

THE TRANSITION FROM FORAGERS TO FARMERS ON THE ISLAND OF OKINAWA

Hiroto Takamiya

Sapporo University, 3-7 Nishioka, Toyohira-Ku, Sapporo, Japan 062-8520

ABSTRACT

The islands of Okinawa were successfully colonized by a human population probably during the period spanning the later part of the Middle to the Late Jomon. By the Gusuku period, around the 12th century AD, complex societies with subsistence based on agriculture had emerged. When did food production begin in the islands? This paper first reviews existing hypotheses on the beginning of agriculture in Okinawa. Then these hypotheses are examined against archaeobotanical data obtained from this region since 1992. The results of the analyses of macrobotanical remains negate all previously proposed hypotheses and narrow down the timing of the subsistence change. The transition from foraging to farming in Okinawa seems to have taken place abruptly.

Who were the foragers and who were the farmers in Japanese prehistory? Many textbooks state that the Jomon people were foragers and the Yayoi people farmers, and that the transition from foraging to farming took place between these two periods (e.g., Aikens and Higuchi 1982). Recent studies suggest that the prehistory of the Japanese archipelago is much more complicated than this stereotypic view generally known outside Japan. For example, some see the Jomon population as complex hunter-gatherers (Cohen 1985; Hayden 1990, 1998), while several Jomon sites have yielded cultigens such as barnyard millet and rice, implying that the Jomon people knew and cultivated crops (D'Andrea 1995; D'Andrea *et al.* 1995; Yoshizaki 1997). In Hokkaido, where the most intensive paleoethnobotanical research has been conducted in Japan, another picture has emerged. To many anthropologists, this island is probably best known as the homeland of the Ainu and for this reason many seem to believe that the island was occupied by foragers until about

one hundred years ago. However, paleoethnobotanical research has revealed that prehistoric human-plant relationships in this region were much more dynamic than previously thought. For example, Crawford (1983) has demonstrated that the Jomon people in Hokkaido not only shifted their plant food diet from one mainly consisting of nuts to one based on grass seeds, but also that this transition may exemplify the local acquisition of plant husbandry. Moreover, it has been shown that by the Satsumon period (c. 8th-12th centuries AD), food production, based mainly on millets, barley and wheat, was being practiced (Crawford and Takamiya 1990; Crawford and Yoshizaki 1987). This agricultural system seems to have disappeared in the following Ainu period (c. 12th-19th centuries AD).

When the prehistory of Japan is extended to the Ryukyu Islands, the southernmost region of the archipelago (Figure 1), another story can be told about the beginning of food production. It is probably safe to state that even less is known outside Japan about the foragers and farmers of the Ryukyu archipelago compared to the rest of Japan. The traditional and generally believed view is that food production was introduced into this region for the first time at the beginning of the Gusuku period (12th century AD) and that hunting and gathering was the subsistence strategy prior to this period. This view has been challenged by several scholars who have proposed different hypotheses. While these hypotheses, including the traditional one, attempt to explain the available archaeological data "logically", they have not been tested against the hard direct data, namely, actual plant remains (*cf.* Ford 1979). I have been conducting flotation on the mainland of Okinawa since 1992 in order to elucidate plant use in the past and the timing of the transition from foragers to farmers on the island. The results obtained to date have narrowed down the timing of the transition and revealed that the shift from hunting and gathering to a farming economy was much more complicated than many

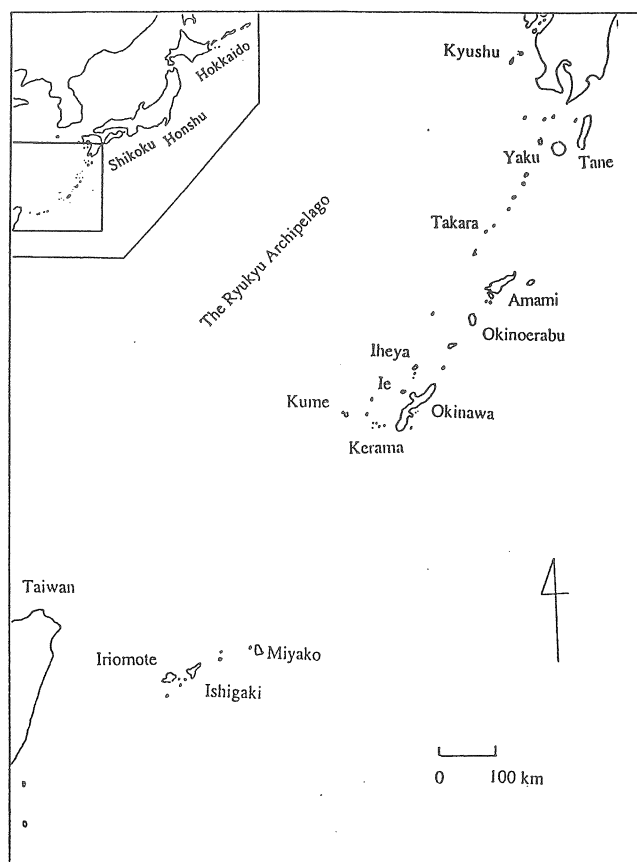


Figure 1: The Ryukyu Archipelago.

have suggested. This paper will first briefly introduce the chronology of the Central Ryukyu region and hypotheses on the timing of transitions from foragers to farmers. Secondly, I will provide archaeobotanical data from the Takachikuchibaru shellmidden (early Yayoi-Heian period) and the Nazakibaru site (late Yayoi-Heian period) in order to demonstrate the transition from a foraging to a farming economy in the Central Ryukyus.¹ Thirdly and finally, a brief comparison will be made between Zvelebil's model (1986, 1996) and the data from this research.

BACKGROUND

Chronology

At least two chronological schemes have been used by archaeologists for the Holocene in Okinawa (Table 1). The main difference between these two schemes is that Scheme 2 attempts to consider the prehistory of this region in the larger context of Japanese history while Scheme 1 emphasizes the uniqueness of the Okinawan sequence. While most Okinawan archaeologists tend to use Scheme 1, I will use Scheme 2 here since this is probably the one familiar to most readers. It should be noted that the terminology

used in this paper differs from that employed by Hudson and Takamiya (this volume).

Hypotheses on the beginning of food production in Okinawa

1. The Gusuku agriculture hypothesis

Most archaeologists support the view that agriculture began at the beginning of the Gusuku period. The Gusuku period is characterized by the emergence of stratified societies, long distance exchange, the use of iron, and other elements which are features of complex societies (*cf.* Earle 1991). Archaeobotanical data demonstrate that Gusuku subsistence was based on agriculture (Asato 1985; Yomitan Board of Education 1985; personal observation at several museums). At the same time, as discussed below, no cultigen remains were associated with pre-Gusuku sites until recently. Thus, it is generally assumed that foragers occupied the area before the Gusuku period and farmers lived here for the first time during this period. Despite this, there is some support for the idea that agriculture would have not begun suddenly at the beginning of this period. Accordingly, several pre-Gusuku agriculture hypotheses have been proposed.

2. The Yayoi agriculture hypothesis

This hypothesis argues that agriculture was first introduced during the Yayoi period. In many regions of Japan, whenever wet rice agriculturists made contact with local foragers, it has been suggested that the latter accepted the new subsistence economy without hesitation. Recent studies from Okinawa have revealed that the early Yayoi-Heian

Table 1. Chronology of Prehistoric Okinawa (the Central Ryukyus). Radiocarbon dates from Hiroe Takamiya (1994)

Scheme 1	Scheme 2	C14 dating bp	Mainland Japan
Shellmidden	Jomon		Jomon
			Incipient
Initial	Initial	6670±140	Initial
		6450±140	
	Early	4880±130	Early
	Middle		Middle
Early	Late	3600±80	Late
		3370±80	
Middle	Final		Final
Late	Yayoi-Heian		Yayoi-Historic
Gusuku	Gusuku		Historic

populations of Okinawa were heavily involved in exchange with the mainland Yayoi. The mainland Yayoi people wanted shell ornaments as status symbols (Kinoshita 1997). The raw materials of these shell ornaments were obtainable only from the Central Ryukyus and regions further south. Several sites in the Central Ryukyus have yielded shell caches in which shells were "stored" for future exchange with the mainland Yayoi (Takemoto and Asato 1993). It is not clearly understood yet what items were brought back to Okinawa in return for these shells. However, more than thirty sites in the Central Ryukyus have yielded mainland Yayoi pottery sherds. This has implied to some that the exchange item was rice, although actual rice grains have not been recovered yet. Furthermore, several sites have yielded mainland Yayoi items such as bronze mirror fragments (Takemoto and Asato 1993). The Maezato shellmidden has yielded Kyushu Yayoi pottery and stone axes. Oda (1984), having examined these artefacts, has suggested that wet rice agriculture may have been practiced at the site. Based on these pieces of evidence, and on the fact that the mainland Yayoi had diffused to the Amami Islands, Hiroe Takamiya (e.g., 1985) expects that evidence of wet rice agriculture would be found on Okinawa Island in the future.

3. The Final Jomon agriculture hypothesis

This hypothesis was first proposed to explain the settlement change from the Late to the Final Jomon. During the Late Jomon, many sites are found at the bottom of cliffs. In the following Final Jomon, people tended to select hilltops or plains for site locations. These settlement locations have suggested to some that Ryukyu was an ideal area to conduct agriculture. In addition to the settlement locations, the paucity of faunal remains and the abundance of grinding slabs have suggested the importance of plant food, possibly cultigens (e.g., Nitta 1969, 1982; Tawada 1956). Furthermore, it is now known that the Final Jomon population of the island began a sedentary way of life. For example, Miyagi Island was "intensively" occupied by sedentary populations (Okinawa Prefecture Board of Education 1985, 1989; Takemoto and Asato 1993). This evidence makes some archaeologists wonder if it would have been possible to live on such a small island (5.57 km²) without agriculture.

4. The Late Jomon agriculture hypothesis

This hypothesis has been proposed based on archaeological data (Ito 1993) and biogeographical theory (Takamiya 1993, 1997a). In one variant based on archaeological data, Ito (1993), having compared the elevation of sites between Okinawa and mainland Japan, noted that the elevation of many mainland Jomon sites is less than 30 m while most sites in Okinawa are located above 30 m. He then examined

the artefact assemblages and felt that there are fewer fishing-related artefacts than plant processing artefacts such as grinding slabs. This suggested to him that plant foods were more important than marine resources. In addition to the site elevation and artefact assemblages, numerous land snails recovered from Late Jomon sites have been interpreted as evidence for site disturbance (Kurozumi 1988). These data have suggested to Ito (1993) that the main plant food must have been crops cultivated on the high elevations using slash and burn techniques.

Another variant of this hypothesis is the biogeographical approach to Late Jomon agriculture, which considers the fact that Okinawa is an island (Takamiya 1993). Islands have lower carrying capacities than continents. Therefore, in many cases it is difficult for hunter-gatherers to colonize island environments. Indeed, many islands were first successfully colonized by human populations who possessed farming (Cherry 1981; Kirch 1984). In some cases, however, hunter-gatherers were able to colonize island environments. This is because the islands concerned are (1) large; (2) provide an abundant or constant supply of large sea mammals; (3) are located close to the mainland; or (4) a combination of (1) to (3). Okinawa is not large, does not provide a constant supply of large sea mammals, and is not close to the nearby continents, although the islands display a stepping stone configuration (Figure 1). Based on these considerations, I have proposed that the initial successful colonizers of the Central Ryukyu region may have been farmers (Takamiya 1993). I believe that the first successful colonization of this region took place during the late Middle to Late Jomon (Takamiya 1993, 1996a, 1996b, 1997a, 1997b, 1998a).

5. The Ocean Road hypothesis

Botanists and ethnographers suggest that the Ryukyu archipelago was one of the routes through which rice was introduced into Japan from Taiwan or southeastern China (Sato 1992, 1998; Takaya 1984; Watabe 1993; Yanagita 1993 [1952]). Kunio Yanagita first proposed this hypothesis in 1952, stating that rice farmers from southeastern China brought rice (*Oryza sativa japonica*) at the beginning of the Yayoi period into Japan through the Ryukyu archipelago. This route was called the "Ocean Road" by Yanagita (1993 [1952]). Since 1952, many scholars have examined Yanagita's hypothesis, and one extension of his proposal is that *Oryza sativa javanica* may have been introduced into mainland Japan along the Ocean Road prior to the Yayoi (Sato 1992, 1998; Watabe 1993). While this hypothesis can support either the Yayoi or the Jomon agriculture hypothesis, I deal with it separately here because this hypothesis focuses strictly upon the introduction of rice farming rather than agriculture in general.

ARCHAEOBOTANICAL DATA

Archaeobotanical data obtained from two sites, the Takachikuchibaru shellmidden and the Nazakibaru site (Figure 2), contribute to an evaluation of the hypotheses discussed above.

The Nazakibaru site

The Nazakibaru site is dated to the late Yayoi-Heian period, about the 8th - 10th centuries AD. It is situated in Naha city, the capital city of Okinawa. The site is located approximately 500 m from the coast and on a hilltop, the elevation of which is approximately 20 m above sea level. This is a typical late Yayoi-Heian site location. Nazakibaru has yielded approximately 2200 potsherds and nine lithic artefacts. While these lithics do not provide chronological information, most sherds exhibit characteristics of late Yayoi-Heian pottery. In terms of the beginning of food production, the most important findings at the site are two lines of ditches and more than 250 hoe marks (Shima 1996). These features are the earliest evidence potentially associated with food production on the island and Shima (1996), who directed the excavation, concludes that dry field agriculture was practiced here.

These two features are only circumstantial evidence for food production at Nazakibaru. What is needed in order to support Shima's conclusion is plant remains which demonstrate that food production was indeed carried out at the site. Approximately 1600 litres of soil were processed by flotation. While the amount of light fraction obtained from the soil samples was extremely small (about 0.07 g/l of soil), the results were astonishing (Takamiya 1996a, 1996c, 1997a). In addition to food production related features, the site has yielded the earliest evidence of actual cultigens: rice (2 grains), wheat (2 fragments), barley (3 fragments) and foxtail millet (2 fragments). Furthermore, while it is difficult to determine whether they are wild or domesticated, 20 legume fragments have been identified. If these plant species were the only plant remains recovered from the Nazakibaru site, two interpretations would be plausible: they were actually cultivated at the site or introduced to the site as a result of exchange. However, the other plant remains recovered from the site support the former interpretation.

Many remains of wild plants have been identified at Nazakibaru. While it is difficult to identify most of them to the species level, many taxa seem to be light-loving plants whose habitat is in disturbed areas. These plants are members of the *Cyperaceae*, *Polygonaceae*, *Solanaceae* and *Asteraceae* families. Possible *Oxalis corniculata* and *Scirpus juncoides* have been identified. According to Kasahara (1979), the former and *Phyllanthus urinaria*, which has been also recovered, are weeds of dry fields. Kasahara

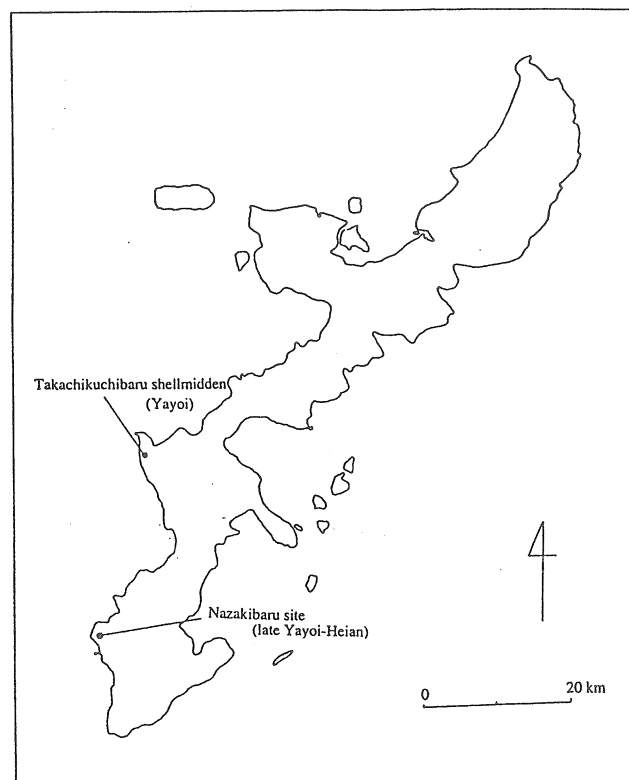


Figure 2: Location of Takachikuchibaru shellmidden and Nazakibaru site.

(1979) and Yoshizaki (1992) mention that *Scirpus juncoides* is a weed of wet rice fields. Shima (pers. comm. 1992) has noted that the eastern side of the Nazakibaru site is a marsh and that the area was used for wet rice fields before World War II. Thus, supported by the recovery of agriculture-related features, it seems likely that the cultigens identified from the Nazakibaru site were grown at the site and not obtained through exchange.

Lastly, it is important to mention that, although more than 1600 litres of soil were processed by flotation, no remains of nuts, not even one fragment, have been identified. Nuts have been considered by many as the most important wild plant food in this region. This strongly suggests that agriculture was conducted at the site, and that people at the Nazakibaru site relied on domesticated rather than wild plants for their subsistence. Furthermore, since the Nazakibaru site is a typical late Yayoi-Heian site in terms of settlement location and pottery, I suggest that agriculture was known in the Central Ryukyus by the 8th-10th centuries AD (Takamiya 1996c).

The archaeobotanical data from the Nazakibaru site do not support the Gusuku agriculture hypothesis since the site dates two to four centuries earlier than the beginning of the Gusuku period. When did the change from foraging to

farming take place? The archaeobotanical data obtained from the early Yayoi-Heian period Takachikuchibaru shellmidden shed light on this important question.

The Takachikuchibaru Shellmidden

The Takachikuchibaru shellmidden is an early Yayoi-Heian period site located in Yomitan, approximately 30 km north of Naha. It is situated about 10-15 m from the coastline on a sand dune, the elevation of which is about 5-10 m. This is a typical early Yayoi-Heian site location in Okinawa. Furthermore, recovered artefacts and ecofacts, such as pottery, lithics and faunal remains, are almost identical to those recovered from other early Yayoi-Heian sites in Okinawa (Nakasone pers. comm. 1996). The site location, artefacts and faunal remains all indicate that the Takachikuchibaru shellmidden is a typical early Yayoi-Heian site in Okinawa. It should be mentioned that while no mainland Yayoi pottery was recovered from the site, the site has yielded modified *Tricornis latissimus* shells (Nakasone 1995). This shellfish species was considered one of the most valuable items by chiefs in mainland Japan. Thus, in terms of exchange network systems, the Takachikuchibaru people seem to have been involved in exchange with the mainland Japanese. This is another typical early Yayoi-Heian period phenomenon in Okinawa.

A total of 2462.5 litres of soil were collected from the Takachikuchibaru shellmidden for flotation. The collected and identified plant species are completely different from those at the Nazakibaru site (Takamiya 1997a). No cultigens have been identified among the remains. Instead, the plant remains from Takachikuchibaru consist of wild species. Among them, nutmeat and shell dominate the assemblage. Thus, nuts were likely an important source of carbohydrate for the Takachikuchibaru people. In addition to nutmeats and shells, *Percea thumbergii*, *Acitnidia rufa*, and *Vitaceae* have been identified. Since the site is a typical early Yayoi-Heian period site on the island, this period in Okinawa appears not to be characterized by wet rice agriculture but by the gathering of wild plants, especially nuts, for food.

DISCUSSION AND CONCLUSIONS

While the beginning of food production in Japan is frequently discussed in the context of the transition from Jomon to Yayoi, this explanation is too simplistic and is certainly not applicable to the Ryukyu Islands. Five hypotheses have been proposed to account for the beginning of food production in Okinawa. These hypotheses have been examined against plant remains recovered from two sites. Archaeobotanical data from the Nazakibaru site and Takachikuchibaru shellmidden do not support the Gusuku agriculture or the Yayoi agriculture hypotheses. The arch-

aeobotanical data also contradict a portion of the Ocean Road hypothesis which has wet rice agriculture being introduced into Japan at the beginning of the Yayoi period through the Ryukyu archipelago. Furthermore, there appears to have been a much narrower time period for the introduction of agriculture to this region. That is, the transition from foraging to farming took place between the early Yayoi-Heian period and the 8-10th centuries AD. I suggest that the transition occurred about the 6th century AD based on the fact that settlement patterns shifted from sand dunes to inland hilltops at about this time (Takamiya 1997a).

However, in 1997 I had an opportunity to collect soil samples from the 6-8th century Yomisaki site on Amami Island. The samples were collected from a 15 cm x 15 cm x 1.5 m column and the total amount of soil collected was only about 30 litres. Because the total amount of soil was very small and was collected from an area which had nothing to do with food preparation or consumption, only four plant remains were obtained from the flotation samples. They were two nutmeat fragments, one *Percea* fragment, and one unknown seed fragment (Takamiya 1998b). This plant assemblage resembles that of the Takachikuchibaru shellmidden rather than that of the Nazakibaru site. If the Yomisaki archaeobotanical sample represents plant use in the 6-8th centuries AD in the central Ryukyus, it can be hypothesized that the region was occupied by hunter-gatherers from the Yayoi period until that time, and that food production was introduced in about the 8-10th centuries AD. This implies that agriculture began suddenly in this region.

The next question is whether or not the pre-Yayoi people were foragers or farmers. If any of the pre-Yayoi hypotheses explains the subsistence economy of the periods concerned, it means that the island shifted from farming in the pre-Yayoi period back to foraging in the early Yayoi-Heian, and to farming again in the late Yayoi-Heian period. This transition seems unlikely. I have demonstrated that population increased rapidly in the "Late" Jomon period (Takamiya 1996b, 1997a,b) and, based on comparative data mainly from Polynesia (cf. Kirch 1984, 1994), have suggested that environmental disturbance may have occurred once the islands were successfully colonized (Takamiya 1993, 1997a). This would have created a population-resource imbalance in the late Late Jomon or Final Jomon periods. If this was the case, intensification of the subsistence economy is expected. Thus, if the pre-Yayoi population was composed of farmers, this farming system should have been further intensified rather than replaced by a foraging economy. An explanation for a shift from farming to foraging followed by no further intensification of farming in this context of population-resource imbalance would be most challenging

but extremely interesting, if indeed such a shift took place in Okinawa. The pre-Yayoi hypotheses should be examined with archaeobotanical data in the near future.

The transition from foraging to farming in Okinawa involved the introduction of farming much as in northern Japan (Crawford and Takamiya 1990) and in northern Europe. In the latter context, Zvelebil (1986, 1996) considers three phases for the transition from foraging to farming. The first phase is what he calls an "availability phase", during which farming is known to the foraging groups and there is an exchange of materials and information between foragers and farmers, but without the adoption of farming. Farmers and foragers develop contacts, but the two societies operate as culturally and economically independent units (Zvelebil 1996:324; also 1986:12).

Zvelebil (1986, 1996) presents two additional stages for the transition from foraging to farming: "substitution" and "consolidation". The substitution stage sees the migration of farmers to the foragers' territory and the acceptance of some farming elements by the foragers. Through competition between the two, the consolidation phase sees the establishment of a farming economy in the territory once occupied by hunter-gatherers. In terms of Zvelebil's (1986, 1996) transitional phases from foraging to farming, the early Yayoi-Heian period in Okinawa is the availability phase. Because they were heavily involved with the mainland Yayoi in an exchange system, the people living in Okinawa at that time must have known that wet rice agriculture was practiced in mainland Japan. On the other hand, the late Yayoi-Heian may be the consolidation phase since no evidence of gathering is apparent in the archaeobotanical data. Is it then possible to state simply that the period from the Takachikuchibaru shellmidden to the Nazakibaru site or from the Yomisaki to the Nazakibaru sites was the substitution phase?

Zvelebil's model "does not attempt to find an underlying cause for the transition to farming. Rather, it provides a descriptive framework for the process" (Zvelebil 1986:13). Indeed, this model provides a framework in which the transition phases in the prehistory of Okinawa may fit superficially. However, the process of the transition in Okinawa may not be a simple unilinear process, and the phase between the availability and consolidation phases cannot be easily recognised as a "substitution" phase.

The Central Ryukyu region will provide an excellent case to test Zvelebil's model and an excellent opportunity to examine causes for the transition from foraging to farming (see e.g., Takamiya 1997a; 1998a). As is well known, in most regions of Japan wet rice agriculture was adopted quickly. The archaeobotanical data suggest that the early Yayoi-Heian period Okinawans did not follow the same pattern. It took several centuries until the island finally witnessed the

beginning of food production. This evidence further indicates that mere contact between foragers and farmers does not provide an adequate explanation for the beginning of food production. It is especially interesting to understand the mechanism for the transition from foraging to farming on the island of Okinawa, a knowledge of which will contribute greatly to our understanding of the origins and spread of food production.

NOTE

¹In this paper long vowels are not shown for Japanese and Okinawan names.

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