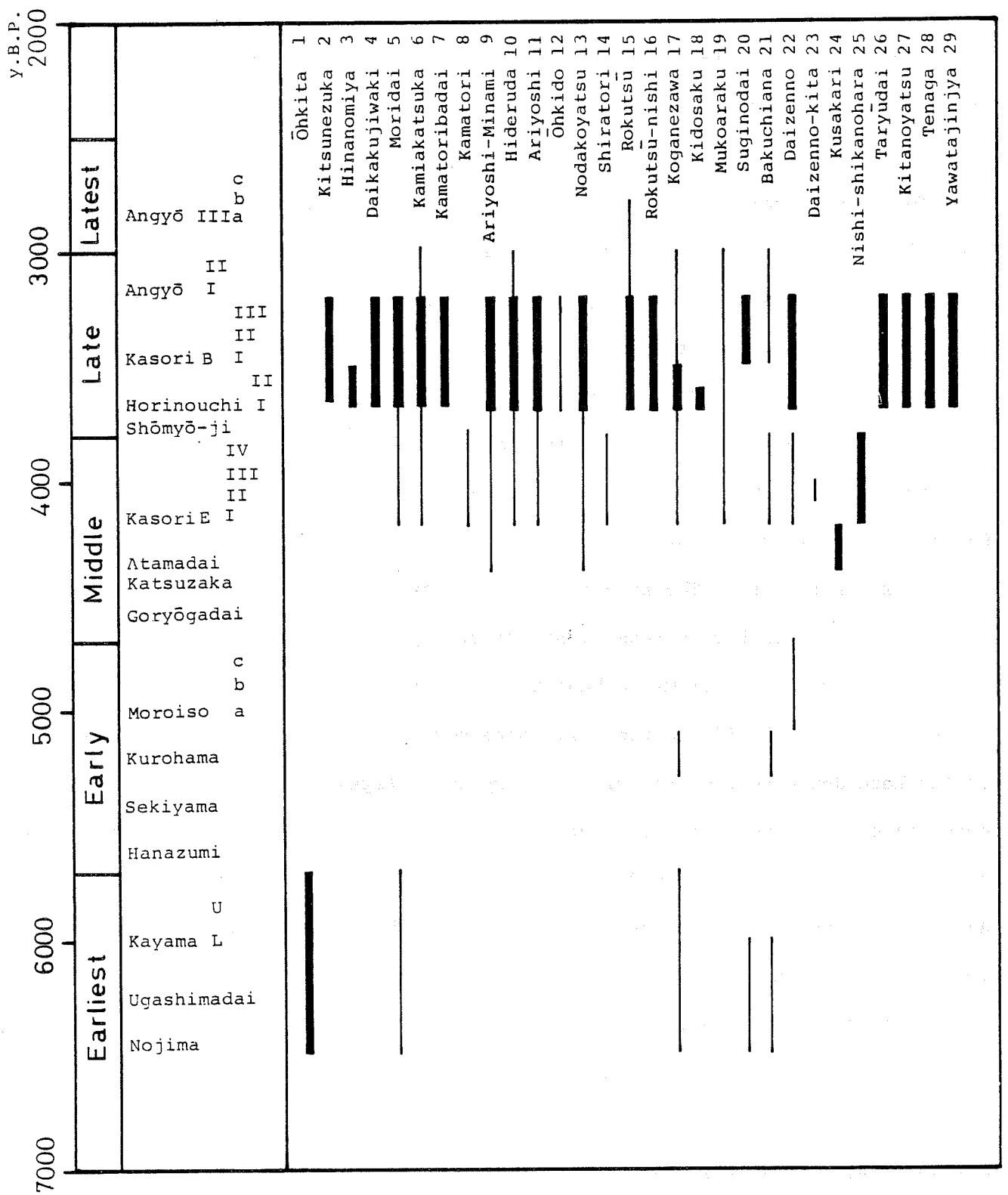

Figure 2. Chronology of Jomon sites in the Murata River Area. (Broad bars indicate period when the site accompanied shell deposits.)

2. Kidosaku Site

The Kidosaku Shellmound Site (Cultural Property Centre of Chiba Prefecture, 1979) sat on a southern terrace of the Izumiyatsu Branch valley. The narrow, short valley is about 100 to 150 m wide and about 1 km long. The site is situated 0.8 km up from the mouth of the valley. There are two other shellmound sites (Ariyoshi and Ariyoshi-minami) in the valley, and they were formed between the later Middle Jomon Period and the early and middle Late Jomon Period.

Potsherds found at the Kidosaku Site were identified as belonging to the Horinouchi Type, perhaps to a single substage of Horinouchi I, suggesting that the occupation in the site was relatively short.

Population of the site

The entire site, when excavated, revealed ten dwelling pits (Fig. 3A). The dwelling pits were distributed on the outskirts of the terrace surrounding a central plaza. Each dwelling pit had a circular plan of 4 to 6 m in diameter with a firepit in the centre and postholes along the wall. Three dwelling pits, found on the southern fringe of the site, had a "bracket" 2 m wide and 1 m long which was assumed to be an entrance. Unfortunately, it is still unclear whether these dwellings had a special function (e.g. ceremonial houses).

The number of dwellings occupied simultaneously was estimated on the basis of overlapping dwellings. Four dwelling pits on the southern edge of the site (Dwelling Nos. 1 to 4) were found to overlap with each other (Fig. 3B). Successive rebuilding of these dwelling pits appeared to have occurred in one of the two following orders: No. 1 → No. 3 → No. 2 → No. 4; or No. 3 → No. 1 → No. 2 → No. 4. Three dwelling pits at the eastern edge of the site were also assumed to have been used independently. Dwelling pits No. 6 and No. 8 overlapped, and dwelling No. 7 was close to these two pits.

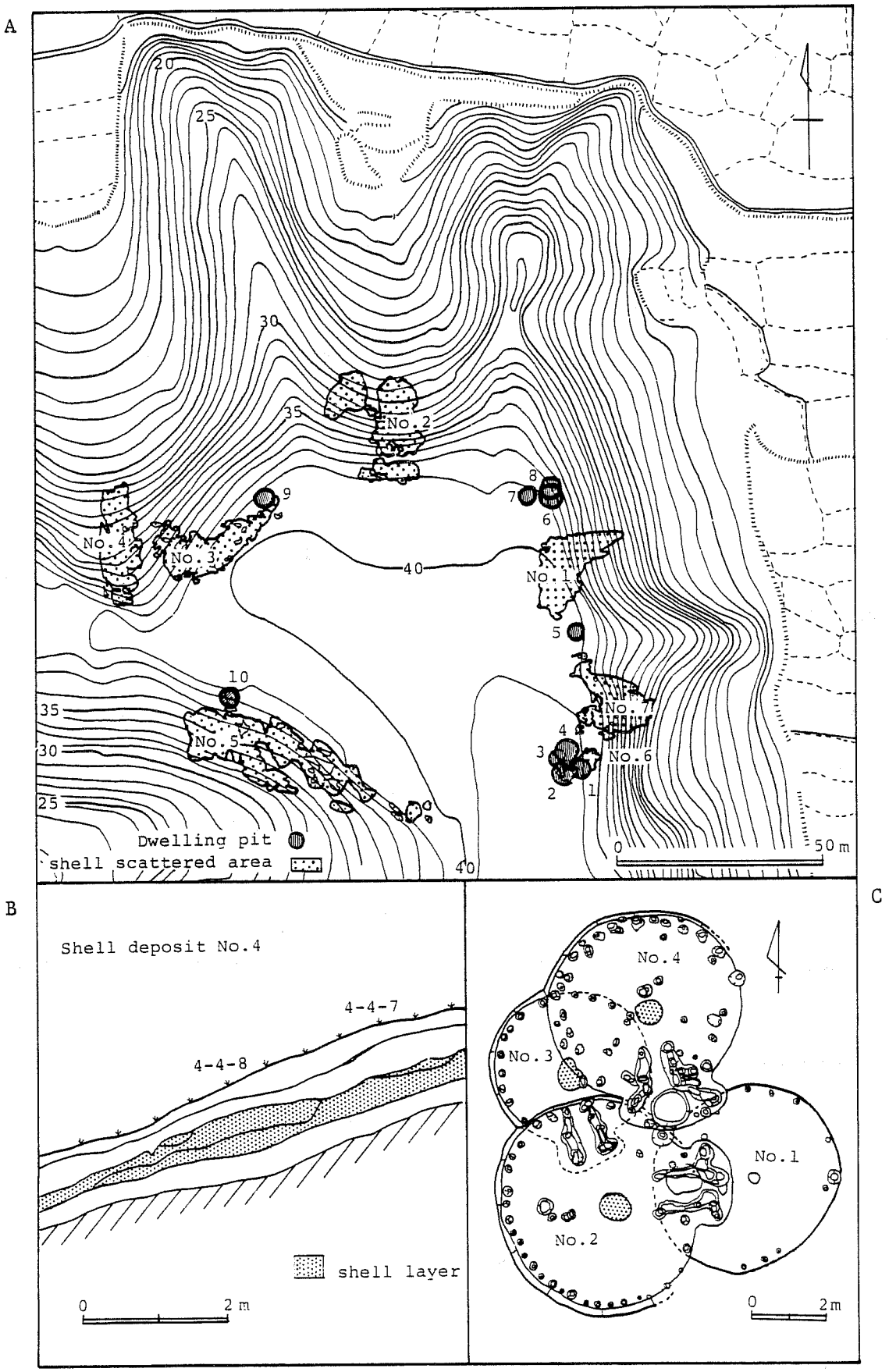

Figure 3. The Kidosaku shellmound site (A), showing section of a shell deposit (B) and plans of overlapping dwelling pits (C).

Shell deposits found in the fill of the dwelling pits were also available for estimating the succession of dwelling occupancy. The deposits suggest that these dwellings were not occupied during the last period of site use. The dwelling pits with shell deposits in the fill were Nos. 1, 2, 3, 9 and 10.

Based on these data, the maximum number of dwellings occupied contemporaneously was estimated to be 5 (Fig. 4). Dwellings No. 1 to No. 4 comprise one unit and dwellings No. 6 to No. 8 comprise another. If the isolated dwellings of No. 5, No. 9 and No. 10 were used independently, they represent 2 or 3 dwellings that were occupied contemporaneously.

The number of occupants in a dwelling of the Jomon Period has been estimated from the size of the dwelling pits using Sekino's formula (Sekino, 1938):

$$\underline{d} = (\underline{S}-3)/3,$$

where $\underline{d}$ is the number of occupants and $\underline{S}$ is the size of a dwelling pit in square meters. Size of the dwelling pits of the Kidosaku Site ranged from 11 to 28 m^2, hence number of occupants was estimated at 3 to 9 persons, with an average of 6 persons. Consequently, population of this site seems to be 26 persons maximum when 5 larger dwellings were occupied. The population would be about 18 when 3 dwellings were occupied by an average of 6 persons.

Molluscan remains

The Kidosaku Shellmound Site was composed of 7 concentrations of shells (shell deposits No. 1 to No. 7) on the fringe of the tongue-shaped plateau that measured 70 m by 100 m (see Fig. 3). These shell deposits lay on a steep slope of about 20 - 30 degrees.

Square measure and volume of each shell deposit were calculated by Goda (1979). The concentrated shell deposits were each 200 - 400 m^2 except for shell deposit No. 6 (Table 1). Maximum thickness of the shell layer was

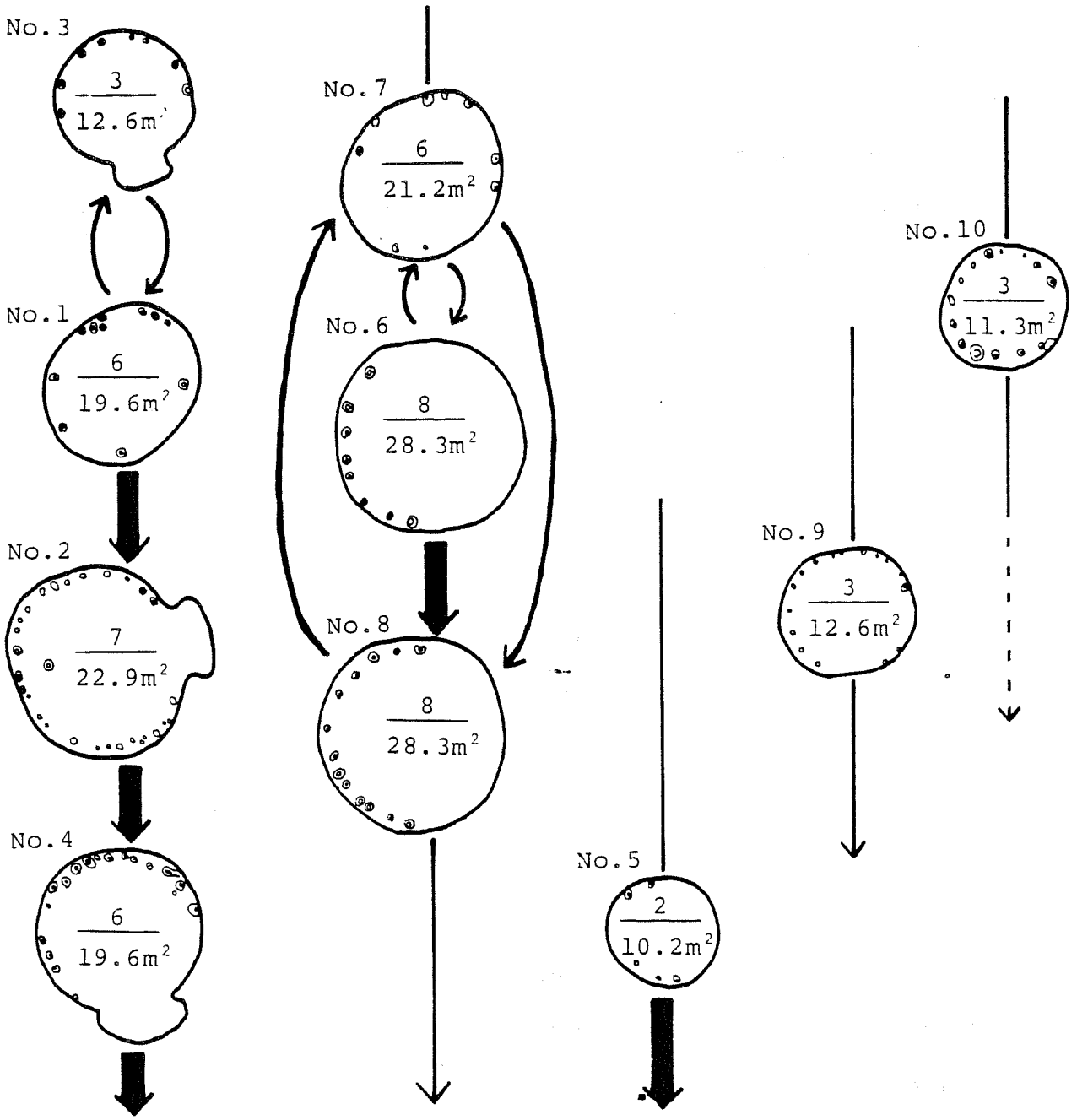

Figure 4. Succession of dwelling pits found from the Kidosaku Site. (Numbers in the dwelling pits indicate the size in square meters and estimated occupants.)

Table 1. Volume of shell deposits and food remains found at the Kidosaku Shellmound Site.

Shell Deposits	Volume of Shell Deposits			Molluscan Remains*				Mammalian Remains**				Fish Remains***
	square meters	average thickness	Volume	*Umbonium moniliferum*	*Meretrix lusoria*	*Mactra veneriformis*	*Tapes japonica*	*Sus scrofa*	*Cervus nippon*	*Nyctereutus procyonoides*	*Lepus brachyurus*	*Acanthopagrus* sp.
No. 1	192 m^2	0.31 m	59.5 m^3	10.9 x10^6	1120 x10^3	170 x10^3	870 x10^3	4	4	1	1	6
No. 2	276	0.27	74.5	7.0	660	50	30	11	12	2	1	6
No. 3	196	0.25	48.0	9.6	710	70	50	5	3	0	1	18
No. 4	194	0.35	67.9	8.7	1010	120	50	7	10	0	0	6
No. 5	394	0.25	98.9	3.6	780	60	30	5	6	1	0	12
No. 6	20	0.42	8.4	0.1	20	10	10	1	1	0	0	0
No. 7	172	0.55	94.6	9.8	1620	230	110	3	3	2	0	5
TOTAL	1444	----	451.6	49.7	5920	710	1150	36	38	6	3	53

* number of shells for gastropoda and number of valves for pelecypoda per sample block (12.5 litres).

** minimum number of individuals for each shell deposit.

*** number of premaxillary elements.

(Ed. note: The total MNI value of 38 for *Cervus nippon* differs from the values of 21 and 29 given in the text of this paper because the two lower values are calculated for all 7 shell deposits at once whereas the value of 38 represents the sum of MNI estimations for each deposit individually. See D. K. Grayson 1973, 1978, 1979.)

about 1 m and usually fell within a range of 20 to 40 cm. Hence, volume of each shell deposit was calculated at 50 to 100 m^3 except for shell deposit No. 6 (8.4 m^3). Total volume of these shell deposits is estimated at 450 m^3.

The molluscan assemblage was analysed by Komiya (1979) using block samples taken from the corner of each 2 m x 2 m excavation unit in the grid covering each shell deposit. The size of a sample block was 50 cm by 50 cm square and usually 5 cm thick. The molluscan remains identified in the block samples consisted of 22 species, and all species were members of the Type B assemblage from a sandy tidal bottom.

A tiny gastropoda, *Umbonium moniliferum*, was most abundant in the molluscan assemblage from this site. An average of more than 2000 *Umbonium* shells were counted within block samples from shell deposits No. 1 and No. 3. The clam *Meretrix lusoria* was dominant among bivalve shells with an average of 100 - 230 valves per block sample. *Mactra veneriformis* (10 - 30 valves/sample) and *Tapes japonica* (5 - 15 valves/sample) were both common in the shell deposits.

Animal remains

Other animal remains were found in the shell deposits. These remains were measured for their locations three dimensionally and were recorded. Small fragments of animal bones, especially fish remains, were detected in block samples which were processed by wet-screening using 1 mm, 2 mm and 4 mm sieves.

Mammalian, avian and reptilian remains were identified by Suwa et al. (1979). The mammalian assemblage consisted mainly of species of the warm temperate zone: wild boar (*Sus scrofa leucomystax*) and sika deer (*Cervus nippon*) were both dominant in this site as in other Jomon sites in central Japan. Besides these larger animals, wild rabbit (*Lepus brachyurus*) and

raccoon dog (*Nyctereutus procyononoides*) were also commonly found.

Complex cusp patterns of molar teeth and their wear conditions are useful indicators for pairing separate mandibles of an individual deer or wild boar. Applying the pairing technique to deer mandibles found in the Kidosaku Site, mandibles with teeth of M2 and M1 and/or M3 were selected from the excavation materials. Only one pair of mandibles were identified among 16 left and 11 right analysed mandibles. The original population can be estimated using a probability formula (Kranze, 1968; Casteel, 1977; Koike 1979). The deer population was estimated at about 100 individuals considerably higher than the preserved population counted by minimum number method (21 individuals counted by lower M2 teeth, or 29 individuals counted by distal humerous. See Table 1). Poor preservation is assumed to be due partly to the acidic humus soil of the site and partly to domesticated dogs kept in the settlement of that time.

Fish remains were identified by Komiya (1979). The assemblage of fish remains consisted mainly of embayment species such as *Clupeioidei* sp., *Trachurus* sp., *Hemiraphus* sp. and *Acanthopagrus* sp. Fish remains identified were usually fragments of vertebra, making it difficult to estimate the minimum number of individuals. Therefore, only the number of premaxillary of *Acanthopagrus* sp. (probably A. *schlegeli*) was listed in Table 1.

Human remains were also found in shell deposits (Suzuki, 1979). Only two burials were excavated from shell layers in the fill of abandoned dwelling pits. Minimum numbers of individuals of human remains were estimated at 9 bodies in the site.

III. Reconstruction of prehistoric shoreline at the Murata River area

The Holocene sediments in this area were studied by Matsushima (1979, 1980) using over 160 core samples distributed from the head to the mouth of

the branch valleys in the Murata River area. Analyses of these core samples enabled a reconstruction to be made of the prehistoric topography and marine resources during the Jomon Transgression.

1. Holocene sediments from boring core samples

A sample stratigraphic section along the Izumiyatsu branch valley where the Kidosaku Shellmound Site is situated is given in Fig. 5. More than 50 cores are distributed from the head to the junction of the branch valley.

Base of the Holocene deposits

Basement topography of the present valley-fill deposits indicates an earlier valley configuration. The present valley corresponds to the upstream end of an earlier valley formed during the regression of the maximum phase of the Würm Glaciation. The original valley is narrow and deep; the -10 m contour line reaches about 100 m upstream from the present mouth of the branch valley, and the +0 m contour line extends about 1.5 km up from the north.

Sediments in the drowned valley

The fill sediments in the valley are composed of sandy mud and peaty deposit. In the Izumiyatsu branch valley (Fig. 5), the lower part of the deposits consists mainly of sandy mud and partly of silty sand. The thickness of the sandy mud is over 15 m at the mouth but it decreases as one moves upstream, disappearing altogether at the head of the valley. The upper part of the deposits consists of peaty humus which is about 6 m thick at the upstream of the valley and about 3 m thick at the mouth.

Molluscan fossils found in the core samples

The sandy mud sediments contained fragments of molluscan fossils indicating that the layer is marine sediments. Boring core samples containing molluscan fossils are distributed up to about 500 m from the mouth of the

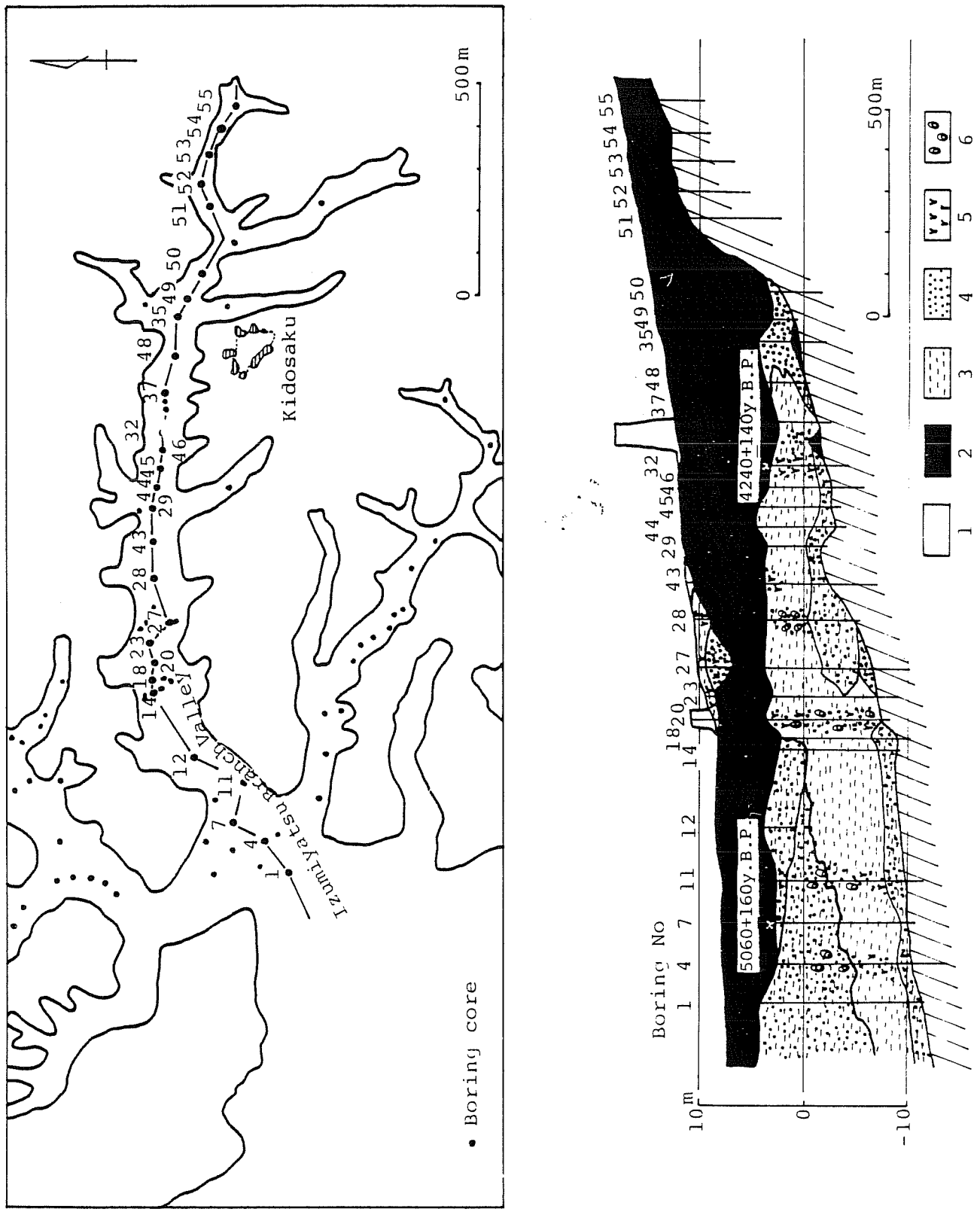

Figure 5. A. Izumiyatsu branch valley of the Murata River where the Kidosaku site is situated, showing locations of boring core samples.

B. Stratigraphic section of Holocene sediments along the Izumiyatsu branch valley: 1. basement; 2. peaty deposit; 3. silt; 4. sand; 5. humus; 6. molluscan fragments.

Izymiyatsu branch valley (core samples No. 11, 20, 26 and 28).

Molluscs identified in the core samples were 25 species of Pelecypoda and 15 species of Gastropoda. These species belong to a Type A assemblage from an innermost bay environment and a Type B assemblage from sandy tidal flats. Shell fragments of the Type A assemblage were found in the muddy sediments at the head of the branch valley. At the mouth, muddy sediments are seen only in the lower and middle layer of the marine deposits. On the contrary, the Type B assemblage were concentrated in the fine sand of the upper deposits in the mouth area of the valley.

These molluscan fossils provide direct information on the prehistoric shoreline. The upper limit of the sediments containing shells in this area was +2.5 to +3.5 m above present sea level while the height of the boundary between the marine deposits and the peaty humus deposits had a relatively wide variation ranging from +2.5 to +5.5 m above present sea level. Molluscan fossils found in the core samples consisted mainly of shells which live in the shallow intertidal zone; that is, the -2 m to +0 m zone. Therefore, the sea level of the maximum phase of the Jomon Transgression in this area can be estimated at +3.5 m to +5.5 m above the present sea level.

2. C-14 dates of the Holocene deposits

The dates of the Jomon Transgression and the age of the sediments were estimated based on the C-14 dating of 12 samples of the peaty humus and 1 sample of molluscan fossils (Matsushima, 1981). Although the dates of the peaty humus covering the marine sediments had a wide range from 6610 ± 180 y.B.P. to 1520 ± 170 y.B.P., they concentrated mostly within 800 years from 5060 ± 160 y.B.P. (Gak-8020) to 4240 ± 140 y.B.P. (Gak-8021). Therefore, the period when almost all of the present area of analysis was covered with the peaty humus is assumed to be between 5000 and 4000 y.B.P.

A shell sample obtained from the uppermost part of the marine bed was dated at 7590 ± 860 y.B.P. (Gak-8016). The large counting error of ± 860 years is thought to result from the small sample size. The date of the peat layer which lay directly on the marine bed is 4720 ± 130 y.B.P. (Gak-8017). Consequently, the period during which the marine sediments were formed is estimated to be 7000 - 6000 y.B.P.

3. Shoreline reconstruction during the Jomon Transgression based on the distribution of the marine sediments

The geological survey using core samples and C-14 dates enabled the shoreline in this area to be reconstructed for three phases: the maximum phase of the transgression (about 6500 y.B.P.), the early post-maximum phase (about 5000 y.B.P.) and the late post-maximum phase (3500 y.B.P.).

Maximum phase of the Jomon Transgression (6500 y.B.P.)

The paleogeography ca. 6500 y.B.P. (Fig. 6) shows that the sea invaded the valleys forming a complicated shoreline surrounding dissected hills. Sediments accumulating in the valleys during this phase were mainly muddy facies of the innermost bay. The molluscan fossils found from the mud in the upstream end of the branch valleys are characteristic of the Type A assemblage of innermost bays, suggesting that these drowned valleys were narrow and deep.

The maximum phase of the Jomon Transgression in this area corresponds to the Kayama pottery-type stage of the late stage of the Earliest Jomon Period. Only four sites contain fragments of the Kayama type pottery. Although excavation of these sites has not been carried out, occupants of these sites generally had not formed shell deposits during the Kayama stage. The exception is the Ohkita Shellmound Site (Site No. 1 in Fig. 6) where small spotted shell deposits belonging to this stage were detected.

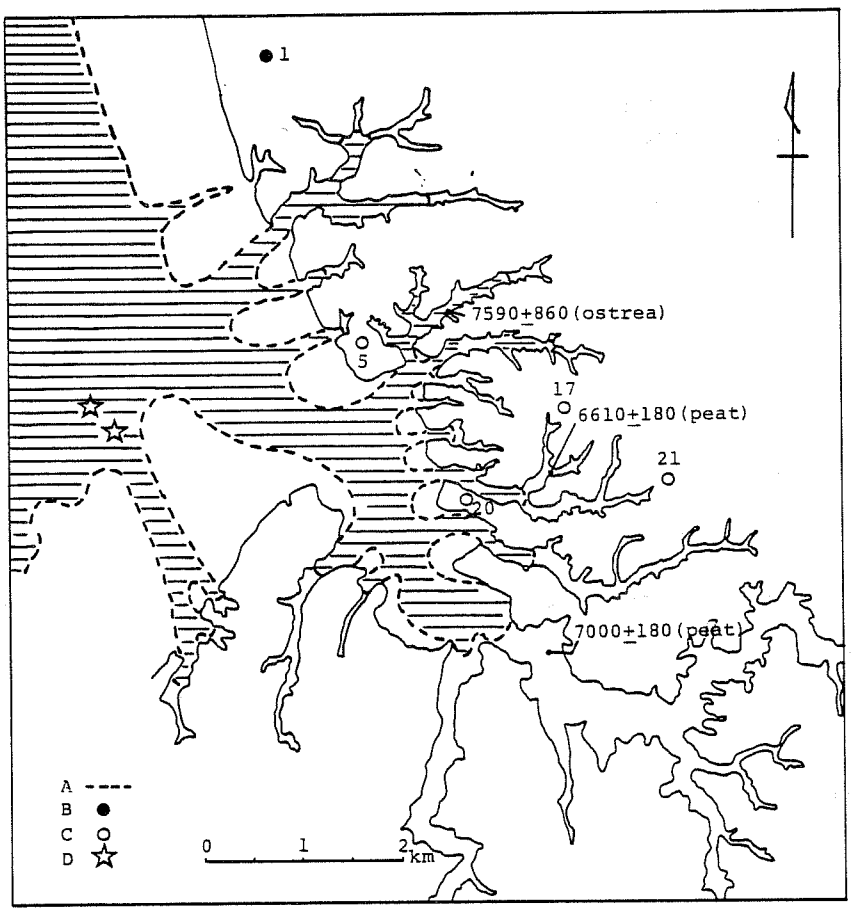

Figure 6. Shoreline of the maximum phase of Jomon Transgression (ca. 6000 y.B.P.) and Jomon sites of this stage. A. estimated shoreline; B. Jomon sites accompanied with shell deposits; C. Jomon sites with no shell deposits; and D. fossil shell beds.

These data might suggest that molluscs of the innermost bay assemblage were not intensively collected by the occupants of these sites. However, wave-cutting of the terraces had taken place through the advancing and maximum phases of the transgression. In fact, the shoreline during the maximum phase in this area extended about 2 m from the recent shoreline toward Tokyo Bay. Therefore, most of the prehistoric sites on the terraces facing the shoreline at this stage have been destroyed by wavecutting, and it would be difficult to estimate the true number of shellmounds during this stage.

Early post-maximum phase of the Jomon Transgression (5000 y.B.P.)

The shoreline ca. 5000 y.B.P. is illustrated in Fig. 7. The complicated shoreline in the maximum phase of the transgression had been changed into a smooth shoreline mainly due to the reclamation of drowned valleys with fluvial deposits. The Shimosa hills are composed of relatively soft Pleistocene beds that were easily eroded even during the early post-maximum phase.

The early post-maximum phase (5000 y.B.P.) corresponds to the Kurohama and Moroiso pottery-type stages. Only three sites are identified as belonging to these stages and none of them is accompanied by shell deposits.

Later post-maximum phase of the Jomon Transgression (3500 y.B.P.)

During the later post-maximum phase (3500 y.B.P.) peaty humus deposits appeared in the heads of the valleys, graudally spreading downstream (Fig. 8). Formation of the upstream peaty deposits indicates that the estuaries had changed into brackish swamps. The shrinkage of the estuaries is also shown in the disappearance of molluscan fauna of the innermost bay assemblages (e.g. *Crassostrea gigas* and *Anadara granosa*). On the other hand, regression of the sea promoted the reclamation of the estuaries with sandy deposits. The sandy sediments provided a new environment at the mouth of the valley. Molluscan fossils of the intertidal assemblage from sandy bottoms such as

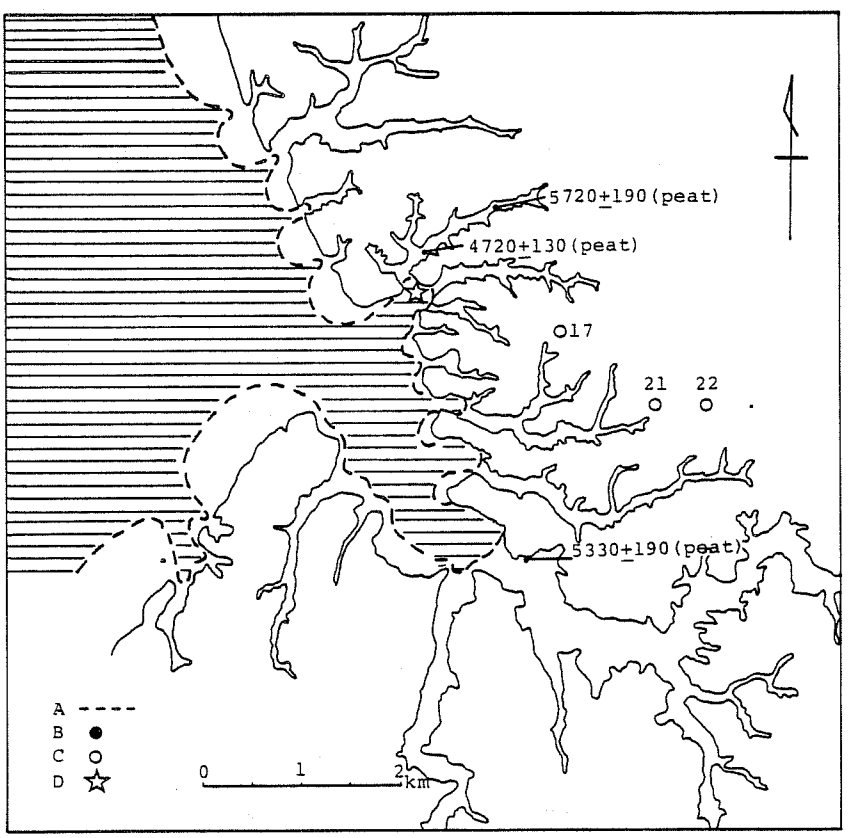

Figure 7. Shoreline of the early post-maximum phase of Jomon Transgression (ca. 3500 y.B.P.) and Jomon sites of this stage.

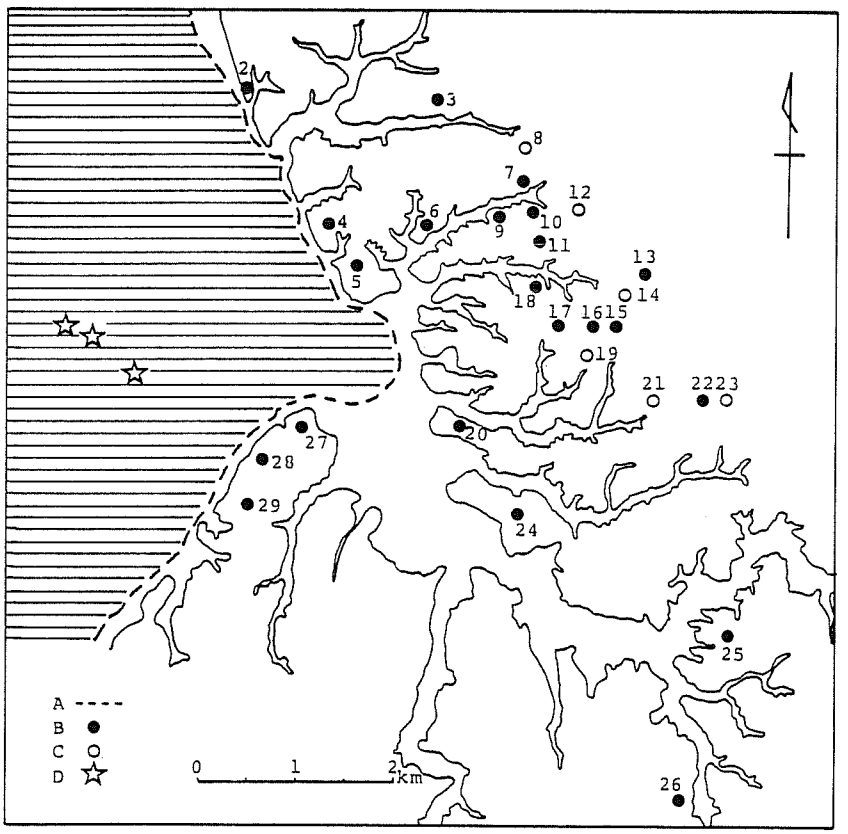

Figure 8. Shoreline of the later post-maximum phase of Jomon Transgression (ca. 3500 y.B.P.) and Jomon sites of this stage.

Meretrix lusoria, *Mactra veneriformis* and *Umbonium moniliferum* were found at the junction of the Izumiyatsu branch valley and even 3 km upstream from the mouth of the main branch valley.

The later post-maximum phase (3500 y.B.P.) corresponds to Horinouchi and Kasori B pottery stages. Shellmounds are abundant in these stages, i.e. 19 of 23 sites are accompanied by molluscan remains.

IV. Present-day shell-collecting activities and ecology of Molluscan assemblage in the Midori River area

The Midori River area (Fig. 9), which is situated in the western coast of Kyushu facing the Ariake Sea, is rich in molluscs and is especially famous as the natural environment of the clam *Meretrix lusoria*. An ecological survey of shellfish resources in the tidal flats of the Ariake Sea was carried out by the Fishery Station of Kumamoto Prefecture in 1950 (Fishery experimental station of Kumamoto Prefecture, 1951). At that time, water pollution had not affected significantly the embayment fauna, providing valuable data on the ecology of molluscs in the tidal flats.

1. Environment of the tidal flats in the Midori River area

The tidal flat extends about 3 km from the embankment to the lowest water neap zone. Two kinds of tidal flats are distinguished among the shellfish-collecting fishermen: "on-foot flat" (Kachi-su) and "off-lying flat" (oki-su). The on-foot flats are situated along the embankment and they can be reached on foot. Off-lying flats are separated from the shore by water and can be reached only by boat except during spring tides.

Tidal range in this area is +5.2 to 0.25 m from the tidal datum level during the spring tide and +3.5 to 2.0 m during the neap tide. At ebb tides during the spring tide, a large tidal flat extends up to 3.5 km from the mouth of the Midori River. At ebb tides during the neap tide, however, only tidal flats near embankments are exposed for a short time.

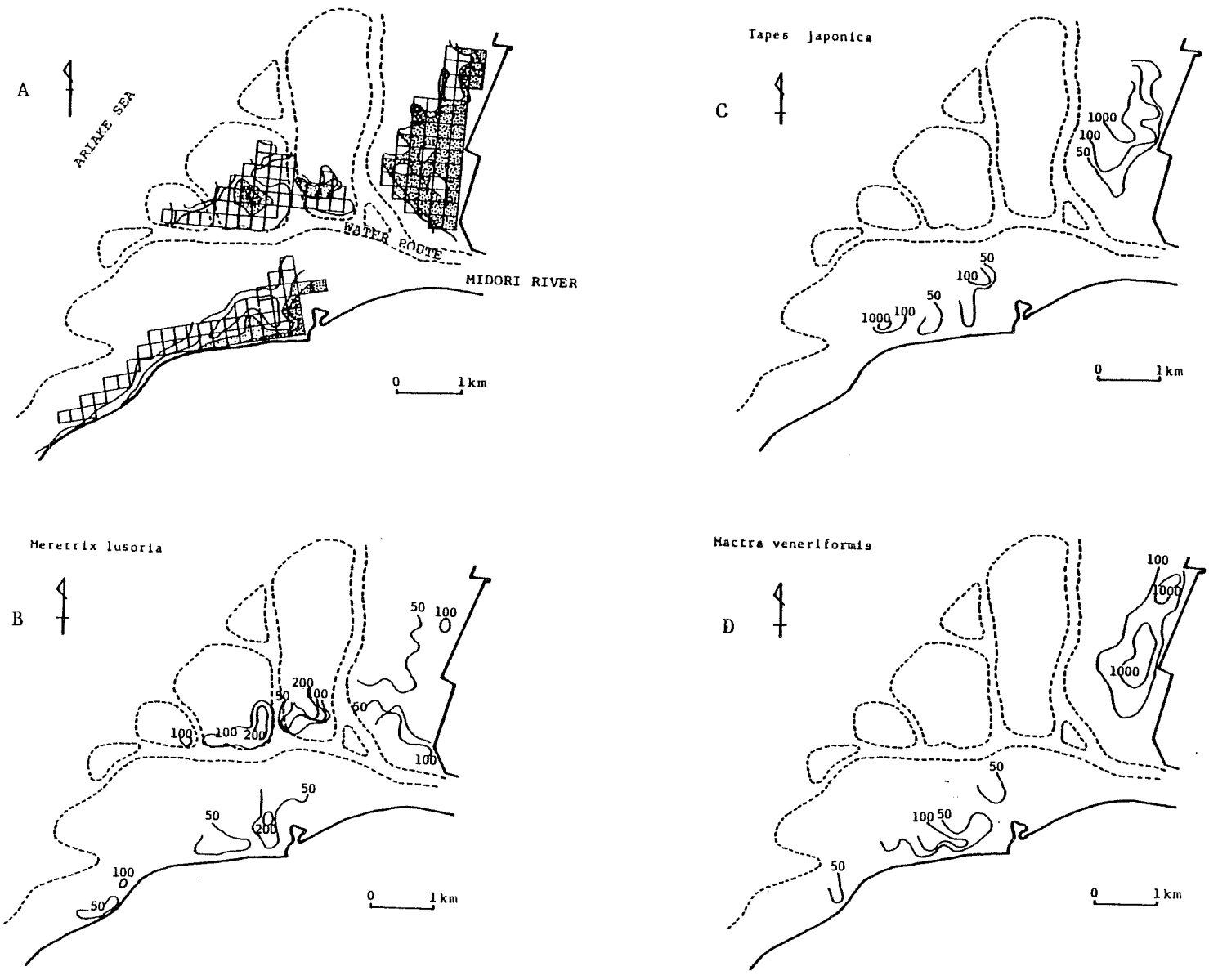

Figure 9. Tidal flats of the Midori River area at the Ariake Sea. A. percent of mud in the sediment; B. density of the clam, *Meretrix lusoria*; C. density of *Tapes japonica*; D. density of *Mactra veneriformis*.

Continuous daily environmental records for sea water temperature, salinity, rainfall and weather conditions in this area can be obtained through the Fishery Station in Uto City. Seasonal variations of sea water temperature range from a maximum of 28°C to a minimum of 10°C. The summer season (July to early September) has a rather wide variation in temperature (23° to 28°C) while it is constant at 11° to 12°C in the winter season (January and February). Salinity is usually constant, ranging between 24°/$_{\infty}$ to 26°/$_{\infty}$, except for the rainy season from June to early July when it drops 15°/$_{\infty}$.

Sea water analyses and grain size analyses of the bottom sediments are also intensively examined at the fixed sample spots in each grid of 200 m by 200 m square (Fig. 9A). Sandy bottoms lie along water routes where the water runs rapidly. Muddy bottoms are found along the embankment and also at hollows in the tidal flats.

2. Density of molluscan species in the tidal flats

As part of the investigation of shellfish resources in 1950, all the shells found within a sampling unit of 1 m by 1 m at the same corner of each 200 m grid covering major mollusc fields were collected.

Shells of *Meretrix lusoria* were distributed mainly along the water routes (Fig. 9B) especially in the off-lying flats. Juvenile shells were detected at junctions of the water routes. Maximum density of the clam *Meretrix lusoria* was 700 individuals/m^2, and areas where its density was 5 - 10 individuals/m^2 were widely distributed in the analysed tidal flat. The area occupied by the clam is estimated to be 7,000,000 m^2 and the weight of this resource is calculated roughly at 4500 tonnes.

The muddy bottom along the embankment had a dense population of *Tapes japonica* (Fig. 9C). Distribution of this species coincides with that of the fine silt bottom of the on-foot flat. Distribution of *Tapes japonica* is

relatively restricted to muddy bottoms where it attained a maximum density of 1400 individuals/m^2.

3. Shell collection in the Midori River area

More than 200 registered union fishermen have been working in this area. Annual clam yields in the area range between 600-700 tonnes, and between 1950 and 1961 the annual yield averaged 1300 tonnes (Fishery Station of Kumamoto Prefecture, 1967). Monthly yield of clams in 1965 (Fig. 10) shows that shellfish collecting activities continued through the year. Shellfish collection is intensive in April due to larger and longer exposure of tidal flats during the spring tide in this season. Clam yield decreases during the rainy season through late May and June. It recovers in July then gradually decreases through autumn and winter. Consumption of clam meat increases during December in conjunction with the New Year, and cultured clams are mainly utilized in this season. Clams overcollected in summer are kept in a culture field until they are required.

An annual yield of 1000 - 1300 tonnes from the shellfish resource base of 4500 tonnes seems to represent maximum productivity. In fact, the shell height histogram of this area (Fig. 11) is mainly composed of young clams with shells of 25 - 35 mm while old clams with shells larger than 40 mm are very rare. The young clams are, in general, the 3-year olds (born in summer and exhibiting 2 winter bands). They grow to about 28 mm in spring and 35 mm in autumn (Koike 1980). The fishermen's union prohibited the collection of clams smaller than 20 mm in order to protect juvenile clams (under 2 years old). The high collecting pressure on clams in this area indicates that fishermen have been collecting to the limits of the resource.

V. Discussion

Reconstruction of prehistoric shorelines at the Murata River area showed

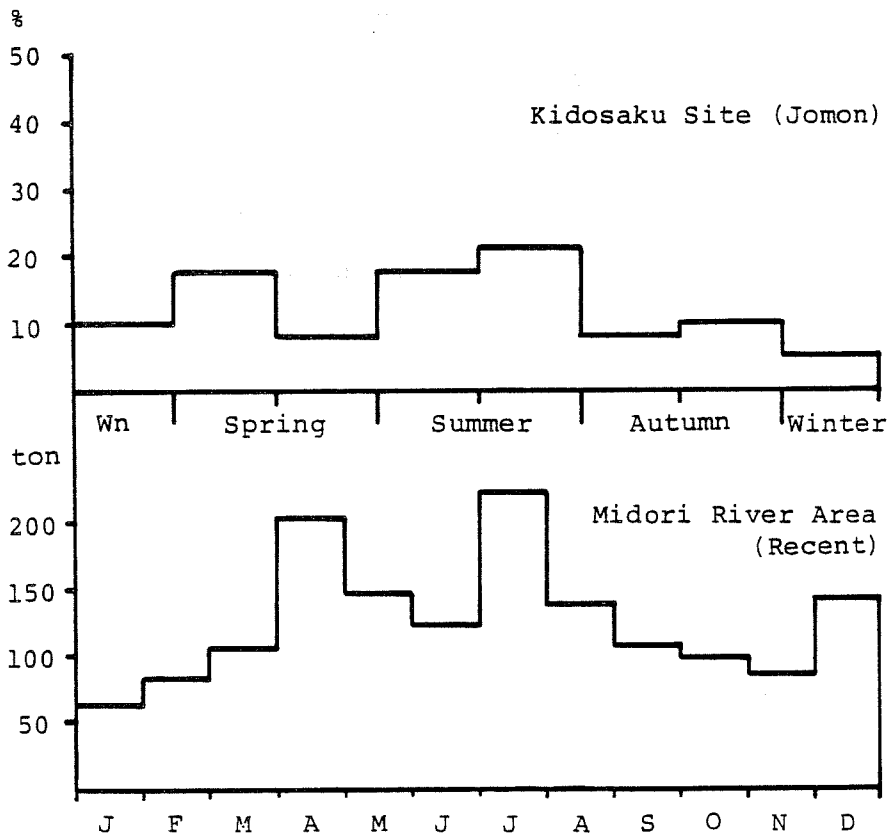

Figure 10. Seasonality of shell collecting activities in the Kidosaku site (estimated by counting daily growth increments in clam shells) and in the recent Midori River area of the Ariake Sea.

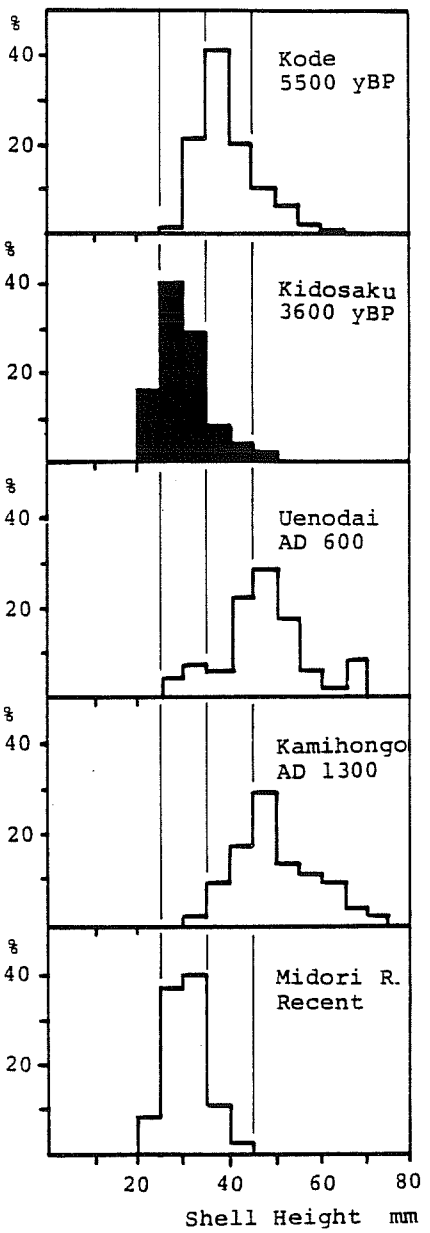

Figure 11. Shell height histogram for the clam *Meretrix lusoria* from the Jomon period to the present.

that the sandy bottom tidal flats developed during the later post-maximum phase of the Jomon Transgression. Large-scale tidal flats that produce the Type B molluscan assemblage emerged in an area extending 3 km or more from the mouth of the main valley. Shellmounds in this area were formed in accordance with the appearance of these tidal flats.

The topography during this stage closely resembled that of the Midori River area in the Ariake Sea. Investigation of molluscan resources by the Fishery Station of Kumamoto Prefecture showed that living clams were estimated at about 4500 tonnes in an area of 7,000,000 m^2 and that the tidal flats can provide a sustained yield of 1000 to 1300 tonnes of clams annually.

If the size of the clam field in the Murata River area was similar to that of the Midori River area, Jomon people in this area could have collected a maximum of about 1000 tonnes of clams a year. In other words, occupants of only a single settlement among the 19 shellmound sites could have collected an average of about 50 tonnes of clams per year.

The seasonal pattern of shellfish collecting is similar between the Jomon people of the Kidosaku Site and the modern fishermen of the Midori River area. The seasonal pattern at the Kidosaku Site (Fig. 10) indicates the continuity of collecting activities through the year, with peaks in spring and summer and a slight decrease in the rainy season.

Collection pressure on shellfish can be estimated by the size of the shell. As illustrated in Fig. 11, about 80% of clams from the Midori River area have a shell height within a range of 25 - 35 mm. The histogram of shell height from the Kidosaku Site is very similar with 70% of the analyzed shells falling into the 25 - 35 mm height range. On the other hand, shell height of clam shells from Historic period sites is larger than either the Midori River or Kidosaku samples. This indicates that clam resource in the prehistoric Murata River area had been under a high collecting pressure, and that pre-

historic fishermen in the Kidosaku Site must have exploited clams in as high an intensity as the recent fishermen in the Midori River area.

The Kidosaku Site yielded 450 m^3 of shell deposits containing an estimated 5,920,000 valves or 3,000,000 individuals. The wet weight of living clams with a shell height of 25 - 35 mm ranges from 8 to 10 g (Fishery Station of Kumamoto Prefecture, 1967). Hence, the total weight of clams found in the whole deposit is roughly 30 tonnes.

Time span of the settlement seems to be very short - within a single substage of a pottery type. Four dwelling pits overlapped suggesting that the settlment was occupied at least during the period when dwellings were rebuilt four times. Based on these data, the time span of occupation of the Kidosaku Site is inferred to be 20 to 30 years. Consequently, the average annual clam yield is estimated at about 1 to 1.5 tonnes at this site.

There is, then, a large gap in the estimated intensity of prehistoric shell collecting activities between a theoretical 50 tonnes annual yield suggested by the environmental analyses and the 1 - 1.5 tonnes indicated by the archaeological evidence. This discrepancy may be accounted for in three ways: (1) difficulties in accurately reconstructing paleoenvironments, in this case shellfish paleobiomass, from geological and ethnological data; (2) possible poor preservation of archaeological shells, thereby creating a discrepancy between actual prehistoric yield and present sample size; and (3) disposal of shell refuse at another location, as in the case of the shellfish collecting camp associated with the Isarago Shellmound Site (Education Committee of Minato Ward, Tokyo, 1982).

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