

Implications of Plant Remains from the Early Jōmon, Hamanasuno Site

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PRELIMINARY RESULTS of the analysis of plant remains and pollen from the Early Jōmon, Hamanasuno site (Chio 1971; Hurley 1974) are providing new information regarding Jōmon subsistence. The Hamanasuno site is a late Early Jōmon village, located in southwestern Hokkaido, dating from about 5000 B.C. to 3000 B.C. (Hurley et al. 1976). The site is situated on a broad, coastal terrace some 20 to 30 m above sea level. Early Jōmon sites in southwestern Hokkaido are often located on such terraces (Morlan 1966). Initial examination of ceramics and lithics from Hamanasuno indicates that the artifact assemblage is typical of the southwestern Hokkaido Early Jōmon Ento Kaso tradition.

In the past, scholars of Japanese prehistory have dealt with the problems of Jōmon subsistence only indirectly. Systematic studies of plant remains from Jōmon sites are virtually nonexistent, although carbonized seeds from Jōmon sites are occasionally reported. Makoto Watanabe has summarized the range of plant remains known in 1975 from Jōmon sites (1975: 12). The list of plants comprises 39 species from 208 sites. The identifications reported by Kotani (1972) and not included by Watanabe bring the total to 43 species. One of the species listed by Watanabe (1975), rice (*Oryza sativa* L.), is a cultigen. Barley (*Hordeum* sp.), another cultigen, was reported by Kotani from Kyushu ca. 1000 B.C. (1972). In addition, gourd remains (*hyōtan*) have recently been reported from the Torihama Shell Mound (Morikawa 1976).

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Although cultigens have been reported from a Jōmon context, the question of the existence of plant husbandry during the Jōmon is not resolved. In western Japan, the Final Jōmon is followed by the Yayoi, which began about 300 B.C. in northern Kyushu. Sosuke Sugihara separates the Yayoi from the Jōmon on the basis of the presence of rice agriculture, iron tools, and weaving (1961). These elements, according to Peter Bleed, "formed but a part of a well-integrated culture that clearly owed much to preceding Japanese cultures" (1972: 20). The Yayoi cultural complex spread rapidly eastward to central Honshu and then spread slowly throughout the rest of Japan south of Hokkaido by 300 A.D. This spread is usually viewed as involving a process of grafting of Yayoi traits, such as wet-rice agriculture, onto the indigenous Jōmon complex of traits. The different rates of transformation to a Yayoi pattern in eastern and western Japan seem to correspond to a "cultural and ecological dichotomy between western and eastern Japan . . ." (Chard 1974: 139). This differential rate of transformation is interpreted as a difference in degree of resistance to change from a hunting and gathering to an agricultural subsistence base.

It is not clear that a transformation from hunting and gathering to agriculture actually occurred at the end of the Jōmon. It has been postulated that agriculture was present in Japan prior to the Yayoi transformation. In southwestern Japan this is probably the case. Flotation analysis of soils from the Uenoharu site in Kyushu, dating to about 1000 B.C., has shown that a form of rice (probably upland rice: *Oryza sativa* L. ssp. *japonicum* Kato) and barley (*Hordeum* sp.) were grown at that time (Kotani 1972). Other evidence for Late Jōmon plant husbandry has been summarized by Richard and Kazue Pearson (1975).

A second hypothesis for pre-Yayoi plant husbandry, elucidated by Pearson and Pearson, deals with the possibility of plant husbandry during the Middle Jōmon period. An increase in the Jōmon population is noted at this time in central Japan (Kidder 1973) and this increase corresponds with a time of "general cultural efflorescence" (Chard 1974: 128). At any rate, there appears to be some difficulty in accepting certain plant-remains identifications from the Middle Jōmon (Pearson and Pearson 1975) and the use of secondary inferences upon which conclusions are based.

The traditional means of separating Final Jōmon sites from later sites in Hokkaido by the presence or absence of major changes in subsistence patterns is not possible according to Morlan (1966: 105). Morlan states that "agriculture never successfully penetrated Hokkaido in prehistoric times, because the climatic regimen was not suitable for the rice paddy cultivation of Yayoi farmers" (1966: 105 from Oba 1959: T22). Instead of the Yayoi in Hokkaido, the Final Jōmon period is followed by the Epi Jōmon and Satsumon periods.

The preceding statements imply that little is known about Jōmon subsistence adaptations and their variations within Japan. Although scholars of the Jōmon generally recognize that a basic adaptation of the Jōmon to the temperate forest region of Japan persisted for about 8000 years (Chard 1974), we know little about this persistent adaptation. One reason for this lack of knowledge is that the assumption often made is that plant materials are not preserved in an archaeological context (e.g., Kamikawana 1968). We are not immune to such beliefs in the New World (for example, see Dragoo [1976: 3] and DeBoer [1975]). On the contrary, by the use of the flotation technique popularized by Stuart Struever (1967), carbonized

plant remains can be recovered regularly and in quantity from archaeological sites. One exception to this disregard of systematic collection of plant remains in Japan is the flotation study carried out by Yoshinobu Kotani at the Uenoharu site, Kyushu (Kotani 1972). Flotation analysis of plant remains from Hamanasuno was undertaken to help begin to fill this gap in our knowledge of Jōmon subsistence.

The objectives in the context of the Hamanasuno site were to (1) determine the kinds of plant foods utilized, (2) delineate the relative importance of particular plant foods, (3) examine the possibility of the existence of plant husbandry, and (4) examine the subsistence ecology of the Early Jōmon site and to make inferences regarding Jōmon subsistence ecology and adaptations in general. Secondly, we collected data which would be of more general environmental significance. The data included pollen samples and wood charcoal for species identifications and radiocarbon dating.

Soils were floated at the Hamanasuno site utilizing a modified method of the hand-flotation technique described by Helbaek (1969) and by Crawford and King (1978). Analysis of the samples followed a modification of a standardized procedure which is outlined in detail by Yarnell (1974). Carbonized seeds and other plant remains requiring detailed inspection were removed from the samples and examined under low magnification ($7\times-30\times$).

Approximately 500 liters of soil were floated. From this soil about 220 grams of quantifiable remains (wood charcoal, bamboo grass, stone flakes, small bone, plant food remains, and unidentified plant remains) have been isolated. Carbonized plant food remains represented principally by seeds comprise less than 1 percent by weight of the quantified remains. Some unidentified tuber remains are also present. A total of 344 seeds were recovered. About 60 percent of the seeds can be identified, and 85 percent of these have been identified to either family, genus, or species. Table 1 lists the plants which so far have been identified. At least 18 species of plants are represented.

The majority of the identified seeds (about 60 percent) are grain seeds. That is, these plants were probably exploited principally for their seeds. Plants such as chenopod, amaranth, and knotweed were probably also collected for greens. The most highly represented plants are knotweeds and grasses. Possibly five species of grass are represented, but they are not identifiable to species. Three of the species probably belong to the Paniceae, or millet tribe. There is no indication, however, that any of the grasses are cultigens. One of the grain seeds, buckwheat, is considered to be a cultigen.

One carbonized seed of buckwheat was recovered in a flotation sample taken near the floor of House 27 and about 120 cm below the soil surface. It is considered to be from good Early Jōmon context. The pericarp of the fruit is not present, leaving only a carbonized partial seed. The seed measures 4.3 mm by 3.1 mm and is within the size range of modern buckwheat seeds. The seed is trigonous with only one face well preserved.

Apparently two species of *Fagopyrum* are known: *F. esculentum* Moensch. (*F. sagittatum* Gilib.) and *F. tataricum* L. *Fagopyrum esculentum* is a cultigen and is grown as a field crop. It occasionally exists as a feral plant. *F. tataricum* is commonly a field weed, growing among crops and along roadsides. It "commonly infests crops of buckwheat, together with which it is distributed in areas in the

TABLE 1. SCIENTIFIC AND JAPANESE TERMS FOR ENGLISH PLANT NAMES USED IN TEXT (FOLLOWING OHWI 1965)

ENGLISH COMMON NAME	SCIENTIFIC NAME	JAPANESE COMMON NAME
<i>Nuts</i>		
Walnut*	<i>Juglans ailanthifolia</i>	<i>Onigurumi</i>
<i>Grains</i>		
Amaranth	<i>Amaranthus</i> sp.	<i>Hiyu</i>
Buckwheat	<i>Fagopyrum esculentum</i> Moensch.	<i>Soba</i>
Chenopod	<i>Chenopodium</i> sp.	<i>Akaza</i>
Grass	<i>Gramineae</i>	<i>Ineka</i>
Knotweed	<i>Polygonum</i> sp.	<i>Tade</i>
Dock-leaved knotweed	<i>P. lapathifolium</i> <i>P. longisetum</i>	<i>Oimutade</i> <i>Inutade</i>
<i>Fleshy Fruits</i>		
Amur corktree	<i>Phellodendron amurense</i> Rupr.	<i>Kihada</i>
Blackberry	<i>Rubus</i> sp.	<i>Kiichigo</i>
Elderberry	<i>Sambucus</i> sp.	<i>Niwatoko</i>
Grape	<i>Vitis</i> sp.	<i>Budo</i>
<i>Others</i>		
Actinidia	<i>Actinidia</i> sp.	<i>Matatabi</i>
Bamboo grass	<i>Sasa</i> sp.	<i>Sasa</i>
Bedstraw	<i>Galium</i> sp.	<i>Yaemugura</i>
Legume	Fabaceae	<i>Mameka</i>
Rush	<i>Juncus</i> sp.	<i>Igusa</i>
Sedge	Cyperaceae	<i>Kayatsurigusa</i>
Sumac	<i>Rhus</i> sp.	<i>Urushi</i>

* English terms for certain Japanese plants do not necessarily exist. In these cases, we have used an approximate English equivalent.

Ukraine, western Siberia, and Kazakhstan" (Komarov 1934: 502). Comparison of the seeds of the two species shows considerable morphological differences. On the basis of this comparison the carbonized seed is obviously not *F. tataricum* (Plate I).

At the present time no data are available on the time and location of the domestication of buckwheat. Previously the earliest records of buckwheat in Japan were in the form of pollen from Lake Nojiri dated at about 400 A.D. (Tsukada 1966) and pollen from a Final Jōmon context at the Rokutana site, northern Kyushu (Nakamura 1970). Tsukada notes that buckwheat does not appear to be native to Japan (personal communication). In Hokkaido today, wherever buckwheat is found growing outside of tended fields, it is considered to have escaped from cultivation (Miyabe and Kudo 1930).



Plate I Buckwheat. Left to right: *Fagopyrum tataricum*; carbonized *Fagopyrum*; and *F. esculentum*, Scale $\times 9.8$.

At least two members of the buckwheat family (Polygonaceae) are known as wild buckwheat. These are *Eriogonum tomentosum* Michaux and *Polygonum convolvulus* L. The common name is misleading and does not necessarily indicate that either plant is ancestral to the buckwheat cultigen. Seeds of both so-called wild buckweats are unlike those of *Fagopyrum*.

Buckwheat requires only 8–10 weeks from sowing to maturity and grows best in moist, cool climates (Griffen and Hallowell 1973), thus making it a cultigen suitable for growing in southwestern Hokkaido.

Seeds of fleshy fruits were less common than grains in the samples, representing about 20 percent of the identified seeds. This does not necessarily mean that fleshy fruits were not commonly eaten. Generally, fewer seeds are produced in fleshy fruits than in grain plants. Further study of the nutrients involved in the various plant foods will be necessary before statements on food equivalence can be made. One significant observation is that there is a general paucity of nut remains in the samples. Nuts may not have been significant in the diet of the Hamanasuno population.

In order to examine the prehistoric subsistence ecology, and in particular, the palaeoethnobotany of the Hamanasuno site, we have tentatively classified the modern environment of the area into six vegetation zones. These include cultivated field, old field, clearings in woodland, roadside, highland, and riverine zones. The immediate coastal habitats probably should be included, but were not examined in detail in 1974. It is evident that a number of environmental zones similar to these were being exploited by the Early Jōmon Hamanasuno population.

Rushes and sedges were likely collected in the riverine zones where they intersect the coastal terrace. Amur corktree berries were probably collected from these zones also. The lack of plant remains of unquestionable highland affiliation implies that mountain plants were relatively unimportant for food. Most of the identified plants are common to disturbed habitats of various types. That is, they are weedy. The extent of the Hamanasuno occupation would support our view that the site area was ecologically a disclimax. Blackberry and elderberry may have grown at the forest edge or along trails, in situations similar to the habitats in which they grow today in the Hamanasuno area. Grape grows profusely today in young, open wooded areas and along stream banks, where there is abundant light.

All of the grain plants reported are suited best to highly disturbed, open areas, particularly those areas disturbed by people. These habitats were likely within and adjacent to the village. The presence of buckwheat at the site is evidence that cultivated land may have formed part of this disturbance, and that plant husbandry was carried out at Hamanasuno in Early Jōmon times.

Preliminary analysis of the pollen samples has proved disappointing. Preservation of the pollen was poor throughout all levels sampled. Herbaceous plant pollen is very common, adding support to the thesis of an open, disrupted terrace ecosystem. At the present time, though, there is not enough quantified pollen to allow us to draw conclusions about the local ecology, or to see changes in vegetation patterns through time. No cultigen pollen has been identified.

Great caution must be exercised in attempting to demonstrate plant husbandry at any site by the use of a single seed of a cultigen. In the comments by Pickersgill and Yarnell to a paper by Harlan and De Wet (1973), it is pointed out that in

such circumstances seeds of the cultigen may have been imported from elsewhere. Nevertheless, if buckwheat was not grown prehistorically at the Hamanasuno site, the source of importation may not have been far away.

Data regarding the Hamanasuno stone stools are not available at this time, but a significant number of *ishizara* (metates) are present; 170 *ishizara* were recovered in 1974 and another several hundred were recovered in 1973. These are generally interpreted as being plant-food processing implements (Yoshizaki 1965; Hurley 1974). The large quantities of these *ishizara* recovered from Early Jōmon sites such as Hamanasuno and Hakodate Airport indicate that plant food was significant to the southwestern Hokkaido Early Jōmon subsistence. At Hamanasuno, at least, seeds including buckwheat were likely candidates for grinding.

If the Hamanasuno occupants were carrying out plant husbandry, the degree of dependence on it for subsistence is suspected to have been low. A preliminary analysis of animal remains from the site indicates that hunting, especially of coastal and marine animals, was an important subsistence activity. Remains of marine mammals (porpoise and seal), coastal birds (cormorant), land mammals, and fish have been identified (Savage 1975). Bone preservation at Hamanasuno was very poor, thus making interpretations of animal food subsistence difficult.

Jōmon subsistence adaptations are considered by most archaeologists to have undergone no drastic changes over 8000 years. The existence of Middle Jōmon agriculture has been hypothesized and plant husbandry in Late-Final Jōmon contexts has been documented, but the first hypothesis has not been tested and we know little of the possible time(s) of the introduction(s) of cultigens to Japan. Presently, there is no reason to contradict the statement made by Tsukada that cereals and buckwheat "were introduced from the Asiatic continent into Japan" (1966: 183). Buckwheat, at least, seems to have been present in Early Jōmon times in Hokkaido. If it was not grown there, it was being grown close by at that time, although topographic and climatic features in the Hamanasuno area were suitable for such crops as buckwheat. We hypothesize that changes in Jōmon subsistence did occur prior to the Final Jōmon period in Japan. It is probable that plant husbandry commenced in Japan sometime earlier than 3000 B.C. and perhaps as early as 5000 B.C. As might be expected, the dependence on cultigens as a food resource was probably not strong early in the Jōmon period. Speculations as to why Jōmon peoples turned to plant husbandry cannot be made at this time because of the paucity of relevant data.

Major changes in subsistence adaptations were occurring in China and Southeast Asia concurrent with the Early Jōmon manifestations of Hokkaido. According to Ping-ti Ho, the foundations of Chinese agriculture were laid in the 5th millennium B.C. (1976) and rice husbandry was preceded by millet husbandry (1969). Millet has been reported from Pan P'o-tsun, a Yangshao village with associated radiocarbon dates of 4115 ± 110 B.C. and 3635 ± 105 B.C. (Chang 1973: 527). Chang believes that east-central China was an area of innovation and intense activity in the 4th millennium B.C. (1973: 528). It may well be that buckwheat domestication began in the context of early Chinese plant husbandry, but no archaeological buckwheat remains from China are known to the authors.

The kind of contact with mainland Asia implied by the buckwheat evidence is not understood. Barbara Pickersgill (1972) has outlined some of the problems involved

in using cultigens as evidence for cultural contacts. At the present time morphological comparisons of archaeological buckwheat seeds cannot be undertaken; evidence is virtually nonexistent. Could buckwheat have been domesticated in both Japan and mainland Asia? Although this question should not be ignored, the present distribution and growth habits of buckwheat imply that the plant is not native to Japan.

Chard's speculation (1974) that Middle Jōmon subsistence adaptations were similar to those of the California Indian populations must be questioned. Kidder (1973) has countered such arguments by showing that there is no reason to believe that nuts were more important to Middle Jōmon populations than to populations of other Jōmon periods. The presence of a late Early Jōmon cultigen lends some credence to suggestions of Middle Jōmon plant husbandry. It would be expected that the Hamanasuno site subsistence data would bear some similarities to the immediately later Middle Jōmon subsistence practices. The general lack of nut remains from Hamanasuno and the apparent dependence on seeds for plant food indicate that in southwestern Hokkaido, at least, Chard's analogy does not hold.

The presumed cultural ecological dichotomy between eastern and western Japan must now be subjected to further scrutiny. Chard (1974) has suggested that the retarded transition of the Jōmon to Yayoi in eastern Japan was due to a change in kind rather than degree of adaptation. In western Japan the Yayoi development involved an intensification of plant husbandry, already extant in the Final Jōmon, whereas in eastern Japan the change was from gathering and hunting to wet-rice agriculture. Rice is reported from three Middle Yayoi sites (ca. 100 A.D.) in Aomori Prefecture, immediately across the Tsugaru Strait from southwestern Hokkaido (Kotani 1972: 59). Thus, although rice may be later in the east than in the west, it does appear, and according to Kotani, may have been grown in a Final Jōmon context in eastern Japan contemporaneously with the Early Yayoi of western Japan. It is postulated that the subsistence developments in eastern Japan may have been similar to those in western Japan; that is, involving an intensification of existing subsistence practices. The relatively slow adoption of wet-rice agriculture in the east could possibly be attributed to the stability of more northerly adapted plant-husbandry techniques rather than to a quantum leap from gathering and hunting to agriculture. Plant remains from all regions of eastern and northern Japan must be systematically collected and interpreted to test this hypothesis.

When statements are made about Jōmon agriculture, care must be taken to discern what kind of plant husbandry is meant. Morlan (1966) uses the terms agriculture and wet-rice agriculture synonymously when discussing the subsistence base of the Hokkaido Jōmon population. As evidenced by Kotani (1972) and this paper, pre-wet-rice husbandry in the form of dry-plant husbandry probably has a long history in Japan.

SUMMARY

The analysis of flotation samples from the late Early Jōmon Hamanasuno site has demonstrated that plant-remains collection is an important adjunct to the more typical archaeological pursuits at Jōmon sites. At least eighteen species of plants have been identified in the flotation samples from Hamanasuno. The remains are

mostly small, carbonized seeds. Grain plants and unidentified tubers seem to be the most important plant foods represented.

Plant husbandry may have been carried out by the Early Jōmon occupants of the site as evidenced by a single, carbonized seed of buckwheat found near the floor of a Jōmon pit house. One cultigen seed from a site is not conclusive demonstration that plant husbandry was practiced there. The seed could have been imported. Nevertheless, the source of imported buckwheat would probably not have been far away. In addition, we cannot yet rule out the possibility of contamination. The large number of *ishizara* recovered at Hamanasuno and the relative importance of weed seeds for food, combined with the buckwheat evidence, strongly suggest that plant husbandry was carried out at Hamanasuno. Gathering and hunting were likely most important for food procurement. Further data regarding subsistence must be collected from southwestern Hokkaido to confirm or reject this plant husbandry hypothesis.

The vicinity of the Hamanasuno site appears to have been the primary source of plant food. The terrace ecosystem was disrupted by the Early Jōmon population and was a productive environment for plant food resources. Riverine zones were also exploited while mountains seem to have been unimportant collecting areas. No conclusions regarding seasonality have been reached.

The conception of Jōmon populations in eastern Japan as having had only a hunting, gathering, and fishing orientation must be questioned. Hypotheses regarding Jōmon peoples as highly adapted to temperate forest and littoral resources must be regarded as too general and therefore untenable as working hypotheses.

Finally, the utility of the flotation technique for recovery of small-scale food remains has been demonstrated for Jōmon archaeology, and it is hoped that this study will serve as an encouragement for such studies in Japan.

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