CHAPTER 22

POST-PLEISTOCENE
TRANSFORMATIONS OF
HUNTER-GATHERERS IN EAST ASIA

The Jomon and Chulmun

JUNKO HABU

East Asia is an exciting area for the study of post-Pleistocene cultural transformation. Prehistoric hunter-gatherer cultures in East Asia, namely the Jomon culture of the Japanese archipelago (hereafter Japan) and the Chulmun culture of the Korean Peninsula (hereafter Korea) are known for their artistic pottery and other elaborate artefacts, the production and use of which were closely intertwined with changes in Jomon and Chulmun societies (e.g. Cho and Ko 2009; Kaner 2009). Furthermore, Jomon and Chulmun data allow us to test conflicting theories about the mechanisms of long-term culture change. Topics to be examined include the impact of the global and local climate change vs. human activities, domestication vs. environmental management, specialized vs. broad-spectrum economies, sedentism vs. mobility, egalitarianism vs. social stratification, and continuity vs. discontinuity to the following agricultural phase. Finally, but not least importantly, bioarchaeological data from these regions help us to understand not only the population history of these regions but also changes in health conditions and lifeways of these people (e.g. Fujita et al. 2007; Fukase and Suwa 2008; Kimura 2006; Suzuki 1998; Temple 2007; 2008).

Overviews of the Jomon and Chulmun cultures are available in such references as Habu (2004; in press), Underhill and Habu (2006), Imamura (1996), Kobayashi (2004), Norton (2007), and Nelson (1993). Rather than repeat the contents of these publications, this chapter concentrates on issues that are key to understanding the importance of East Asian data in world hunter-gatherer archaeology and anthropology. Emphases are on the issues that are relevant to recent discussions in the field of historical ecology (Balée 2006; Thompson and Waggoner 2013). These issues include long-term sustainability, collapses and subsequent recoveries of human socio-economic systems, human impacts on the biosphere, and the examination of the processes operating among temporal scales of varying duration.
CHRONOLOGY

Before moving on to the key issues listed above, a brief overview of the chronological framework will be useful. As discussed elsewhere (Habu 2004; 2008), temporal and regional variability within the Jomon and Chulmun cultures is extremely large. The only common cultural element for the entire span of these periods is the presence of pottery. Thus, it is more appropriate to think about Jomon cultures and Chulmun cultures rather than about the Jomon culture and the Chulmun culture. Both the Jomon and Chulmun periods are divided into several sub-periods on the basis of pottery chronology (Table 22.1). Each sub-period is further subdivided into multiple phases based on typological chronology of pottery.

The calendar dates for the sub-periods shown in Table 22.1 are still tentative. For the chronological placement of Jomon data, Japanese archaeologists moved slowly in systematically adopting radiocarbon dates (see Habu 2004, 37–42). Because Japanese archaeologists were relying heavily on the relative chronology based on their fine-grained typology of pottery, which goes back to the works by Yamanouchi (1932; 1937; 1939), most of them had assumed that radiocarbon dates were of little use in establishing a relative chronological framework until the 1990s.

New AMS 14C dates since the late 1990s have significantly contributed to our understanding of Jomon absolute dates (Kobayashi 2007; 2008; Kokuritsu, Tekishi Minzoku Hakubutsukan 2003; Nihon Senshi Jidai no 14C Nendai Henshuinkai 2000; Nishimoto 2006). The correspondence between pottery chronology and calendar dates, however, has yet to be finalized. For the beginning of the Jomon period, radiocarbon dates for the carbonized adhesion on potsherds excavated from the Odai Yamamoto I site in Aomori Prefecture

Table 22.1 Approximate dates (calibrated BP) for the six Jomon and four Chulmun sub-periods (modified from Habu in press)

<table>
<thead>
<tr>
<th>Sub-period</th>
<th>Jomon*</th>
<th>Chulmun**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final</td>
<td>3300–2400 cal BP</td>
<td>N/A</td>
</tr>
<tr>
<td>Late</td>
<td>4300–3300 cal BP</td>
<td>4000–3300 cal BP</td>
</tr>
<tr>
<td>Middle</td>
<td>5500–4300 cal BP</td>
<td>5500–4000 cal BP</td>
</tr>
<tr>
<td>Early</td>
<td>7000–5500 cal BP</td>
<td>7000–5500 cal BP</td>
</tr>
<tr>
<td>Initial</td>
<td>11,000–7000 cal BP</td>
<td>N/A</td>
</tr>
<tr>
<td>Incipient</td>
<td>16,000–11,000 cal BP</td>
<td>11,500–7000 cal BP</td>
</tr>
</tbody>
</table>

* Based primarily on radiocarbon dates from the Kanto and Tohoku regions.
 returned ages of approximately 13,800–12,700 uncal BP, or c.16,500–14,900 cal BP (see Habu 2004, 28–36). Because of the lack of dendrochronological data for calibration before 12,450 cal BP, these dates for the Odai Yamamoto pottery should be considered as tentative (see Kobayashi 2008).

Calendar dates for the end of the Jomon period show regional variability. Traditionally, scholars assumed that the end of the Jomon period in Kyushu, which was marked by the introduction of wet rice agriculture from continental Asia, was dated to c.2500 cal BP (see Habu 2004, 258; in press). More recently, a series of AMS dates obtained from Kyushu indicate that the end of the Jomon period, which was marked by the appearance of rice paddy fields, dates to as early as c.3000 cal BP in south-western Japan (Fujio et al. 2005; Harunari et al. 2003; Nishimoto 2006), but not all scholars have accepted this new chronological framework (Uno 2008). Using a small number of new AMS dates from the Tohoku region, Ken’ichi Kobayashi (2008) tentatively suggests the end of the final Jomon in north-eastern Japan as 2450–2350 cal BP.

Reliable radiocarbon dates for establishing Chulmun absolute chronology are still limited (see Lee 2011). Raised design pottery from the Osan-ni site (Han 1995; Nelson 1993) is dated to 7050 ±120 uncal BP (KSU-515) or c.8000 cal BP, which is commonly used as the oldest reliable date for Chulmun pottery. According to Cho and Ko (2009), the Kosan-ni site on Cheju Island is associated with ‘archaic’ plain ware, which dates to 10,000 uncal BP (c.11,500 cal BP) or older if its stratigraphic context was intact. However, radiocarbon dates from the Kosan-ni site (Kuzmin 2006, 366) show wide variability, making further study necessary. Reliable radiocarbon dates to determine the end of the Chulmun culture are also rare. Ambiguity of the criteria for drawing the boundary between the Chulmun and the following Mumun periods is another factor that complicates the discussion of Chulmun absolute chronology.

TEMPORAL AND REGIONAL VARIABILITY OF THE JOMON AND CHULMUN CULTURES

As discussed above, marked regional and temporal variability has been observed among Jomon and Chulmun cultures. Changes through time were not necessarily gradual, nor directional from simple to complex. In some cases, the growth and decline of the population and changes in aspects of cultural complexity (see Habu 2004, 15–16) occurred within a relatively short time span. Cyclical changes are also observed. These data provide us with an excellent opportunity to understand the complex relationships among environmental, economic, and social factors, including (1) changes in, as well as human impacts on, the biosphere, including climate change and diseases, (2) subsistence/food diversity, (3) mobility of people, goods, and information, (4) technological innovations, and (5) rituals and social structure. Of the six Jomon sub-periods, the incipient Jomon period (c.16,000–11,000 cal BP) shares a number of cultural characteristics in common with the preceding Palaeolithic period. Since the incipient Jomon falls outside of the post-Pleistocene, the following discussion focuses primarily on the initial to final Jomon and the incipient to late Chulmun periods.
Two important lines of evidence to infer regional and temporal variability are site density and average site size data. For the four main islands of the Japanese archipelago (Hokkaido, Honshu, Shikoku, and Kyushu), the Jomon data of north-eastern Honshu (the Tōhoku, Kanto, Chubu, Tokai, and Hokuriku regions; hereafter Zone I) reveal much higher site density and larger average site size than those of south-western Honshu (Kinki and Chugoku regions), Shikoku, and Kyushu (hereafter Zone II) (see Figure 22.1). In Zone I, site density, as well as average site size, increased steadily from the initial to the middle Jomon, reached its maximum during the middle Jomon period, and then declined through the late and final Jomon periods (see Koyama 1978; 1984). This zone is characterized by a larger amount of ornate pottery and ritual artefacts. In Zone II, where site density was much lower than in the former area, it increased steadily from the initial to the final Jomon (Koyama 1978; 1984). Many of these characteristics were noted as early as during the 1950s and 1960s and were clearly shown in Koyama’s (1978; 1984) Jomon population estimates (see Habu 2001, 24–6; 2004, 46–50).

Detailed analysis of site density and site size for the Chulmun period has yet to be conducted. The lack of systematic analysis for site density and site size is due to two facts: the limited number of large-scale excavations of Chulmun sites, and the regional disparity in the availability of the excavation record. Nevertheless, the general patterns indicated in Lee (2001), Nelson (1993), and Norton (2007) seem to be more similar to those of the Jomon of south-western Honshu, Shikoku, and Kyushu than those of north-eastern Honshu. Thus, if we are to identify two distinct courses of post-Pleistocene cultural transformation, the regional boundary is not necessarily between the Korean Peninsula and the Japanese archipelago but may have been between north-eastern and south-western Japan.

In a previous paper (Habu in press), I divided the post-Pleistocene Jomon and Chulmun sequences into three distinct phases. The first phase, c.11,000–7000 cal BP, was characterized by the expansion of target resources and the beginning of subsistence specialization. The second phase, c.7000–4000 cal BP, showed evidence of subsistence intensification and the development of more sedentary lifeways. During the final phase, c.4000–2500 cal BP, the diverging pathways between Jomon Zone I and Jomon Zone II/Chulmun became pronounced. Put another way, the long time span of the Jomon and Chulmun cultures was punctuated by three major changes that occurred at around 11,000, 7000, and 4000 cal BP (see also Habu 2004, chapter 7).

It is also important to note that in Zone I of Japan the transition to the following Yayoi agricultural period occurred later than it occurred in Zone II of Japan and the Korean Peninsula, probably as late as 2450–2350 cal BP (see above). In the latter areas, influences from China (from the Neolithic and subsequent state societies) were more direct than in Zone I. Rice was possibly grown on the Korean Peninsula during the late Chulmun period, but more evidence is needed (Crawford 2006; Lee 2011). Rice paddy fields in northern Kyushu are dated to as early as c.3000 and 2800 cal BP (see above).

Hunter-gatherers of Hokkaido and Okinawa Jomon did not adopt rice cultivation at the end of the Jomon period. Unfortunately, no population estimate for these regions was available in Koyama’s (1978; 1984) work. In Hokkaido, the Epi-Jomon culture, a distinct hunter-gatherer culture that followed the Jomon culture, lasted from the third century BC to the seventh century AD. The following Satsumon culture (eighth–twelfth century AD), which flourished in the south-western half of Hokkaido, was characterized by agricultural practice, but evidence reveals that residents used wild food resources continuously...
as well. At about the same time, in north-eastern Hokkaido, Sakhalin, and the southern Kuril Islands, the Okhotsk culture (seventh–thirteenth century AD) flourished with its focus on sea mammal hunting and fishing. These two cultures formed the foundation for the proto-Ainu culture (c. twelfth–sixteenth century AD), which partly overlapped with
the Okhotsk. Although people of the proto-Ainu culture were once assumed to have subsisted primarily on hunting-gathering, new evidence indicates that they actually played key roles in forming active medieval trade networks between Japan and China. In Okinawa (the Ryukyu Islands), the equivalent of the Jomon period (often referred to as the initial to middle Shellmidden periods) is followed by another hunter-gatherer period, which is called the Parallel period of the Yayoi-Heian (also referred to as the late Shellmidden period). No clear evidence of agriculture has been reported from the latter period (e.g. Shinzato 2010).

Takamiyas (2003) work indicates that the population remained small until the end of the Yayoi-Heian period. During the following medieval Gusuku period (c. twelfth–fifteenth century AD), state formation took place. Flotation at Gusuku period sites has revealed ample evidence of cultigens (Shinzato 2010).

**Understanding Mechanisms of Long-Term Culture Change**

**Environmental Change**

Environment is a key factor in the recent discussion of the post-Pleistocene transformation of Jomon and Chulmun cultures. The warming trend during the first half of the Holocene resulted in major changes in vegetation (Tsuji 2009), sea levels (Kosugi 1989; Lee 2011; Nagaoka and Nakano 2009; Yokoyama 2009), and other aspects of the biosphere, which in turn affected people’s lifeways. This by no means implies, however, that the perspective of environmental determinism is widely accepted.

According to Tsuji (2009, 73), by 7000 uncal BP, the Japanese archipelago from Hokkaido to Kyushu was basically divided into four vegetation zones: (1) cold temperate coniferous forest zone in eastern Hokkaido, (2) temperate mixed forest in western Hokkaido, (3) temperate deciduous forest in north-eastern Japan, and (4) warm temperate deciduous and evergreen forest zone in south-western Honshu, Shikoku, and Kyushu. The boundary between (3) and (4) roughly corresponds to the cultural boundary between north-eastern Honshu (Zone I above) and south-western Honshu, Shikoku, and Kyushu (Zone II).

A key environmental factor that significantly affected post-Pleistocene human lifeways in insular East Asia was a sea level rise that was caused by the combination of the eustatic sea level rise (corresponding to the change in ocean volume because of ice-sheet melting) and the hydroisostatic change (isostatic change due to sea water load) (Kosugi 1989; Lee 2011; Nagaoka and Nakano 2009; Yokoyama 2009). Yokoyama (2009) points out that the sea level rise from the Last Glacial Maximum (LGM: c.19,000 cal BP) to 7000 cal BP was caused primarily by eustatic changes, whereas the marine regression and other minor sea level changes after 7000 cal BP were caused by hydroisostatic changes. The excavation of the initial Jomon Mazukari shellmidden (c.9000 cal BP; Aichi Prefecture), which is located 10 m below the sea level and was covered by marine silt and sand deposits, has revealed that during the early Holocene period the sea water often inundated coastal valleys even when the sea level was lower than the present-day sea level (see Habu et al. 2011). Takahashi (2009) suggests that many incipient to early Jomon sites on coastal plains might have been submerged under the sea as a result of eustatic and hydroisostatic changes. This supports the idea that the early Jomon culture was highly mobile and adapted to changing environments.

Subsistence

Subsistence history of Jomon and Chulmun cultures is a key factor in the recent discussion of the post-Pleistocene transformation of these cultures. The warming trend during the first half of the Holocene resulted in major changes in vegetation (Tsuji 2009), sea levels (Kosugi 1989; Lee 2011; Nagaoka and Nakano 2009; Yokoyama 2009), and other aspects of the biosphere, which in turn affected people’s lifeways. This by no means implies, however, that the perspective of environmental determinism is widely accepted.

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the sea as a result of the Holocene transgression, particularly in south-western Japan. The excavation of the Mazukari shellmidden and resulting early and middle Jomon data from north-western Kyushu provided by Nagaoka and Nakao (2009) indicate that micro-regional variability in hydroisostatic changes can be observed, which affected the distribution of sites with waterlogged nut-storage pits in the intertidal zone.

A controversial topic regarding the environmental changes in Holocene insular East Asia is the cooling climate that is said to have occurred at c.4200 cal BP. While many scholars suggest that the cooling climate was the direct cause of the rapid decline in Zone I in the number and size of settlements in the latter half of the middle Jomon period (e.g. Kawahata et al. 2009; Tsuji 2002; Yasuda 1989), Habu (2008) and Habu and Hall (2013) point out that cooling climate was not necessarily the main cause of these cultural changes. Ken'ichi Kobayashi's (2008) data also indicate that these cultural changes may have occurred as early as 4800 cal BP before the cooling climate hit the Japanese archipelago.

New environmental data, including pollen, phytoliths, and diatoms, could significantly enhance our understanding of human-environmental interaction in post-Pleistocene East Asia (e.g. Kawahata et al. 2009; Kitagawa and Yasuda 2004; 2008; Yi 2011). The problems of Jomon and Chulmun absolute chronology discussed above and the relative scarcity of high-resolution environmental data, however, make understanding the timing and causal relationships between environmental changes and archaeological data challenging.

Subsistence, Settlement, and Society

Subsistence data from the Jomon and Chulmun periods are extremely large. In the early history of Jomon and Chulmun archaeology, subsistence studies were under-represented because of the scarcity of zooarchaeological and palaeoethnobotanical specialists and because of the generally poor preservation of faunal and floral remains (see e.g. Habu 2004, 57–60). However, systematic flotation and water-screening of soil samples over the past several decades, including those from shellmiddens and waterlogged sites, have significantly enhanced our understanding of Jomon and Chulmun subsistence (e.g. Crawford 2011; Crawford and Lee 2003; Itou 2011; Lee 2011; Takamiya 2003; Tsuji 2002; 2009).

Food diversity, together with its correlate subsistence diversity (i.e. diversity in the methods of food acquisition), is a critical factor in the discussion of Jomon/Chulmun human-environmental interaction. Many archaeologists have suggested that the rich environment of Japan and Korea with a wide variety of food resources enabled the early development of 'complex' hunter-gatherer cultures in these regions (e.g. Kim 2006; Kobayashi 1977; Norton 2007). In terms of food diversity measured by richness (i.e. the number of different nominal classes of items observed in the sample), an expansion of target resource types from c.11,000 to 7000 cal BP is evident in the Jomon and Chulmun data. Faunal and floral studies revealed that the Jomon and Chulmun diet in this period incorporated plants, fish, and shellfish, including domesticated plants (Crawford 2011; Crawford and Lee 2003; Habu 2004, 248–50). On the south-west coast of Korea, an abundance of shellmidden sites, including the Tongsam-dong, seems to imply a heavy reliance on marine food (see the results of carbon and nitrogen stable isotope analysis below). Developments of new food-processing technologies, such as the removal of tannic acid from buckeyes (Aesculus
Many scholars suggest that this expansion of target resources resulted in a general shift from hunting terrestrial mammals to collecting plant and marine food. By the middle Holocene, limited types of food plant and/or marine resources such as nuts, tubers, and fish were intensively exploited and stored. In other words, early Holocene diversification in food richness eventually led to the process of subsistence intensification and specialization. In particular, the development of large early middle Jomon (c.7000-4000 cal BP) settlements in north-eastern Japan is likely to have been supported by mass exploitation of plant food. In central Japan, abundant so-called chipped stone 'axes' (probably used as digging tools) are thought to be a reflection of an intensive exploitation of plant roots, such as the roots of yam, bracken, kuzu vine, and lilies. Reports of storage pits with nut remains and an abundance of chestnut pollens from several Jomon settlements, including Sannai Maruyama in Aomori Prefecture, make several scholars think that chestnuts, acorns, and other nuts became Jomon staple food during and after the Middle Jomon period. Ultimately, analysis of starch grains may provide clues to determine the importance of plant roots and various nuts in overall Jomon diet, but the results are still preliminary (Shibutani 2008; 2010). Reports of acorn (Quercus) remains from several Chulmun sites in central-western Korea, including Amsa-dong and Misa-ri, are also indicative of the importance of nut collecting.

The heavy reliance on plant food may have required a form of environmental management or plant cultivation. Thus, one of the controversial topics is the importance of cultigens in Jomon and Chulmun subsistence and diet (Bleed and Matsui 2010; Crawford 2008; 2011). Several cultigens were utilized by Jomon and Chulmun people (e.g. Crawford 2006; 2011; Lee 2011; Kurobô and Takase 2003; Yoshizaki 1995). Commonly reported taxa from early to final Jomon sites (see Habu 2004, 59) include egoma and/or shiho mint (Perilla), bottle gourd (Lagenaria), lacquer tree (Toxicodendron), barnyard millet (Echinochloa utilis), and beans (Leguminosae), including azuki and soy beans. In particular, charred remains of Echinochloa utilis have been reported from over 20 Jomon sites. Many of these are located in the northern part of Honshu and Hokkaido (Takase 2007; Yamada 2007), but many of these findings are small in number, and examples associated with reliable 14C dates are limited. Among these, barnyard millet from the Tominosawa in Aomori Prefecture was directly AMS dated, giving the dates of c.4800–4300 cal BP (Nishimoto et al. 2007).

Carbon and nitrogen stable isotope analysis of human skeletal remains has contributed significantly to our understanding of Jomon and Chulmun diet. For the Jomon period, regionally specific patterns have been detected. Minagawa and Akazawa's (1992) work indicates that Hokkaido Jomon people at the Kitakogane site (early Jomon) relied heavily on marine food, possibly marine mammals, whereas residents of the Sanganji shellmidden (middle–final Jomon) in the southern Tohoku region, the Kosaku shellmidden (late Jomon) in the Kanto region, and the Kitamura site (late Jomon) in the Chubu region relied more heavily on terrestrial resources. It is worth noting that the stable isotope data from the two shellmidden sites in Tohoku and Kanto, Sanganji and Kosaku, indicate low dependence on marine food. None of these studies indicate that C4 plants, including barnyard millet or grass, contributed significantly to the Jomon and Chulmun diet.

Isotope data also seem to indicate similarities between shellmidden sites in western Japan and southern Korea. Residents of two shellmidden sites in western Japan, Tsukumo (late
Jomon) in the Chugoku region and Todoroki (early Jomon) in Kyushu, were heavily reliant on marine food, probably fish (Minagawa 2001). Analysis of human and dog remains from Tongsam-dong shellmidden indicates that their diet was also dependent on marine food (Choy and Richard 2010).

Studies by Yoneda (2010) and Chisholm and Habu (2003) suggest that Jomon people in the northern Tohoku region and the Hokuriku region may have had higher intake of marine food than those in southern Tohoku, Kanto, and Chubu, but the sample size is still very small. Yoneda's (2010) work also shows great diversity among individuals excavated from nine shellmidden sites in the Kanto and Tokai regions: the data show linear distribution between terrestrial and marine food sources, suggesting that Kanto and Tokai Jomon people were relying on a varying degree of a combination of the two resources. Chisholm et al.'s (1992) results of carbon isotope studies also detected differences between individuals, including male–female differences.

In my previous work, I emphasized that the process of sedentarization went hand in hand with the diversification in the richness of target food resources and the following subsistence specialization (Habu 2004; in press). Although Jomon and Chulmun people are known as examples of 'sedentary' hunter-gatherers, most scholars agree that, with a few exceptions such as in southern Kyushu (e.g. Pearson 2006), signs of sedentism were not apparent until c.7000 cal BP. Using models of hunter-gatherer subsistence and settlement, I argued that early Jomon sedentism was not necessarily year-round sedentism but more likely seasonal sedentism, and the degree of sedentism changed within a short time span (Habu 2001; but see Kobayashi 2004). Ogawa's (2009) study of life histories of early Jomon pit dwellings in the Tokyo Bay area supports this view of flexibility in early Jomon residential mobility. I also proposed that, even for extremely large middle Jomon settlements such as Sannai Maruyama, the possibility of seasonal mobility and changing site functions should be considered (Habu 2004; 2008). Not all scholars agree with this perspective (e.g. Imamura 2006; Okada 2003). These differences are coming not only from different interpretations of the available settlement data, but also from different perspectives on the role of mobility in hunter-gatherer lifeways. Data to infer Jomon and Chulmun residential mobility in south-western Japan and Korea are still limited. Seguchi (2009) suggests that hunter-gatherers in the Lake Biwa area established fully-sedentary systems that relied on storage pits and dugout canoe transportation.

Changes in subsistence strategies and settlement systems were inextricably linked to changing Jomon and Chulmun social landscapes (Choe and Bale 2002; Habu 2004; Lee 2006; Kobayashi 2004; Pearson 2006). Developments of social networks are evidenced by the long-distance trade of exotic items (e.g. obsidian, jade, and asphalt; see Habu 2004, 221–33). Technological innovations can be seen in the production of various types of artefacts such as lacquerware and transportation technologies including dugout canoes (see Habu 2010). Belief systems are reflected in ritual artefacts and mortuary practice.

In order to understand the causes, conditions, and consequences of long-term culture change, it is critical to examine these lines of evidence with a fine-grained time-scale so that the sequence of these changes can be modelled and further tested. For example, data from the Sannai Maruyama site seems to indicate that subsistence specialization with a focus on plant food occurred first from the end of the early Jomon to the middle of the middle Jomon, which was followed by a decrease in settlement size and a decline of ritual practice represented by clay figurines (Habu 2008; Habu and Hall 2013). This may indicate that
over-specialization among hunter-gatherers, which leads to the loss of subsistence and food diversity, can contribute to a rapid decline or a seeming ‘collapse’ in their socio-economic systems, followed by a shift to a new subsistence strategy among reduced populations. As a working hypothesis, this idea has the potential to be applied to multiple cases in not only prehistoric but also historic and contemporary situations. To further test the hypothesis, more AMS radiocarbon dates are needed to identify the precise timing of these incidents in relation to changing climate. Starch grain analysis of grinding stones and other artefacts, as well as residue analysis of pottery, may be the key to understanding the type(s) of plant food resources that played a critical role in these changes.

**CONCLUDING REMARKS**

From the above, it is clear that the rich Jomon and Chulmun data provide excellent opportunities to explore key issues in hunter-gatherer archaeology today. Results of these studies can be used for comparative studies with post-Pleistocene hunter-gatherers and early agriculturalists in other parts of the world, including hunter-gatherers on the Northwest Coast of North America, California, and Neolithic China. The diverging pathways between north-eastern Japan and south-western Japan/Korea after c.4000 cal BP make us reconsider the regional boundaries that we currently use to describe the post-Pleistocene hunter-gatherer cultures in these regions.

While the amount of data from Jomon and Chulmun sites continues to grow (see e.g. Crawford 2011; Kim 2006; Kosugi et al. 2007–10; Lee 2011), the total number of rescue excavations per year in Japan has been declining since the late 1990s due to a slower economy and a resulting decrease in large-scale land development projects (Habu 2004, 20). These circumstances not only provide scholars with an opportunity to reanalyse the large amount of data that have been accumulated over the past several decades, but a new generation of archaeologists who are conducting their research in a new socio-political environment will likely set new goals and approaches to the study of Jomon and Chulmun archaeological materials. Active information exchange between Jomon/Chulmun archaeologists and scholars working on post-Pleistocene hunter-gatherers and agriculturalists in other parts of the world will be critical.

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Chisholm, B., hunter-gatherers 69–73. Pullin


CONCLUDING REMARKS

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