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The origins and implications of late prehistoric plant husbandry in northern Japan

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Introduction

Processes of acculturation and assimilation in contact situations have been the subject of considerable interest to North American and Japanese prehistorians alike. In the latter case, research has emphasized the transition, beginning about 1000 BC, to the wet-rice-focussed Yayoi (Akazawa 1981, 1986) (see TABLE 1 for

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scientific name	English name	Japanese name
cultigens		
Cannabis sativum	hemp	*asa*
Carthamus tinctorius	safflower	*benibana, safurawa*
Cucumis melo	melon	*meron, makuwa-uri*
Fagopyrum esculentum	buckwheat	*soba*
Hordeum vulgare	barley	*ou-mugi*
Linum usitatissimum	flax	*ama*
Oryza sativa var *japonicum*	rice	*kome, ine*
Panicum miliaceum	common or broomcorn millet	*inakibi*
Perilla frutescens var *crispa*	beefsteak plant	*shiso*
Setaria italica ssp. *italica*	foxtail millet	*awa*
Sorghum bicolor	sorghum	*morokoshi*
Triticum aestivum	wheat, bread wheat	*ko-mugi*
Vigna radiatus var *radiatus*	mung bean	*ketsuru-azuki*
V. angularis var *angularis*	adzuki bean	*azuki*
Zea maize	maize	*tou-morokoshi,tou-kibi*
weedy grains/greens		
Chenopodium sp.	chenopod	*akaza zoku*
Hordeum murinum	wall barley	*mugi-kusa*
Polygonum sp.	knotweed	*tade ka*
P. densiflorum		*inu-tade*
P. sachalinense		*ou-itadori*
P. cuspidatum		*itadori*
Rumex sp.	dock (sheep sorrel)	*gishi-gishi zoku*
Setaria italica ssp. *viridis*	foxtail grass	*enokoro-gusa*
Setaria talica ssp. *glauca*	foxtail grass	*kin-enokoro*
fleshy fruits		
Actinidia sp.	silvervine	*matatabi zoku*
Aralia sp.		*udo/tara-no-ki*
Cornus sp.	dogwood	*mizu-ki zoku*
Empetrum nigrum	crowberry	*gankou-ran*
Phellodendron amurense	Amur corktree	*kihada*
Physalis sp.	Chinese lantern plant	*houzuki*
Rubus sp.	bramble	*ki-ichigo zoku*
Sambucus sp. *cf. S. sieboldiana*	elder, elderberry	*niwatoko*
Solanum nigrum	black nightshade	*inu-houzuki*
Vitis sp.	grape	*budou (yama-budou)*
others		
Allium monanthum	wild onion, leek	*hime-nira*
Arctium lappa	great burdock	*gobou*
Castanea crenata	chestnut	*kuri*
Corydalis ambigua	corydalis	*Ezo-engosaku*
Juglans ailanthifolia	walnut	*onigurumi*
Quercus sp.	oak (acorn)	*donguri*
Rhus sp.	sumac	*urushi zoku*

TABLE 1. *Plant nomenclature used in text.*

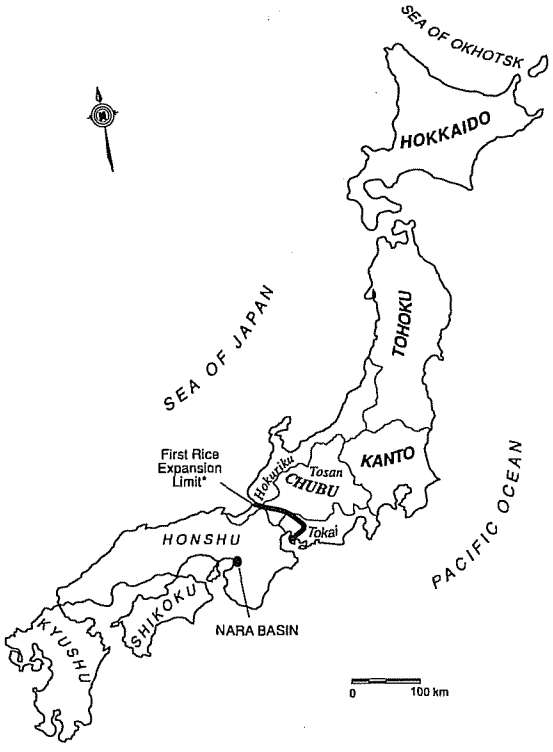

FIGURE 1. *Overview of Japan showing regions and the northern limit of rice expansion delineated by Akazawa (1982: 162)*

plant nomenclature used in this paper). The spread of agriculture to northeastern Japan is usually viewed as a northeastward progression of a frontier that reached northern Tohoku by the Middle Yayoi (FIGURES 1 & 2). However, the situation is more complex than this, in our view, and involves a spatial and cultural dichotomy between Hokkaido and northern Tohoku on the one hand and southern Tohoku–southwestern Japan on the other. Furthermore, we interpret Ainu culture (as distinct from the Ainu biological population) of Hokkaido and Sakhalin to be an outcome of a long period of social interaction along this boundary.

A broad frontier extended through southwestern Hokkaido and northern Tohoku beginning in the early half of the 1st millennium AD (FIGURES 1, 2 & 3). To the northeast of the frontier lived so-called native populations. To the southwest were fully agricultural societies who, by AD 500, were articulated with the Yamato state. At the end of the Final Jomon in northern Tohoku and Hokkaido, a significant process of culture change took place, involving among other processes, the introduction of food production. By the 9th century AD, food production was more extensive in southwestern Hokkaido than previously thought (Crawford & Yoshizaki 1987). At one Ezo site, Sakushu-Kotoni River, large quantities of carbonized plant remains are evidence of a high degree of dependence on millets, wheat, barley, beans, and several other upland crops, rather than wet rice. The genesis of this plant husbandry complex is not well documented.

In this paper we explore how the introduction of food production proceeded, relying mainly on plant remains data collected in the last few years in Hokkaido. We speculate that the development of the non-rice-based system was in part a response to selection pressures in Tohoku. The processes we examine took place well northeast of the northern Tokai boundary identified by Akazawa (1981; 1986) in his model of agricultural expansion in Japan. We have a number of objections to Akazawa's model, in particular to its applicability to northern Tohoku and Hokkaido. He relies on secondary evidence for plant procurement in the Chubu District and southern Tohoku, including the Pacific coast, in order to propose two types of procurement systems: a narrow spectrum and a broad spectrum system (Akazawa 1986: 200). Without systematically-collected plant remains, adequate assessment of the proposed contrast cannot be made, no matter what clustering of fishing-technology specializations or resource potential is observed. Akazawa (1981; 1986) makes the assumption, as do many others, that the spread of *agriculture* is the spread of *rice agriculture*, and that the appearance of Yayoi traits at sites signals the change to a food-producing economy. It is clear that in northeastern Japan, a non-rice-based food-production system arose. Any model of food-production origins in northeastern Japan must take this system into account and explain its relation to the Yayoi culture.

A model involving agricultural spread to western Europe has been proposed by Zvelebil (1986). This model, while not explanatory, is heuristic in that it provides a way to describe the processes that ensued during protohistoric contact periods in northeastern Japan. Zvelebil (1986) outlines a three-phase partition of agri-

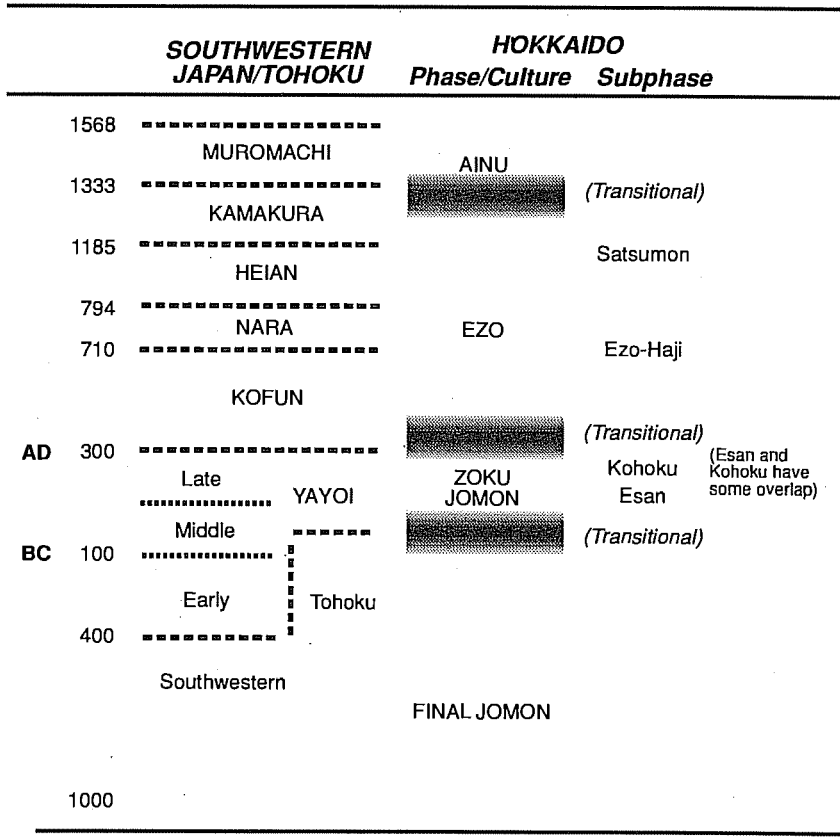

FIGURE 2. *Japanese periodization from 1000 BC to AD1568.*

cultural frontiers: first there is an availability phase; this is followed by a substitution phase, and finally by a consolidation phase. The period of Yayoi–Jomon interaction (about 400 BC to AD 300) is the phase of availability in northern Tohoku and Hokkaido regions. The substitution and consolidation phases were initiated with the demise of the Hokkaido Jomon beginning about AD 300 and the subsequent appearance of a northern agricultural complex in the latter half of the 1st millennium AD.

In order to examine the origins of food production in Tohoku and Hokkaido in the late prehistoric and early proto-historic periods, this paper is set out in two sections. First we review the cultural history of Tohoku and Hokkaido in the context of subsistence change. The second section summarizes our recent research on subsistence in Hokkaido. Previous researchers such as Akazawa (1981; 1986) were not able to use plant-remains data for models of agricultural development in northeastern Honshu. Considerable data now exist, although precious few plant remains have yet been retrieved from Tohoku. Most such remains in northeastern Japan are from Hokkaido but often from cultural contexts with similar counterparts in Tohoku.

Culture history

The temporal emphasis of this paper is from about 1000 BC to the proto-historic period of northern Tohoku and Hokkaido which began in the 7th century AD, and lasted until the early 20th century in parts of Hokkaido. We also examine the relationship of these phases to archaeologically- and historically-documented periods in southwestern Japan. Of particular concern are the Final Jomon, Tohoku Yayoi, Zoku (Epi-) Jomon, the Ezo-Haji and Satsumon subdivisions of Ezo, and Ainu.

Final Jomon (Tohoku and Hokkaido)

The end of the Jomon in northeastern Japan involved the demise of two cultures: the Final Jomon in Tohoku and Hokkaido and the later

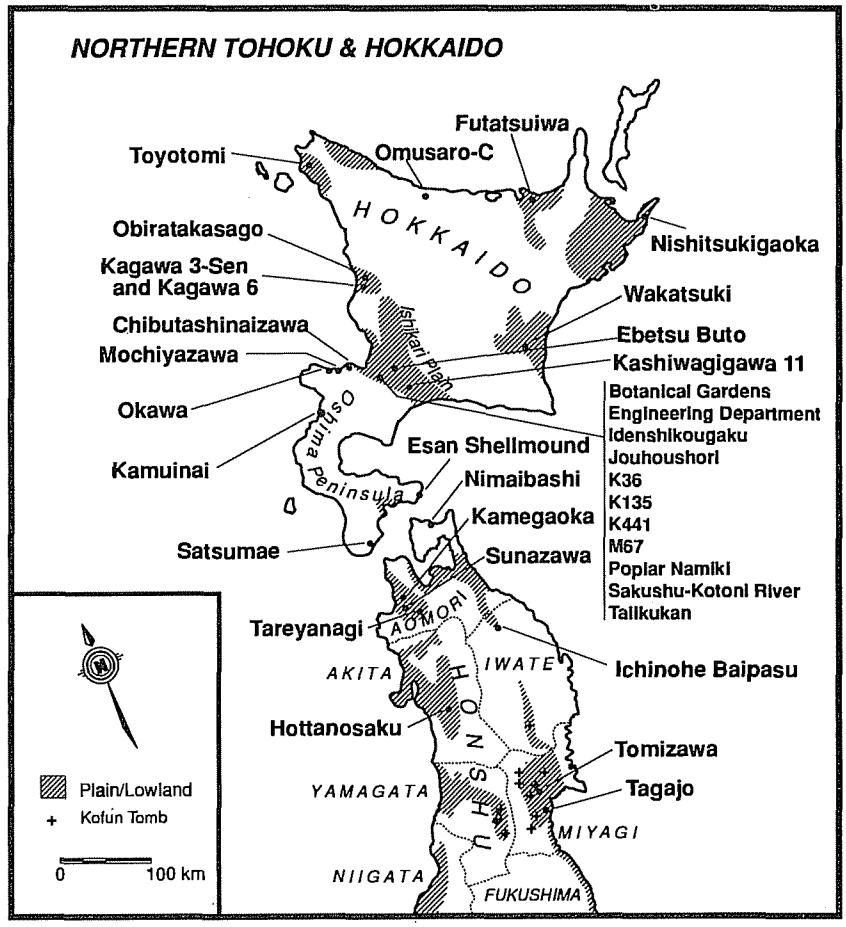

FIGURE 3. *Map of Hokkaido Island and Tohoku (i.e. the northern Honshu island) showing locations of sites mentioned in text.*

Zoku Jomon, mainly in Hokkaido. The Final Jomon ceased everywhere in northeastern Japan with the beginning of the Tohoku Yayoi, an intensive agriculture phase intruding into Tohoku from the southwest. After this intrusion began, most of Hokkaido was occupied by the Zoku Jomon while the Zoku Jomon had only a peripheral presence in Tohoku.

The Final Jomon period in Aomori Prefecture may be divided into seven phases (Suzuki 1986). They are called from the earliest to the latest: Obora B, Obora BC, Obora C_1, Obora C_2, Obora A, Obora A' and Sunazawa. In southern Tohoku, Obora is succeeded by the Fukurashima phase whereas in northern Tohoku, Fukurashima, although present is difficult to place chronologically. The Sunazawa phase usually closes out the Final Jomon there (Ito 1984: 23; Suto & Sahara 1987: 201–4). In other words, northern and southern Tohoku are somewhat distinct from each other at the end of the Final Jomon.

The Final Jomon of Tohoku and Hokkaido is often typified by the rich Kamegaoka site in western Aomori Prefecture and from which the so-called 'Kamegaoka Culture' takes its name. Local archaeologists today rarely refer to a 'Kamegaoka Culture', however. Sites of this period are usually referred to as 'Obora' phase. Nevertheless, the Final Jomon in this region is quite distinctive. For example, Okamoto (1966: 420) points out that 'the Kamegaoka culture had reached the highest level of culture which can be achieved by hunting and gathering populations'. Setting aside any discussion of the veracity of this statement, there is little doubt that the Obora-phase Jomon was quite successful. Obora material culture is characterized by thin-walled, well-made pottery in a variety of forms with zoned, cord-marked

motifs; stone technology which included polished stone batons; a variety of jewellery; pottery figurines; and a substantial technology based on perishable materials evidenced at several wet sites. Obora-phase people were involved in exchange with outlying areas. For example, artefacts made from shell which is available only in southwestern Japan have been recovered from Obora sites. Obora pottery has been reported from as far south as the Kinki region (Hayashi 1976: 191–2). Katoh & Suto (1986: 168) feel that this exchange network provided an avenue whereby Yayoi cultural elements were introduced to Tohoku.

Final Jomon subsistence is assumed to have relied upon hunting, gathering and fishing. However, evidence indicates that plant- husbandry was part of subsistence activities in the Early and Middle Jomon of Hokkaido (Crawford 1983) as well as the Early Jomon of southwestern Japan (Tsukada *et al.* 1986). We have no reason to believe that plant-husbandry would not have continued into the Late and Final Jomon, assuming it was present earlier. A proper understanding of Final Jomon subsistence must await systematic collection of both plant and animal remains, in particular by flotation. Pollen analysis, however, suggests that buckwheat husbandry was carried out (Yasuda 1988: 53–4; 16–4). The late Final Jomon peoples, who were contemporaries of the Early Yayoi, were undoubtedly aware of rice. Large quantities of carbonized rice remains have been reported from sites as far north as the Kamegaoka locality itself in association with Obora A pottery (Sato 1984). Obora-A-phase pottery with rice impressions is also reported (Tasaki 1986: 9; Ito 1986: 351–2; Sasaki 1983: 53; Ito 1984: 21–2; Katoh & Suto 1986: 167). Rice paddies have recently been reported from the Sunazawa-phase type site. The full implications of the discovery have not yet been explored but at least one archaeologist thinks that this may indicate an experimental stage of rice agriculture in Aomori Prefecture (Murakoshi 1988: 211–13). Yayoi glass beads and spindle whorls are associated with the Sunazawa phase as well (Hayashi 1986: 118). Moreover, Ongagawa-type pottery, the earliest Yayoi pottery in western Japan – the spread of which has been used as evidence for the diffusion of rice agriculture throughout Honshu – has been reported from several Sunazawa phase sites in this region (Suzuki 1986: 83–4; Suto & Sahara 1987: 206; Katoh & Suto 1986: 168; Ito 1984: 1; Takahashi 1986: 35). Ito (1984: 23) notes that Yayoi beads are found in Obora-A contexts at the Kamegaoka site. In southern Tohoku, on the other hand, it is not clear that rice was known to the latest phase of the Final Jomon there, but likely it was. We may postulate that gardening, adoption of rice and exchange with Yayoi peoples were components of a mechanism that was maintaining a distinctive northern socio-economic system in the face of Yayoi expansion in the southwest. Although a Tohoku Yayoi is recognized after the Final Jomon, it is distinguished only by rice agriculture and a material culture that is Yayoi-like but is still similar to the preceding Jomon. A local identity is maintained.

Tohoku Yayoi

The presence of Yayoi culture in northern Tohoku was not generally accepted until rice production was confirmed in the archaeological record there. Certain traits at sites were similar to Yayoi traits, but the assemblages still resembled the Final Jomon, particularly the Final Jomon pottery. Ito (1984: 1), as early as the 1950s, believed that rice agriculture began in Tohoku immediately after the Jomon-period. His argument was based first on pottery sherds from the Inakadate site. The pottery was similar to western Japanese Yayoi pottery rather than Final Jomon pottery types (1984: 2–3). Many researchers believed that this region was too cold for rice agriculture and that the Yayoi elements were simply a consequence of trade (1984: 1). In 1955, Ito recovered two carbonized rice grains and several pieces of pottery with rice impressions from the Tareyanagi site (1984: 3). However, rice-impressed pottery sherds and rice grains were not enough evidence to confirm the presence of rice agriculture in northern Tohoku.

It was not until 1983, when actual rice paddy fields were found at Tareyanagi, that archaeologists were convinced that rice was cultivated in northern Tohoku as early as the Inakadate phase (Komoto & Yamazaki 1984: 41; Ito 1984: 7; 1985: 350; Katoh & Suto 1986: 170; Tasaki 1986: 19). As of 1986, 654 paddy fields comprising approximately 3967 sq. m had been unearthed. Moreover, the paddy fields are well organized. Most of them exhibit either regular

square or rectangular shapes, ranging in size from 2.98 sq. m to 18 sq. m, averaging about 10 sq. m. In addition, the site occupants also installed waterways along the paddy fields (Komoto & Yamazaki 1984: 41; Ito 1984: 7; 1985: 346–50). Sasaki (1983: 46) reports that Fujiwara, who conducted plant opal analysis of the site, concludes that rice agriculture must have been an important aspect of the Tareyanagi subsistence system for a considerable period of time.

The processes and results of the expansion of rice production throughout Japan are significantly different between the southwest and northeast (Akazawa 1986: 163). As Kanaseki & Sahara (1978: 20–21) point out, the spread of the Early Yayoi from Kyushu to a line near modern Nagoya (Akazawa's Tokai boundary) was rapid. One type of pottery, Ongagawa, is shared throughout Japan west of this line at this time. Not until the Middle Yayoi does Yayoi become established in Tohoku (after 100 BC). This occurs during what Akazawa (1986: 163) calls a second phase of rice agriculture expansion. Contrasting the first, rapid spread of rice agriculture with the second phase of northeastward expansion of the Yayoi, Akazawa sees an initial resistance to food production by narrow spectrum food procurers, particularly along the Pacific coast (1986: 200). Along the boundary of the Tokai district, rice appears to move first through inland areas where people were more receptive to agricultural innovation. Akazawa hypothesizes that this is due to their experience with 'intensive plant collecting and/or plant cultivation' (1986: 200). In the areas he is concerned with, there are no substantial collections of plant remains to support or disconfirm the suggestion. Finally, Akazawa does not indicate whether his model is applicable to Tohoku in general and northern Tohoku specifically. We argue that it is not. In fact, as has already been pointed out, rice had made its way into Tohoku as early as the Obora-A phase of the Final Jomon, contemporaneous with the Early Yayoi.

The dichotomy between southern and northern Tohoku, first recognized during the late Final Jomon (post-Obora), is apparent during the Yayoi period as well. In southern Tohoku, the Fukurashima phase is succeeded by the Tanakura, Matsukata Gakoi, Enda and Sakurai phases (Ito 1966: 208–11; 215–19; Katoh & Suto 1986: 167). This sequence seems to have been strongly influenced by the Kanto region Yayoi (Katoh & Suto 1986: 166). On the other hand, the northern Tohoku Yayoi retained Jomon elements despite influence from the south (Ito 1966: 211–14). The Yayoi period of northern Tohoku may be divided into five phases: Nimaibashi, Utetsu II, Inakadate, Nenbutsuma and Chokaiyama (Itoh & Suto 1982: 361). According to Katoh & Suto (1986: 167), the Nimaibashi pottery type is the progenitor of the Esan pottery type and is closely related to the Esan culture, the earliest Zoku–Jomon phase on Hokkaido (Ito 1966: 211–14). It seems that the main reason to separate Esan from Nimaibashi is not by ceramic attributes, but by the apparent lack of rice agriculture in association with Esan pottery. Regional complexes continued to maintain local identities which, in the case of northernmost Tohoku and southernmost Hokkaido, are sometimes difficult to distinguish in the archaeological record.

In southern Tohoku, rice agriculture was likely established by the Matsukata Gakoi Yayoi phase, which is contemporaneous with Inakadate of northern Tohoku (Hayashi 1986: 114; Katoh & Suto 1986: 168–70; Ito 1966: 208–11; Tasaki 1986: 19). Rice paddies have been reported from the Tomizawa site, Miyagi prefecture, for example (Katoh & Suto 1986: 170). During this period, the sites tend to be distributed on flat alluvial planes less than 10 m above sea level (Ito 1966: 208–11). Furthermore, out of 75 sites with rice grain impressed pottery sherds, 59% of the sites are located in southern Tohoku (Ito 1985: 337–42).

If we are to assess the origins and development of the non-rice-based food production system documented in Hokkaido for the 1st millennium AD, it is important to know what crops, other than rice, may have been grown during the Tohoku Yayoi. To date, little work has been done to examine the range of crops used by the Tohoku Yayoi – we know more about Yayoi crops in southwestern Japan. Even so, the lack of detailed quantification of plant remains in most site reports makes it difficult to assess the relative abundance of plant taxa from Yayoi sites. Grains reported from southwestern Japan include rice, wheat, barley, millet and beans (Kasahara *et al.* 1986: 101–6; Crawford n.d.). However, one of us (Crawford) has examined a number of collections of Yayoi plant

remains assemblages, and it is clear that wheat is quite rare. Barley and millet are usually not recovered in much quantity either. There appears to be no Yayoi crop assemblage in southwestern Japan during the Yayoi analogous to those assemblages being recovered in Hokkaido. Phytolith analyses provide some suggestion that rice was not the only crop grown by the Tohoku Yayoi. *Panicum* sp. phytoliths, for example, are reported from the Babano II site in Iwate (Ito 1984: 23). Rice is notably absent.

Barnyard and foxtail millet played an important role in Tohoku subsistence until recently (Yabuno 1987). Barnyard millet not only provides higher protein levels (twice that of polished rice) and can be stored for long periods, it is also better adapted to areas in the Tohoku region where rice agriculture is not suitable (Yabuno 1987: 486). Yabuno (1987: 486) points out that barnyard millet provided insurance against rice crop failure in some areas and that in Iwate Prefecture, barnyard millet was a substitute and an extender for rice until the 1940s. Until the Meiji period in Shimokita, Sanbongihara, and in the mountainous areas of Kitakami, barnyard millet was the major crop grown in paddy fields (Ichikawa 1985: 111). In Ichikawa's opinion (1985: 111), the interpretation that paddy fields always mean rice production does not necessarily apply until the Late Meiji period in Tohoku. In northern Iwate Prefecture where cold weather prevents rice production, barnyard millet, foxtail millet, wheat, and soy bean were grown instead of rice (Yabuno 1987: 429).

Although agricultural society in northeastern Japan rapidly evolved after the mid Middle Yayoi period (Suto & Sahara 1987: 212–13), the crops may not have been the same as, or, at least, may not have been grown in the same proportions as in southwestern Japan. During the Early Yayoi, rice, barley, wheat, millet (foxtail, common, and barnyard), and bean appeared in the southwest, but rice dominates the plant remains assemblages from Middle and Late Yayoi sites in the southwest. There is evidence to suggest that barley, wheat, millet, and bean were more common than rice in northeastern Japan during the Yayoi (and perhaps during the following Kofun period) (Terasawa 1986: 24–7). Three members of the Fujiwaras, a powerful family during the 12th century in northeastern Japan, were buried not with rice but with barnyard millet in Iwate Prefecture (Yabuno 1987: 488), indicating that barnyard millet had become an important part of the economic system by this time. The suggestion of substantial non-rice agriculture from the Yayoi period and later in Tohoku is, in our view, quite viable in light of later assemblages of plant remains in Hokkaido (Crawford & Yoshizaki 1987).

Zoku Jomon (Hokkaido)

A later Jomon variant, the Zoku Jomon, appears in southwestern Hokkaido by 150 BC. Most radiocarbon dates for the Zoku Jomon in Hokkaido are older than AD 300 (FIGURE 6). The earliest Zoku Jomon stage is contemporaneous with the Yayoi and late Final Jomon. The earliest phase is characterized by Esan pottery, first recognized at the Esan site on the Oshima Peninsula (see Yoshizaki 1984). Non- acculturated Zoku Jomon peoples on Hokkaido continued to survive, but not at the level of complexity of the preceding Final Jomon. A North American analogue to this Final Jomon– Zoku Jomon transition might be the Hopewell– Late Woodland transition in the midwestern United States. Hopewell was a ranked society with plant husbandry based on crops other than maize. The complex and perhaps competitive cultural system involving a broadly based interaction sphere declined (the 'Hopewell decline'), to be followed by a less complex set of cultures, called the Late Woodland. The Late Woodland is a period with varying degrees of dependence on maize, depending on location.

Oddly, few living sites are known for the Zoku Jomon in Hokkaido. Most sites are cemeteries or cemetery-middens (e.g. Esan, Poplar Namiki). The best known non-cemetery site is K135, discussed later in this paper. Interaction between Zoku Jomon and southwestern Japanese groups is seen in exchange that brought metal tools, glass beads, and pottery as far north as Hokkaido, while Zoku Jomon pottery is the only recognizable Hokkaido and northern Tohoku product on Tohoku Yayoi sites. Two reports of cultigens on Zoku Jomon sites, as well as cultigen pollen indicate that perishable products were moving through the system as well (Crawford 1987; Yamada 1986; 1987). Thus, cultigens, in addition to metal, glass, and Yayoi pottery were available to Zoku Jomon people from their contemporaries – the

Tohoku Yayoi, thus making this a stage of availability in Zvelebil's (1986) terms.

Historic period in Tohoku

The Japanese began intruding into Tohoku soon after the Kofun period began in southwestern Japan. Each successive regime of the Yamato state made its mark in northern Honshu. As early as the Heian period, the regions beyond the frontier were often considered havens for people to escape taxation and control of the state (Sansom 1958). There was no single consolidation of the Japanese state's presence in Hokkaido until the 1600s. Many southern-style *kofun* (burial mounds) are known in Tohoku (FIGURE 3), but little more is known about this early state's presence in the region. The appearance of *kofun* in Tohoku corresponds with the widespread appearance of Haji pottery (Hajiki) in the Middle Kofun that is characteristic of the southwestern Japanese Kofun period (Okada 1984). Early Kofun Hajiki is not common in Tohoku. Yayoi pottery in Tohoku ceased to be made during the Tohoku early Kofun but just how and why this happened is unknown. In northern Aomori Prefecture, the Zoku Jomon persisted for a short time, but Hajiki is quite common elsewhere in Aomori (Okada 1984). Okada feels that by the late Kofun (late 6th century AD), Hajiki developed a local Tohoku appearance with, for example, dark interiors (Okada 1984).

In a period of less than 200 years, northern Tohoku peoples had come under influence from the Yamato state. The relationship between the state and Tohoku peoples is unknown. Okada (1984) feels that the change from Yayoi to a culture under some form of Yamato influence was relatively peaceful. The northern culture was, in all likelihood, the local Yayoi society acculturated to some extent by contact with, and influence from, Kofun-period Japanese. There is little evidence for extensive migration of Japanese into northern Tohoku, although some migration likely took place. After the Kofun period ended in southwestern Japan, the Nara period Japanese made their own pioneering efforts in Tohoku. The seat of government at that time was in the Nara Basin. Kanto, the current seat of Japanese government, was considered a frontier territory.

Post-Kofun-period Japanese incursions to the north met with great resistance from local populations. As a result, northern Japan was a relatively hostile environment for the state-sanctioned expansion of Japanese interests. Aboriginal peoples south of present-day Akita and Iwate often lived amicably along side their Japanese counterparts; however, in Akita and Iwate and further north lived 'a very large number of turbulent people, including Japanese who had thrown in their lot with the Ainu' (Sansom 1958: 104). Palisaded Nara/Heian-period communities such as the *c.* AD 800 Hottanosaku site were built by Japanese in Tohoku. The people they were encountering are called *Emishi* (*Yemishi*) or *Ezo* in early records such as the *Nihongi* (Aston 1896) and they are usually assumed to be Ainu. In AD 642, the first mention of indigenous peoples – in Akita Prefecture – was made (Peng & Geiser 1977). An attack by the Japanese is recorded in AD 658, and many Ezo died (Chamberlain 1887: 45). Other clashes include an attack on Tagajo, a Japanese fortification near Sendai, Miyagi Prefecture, which was overrun by Ezo in the late 8th century AD. At the end of the following century, in AD 875, 80 boat-loads of Ezo raided Akita (Peng & Geiser 1977).

Many of the earliest accounts depict more peaceful relationships. The *Nihongi* describes efforts by the Japanese to peacefully bring the Ezo into submission. For example, in the summer of AD 658, Abe no Omi is said to have commanded 180 ships against the people of what is now Akita Prefecture (Aston 1896: XXVI, 252). The Ezo apparently submitted to Abe no Omi's forces without a struggle. During the same campaign, there is mention of the 'Yemishi of Watari no Shima' who were provided a great feast by Abe at an unknown location known as 'Arima' (Aston 1896: XXVI, 252). Aston (1896: XXVI, 252) believes that Watari no Shima is the island of Yezo, or Hokkaido as it is now known. In AD 658, 200 Ezo bearing presents reportedly appeared before the empress (Aston 1896: XXVI, 254). These may have been Ezo from Akita who had submitted to Abe no Omi.

At least three groups of Ezo were known to the Japanese, and one, the *Nigi-Yemishi*, brought annual tribute to the Yamato court (Aston 1896: XXVI, 262). This Ezo group is thought to have been the most 'civilized', while the *Ara-Yemishi*, and *Tsugaru-Yemishi* were less 'civilized'. The Hokkaido Ezo are not men-

tioned in this reference. The identification of three native groups may not only be a measure of the degree of hostility each group showed toward the Japanese, but it may also be a measure of geographic distance from the Japanese. Furthermore, the Final Jomon and Yayoi of northern Tohoku show regional variation as well and the possibility that their ethnohistoric counterparts are recorded in the *Nihongi* through the Japanese recognition of distinct native groups in the 7th century AD should remain open.

In AD 659, the Ezo suggested that a seat of government be established in Shiribeshi, thought to be on the west coast of Hokkaido, near the mouth of the Ishikari River (Aston 1896: XXVI, 260). Abe no Omi apparently did so. Given that Shiribeshi is, indeed, on Hokkaido, the expedition provides us with the first written account of a Japanese visit to Hokkaido. The encounter with the Ishikari Ezo seems to have been a cooperative one. The Ezo were said to have asked for assistance to thwart an attack by a group Aston calls the Su-shen (presumably the Ju-chen of Manchuria). Abe no Omi, with as many as 3000 troops according to one estimate (Yoshizaki 1984), defeated the Ju-chen and presented 49 captives to the empress (Aston 1896: XXVI, 260 & 264). The legacy left by the government post at Shiribeshi is unknown.

Little about Ezo subsistence was recorded in the *Nihongi*. During an AD 659 Japanese visit to the Tang emperor of China, two Ezo, a man and a woman, accompanied the envoys (Aston 1896: XXVI, 261). The Tang emperor asked if there were five kinds of grain in their (Ezo) country. The envoys answered that there were not. In the same discussion the envoys said that the Ezo dwellings were 'under the trees in the recesses of the mountains' (Aston 1896: XXVI, 262). The archaeological record of 7th-century Hokkaido shows this statement to be misleading, considering that Ezo hamlets consisted of substantial houses in locations other than recesses of mountains. The Ezo were not speaking for themselves, so we have a report of the envoys' conversation about what they thought of Ezo lifeways or of what they thought the Tang emperor should hear. In view of these observations, we suspect that other details of Ezo life coming from this conversation in China cannot be considered of much value.

Although rice agriculture is known in Tohoku before AD 600, rice production appears to have been risky with occasional crop failures forcing the Japanese to retreat occasionally from Tohoku (Okada 1984). Sansom speculates (1958: 106) that the 'Ainu', as he calls the natives of Tohoku, were able to hold out for so long in Tohoku due to the assistance of local pioneers who resisted the intrusion of the central government. Furthermore, the Ezo's relative success in the area is probably in no small way due to a food-production system based on barley, wheat, millets, and bean among other temperate crops, rather than rice. Plant remains from the 9th century AD Ichinohe Baipasu site in Iwate Prefecture are predominantly wheat (Sato 1986). At Hottanosaku in Akita Prefecture, one of us (Crawford) was able to observe barley, millet, beans and hemp in a sample from a house floor.

From the beginning of the Kofun period nearly 800 years passed before Tohoku and parts of Hokkaido were under Japanese control. By the mid 7th century AD, only three centuries after the end of the Yayoi in southwestern Japan, the Japanese were encountering powerful and, at times, hostile Ezo. Culturally, we can postulate that 7th-century populations in Tohoku were Kofun–acculturated descendants of Yayoi who, to a large extent, were acculturated Obora Final Jomon. The Ezo appear to have maintained their identity and territorial hold on northern Tohoku and southern Hokkaido in part because of an economic system based not on wet rice or only foraging, but on a dry-food-production system that was relatively secure in the northern regions.

Archaeological Ezo: the Ezo-Haji

By AD 800, the indigenous Ezo appear to have been extirpated in Tohoku (Takakura 1960) – assimilated into Japanese society in Tohoku and/or killed, but there is evidence of emigration of this population to Hokkaido at the end of the Zoku Jomon. This corresponds to the decline of the Zoku Jomon in Hokkaido. The Ezo–Haji period has only recently been recognized as a distinctive phase in Hokkaido and as a result, its extent and meaning are not well understood (Yoshizaki 1984). This phase likely begins earlier, with some overlap between the Zoku–Jomon and Ezo–Haji likely occurring (FIGURES 2, 6 & 7). Ezo–Haji appears to have been distributed primarily in the Ishikari Plain

south into the Oshima Peninsula (Yoshizaki 1984). The northern coastal areas of Hokkaido were occupied by the Okhotsk Culture. The better known Satsumon terminology is now usually reserved for the latter half of this period (Yoshizaki 1984; Crawford & Yoshizaki 1987). Satsumon sites are distributed as far north in Hokkaido as the coast of the Sea of Okhotsk.

The name 'Ezo–Haji' is a metaphor for the strongly-acculturated form that this early phase exhibits. The Ezo–Haji terminology implies that this pottery is not the true Haji ware of the Japanese. It was locally produced earthenware, often turned on a potter's wheel and bearing strong morphological resemblance to the original Haji pottery. House forms, however, are similar to Kanto and Tohoku Kofun-period dwellings. They are semi-subterranean, rectangular, and have one or occasionally two ovens in one wall. By AD 1200 this house form is found all over Hokkaido. Grey Sue stoneware (Sueki) pottery made in Tohoku, fired in kilns, is a rare component of Ezo–Haji ceramic assemblages. Few stone tools are found at these sites; tool technology was based on metal and wood. Our research documents that their subsistence base included agriculture (Crawford & Yoshizaki 1987). Three burial mounds are known from the Ishikari Plain during this period but their implications for the Ezo–Haji phenomenon are unknown. Future research should consider the socio-political organization of the Ezo–Haji. There is some indication of a hierarchical settlement organization but no data have been compiled to test this suggestion.

Satsumon

The manufacture of Ezo–Haji ware ceases about AD 1000 and Sueki is no longer found in Hokkaido after this time. Instead, pottery, some with Haji-like forms, is no longer made on a potter's wheel and is decorated with a variety of trailing and incised patterns and patterns produced by scraping the clay surface with a piece of wood. The latter technique is called 'Satsumon,' after which this phase is named. Bowl forms are more common as well. Otherwise this phase is much like the preceding Ezo–Haji. It is widely distributed in Hokkaido. Satsumon also continues the Ezo–Haji pattern of plant husbandry, possibly taking it into northern Hokkaido. Cultigens are reported from the Toyotomi site in northwestern Hokkaido and from the Nishitsukigaoka site in the northeast (Kohno 1959; Iwasaki 1966). The cultigens from these sites were fortuitous discoveries so the extent to which the site occupants were involved in plant husbandry is not known. We have obtained flotation samples from one other Satsumon site in northern Hokkaido, Omusaro-C, but the samples contained no cultigens. Interestingly, barley or wheat, broomcorn millet, and foxtail millet were recovered from flotation samples from the Futatsuiwa site, an Okhotsk culture occupation near Abashiri. The site also contained some Satsumon pottery. For the moment we cannot eliminate exchange as an explanation for the presence of cultigens in the northern extremes of Hokkaido. The extent to which food production spread into northern Hokkaido remains an important issue in Hokkaido prehistory.

Ainu

With the establishment of districts, or *basho*, in Hokkaido in 1615, the Matsumae government of Hokkaido attempted to assert control over Hokkaido and its people. Trading posts were established on the coast of each *basho* (Takakura 1960; Watanabe 1972: 86). In *bashos* with good fishing, Ainu were placed into compulsory service in the fishing industry (Watanabe 1972: 86). The *basho* system was eventually a fundamental influence on Ainu culture change; by the 18th century the Ainu and their territory were being exploited to such an extent that survival became difficult for them (Peng & Geiser 1977: 10–11).

Presently, life for the estimated 17,000 Ainu (Watanabe 1972: 1) in Hokkaido is much like that of the Japanese. Traditional Ainu society in Hokkaido is usually a reconstruction of life before the *basho* system. Until the turn of the 20th century, the Sakhalin Ainu lived in a manner thought to have been relatively unchanged by political events to the south on Hokkaido (Ohnuky-Tierney 1974). It is generally understood that Ainu society was egalitarian and not organized under a centralized power. Their religion was animistic, with the bear and owl deities being among the most powerful spiritual forces (Ohnuki-Tierney 1974: 90, 97). Birds, symbolized by the sacred shaved sticks (*inau* and *ikupasai*), were intermediaries between the Ainu and the deities.

Houses were one-room, rectangular struc-

tures usually oriented upstream (towards the mountain-dwelling deities) or to the east. Storage facilities were separate from the dwelling, constructed with floors raised well above the ground and oriented in the same direction as the dwellings (Watanabe 1972: 9–10). Ainu settlements were composed of 10 or fewer households and each often consisted of a single family. In the Tokapchi Valley, site location was usually close to dog-salmon spawning grounds. Within a settlement, houses were often separated by 100–500 m (Watanabe 1972: 9–10).

About the time the *basho* system was abolished (1869), the Japanese government encouraged the Ainu to take up farming (Watanabe 1972: 87). This government policy seems to imply that the Ainu had no form of agriculture until the late 1800s, but Watanabe (1972) and Hayashi (1969) both note that subsistence farming in Hokkaido appears to have a longer history than this. Certainly, the archaeological record documents plant-husbandry by Ainu ancestors as early as the 1st millennium AD. We suggest that the 19th-century Japanese government wanted the Ainu to participate in a farming economy, a system in which men could be considered by the Japanese government to be employed as full-time farmers. The Ainu resisted this transition to what amounted to full-time farming, but not because they were unfamiliar with farming practices. Peng & Geiser (1977: 14–16) note that a change from an egalitarian, subsistence level economy to participation in a redistributive, state-level production system would require fundamental changes in sex rôles, social status, regulatory mechanisms, and religion. Under these conditions, resistance to change is not surprising.

Osteological research has established a close relationship between the Ainu and the Jomon (Brace & Nagai 1982; Brace et al. 1989; Hanihara 1986). Modern Japanese are closely related to Koreans and Chinese rather than Jomon or Ainu (Brace & Nagai 1982; Brace et al. 1989). Furthermore, the Tohoku Japanese population exhibits similarities to both the Jomon and Ainu (Hanihara 1986: 83). The Sakhalin Ainu do not fall neatly into these groupings. One reason may be their long-time association with the Gilyak with whom they often intermarried (Ohnuky-Tierney 1974: 10).

North Asian plant-husbandry project

One outcome of the recent attention being paid to the late prehistoric period in Hokkaido has been the examination of the organization and development of the dry, temperate plant- husbandry system of the Ainu ancestors (Crawford & Yoshizaki 1987). Over the last five years, systematic flotation has been conducted as an integral component of excavations at many late prehistoric sites in Hokkaido. An underlying assumption to this research is that plants, particularly domesticated plants and their associated weed complexes, can provide good indications of relationships between geographically separate areas. Along with this analysis, flotation produces a quantity of items that are excellent for radiocarbon dating – cultigens that are artefacts with a single-year lifespan that when dated provide fine chronological controls.

Zoku Jomon sites sampled so far in the North Asian Plant Husbandry Project include the Esan Shellmound, Mochiyazawa, Poplar Namiki, and the K135-4 and K135-5 sites (two localities at the Sapporo Station, North Entrance). Ezo-period sites sampled to date are: Chibutashinaizawa, Kagawa 3-Sen, Kagawa 6-Sen, Kashiwagigawa 11, K67, K441, Okawa, Omusaro-C, Sakushu-Kotoni River, Sapporo Botanical Gardens, and Taiikukan. Two sites of mixed or indeterminable contexts are Idenshikougaku and Jouhoushori on the Hokkaido University campus. Most of these sites have been excavated as part of Hokkaido salvage archaeology programmes.

Sporadic reports of carbonized cultigen remains from several Ezo-period sites excavated before our project began, made it clear that cultigens were widespread in Hokkaido by AD 1200. Such remains fortuitously (no flotation or screening) came to light from the Nishitsukigaoka, Wakatsuki and Toyotomi sites (Iwasaki 1966; Kohno 1959; Ishibashi 1974; Matsutani 1980). Barley, broomcorn millet and beefsteak plant seeds were recovered from Wakatsuki. Seeds of *Vigna* sp., safflower, and broomcorn millet have been found at Toyotomi. Broomcorn millet has been identified from the Nishitsukigaoka site. The problem with such fortuitous discoveries is that without corroborative data, the significance of these discoveries is difficult to assess. For example, a case for widespread plant-husbandry (as opposed to widespread

cultigens) in Ezo-period Hokkaido depends on supporting evidence such as the presence/absence of weed seeds and cultigen by-products such as chaff, the distribution of cultigen and weed remains, and site locational analyses. The salvage excavation in the early 1980s at Sakushu-Kotoni River provided such an opportunity. As analysis began on the flotation samples from Sakushu-Kotoni River in 1984, we quickly realized that cultigen remains and weed seeds were distributed throughout the site and in high densities (Crawford 1986; Crawford & Yoshizaki 1987).

As the results from Sakushu-Kotoni River became known, colleagues made quick checks of three sites. Soil from Obiratakasago left over from pollen sampling was floated. A single small sample from Kamuinai was processed and a number of soil samples from the Satsumae site were washed. Five or six cultigens occur in flotation samples from Satsumae: broomcorn millet, barley, foxtail millet, rice, wheat, and possibly sorghum (Matsumae-cho Kyoiku Iinkai 1986; Yamada & Tsubakisaka 1989a). One taxon each is reported from Ebetsu Buto, Kamuinai, and Obiratakasago. These are hemp, foxtail millet, and *Vigna* sp., respectively (Ishizuki 1984; Yamada 1986). To date, cultigens have been recovered from 23 Zoku Jomon and Ezo-period sites in Hokkaido. Only Omusaru-C and Taiikukan have no cultigens and the analysis of samples from Mochiyazawa is in progress. In the following section we outline details of completed, or nearly completed, research at these sites.

Sapporo Station: K135-4 Chome and K135-5 Chome

Flotation samples from two Zoku Jomon localities, K135-4 Chome and K135-5 Chome, at the Sapporo railway station provide a detailed view of subsistence variation during the Zoku Jomon and a contrast with the succeeding Ezo–Haji (Crawford 1987). The localities are stratified and represent multiple occupations over only two or three centuries. The Zoku Jomon peoples were scheduling their visits to this location for reasons yet unknown, but nut harvesting or a combination of nut harvesting, hunting, and fishing may have been involved in the decision to move to this locale. Salmon bones are common in the earlier occupation levels while rare in the later occupation levels. This suggests that fishing was less important toward the end of the Zoku Jomon at K135. The other plants represented at the site are not as cyclically productive as nuts and would have been available at forest edges, on banks, and at other disturbed habitats in the fall of most years.

The archaeological horizons at both sites are separated by thick layers of alluvial deposits which allow clear occupational distinctions to be made. Flotation samples from two Zoku Jomon localities provide a detailed view of subsistence variation during the Zoku Jomon (Crawford 1987). An older and a younger stage of the Kohoku C2-D phase are present at 4-Chome. Two horizons are present at 5-Chome as well; the upper level is equivalent to the younger Kohoku C2-D phase at 4-Chome. The older horizon at 5-Chome is the Esan phase which precedes both Kohoku phases. The samples total just over 3700 kg of soil; about three-quarters of this is from K135-4. To date, 2244 carbonized seeds have been sorted, about 70% of these from K135-4. Nearly 572 grams of carbonized nut remains have been recovered so far.

K135-4 Chome. The samples from K135-4 Chome are from the flotation of 2910 kg of soil and represent several sequential occupations and two types of contexts: burned soil lenses and unburned fill. Most of the samples (1880 kg of soil) are from the early Kohoku C2-D-period occupation (level VIIc). In general, the samples are composed of variable quantities of walnut shell, chestnut meat, seeds of fleshy fruits (mainly grape, silvervine, and elder), and a few seeds of weedy annuals (mainly knotweed). Four whole, carbonized grapes occur in unit D-6, level VIIc. No acorn remains have been identified in samples other than in one sample from level II. Seed concentrations in the burned soil lenses and other samples are similar, on average. The seed concentrations are quite variable, ranging from 0 to 56 seeds per 10 kg of soil in level VII.

Within level VII, distinctions in spatial distribution of plant remains pertain mainly to nut concentrations and types of nuts. Grid unit D-6 (unburned fill) has nut concentrations nearly 80 times that of the adjacent grid unit D-5. In addition, walnut is the only type of nut remains

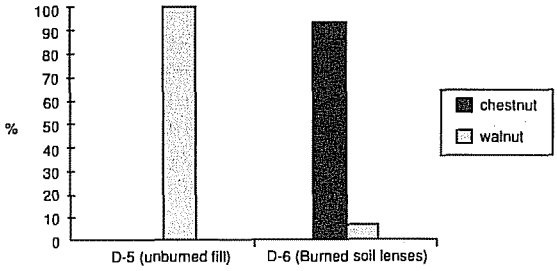

FIGURE 4. Comparison of nut composition between *Units D-5 and D-6 at K135-4.*

in the unburned fill of unit D-5, and this nut shows up in small quantities in about half the samples from this unit. The unit D-6 samples are about 93% chestnut (FIGURE 4). Walnut appears in only seven of the D-6 samples and one sample (Block 9) accounts for most of the D-6 walnut. Chestnut dominates the samples from this unit and is present in rather high concentrations (up to 21.64 g per kg of soil). Only one of the 10 level-VII, D-5 burned soil lens samples (no. 90) contains any nut remains, and these are mostly chestnut. The highest concentrations of nuts in the samples are found in unit D-6, although the burned soil lens nut concentration, on average, is lower than that in non-burned soil lenses in D-6. Again, the D-6 samples are predominantly chestnut, although more walnut occurs in the burned soil lens, Unit-6 samples, than in the unburned fill from unit D-6. About 70% of the total nut remains from the burned soil lenses, level VII, is chestnut meat.

Level-by-level comparison shows few obvious differences that might represent subsistence or ecological change through time. The upper levels are low in both nut and seed concentrations. The seeds are mainly grape, elderberry and some knotweed. The nut remains are mainly walnut shell. Seeds/g nuts, a statistic which usually increases with ecological disruption and agricultural development, does not appear to have any systematic variation at this site.

The only unusual carbonized remains from the upper levels is a single grain of barley in D-5, stratum IIIa. Late Yayoi pottery has been recovered from stratum VII (Sapporo-shi Kyoiku linkai 1987: 311) so the barley likely dates sometime after AD 200 and before AD 400. This specimen is the earliest record of barley in Hokkaido. The specimen measures 6.1 (L) by 2.7 (B) by 2.0 (T) mm. One other grass seed that is from a plant introduced to Hokkaido is a specimen of wall barley in level VIIc, burned soil lens no. 120. It measures 5.3 (L) by 1.8 (B) by 1.7 (T) mm. This weed form of barley is not native to Japan and likely was introduced, in association with crops such as barley and bread wheat. By Zoku Jomon times, rice agriculture was present in Tohoku (e.g. Tareyanagi site), and weed communities associated with food production would have been present as well. The presence of an introduced grass in the early Kohoku assemblage hints at some form of communication with food producing areas in early 1st-millennium AD Hokkaido. One other taxon from this component is not considered to be native to Hokkaido. Carbonized bulbs (numbering 12) of a wild onion or leek (*Allium monanthum*), occur in screened samples from units E7 and D7, level VIIc. The only other archaeological occurrences of this plant in Japan are at the Sakushu-Kotoni River site (Crawford and Yoshizaki 1987), and at the Ezo-period Chibutashinaizawa site in Otaru. These 4-Chome leek specimens represent their earliest known occurrence in Hokkaido.

K135-5 Chome. Twenty-two soil samples weighing a total of 813 kg were floated from K135-5 Chome. One set of nine samples is from Esan contexts while the remaining samples are from the later Kohoku phase. The Kohoku samples contain fewer taxa and much lower concentrations of plant remains than the preceding Esan samples. Seed densities are 85 times higher in the Esan samples than in the Kohoku samples. The Kohoku samples, in terms of plant taxa and quantities, are generally within the range of variation of the samples from K135-4. Acorn is somewhat more common at 5-Chome. As in the early Kohoku 4-Chome samples, the Esan samples contain no acorn. Chestnut is conspicuous in its absence from this site, considering its abundance at 4-Chome. One other characteristic makes the Esan samples at 5-Chome unusual compared to the other samples: the high concentrations of knotweed.

Poplar Namiki

Poplar Namiki is a Zoku Jomon cemetery on the Hokkaido University campus. Flotation samples were taken from grave pits, other pits, and areas

where carbonized remains were noted during the excavation. A variety of wild and domesticated plant seeds are present in the samples. So far identified are chenopod, knotweed, dock (sheep sorrel), Chinese lantern plant, bramble, elderberry, crowberry, *Aralia*, grape, dogwood, silvervine, legume, sumac, broomcorn millet, bread wheat, and flax. The 46 cultigen seeds are all from shallow pit-fill levels except for a single broomcorn millet grain from the deepest fill layer. The wheat is a large bread wheat, quite distinct from the small variety of bread wheat found at Sakushu-Kotoni River (Crawford and Yoshizaki 1987). The flax is unusual at this site as well; it has not been found in any prehistoric context in Hokkaido previously. The Poplar Namiki wheat from level III has been radiocarbon dated to 210±50 BP (TO 687). Walnut from deeper fill dates to 1920±50 BP. It would be prudent to assume that, except for the broomcorn millet, the cultigens (the large bread wheat and flax) from Poplar Namiki are recent.

Sakushu-Kotoni River

Sakushu-Kotoni River, the site which has been instrumental in our reassessment of 1st-millennium AD Hokkaido prehistory is a 9th-century AD Ezo–Haji hamlet on the campus of Hokkaido University (Yoshizaki 1986; Crawford & Yoshizaki 1987). This site has brought to light an extensive collection of archaeological plant remains, the majority of which are 11 types of cultigens (all but buckwheat, flax, maize and sorghum in TABLE 1). The total number of seeds identified from the site so far number about 200,000; cultigen seeds alone total 186,000. Nearly 93% of the cultigens are barley, bread wheat, broomcorn (common) millet, foxtail millet, indistinguishable wheat/barley, indistinguishable broomcorn/foxtail millet and hemp, with the remainder being adzuki/mung bean (<1%), melon (<1%), rice (<1%), beefsteak plant (<1%), and safflower (<1%). Whether the percentage composition of the cultigens is expressed in terms of weight or number gives a different view of their relative abundance. For that reason, we have illustrated the grain data in two ways in FIGURE 5. With a sample about 70% larger than we reported in 1987 (Crawford & Yoshizaki 1987), the only major change is that barley is more abundant relative to the other grains in our current analysis. Weedy annuals include chenopod, knotweed, dock, and two foxtail grasses. Fleshy fruits include silvervine, dogwood, crowberry, Amur corktree, Chinese lantern plant, bramble, elder, black nightshade, and grape. A few carbonized fragments of walnut shell, some sumac seeds, and bulbs of a wild onion also occur in the Sakushu-Kotoni River samples. Seed densities average about 800 per litre of soil. Most types of contexts have now been documented. One difficulty in developing a comparison of this site with other sites is that no other Ezo site in Hokkaido has the extensive middens and burned soil lenses that Sakushu-Kotoni River has. It will take some time to understand the full significance of the resulting data. Current research efforts are directed towards quantitative analysis with an empha-

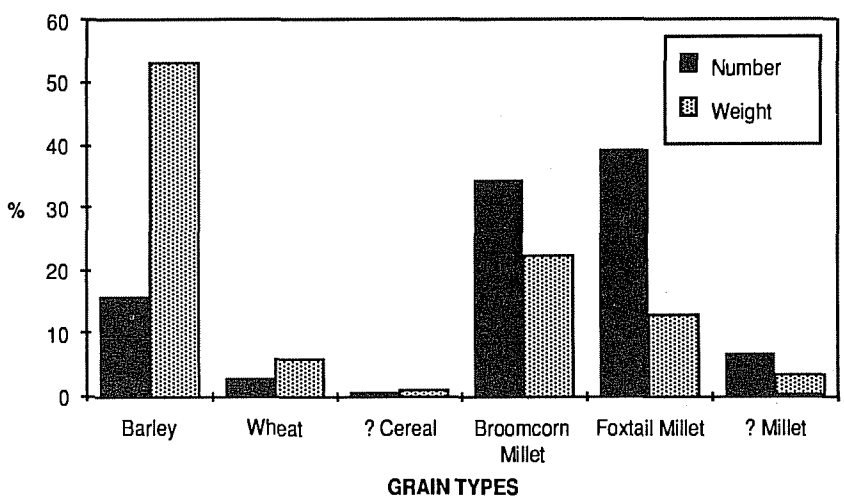

FIGURE 5. *Sakushu-Kotoni River grain type proportions as percentage of total number (186,000) and percentage of total weight of carbonized remains (339 g).*

sis on spatial analysis of the Sakushu-Kotoni River remains.

Some variation in plant remains suggesting crop processing has been found. Barley breadth distributions indicating sieving by-products can be recognized here. At least one sample, from Pit 4, has fewer than 100 barley grains and they all have widths less than 2.3 mm. The mean barley width at the site is 2.5 mm. Otherwise, the main distributional pattern is a contrast between house contexts and pit/midden samples. House samples are relatively clean while external house samples appear not to be primary contexts for plant remains but are secondary refuse deposits with remarkable similarities from sample to sample.

Kagawa 3-Sen and Kagawa 6 sites

Examination of a few flotation samples from two late Ezo sites in Tomamae near the Japan sea coast of Hokkaido have revealed the presence of four cultigens (Crawford 1986; Yoshizaki 1987). One flotation sample was collected from an L-shaped storage pit in House 5 at Kagawa 3-Sen. Most of the plant remains is wood charcoal (59.38 g), amounting to a density of 11.88 g/litre of soil. Carbonized seeds number 24, amounting to a density of 48 seeds/10 litres of soil. Nine of these specimens are unidentifiable. That is, they are too badly preserved to be identified. The remaining 15 seeds are all from cultigens: barley (3), broomcorn millet (5), foxtail millet (1) and 6 specimens of unidentifiable millet. One specimen appears to be a carbonized leek bulb.

Only one of the barley grains is preserved well enough to measure in three dimensions. It measures 5.1 (L) by 3.8(B) by 2.9 (T) mm. Two of the broomcorn millet measure 2.0 (L) by 1.7 (B) by 1.4 (T) mm and 1.6 (L) by 1.7 (B) by 1.4 (T) mm. The foxtail millet measures 1.3 (L) by 1.2 (B) by 0.9 (T) mm. All measurements fall within the size range of the respective grains from the Sakushu-Kotoni River site (Crawford 1986).

Sixty-eight litres of soil from Kagawa 6 produced 255 carbonized cultigen seeds. The samples are from ovens, hearths, burned soil lenses, house floors, and pits. The remains are mainly foxtail millet (75), broomcorn millet (89), unidentifiable millet (95), and one specimen each of barley and beefsteak plant. The foxtail millet averages 1.3 (L) by 1.2 (W) by 1.0 (T) mm. The broomcorn millet averages 1.9 (L) by 1.6 (W) by 1.3 (T) mm. The single barley measures 4.9 (L) by 3.1 (W) by 2.5 (T) mm. Weed seeds are few in number, represented by chenopod and knotweed only.

Botanical Gardens

In October of 1986, the salvage archaeology centre at Hokkaido University conducted an excavation of a house pit in the Botanical Gardens in Sapporo. The main purpose was to retrieve subsistence related data from an undisturbed context dating to the same period as Sakushu-Kotoni River. An iron shoe for a wooden hoe was recovered from the house floor and is the first well-documented find of its kind from a house in Hokkaido. Half the house was excavated and we managed to collect 44 (174 l) flotation samples. The samples are not particularly rich, averaging 6.5 seeds per 10 litres. Seven of the 113 seeds are cultigens: broomcorn and foxtail millet. Most of the remaining identified seeds are from weedy knotweeds and fleshy fruits.

K441

Situated in northern Sapporo, K441 is a 10th-century AD Ezo occupation (Sapporo-shi Kyoiku Iinkai 1989: 70). Twenty-three flotation samples from level VIb contain 668 carbonized cultigen seeds (Yoshizaki 1989). These are mainly foxtail (187) and broomcorn millet (366). The remaining seeds are beefsteak plant (9), probably wheat (2), and a single specimen of buckwheat. The only other archaeological buckwheat dating before AD 1000 in Hokkaido is from the Early Jomon Hamanasuno site (Crawford *et al.* 1978; Crawford 1983). One other potential cultigen from K441 is Chinese lantern plant (6 seeds). Herbaceous weeds are represented by barnyard grass (611), chenopod (55) and knotweed (31).

Satsumae

Satsumae is an Ezo site approximately contemporaneous with Sakushu-Kotoni River. Situated on the southern tip of the Oshima Peninsula, it is the southernmost site in Hokkaido so far sampled for flotation. Fourteen small samples were analyzed by Yano (1985) and 11 samples were analyzed by Yamada & Tsubakisaka (1989a). Yano reports an unspecified number of foxtail millet grains, three barley grains and 1 sorghum caryopsis from houses 6, 10, 11 and 14 (1985: 303–4). Yamada &

Tsubakisaka (1989a) report a total of 96 specimens from hearths, ovens and floors of houses 34 and 36 and from a burned soil lens (K-14). The seeds are identified as barley (42), rice (5), sorghum (1), and wheat (48). This is the only substantial sample of Ezo bread wheat besides that from Sakushu-Kotori River. The wheat is identical to the compact type of bread wheat from Sakushu-Kotoni River.

Idenshikougaku

An oblong structure (Feature 1) and pit (Feature 2) were excavated at Idenshikougaku on the Hokkaido University Campus. Artefacts are all Ezo-period (Hokkaido Daigaku Maizo Bunkazai Chosashitsu 1988). Flotation samples were taken from levels X_1 and X_2 of Feature 1. The shallower level X_1 contained 223 cultigen seeds. These are barley (37), wheat (204), broomcorn millet (1), possible beefsteak plant (1), unknown bean (2) and maize (1). Wild plant remains are silvervine, Amur cork tree, knotweed, elderberry and sumac. The maize is from an 8-row variety common in North America after AD 800. Its undoubted New World origin points to a relatively recent date for level X_1 or mixing of Ezo and recent soil in level X_1. All but 38 of the wheat grains are large bread wheat. There are only two reports of such wheat in an archaeological context in Hokkaido. The other is from Poplar Namiki on the Hokkaido University campus which has been radiocarbon dated to 210±50 BP.

Kashiwagigawa 11

Kashiwagigawa 11, excavated in 1989, is an Ezo-period site in Shimamatsu-cho, Eniwa city. The analysis is in progress samples from House 1 indicate that cultigen remains are present in high densities. House 1 was destroyed by a fire, so it was an excellent opportunity to examine the distribution of remains on or near the house floor. The floor was sampled in 50-cm squares and 90 of these samples have been examined to date. Cultigen seeds number 10,000 and are mainly foxtail (54%) and broomcorn millet (44%). The remainder are hemp, unidentified millet and one unidentified bean. A large number of weed seeds include chenopod, grasses, and knotweed.

Radiocarbon dates

Radiocarbon dates for the Hokkaido Zoku Jomon and Ezo periods are summarized in FIGURES 6 & 7 (see also Ishizuki 1986). Radiocarbon dates from individual sites and/or *keishiki* (pottery assemblages) are arranged together on the charts in order to indicate intra-site/*keishiki* variation of dates. In an attempt to examine the local chronology in greater detail, seeds from several flotation samples were submitted to the University of Toronto (ISOTRACE) accelerator dating facility. Results are summarized in TABLE 2 and are indicated in FIGURE 6 by solid ellipses. Seeds were chosen for dating when possible because of their short life span. The cellulose carbon component was extracted for dating. One sample from K135 did not have sufficient cellulose carbon for a radiocarbon date.

One date from level VIIc at K135 (TO-627) is in the early range for the Kohoku phase. The other date from level VIIC (TO-624) appears to be too young, indicating contamination of some sort. The level III date (TO-626) is about a century younger than the TO-627 date, confirming our suspicions that the deeply stratified K135 site represents a short time-span within the Zoku Jomon. Until we are able to secure many more dates from this site, the radiocarbon chronology remains rather uncertain. The Esan Shellmound date corresponds roughly with one date on Esan Shellmound material (N-3388) that falls within the 4th and 5th centuries BC. The single 9th-century BC date (N-3786) for Esan is unacceptably old. One date from Poplar Namiki (TO-630) from deep pit fill falls within the Zoku Jomon range but the wheat from a shallower level (III) at the same site is historic (TO-687). This was expected because the wheat is non-compact bread wheat that is not found in definite Ezo-period contexts. Flax was found in similar deposits at Poplar Namiki. Similar deposits at Idenshikougaku on the Hokkaido University campus produced 8-row maize, a new-world crop that was introduced to Japan sometime after the 16th century AD. The Okhotsk sample (TO-628), from a burial, is within its expected time frame.

The chronological details of the Zoku Jomon and Ezo-periods in Hokkaido are still being worked out but it is becoming clear that we are not dealing with a simple linear periodization. Esan has some overlap with Kohoku indicating that at least two populations are responsible for these pottery assemblages. Furthermore, the

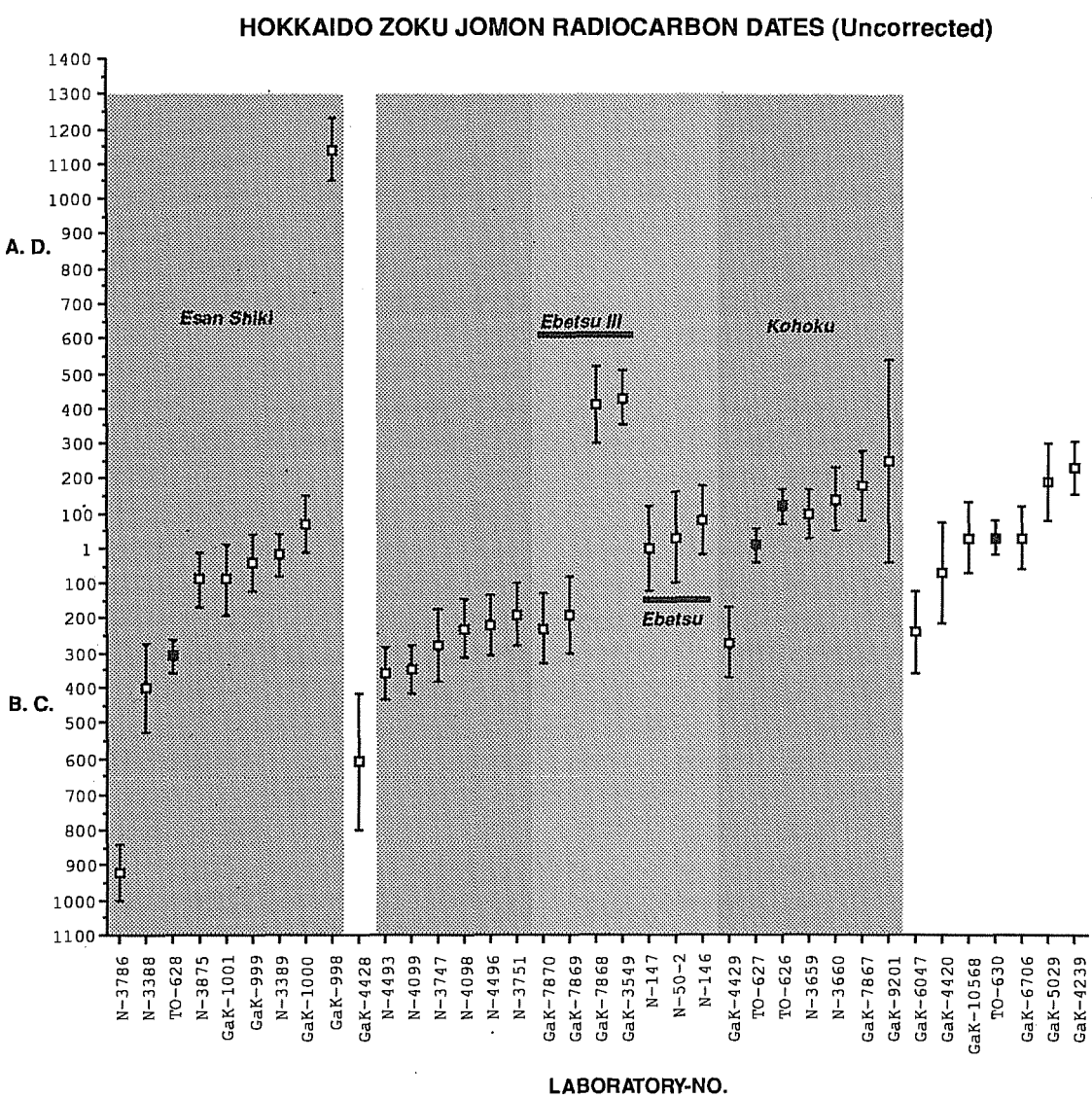

FIGURE 6. *Hokkaido Zoku Jomon radiocarbon dates (uncorrected). Dates within the same shade of grey are from the same site; unshaded dates represent sites with single dates. White squares and bars indicate the mean and standard deviation for each radiocarbon date; black squares are University of Toronto dates.*

earliest Ezo dates range from AD 200 to 400 and the latest Zoku Jomon dates cluster around AD 200 to 300, assuming that the two late Ebetsu III dates and the GaK-9201 date with a wide error margin are incorrect (FIGURES 6 & 7). There appears to be some temporal overlap of no more than a century at the end of the Zoku Jomon and beginning of the Ezo period. This would not be out of line with a model postulating Ezo origins in Tohoku followed by a subsequent northward expansion into a Hokkaido occupied by Zoku Jomon populations.

Discussion

The data from the many intensively researched late prehistoric sites excavated in the last few years in Hokkaido are providing a new perspective on the Japanese northern frontier in the 1st

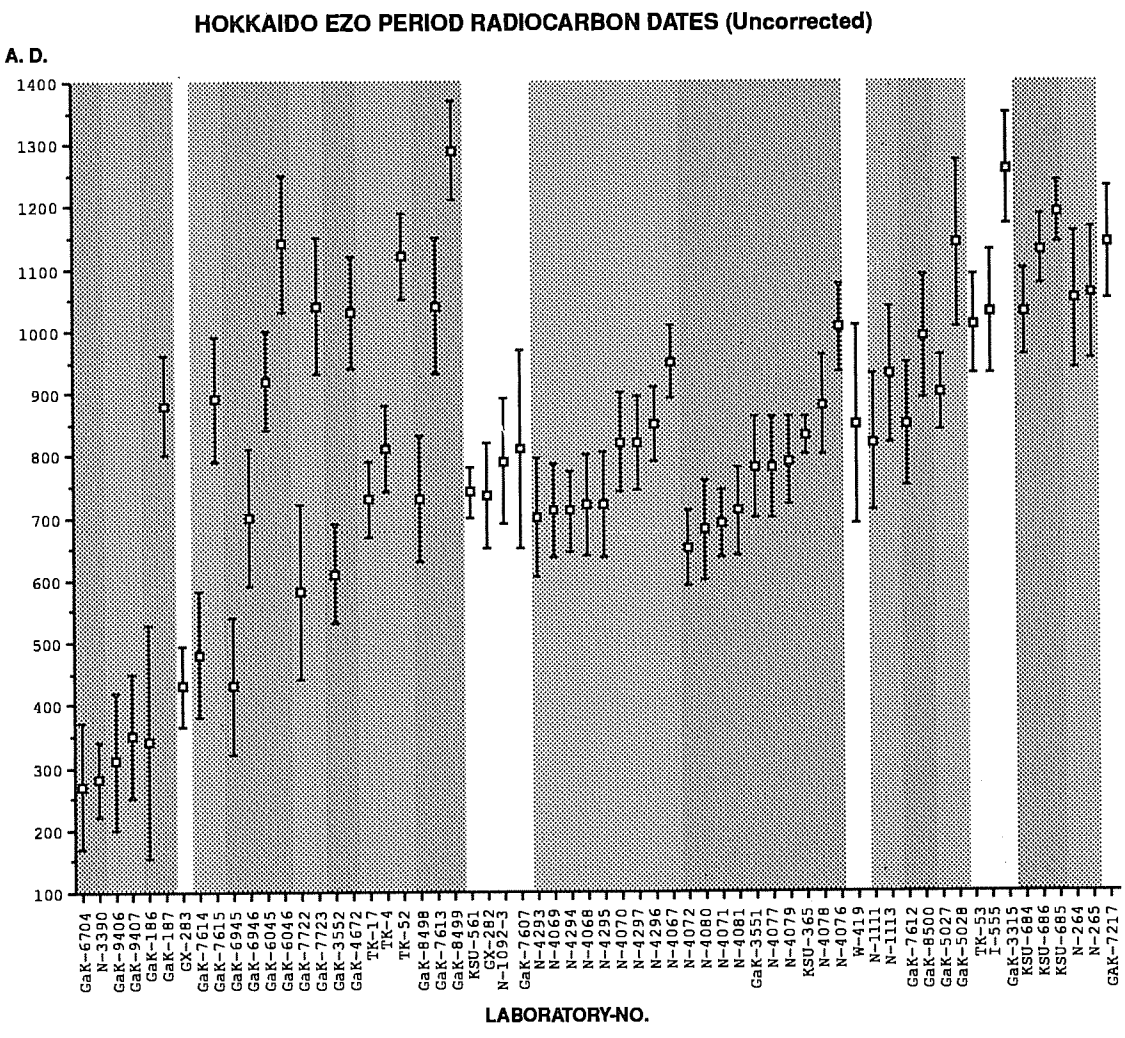

FIGURE 7. *Ezo-period radiocarbon dates (uncorrected). Dates within the same shade of grey are from the same site; unshaded dates represent sites with single dates. White squares and bars indicate the mean and standard deviation for each radiocarbon date.*

millennium AD. Detailed subsistence and other archaeological data reported here represent collections from the beginning of the Zoku Jomon through the two phases of the Ezo period. Zoku Jomon subsistence clearly contrasts with that of the Ezo–Haji which immediately succeeds it in central and southern Hokkaido. In many ways, including the degree of sedentism, ceremonialism, subsistence, and technology, the Hokkaido Zoku Jomon differs from the preceding Final Jomon as well.

The Zoku Jomon is a local Hokkaido population who had some interaction with the agricultural Tohoku Yayoi and later Kofun-period Japanese but plant husbandry seems to have been peripheral to their way of life. From the limited living-site evidence available, particularly that from K135, greater seasonal mobility than in the preceding Final Jomon is apparent. K135 evidence indicates repeated use and abandonment of the site. Nut, small grain and berry harvesting, in addition to salmon-fishing and deer-hunting were common pursuits. Further data are required in order to assess whether short encampments such as the ones at K135 were linked to long-term villages

	sample	laboratory number	b.p. (uncalibrated)	calibrated
K135				
C-5 Level III	acorn	TO-626	1830±50	AD 127–260
D-5 Level VIIc	grape seed	TO-624	1240±50	AD 759–781
C-4 Level VIIc	grape seed	TO-627	1940±50	AD 17–81
Esan Shell Mound				
	Amur cork tree seed	TO-628	2260±50	395 BC–353 BC 294 BC–232 BC
Poplar Namiki				
01-04(31)	walnut	TO-630	1920±50	AD 48–129
Level 3	wheat (large)	TO-687	210±50	AD 1603–1706
Oumugawajiri (Okhotsk)				
	corydalis tuber	TO-688	1620±50	AD 386–434

These results are the average of two machine-ready targets measured on different occasions. They have been corrected for natural, preparation, and spluttering fractionation to be a base of $\delta^{13} = -25$ 0/00. The uncalibrated ages are quoted in radiocarbon years using the Libby ^{14}C meanlife of 8033 years. The errors represent 68.3% confidence limits. The calibrations are courtesy of R. Beukens, ISOTRACE laboratory, University of Toronto.

TABLE 2. *Accelerator radiocarbon dates from Hokkaido.*

that may have had some plant husbandry. The presence of a few cultigen seeds is not adequate evidence to allow us to conclude that the Zoku Jomon people were growing the crops. They could have been imported. Nevertheless, Zoku Jomon peoples were aware of cultigens. Besides the barley from K135, only one other Zoku Jomon site has produced cultigen remains – hemp and great burdock from Ebetsu Buto (Yamada 1986). Cultigens from Poplar Namiki appear all to be recent. This phase of availability, however, did not lead progressively to acceptance and consolidation of agriculture on Hokkaido.

The succeeding Ezo–Haji phase brings to Hokkaido an entirely new technology and subsistence system. The change appears to be sudden and represents a substitution phase of agricultural origins in Hokkaido. Sakushu-Kotoni River is our best example of an agriculturally-oriented community in Hokkaido at this time. The agriculture is based on a variety of crops. Rice, although present, seems to have been of lesser importance than barley, wheat, millet, beans and other crops. To what degree agriculture became consolidated in Hokkaido is difficult to assess. Later Satsumon sites have evidence of cultigens but not in the large quantities found at Sakushu-Kotoni River. A consolidation phase, when agricultural peoples occupied all arable land in southern Hokkaido, may never have happened in proto-historic times. It is possible that there were varying degrees of dependence on food production from northern Hokkaido, where there was none at all (Omusaro-C produced no cultigen remains) to the Ishikari Plain, where plant-husbandry was better established. Pottery manufacture eventually declined, not as a devolution of local technology, but because Japanese ceramic and metal technology provided replacements for vessels and tools in much the same way as in the New World after European contact.

Ethnographers generally assume that Ainu plant-husbandry is a recent introduction to Hokkaido, perhaps not being established until the 19th century (e.g. Watanabe 1972). This is clearly an oversimplification. Hayashi (1969), without the benefit of archaeological data, suggests that there is reason to believe that Ainu food production is, in fact, Yayoi-like in many ways, and therefore has a relatively long history. Based on linguistic, ethnographic (folklore), and ethnohistoric data, Hayashi concludes that here is little doubt that Ainu

agriculture was derived from a Japanese agriculture system (1969: 191). The Ainu use of shell-sickles for harvesting and storage houses with raised floors, for example, are 'characteristics of the Yayoi agriculture system' (Hayashi 1969: 187). In addition, he sees morphological similarities between the mortar and pestle of the Yayoi and Ainu (1969: 187 & 215). He suggests that, while the Yayoi agriculture system evolved through time in western Japan, the Ainu agriculture system remained 'primitive' in Hokkaido until recently (1969: 187).

The complexities of southwestern Hokkaido prehistory indicate that it is an oversimplification to assume that the Ainu are a remnant Jomon population who continued hunting and gathering practices until recently. Biologically, there is continuity from the Jomon to the Ainu (Brace *et al.* 1989), but culturally, the Ainu are not the product of a linear descent from the Jomon of northeastern Japan. The Final Jomon began to feel the effects of contact with Yayoi peoples, a contact first evidenced with the appearance in Aomori of Ongagawa pottery, Yayoi beads, and rice as early as the Obara A phase. Subsequently, the establishment of rice paddies by the first century AD in Aomori signalled the end of the Final Jomon in Tohoku and Hokkaido. With the collapse of the Final Jomon came the appearance of local groups whose pottery bears varying degrees of resemblance to Jomon and Yayoi pottery and who are now usually referred to as Tohoku Yayoi. Assimilation and acculturation likely took place, and the Yayoi's local quality, particularly in northern Tohoku, seems to result from the development of local, independent chiefdoms from a substantial Jomon base.

The contemporaries of the Tohoku Yayoi on Hokkaido were the Zoku Jomon whose pottery in southern Hokkaido is Yayoi-like (Esan). In central Hokkaido Kohoku pottery bears little resemblance to Yayoi pottery. At this time, an intensive dry plant-husbandry system may well have been beginning to evolve in northern Tohoku. A new phase of change came about when the Yamato State extended its influence into parts of Tohoku. This period is the least known in the archaeology of northeastern Japan. Shortly thereafter, written documents refer to the natives of the region as distinct from early Japanese. The natives are the Ezo-period occupants who soon spread to Hokkaido, bringing about the termination of the Zoku Jomon there.

The emergence of the Ainu is therefore a set of processes involving the Jomon, the Yayoi, and the Yamato state – processes not clearly understood at the moment. Until the confirmation of food production as a significant aspect of Ezo culture, the Ezo and their Ainu descendants were easy to set apart from the Japanese. The cultural system – including agriculture – that emerged by the 8th century AD in Tohoku and Hokkaido, because of its close historical relationship to the Yayoi chiefdoms and Yamato state, was quite similar to that of the 8th-century Japanese. Archaeological research on late prehistoric and proto-historic period in Hokkaido is still young, so we expect to demonstrate many new aspects of culture change in general and agricultural history specifically as research continues.

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