Jomon People Subsistence and Settlements: Discriminatory Analysis of the Later Jomon Settlements*

Takeru AKAZAWA
Department of Anthropology and Prehistory
The University Museum
The University of Tokyo

Abstract This study concerns with the subsistence diversity of the prehistoric hunter-gatherers of Japan during the Jomon period. Discriminant function analysis of 91 lithic assemblages from later Jomon settlements is utilized to divide the Jomon societies into homogeneous subgroups. The study has four sections. First, a general outline of Japanese prehistory is given; second, the approach chosen for the study is described; and third, the results from the discriminant analysis of the Jomon settlements and associated lithic assemblages are presented. The concluding part examines the problem of how and why the diversity in subsistence activities and associated technologies occurred in the Jomon societies. The cultural dichotomy between western and eastern Japan during the later Jomon period is studied: intensive plant collecting and/or incipient plant cultivating societies flourished in the west, whereas more specialized fishing and hunting societies with less specialized plant collecting activities flourished in the east.

INTRODUCTION

There has been much discussion among prehistoric archaeologists over the meaning of cultural dichotomization in Japanese archipelago, that the differences in artifact assemblages suggest (e.g., Kondo, 1962; Kanaseki and Sahara, 1978; Akazawa, 1981, 1982). Although many investigators have presented the actual evidence of dichotomy in Japanese culture, there have been few systematic studies on how and why this situation arose in Japanese history.

The purpose of this paper is to show cultural dichotomization in Japan that occurred during the Jomon period, and to explain this phenomenon with reference to the adaptive processes of different groups of Jomon people. It is hoped that a better understanding of man’s relationship to his environment will give us a better perspective in understanding the cultural change from hunting-gathering subsistence system to one based on agriculture in Japan.

The paper is divided into four sections. In the first section, a general outline of Japanese prehistory is presented, with particular emphasis on the fact that different groups of Jomon people followed divergent paths at variable rates in the

* This paper is dedicated to Emeritus Professor Hisashi Suzuki of the University of Tokyo in commemoration of his seventieth birthday.
transition to a settled life of agriculture, and that the Jomon groups of eastern Japan seemingly resisted accepting rice cultivation. This is followed by a description of the approach chosen for the study, a multivariate method of clustering Jomon settlements. The result of the discriminatory analysis of the Jomon settlements and associated lithic artifacts is given in the third section, where the clustering of the Jomon settlements due to artifact differences is discussed. The concluding part examines the possibility of diversity in subsistence activities and associated technologies of the Jomon people.

GENERAL OUTLINE OF JAPANESE PREHISTORY

A knowledge of chronology of cultural periods in Japan is necessary to understand the cultural diversity and evolutionary processes during the prehistoric era. For our purposes, it is sufficient to point out some of the broad distinctions by subsistence and material cultures.

Since the discovery of the Japanese Palaeolithic at the Iwajuku site (Sugihara, 1956) in 1949, thousands of investigations have vastly improved our understanding of Japanese prehistory. Thus, there can be no doubt that Japanese history originated in the Pleistocene epoch, but the question of when and from where these earliest Japanese immigrants came remains unanswered. For instance, after 30 years of work since the Iwajuku excavation, a debate over the beginning of the Japanese Palaeolithic still continues.

Palaeolithic materials in the Kanto district, that has been most intensively investigated in the Japanese archipelago, are found in loamy formations. The loamy formation of the Kanto district is divided into four stratigraphic units: from bottom to top, the Tama, Shimosueyoshi, Musashino and Tachikawa Loam formations. Palaeolithic remains have been obtained from the Tachikawa loam only dated to a period from about 30,000 to 8,000 B.C. by the radiocarbon and fission-track methods (Oda and Keally, 1979; Akazawa et al., 1980: 136).

Ikawa-Smith (1980) stated that there were about 100 sites that have been said to have produced lithic artifacts older than 30,000 years, although more than 90 percent of materials discovered in the Pleistocene deposits so far dated between 30,000 to 10,000 years ago. The early assemblages referred to by Ikawa-Smith as Early Palaeolithic are still the subject of much debate among Japanese archaeologists. The most troublesome is a debate as to whether these objects are really man-made. As she put it: “some archaeologists believe that human occupation of the Japanese archipelago began over 100,000 years ago; others believe that it did not begin until about 30,000 years ago; and still others, including myself, feel about 50,000 is the reasonable figure.” (Ikawa-Smith, 1980: 136).

Japanese prehistory shifted to the new chronological and cultural period known as Jomon over 10,000 years ago (Table 1). Japanese prehistory in the Jomon period is one of the most extensively inves-
Table 1. Chronology of Japanese cultural periods (Modified from Ikawa-Smith, 1980: Table 1).

<table>
<thead>
<tr>
<th>Period</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historic</td>
<td>A.D. 600—present</td>
</tr>
<tr>
<td>Kofun</td>
<td>A.D. 300—A.D. 600</td>
</tr>
<tr>
<td>Yayoi</td>
<td>300 B.C. — A.D. 300</td>
</tr>
<tr>
<td>Jomon Final</td>
<td>1,000 B.C. — 300 B.C.</td>
</tr>
<tr>
<td>Late</td>
<td>2,500 B.C. — 1,000 B.C.</td>
</tr>
<tr>
<td>Middle</td>
<td>3,600 B.C. — 2,500 B.C.</td>
</tr>
<tr>
<td>Early</td>
<td>5,300 B.C. — 3,600 B.C.</td>
</tr>
<tr>
<td>Initial</td>
<td>7,500 B.C. — 5,300 B.C.</td>
</tr>
<tr>
<td>Incipient</td>
<td>11,000 B.C. — 7,500 B.C.</td>
</tr>
<tr>
<td>Palaeolithic</td>
<td>before 11,000 B.C.</td>
</tr>
</tbody>
</table>

tigated and documented fields anywhere in the world. Although this cultural period, covering approximately 10,000 years, saw the development of very sophisticated pottery and various polished stone tools, the subsistence economy was primarily based on hunting, gathering and fishing.

Pearson and Pearson (1978) presented a useful review of hypothesis, proposed by some archaeologists and botanical ecologists, that swidden agriculture may have been introduced during the Jomon period. Recent research on plant remains strengthens the possibility that some kind of incipient cultivation was practiced by the Jomon people (Ikawa-Smith, 1980). Furthermore, based on the palaeobotanical studies, there can be no doubt that the occupants of the northern Kyushu at least cultivated rice at the final stage of the Jomon period around 3,000 B.P. (Nakamura, 1979, 1980; Fujisawa et al., 1980). Nevertheless, the available data suggest that the majority of Jomon subsistence was probably supported by wild plants and animals (Akazawa, 1981, 1982), even though it was regionally diversified as will be discussed in the following sections. In other words, the Jomon people should be defined as affluent hunter-gatherers involving intensive collection of a wide variety of wild foods.

The succeeding Yayoi period witnessed the appearance of a settled life of agriculture in a true sense. The initial appearance of rice cultivation in Japan has been regarded as the product of diffusion, during the final stage of the Jomon period, to northern Kyushu, via southern Korea and/or directly, from the lower reaches of the Yangtze River in southern China. This rice culture complex included irrigated paddy fields equipped with special devices such as dams, and various agricultural equipment such as harvesting stone sickles and wooden hoes (Shimojo, 1979: 137-139.)

Following the initial introduction of rice cultivation was the Yayoi-pottery stage around 300 B.C. About this time Yayoi agricultural societies, which had developed new technological and social systems, were established in northern Kyushu, although the former situation during the Final Jomon stage might have been a prelude to a true settled life of rice agriculture. Simultaneously, the Yayoi culture spread eastward and southward (Fig.1).

The first expansion of rice culture complex occurred quite rapidly through Chugoku and Kinki districts up to around the western part of the Tokai district (e.g., Kondo, 1962; Kanaseki and Sahara,
According to the radiocarbon dating, around the same age as the formation of the Yayoi settlements in Kyushu, the first expansion of rice cultivation reached up to around the Tokai district (Akazawa, 1981: 217). After passing through the Tokai district, rice cultivation spread farther eastward as the second stage of rice expansion.

During the middle stage of the Yayoi period, the Jomon people of Chubu, Kanto, and the southern part of Tohoku continuously accepted the new way of life developing in the west. By around A.D. 300, the beginning of the next cultural period known as Kofun, the Yayoi culture
had spread over most of the Japanese archipelago except Hokkaido.

The Kofun period was characterized by the increasing integration of the prehistoric communities of the Japanese archipelago into a single state, that was to be completed during the Asuka and Nara Periods. By this time, documents and manuscripts were added to the archaeological remains as source materials for the reconstruction of Japanese history.

In summarizing Japanese prehistory as outlined above, it has been found that the cultural change from food procuring to food production which occurred in the final stage of Jomon period was the most innovational event in Japanese history. Thus, rice culture complex has survived into later times as the basic trend in the various spheres of Japanese culture.

Although it is certain that the cultural diffusion was crucial in mediating the transition between these two different technologies, evidence that the expansion of rice technology was due to the arrivals of large immigrant groups has not been obtained in the field of physical anthropology. That is, this cultural change, even if innovational and dramatic event in Japan, can be explained substantially as a series of adaptive processes on the part of Jomon people. Comparisons between different Jomon groups reveal, however, a number of significant differences both in the process and the results of the acceptance of rice culture complex. The most significant ones, as discussed in various papers (Kondo, 1961; Kanaseki and Sahara, 1978; Akazawa, 1981, 1982), are summarized below.

1) The observed routes of rice expansion were different between the first and the succeeding stages. The first Early Yayoi settlements were located in the lowlands through Kyushu to Tokai because the first rice dispersal had followed this route. The succeeding rice expansion, however, spread into mountainous inland zones, and as a result, left its trace behind as habitation sites in inland regions, along with the settlement sites in the coastal regions that continued to be occupied (see Fig.1).

2) A significant regional difference in the Jomon influence is seen in the Early Yayoi pottery. All the sites of the Early Yayoi period throughout the area of the first stage of rice expansion produced pottery which has very similar technological and morphological features. In contrast, the Yayoi pottery complex of eastern Japan was characterized by the influences from the local Jomon ceramic traditions.

3) Another difference can be seen in subsistence economy by area. It can be postulated that the eastern Yayoi people retained, to some extent, the hunting-gathering economy of the preceding Jomon-type subsistence after adopting rice agriculture. Particularly, Jomon influence can be seen in fishing gear discovered in a number of cave deposits along the Pacific coast in the Kanto district. These tools were made by the same technological traditions as those of the preceding Jomon shell-midden people in this region.

Thus, the Yayoi people of eastern Japan retained a traditional lifestyle based upon the locally flourishing, preceding Jomon
tradition, and showed a strong tendency toward cultural regionalism in contrast to the cultural uniformity observed in the early western Yayoi culture. These differences of culture change from Jomon to Yayoi by area have been discussed by various authors (e.g., Kondo, 1962; Kanaseki and Sahara, 1978; Akazawa, 1981, 1982), but they tend to focus on a rather general description of the cultural dichotomy between the area where rice spread smoothly and the area where it was resisted. Therefore, further examination is required, if we are to understand the kinds of preadjustment and readjustment that occurred in the Jomon hunting-gathering societies in the process of their transition to the agricultural society of the Yayoi period. In other words, examinations of these subjects should lead us to a better understanding of the reasons for the regional differences in receptivity processes and the results of rice agriculture. For our purposes, we need to examine the circumstances of the Jomon societies around the time when rice spread in the Japanese archipelago.

METHOD

In this paper, I intend to demonstrate statistically that different preadjustments for receptivity to rice agriculture existed in the Jomon societies. The area where rice spread quickly coincided with the distribution of societies characterized by a subsistence economy specifically based on wild plants, and the area where it was resisted coincided with the area where the subsistence economy was strongly oriented to fishing and hunting land animals. In order to test this hypothesis, I propose a working model of an inter-assemblage variability in the Jomon settlements.

The variability among the prehistoric settlements is reflected in the combination and proportion of various artifacts. Although the significance of the variability displayed by artifact assemblages has been discussed before, I argue here that these differences are due to the differences in activity in different environments.

In demonstrating these differences among Jomon assemblages, I chose a multivariate statistical method of discriminant analysis. The mathematical objective of discriminant analysis is to distinguish between two or more groups of cases, and to combine the discriminating variables so that the groups are forced to be as statistically distinct as possible (e.g., Hanihara, 1981). In this instance, the groups are composed of the Jomon settlements under examination. To distinguish the groups, a set of discriminating variables of lithic artifacts is selected to measure characteristics on which the groups are expected to differ.

The actual analysis will concern the examination of the context of the Jomon lithic artifact assemblages and the significance of their inter-assemblage variability. In this case, 91 assemblages are employed. These assemblages are approximately contemporaneous, Late to Final Jomon assemblages from the period when the prelude to a new way of life based on rice agriculture began. To distinguish
between groups of these assemblages statistically, lithic artifact types are used as variables.

Where previous groups have not been established, discriminant function is of no assistance, and other techniques have to be employed (Sokal and Rohlf, 1969: 489). This is one of the cases where no satisfactory grouping method has been obtained. Therefore, I begin by grouping the Jomon settlements according to biophysical environments of the Japanese archipelago. Figure 2 shows the distribution of 91 sites belonging to each of lithic

---

**Fig. 2.** Distribution of 91 settlement sites utilized for discriminant function analysis of later Jomon settlements.
Table 2. Site numbers defined as known groups. The site numbers correspond to those in Figure 2.

<table>
<thead>
<tr>
<th>Site groups</th>
<th>No. of cases</th>
<th>Site numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>28</td>
<td>1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35</td>
</tr>
<tr>
<td>B</td>
<td>44</td>
<td>24, 26, 28, 29, 30, 31, 32, 36, 37, 38, 39, 40, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78</td>
</tr>
<tr>
<td>C</td>
<td>19</td>
<td>41, 42, 43, 44, 45, 46, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91</td>
</tr>
</tbody>
</table>

assemblages under examination. These sites are categorized into three groups beforehand, on the basis of regional differences in biophysical conditions outlined below (Table 2).

The Japanese archipelago lies along the east coast of Asia, stretching for approximately 3000 km from north to south. Its latitude extends over 22°, and climatic conditions vary. An important argument recently put forth claims the existence of a number of distinctive vegetational zones of this elongated archipelago. According to botanists (e.g., Honda, 1912; Yamanaka, 1979), the natural vegetation of Japan can be broadly divided into two major zones between a boundary line of around 137° N.E.: laurel forest zone of western Japan and deciduous forest zone of eastern Japan.

Another distinction is observed in the maritime conditions mainly due to the two oceanic currents of Kuroshio and Oyashio. Although prehistoric sites of the Jomon period in the coastal regions are characterized by extensive shell middens, this development is concentrated along the Pacific coast of eastern Japan, from Tokai to Tohoku, and in the Inland Sea and Ariake Bay areas of western Japan. But, the nature of fishing adaptation differed from area to area (Akazawa, 1982).

The most significant distinction can be seen in the marine conditions of the Tohoku district and those of other areas. The fishing adaptation along the Pacific coast of Tohoku district was characterized by the ocean-oriented subsistence system that was developed in the coastal regions influenced by the Oyashio and the junction of the Oyashio and Kuroshio currents. In contrast, the fishing adaptation of other areas is characterized by littoral-oriented and embayment-oriented subsistence systems that generally flourished in the coastal regions influenced by the Kuroshio current, and by a lake- to riverine-oriented subsistence system.

The original data were derived from Maeyama (n.d.). Maeyama's data were composed of 24 artifact types classified under standard nomenclature of Japanese archaeology. Eleven of these artifacts were selected for the present analysis (see Table 3). These types were selected because they were all lithic artifacts not influenced by the preservation conditions.
of the deposits. Artifacts made of organic materials, such as antler fishhooks, were excluded from the analysis since these artifacts are found only in midden deposits.

The raw data for calculation were given in the form of percentage frequencies of eleven tool types in the single assemblage.

Table 3. Variables utilized for discriminant function analysis of the later Jomon settlements.

<table>
<thead>
<tr>
<th>Variables No.</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>V₁</td>
<td>Grooved stone net-sinkers</td>
</tr>
<tr>
<td>V₂</td>
<td>Notched stone net-sinkers</td>
</tr>
<tr>
<td>V₃</td>
<td>Stone querns</td>
</tr>
<tr>
<td>V₄</td>
<td>Grinding slabs</td>
</tr>
<tr>
<td>V₅</td>
<td>Stemmed scrapers</td>
</tr>
<tr>
<td>V₆</td>
<td>Stone awls</td>
</tr>
<tr>
<td>V₇</td>
<td>Chipped stone axes</td>
</tr>
<tr>
<td>V₈</td>
<td>Flake scrapers</td>
</tr>
<tr>
<td>V₉</td>
<td>Grinding stones</td>
</tr>
<tr>
<td>V₁₀</td>
<td>Chipped stone arrowheads</td>
</tr>
<tr>
<td>V₁₁</td>
<td>Polished stone axes</td>
</tr>
</tbody>
</table>

The computations were processed by the HITAC system of the University of Tokyo Computer Center using the SPSS program DISCRIMINANT, with Mahalanobis' D²s as the distance measures.

The program was employed to examine two aspects of the inter-assemblage variability. It was run once to ascertain to what degree the lithic assemblages differed among the three groups of sites. At the same time, it was run to see how well the lithic assemblages would be classified correctly in order to evaluate the internal consistency of artifact similarity for the assemblages belonging to each site group.

RESULTS

Table 4 presents the means and standard deviations for all the variables for the three groups of sites analysed here. Mean groups of site group A are higher than the corresponding figures of the other two
Table 5. Standardized canonical discriminant function coefficients based on the utilized variables. \(V_{11}\) did not pass the tolerance test of 0.001 level.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Function 1</th>
<th>Function 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V_1)</td>
<td>0.1726</td>
<td>0.2047</td>
</tr>
<tr>
<td>(V_2)</td>
<td>0.2429</td>
<td>−1.3595</td>
</tr>
<tr>
<td>(V_3)</td>
<td>0.1978</td>
<td>−0.4244</td>
</tr>
<tr>
<td>(V_4)</td>
<td>0.1819</td>
<td>−0.5080</td>
</tr>
<tr>
<td>(V_5)</td>
<td>−0.8471</td>
<td>−0.8706</td>
</tr>
<tr>
<td>(V_6)</td>
<td>−0.2933</td>
<td>−0.3458</td>
</tr>
<tr>
<td>(V_7)</td>
<td>0.3392</td>
<td>−2.5224</td>
</tr>
<tr>
<td>(V_8)</td>
<td>−0.5887</td>
<td>−1.7372</td>
</tr>
<tr>
<td>(V_9)</td>
<td>0.1960</td>
<td>−1.7372</td>
</tr>
<tr>
<td>(V_{10})</td>
<td>0.3895</td>
<td>−1.7442</td>
</tr>
<tr>
<td>(V_{11})</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Site group B exceeds site groups A and C in average value for \(V_1, V_{10}\) and \(V_{11}\). Site group C exceeds the other two site groups in \(V_2, V_3, V_4, V_7\) and \(V_9\). Based upon the variance ratios (F-ratios) obtained, the null hypothesis that the inter-group differences in frequencies of lithic artifacts are zero was rejected for eight variables except \(V_3, V_4\) and \(V_{11}\). From these results, we can postulate the possibility that certain sets of lithic artifacts were developed in certain groups of settlements. This is confirmed by applying the statistical practice known as a tolerance test.

Fig. 3. Constellation of 91 settlement sites discriminated as the three groups, plotted with respect to the first (horizontal axis) and second (vertical axis) discriminant scores.
result, all the variables except V11 are significant, that is, they are better discriminators than would be expected by chance. But the V11 failed to pass the tolerance test of minimum level of 0.001 for the present study.

The discriminant function is used to produce a series of weightings of the original variables, which is given in Table 5 for the two standardized canonical discriminant function coefficients. These show that the first function is weighted to use V5 and V8, and the second is weighted to use V2, V7, V8, V9 and V10 very heavily. Thus the analysis must at least be seen to stress the discriminatory power of V2, V5, V7, V8, V9 and V10. This result seems to be very satisfactory from the viewpoint of the logical understanding of the best possible discrimination between site groups based on a weighted combination of the original variables.

Figure 3 includes 91 sites classified as three groups beforehand, positioned by plotting the computed value of the first (horizontal axis) and second (vertical axis) discriminant scores. All the members have been very well discriminated and can at the same time be arranged in three clusters. The sites of group A occupy the left half of the space and are quite separate from the other two groups which occupy the right half. Within the sites in the right half, there is a division into two clusters B and C. The sites of groups B and C are plotted in the upper and lower halves of the space respectively.

Table 6 displays the results of the discriminant analysis. Site group B has the highest incidence of correctly predicted group membership at 93.2 percent. Site groups A and C are both 89.3 percent. These high rates of correct classification allow a cluster to be drawn centered on the group mean whose area covers approximately 90 percent of the sites grouped as A, B and C (see Fig. 3).

Finally, it is necessary to examine the meaning of clustering the Jomon sites into three groups in terms of weighted combinations of the original variables.
The most direct way of seeing this is by examining the correlation between the discriminating variables and the discriminant functions (Table 7).

The first canonical discriminant function is most negatively correlated with $V_5, V_6$ and $V_8$. This means that two major clusterings of site groups seen in Figure 3 are significantly due to the frequency difference of these variables—that is, site group A tends to have high values, and site groups B and C tend to have low values. Particularly, it is safe to conclude the high frequency of $V_5$ for the assemblage of site group A. The second canonical discriminant function is most highly correlated with $V_{10}$ at the positive end, and with $V_7$ at the negative end. These correlations then suggest that two site groups B and C which occupy the right half of the space in Figure 3 relate to the high positive weighting on $V_{10}$ and on $V_7$ respectively.

Although the explanation mentioned above focused on using variables showing the largest correlation obtained, the discriminant analysis extends to the idea of finding a weighted sum of all the variables that gives the best possible discrimination between groups. In other words, the computation performed produces a discriminant function which is as effective as possible in separating the group means while minimizing within group variance. In conclusion, a weighted combination of the original variables that can be used to give a mean value that locates a particular group is composed of almost all the variables utilized here.

**DISCUSSION**

Based on the well-defined discriminations, we can postulate the possibility that certain sets of lithic artifacts were developed in certain groups of sites, at least in the site analysed here. Further, it might be possible that a certain group of sites characterized by the same pattern of hunting-gathering equipment had a similar kind of adaptation process to biophysical conditions, if the working model for the present study is correct.

Therefore, we will examine the geographical distribution of the Jomon sites based upon associated lithic assemblages that were representative of significant variation in the data.

Figure 4 shows the distribution of 91 settlements discriminated into three groups. Another conclusion is to be drawn by the fact that several sites were misclassified (see Table 6); three sites of 16, 17 and 19 in the group A, three sites of 36, 50 and 62 in the group B, and two sites of 79 and 80 in the group C. Nevertheless, the distribution pattern of the three site groups coincides with one characterized by regional differences in biophysical conditions defined previously.

Thus, we can see, in general, the formation of three major clusters. On closer examination of these clusters, through the original data used in the present study, each cluster can be explained according to diagnostic, discriminating lithic artifacts.

1) Site group A distributed in the northern part of Tohoku district is separated
from other site groups by the discriminatory power of three lithic artifacts, stemmed scrapers, stone awls and flake scrapers. In particular, the analysis seemed to stress the discriminating variable of the stemmed scrapers. Frequency of these artifacts are most positively correlated with this group of sites, while chipped stone axes are highly correlated at the negative end.

2) Site group B distributed in the central part of Japan including Kanto, Chubu and
Tokai districts is separated from other site groups by the discriminatory power of three artifacts, grooved stone net-sinkers, chipped stone arrowheads, and polished stone axes. Among them, the chipped stone arrowheads, with the highly significant within-group correlation, are better discriminators than any other artifact.

3) Site group C distributed in the western part of Japan is separated from the other groups by the discriminatory power of three artifacts, notched stone net-sinkers, chipped stone axes and grinding stones. Among them, the chipped stone axes are very positively correlated with sites of this group. Two artifact types of stone querns and grinding slabs show a moderate degree of overlap in frequencies between the assemblages of site groups B and C. A tolerance test was performed as part of the program and the computed values were significant, indicating that there does exist a considerable degree of differentiation between the two site groups in spite of the attributed value overlap. That is, these artifacts are also correlated with discrimination of the site group C at the positive end.

In order to explain these inter-assemblage differences of Jomon sites by area, it is necessary to learn more about the way in which these stone tools were used. The functional interpretations of archaeological material are always a subject of discussion in the description of artifact assemblages. Nevertheless, a number of working hypotheses have been offered so far, inferred from archaeological context and the ethnographic record. Here, we show some reliable data of use and function of tools analysed which would be useful in reconstructing the subsistence economy by area.

First, stemmed scrapers, stone awls and flake scrapers selected as diagnostic of site group A are all categorized as non-primary tools. Kobayashi (1975) claimed that these tools were used not for tasks related to exploiting resources in the field, but for processing food resources obtained. From morphological features of these tools, it can be reasonably postulated that they are associated with scraping, slicing and chopping actions, as well as piercing and sharpening materials (Kusumoto, 1973). This site group, therefore, is discriminated by weighted combination of secondary tools for food preparation and tool-making.

Second, grooved stone net-sinkers, chipped stone arrowheads and polished stone axes selected as diagnostic of site group B are composed of two categories of tools. The first two are primary tools utilized for exploiting land, aquatic animal resources (Okamoto, 1965; Kobayashi, 1975). As for use and function of the polished stone axes, Kimura (1970) and Kusumoto (1973), based on their experimental studies, proposed that they were woodworking tools used for felling and preparing trees. Nevertheless, only this variable is not a significant variation in the data, indicating that the woodworking tool of this type was developed throughout the Jomon society.

Tools selected as diagnostic of site group C are the largest in number. Among
them, chipped stone axes, the most diagnostic variable for this site group, have been considered as harvesting tools of plant foods such as roots and bulbs (e.g., KOBAYASHI, 1975). It is noteworthy that this tool formed the same combination pattern with stone querns, grinding slabs and grinding stones that have very frequently been defined as tools used in processing plant foods (e.g., MUTO, 1965, 1968; WATANABE, 1969; KOBAYASHI, 1975).

The comparison between the activity differences of the Jomon people classifiable as the three groups reveals a significant difference. Although the evidence is not yet sufficient, the hypothesis that Jomon people in site group C were engaged in intensive plant collecting and/or incipient plant cultivation of wild species rather than fishing and hunting appears to have been supported by the available data reasonably well. A greater emphasis on hunting and fishing among the Jomon people of site groups A and B is consistent with the extensive shell middens along the Pacific coast of Japan.

Recent research on the cultural change from hunting-gathering to rice agriculture in Japan suggests that different groups of Jomon people followed divergent paths at variable rates in the transition to a settled life of agriculture. This variability could be related to the differences in adaptive processes within the archipelago during the Jomon period. That is to say, subsistence activities diversified by area during the Jomon period, and agricultural innovation was more easily achieved in western Japan where people had relied more on plant foods. The area where rice cultivation spread rapidly had been relying more on plants, and had developed an appropriate cultural milieu for the acceptance of the innovation. On the other hand, the Jomon people in eastern Japan discriminated as groups A and B did not react positively to a new way of life since they had developed the exploitative system very different from the one leading to a number of preadaptations of rice cultivation economy.

Comparing regional differences in the settlements classifiable into these two major groups at the later Jomon period, it is reasonable to apply to Japanese prehistory the working model proposed previously: "The significance of the variability displayed by artifact assemblages is due to activity differences adapted to different environments." The most outstanding feature concerned with this hypothetical view is high species diversity and density in ecotonal areas between two major vegetational zones of the laurel forest and deciduous forest zones in western and eastern Japan respectively (Fig. 5). That is to say, the distribution of these two major forest zones generally overlap the areas occupied by the site group A and other site groups. In addition, the coastal region of eastern Japan included in the same forest zones of western Japan is characterized by a specific variety of subsistence economy, as is evidenced by extensive shell middens consisting of a variety of fish species and fishing equipment. This circumstance is also due to the maritime conditions providing a wide range of re-
source potentials on which Jomon hunter-gatherers could have developed a specific variety of subsistence activities (Akazawa, 1982).

In conclusion, rice cultivation spread over most of the Japanese islands by the end of the Yayoi period, but the cultural dichotomy that existed during the Jomon period survived through the Yayoi and historic periods. One of the reasons for the cultural dichotomization between western and eastern Japan still observed today may be traced at least as far back as Jomon times.

ACKNOWLEDGEMENTS

For the material on which this study has been carried out I am much indebted
to Kiyok A Maeyama who has furnished me with every help when his assistance has been sought. Also I should like to express my gratitude to Fumiko Ikawa-Smith who read the draft of this manuscript and gave me invaluable suggestions and criticism.

REFERENCES


[Translation notes: for the foreign references, I have attempted to provide English translations of the titles and summaries where possible.]


(Received May 25, 1982)
判別分析法に基づく縄文遺跡の分類：日本文化地方差の起源・系統に関する一考察

赤 沢 威
東京大学・総合研究資料館・人類先史部門

日本人および文化の地方差はさまざまな分野で指摘され、その原因もまたそれぞれの分野で検討されていている。この小稿では、今日しばしば指摘されている日本文化の地方差、特に西日本文化と東日本文化という現象の源流が縄文時代にまでさかのぼって認められることを考古学上のデータに基づいて論じている。研究の目的は、縄文遺跡を石器の特徴に基づいて分類しその結果をもって縄文時代の生活活動の地方差を類推することである。

分析に用いた遺跡は、縄文時代の後期末葉から晚期に属する遺跡である（Fig. 2）。これらの遺跡を11種類の石器出土頻度に基づいて分類する（Table 3）。分析の手法は判別分析である。判別分析のためには11遺跡をあらかじめ一定の基準に基づいてグループ分けしなければならないが、今回の基準は遺跡周辺のマクロな自然環境である（Table 2）。

遺跡グループA：北緯38°以北の東北地方に分布する遺跡である（北海道を除く）。この地方の太平洋洋岸は、親潮および親潮と黒潮の洋潮の影響を受ける。

遺跡グループB：北緯38°以南、東経137°以東の中央日本に分布する遺跡である。

遺跡グループC：東経137°以西の西日本に分布する遺跡である。

すなわち、本州の森林帯を2分する落葉樹林帯にほぼ一致して分布する遺跡をグループAとし、落葉樹林帯にほぼ一致して分布する遺跡をさらに湖山の影響の違い等を考慮してグループAとグループBとに細分化することになる。

分析の結果、あらかじめ3つのグループに分類されていた遺跡が高次の単位で判別できることを示す（Table 6）、かつ各グループを特徴づける判別変数を抽出することができた（Tables 5,7）。

遺跡グループAの判別変数：石類、石器、石器の形状が抽出されるが、なかでは石器が最も重要な判別変数である。

遺跡グループBの判別変数：有溝石細、石細、磨石斧が抽出されるが、なかでは石細が最も高い判別力を示した。

遺跡グループCの判別変数：礫石細、打石斧、磨石、その他石皿、石碑が抽出できるが、打石斧が最も重要な判別変数を示した。

以上の結果は、あらかじめ3つのグループに分類されていた遺跡が、偶然ではなく、同1グループに属する遺跡相互の間では共通した石器の組み合わせがあり、その組み合わせはグループの間では一致しないことを示す。

ところで、遺跡で発見される道具と量的組み合わせが地方差、時代差を示すことは周知である。そのような現象が起る原因については議論が絶えないが、今回は、遺跡の変異は異なる環境への適応の結果を示すという仮説を設定してみると、上記判別分析の結果から次のような理解が可能となる。

西日本落葉樹林帯に適応した縄文時代人は植物食料資源の調達にとどまらなく、農業活動と深く関係していると考える道具類を発達させた。一方東日本落葉樹林帯に適応した縄文時代人は野生動物食料資源の調達および収穫物の調理やおそらく骨角器等の製作用具と考えられる道具類を発達させた。東日本の太平洋岸、日本海側に近い西日本型落葉樹林帯に適応した縄文時代人は東日本の落葉樹林帯に適応した縄文時代人と同様の特徴を示すが、この一帯は貝塚遺跡が密集する地域とほぼ一致する。

今回の遺跡分類の基準とした森林帯は6～7000年前に形成されたと考えられている。そして分析に用いた遺跡はその約3000年後に形成された。この約3000年の間に、西日本縄文時代人は落葉樹林帯の中で植物食料に重点を置いて漁業活動を発達させ、東日本縄文時代人は落葉樹林帯と特徴的な海岸地形と海流の影響のもとで主として動物食料に重点を置いて漁業活動を発達させた。

さて、縄文時代の終末期大から稲作技術が伝来し、がた国は弥生時代へと移行していく。しかし、縄文時
代の採集狩猟生活から弥生時代の農耕生活への移行は日本全土で一様に起ったものではない。すなわち、稲作技術の伝播パターン、受容後の弥生文化の特徴は地方によって異なる。西日本は比較的スムーズに受容したが、東日本は一見消極的であったし、受容後も縄文時代の伝統を強く残している。このような違いが生じた原因は、縄文時代の終り頃に認められた生業活動の地方差に基づく可能性が高い。
Plate 1. Artifact group assigned most often to later Jomon settlements (site groups A and B in the text) of eastern Japan based on the discriminant analysis of associated lithic artifacts: (1-3) Grooved stone net-sinkers, (4-9) Chipped stone arrowheads, (10-11) stemmed scrapers, (12-13) Flake scrapers, (14-16) Polished stone axes, and (17) Stone awl.
Plate 2. Artifact group assigned most often to later Jomon settlements (site group C in the text) of western Japan based on the discriminant analysis of associated lithic artifacts: (1-2) Chipped stone axes, (3-4) Notched stone net-sinkers, (5) stone quern, and (6-7) Grinding stones.